WORKSHOP MANUAL

AXIOM
(UPR/S)

FOREWORD

This manual includes special notes, important points, service data, precautions, etc. That are needed for the maintenance, adjustments, service, removal and installation of vehicle components.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication.

All rights are reserved to make changes at any time without notice.

Arrangement of the material is shown in the table of contents on the right-hand side of this page. A black spot on the first page of each section can be seen on the edge of the book below each section title. These point to a more detailed table of contents preceding each section.

This manual applies to 2002 models.

SECTION	TABLE OF CONTENTS
	GENERAL INFORMATION
0A	General Information
0B	Maintenance and Lubrication
	HEATING, VENTILATION AND AIR CONDITIONING
1A	HVAC System
	STEERING
2A	Power-Assisted System
	SUSPENSION
3C	Front Suspension
3D	Rear Suspension
3E	Wheel and Tire System
3F	Intelligent Suspension System
	DRIVELINE/AXLE
4A1	Differential (Front)
4A2	Differential (Rear)
4B1	Driveline Control System
4B2	Driveline Control System (TOD)
4C	Drive Shaft System
4D2	Transfer Case (TOD)
	BRAKE
5A	Brake Control System
5B	Anti-Lock Brake System
5C	Power-Assisted Brake System
5D1	Parking Brake System (4×4 model)
5D2	Parking Brake System (4×2 model)
	ENGINE
6A	Engine Mechanical
6B	Engine Cooling
6C	Engine Fuel
6D1	Engine Electrical
6D2	Ignition System
6D3	Starting and Charging System
6E	Driveability and Emissions
6F	Engine Exhaust
6G	Engine Lubrication
6H	Engine Speed Control System
6J	Induction
	TRANSMISSION
7A	Automatic Transmission
7A1	Transmission Control System
	BODY AND ACCESSORIES
8A	Lighting System
8B	Wiper/Washer System
8C	Entertainment
8D	Wiring System
8E	Meter and Gauge
8F	Body Structure
8G	Seats
8H	Security and Locks
8I	Sun Roof/Convertible Top
8J	Exterior/Interior Trim
	RESTRAINTS
9A	Seat Belt System
9J	Supplemental Restraint System (Air Bag System)
9J1	Restraint Control System
	CONTROL SYSTEM
10A	Cruise Control System

AXIOM

GENERAL INFORMATION

CONTENTS

General Information 0A
Maintenance and Lubrication 0B

General Information

CONTENTS

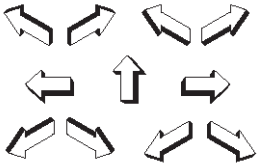
General Repair Instruction 0A–1
Illustration Arrows 0A–2
Identification 0A–3
Theft Prevention Standard 0A–5
Lifting Instructions 0A–9
Standard Bolts Torque Specifications 0A–11
Abbreviations Charts 0A–12
Service Parts Identification Plate 0A–13

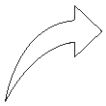
General Repair Instruction

1. If a floor jack is used, the following precautions are recommended.
   Park vehicle on level ground, “block” front or rear wheels, set jack against the recommended lifting points (see “Lifting Instructions” in this section), raise vehicle and support with chassis stands and then perform the service operations.
2. Before performing service operations, disconnect ground cable from the battery to reduce the chance of cable damage and burning due to short circuiting.
3. Use a cover on body, seats and floor to protect them against damage and contamination.
4. Brake fluid and anti–freeze solution must be handled with reasonable care, as they can cause paint damage.
5. The use of proper tools and recommended essential and available tools, where specified, is important for efficient and reliable performance of service repairs.
6. Use genuine Isuzu parts.
7. Used cotter pins, plastic clips, gaskets, O–rings, oil seals, lock washers and self–locking nuts should be discarded and new ones should be installed, as normal function of the parts cannot be maintained if these parts are reused.
8. To facilitate proper and smooth reassembly operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nuts separate is very important, as they vary in hardness and design depending on position of installation.
9. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air, and make certain they are free from restrictions.
10. Lubricate rotating and sliding faces of the parts with oil or grease before installation.
11. When necessary, use a sealer on gaskets to prevent leakage.
12. Carefully observe all specifications for bolt and nut torques.
13. When removing or replacing parts that require refrigerant to be discharged from the air conditioning system, be sure to use the Vehicle Refrigerant Recovery and Recycling Equipment (VRRRE) to recover and recycle Refrigerant–134a.
14. When a service operation is completed, make a final check to be sure the service has been done properly and the problem has been corrected.
15. SUPPLEMENTAL RESTRAINT SYSTEM
    The vehicle is equipped with a Supplemental Restraint System (SRS) – Air Bags. This system is not to be serviced without consulting the appropriate service information. Consult Section 9J “SRS System” if work is to be done on the front of the vehicle such as bumper, sheet metal, seats, wiring, steering wheel or column. Also review SRS system information if any arc welding is to be done on the vehicle. The SRS system equipped vehicle can be identified by:
    1. “AIR BAG” warning light on the instrument cluster.
    2. A Code “K” or “M” for fifth digit of Vehicle Identification Number.

Illustration Arrows

Arrows are designed for specific purposes to aid your understanding of technical illustrations.

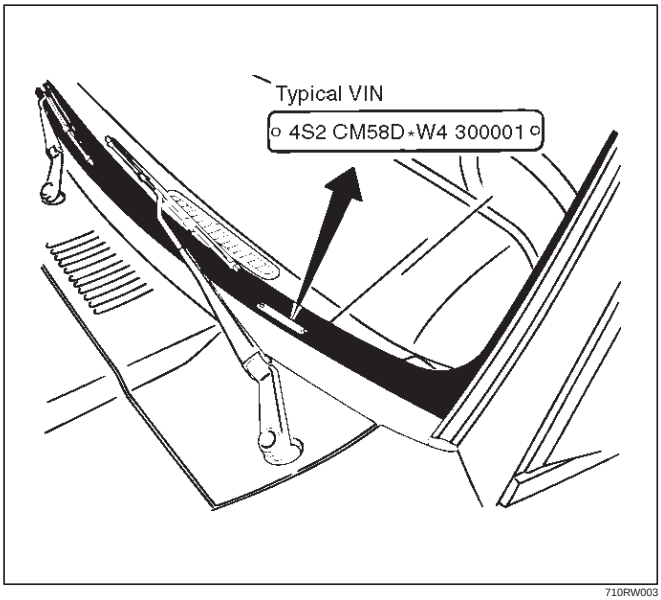
Arrow Type	Application
	Front of vehicle
	Up Side
	Task Related
	View Detail
	View Angle
	Dimension (1:2)
	Sectioning (1:3)

Arrow Type	Application
	▼Ambient/Clean air flow ▼Cool air flow
	▼Gas other than ambient air ▼Hot air flow
	▼Ambient air mixed with another gas ▼Can indicate temperature change
	Motion or direction
	Lubrication point oil or fluid
	Lubrication point grease
	Lubrication point jelly

Identification

Vehicle Identification Number (VIN)

This is the legal identification of the vehicle. it is located on the left bottom of the windshield. It can be easily seen through the windshield from outside the vehicle.



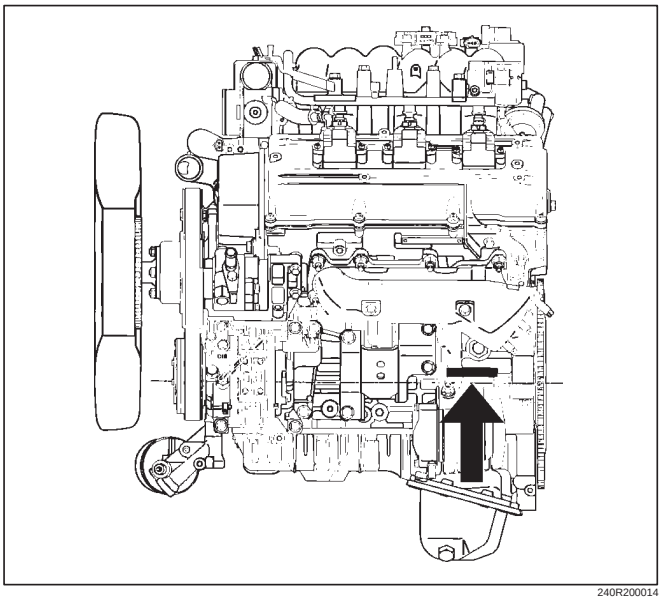
710RW003

4S2 C M 5 8 D * W 4 300001

- 300001 — Sequential Number
- W — Assembly Plant
- * — Model Year (2 = 2002)
- D — Check Digit
- 8 — Engine Type (X = 3.5L V6 DOHC ; 6VE1)
- 5 — Body Type (8 = Van; 4Door Utility)
- M — Series (5 = 5 - seater plus 1/4 ton (nominal))
- C — Vehicle Line (E = 4 x 2, Active belts W/dr. & ps. inflatable restraint)
  (F = 4 x 4, Active belts W/dr. & ps. inflatable restraint)
- 4S2 — GVWR Range (C = 4001 - 5000 LBS)
  (D = 5001 - 6000 LBS)
- C — World Manufacturer Identifier
  (4S2 SIA Built ISUZU Multipurpose Passenger Vehicle)

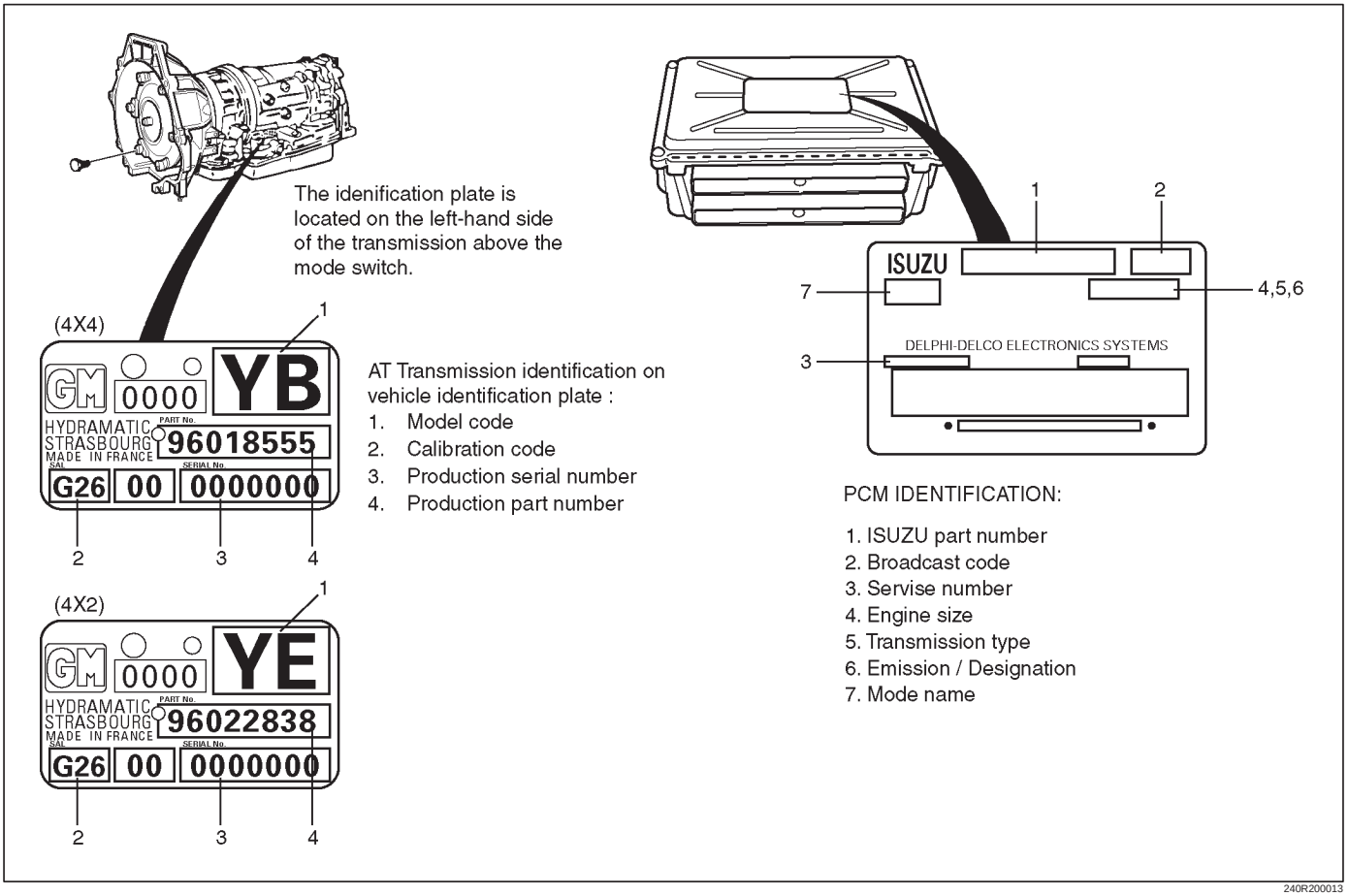
Engine Serial Number

The gasoline engine serial number is stamped on the left rear lower area of the cylinder block above the starter.



240R200014

Automatic : Stamped on the identification plate, located on the left side of the transmission above the mode switch.



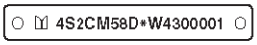
240R200013

Theft Prevention Standard

The 11 major components listed below will be marked with 17 digit VIN at the stage of production. In addition its service parts will be marked with manufacturer's trade mark, "R" mark and "DOT" mark.

Reference Figure No.	COMPONENT		INDICATION	
			PRODUCTION	SERVICE PARTS
0A-10	ENGINE	1– 6VE1	VIN plate	RMDOT Mark stamping
0A-11	TRANSMISSION	2– Automatic transmission	VIN plate	RMDOT Mark stamping
0A-11	BODY	3– Engine hood 4– Front door 5– Rear door 6– Fender 7– Rear Quarter panel 8– Front bumper 9– Back door left side 10– Back door right side 11– Rear bumper	VIN label	RMDOT Mark label

Anti Theft Stamping/Plate/Label

	STAMPING/PLATE	LABEL
PRODUCTION	Example 	Example
SERVICE PARTS		

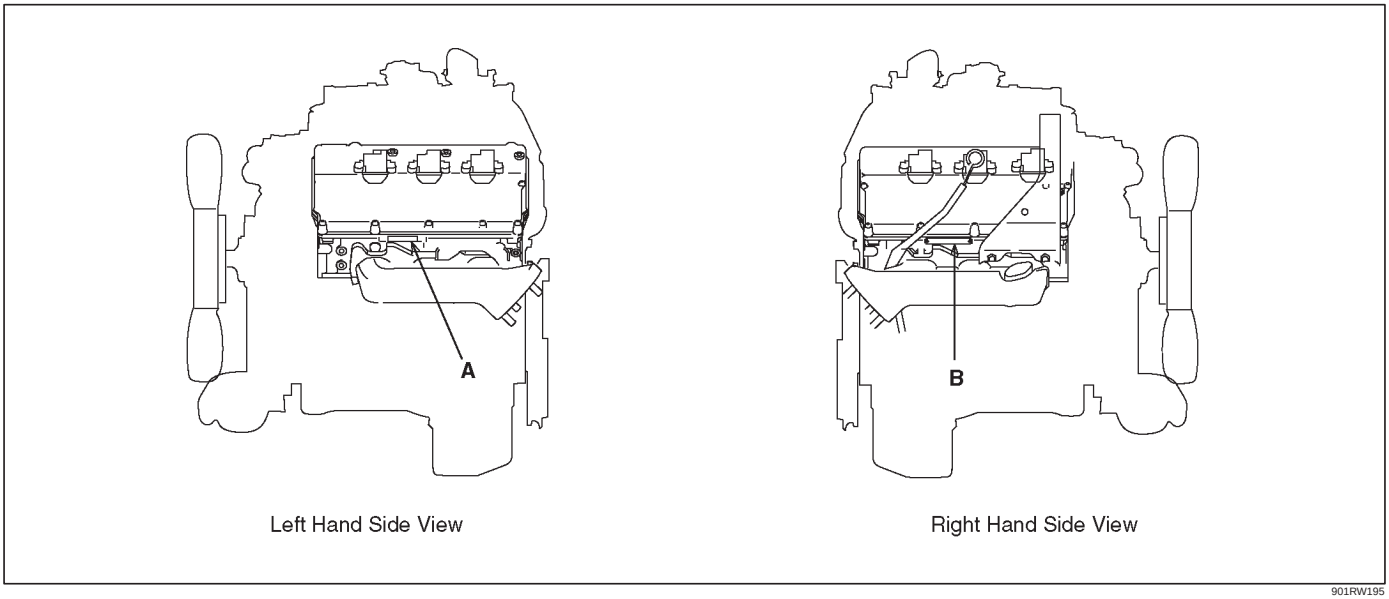
Anti Theft Stamping/Label/Plate Location

The stamping, label and plate locations are indicated by arrows in the illustration below.

NOTE:

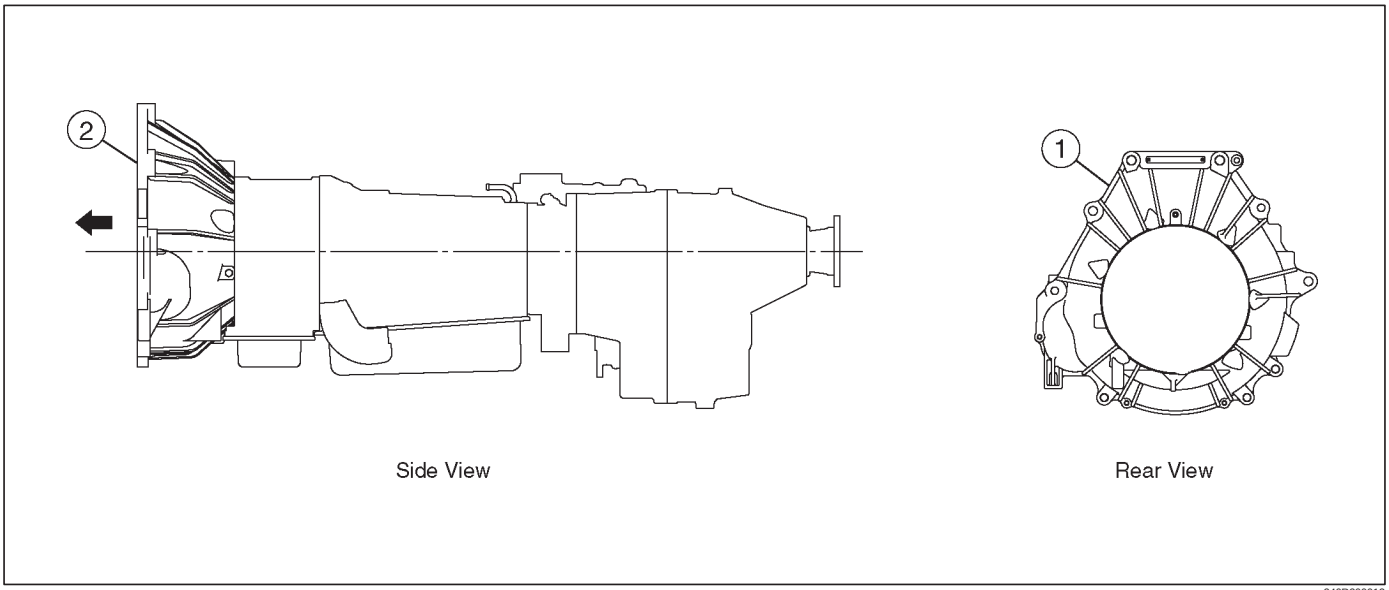
1. VIN plate locations for production.
2. Stamping locations for service parts.

Engine



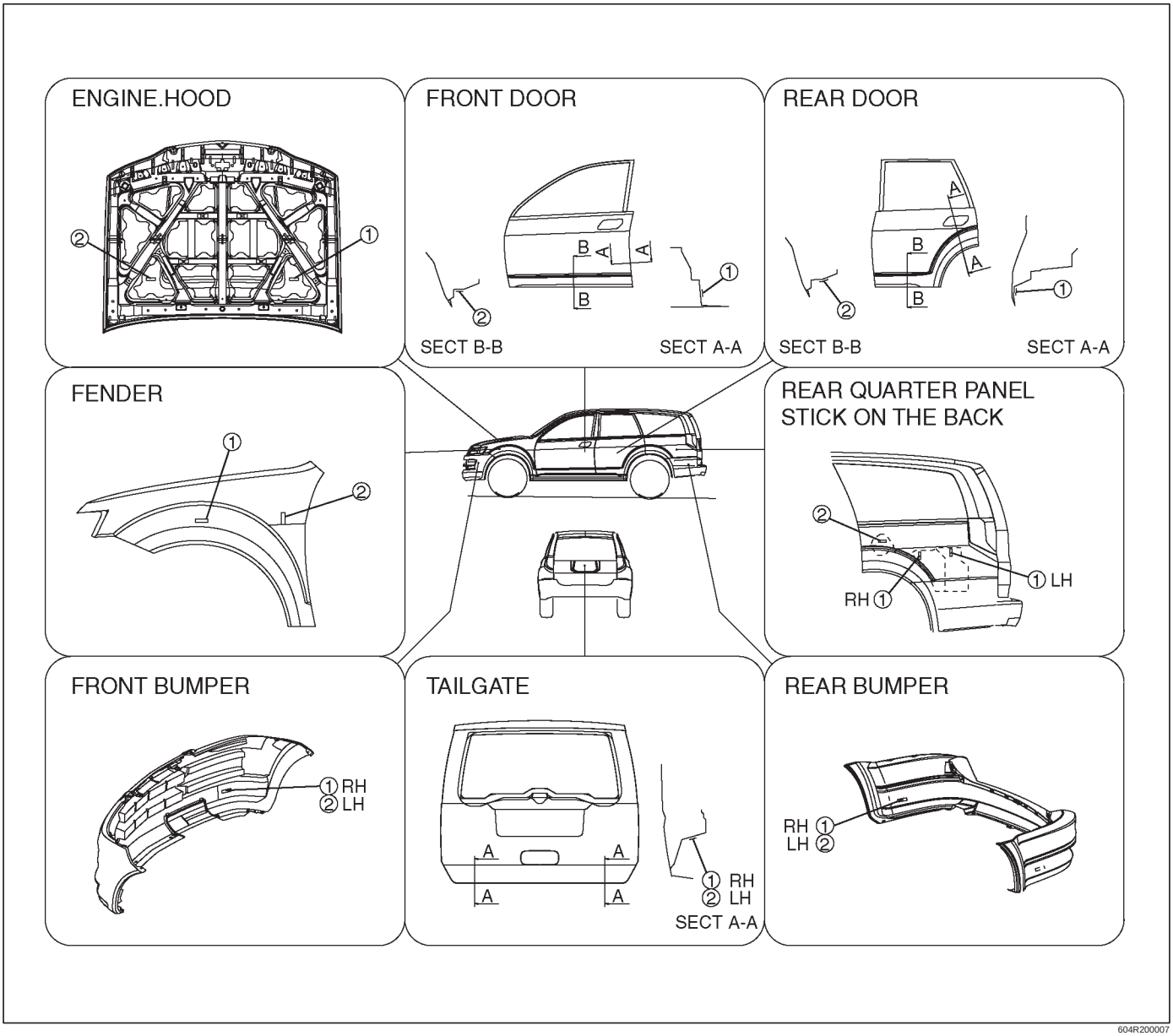
901RW195

Automatic Transmission



240R200012

Body

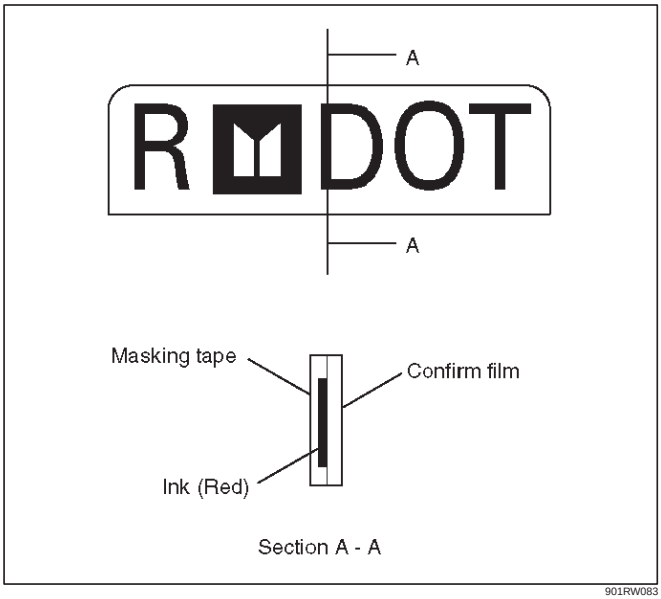

ENGINE.HOOD
FRONT DOOR
SECT B-B
SECT A-A
REAR DOOR
SECT B-B
SECT A-A
FENDER
REAR QUARTER PANEL
STICK ON THE BACK
RH
LH
FRONT BUMPER
RH
LH
TAILGATE
RH
LH
SECT A-A
REAR BUMPER
RH
LH
604R200007

Body Label Instructions

Do not peel off the masking tape until completion of paint work when replacing these parts, as the tape is affixed on the label attached to service parts for body of the anti–theft component.

NOTE: Be sure to pull off the masking tape after paint work has been completed.

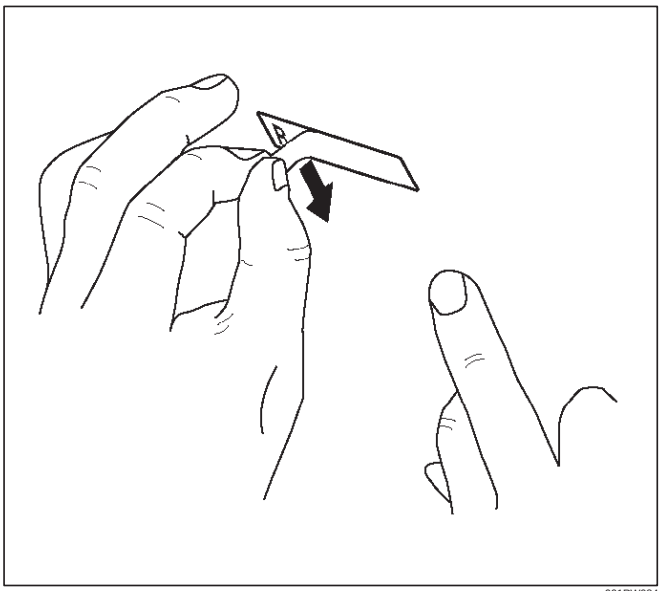
Do not attempt to remove this label for any reason.



901RW083

Precautions in pulling off the masking tape

1. Use only your finger nail or a similar blunt instrument to peel off the masking tape. Use of a sharp object will damage the underlying anti–theft label.
2. Be careful not to damage the paint around the label.



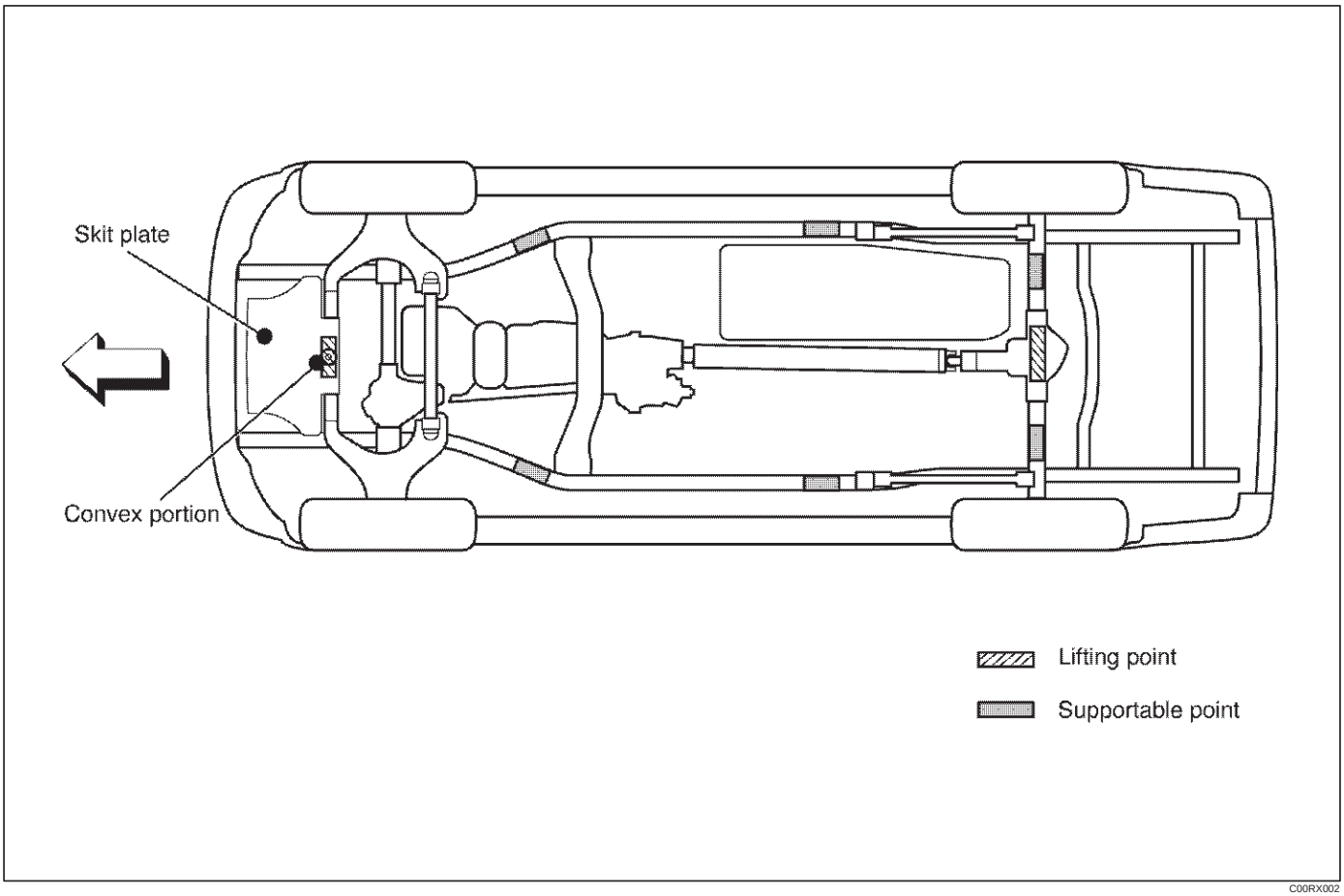
901RW084

Lifting Instructions

CAUTION:

- **If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. Raising the vehicle from any other point may result in serious damage.**
- **When jacking or lifting a vehicle at the frame side rail or other prescribed lift points, be certain that lift pads do not contact the catalytic converter, brake pipes or cables, or fuel lines. Such contact may result in damage or unsatisfactory vehicle performance.**

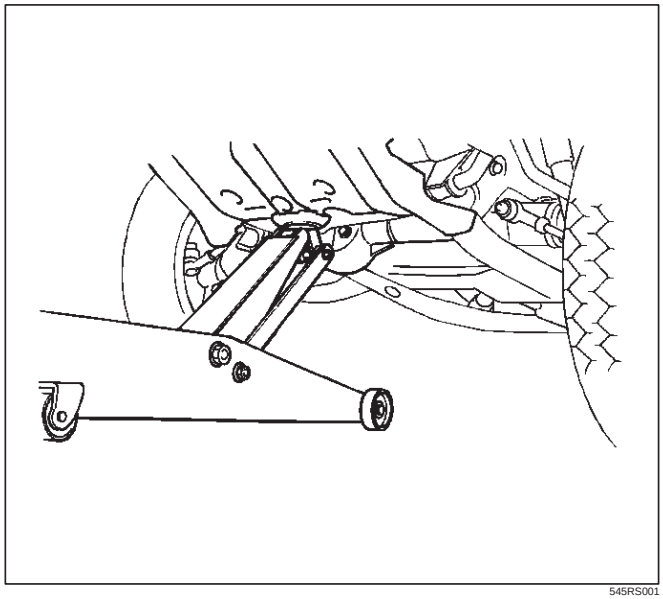
Lifting Points and Supportable Point Locations



C00RX002

Lifting Point: Front

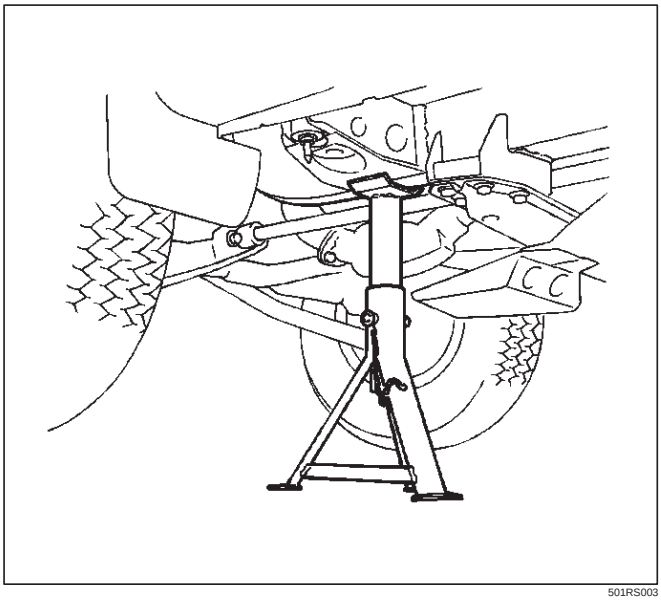
- When using a floor jack, lift on the Convex portion of the skid plate.



545RS001

Supportable Point: Front

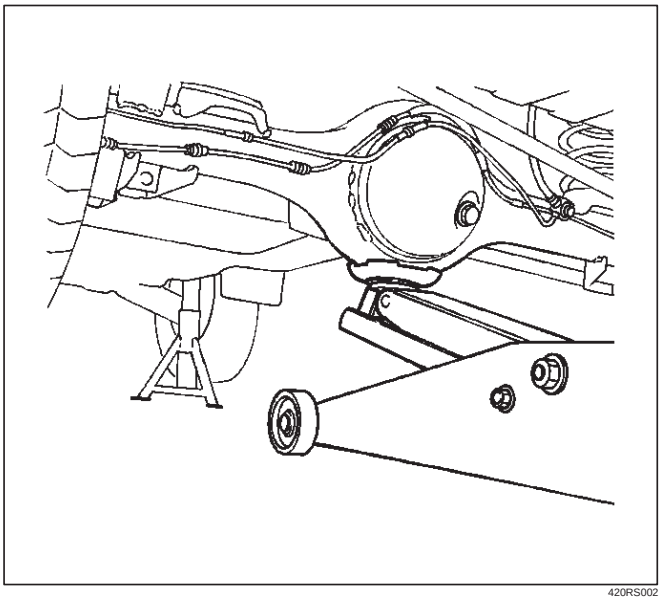
▼ Position the chassis stands at the bottom of the frame sidemember, behind the front wheel.



501RS003

Lifting Point: Rear

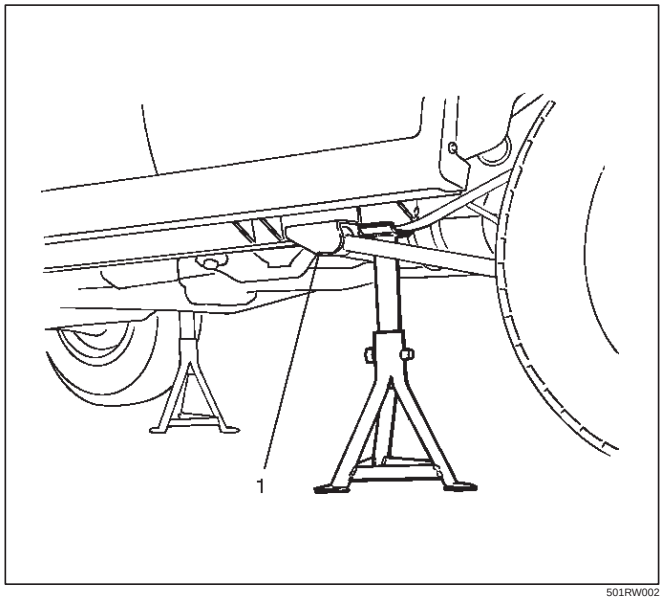
▼ Position the floor jack at the center of the rear axle case when lifting the vehicle.



420RS002

Supportable Point: Rear

▼ Position the chassis stands at the bottom of the frame sidemember, just behind the trailing link bracket.



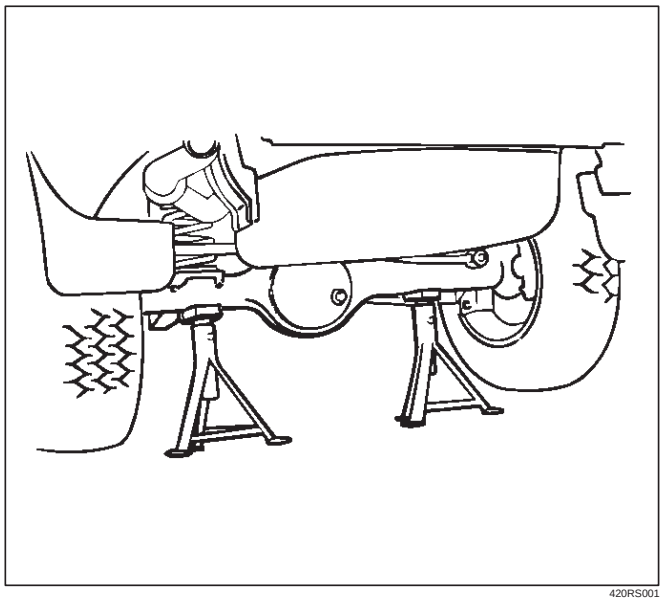
501RW002

Legend

(1) Trailing Link Bracket

Supportable Point: Rear

▼ Position the chassis stands at the bottom of the rear axle case.



420RS001

Standard Bolts Torque Specifications

The torque values given in the following table should be applied where a particular torque is not specified.

Strength Class	4.8	8.8		9.8
		Refined	Non-Refined	
Bolt Identification				
	No mark			
Bolt Diameter × Pitch (mm)				
M 6X1.0	4 – 8 N·m (3 – 6 lb ft)	5 – 10 N·m (4 – 7 lb ft)		–
M 8X1.25	8 – 18 N·m (6 – 13 lb ft)	12 – 23 N·m (9 – 17 lb ft)		17 – 30 N·m (12 – 22 lb ft)
M 10X1.25	21 – 34 N·m (15 – 25 lb ft)	28 – 46 N·m (20 – 34 lb ft)		37 – 63 N·m (27 – 46 lb ft)
* M10X1.5	20 – 33 N·m (14 – 25 lb ft)	28 – 45 N·m (20 – 33 lb ft)		36 – 60 N·m (27 – 44 lb ft)
M12X1.25	49 – 74 N·m (36 – 54 lb ft)	61 – 91 N·m (45 – 67 lb ft)		76 – 114 N·m (56 – 84 lb ft)
* M12X1.75	45 – 69 N·m (33 – 51 lb ft)	57 – 84 N·m (42 – 62 lb ft)		72 – 107 N·m (53 – 79 lb ft)
M14X1.5	77 – 115 N·m (56 – 85 lb ft)	93 – 139 N·m (69 – 103 lb ft)		114 – 171 N·m (84 – 126 lb ft)
* M14X2.0	72 – 107 N·m (53 – 79 lb ft)	88 – 131 N·m (65 – 97 lb ft)		107 – 160 N·m (79 – 118 lb ft)
M16X1.5	104 – 157 N·m (77 – 116 lb ft)	135 – 204 N·m (100 – 150 lb ft)		160 – 240 N·m (118 – 177 lb ft)
* M16X2.0	100 – 149 N·m (74 – 110 lb ft)	130 – 194 N·m (95 – 143 lb ft)		153 – 230 N·m (113 – 169 lb ft)
M18X1.5	151 – 226 N·m (111 – 166 lb ft)	195 – 293 N·m (144 – 216 lb ft)		230 – 345 N·m (169 – 255 lb ft)
M20X1.5	206 – 310 N·m (152 – 229 lb ft)	270 – 405 N·m (199 – 299 lb ft)		317 – 476 N·m (234 – 351 lb ft)
M22X1.5	251 – 414 N·m (185 – 305 lb ft)	363 – 544 N·m (268 – 401 lb ft)		425 – 637 N·m (313 – 469 lb ft)
M24X2.0	359 – 539 N·m (265 – 398 lb ft)	431 – 711 N·m (318 – 524 lb ft)		554 – 831 N·m (409 – 613 lb ft)

The asterisk * indicates that the bolts are used for female–threaded parts that are made of soft materials such as casting, etc.

Abbreviations Charts

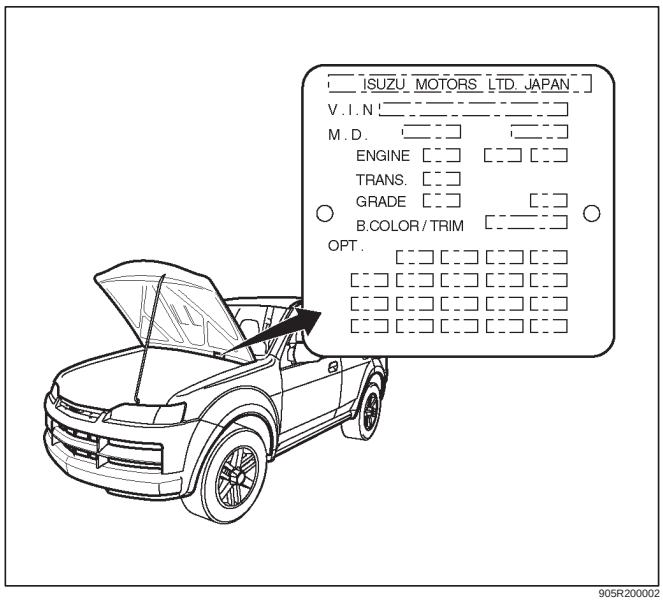
List of automotive abbreviations which may be used in this manual

A — Ampere(s)
ABS — Antilock Brake System
AC — Alternating Current
A/C — Air Conditioning
ACCEL — Accelerator
ACC — Accessory
ACL — Air Cleaner
Adj — Adjust
A/F — Air Fuel Ratio
AIR — Secondary Air Injection System
Alt — Altitude
AMP — Ampere(s)
ANT — Antenna
ASM — Assembly
A/T — Automatic Transmission/Transaxle
ATDC — After Top Dead Center
ATF — Automatic Transmission Fluid
Auth — Authority
Auto — Automatic
BARO — Barometric Pressure
Bat — Battery
B+ — Battery Positive Voltage
Bbl — Barrel
BHP — Brake Horsepower
BPT — Backpressure Transducer
BTDC — Before Top Dead Center
° C — Degrees Celsius
CAC — Charge Air Cooler
Calif — California
cc — Cubic Centimeter
CID — Cubic Inch Displacement
CKP — Crankshaft Position
CL — Closed Loop
CLCC — Closed Loop Carburetor Control
CMP — Camshaft Position
CO — Carbon Monoxide
Coax — Coaxial
Conn — Connector
Conv — Converter
Crank — Crankshaft
Cu. In. — Cubic Inch
CV — Constant Velocity
Cyl — Cylinder(s)
DI — Distributor Ignition
Diff — Differential
Dist — Distributor
DLC — Data Link Connector
DOHC — Double Overhead Camshaft
DTC — Diagnostic Trouble Code
DTM — Diagnostic Test Mode
DTT — Diagnostic Test Terminal
DVM — Digital Voltmeter (10 meg.)
DVOM — Digital Volt Ohmmeter
EBCM — Electronic Brake Control Module
ECM — Engine Control Module
ECT — Engine Coolant Temperature
EEPROM — Electronically Erasable Programmable Read Only Memory
EGR — Exhaust Gas Recirculation
EI — Electronic Ignition
ETR — Electronically Tuned Receiver
EVAP — Evaporation Emission
Exh — Exhaust
° F — Degrees Fahrenheit
Fed — Federal (All States Except Calif.)
FF — Front Drive Front Engine
FL — Fusible Link
FLW — Fusible Link Wire
FP — Fuel Pump
FRT — Front
ft — Foot
FWD — Front Wheel Drive
4WD — Four Wheel Drive
4 x 4 — Four Wheel Drive
4 A/T — Four Speed Automatic Transmission/Transaxle
Gal — Gallon
GEN — Generator
GND — Ground
Gov — Governor
g — Gram
Harn — Harness
HC — Hydrocarbons
HD — Heavy Duty
Hg — Hydrargyrum (Mercury)
HiAlt — High Altitude
HO2S — Heated Oxygen Sensor
HVAC — Heater–Vent–Air–Conditioning
IAC — Idle Air Control
IAT — Intake Air Temperature
IC — Integrated Circuit / Ignition Control
ID — Identification / Inside Diameter
IGN — Ignition
INJ — Injection
IP — Instrument Panel
IPC — Instrument Panel Cluster
Int — Intake
ISC — Idle Speed Control
J/B — Junction Block
kg — Kilograms
km — Kilometers
km/h — Kilometer per Hour
kPa — Kilopascals
kV — Kilovolts (thousands of volts)
kW — Kilowatts
KS — Knock Sensor
L — Liter
lb ft — Foot Pounds
lb in — Inch Pounds
LF — Left Front
LH — Left Hand
LR —Left Rear
LS — Left Side
LWB — Long Wheel Base
L–4 — In–Line Four Cylinder Engine
MAF — Mass Air Flow
MAN — Manual
MAP — Manifold Absolute Pressure
Max — Maximum
MC — Mixture Control
MFI — Multiport Fuel Injection
MIL — Malfunction Indicator Lamp
Min — Minimum
mm — Millimeter
MPG — Miles Per Gallon
MPH — Miles Per Hour
M/T — Manual Transmission/Transaxle
MV — Millivolt

N — Newtons
NA — Natural Aspirated
NC — Normally Closed
N·M — Newton Meters
NO — Normally Open
NOX — Nitrogen, Oxides of
OBD — On-Board Diagnostic
OD — Outside Diameter
O/D — Over Drive
OHC — Overhead Camshaft
OL — Open Loop
O2 — Oxygen
O2S — Oxygen Sensor
PAIR — Pulsed Secondary Air Injection System
P/B — Power Brakes
PCM — Powertrain Control Module
PCV — Positive Crankcase Ventilation
PRESS — Pressure
PROM — Programmable Read Only Memory
PNP — Park/Neutral Position
P/S — Power Steering
PSI — Pounds per Square Inch
PSP — Power Steering Pressure
Pt. — Pint
Pri — Primary
PWM — Pulse Width Modulate
Qt. — Quart
REF — Reference
RF — Right Front
RFI — Radio Frequency Interference
RH — Right Hand
RPM — Revolutions Per Minute
RPM Sensor — Engine Speed Sensor
RPO — Regular Production Option
RR — Right Rear
RS — Right Side
RTV — Room Temperature Vulcanizing
RWAL — Rear Wheel Antilock Brake
RWD — Rear Wheel Drive
SAE — Society of Automotive Engineers
Sec — Secondary
SFI — Sequential Multiport Fuel Injection
SI — System International
SIR — Supplemental Inflatable Restraint System
SOHC — Single Overhead Camshaft
Sol — Solenoid
SPEC — Specification
Speedo — Speedometer
SRS — Supplemental Restraint System
ST — Start / Scan Tool
Sw — Switch
SWB — Short Wheel Base
SYN — Synchronize
Tach — Tachometer
TB — Throttle Body
TBI — Throttle Body Fuel Injection
TCC — Torque Converter Clutch
TCM — Transmission Control Module
TDC — Top Dead Center
Term — Terminal
TEMP — Temperature
TOD— Torque On Demand
TP — Throttle Position
TRANS — Transmission/Transaxle
TURBO — Turbocharger
TVRS — Television & Radio Suppression
TVV — Thermal Vacuum Valve
TWC — Three Way Catalytic Converter
3 A/T — Three Speed Automatic Transmission/Transaxle
2WD — Two Wheel Drive
4 x 2 — Two Wheel Drive
U–joint — Universal Joint
V — Volt(s)
VAC — Vacuum
VIN — Vehicle Identification Number
VRRRE — Vehicle Refrigerant Recovery and Recycling Equipment
V–ref — ECM Reference Voltage
VSS — Vehicle Speed Sensor
VSV — Vacuum Switch Valve
V–6 — Six Cylinder “V” Engine
V–8 — Eight Cylinder ”V” Engine
W — Watt(s)
w/ — With
w/b — Wheel Base
w/o — Without
WOT — Wide Open Throttle

Service Parts Identification Plate

The Vehicle Information Plate (Service Parts ID plate) is provided on all vehicle models.
It is located on the center dash wall inside the engine compartment. The plate lists the VIN (Vehicle Identification Number), paint information and all production options and special equipment on the vehicle when it was shipped from the factory.



905R200002

AXIOM

GENERAL INFORMATION

Maintenance and Lubrication

CONTENTS

Maintenance Schedule List 0B–1
Explanation of Complete Vehicle Maintenance Schedule 0B–5
Recommended Fluids and Lubricants 0B–8
Lubricant Viscosity Chart 0B–9
Recommended Liquid Gasket 0B–11
Recommended Thread Locking Agents . . . 0B–11
Maintenance Service Data 0B–12

Maintenance Schedule List

Normal Vehicle Use

The maintenance instructions in this Maintenance Schedule are based on the assumption that the vehicle will be used as designed:

- ▼ to carry passengers and cargo within the limitations specified on the tire placard located on the inside of the glove compartment door;
- ▼ to be driven on reasonable road surfaces within legal operating limits;
- ▼ to be driven on a daily basis, as a general rule, for at least several miles/kilometers;
- ▼ to be driven on unleaded fuel

Unusual or severe operating conditions will require more frequent vehicle maintenance, as specified in the following sections.

Severe Driving Conditions

If the vehicle is usually operated under any of the severe driving conditions listed below, it is recommended that the applicable maintenance services be performed at the specified interval shown in the chart below.

Severe driving conditions:

- ▼ Towing a trailer, using a camper or car top carrier.
- ▼ Repeated short trips of less than 8 Km (5 miles) with outside temperature remaining below freezing.
- ▼ Extensive idling and/or low speed driving for long distances, such as police, taxi or door–to–door delivery use.
- ▼ Operating on dusty, rough, muddy or salt spread roads.

ITEMS	INTERVAL
CHANGE ENGINE OIL AND OIL FILTER	Every 3,000 miles (4,800 km) or 3 months
CHANGE AUTOMATIC TRANSMISSION FLUID	Every 20,000 miles (32,000 km)
CHANGE REAR AXLE OIL	Every 15,000 miles (24,000 km)
REPLACE TIMING BELT	Every 75,000 miles (120,000 km)
REPLACE AIR CLEANER FILTER	See explanation of service, page 0B–5
CHANGE POWER STEERING FLUID	Every 30,000 miles (48,000 km)

MILEAGE ONLY ITEMS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE ONLY ITEMS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	CHANGE FRONT AND REAR AXLE OIL		■		■				■				■				■	
2	* CHECK AND ADJUST OR CHANGE AUTOMATIC TRANSMISSION FLUID (IF NECESSARY)																■	
3	CHECK AUTOMATIC TRANSMISSION FLUID LEAKAGE		■		■		■		■		■		■		■		■	
4	CHENGE TRANSFER CASE OIL		■		■				■				■				■	
5	* REPLACE AIR CLEANER FILTER				■				■				■				■	
6	REPLACE SPARK PLUGS	Replace every 100,000 miles																
7	CHANGE ENGINE COOLANT				■				■				■				■	
8	REPLACE TIMING BELT	Replace every 100,000 miles																
9	CHECK AND ADJUST VALVE CLEARANCE (IF NECESSARY)	If noisy																
10	ROTATE TIRES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
11A	REPLACE FRONT WHEEL BEARINGS GREASE (Vehicles produced before July/31/2001)				■				■				■				■	
11B	CHECK FRONT WHEEL BEARINGS AXIAL RATTLE (Vehicles produced after Aug./1/2001)								■								■	
12	CLEAN RADIATOR CORE AND A/C CONDENSER								■								■	

* : UNDER SEVERE DRIVING CONDITIONS, MORE FREQUENT MAINTENANCE IS REQUIRED. REFER TO "SCHEDULED MAINTENANCE UNDER SEVERE DRIVING CONDITIONS".

■ SHADED AREA INDICATES SERVICE TO BE PERFORMED.

MILEAGE/MONTHS

	MILEAGE/MONTHS whichever comes first	IN MONTHS	IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)																DESCRIPTION
			7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
1	CHECK ENGINE COOLANT LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2	CHECK BRAKE FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3	CHECK FLUID LEAKS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4	• CHANGE ENGINE OIL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
5	• REPLACE ENGINE OIL FILTER	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
6	CHECK COOLING AND HEATER HOSES	12		■		■		■		■		■		■		■		■	
7	*(2) CHECK EXHAUST SYSTEM	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
8	*(2) CHECK FUEL LINE AND FUEL TANK/CAP	12								■								■	
9	CHECK ENGINE DRIVE BELT	24				■				■				■				■	
10	CHECK TIRES AND WHEELS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
11	CHECK STEERING OPERATION	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
12	CHECK BRAKE LINES AND HOSE	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
13	CHECK DRUM AND DISC BRAKES	12		■		■		■		■		■		■		■		■	
14	CHECK BRAKE PEDAL PLAY	12		■		■		■		■		■		■		■		■	
15	ADJUST BRAKE PEDAL PLAY	12		■		■		■		■		■		■		■		■	

*(2); This service is recommended for vehicles sold in California, and it is required for vehicles sold in other areas.

• UNDER SEVERE DRIVING CONDITIONS, ADDITIONAL MAINTENANCE IS REQUIRED. REFER TO "MAINTENANCE SCHEDULE UNDER SEVERE DRIVING CONDITIONS" LATER IN THIS SECTION

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

MILEAGE/MONTHS

	MILEAGE/MONTHS whichever comes first	IN MONTHS	IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)																DESCRIPTION
			7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	
16	CHECK PARKING BRAKE	12		▒		▒		▒		▒		▒		▒		▒		▒	
17	LUBE ACCELERATOR PEDAL LINKAGE	6	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	
18	CHECK SUSPENSION AND STEERING	12	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	
19	• CHECK POWER STEERING FLUID LEVEL	6	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	
20	LUBE BODY AND CHASSIS	6	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	
21	LUBE REAR PROPELLER SHAFT	6	▒		▒		▒		▒		▒		▒		▒		▒		
22	CHECK PROPELLER SHAFT FLANGE TORQUE	12	▒		▒		▒		▒		▒		▒		▒		▒		
23	CHECK SHIFT ON THE FLY SYSTEM GEAR OIL	12		▒		▒				▒				▒				▒	
24	CHECK AUTO CRUISE CONTROL LINKAGE AND HOSES	12		▒		▒		▒		▒		▒		▒		▒		▒	
25	CHECK STARTER SAFETY SWITCH	12	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	
26	CHECK ACCELERATOR LINKAGE	12		▒		▒		▒		▒		▒		▒		▒		▒	
27	LUBE KEY LOCK CYLINDER	12		▒		▒		▒		▒		▒		▒		▒		▒	

• UNDER SEVERE DRIVING CONDITIONS, ADDITIONAL MAINTENANCE IS REQUIRED. REFER TO "MAINTENANCE SCHEDULE UNDER SEVERE DRIVING CONDITIONS" LATER IN THIS SECTION

▒ SHADED AREA INDICATES SERVICE TO BE PERFORMED.

Explanation of Complete Vehicle Maintenance Schedule

Brief explanations of the services listed in the preceding Maintenance Schedule are presented below.
Replace all questionable parts and note any necessary repairs as you perform these maintenance procedures.

Front and Rear Axle Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the front and rear axle lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Air Cleaner Element Replacement

Replace the air cleaner under normal operating conditions every 30,000 miles (48,000 km).
Operation of the vehicle in dusty areas will necessitate more frequent replacement.

Spark Plug Replacement

Replace the plugs at 100,000 miles (160,000 km) intervals with the type specified at the end of this section.

Cooling System Service

Drain, flush and refill system with new engine coolant. Refer to *"Recommended Fluids and Lubricants" in this section, or ENGINE COOLING (SEC.6B).*

Timing Belt Replacement

Replacement of the timing belt is recommended at every 100,000 miles (160,000 km).
Failure to replace the timing belt may result in serious damage to the engine.

Valve Clearance Adjustment

Incorrect valve clearance will result in increased engine noise and reduced engine output.
Retorque the camshaft bracket bolts before checking and adjusting the valve clearance.
Check and adjust the valve clearance whenever increased engine noise is heard.

Tire Rotation

Rotate tires every 7,500 miles (12,000 km).

Front Wheel Bearings Lubricant Replacement (Vehicles Produced Before July/31/2001)

Clean and repack the front wheel bearings at 30,000 miles (48,000 km) intervals.
Refer to **DRIVE SHAFT SYSTEM (SEC. 4C).**

Front Wheel Bearings Check (Vehicles Produced After Aug./1/2001)

Inspect hub unit bearing at every 60,000 miles (96,000 km).
If there is abnormal condition, replace hub unit bearing.

Radiator Core and Air Conditioning Condenser Cleaning

Clean the front of the radiator core and air conditioning condenser, at 60,000 miles (96,000 km) intervals.

Fluid Level Check

A fluid loss in any system (except windshield washer) may indicate a problem. Repair the system at once.

Engine oil level

Check level and add if necessary. The best time to check the engine oil level is when the oil is warm. After stopping the engine with the vehicle on a level surface, wait a few minutes for the oil to drain back to the oil pan. Pull out the oil level indicator (dipstick). Wipe it clean and push the oil level indicator back down all the way. Pull out the oil level indicator, keeping the tip down, and look at the oil level on it.

Add oil, if needed, to keep the oil level above the "ADD" mark and between the "ADD" and "FULL" marks in the operating range area. Avoid overfilling the engine since this may cause engine damage. Push the oil level indicator back down all the way after taking the reading.
If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level.

Engine coolant level and condition

Check engine coolant level in the coolant reservoir and add engine coolant if necessary. Inspect the engine coolant and replace it if dirty or rusty.

Windshield washer fluid level

Check washer fluid level in the reservoir and add if necessary.

Power steering system reservoir level

Check and keep at the proper level.

Brake master cylinder reservoir level

Check fluid. Keep fluid at proper level. A low fluid level can indicate worn disc brake pads which may need to be serviced.

Hydraulic clutch system

Check fluid level in the reservoir. Add fluid as required.

Battery fluid level

Check fluid level in the battery.

Fluid Leak Check

Check for fuel, water, oil or other fluid leaks by looking at the surface beneath the vehicle after it has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice gasoline fumes or fluid at any time, locate the source and correct it at once.

Engine Oil and Oil Filter Replacement

Always use API SE, SF, SG, SH or ILSAC GF–1 quality oils of the proper viscosity.
When choosing an oil, consider the range of temperatures the car will be operated in before the next oil change. Then, select the recommended oil viscosity from the chart.

Always change the oil and the oil filter as soon as possible after driving in a dust storm.

Engine Cooling System Inspection

Inspect the coolant/anti–freeze. If the coolant is dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture for proper freeze protection, corrosion inhibitor level and best engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten the hose clamps if equipped with screw–type clamps. Clean outside of radiator and air conditioning condenser. Wash filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and the cap is also recommended.

Exhaust System Inspection

Visually inspect the exhaust pipes, muffler, heat shields and hangers for cracks, deterioration, or damage.

Be alert to any changes in the sound of the exhaust system or any smell of fumes. These are signs the system may be leaking or overheating. Repair the system at once, if these conditions exist. (See also “Engine Exhaust Gas Safety” and “Three Way Catalytic Converter” in the Owner’s manual.)

Fuel Cap, Fuel Lines, and Fuel Tank Inspection

Inspect the fuel tank, the fuel cap and the fuel lines every 60,000 miles (96,000 km) for damage which could cause leakage.

Inspect the fuel cap and the gasket for correct sealing and physical damage. Replace any damaged parts.

Drive Belt Inspection

Check the serpentine belt driving for cracks, fraying, wear, and correct tension every 30,000 miles (48,000 km). Replace as necessary.

Wheel Alignment, Balance and Tires Operation

Uneven or abnormal tire wear, or a pull right or left on a straight and level road may show the need for a wheel alignment. A vibration of the steering wheel or seat at normal highway speeds means a wheel balancing is needed. Check tire pressure when the tires are “cold” (include the spare).

Maintain pressure as shown in the tire placard, which is located on the driver’s door lock pillar.

Steering System Operation

Be alert for any changes in steering operation. An inspection or service is needed when the steering wheel is harder to turn or has too much free play, or if there are unusual sounds when turning or parking.

Brake Systems Operation

Watch for the “BRAKE” light coming on. Other signs of possible brake trouble are such things as repeated pulling to one side when braking, unusual sounds when braking or between brake applications, or increased brake pedal travel. If you note one of these conditions, repair the system at once.

For convenience, the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, bindings, leaks, crack, chafing etc. Inspect disc brake pads for wear and rotors for surface condition.

Inspect other brake parts, including parking brake drums, linings etc., at the same time. Check parking brake adjustment.

Inspect the brakes more often if habit or conditions result in frequent braking.

Parking Brake and Transmission Park Mechanism Operation

Park on a fairly steep hill and hold the vehicle with the parking brake only. This checks holding ability. On automatic transmission vehicles, shifting from “P” position to the other positions cannot be made unless the brake pedal is depressed when the key switch is in the “ON” position or the engine is running.

WARNING: BEFORE CHECKING THE STARTER SAFETY SWITCH OPERATION BELOW, BE SURE TO HAVE ENOUGH ROOM AROUND THE VEHICLE. THEN FIRMLY APPLY BOTH THE PARKING BRAKE AND THE REGULAR BRAKE. DO NOT USE THE ACCELERATOR PEDAL. IF THE ENGINE STARTS, BE READY TO TURN OFF THE KEY PROMPTLY. TAKE THESE PRECAUTIONS BECAUSE THE VEHICLE COULD MOVE WITHOUT WARNING AND POSSIBLY CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Starter Safety Switch Operation

Check by trying to start the engine in each gear while setting the parking brake and the foot brake. The starter should crank only in “P” (Park) or “N” (Neutral).

Accelerator Linkage Lubrication

Lubricate the accelerator pedal fulcrum pin with chassis grease.

Steering and Suspension Inspection

Inspect the front and rear suspension and steering system for damaged, loose or missing parts or signs of wear. Inspect power steering lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc.

Body and Chassis Lubrication

Lubricate the key lock cylinders, the hood latch, the hood and door hinges, the door check link, the parking cable guides, the underbody contact points, and the linkage.

Propeller Shaft Inspection and Lubrication

Check the propeller shaft flange–to–pinion bolts for proper torque to 63 N•m (46 lb ft) for front and rear propeller shaft.

Automatic Transmission Fluid Replacement

Under harsh operating conditions, such as constant driving in heavy city traffic during hot weather, or in hilly or mountainous terrain, change the transmission fluid and service the sump filter after every 20,000 miles (32,000 km) of operation.
More over, the remaining life percentage of ATF can be estimated by using TECH–II as an auxiliary tool to judge the right time for ATF replacement.
The remaining life percentage is calculated from ATF'S heat history. When it is close to 0%, ATF replacement is recommended.

Auto Cruise Control Inspection

Check to see if the clearance between cruise link and accelerator link is normal. Also check that the connected properly.

Accelerator Linkage Inspection

Inspect for interference, binding, and damaged or missing parts. Check accelerator pedal for smooth operation and even pedal effort. Replace parts as needed.

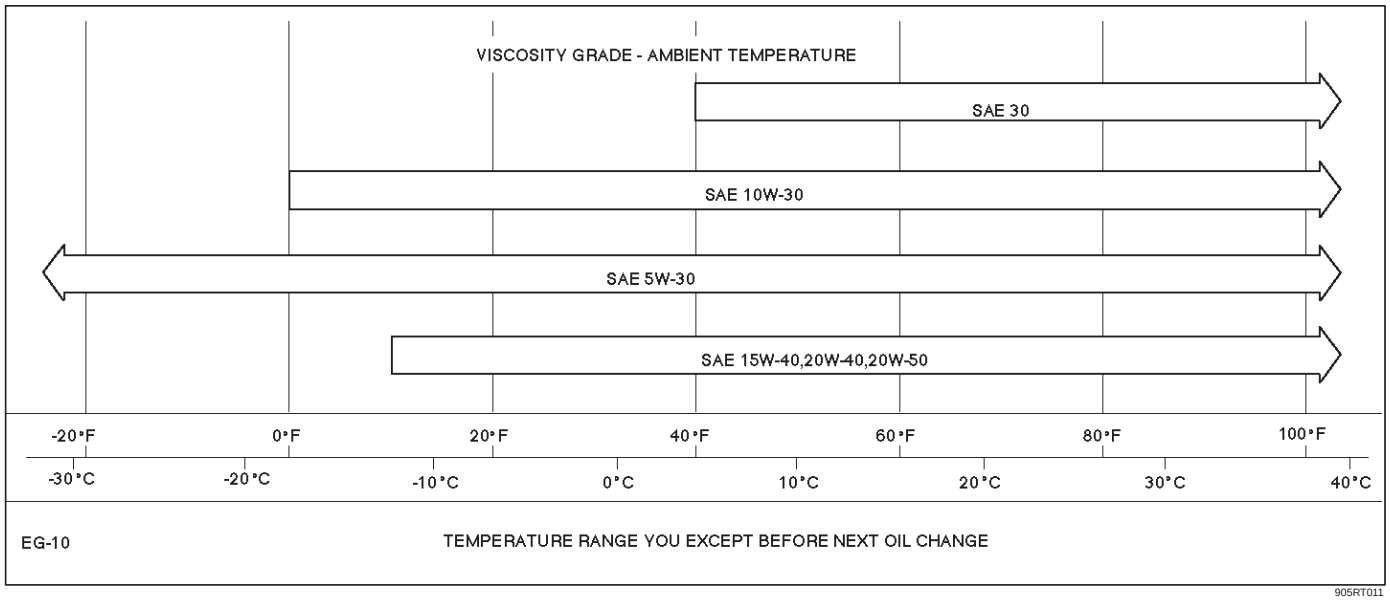
Recommended Fluids and Lubricants

USAGE	FLUID/LUBRICANT
Engine	API SE, SF, SG, SH or ILSAC GF-1 Engine oil (See oil chart on the following page for proper viscosity)
Engine coolant	Mixture of water and good quality ethylene glycol base type antifreeze.
Brake system	DOT-3 hydraulic brake fluid.
Power steering system	DEXRON® -III Automatic transmission fluid.
Automatic transmission	DEXRON® -III Automatic transmission fluid.
TOD SYSTEM (TOD system model only)	DEXRON® -IIE or DEXRON® -III Automatic transmission fluid.
Rear axle and front axle	GL-5 gear lubricant (Standard differential) GL-5 Limited slip differential gear lubricant together with limited slip differential lubricant additive (Part No. 8-01052-358-0) or equivalent (If equipped with optional limited slip differential) (See oil chart in this section for proper viscosity)
Hood latch assembly a. Pivots and spring anchor b. Release pawl	 Engine oil Chassis grease
Hood and door hinges	Engine oil
Chassis lubrication	Chassis grease
Parking brake cables	Chassis grease
Front wheel bearings	Multipurpose grease
Shift on the fly system	GL-5 gear lubricant (SAE 75W-90)
Body door hinge pins and linkage, fuel door hinge, rear compartment lid hinges	Engine oil
Windshield washer solvent	Washer fluid
Key lock cylinder	Synthetic light weight engine oil (SAE 5W-30)
Accelerator linkage	Chassis grease

Lubricant Viscosity Chart

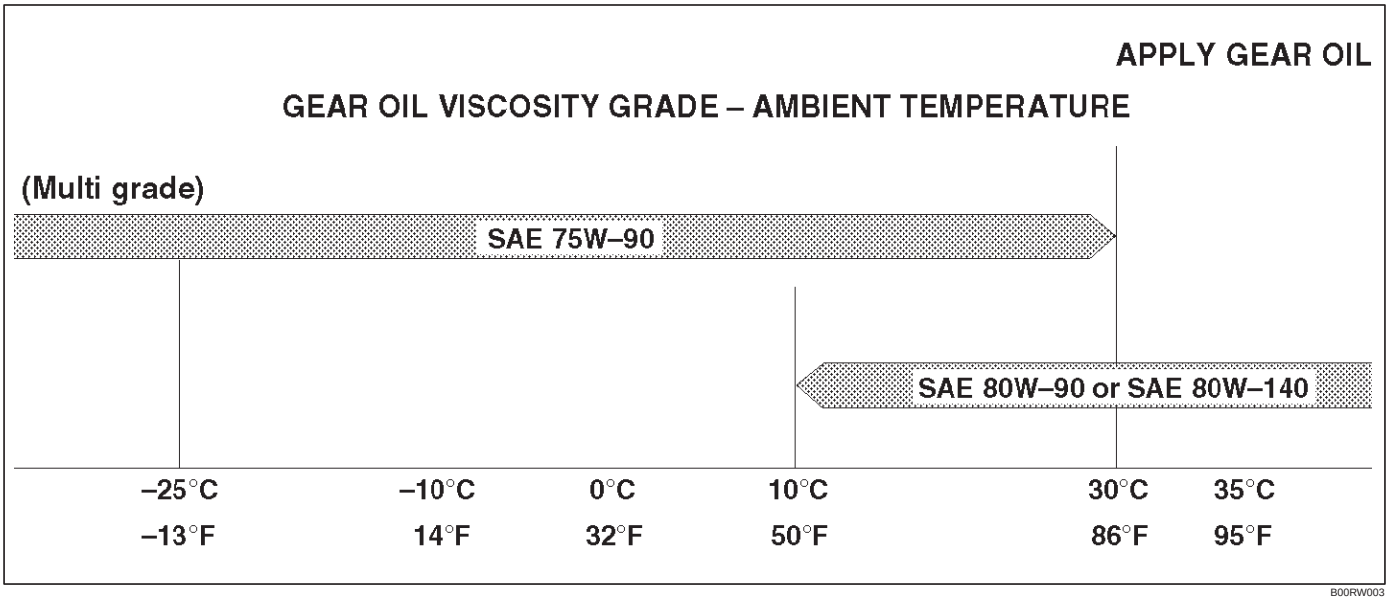
Lubricants should be carefully selected according to the lubrication chart. It is also important to select viscosity of lubricants according to the ambient temperature by referring to the following table.

Oil Viscosity Chart for Gasoline Engine



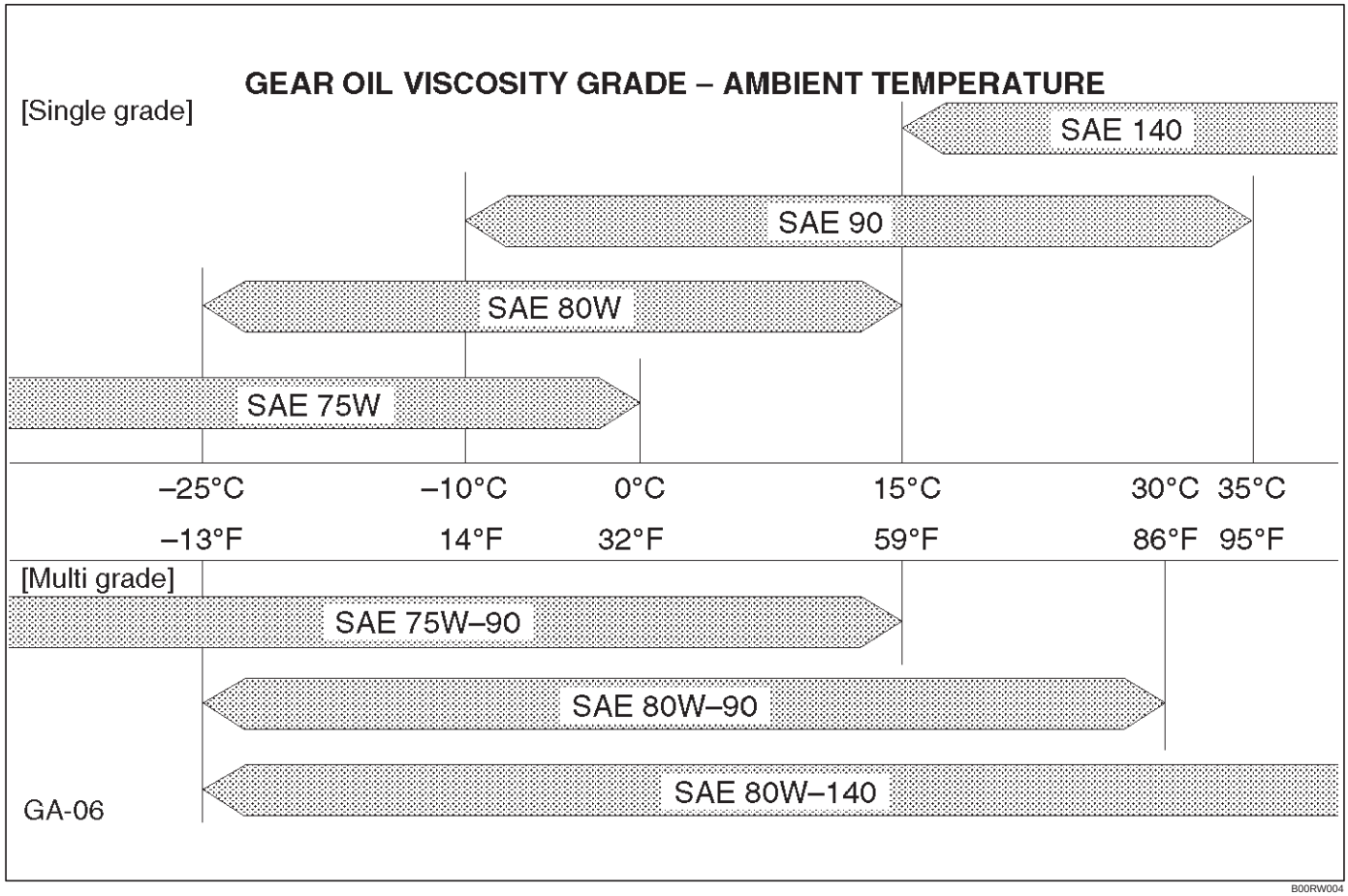
905RT011

Oil Viscosity Chart for Front Axle



B00RW003

Oil Viscosty Chart for Rear Axle



B0ORW004

Recommended Liquid Gasket

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	Three Bond 1207B Three Bond 1207C Three Bond 1215 Three Bond 1280 Three Bond 1281	Three Bond Three Bond Three Bond Three Bond Three Bond	For Engine Repairs For Axle Case Repairs T/M Repairs T/M
Water Base	Three Bond 1141E	Three Bond	For Engine Repairs
Solvent	Three Bond 1104 Belco Bond 4 Belco Bond 401 Belco Bond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anaerobic	LOCTITE 515 LOCTITE 518 LOCTITE 17430	Loctite Loctite Loctite	All

* RTV: Room Temperature Vulcanizer

NOTE:

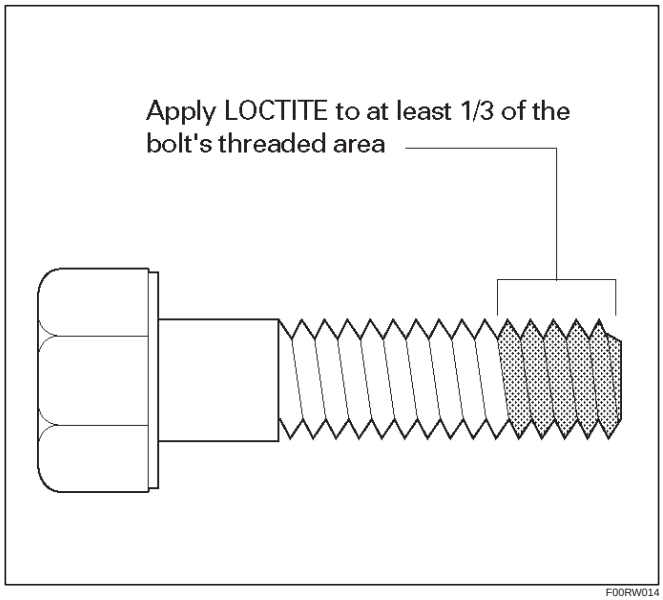
1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
2. Be careful to use the specified amount of liquid gasket.
   Follow the manufacturer's instructions at all times.
3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
   The connecting surfaces must be perfectly dry.
4. Do not apply LOCTITE 17430, LOCTITE 515 and LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

Recommended Thread Locking Agents

LOCTITE Type	LOCTITE Color
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female-threaded surfaces of the parts to be joined.
   The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.



3. Tighten the bolts to the specified torque.
   After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

NOTE: When the application procedures are specified in this manual, follow them.

Maintenance Service Data

Service Data and Specifications

ENGINE	Valve clearance (cold)	Intake 0.28±0.05 mm (0.011±0.002 in) Exhaust 0.3±0.05 mm (0.012±0.002 in)
	Spark plug type	K16PR-P11/PK16PR11/RC10PYP4
	Spark plug gap	1.05 mm (0.04 in)
BRAKE	Brake pedal free play	6–10 mm (0.24–0.39 in)
	Parking brake travel	6–7 notches
WHEEL ALIGNMENT	Toe-in (Front)	0 to +2 mm (0 to +0.08 in)
	Toe-in (Rear)	0±5 mm (0±0.2 in)
	Camber (Front)	0˚±30’
	Camber (Rear)	0˚±1˚
	Caster (Front)	2˚30’±45’
	Toe–Axis (Rear)	±1˚
PROPELLER SHAFT	Flange torque	63 N·m (46 lb ft)
WHEEL AND TIRES	Size	P235/65R17
	Wheel nut torque	118 N·m (87 lb ft)
	Tire inflation pressure (Front)	180 kPa (26 psi)
	* Tire inflation pressure (Rear)	180 kPa (26 psi)

* Unless otherwise specified on tire information label on the vehicle.

Approximate Capacities

	Items	Metric Measure	U.S. Measure
Fuel tank		74 L	19.5 Gal.
* Crankcase	Oil Change with Filter	4.7 L	5.0 Qt
	Oil Change without Filter	4.0 L	4.2 Qt
Coolant	A/T	11.1 L	11.7 Qt
Transmission	Automatic	8.6 L	9.1 Qt
Transfer		1.35 L	1.4 Qt
Axle	Rear	1.77 L	1.87 Qt
	Front	1.25 L	1.33 Qt
Shift on the fly system		0.12 L	0.13 Qt
Power steering		1.0 L	1.1 Qt
Air conditioning (R-134a)		0.6 L	1.32 Qt

*Crankcase capacities shown are approximate refill capacities. After refill, recheck oil level.

AXIOM

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

HVAC SYSTEMS

CONTENTS

Service Precaution 1A–3
Heating and Ventilation System 1A–3
General Description 1A–3
Heater Unit 1A–6
Heater Unit and Associated Parts 1A–6
Removal 1A–6
Installation 1A–6
Heater Core and / or Mode Door 1A–7
Disassembled View 1A–7
Removal 1A–8
Inspection 1A–8
Installation 1A–8
Heater Mode Control Link Unit 1A–9
Disassembled View 1A–9
Removal 1A–9
Installation 1A–10
Heater Temperature Control Link Unit 1A–11
Disassembled View 1A–11
Removal 1A–11
Installation 1A–11
Blower Assembly 1A–12
Blower Assembly and Associated Parts 1A–12
Removal 1A–12
Installation 1A–12
Blower Link Unit and / or Mode door 1A–13
Disassembled View 1A–13
Removal 1A–13
Installation 1A–14
Blower Motor 1A–15
Blower Motor and Associated Parts 1A–15
Removal 1A–15
Installation 1A–15
Rear Heater Duct, Defroster Nozzle and Ventilation Duct 1A–16
Rear Heater Duct, Defroster Nozzle, Ventilation Duct and Associated Parts 1A–16
Removal 1A–16
Installation 1A–17
Air Conditioning System 1A–18
General Description 1A–18
Diagnosis 1A–24
Air Conditioning System 1A–31
Individual Inspection 1A–31
General Repair Procedure 1A–31
Leak Check 1A–33
Compressor Assembly 1A–38
Compressor Assembly and Associated Parts (6VE1) 1A–38
Removal 1A–38
Installation 1A–39
New Compressor Installation 1A–39
Condenser Assembly 1A–40
Condenser Assembly and Associated Parts 1A–40
Removal 1A–40
Installation 1A–41
Condenser Fan Motor 1A–42
Condenser Fan Motor and Associated Parts 1A–42
Removal 1A–42
Installation 1A–42
Receiver / Drier 1A–43
Receiver / Drier and Associated Parts 1A–43
Removal 1A–43
Installation 1A–43
Pressure Switch 1A–44
Pressure Switch and Associated Parts 1A–44
Removal 1A–44
Installation 1A–44
Evaporator Assembly 1A–45
Evaporator Assembly and Associated Parts 1A–45
Removal 1A–45
Installation 1A–46
Duct Sensor, Evaporator Core and/or Expansion Valve 1A–47
Disassembled View 1A–47
Removal 1A–47
Installation 1A–48
Refrigerant Line 1A–49
Refrigerant Line and Associated Parts 1A–49
Removal 1A–49
Installation 1A–50
Main Data And Specifications 1A–51

Compressor 1A–53
Service Precaution 1A–53
General Description 1A–53
Diagnosis 1A–54
Magnetic Clutch Assembly (DKV-14G Type) 1A–55
Parts Location View 1A–55
Removal 1A–55
Inspection and Repair 1A–57
Installation 1A–57
Compressor Oil 1A–59
Oil Specification 1A–59
Handling of Oil 1A–59
Compressor Oil Check 1A–59
Checking and Adjusting Oil Quantity for Used Compressor 1A–59
Checking and Adjusting for Compressor Replacement 1A–60
Contamination of Compressor Oil 1A–60
Oil Return Operation 1A–60
Replacement of Component Parts 1A–60
Main Data and Specifications 1A–61
Special Tools 1A–63
Automatic Air Conditioning System 1A–64
General Description 1A–64
Automatic Air Conditioner Parts Configuration 1A–64
Circuit Diagram 1A–65
Functions and Features 1A–70
Automatic Air Conditioner Block Diagram . 1A–71
Control Panel Layout 1A–72
Air Control Functions 1A–73
Control Panel Switch Operation 1A–74
Overview of Construction, Movement and Control of Major Parts of Automatic Air Conditioner System 1A–77
Overview of Automatic Control of Automatic Air Conditioner 1A–81
Automatic Air Conditioning System 1A–82
Troubleshooting 1A–86
Troubleshooting, Its Overview and Procedures 1A–86
Auto Air Conditioner Control Unit Power Supply Diagnosis 1A–87
Performance and Movement checklist for Automatic Air Conditioner Related Parts . 1A–89
Troubleshooting With Self-Diagnosis Function 1A–91
Inspection By Failed Location 1A–97
Inspection of the Sensors 1A–97
Inspection of the Intake Actuator System . 1A–101
Inspection of the Mix Actuator System 1A–104
Inspection of the Mode Actuator System . . 1A–107
Inspection of the Fan Motor System 1A–110
Inspection of the Magnetic Clutch System 1A–115
Individual Inspection 1A–118
On-Vehicle Service 1A–121
Power Transistor 1A–121
Removal 1A–121
Installation 1A–121
Automatic Heater/Air Conditioner Control Unit 1A–121
Removal 1A–121
Installation 1A–121
In Car Sensor 1A–122
Removal 1A–122
Installation 1A–122
Ambient Sensor 1A–122
Removal 1A–122
Installation 1A–122
Sun Sensor 1A–123
Removal 1A–123
Installation 1A–123
Duct Sensor 1A–123
Removal 1A–123
Installation 1A–123
Mode Actuator 1A–124
Removal 1A–124
Installation 1A–124
Mix Actuator 1A–124
Removal 1A–124
Installation 1A–124
Intake Actuator 1A–125
Removal 1A–125
Installation 1A–125

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Heating and Ventilation System

General Description

Heater

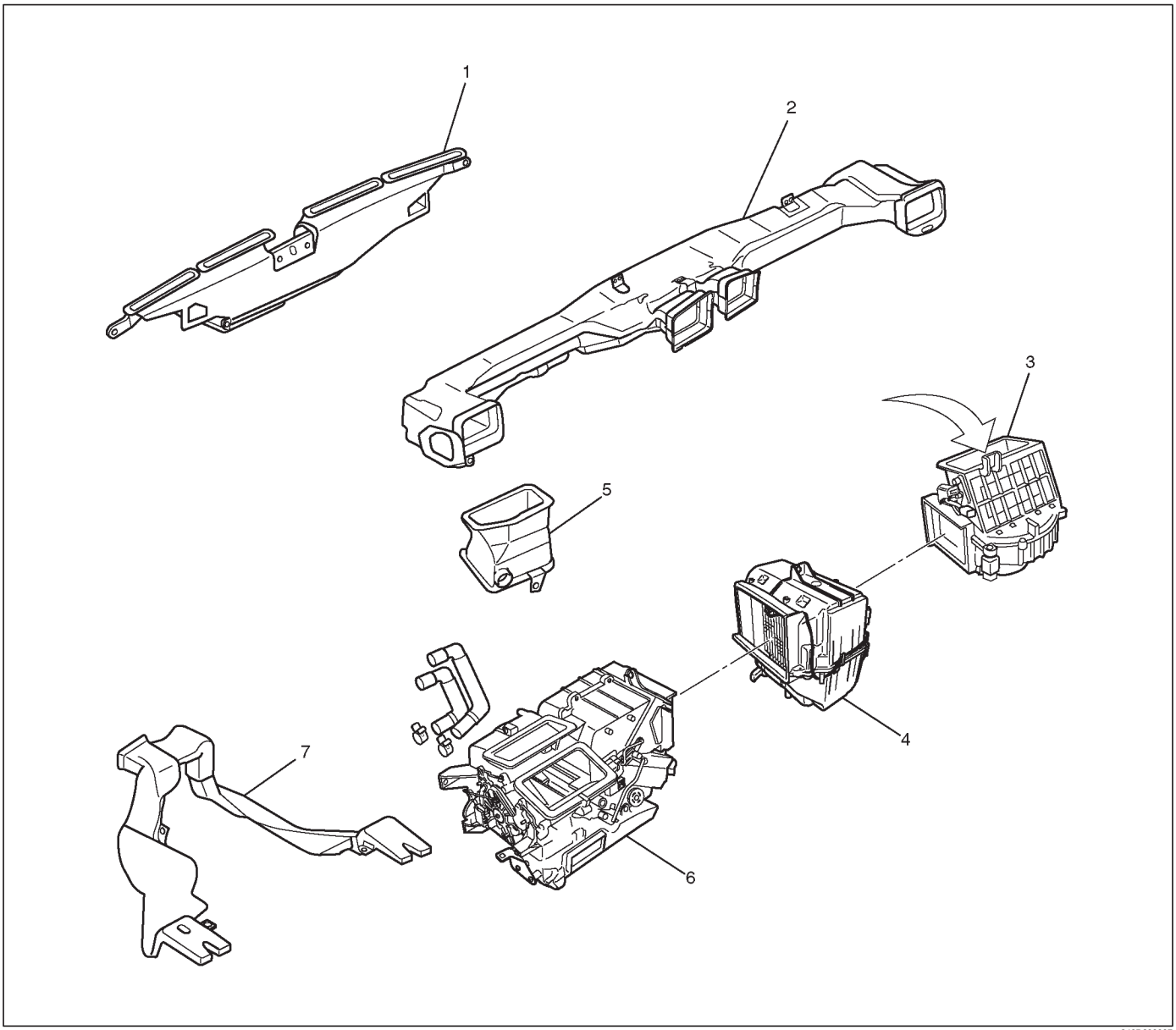
When the engine is warming up, the warmed engine coolant is sent into the heater core. The heater system supplies warm air into the passenger compartment to warm it up.

Outside air is circulated through the heater core of the heater unit and then into the passenger compartment. By controlling the mixture of outside air and heater core air, the most comfortable passenger compartment temperature can be selected and maintained.

The temperature of warm air sent to the passenger compartment is controlled by the temperature control knob. This knob acts to open and close the air mix door, thus controlling the amount of air passed through the heater core.

The air selector switch (Mode SW), with its different modes, also allows you to select and maintain the most comfortable passenger compartment temperature.

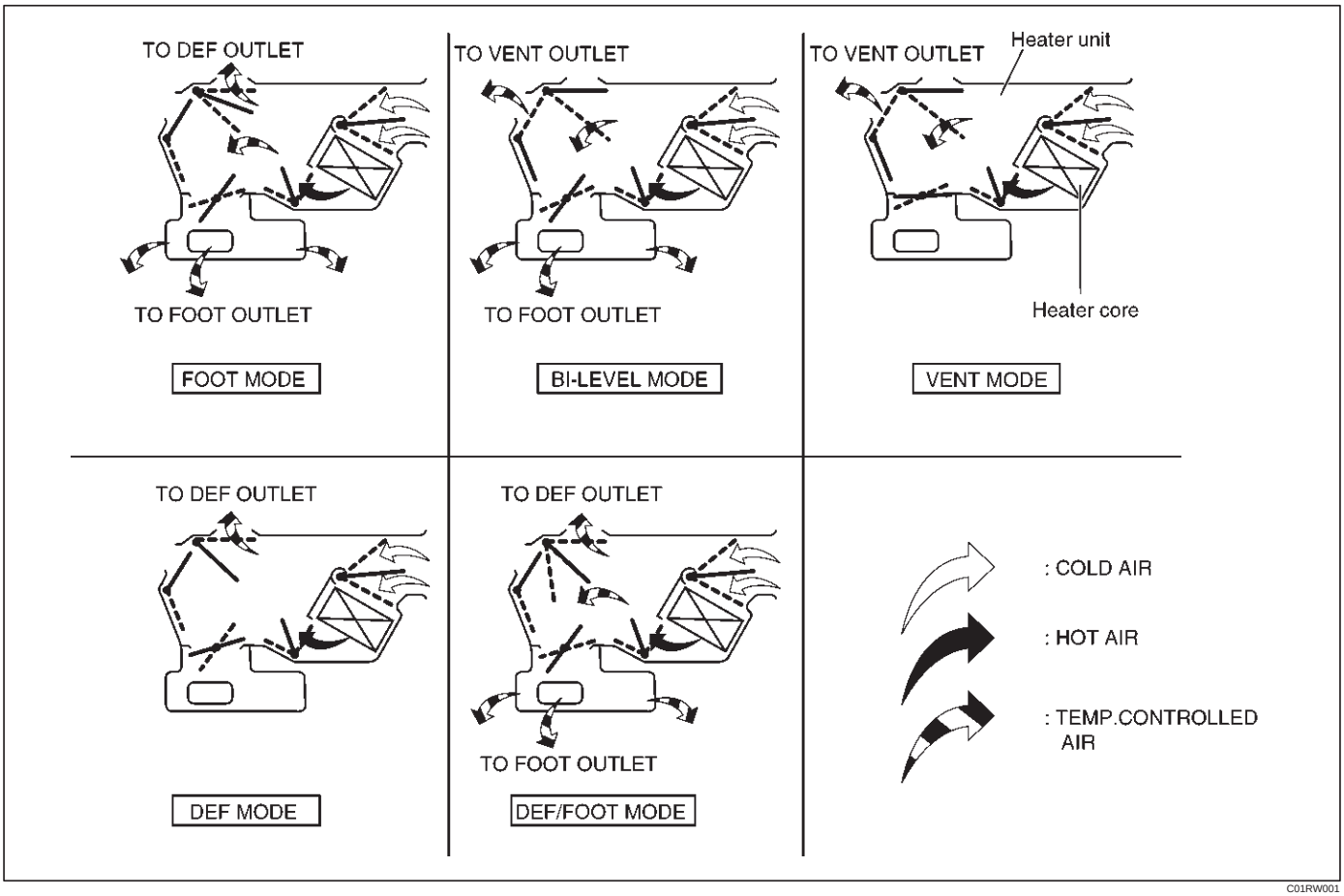
The air source select switch is used to select either “FRESH” for the introduction of the outside air, or “CIRC” for the circulation of the inside air. When the switch is set to “FRESH”, the outside air is always taken into the passenger compartment. When setting the switch to “CIRC” position, the circulation of air is restricted only to the inside air with no introduction of the outside air and the air in the passenger compartment gets warm quickly. However, the switch is normally set to “FRESH” to prevent the windshield from clouding.



840R200007

Legend

(1) Defroster Nozzle
(2) Ventilation Duct
(3) Blower Assembly
(4) Evaporator Assembly
(5) Ventilation Lower Duct
(6) Heater Unit
(7) Rear Heater Duct



Air Source Select Switch

Press this button to select either Fresh Air Intake or CIRC (inside air circulation). There is an indicator light inside the button. This light indicates that the CIRC mode is “ON”. Fresh Air Intake is the default setting for both DEFROST and FOOT/DEFROST.

Fan Control Switch

This switch controls the blower motor speed to regulate the amount of air delivered to the defrost, foot, and ventilation ducts:

1. L0
2. M1
3. M2
4. M3
5. HI

Temperature Control Switch

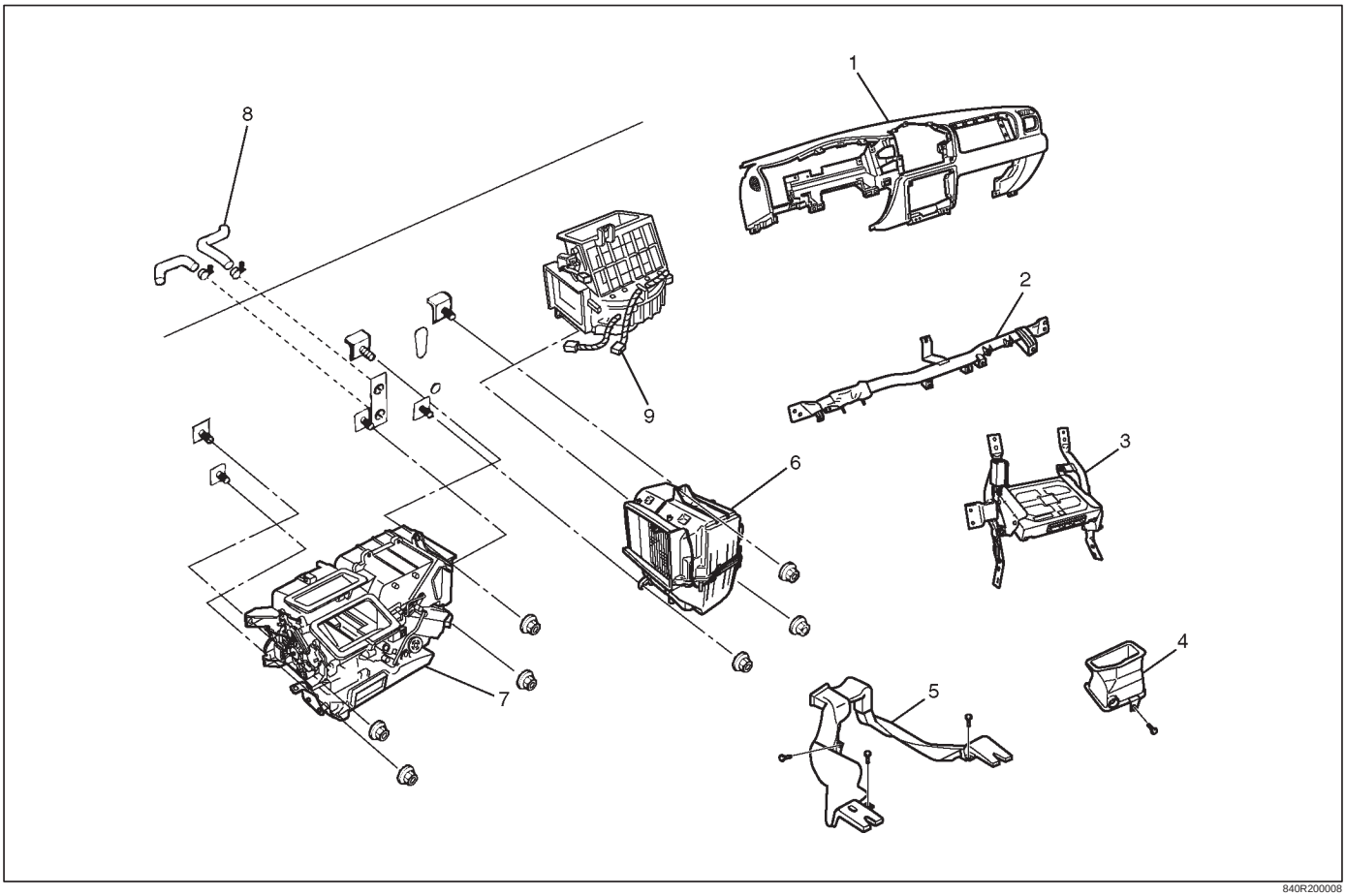
When the temperature control switch is in the “18˚C (65˚F)” position, the air mix door closes to block the air flow to the heater core.

When the temperature control switch is in the “32˚C (90˚F)” position, the air mix door opens to allow air to pass through the heater core and heat the passenger compartment.

Selecting the desired temperature will control the air flow through the heater core, allowing control of the cabin temperature.

Heater Unit

Heater Unit and Associated Parts



840R200008

Legend

(1) Instrument Panel Assembly
(2) Cross Beam Assembly
(3) Instrument Panel Bracket W/Suspension Control Unit
(4) Ventilation Lower Duct
(5) Rear Heater Duct
(6) Evaporator Assembly
(7) Heater Unit Assembly
(8) Heater Hose
(9) Power Transistor Connector

Removal

1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   ▼Refer to *Refrigerant Recovery in this section.*
4. Remove the Instrument panel assembly.
   ▼Refer to *Instrument Panel Assembly in Body and Accessories section.*
5. Remove instrument panel bracket w/suspension control unit.
   ▼Refer to *Cross Beam Assembly in Body and Accessories section.*
6. Cross Beam Assembly.
   ▼Refer to *Cross Beam Assembly in Body and Accessories section.*
7. Disconnect power transistor connector.
8. Remove evaporator assembly.
   ▼Refer to *Evaporator Assembly in this section.*
9. Remove ventilation lower duct.
10. Remove rear heater duct.
    ▼Remove foot rest, carpet and 3 clips.
11. Disconnect mode/mix actuator connector.
12. Remove heater unit assembly.
    ▼Disconnect heater hoses at heater unit.

Installation

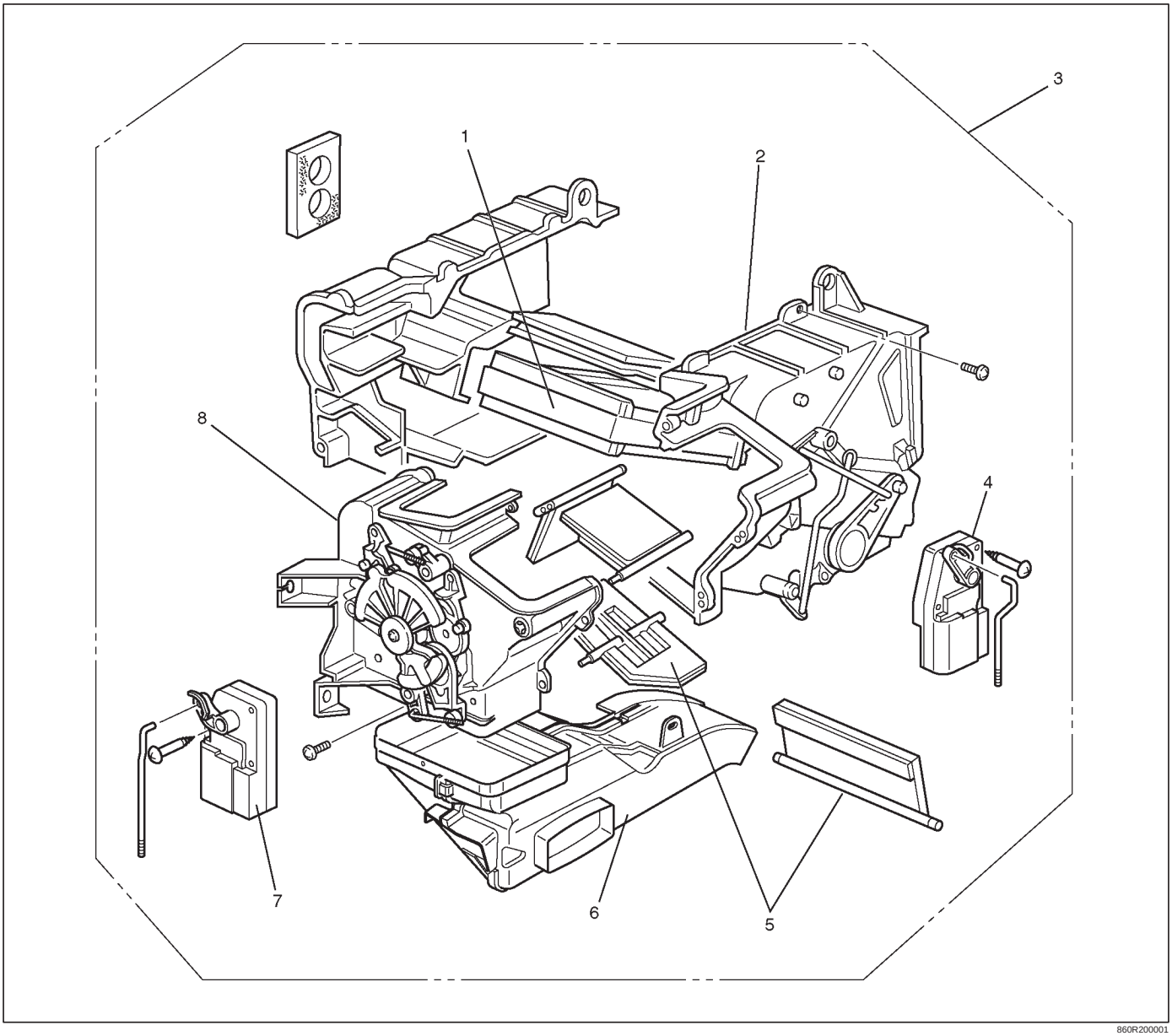
To install, follow the removal steps in the reverse order, noting the following points:

1. When handling the PCM and the control unit, be careful not to make any improper connection of the connectors.

2. When installing the heater unit, defroster nozzle and center vent duct, be sure that the proper seal is made, without any gap between them.

Heater Core and / or Mode Door

Disassembled View



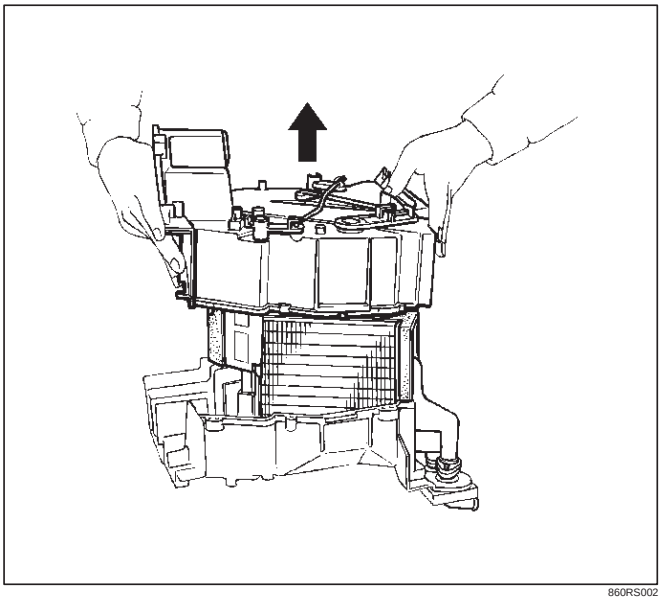
860R200001

Legend

(1) Heater Core
(2) Case (Temperature Control)
(3) Heater Unit
(4) Mix Actuator
(5) Mode Door
(6) Duct
(7) Mode Actuator
(8) Case (Mode Control)

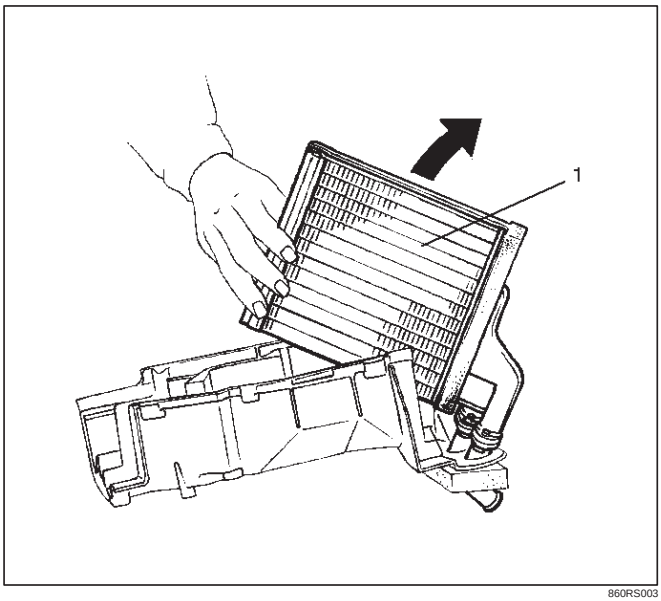
Removal

1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   ▼Refer to *Refrigerant Recovery in this section.*
4. Remove heater unit.
   ▼Refer to *Heater Unit in this section.*
5. Remove duct.
6. Remove mix actuator.
7. Remove mode actuator.
8. Remove case (Mode control) and do not remove link unit at this step.
9. Remove case (Temperature control) separate two halves of core case.



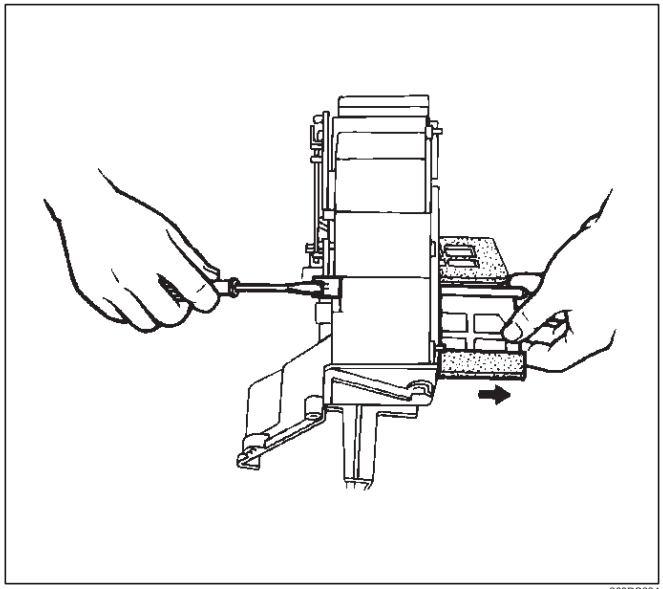
860RS002

10. Remove heater core (1).



860RS003

11. Pull out the mode door while raising up the catch of the door lever.



860RS004

Inspection

Check for foreign matter in the heater core, stain or the core fin defacement.

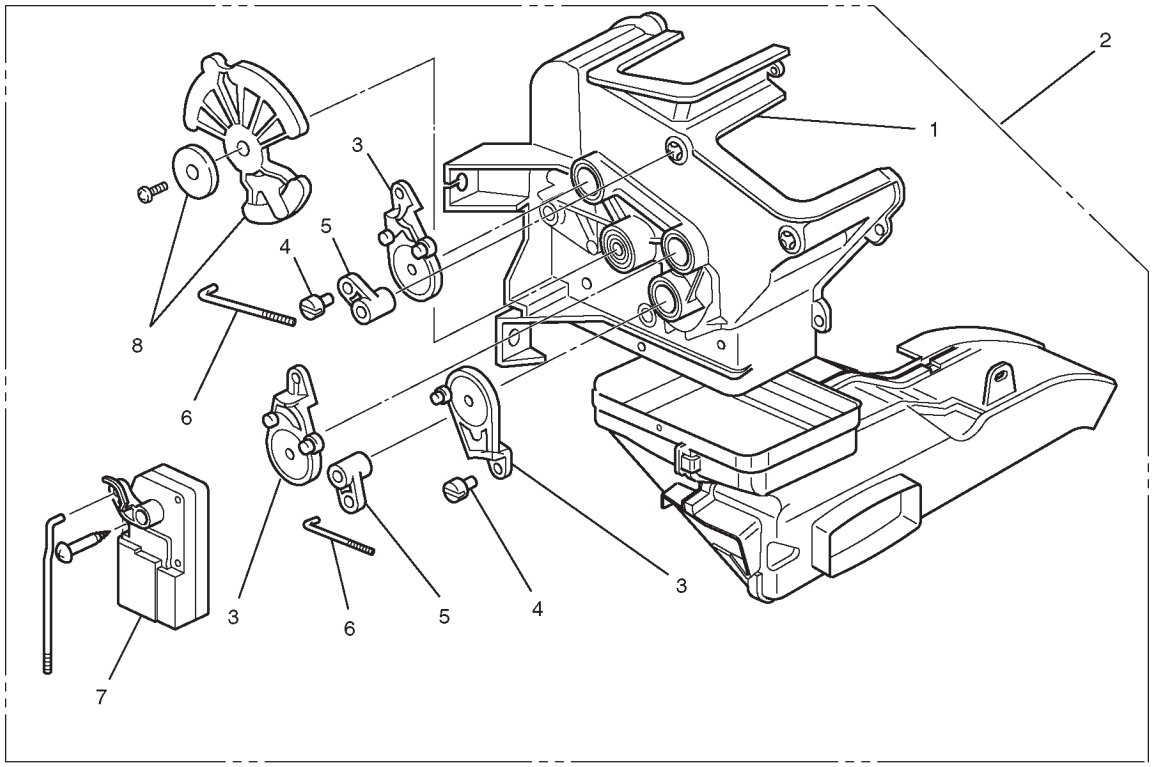
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Check that each mode door operates properly.

Heater Mode Control Link Unit

Disassembled View



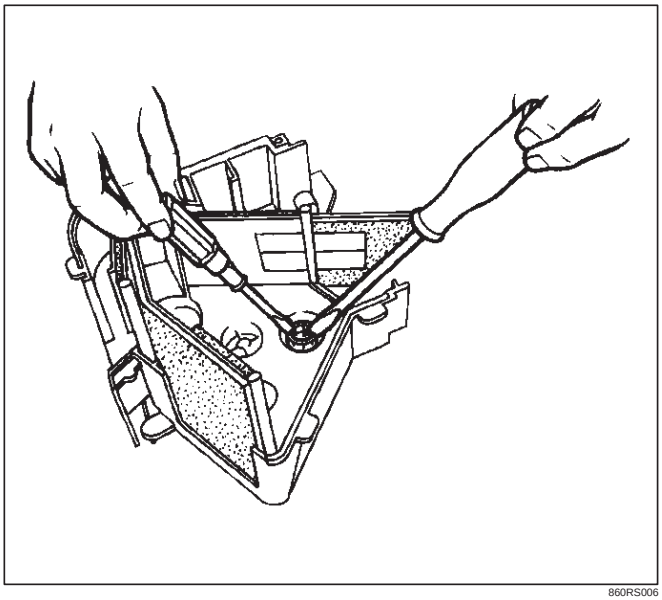
860R200002

Legend

(1) Case (Mode Control)
(2) Heater Unit
(3) Mode Sub-lever
(4) Clip
(5) Door Lever
(6) Rod
(7) Mode Actuator
(8) Washer and Mode Main Lever

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning)
   ▼Refer to *Refrigerant Recovery in this section.*
4. Remove heater unit.
   ▼Refer to *Heater Unit in this section.*
5. Remove mode actuator.
6. Remove the case (Mode control) from heater unit.
7. Remove washer and the mode main lever.
8. Remove rod.
9. Press the tab of the sub-lever inward, and take out the sub-lever.



860RS006

10. Pull out the door lever while raising up the catch of the door lever.
11. Remove clip.

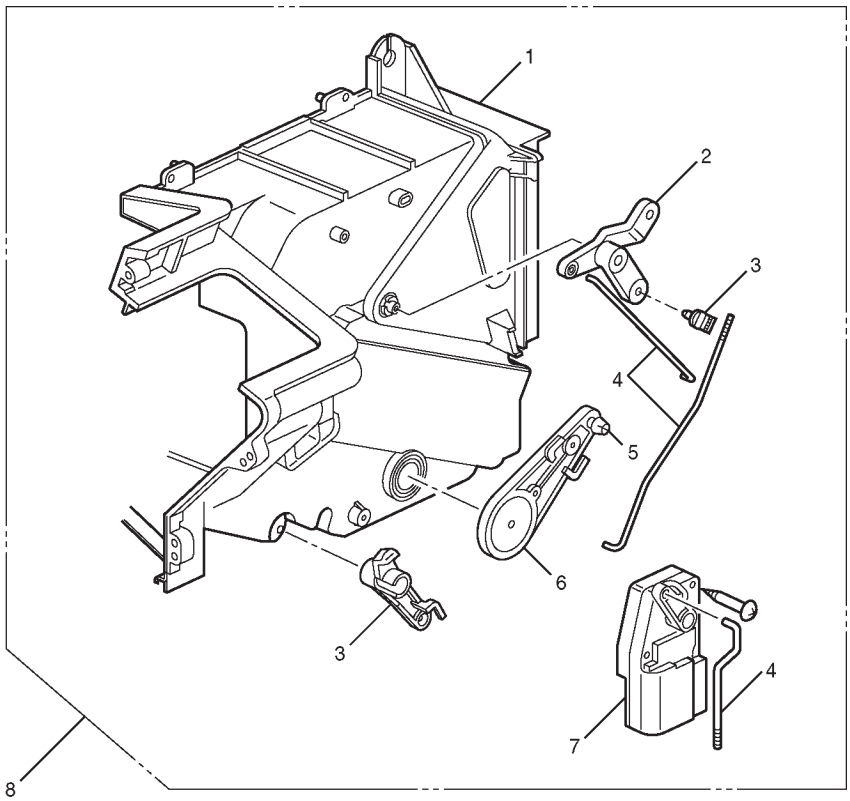
Installation

To install, follow the remove steps in the reverse order, noting the following points:

1. Apply grease to the mode sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Heater Temperature Control Link Unit

Disassembled View



860R200003

Legend

(1) Case (Temperature control)
(2) Door Lever
(3) Clip
(4) Rod
(5) Clip
(6) Sub-lever
(7) Mix Actuator
(8) Heater Unit

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning).

   ▼Refer to *Refrigerant Recovery in this section.*
4. Remove heater unit.

   ▼Refer to *Heater Unit in this section.*
5. Remove mix actuator.
6. Remove the case (Temperature control) from the heater unit.
7. Remove rod.
8. Remove sub-lever.
9. Pull out the door lever while raising up the catch of the door lever.
10. Remove clip.

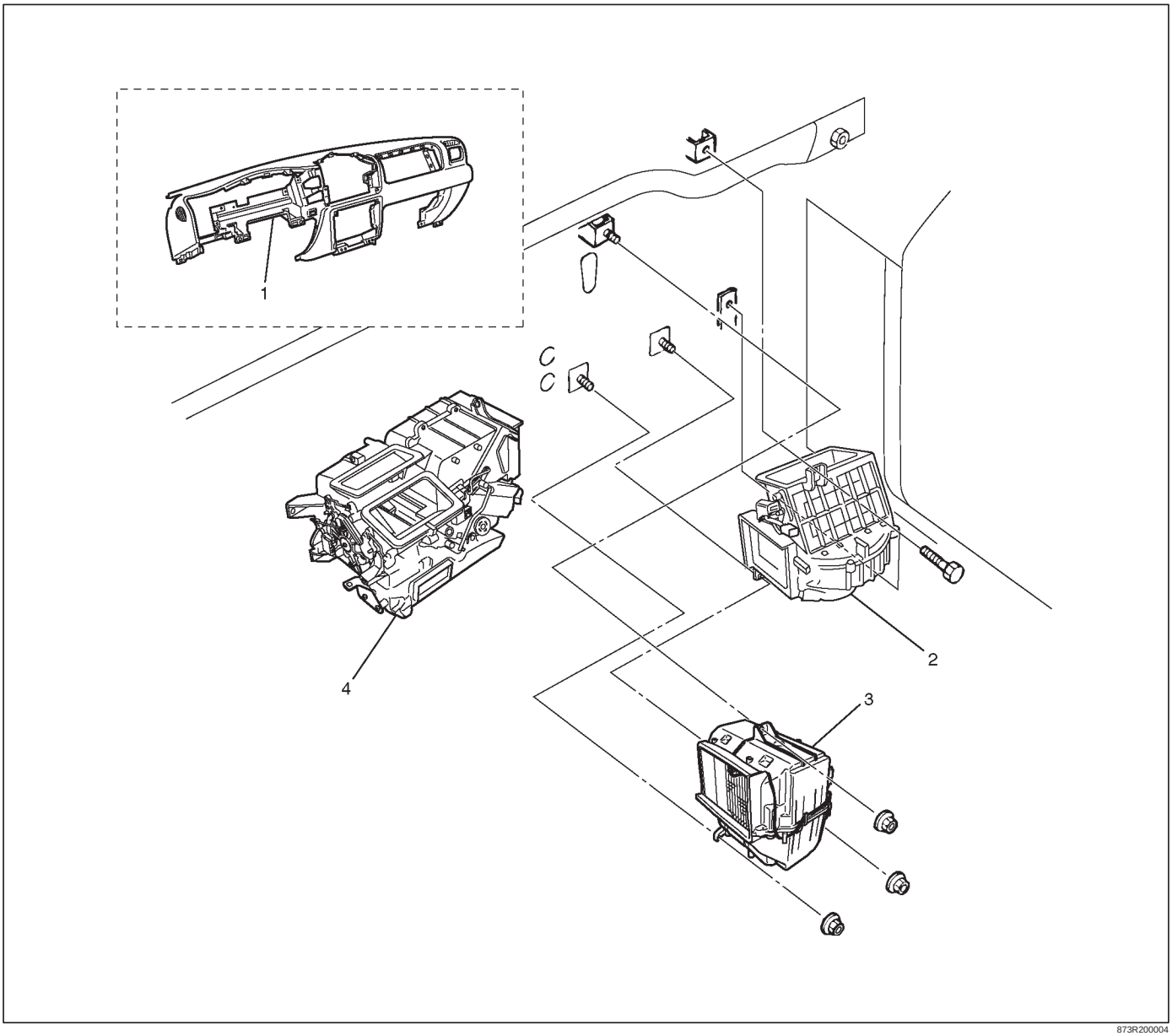
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Blower Assembly

Blower Assembly and Associated Parts



873R200004

Legend

(1) Instrument Panel Assembly
(2) Blower Assembly
(3) Evaporator Assembly
(4) Heater Unit

Removal

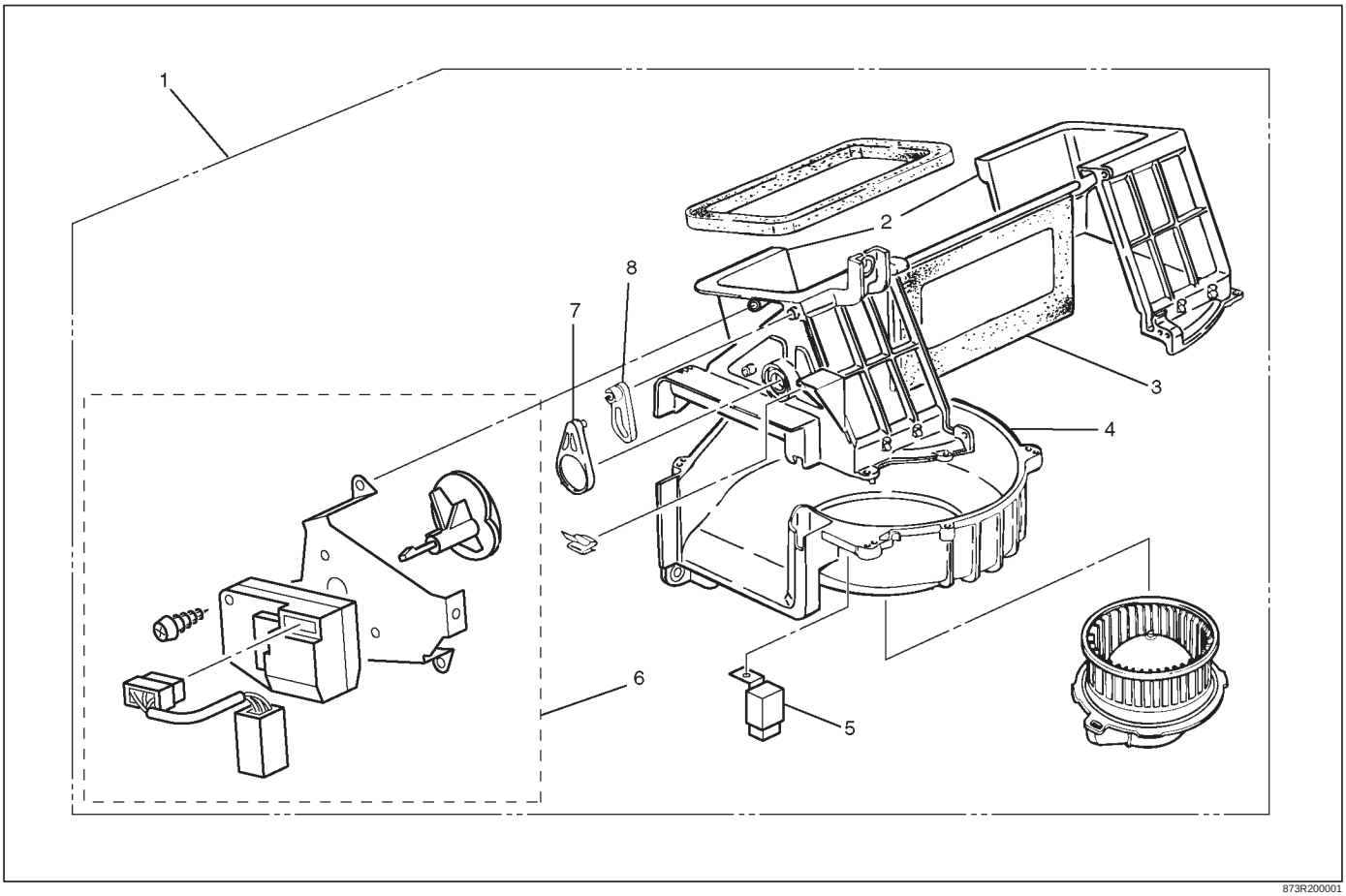
1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove instrument panel assembly.
   ▼Refer to *Instrument Panel Assembly in Body and Accessories section.*
4. Disconnect power transistor connector.
5. Remove evaporator assembly.
   ▼Refer to *Evaporator Assembly in this section.*
6. Disconnect blower motor/intake actuator connector.
7. Remove blower assembly.

Installation

To install, follow the removal steps in the reverse order.

Blower Link Unit and / or Mode door

Disassembled View



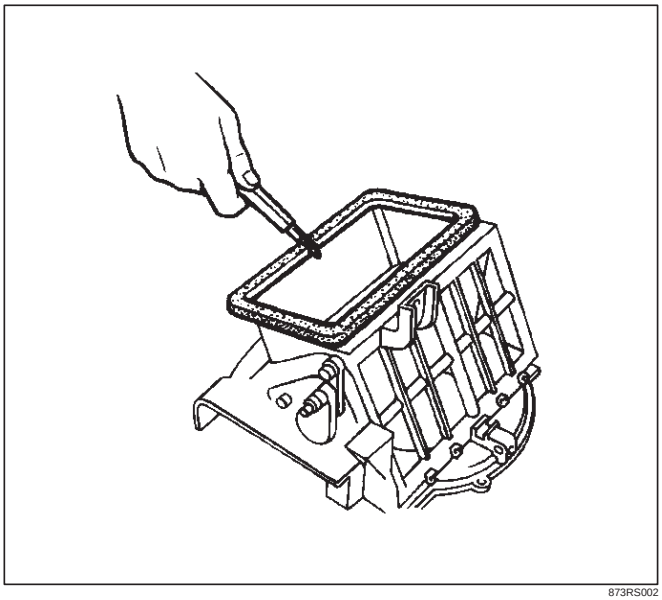
873R200001

Legend

(1) Blower Assembly
(2) Upper Case
(3) Mode Door
(4) Lower Case
(5) Max High Relay
(6) Intake Actuator
(7) Sub Lever
(8) Door Lever

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove blower assembly.
   ▼Refer to *Blower Assembly in this section.*
4. Remove intake actuator.
5. Remove max high relay.
6. Remove lower case.
7. Separate the upper case and slit the lining parting face with a knife.



873RS002

8. Pull out the mode door while raising up the catch of door lever.
9. Remove sub-lever.
10. Remove door lever.

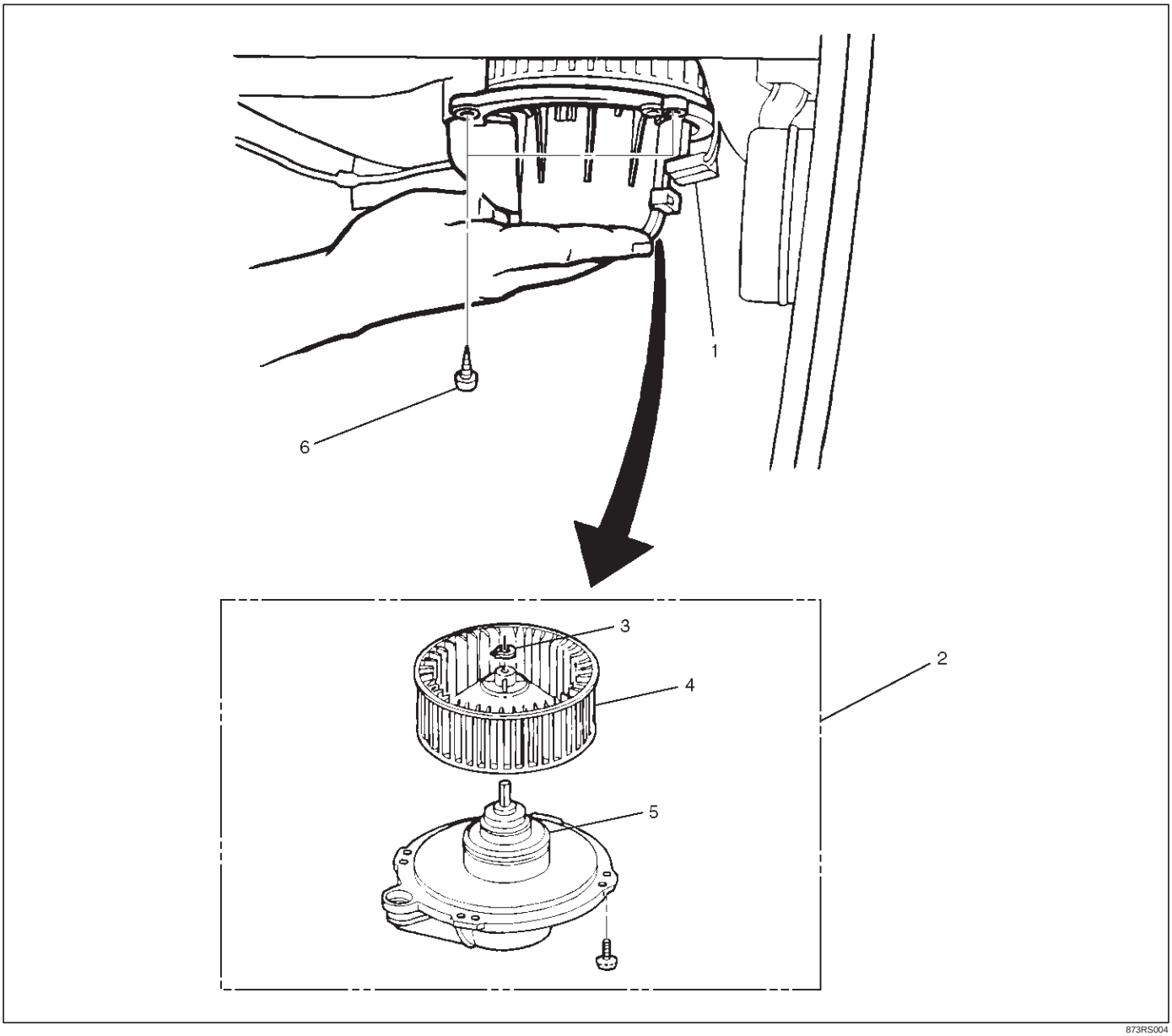
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the door lever and to the abrasive surface of the upper case.
2. Apply an adhesive to the parting face of the lining when assembling the upper case.

Blower Motor

Blower Motor and Associated Parts



873RS004

Legend

(1) Blower Motor Connector
(2) Blower Motor Assembly
(3) Clip
(4) Fan
(5) Blower Motor
(6) Attaching Screw

Removal

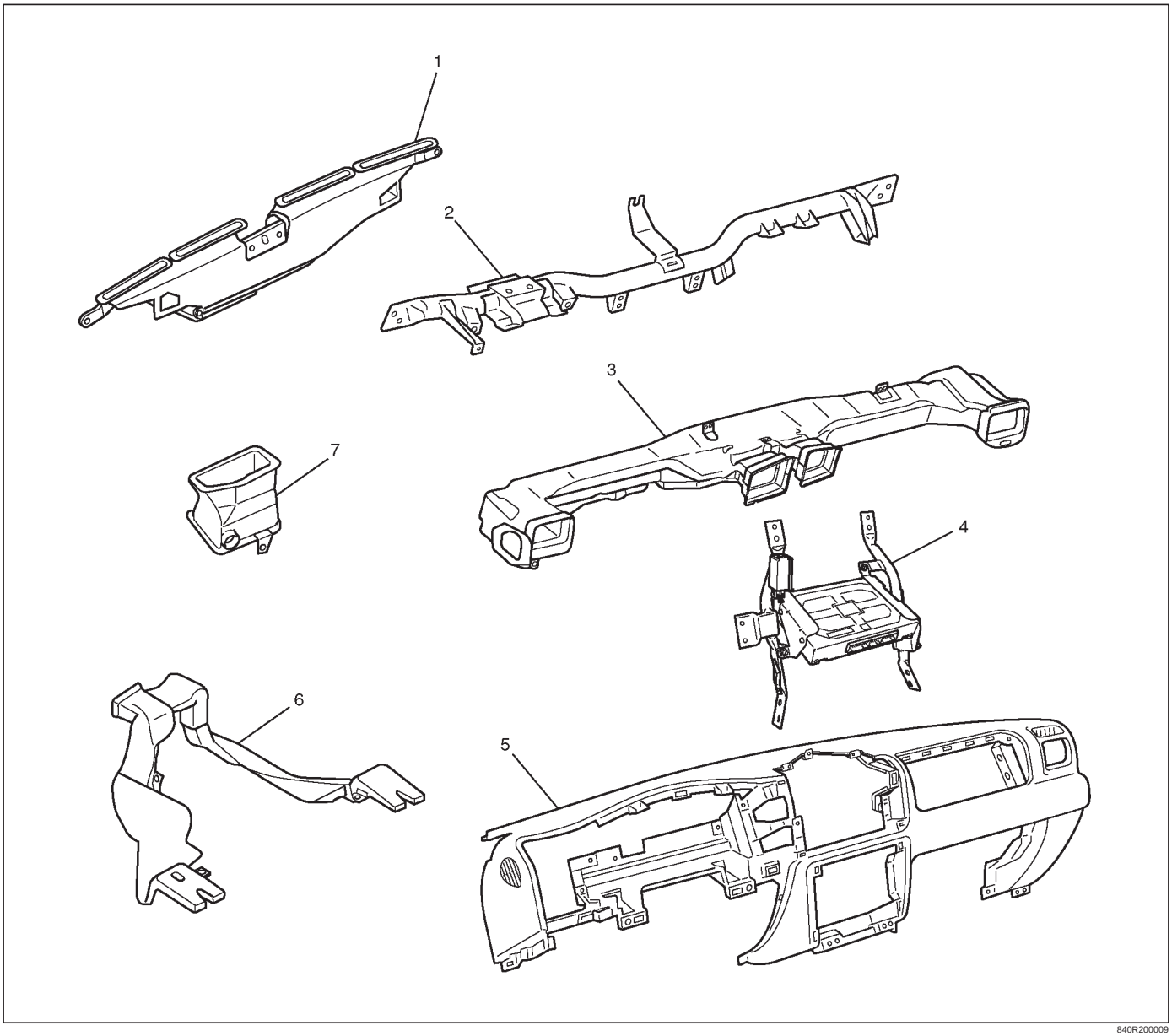
1. Disconnect the battery ground cable.
2. Remove blower motor connector.
3. Remove attaching screw.
4. Remove blower motor assembly.
5. Remove clip.
6. Remove fan.
7. Remove blower motor.

Installation

To install, follow the removal steps in the reverse order.

Rear Heater Duct, Defroster Nozzle and Ventilation Duct

Rear Heater Duct, Defroster Nozzle, Ventilation Duct and Associated Parts



840R200009

Legend

(1) Defroster Nozzle
(2) Cross Beam Assembly
(3) Center Ventilation Duct and Side Defroster Duct
(4) Instrument Panel Bracket W/Suspension Control Unit
(5) Instrument Panel Assembly
(6) Rear Heater Duct
(7) Ventilation Lower Duct

Removal

1. Disconnect the battery ground cable.
2. Remove instrument panel assembly.
   ▼Refer to *Instrument Panel Assembly in Body and Accessories section.*
3. Remove center ventilation duct and side defroster duct.
   ▼Remove 5 screws.
4. Remove instrument panel brackets w/suspension control unit.
   ▼Refer to *Cross Beam Assembly in Body and Accessories section.*
5. Remove cross beam assembly.
   ▼Refer to *Cross Beam Assembly in Body and Accessories section.*
6. Remove ventilation lower duct.

7. Remove rear heater duct.
   ▼Remove foot rest carpet and 3 clips.
8. Remove defroster nozzle.

Installation

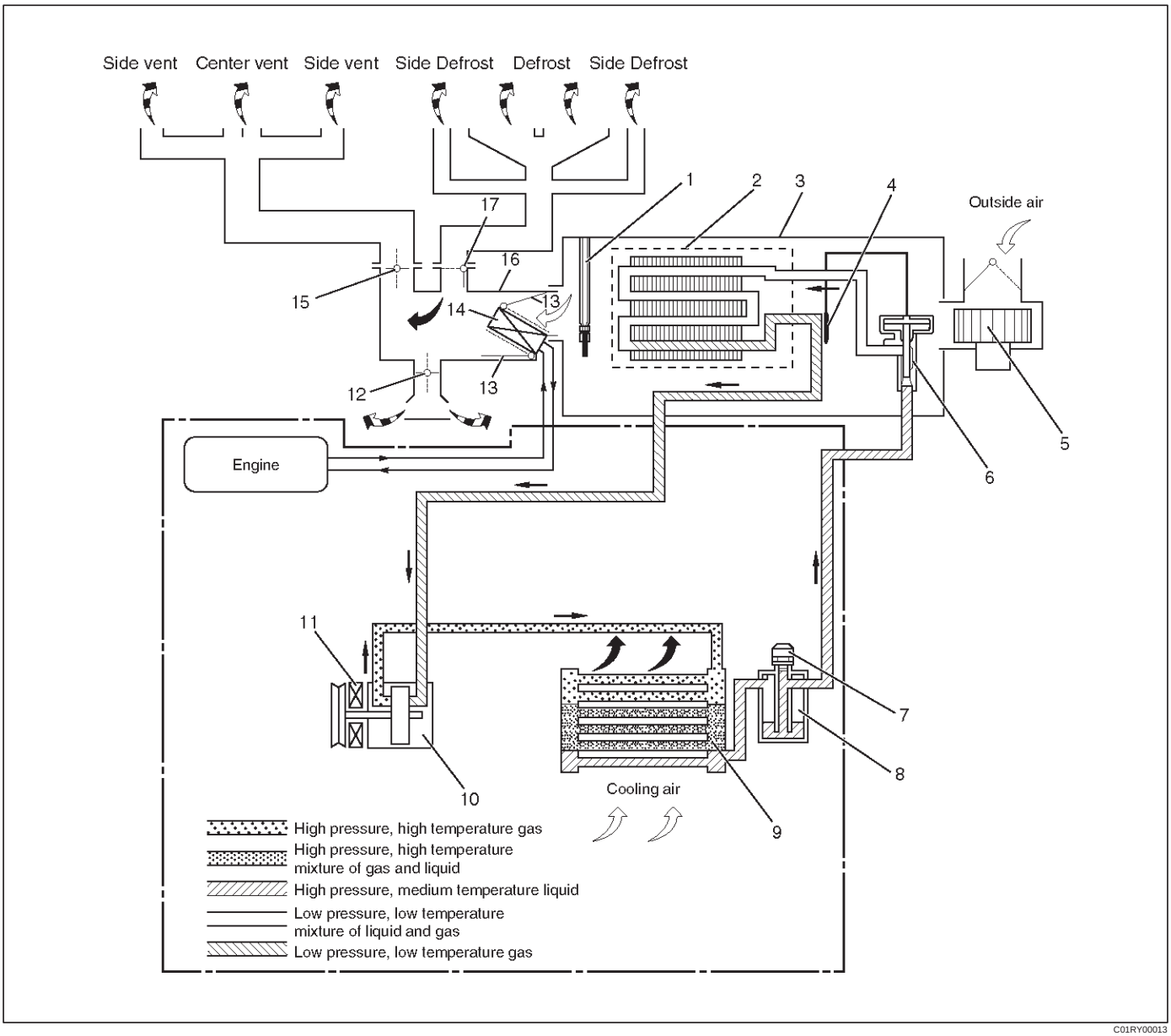
To install, follow the removal steps in the reverse order, noting the following point:

1. Connect each duct and nozzle securely leaving no clearance between them and making no improper matching.

Air Conditioning System

General Description

Air Conditioning Refrigerant Cycle Construction



C01RY00013

Legend

(1) Duct Sensor
(2) Evaporator Core
(3) Evaporator Assembly
(4) Temperature Sensor
(5) Blower Motor
(6) Expansion Valve
(7) Pressure Switch
(8) Receiver/Drier
(9) Condenser
(10) Compressor
(11) Magnetic Clutch
(12) Mode (HEAT) Control Door
(13) Temp. Control Door (Air Mix Door)
(14) Heater Core
(15) Mode (VENT) Control Door
(16) Heater Unit
(17) Mode (DEF) Control Door

The refrigeration cycle includes the following four processes as the refrigerant changes repeatedly from liquid to gas and back to liquid while circulating.

Evaporation

The refrigerant is changed from a liquid to a gas inside the evaporator. The refrigerant mist that enters the evaporator vaporizes readily. The liquid refrigerant removes the required quantity of heat (latent heat of vaporization) from the air around the evaporator core cooling fins and rapidly vaporizes. Removing the heat cools the air, which is then radiated from the fins and lowers the temperature of the air inside the vehicle.
The refrigerant liquid sent from the expansion valve and the vaporized refrigerant gas are both present inside the evaporator as the liquid is converted to gas.
With this change from liquid to gas, the pressure inside the evaporator must be kept low enough for vaporization to occur at a lower temperature. Because of that, the vaporized refrigerant is sucked into the compressor.

Compression

The refrigerant is compressed by the compressor until it is easily liquefied at normal temperature.
The vaporized refrigerant in the evaporator is sucked into the compressor. This action maintains the refrigerant inside the evaporator at a low pressure so that it can easily vaporize, even at low temperatures close to 0˚C (32˚F).
Also, the refrigerant sucked into the compressor is compressed inside the cylinder to increase the pressure and temperature to values such that the refrigerant can easily liquefy at normal ambient temperatures.

Condensation

The refrigerant inside the condenser is cooled by the outside air and changes from gas to liquid.
The high temperature, high pressure gas coming from the compressor is cooled and liquefied by the condenser with outside air and accumulated in the receiver/drier. The heat radiated to the outside air by the high temperature, high pressure gas in the compressor is called heat of condensation. This is the total quantity of heat (heat of vaporization) the refrigerant removes from the vehicle interior via the evaporator and the work (calculated as the quantity of heat) performed for compression.

Expansion

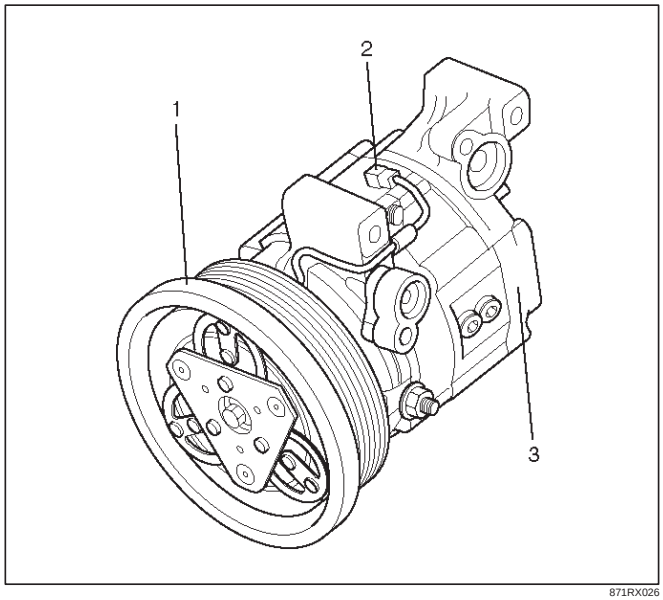
The expansion valve lowers the pressure of the refrigerant liquid so that it can easily vaporize.
The process of lowering the pressure to encourage vaporization before the liquefied refrigerant is sent to the evaporator is called expansion. In addition, the expansion valve controls the flow rate of the refrigerant liquid while decreasing the pressure.
That is, the quantity of refrigerant liquid vaporized inside the evaporator is determined by the quantity of heat which must be removed at a prescribed vaporization temperature. It is important that the quantity of refrigerant be controlled to exactly the right value.

Compressor

The compressor performs two main functions:
It compresses low-pressure and low-temperature refrigerant vapor from the evaporator into high-pressure and high-temperature refrigerant vapor to the condenser.
It pumps refrigerant and refrigerant oil through the air conditioning system.
This vehicle is equipped with a five-vane rotary compressor.
The specified amount of the compressor oil is 150cc (5.0 fl. oz.).
The oil used in the HFC-134a system compressor differs from that used in R-12 systems.
Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.
If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.
The magnetic clutch connector is a waterproof type.

Magnetic Clutch

The compressor is driven by the drive belt from the crank pulley of the engine. If the compressor is activated each time the engine is started, this causes too much load to the engine. The magnetic clutch transmits the power from the engine to the compressor and activates it when the air conditioning is ON. Also, it cuts off the power from the engine to the compressor when the air conditioning is OFF. Refer to *Compressor in this section for magnetic clutch repair procedure.*



871RX026

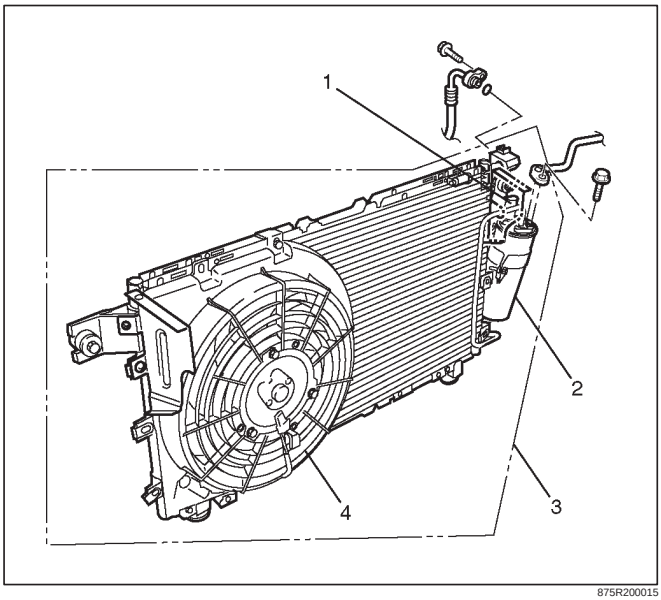
Legend

(1) Magnetic Clutch
(2) Magnetic Clutch Connector
(3) Compressor

Condenser

The condenser assembly is located in front of the radiator. It provides rapid heat transfer from the refrigerant to the cooling fins.
Also, it functions to cool and liquefy the high-pressure and high-temperature vapor sent from the compressor by the radiator fan or outside air.

A condenser may malfunction in two ways: it may leak, or it may be restricted. A condenser restriction will result in excessive compressor discharge pressure. If a partial restriction is present, the refrigerant expands after passing through the restriction.
Thus, ice or frost may form immediately after the restriction. If air flow through the condenser or radiator is blocked, high discharge pressures will result. During normal condenser operation, the refrigerant outlet line will be slightly cooler than the inlet line.
The vehicle is equipped with the parallel flow type condenser. A larger thermal transmission area on the inner surface of the tube allows the radiant heat to increase and the ventilation resistance to decrease.
The refrigerant line connection has a bolt at the block joint, for easy servicing.



875R200015

Legend
(1) Pressure Switch
(2) Receiver Drier
(3) Condenser & Receiver Tank Assembly
(4) Condenser Fan

Receiver / Drier

The receiver/drier performs four functions:

- As the quantity of refrigerant circulated varies depending on the refrigeration cycle conditions, sufficient refrigerant is stored for the refrigeration cycle to operate smoothly in accordance with fluctuations in the quantity circulated.
- The liquefied refrigerant from the condenser is mixed with refrigerant gas containing air bubbles. If refrigerant containing air bubbles. If refrigerant containing air bubbles is sent to the expansion valve, the cooling capacity will decrease considerably. Therefore, the liquid and air bubbles are separated and only the liquid is sent to the expansion valve.
- The receiver/drier utilizes a filter and drier to remove the dirt and water mixed in the cycling refrigerant.

A receiver/drier may fail due to a restriction inside the body of the unit. A restriction at the inlet to the receiver/drier will cause high pressure.
Outlet restrictions will be indicated by low pressure and little or no cooling. An excessively cold receiver/drier outlet may indicate a restriction.
The receiver/drier of this vehicle is made of aluminum with a smaller tank. It has a 300cc refrigerant capacity.
The refrigerant line connection has a bolt at the block joint, for easy servicing.

Triple Pressure Switch (V6, A/T)

Triple pressure switch is installed on the upper part of the receiver/drier. This switch is constructed with a unitized type of two switches. One of them is a low and high pressure switch (Dual pressure switch) to switch “ON” or “OFF” the magnetic clutch as a result of irregularly high–pressure or low pressure of the refrigerant. The other one is a medium pressure switch (Cycling switch) to switch “ON” or “OFF” the condenser fan sensing the condenser high side pressure.

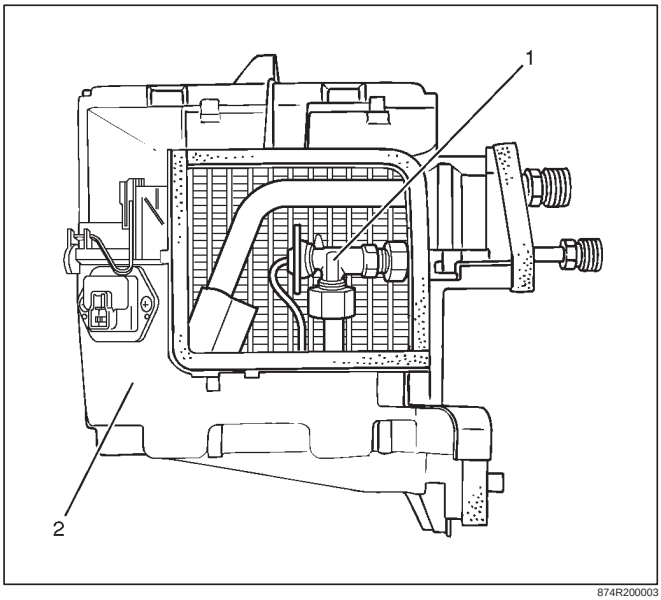
Compressor	ON (kPa/psi)	OFF (kPa/psi)
Low-pressure control	206.0±30.0 (29.8±4.3)	176.5±24.5 (25.6±3.6)
High-pressure control	2353.6±196.1 (341.3±28.4)	2942.0±196.1 (426.6±28.4)

Condenser fan	ON (kPa/psi)	OFF (kPa/psi)
Medium-pressure control	1471.0±98.1 (213.3±14.2)	1078.7±117.7 (156.4±17.1)

Expansion Valve

This expansion valve is an external pressure type and it is installed at the evaporator intake port.
The expansion valve converts the high pressure liquid refrigerant sent from the receiver/drier to a low pressure liquid refrigerant by forcing it through a tiny port before sending it to the evaporator.
This type of expansion valve consists of a temperature sensor, diaphragm, ball valve, ball seat, spring adjustment screw, etc.
The temperature sensor contacts the evaporator outlet pipe, and converts changes in temperature to pressure. It then transmits these to the top chamber of the diaphragm.
The refrigerant pressure is transmitted to the diaphragm's bottom chamber through the external equalizing pressure tube.
The ball valve is connected to the diaphragm. The opening angle of the expansion valve is determined by the force acting on the diaphragm and the spring pressure.

The expansion valve regulates the flow rate of the refrigerant. Accordingly, when a malfunction occurs to this expansion valve, both discharge and suction pressure decreases, resulting in insufficient cooling capacity of the evaporator.
The calibration has been changed to match the characteristics of HFC-134a.



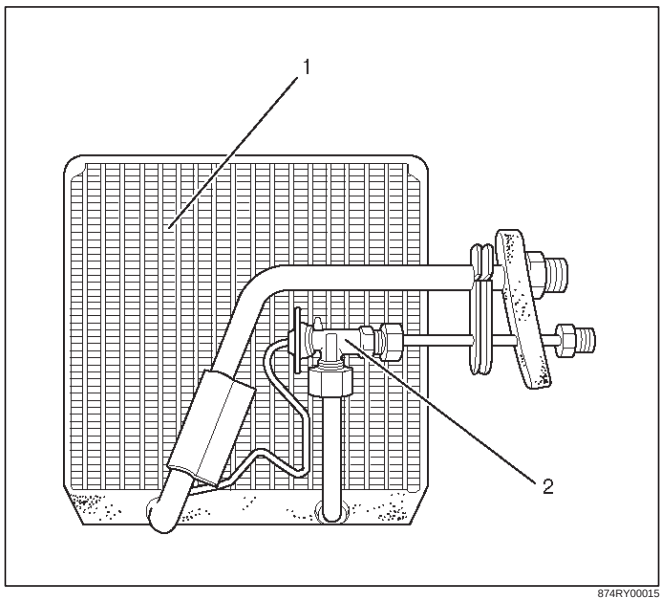
874R200003

Legend
(1) Expansion Valve
(2) Evaporator Assembly

Evaporator

The evaporator cools and dehumidifies the air before the air enters the passenger compartment. High-pressure liquid refrigerant flows through the expansion valve into the low-pressure area of the evaporator. The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air.
As heat is lost between the air and the evaporator core surface, moisture in the vehicle condenses on the outside surface of the evaporator core and is drained off as water.
When the evaporator malfunctions, the trouble will show up as an inadequate supply of cool air. The cause is typically a partially plugged core due to dirt, or a malfunctioning blower motor.

The evaporator core with a laminate louver fin is a single-sided tank type where only one tank is provided under the core.

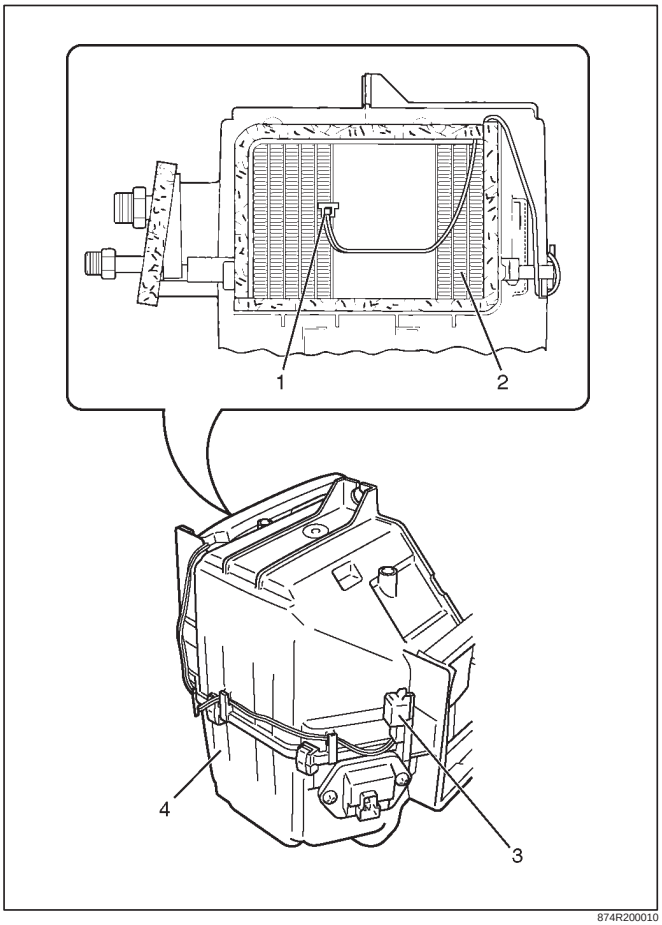


874RY00015

Legend
(1) Evaporator Core
(2) Expansion Valve

Duct Sensor

The duct sensor is the sensor to detect temperature change of the side of evaporator blower coming by fresh recirculation of intake door or “on” “off” of compressor.
The temperature is converted to resistant rate.
And it works as thermostat to control to prevent freezing of evaporator.
This sensor is installed in the upper case of evaporator.



874R200010

Legend

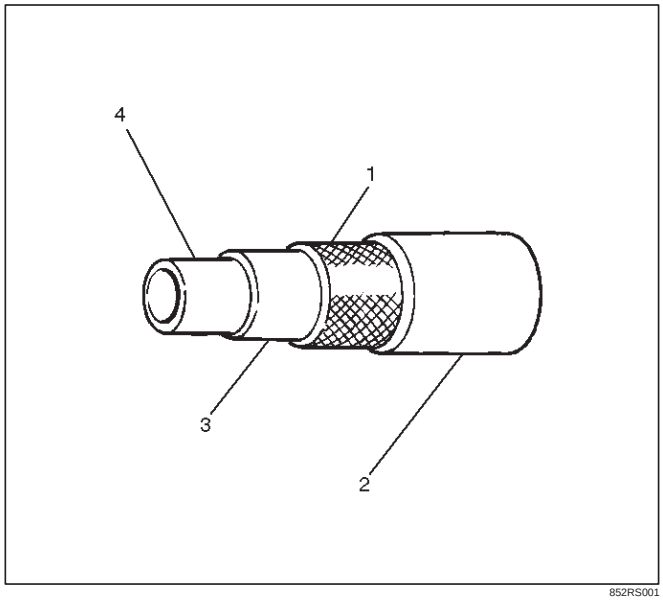
(1) Sensor Part
(2) Evaporator Core
(3) Duct Sensor Assembly
(4) Evaporator Assembly

Refrigerant Line

Restriction in the refrigerant line will be indicated by:

1. Suction line — A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or no cooling.
2. Discharge line — A restriction in the discharge line generally will cause the discharge line to leak.
3. Liquid line — A liquid line restriction will be evidenced by low discharge and suction pressure and insufficient cooling.

Refrigerant flexible hoses that have a low permeability to refrigerant and moisture are used. These low permeability hoses have a special nylon layer on the inside.

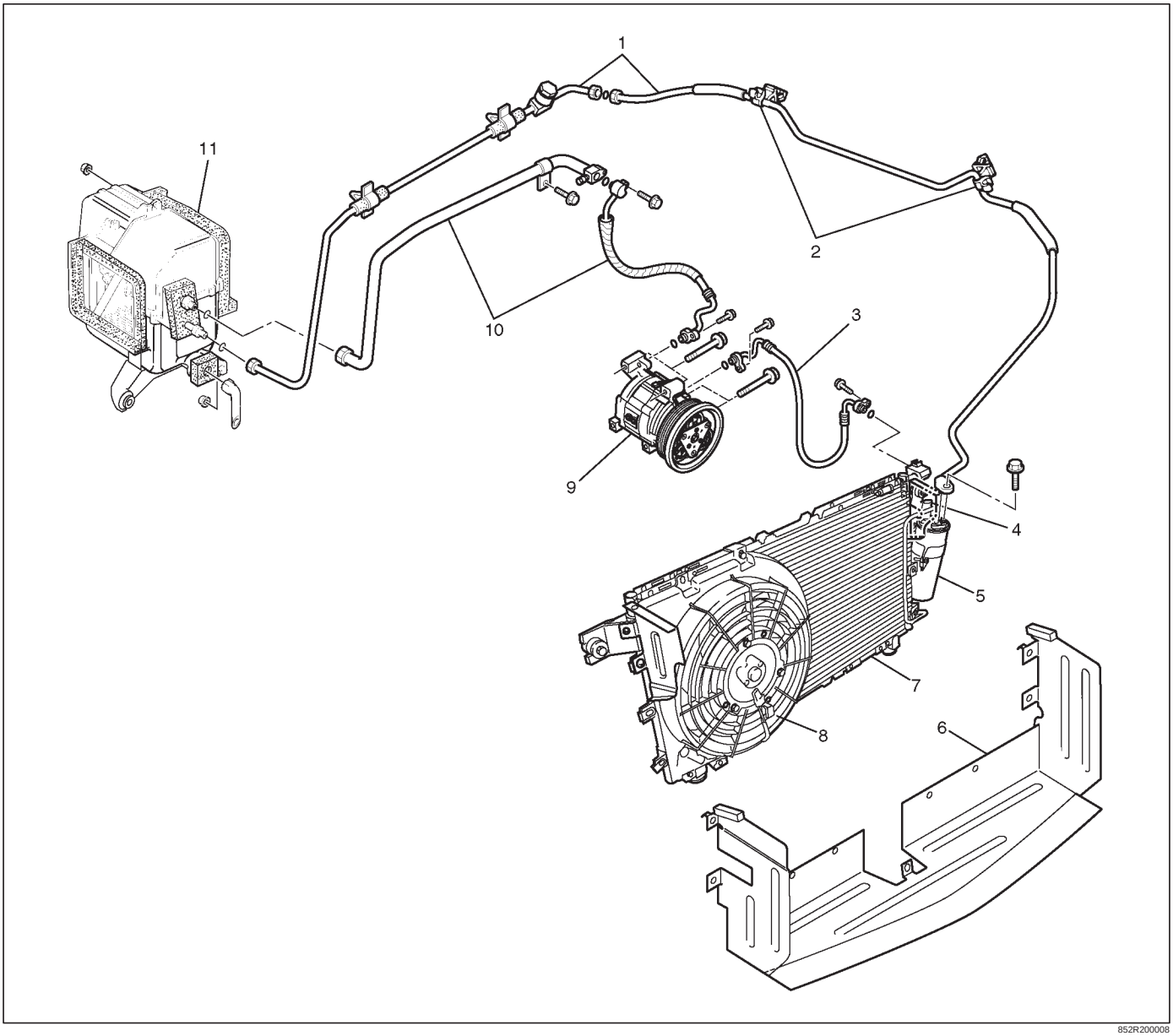


852RS001

Legend

(1) Reinforcement Layer (Polyester)
(2) External Rubber Layer
(3) Internal Rubber Layer
(4) Resin Layer (Nylon)

Air Conditioning Parts



852R200008

Legend

(1) Liquid Line (High-Pressure Pipe)
(2) Clip
(3) Discharge Line (High-Pressure Hose)
(4) Pressure Switch
(5) Receiver/Drier
(6) Condenser Air Guide
(7) Condenser & Receiver Tank Assembly
(8) Condenser Fan
(9) Compressor
(10) Suction Line (Low-Pressure Hose)
(11) Evaporator Assembly

Diagnosis

Air Conditioning Cycle Diagnosis

Condition	Possible cause	Correction
No cooling or insufficient cooling.	Magnetic clutch does not run.	Refer to *"Magnetic Clutch Diagnosis" in this section.*
	Compressor is not rotating properly. Drive belt is loose or broken.	Adjust the drive belt to the specified tension or replace the drive belt.
	Compressor is not rotating properly. Magnetic clutch face is not clean and slips.	Clean the magnetic clutch face or replace.
	Compressor is not rotating properly. Incorrect clearance between magnetic drive plate and pulley.	Adjust the clearance. Refer to *Compressor in this section.*
	Compressor is not rotating properly. Compressor oil leaks from the shaft seal or shell.	Replace the compressor
	Compressor is not rotating properly. Compressor is seized.	Replace the compressor
	Insufficient or excessive charge of refrigerant.	Discharge and recover the refrigerant. Recharge to the specified amount.
	Leaks in the refrigerant system.	Check the refrigerant system for leaks and repair as necessary. Discharge and recover the refrigerant. Recharge to the specified amount.
	Condenser is clogged or insufficient radiation.	Clean the condenser or replace as necessary.
	Temperature control link unit of the heat unit is defective.	Repair the link unit.
	Unsteady operation due to a foreign substance in the expansion valve.	Replace the expansion valve.
	Poor operation of the electronic thermostat.	Check the electronic thermostat and replace as necessary.
Insufficient velocity of cooling air.	Evaporator clogged or frosted.	Check the evaporator core and replace or clean the core.
	Air leaking from the cooling unit or air duct.	Check the evaporator and duct connection, then repair as necessary.
	Blower motor does not rotate properly.	Refer to *Fan Control Lever (Fan Switch) Diagnosis in this section.*

*For the execution of the charging and discharging operation in the table above, refer to *Recovery, Recycling, Evacuating and Charging in this section.*

Checking The Refrigerant System With Manifold Gauge

Since Refrigerant-134a (HFC-134a) is used in the air conditioning system in this vehicle, be sure to use manifold gauges, charging hoses and other air conditioning service tools for HFC-134a when checking the refrigerant system.

Conditions:

- ▼ Run the engine at idle
- ▼ Air conditioning switch is “ON”
- ▼ Run the blower motor at “HIGH” position (5 positions)
- ▼ Temperature control set to “MAX COLD” (65˚F)
- ▼ Air source selector at “CIRC”
- ▼ Open the engine hood
- ▼ Close all the doors

Normal Pressure:

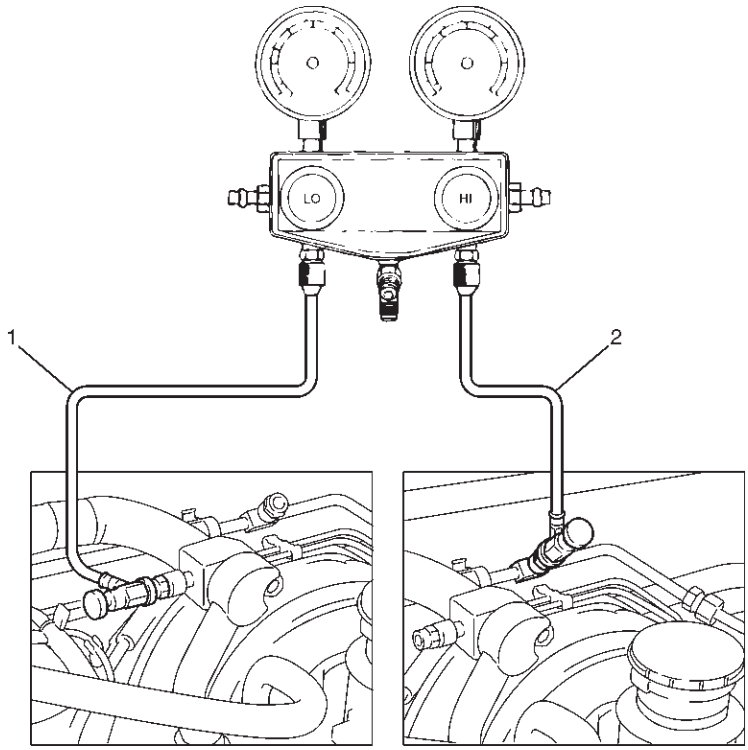
- ▼ At ambient temperature: approx. 25–30˚C (77–86˚F).
- ▼ At low-pressure side: approx. 147.1–294.2 kPa (21.3–42.7 psi).
- ▼ At high-pressure side: approx. 1372.9–1863.3 kPa (199.1–270.2 psi).

Refer to the table on the refrigerant pressure-temperature relationship.

HFC-134a Pressure-Temperature Relationship			
Pressure		Temperature	
(kPa)	(psi)	(˚C)	(˚F)
36	5.3	–20	–4.4
67	9.7	–15	5
104	15	–10	14
147	21	–5	23
196	28	0	32
255	37	5	41
314	45	10	50
392	57	15	59
471	68	20	68
569	82	25	77
677	98	30	86
785	114	35	95
912	132	40	104
1059	154	45	113
1216	176	50	122

Connect The Manifold Gauge

Low-pressure hose (LOW) — Suction side
High pressure hose (HI) — Discharge side



901R100020

Legend

(1) Low Side
(2) High Side

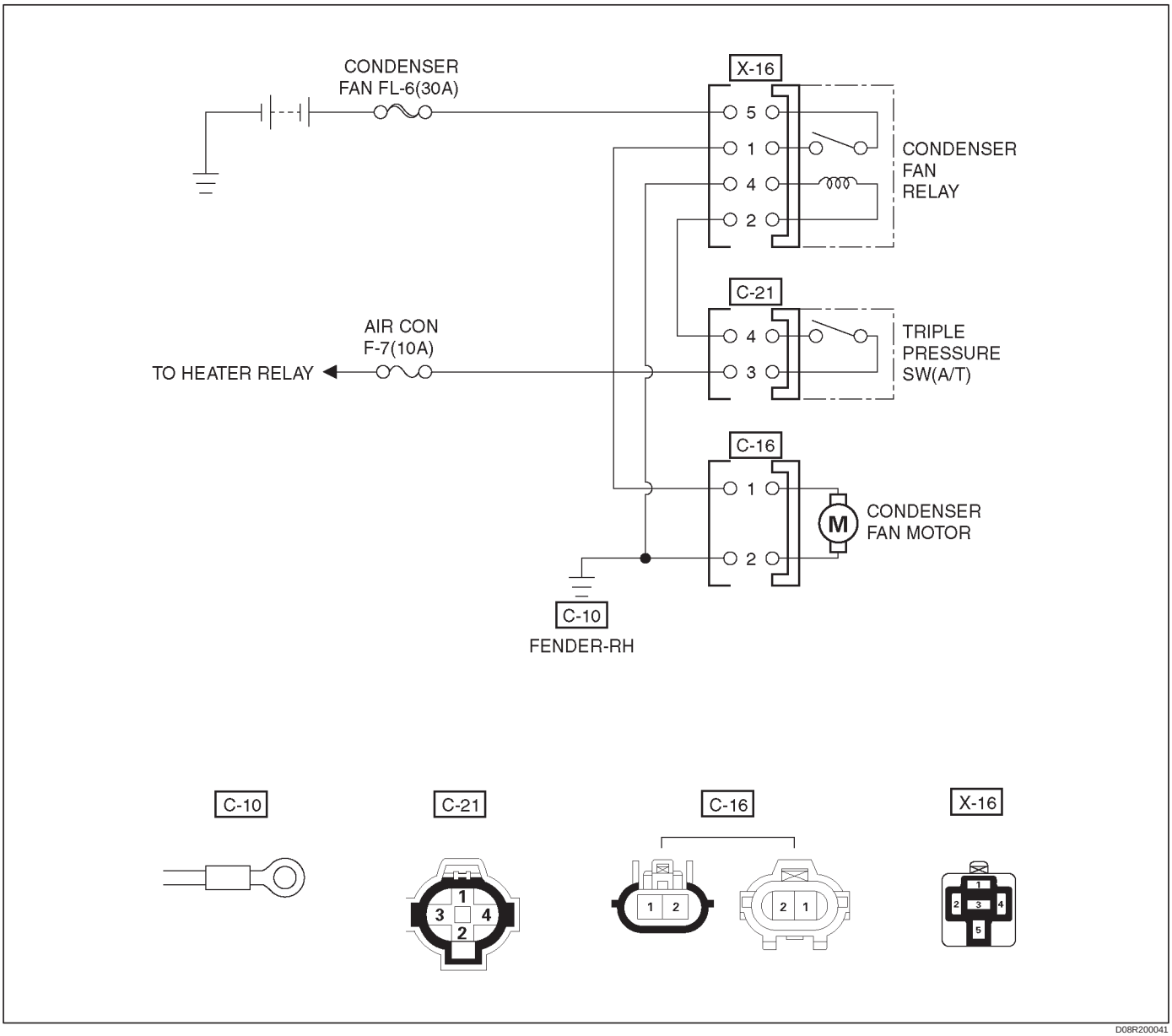
Condition	Possible cause	Correction
Discharge (High Gauge) Pressure Abnormally High	Condenser clogged or dirty.	Clean the condenser fins
	Cooling fan does not operate properly.	Check the cooling fan operation.
Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover refrigerant. Recharge to specified amount.
Discharge (High Gauge) Pressure Abnormally High. High pressure gauge drop. (After stopping A/C, the pressure drops approx. 196 kPa (28 psi) quickly)	Air in system.	Evacuate and charge refrigerant system.
Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to the specified amount.
Discharge (High Gauge) Pressure Abnormally Low. Low pressure gauge indicates vacuum.	Clogged or defective expansion valve.	Replace the expansion valve.
Discharge (High Gauge) Pressure Abnormally Low. Frost or dew on refrigerant line before and after the receiver/drier or expansion valve, and low pressure gauge indicates vacuum.	Restriction caused by debris or moisture in the receiver/drier.	Check system for restriction and replace the receiver/drier.
Discharge (High Gauge) Pressure Abnormally Low. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor seal defective	Repair or replace the compressor.
	Poor compression due to a defective compressor gasket.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally High. Low pressure gauge (Low pressure gauge is lowered after condenser is cooled by water.)	Excessive refrigerant in system.	Discharge and recover refrigerant Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally High. Low pressure hose temperature. (Low pressure hose temperature around the compressor refrigerant line connector is lower than around evaporator.)	Unsatisfactory valve operation due to defective temperature sensor of expansion valve.	Replace the expansion valve.
	Expansion valve opens too long.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally High. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor gasket is defective.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally Low. Insufficient cooling.	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally Low. Frost on the expansion valve inlet line	Expansion valve clogged.	Replace the expansion valve.

Condition	Possible cause	Correction
Suction (Low Gauge) Pressure Abnormally Low Receiver/drier inlet and outlet refrigerant line temperature. (A distinct difference in temperature develops.)	Receiver/Drier clogged.	Replace the receiver/drier.
Suction (Low Gauge) Pressure Abnormally Low. Expansion valve outlet refrigerant line. (Not cold and low pressure gauge indicates vacuum.)	Expansion valve temperature sensor is defective.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally Low. When the refrigerant line is clogged or blocked, the low pressure gauge reading will decrease, or a vacuum reading may be shown.	Clogged or blocked refrigerant line.	Replace refrigerant line.
Suction (Low Gauge) Pressure Abnormally Low. Evaporator core is frozen.	Thermo switch defective.	Replace thermo switch.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover the refrigerant, the Recharge to the specified amount.
	Condenser clogged or dirty.	Clean the condenser fin.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Suction (Low) pressure hose (Not cold).	Air in system.	Evacuate and charge refrigerant.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover refrigerant. Recharge to specified amount.

A/C — Air Conditioning

Condenser Fan Diagnosis

While the air conditioning is ON, the cycling switch in the triple pressure switch senses the refrigerant pressure, and activates the condenser fan to improve the cooling capacity of the condenser when the refrigerant pressure exceeds a set pressure value. The condenser fan stops when the air conditioning is turned “OFF” or when the pressure goes down below the set pressure value.



D08R200041

Condition	Possible cause	Correction
Condenser fan does not run.	–	Refer to “Chart A”.
	–	Refer to “Chart B”.

Chart “A” Condenser Fan Does Not Run

Step	Action	Yes	No
1	Are 30A fuse normal?	Go to *Step 2*	Replace
2	Is relay (X-16) normal?	Go to *Step 3*	Replace
3	Is pressure switch normal?	Go to *Step 4*	Switch defective or insufficient refrigerant.
4	Is fan motor normal?	Go to *Step 5*	Replace
5	1. Disconnect condenser fan relay (X-16). 2. Check to see if battery voltage is present at the chassis side relay terminal NO. X16-5. Is there a battery voltage?	Go to *Step 6*	Repair open circuit between Condenser Fan fuse (30A) and No.X16-5.
6	1. Reconnect condenser fan relay (X-16). 2. Check to see if battery voltage is present at chassis side connector terminal No.C21-3. Is there a battery voltage?	Go to *Step 7*	Repair open circuit between fuse (10A) and C21-3.
7	Check to see if continuity between chassis side relay terminal No.X16-2 and the chassis side connector terminal No.C21-4. Is there a continuity?	Go to *Step 8*	Repair open circuit.
8	Check to see if continuity between chassis side connector terminal No. C16-1 and chassis side relay terminal No.X16-1. Is there a continuity?	Poor ground or open circuit between chassis side connector terminal No.X16-4 (or No.C16-2) and body ground (No.C10).	Repair open circuit.

Chart “B” Condenser Fan Does Not Stop

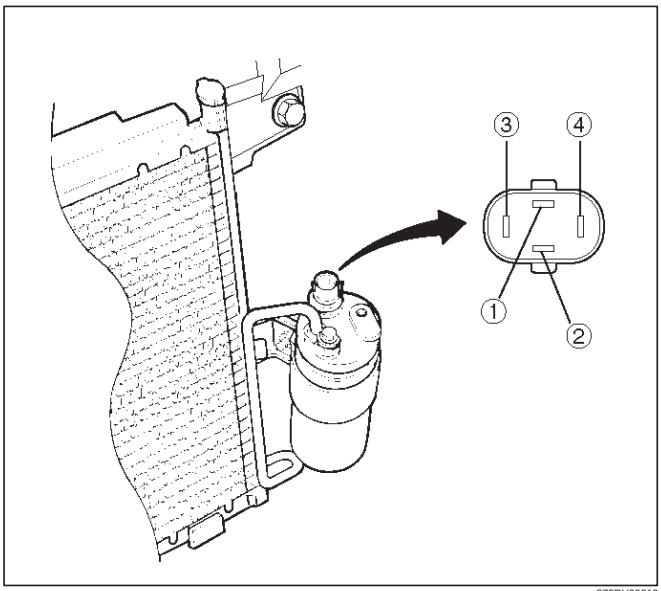
Step	Action	Yes	No
1	1. Disconnect the triple pressure connector. Does condenser fan stop?	Replace the triple pressure switch.	Replace the condenser fan relay.

Air Conditioning System

Individual Inspection

Triple Pressure Switch (V6, A/T)

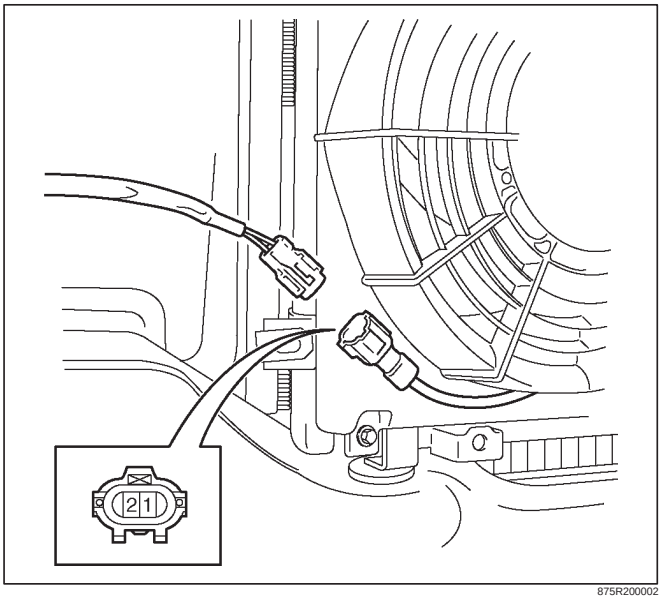
1. Disconnect the connector and check for continuity between pressure switch side connector terminals (1) and (2).
2. Reconnect the connector to activate the A/C switch, and check to see if there is continuity between the chassis side connector terminals (3) and (4) and the fan operates.



875RY00010

Condenser Fan

1. Disconnect the condenser fan connector.
2. Connect the battery positive terminal to the condenser fan side connector terminal No.C-16-1 and negative to the No.C-16-2.
3. Check that condenser fan is rotating correctly.



875R200002

General Repair Procedure

Precautions For Replacement or Repair of Air Conditioning Parts

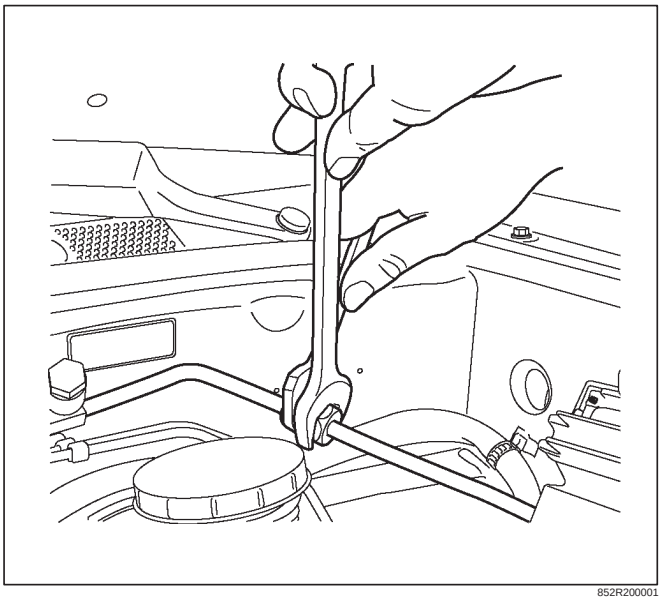
There are certain procedures, practices and precautions that should be followed when servicing air conditioning systems:

- ▼ Keep your work area clean.
- ▼ Always wear safety goggles and protective gloves when working on refrigerant systems.
- ▼ Beware of the danger of carbon monoxide fumes caused by running the engine.
- ▼ Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- ▼ Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioning system.
- ▼ When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- ▼ Keep moisture and contaminants out of the system. When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately.
  Never remove the caps or plugs until the lines or parts are reconnected or installed.
- ▼ When disconnecting or reconnecting the lines, use two wrenches to support the line fitting, to prevent from twisting or other damage.
- ▼ Always install new O-rings whenever a connection is disassembled.
- ▼ Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- ▼ When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this section must be performed in the following sequence:
  1. Use the J-39500 (ACR4: HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent to thoroughly discharge and recover the refrigerant.
  2. Remove and replace the defective part.
  3. After evacuation, charge the air conditioning system and check for leaks.

Repair Of Refrigerant Leaks

Refrigerant Line Connections

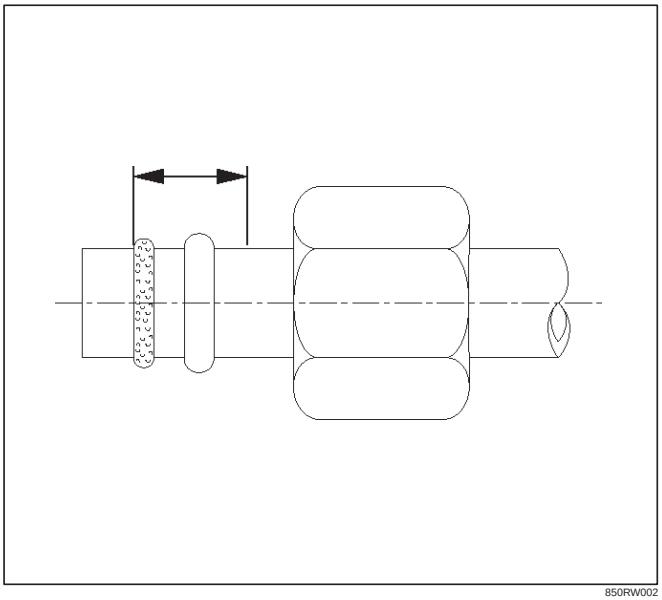
Install new O-rings, if required. When disconnecting or connecting lines, use two wrenches to prevent the connecting portion from twisting or becoming damaged.



852R200001

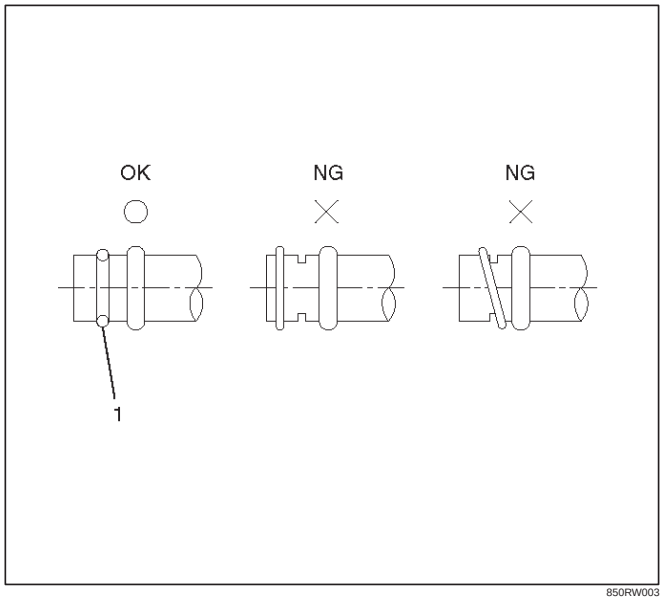
When connecting the refrigerant line at a block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt. Apply the specified compressor oil to the O-rings prior to connecting.

CAUTION: Compressor (PAG) oil to be used varies according to the compressor model. Be sure to apply oil specified for the model of compressor.



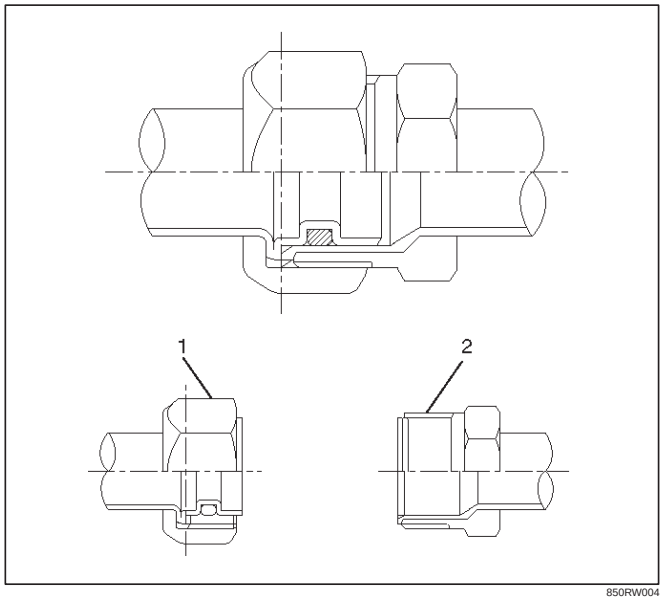
850RW002

O-rings (2) must be fitted in the groove (1) of refrigerant line.



850RW003

Insert the nut into the union.
First, tighten the nut by hand as much as possible, then tighten the nut to the specified torque.



850RW004

Leak Check

Inspection of refrigerant leak

Refrigerant leak may cause an adverse effect not only on the performance and durability of each component of the air–conditioner, but also on the global atmosphere. Therefore, it is most important to repair refrigerant leak when there is any leak found.

Inspection flow of refrigerant leak

Step	Action	Yes	No
1	1. Evacuate the refrigerant system. 2. Charge the refrigerant. Is there any refrigerant leak?	Repair refrigerant system.	Go to *Step 2*
2	1. Operate the compressor for more than 5 minutes to raise the pressure on the high pressure side. Is there any refrigerant leak at high pressure components?	Repair refrigerant system.	Compressor operation to be confirmed.

Inspection Steps

Check the components of air–conditioner to see if there occurs any refrigerant leak along the flow of refrigerant.

NOTE:

- ▼To avoid refrigerant leak detection error, avoid refrigerant vapor and cigarette smoke presence when performing the inspection. Also, select a location that is not susceptible to wind, in case refrigerant vapor is found it will not be blown off.
- ▼Inspection should be conducted chiefly on the pipe connections and sections where a marked oil contamination is found. When refrigerant is leaking, oil inside is also leaking at the same time.
- ▼It is possible to visually check the leak from inside the cooling unit. Follow the method below when performing the inspection. Remove the drain hose or resistor of the cooling unit, and insert a leak detector to see if there are signs of leakage.

High Pressure Side

1. Discharger section of compressor.
2. Inlet/outlet section of condenser.
3. Inlet/outlet section of receiver driver.
4. Inlet section of cooling unit.

Low Pressure Side

1. Outlet section of cooling unit.
2. Intake section of compressor.

Major Checking Points of Refrigerant Leak

Compressor

- ▼Pipe connection
- ▼Sealing section of shaft
- ▼Mating section or cylinder

Condenser

- ▼Pipe connection
- ▼Welds of condenser body

Receiver driver

- ▼Pipe connection
- ▼Attaching section of pressure switch
- ▼Section around the sight glass

Evaporator unit (cooling unit)

- ▼Pipe connections
- ▼Connections of expansion valve
- ▼Brazed sections of evaporator

NOTE:

- ▼The evaporator and expansion valve are contained in the case. Remove the drain hose or the resistor of the cooling unit and insert a leak detector when checking for any leak.

Flexible hose

- ▼Pipe connection
- ▼Caulking section of the hose
- ▼Hose (cracks, pinholes, flaws)

Pipe

- ▼Pipe connection
- ▼Pipe (cracks, flaws)

Charge valve

NOTE:

- ▼The charge valve, which is used to connect the gauge manifold, is normally provided with a resin cap. When the valve inside gets deteriorated, refrigerant will leak out.

Leak at Refrigerant Line Connections

1. Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
   - ▼Use two wrenches to prevent twisting and damage to the line.
   - ▼Do not over tighten.
2. Perform a leak test on the refrigerant line fitting.

3. If the leak is still present, discharge and recover the refrigerant from the system.
4. Replace the O-rings.
   ▼O-rings cannot be reused. Always replace with new ones.
   ▼Be sure to apply the specified compressor oil to the new O-rings.
5. Retighten the refrigerant line fitting to the specified torque.
   ▼Use two wrenches to prevent twisting and damage to the line.
6. Evacuate, charge and retest the system.

Leaks In The Hose

If the compressor inlet or outlet hose is leaking, the entire hose must be replaced. The refrigerant hose must not be cut or spliced for repair.

1. Locate the leak.
2. Discharge and recover the refrigerant.
3. Remove the hose assembly.
   ▼Cap the open connections at once.
4. Connect the new hose assembly.
   ▼Use two wrenches to prevent twisting or damage to the hose fitting.
   ▼Tighten the hose fitting to the specified torque.
5. Evacuate, charge and test the system.

Compressor Leaks

If leaks are located around the compressor shaft seal or shell, replace or repair the compressor.

Recovery, Recycling, Evacuation and Charging of HFC-134a

Air conditioning systems contain HFC-134a. This is a chemical mixture which requires special handling procedures to avoid personal injury.

- ▼ Always wear safety goggles and protective gloves.
- ▼ Always work in a well-ventilated area. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.
- ▼ If HFC-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.
- ▼ If it is necessary to transport or carry any container of HFC-134a in a vehicle, do not carry it in the passenger compartment.
- ▼ If it is necessary to fill a small HFC-134a container from a large one, never fill the container completely. Space should always be allowed above the liquid for expansion.
- ▼ HFC-134a and R-12 should never be mixed as their compositions are not the same.
- ▼ HFC-134a PAG oil tends to absorb moisture more quickly than R-12 mineral oil and, therefore, should be handled more carefully.
- ▼ Keep HFC-134a containers stored below 40˚C (104˚F).

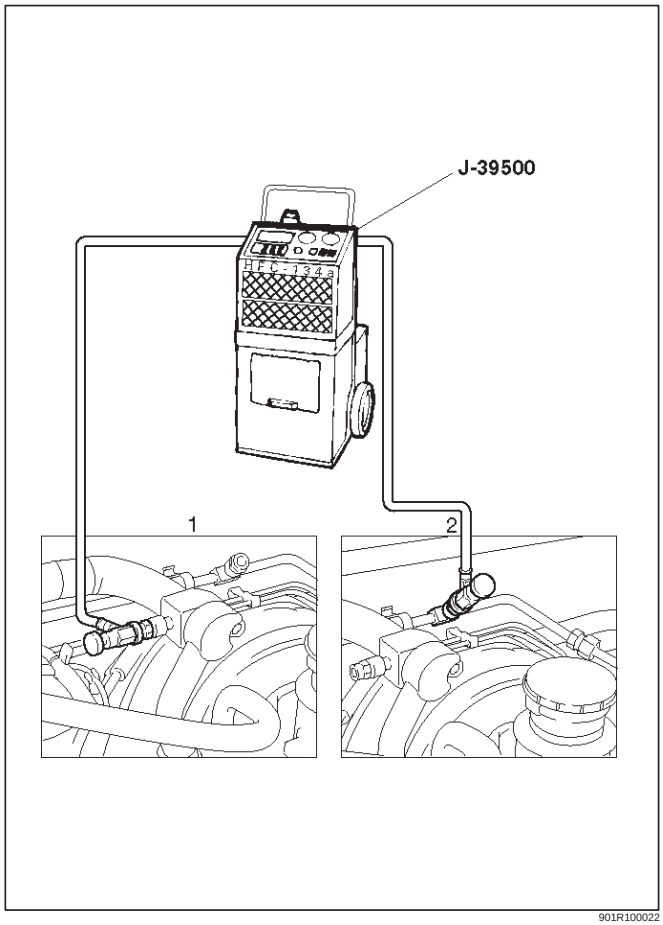
WARNING:

- ▼ **SHOULD HFC-134A CONTACT YOUR EYE(S), CONSULT A DOCTOR IMMEDIATELY.**
- ▼ **DO NOT RUB THE AFFECTED EYE(S). INSTEAD, SPLASH QUANTITIES OF FRESH COLD WATER OVER THE AFFECTED AREA TO GRADUALLY RAISE THE TEMPERATURE OF THE REFRIGERANT ABOVE THE FREEZING POINT.**
- ▼ **OBTAIN PROPER MEDICAL TREATMENT AS SOON AS POSSIBLE. SHOULD THE HFC-134A TOUCH THE SKIN, THE INJURY MUST BE TREATED THE SAME AS SKIN WHICH HAS BEEN FROSTBITTEN OR FROZEN.**

Refrigerant Recovery

The refrigerant must be discharged and recovered by using the J-39500 (ACR⁴:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent before removing or mounting air conditioning parts.

1. Connect the high and low charging hoses of the ACR⁴(or equivalent) as shown below.



901R100022

Legend

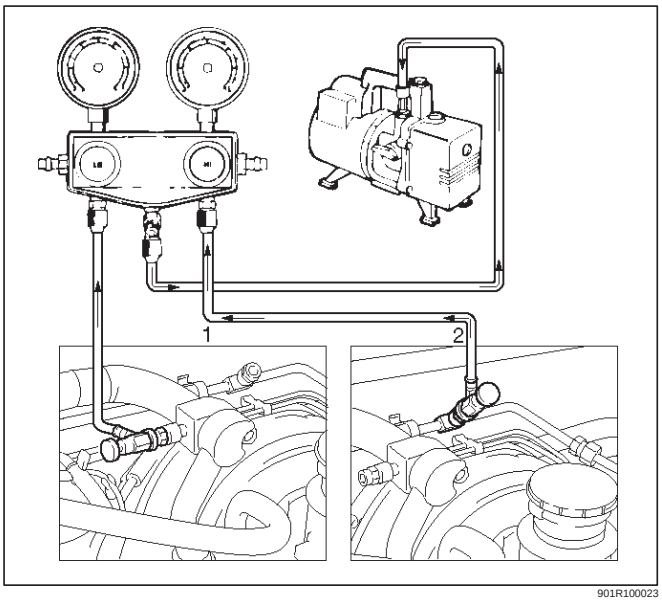
(1) Low Side
(2) High Side

2. Recover the refrigerant by following the Manufacturer's Instructions.
3. When a part is removed, put a cap or a plug on the connecting portion so that dust, dirt or moisture cannot get into it.

Refrigerant Recycling

Recycle the refrigerant recovered by J-39500 (ACR4:HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent.
For the details of the actual operation, follow the steps in the ACR4(or equivalent) Manufacturer's Instructions.

Evacuation of The Refrigerant System



901R100023

Legend
(1) Low Side
(2) High Side

NOTE: Explained below is a method using a vacuum pump. Refer to the ACR4(or equivalent) manufacturer's instructions when evacuating the system with a ACR4(or equivalent).

Air and moisture in the refrigerant will cause problems in the air conditioning system. Therefore, before charging the refrigerant, be sure to evacuate air and moisture thoroughly from the system.

1. Connect the gauge manifold.
   ▼High-pressure valve (HI) — Discharge-side.
   ▼Low-pressure valve (LOW) — Suction-side.
2. Discharge and recover the refrigerant.
3. Connect the center hose of the gauge manifold set to the vacuum pump inlet.
4. Operate the vacuum pump, open shutoff valve and then open both hand valves.
5. When the low-pressure gauge indicates approximately 750 mmHg (30 inHg), continue the evacuation for 5 minutes or more.
6. Close both hand valves and stop the vacuum pump.
7. Check to ensure that the pressure does not change after 10 minutes or more.
   ▼If the pressure changes, check the system for leaks.
   ▼If leaks occur, retighten the refrigerant line connections and repeat the evacuation steps.
8. If no leaks are found, again operate the vacuum pump for 20 minutes or more. After confirming that the gauge manifold pressure is at 750 mmHg (30 inHg), close both hand valves.
9. Close positive shutoff valve. Stop the vacuum pump and disconnect the center hose from the vacuum pump.

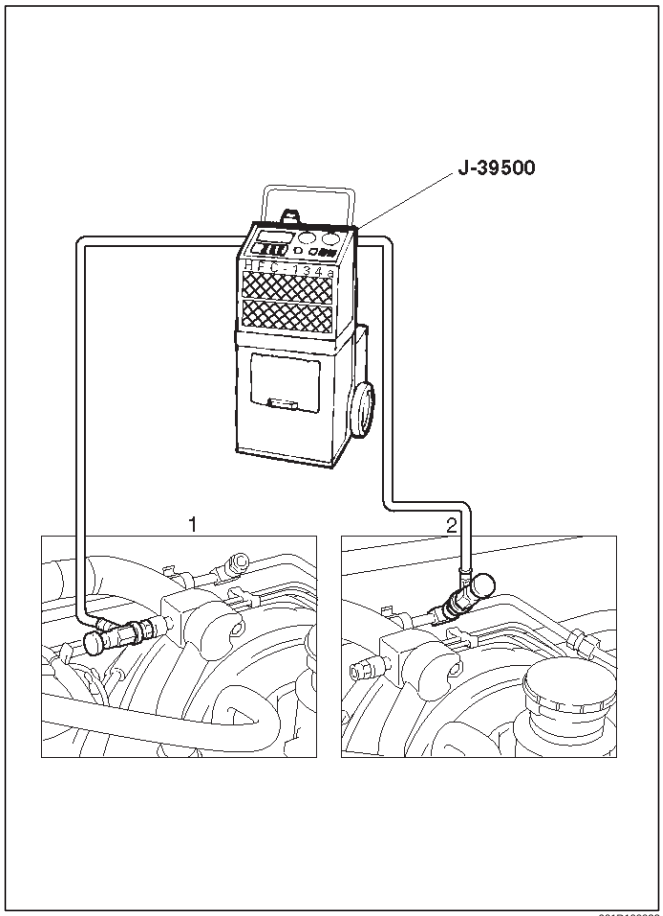
Charging The Refrigerant System

There are various methods of charging refrigerant into the air conditioning system.
These include using J-39500 (ACR4:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent and direct charging with a weight scale charging station.

Charging Procedure

▼ACR4(or equivalent) Method

For the charging of refrigerant recovered by ACR4(or equivalent), follow the manufacturer's instruction.



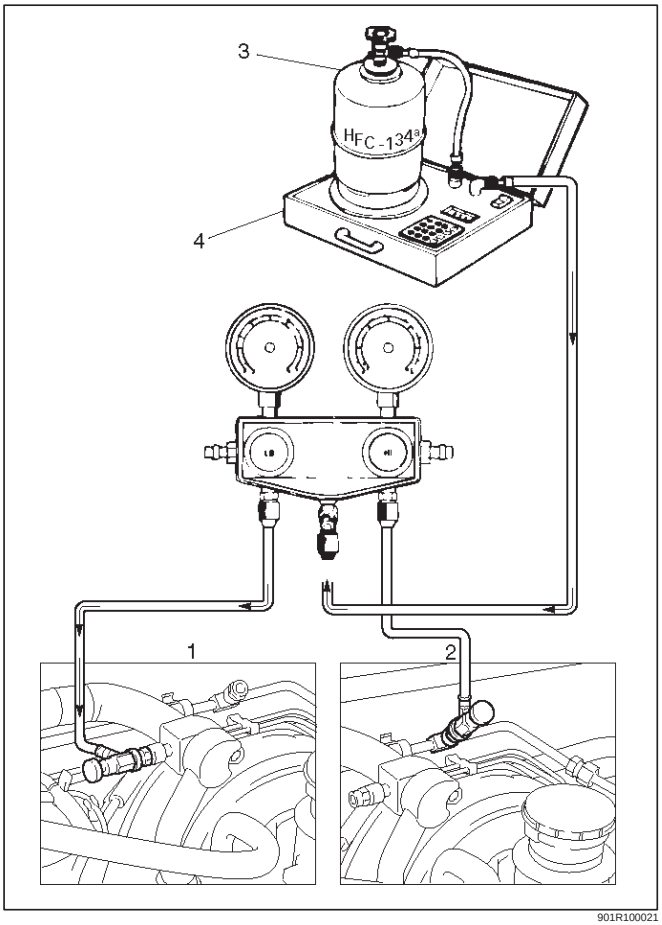
901R100022

Legend
(1) Low Side
(2) High Side

▼Direct charging with a weight scale charging station method

1. Make sure the evacuation process is correctly completed.
2. Connect the center hose of the manifold gauge to the weight scale.

3. Connect the low pressure charging hose of the manifold gauge to the low pressure side service valve of the vehicle.
4. Connect the high pressure charging hose of the manifold gauge to the high pressure side service valve of the vehicle.

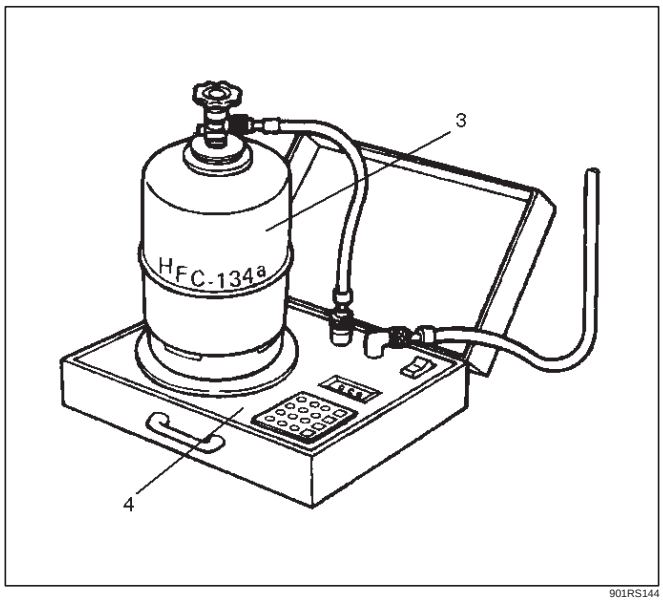


901R100021

Legend

(1) Low Side
(2) High Side
(3) Refrigerant Container
(4) Weight Scale

5. Place the refrigerant container(3) up right on a weight scale(4).
   Note the total weight before charging the refrigerant.
   a. Open the refrigerant container valve.
   b. Open the low side vale on the manifold gauge set. Refer to the manufacturer's instructions for a weight scale charging station.



901RS144

6. Perform a system leak test:
   ▼Charge the system with approximately 200 g (0.44 lbs) of HFC-134a.
   ▼Make sure the high pressure valve of the manifold gauge is closed.
   ▼Check to ensure that the degree of pressure does not change.
   ▼Check for refrigerant leaks by using a HFC-134a leak detector.
   ▼If a leak occurs, recover the refrigerant. Repair the leak and start all over again from the first step of evacuation.
7. If no leaks are found, continue charging refrigerant to the air conditioning system.
   ▼Charge the refrigerant until the scale reading decreases by the amount of the charge specified.

Specified amount: 700 g (1.54 lbs)

▼If charging the system becomes difficult:

1. Run the engine at idle and close all the vehicle doors.
2. Turn A/C switch "ON".
3. Set the fan switch to its highest position.
4. Set the air source selector lever to "CIRC".
5. Slowly open the low side valve on the manifold gauge set.

WARNING: BE ABSOLUTELY SURE NOT TO OPEN THE HIGH PRESSURE VALVE OF THE MANIFOLD GAUGE. SHOULD THE HIGH PRESSURE VALVE BE OPENED, THE HIGH PRESSURE REFRIGERANT WOULD FLOW BACKWARD, AND THIS MAY CAUSE THE REFRIGERANT CONTAINER TO BURST.

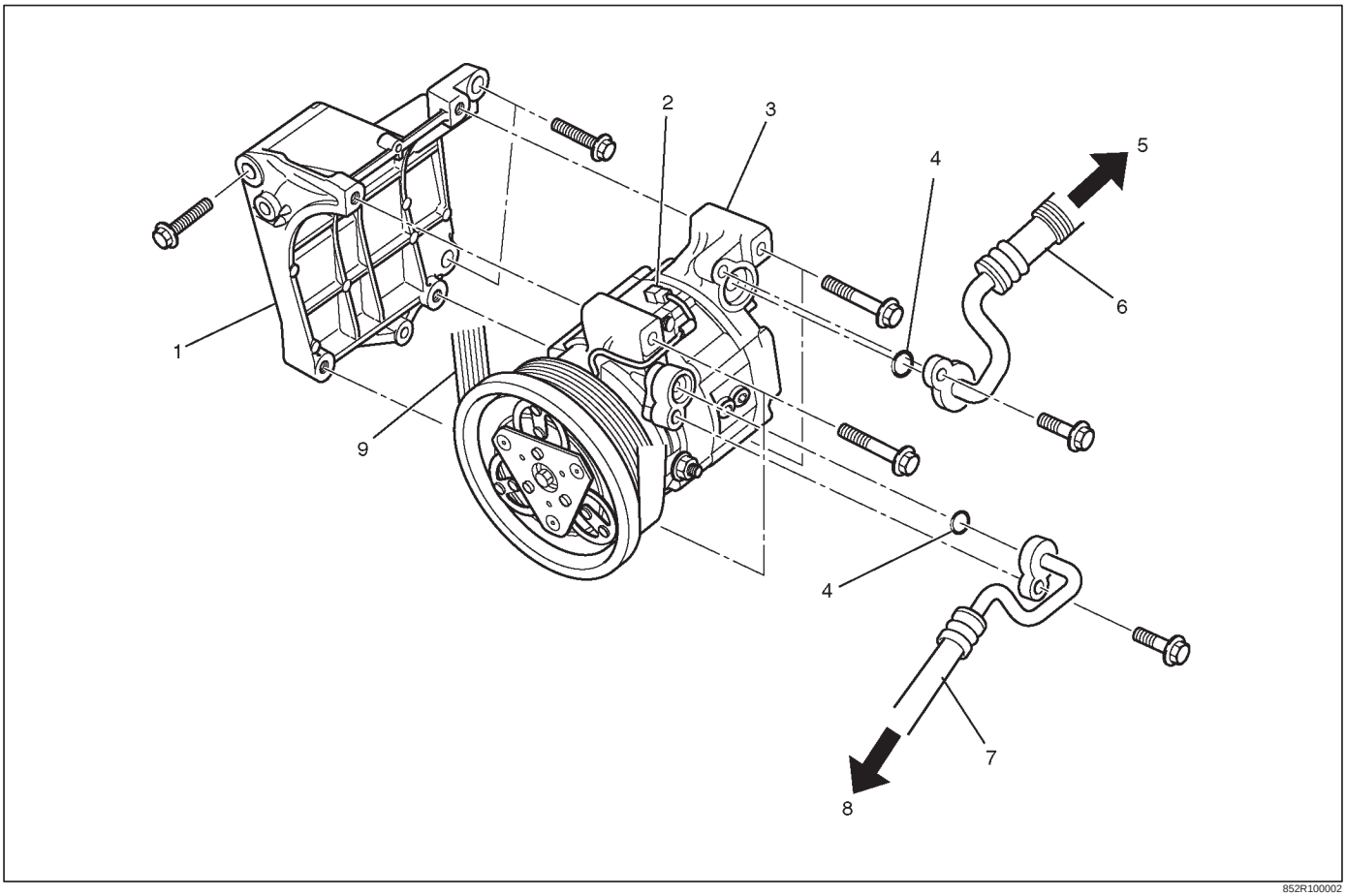
8. When finished with the refrigerant charging, close the low pressure valve of the manifold gauge and container valve.
9. Check for refrigerant leaks.

Checking The A/C System

1. Run the engine and close all the vehicle doors.
2. Turn A/C switch “ON”, set the fan switch to its highest position.
3. Set the air source switch to “CIRC”, set the temperature switch to the full cool position.
4. Check the high and low pressure of the manifold gauge.
   - ▼Immediately after charging refrigerant, both high and low pressures might be slightly high, but they settle down to the pressure guidelines shown below:
   - ▼The ambient temperature should be between 25–30˚C (77–86˚F).
   - ▼The pressure guideline for the high-pressure side is approximately 1372.9–1863.3 kPa (199.1–270.2 psi).
   - ▼The pressure guideline for the low-pressure side is approximately 147.1–294.2 kPa (21.3–42.7 psi).
   - ▼If an abnormal pressure is found, refer to *Checking The Refrigerant System With Manifold Gauge in this section.*
5. Put your hand in front of the air outlet and move the temperature switch of the control panel to different positions. Check if the outlet temperature changes as selected by the control switch.

Compressor Assembly

Compressor Assembly and Associated Parts (6VE1)



852R100002

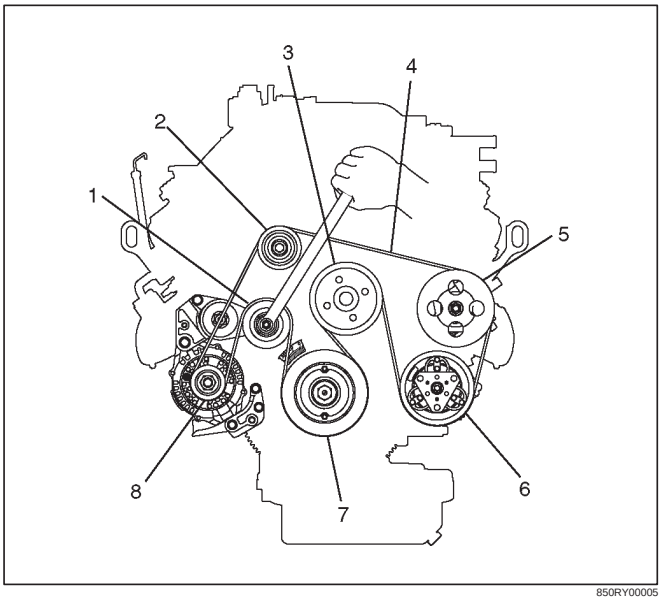
Legend

(1) Compressor Bracket
(2) Magnetic Clutch Harness Connector
(3) Compressor
(4) O-ring
(5) To Evaporator
(6) Suction Line (Low-Pressure Hose)
(7) Discharge Line (High-Pressure Hose)
(8) To Condenser
(9) Serpentine Belt

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant
   ▼Refer to *Refrigerant Recovery in this section.*
3. Disconnect magnetic clutch harness connector.

4. Remove serpentine belt.
   ▼Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



850RY00005

Legend
(1) Auto Tensioner
(2) Idle Pulley
(3) Cooling Fan Pulley
(4) Serpentine Belt
(5) Power Steering Oil Pump
(6) Air Conditioner Compressor
(7) Crankshaft Pulley
(8) Generator

5. Disconnect refrigerant line connector.
   ▼When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
6. Remove compressor.

Installation

1. Install compressor.
   ▼Tighten the compressor fixing bolts to the specified torque.

   Torque: 19 N•m (14 lb•ft)
2. Connect refrigerant line connector.
   ▼Tighten the refrigerant line connector fixing bolts to the specified torque.

   Torque: 15 N•m (11 lb•ft)

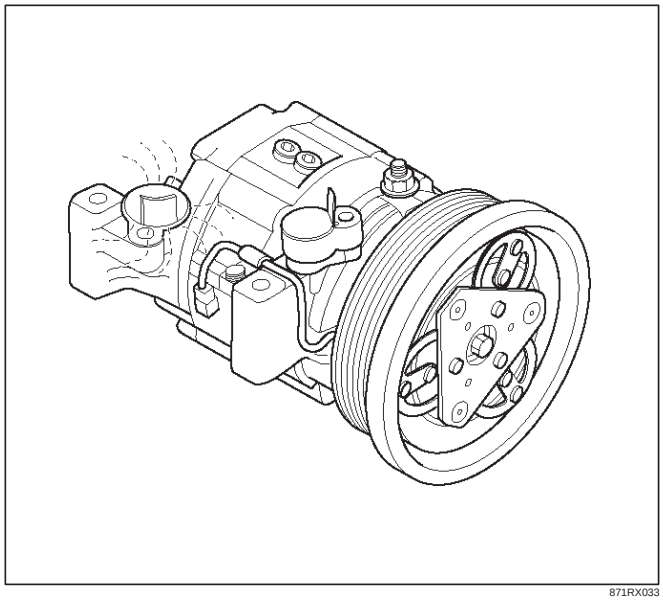
   ▼O-rings cannot be reused. Always replace with new ones.

   ▼Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
3. Install serpentine belt.
   ▼Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Connect magnetic clutch harness connector.

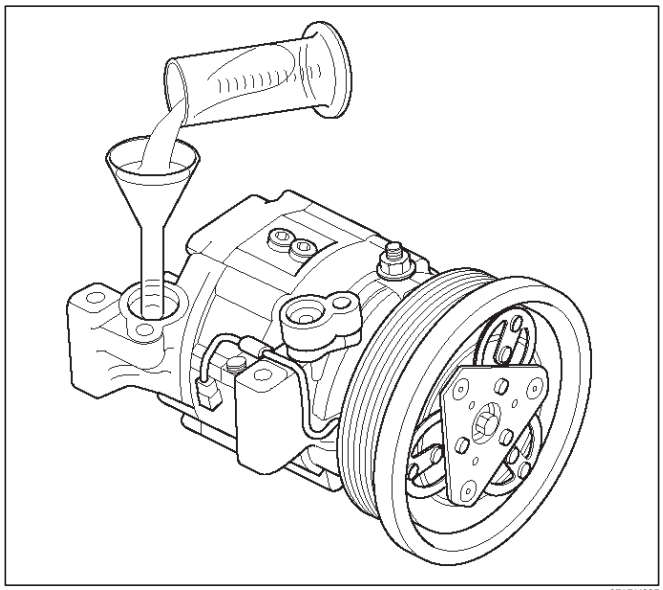
New Compressor Installation

The new compressor is filled with 150cc (5.0fl.oz.)of compressor oil and nitrogen gas. When mounting the compressor on the vehicle, perform the following steps;

1. Gently release nitrogen gas from the new compressor.
   ▼Take care not to let the compressor oil flow out.
   ▼Inspect O-rings and replace if necessary.

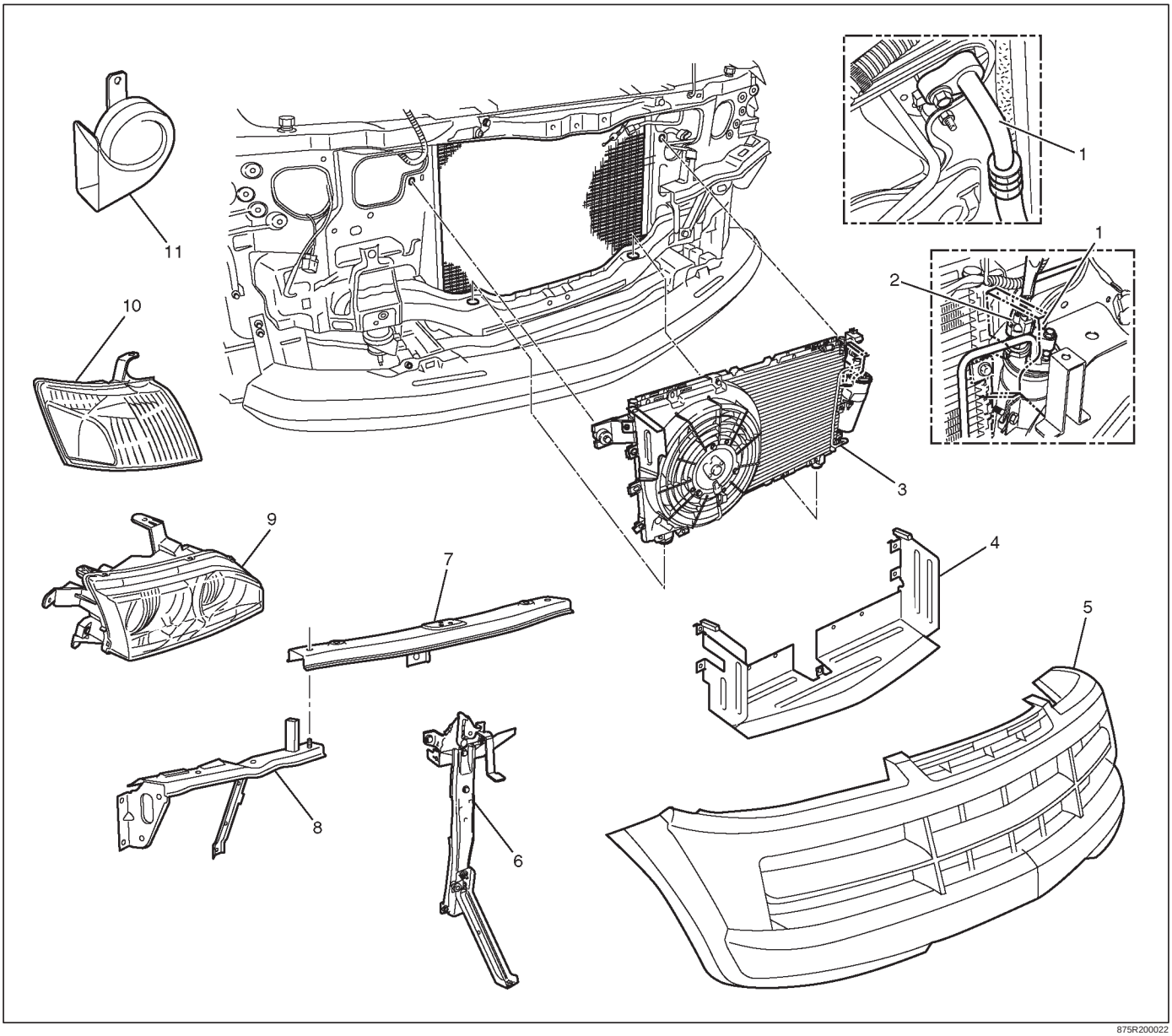

871RX033

2. Turn the compressor several times by hand and release the compressor oil in the rotor.
3. When installing on a new system, the compressor should installed as it is. When installing on a used system, the compressor should be installed after adjusting the amount of compressor oil. (Refer to *Compressor in this section*)


871RX035

Condenser Assembly

Condenser Assembly and Associated Parts



875R200022

Legend

(1) Refrigerant Line
(2) Pressure Switch Connector
(3) Condenser & Receiver Tank Assembly
(4) Condenser Air Guide
(5) Front Bumper Assembly
(6) Engine Hood Front End W/Engine Hood Lock & Bumper Stay
(7) Front Center Bumper Retainer
(8) Front Side Bumper Retainer (RH)
(9) Head Light (R/LH)
(10) Front Side Turn Signal Light (R/LH)
(11) Horn (R/LH)

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove front bumper assembly.
   ▼Refer to the *Front Bumper in Body Structure section.*
4. Remove front center bumper retainer.
5. Remove front side bumper retainer (RH).
6. Remove condenser air guide.
7. Remove engine hood front end with engine hood lock & bumper stay.
   ▼Apply setting mark to the engine hood lock fixing position before removing it.

8. Remove horn (R/LH).
9. Remove front side turn signal light (R/LH).
10. Remove head light (R/LH).
11. Disconnect pressure switch, ambient sensor and condenser fan connector.
12. Disconnect refrigerant line.
    ▼When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
13. Remove condenser & receiver tank assembly.
    ▼Handle with care to prevent damaging the condenser or radiator fin.

Installation

1. Install condenser & reciver tank assembly.
   ▼If installing a new condenser, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
   ▼Tighten the condenser fixing bolts to the specified torque.

   Torque: 6 N•m (52 lb in)
2. Connect refrigerant line.
   ▼Tighten the inlet line connector fixing bolt to the specified torque.

   Torque: 15 N•m (11 lb ft)

   ▼Tighten the outlet line connector fixing bolt to the specified torque.

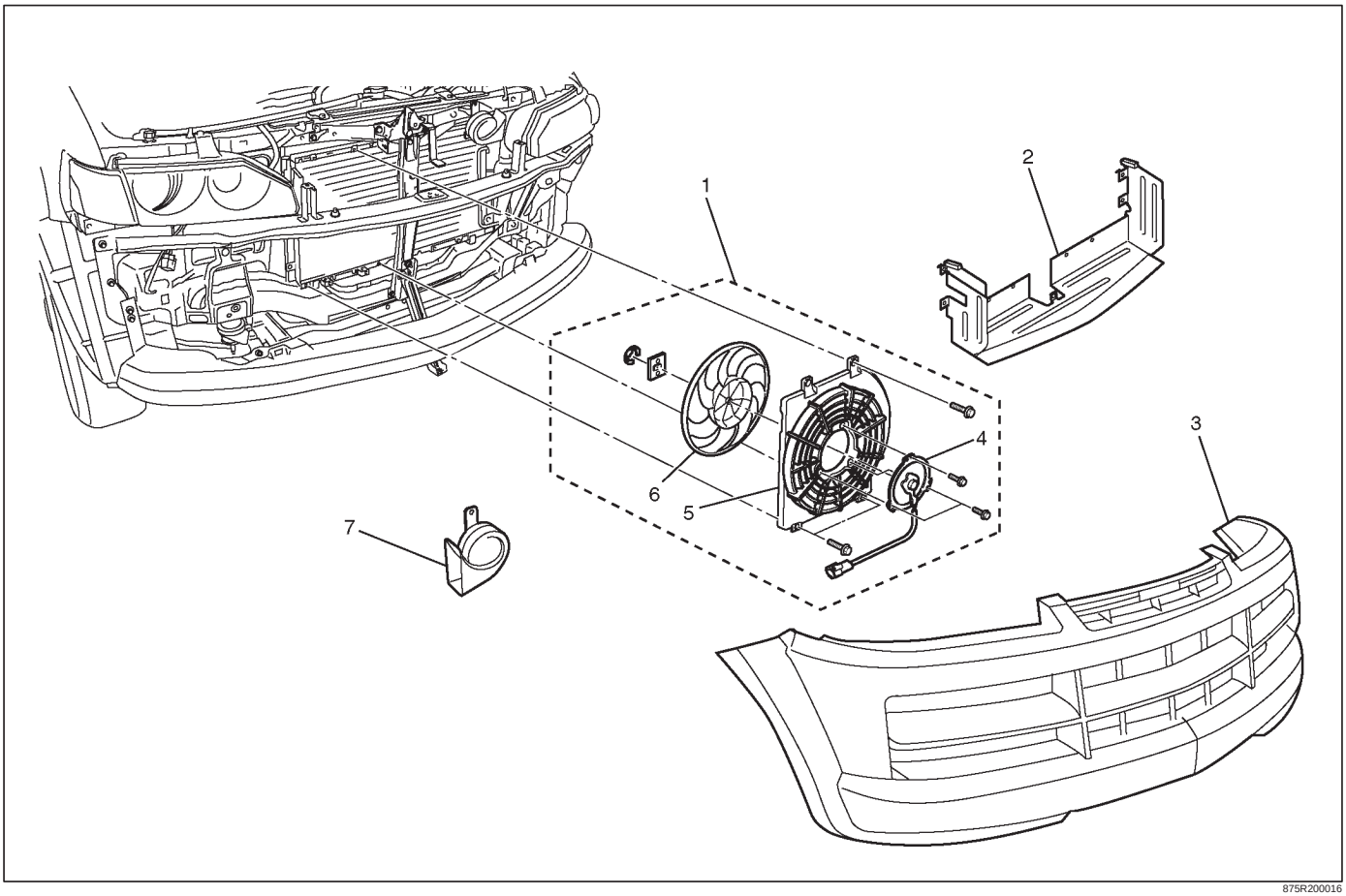
   Torque: 6 N•m (52 lb in)

   ▼O-rings cannot be reused. Always replace with new ones.

   ▼Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.
3. Connect pressure switch, ambient sensor and condenser fan connector.
4. Install head light (R/LH).
5. Install front side turn signal light (R/LH).
6. Install horn (R/LH).
7. Install engine hood front end with engine hood lock & bumper stay.
   ▼Align the setting mark when installing.
8. Install condenser air guide.
9. Install front side bumper retainer (RH).
10. Install front center bumper retainer.
11. Install front bumper assembly.

Condenser Fan Motor

Condenser Fan Motor and Associated Parts



Legend

(1) Condenser Fan Assembly
(2) Condenser Air Guide
(3) Front Bumper Assembly
(4) Condenser Fan Motor
(5) Shroud
(6) Fan
(7) Horn (RH)

Removal

1. Disconnect the battery ground cable.
2. Remove the front bumper assembly.
   ▼Refer to the *Front Bumper in Body Structure section.*
3. Remove the condenser air guide.
4. Remove the horn (RH).
5. Remove the condenser fan assembly.
   ▼Disconnect the fan motor connector and remove the 3 fixing bolts.
6. Remove the shroud.
   ▼Remove the 3 fixing nuts.
   ▼Loosen the condenser fixing nut and disconnect the fan motor connector from bracket.
7. Remove the fan.
   ▼Remove the fan fixing C-ring and plate.
8. Remove the condenser fan motor.

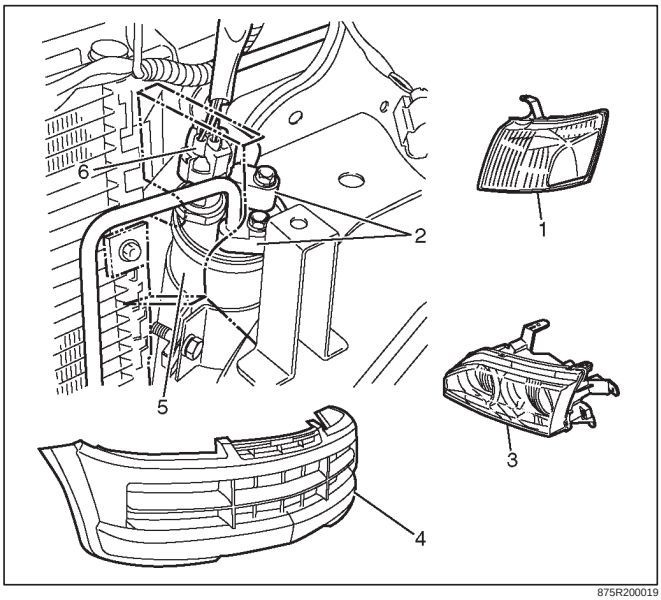
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Route the fan motor harness in its previous position, and fix it securely with clip and bracket.

Receiver / Drier

Receiver / Drier and Associated Parts



875R200019

Legend

(1) Front Side Turn Signal Light (LH)
(2) Refrigerant Line
(3) Head Light (LH)
(4) Front Bumper Assembly
(5) Receiver / Drier
(6) Pressure Switch Connector

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove front bumper assembly.
   ▼Refer to the *Front Bumper in Body Structure section.*
4. Remove front side turn signal light (LH).
5. Remove head light (LH).
6. Disconnect pressure switch connector.
7. Disconnect refrigerant line.
   ▼When removing the line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
8. Remove receiver/drier.
   ▼Loosen the bolt, then, using care not to touch or bend the refrigerant line, carefully pull out the receiver/drier.

Installation

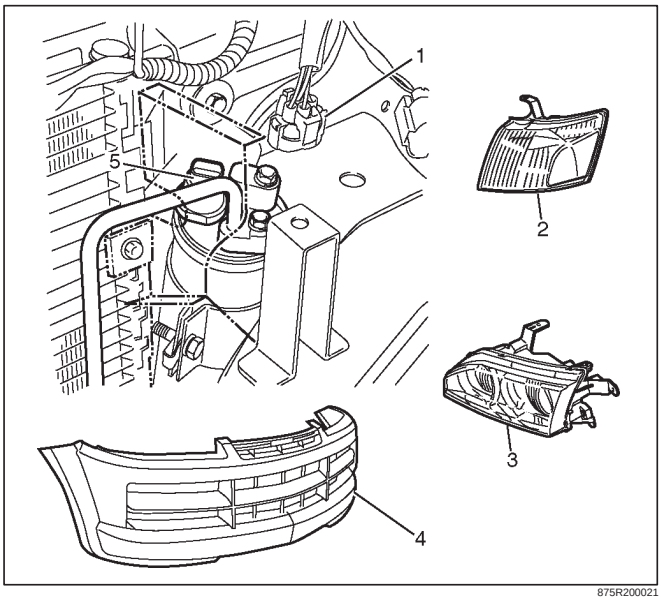
To install, follow the removal steps in the reverse order, noting the following points:

1. If installing a new receiver/drier, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
2. Put the receiver/drier in the bracket and connect with the refrigerant line. Check that no excessive force is imposed on the line. Fasten the bracket bolt to the receiver/drier.
3. Tighten the refrigerant line to the specified torque.

   Torque: 6 N•m (52 lb in)
4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.

Pressure Switch

Pressure Switch and Associated Parts



Legend

(1) Pressure Switch Connector
(2) Front Side Turn Signal Light (LH)
(3) Head Light (LH)
(4) Front Bumper Assembly
(5) Pressure Switch

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *"Refrigerant Recovery in this section.*
3. Remove the front bumper assembly.
   ▼Refer to the *Front Bumper in Body Structure section.*
4. Remove the front side turn signal light (LH).
5. Remove the head light (LH).
6. Disconnect pressure switch connector.
7. Disconnect pressure switch.
   ▼When removing the switch connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

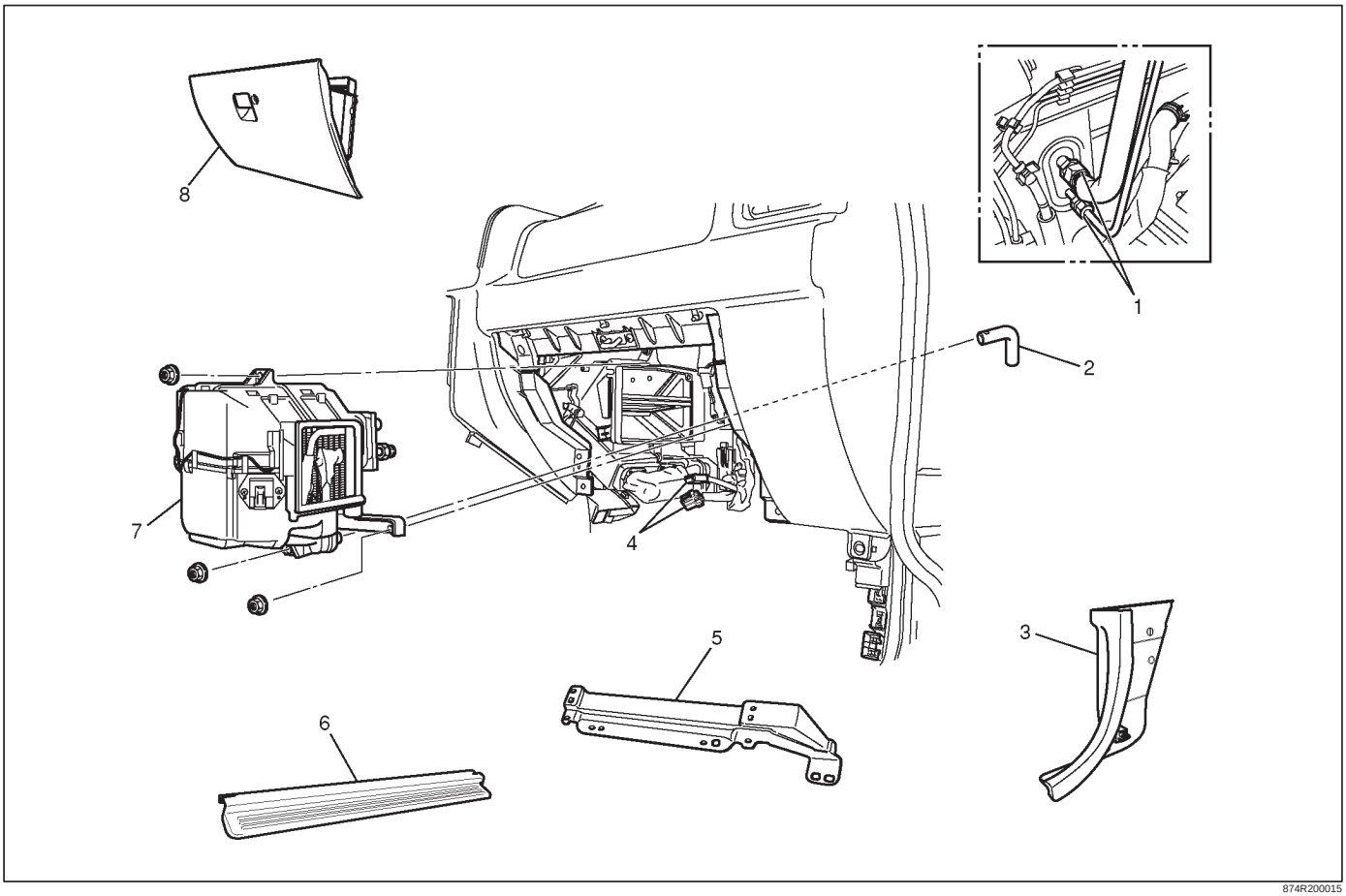
To install, follow the removal steps in the reverse order, noting the following point:

1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.

   Torque: 13 N•m (113 lb in)

Evaporator Assembly

Evaporator Assembly and Associated Parts



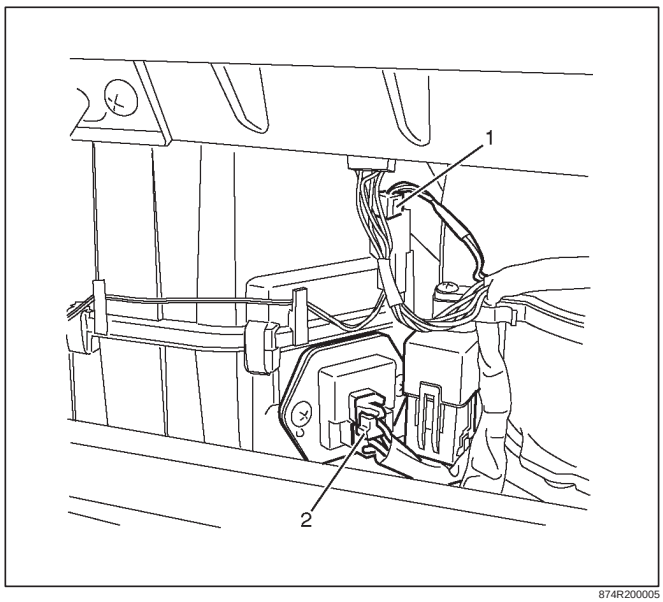
874R200015

Legend

(1) Refrigerant Line
(2) Drain Hose
(3) Dash Side Trim Panel
(4) Power Transistor and Duct Sensor Connector
(5) Passenger Lower Bracket
(6) Sill Plate
(7) Evaporator Assembly
(8) Glove Box

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove glove box.
4. Disconnect power transistor (2) and duct sensor connector (1).
5. Remove sill plate.
6. Remove dash side trim panel.
7. Remove passenger lower bracket.
8. Disconnect drain hose.



874R200005

9. Disconnect drain hose.
10. Disconnect refrigerant line.

▼Use a back-up wrench when disconnecting and reconnecting the refrigerant lines.

▼When removing the refrigerant line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

11. Remove evaporator assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. To install a new evaporator assembly, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
2. Tighten the refrigerant outlet line to the specified torque.

   Torque: 25 N•m (18 lb ft)

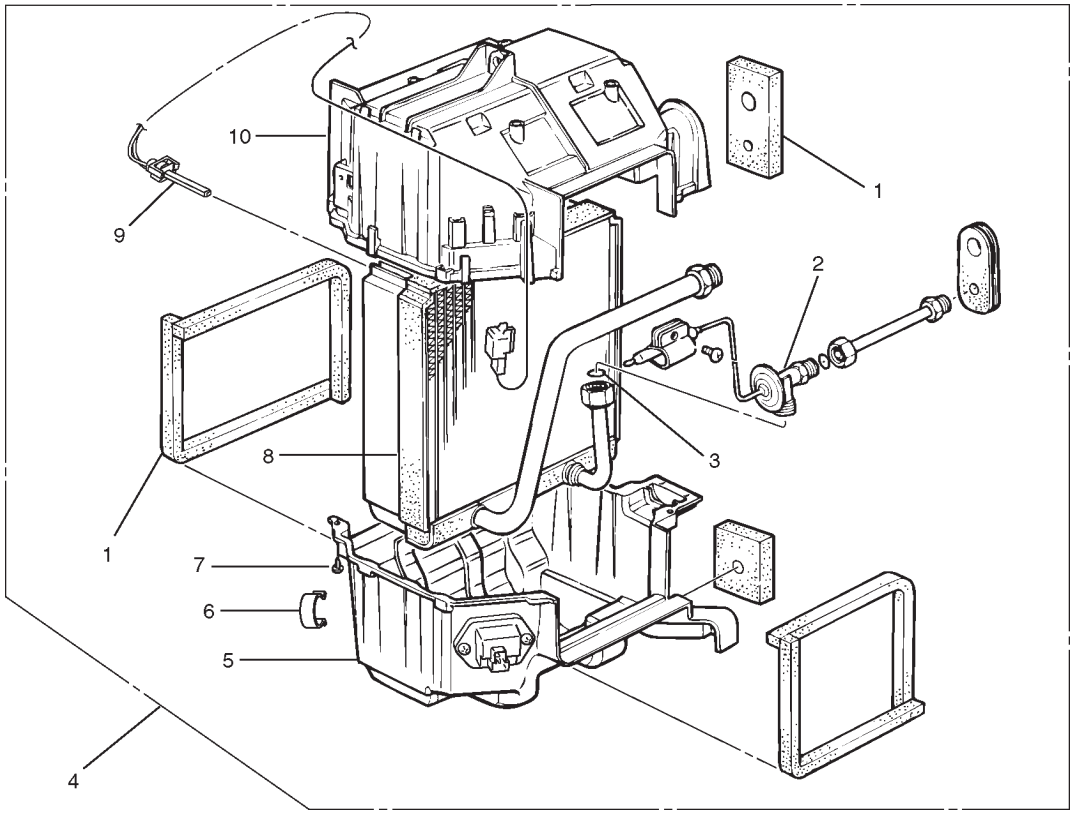
3. Tighten the refrigerant inlet line to the specified torque.

   Torque: 15 N•m (11 lb ft)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.

Duct Sensor, Evaporator Core and/or Expansion Valve

Disassembled View



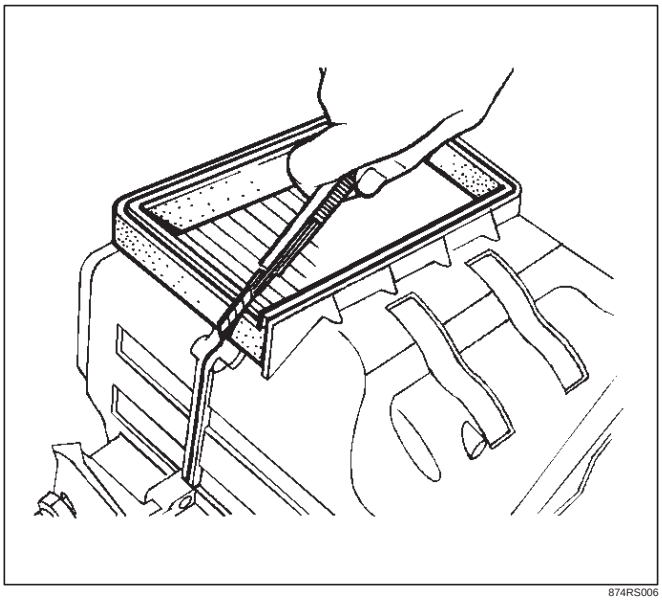
874R200012

Legend

(1) Lining
(2) Expansion Valve
(3) O-ring
(4) Evaporator Assembly
(5) Lower Case
(6) Clip
(7) Attaching Screw
(8) Evaporator Core
(9) Duct Sensor
(10) Upper Case

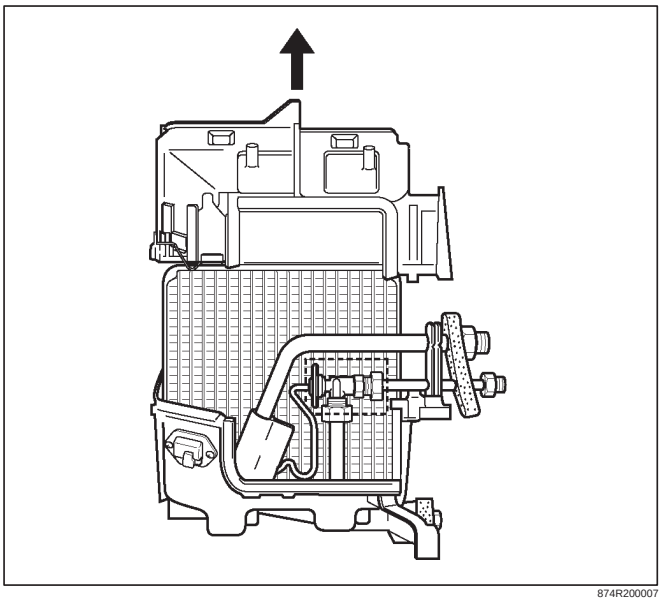
Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove evaporator assembly.
   ▼Refer to *Evaporator Assembly in this section.*
4. Remove the duct sensor fixing clip.
   Pull the sensor from the evaporator assembly.
5. Remove clip.
6. Remove attaching screw.
7. Remove upper case.
8. Remove lower case.
   ▼Slit the case parting face with a knife since the lining is separated when removing the evaporator.



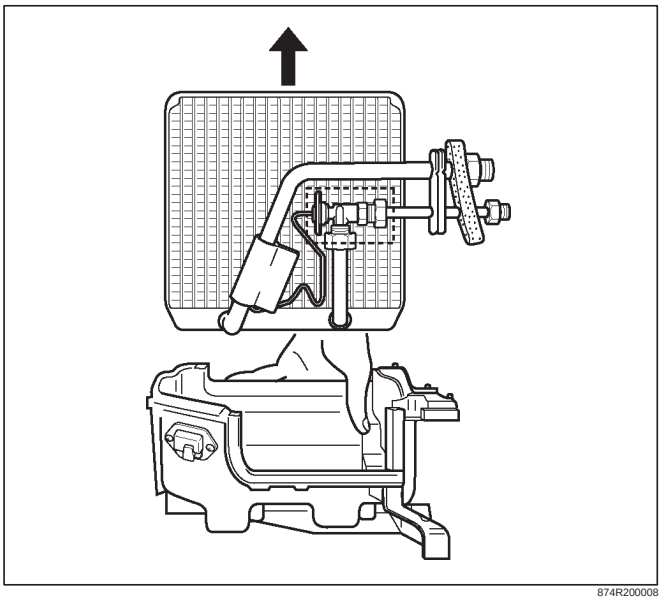
874RS006

▼Lift to remove the upper case.



874R200007

9. Remove evaporator core.



874R200008

10. Remove expansion valve.

▼Tear off the insulator carefully.

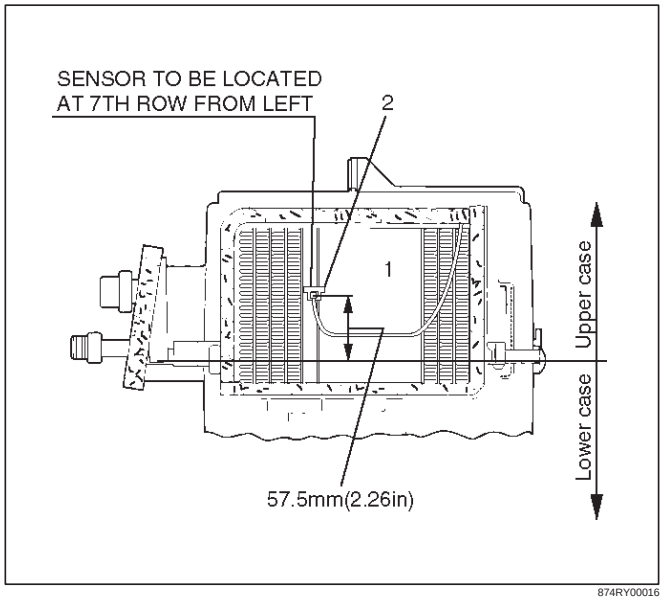
▼Remove the sensor fixing clip.

▼Use a back-up wrench when disconnecting all refrigerant pipes.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. The sensor is installed on the core with the clip.
2. The sensor must not interfere with the evaporator core.
3. When installing the new evaporator core, install the duct sensor (2) to the evaporator core (1) specified position with the clip in the illustration.

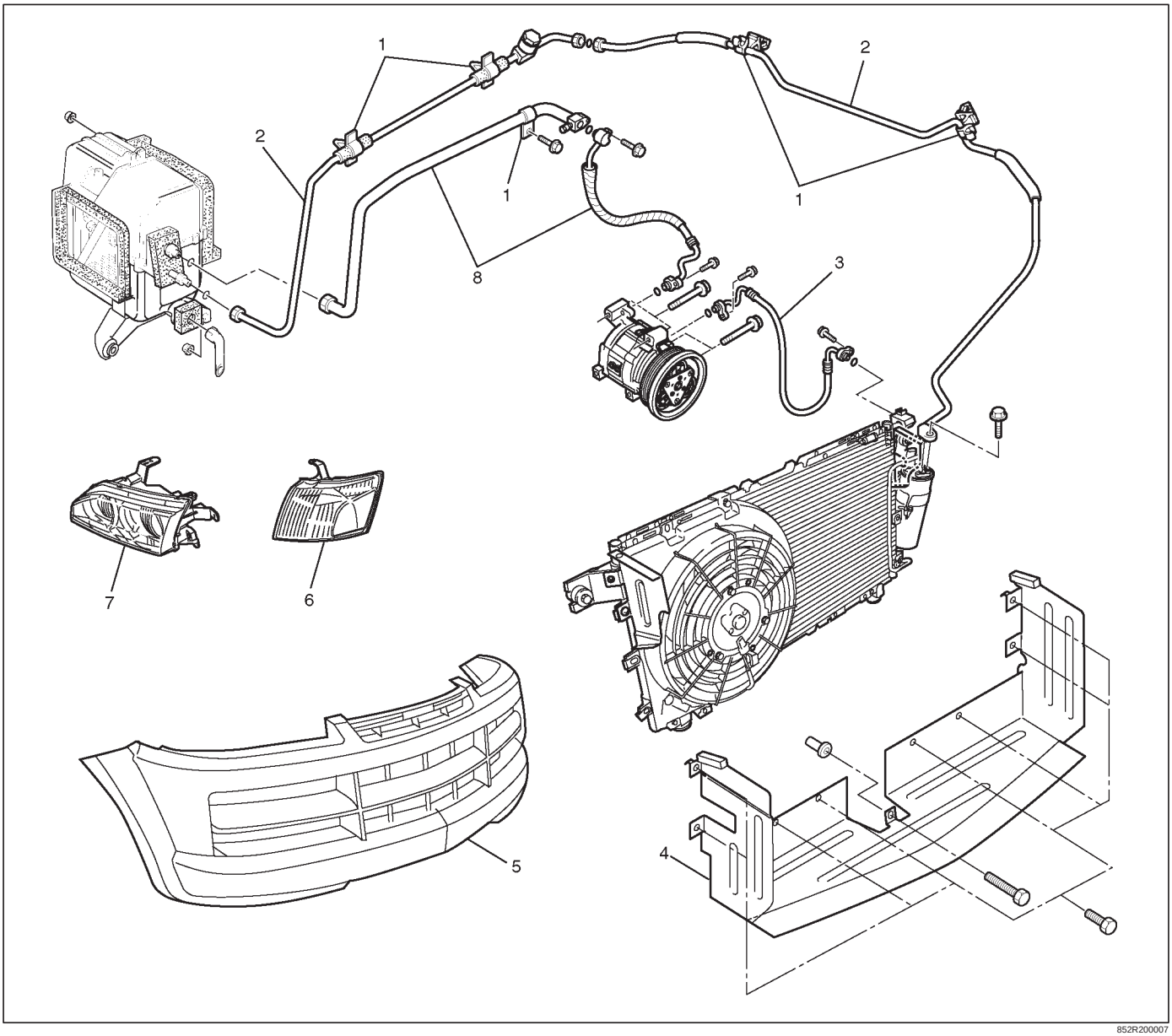


874RY00016

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.
6. Be sure to install the sensor and the insulator on the place where they were before.
7. To install a new evaporator core, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
8. Tighten the refrigerant lines to the specified torque. Refer to *Main Data and Specifications for Torque Specifications in this section.*
9. Apply an adhesive to the parting face of the lining when assembling the evaporator assembly.

Refrigerant Line

Refrigerant Line and Associated Parts



852R200007

Legend

(1) Clip and Clamp
(2) Liquid Line (High-Pressure Pipe)
(3) Discharge Line (High-Pressure Hose)
(4) Condenser Air Guide
(5) Front Bumper Assembly
(6) Front Side Turn Signal Light (LH)
(7) Head Light (LH)
(8) Suction Line (Low-Pressure Pipe)

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove the front bumper assembly.
   ▼Refer to the *Front Bumper in Body Structure section.*
4. Remove the condenser air guide.
5. Remove the front side turn signal light (LH).
6. Remove the head light (LH).
7. Remove clip and clamp.
8. Disconnect liquid line (High-pressure pipe).
9. Disconnect suction line (Low-pressure pipe) using a back-up wrench.
10. Disconnect suction line (Low-pressure hose) using a back-up wrench.

11. Disconnect discharge line (High-pressure hose) using a back-up wrench.

    ▼Use a backup wrench when disconnecting and reconnecting the refrigerant lines.

    ▼When removing the refrigerant line connecting part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

To install, follow the removal steps in the reverse order, noting the following point:

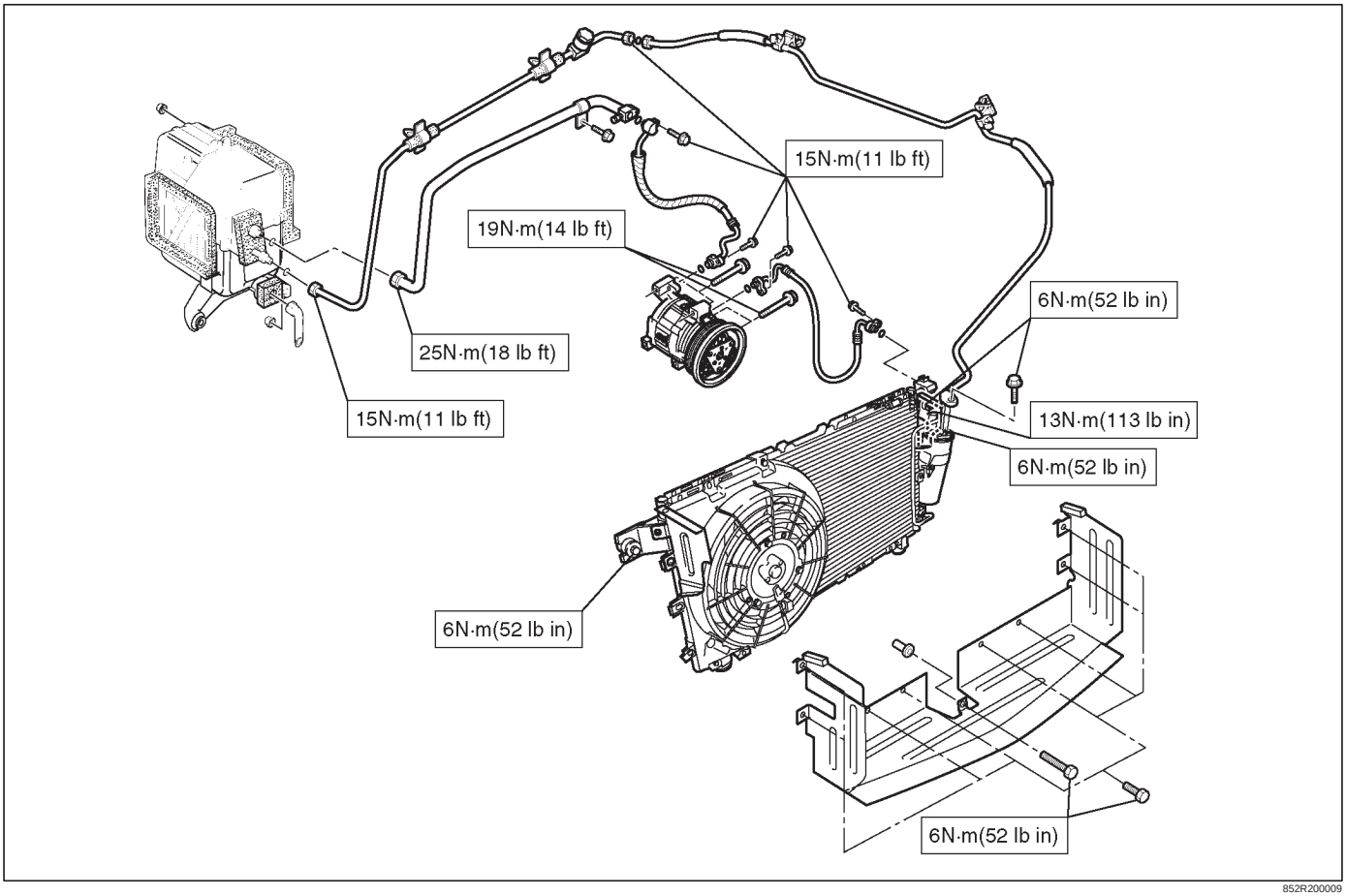
1. O-rings cannot be reused. Always replace with new ones.
2. Be sure to apply new compressor oil to the O-rings when connecting lines.
3. Tighten the refrigerant line to the specified torque.
   Refer to *Main Data and Specifications for Torque Specifications in this section.*

Main Data And Specifications

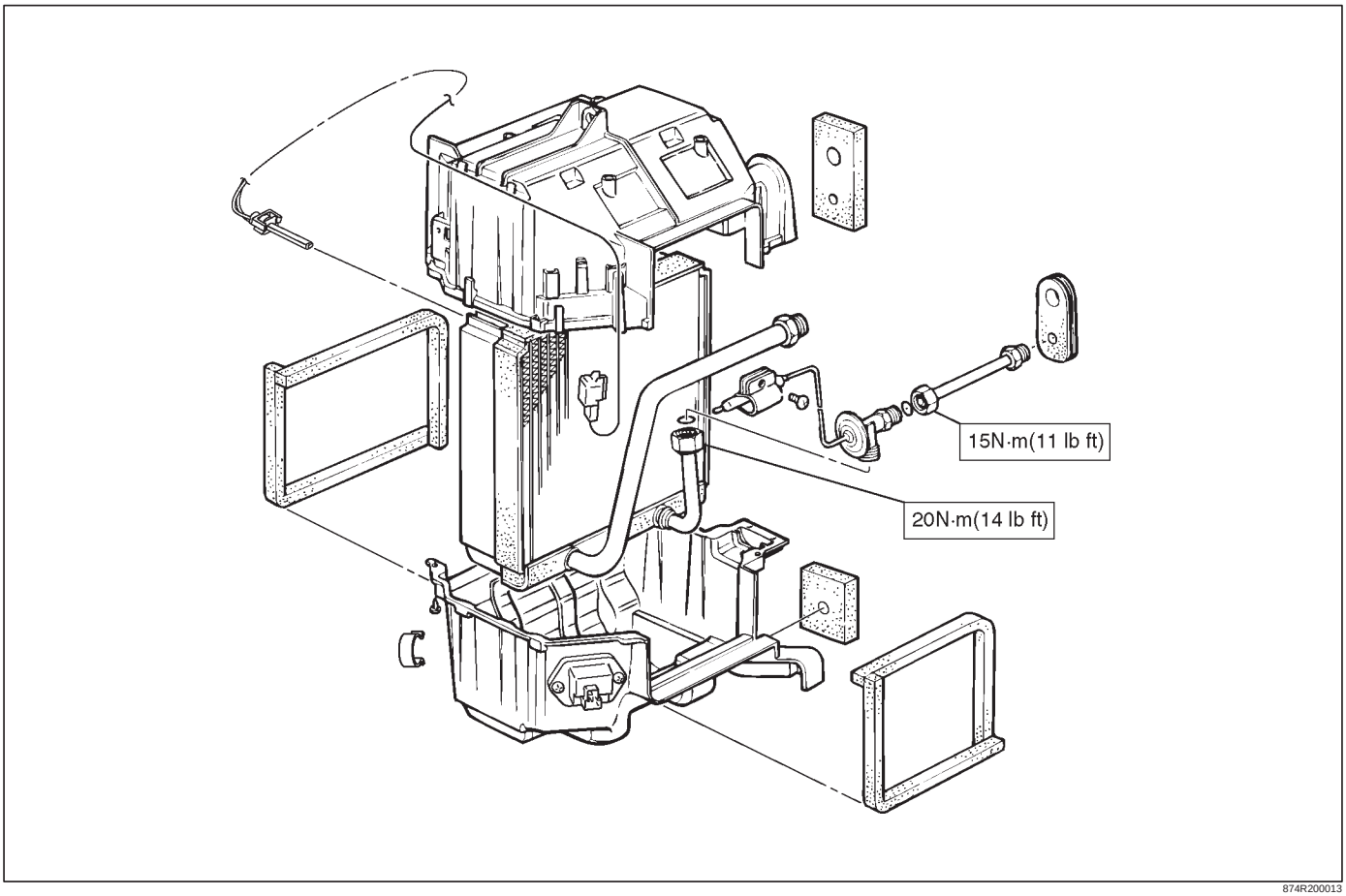
General Specifications

Heater Unit	
Temperature control	Reheat air mix system
Capacity	4.3 kw (3700 Kcal./hr.)
Air flow	280 m^3/h
HEATER CORE	
Type	Plate and corrugate fin
Element dimension	167 mm (6.6 in.) × 151 mm (5.9 in.) × 35 mm (1.4 in.)
Radiating area	Approx. 2.4 m^2
EVAPORATOR ASSEMBLY	
Capacity	4.8 kw (4100 Kcal./hr.)
Air flow	430 m^3/hr
EVAPORATOR CORE	
Type	Al-laminate louver fin type
Element dimension	235 mm (9.3 in.) × 224 mm (8.8 in.) × 60 mm (2.4 in.)
EXPANSION VALVE	
Type	Internal pressure equalizer type
CONDENSER	
Type	Parallel flow type
Radiation performance	14.8 kw (12,700 Kcal./hr.)
CONDENSER FAN	
Air flow	850 m^3/h
Fan size	Ω261
RECEIVER/DRIER	
Type	Assembly includes triple pressure switch
Internal volume	300 cc (10 fl.oz.)
PRESSURE SWITCH	
Type	Triple pressure switch
	Low pressure control ON: 206.0±30.0 kPa (29.8±4.3 psi) OFF: 176.5±19.6 kPa (25.6±2.8 psi)
	Medium pressure control ON: 1471.0±98.1 kPa (213.3±14.2 psi) OFF: 1078.7±117.7 kPa (156.4±17.7 psi)
	High pressure control ON: 2353.6±196.1 kPa (341.3±28.4 psi) OFF: 2942.0±196.1 kPa (426.6±28.4 psi)
REFRIGERANT	
Type	HFC-134a
Specified amount	700 g (1.54 lbs.)

Torque Specifications



852R200009



874R200013

Compressor

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS ON-VEHICLE SERVICE INFORMATION. FAILURE TO FOLLOW CAUTIONS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor should be cleaned before any ”On–Vehicle” repair, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene, or equivalent solvent, and dried with dry air. Use only lint free cloths to wipe parts.

The operations described below are based on bench overhaul with compressor removed from the vehicle, except as noted. They have been prepared in order of accessibility of the components. When the compressor is removed from the vehicle for servicing, the oil remaining in the compressor should be discarded and new compressor oil added to the compressor.

Compressor malfunction will appear in one of four ways: noise, seizure, leakage or low discharge pressure. Resonant compressor noises are not cause for alarm; however, irregular noise or rattles may indicate broken parts or excessive clearances due to wear. To check seizure, de–energize the magnetic clutch and check to see if the drive plate can be rotated. If rotation is impossible, the compressor is seized. Low discharge pressure may be due to a faulty internal seal of the compressor, or a restriction in the compressor. Low discharge pressure may also be due to an insufficient refrigerant charge or a restriction elsewhere in the system. These possibilities should be checked prior to servicing the compressor. If the compressor is inoperative, but is not seized, check to see if current is being supplied to the magnetic clutch coil terminals.

The compressor oil used in the HFC–134a system compressor differs from that used in R–12 systems.

Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.

If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.

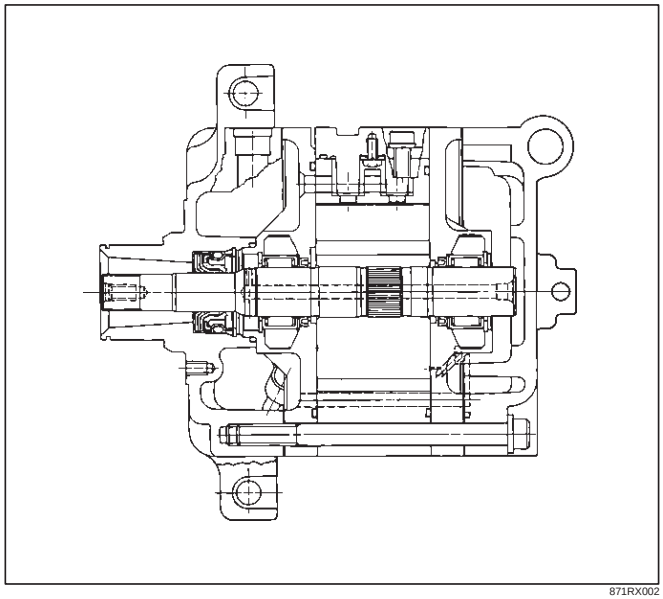
DKV-14G Type Compressor

DKV–14G is equipped with five–vane rotary compressor. These vanes are built into a rotor which is mounted on a shaft.

When the shaft rotates, the vanes built into the cylinder block assembly are operated by centrifugal force.

This changes the volume of the spare formed by the rotor and cylinder, resulting in the intake and compression of the refrigerant gas. The discharge valve and the valve stopper, which protects the discharge valve, are built into the cylinder block assembly. There is no suction valve but a shaft seal is installed between the shaft and head; a trigger valve, which applies back pressure to the vanes, is installed in the cylinder block and a refrigerant gas temperature sensor is installed in the front head.

The specified quantity of compressor oil is contained in the compressor to lubricate the various parts using the refrigerant gas discharge pressure.



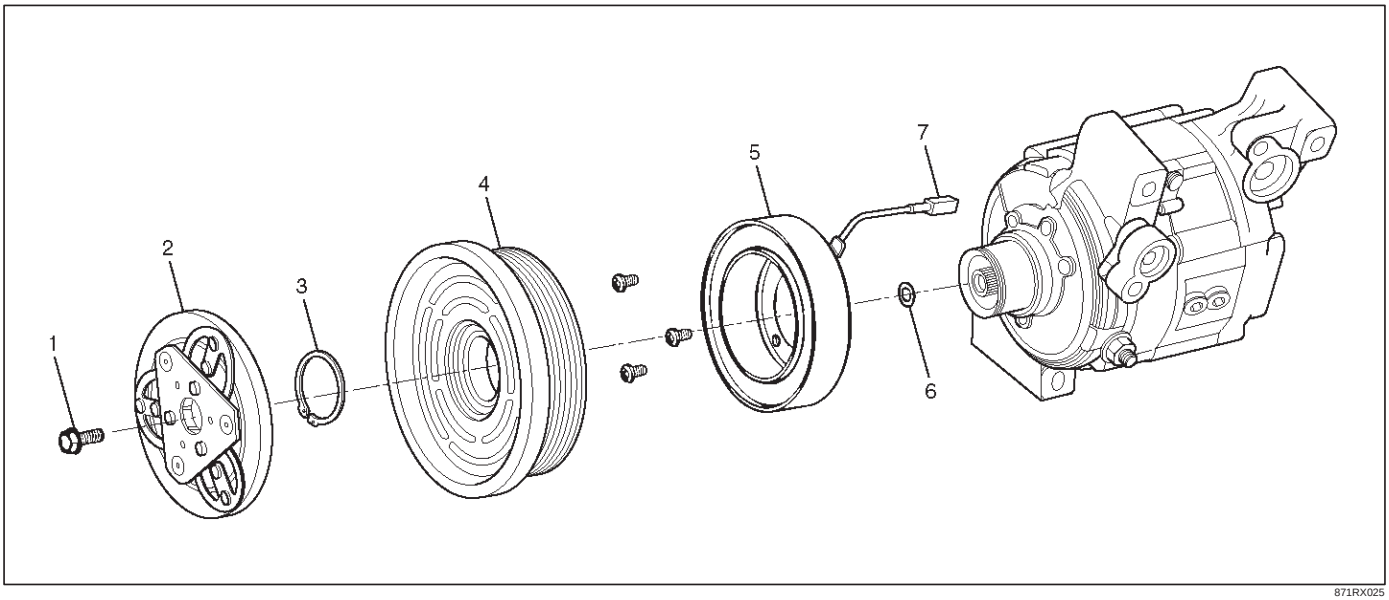
871RX002

Diagnosis

Condition	Possible cause	Correction
Noise from compression	Defective rotor/piston	Replace compressor/cylinder and shaft assembly
	Defective shaft	Replace compressor/cylinder and shaft assembly
Noise from magnetic clutch	Defective bearing	Replace magnetic clutch
	Defective clutch	Replace magnetic clutch
	Clearance between drive plate and pulley not standard	Adjust the clearance or replace magnetic clutch
Insufficient cooling	Defective gasket	Replace compressor/gasket
	Defective rotor/reed valve	Replace compressor/valve plate
	Defective trigger valve/suction valve	Replace compressor/suction valve
Not rotating	Defective rotor/piston	Replace compressor/cylinder and shaft assembly
	Defective shaft	Replace compressor/cylinder and shaft assembly
	Rotating parts seized due to insufficient oil	Replace compressor
Oil and/or gas leakage	Defective seal	Replace compressor/shaft seal
	Defective O-ring	Replace

Magnetic Clutch Assembly (DKV-14G Type)

Parts Location View



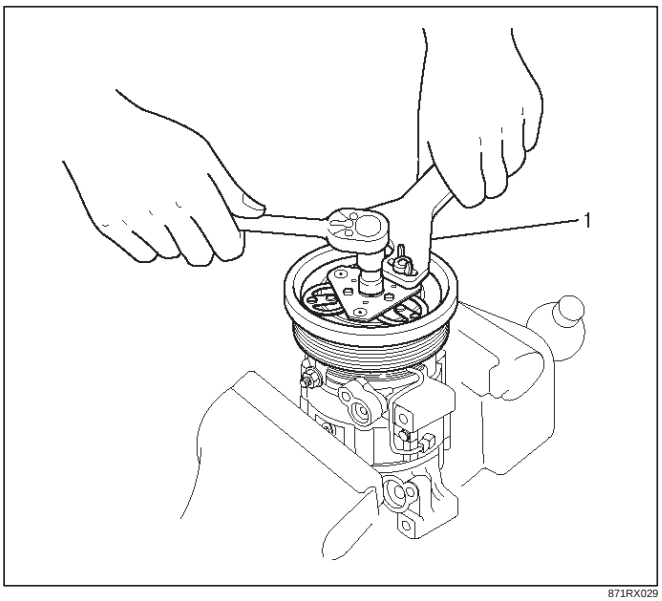
871RX025

Legend

(1) Drive Plate bolt
(2) Drive Plate
(3) Snap Ring
(4) Pulley Assembly
(5) Field Coil
(6) Shim (s)
(7) Lead Wire

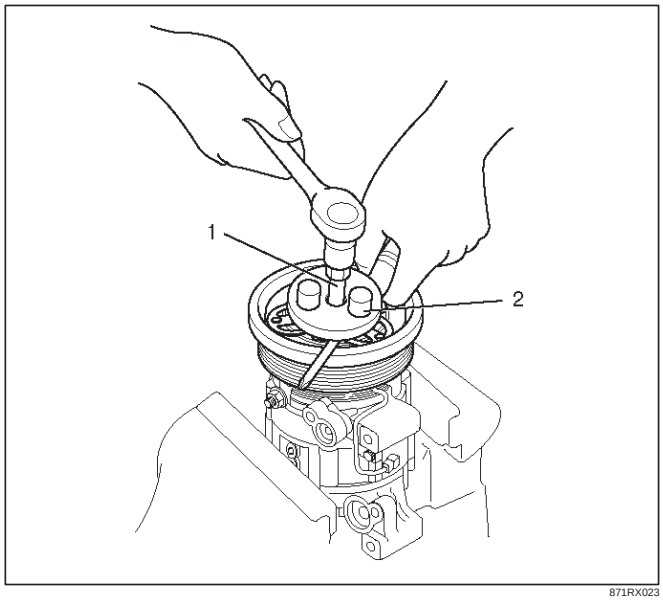
Removal

1. Using drive plate holder J-33939 (1) to prevent the drive plate from rotating, then remove the drive plate bolt.



871RX029

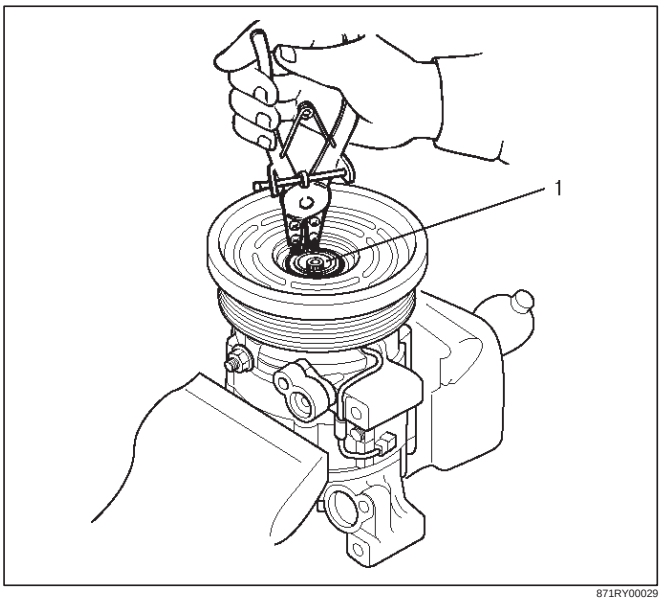
2. Remove drive plate by using drive plate puller J-33944-A (2) and forcing screw J-33944-4 (1).



871RX023

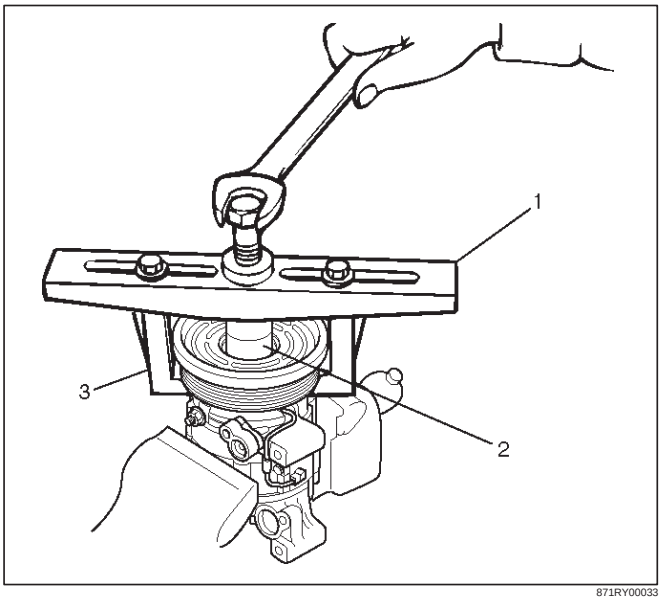
3. Remove shim (s).

4. Remove snap ring (1) by using snap ring pliers.



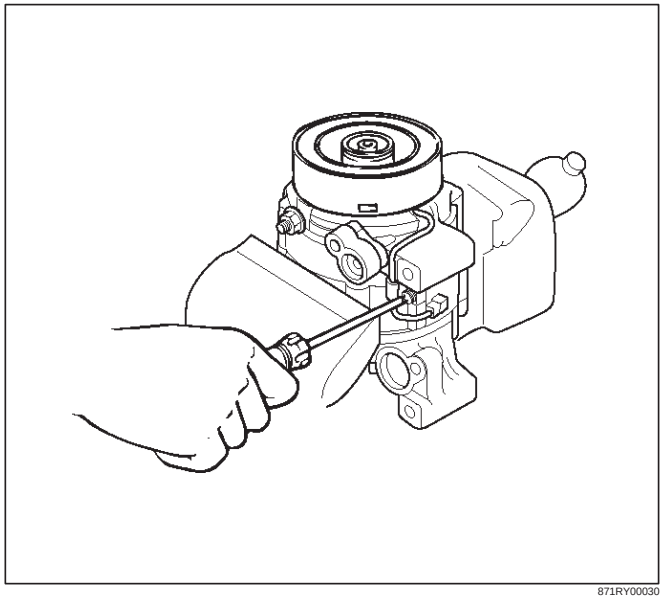
871RY00029

5. Remove pulley assembly by using pulley puller pilot J-38424 (2), pulley puller J-8433 (1) and pulley puller leg J-24092-2 (3).



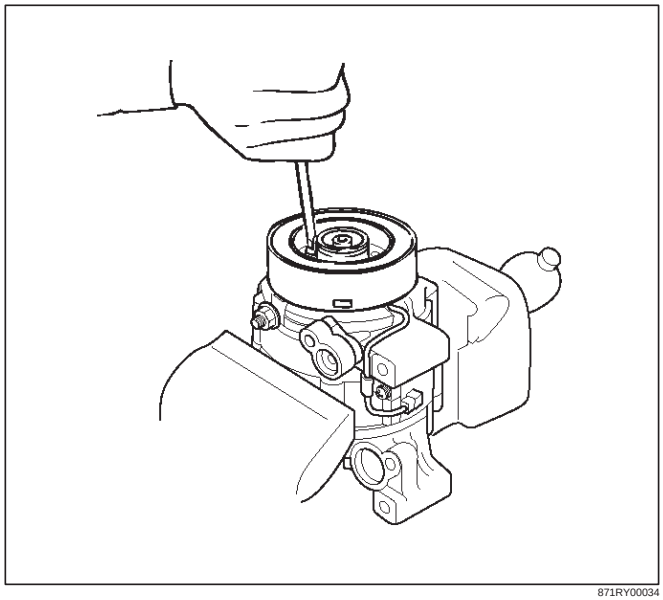
871RY00033

6. Loosen screw and disconnect the field coil wire connector.



871RY00030

7. Loosen three screws and remove the field coil.



871RY00034

Inspection and Repair

Drive Plate

If the frictional surface shows signs of damage due to excessive heat, the drive plate and pulley should be replaced.

Pulley Assembly

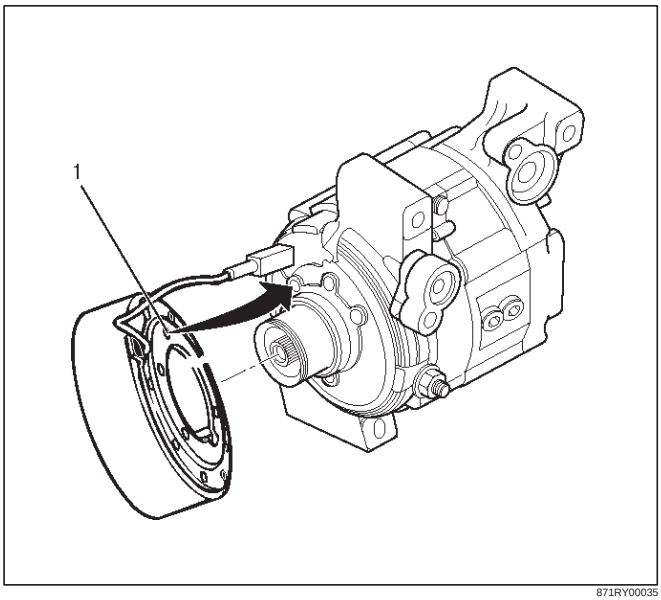
Check the appearance of the pulley assembly. If the frictional surface of the pulley shows signs of excessive grooving due to slippage, both the pulley and drive plate should be replaced. The frictional surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

Coil

Check coil for loose connector or cracked insulation.

Installation

1. Install field coil.
   ▼Align the located portion (1) of the field coil and compressor.

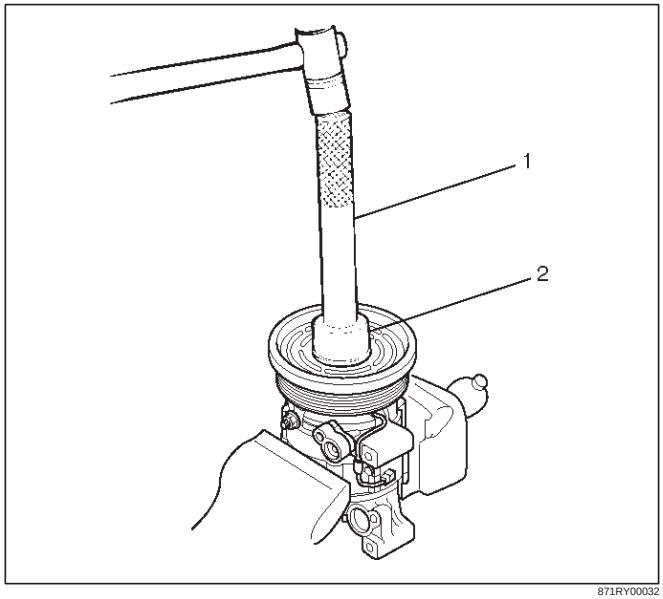


871RY00035

   ▼Tighten the mounting screw to the specified torque.

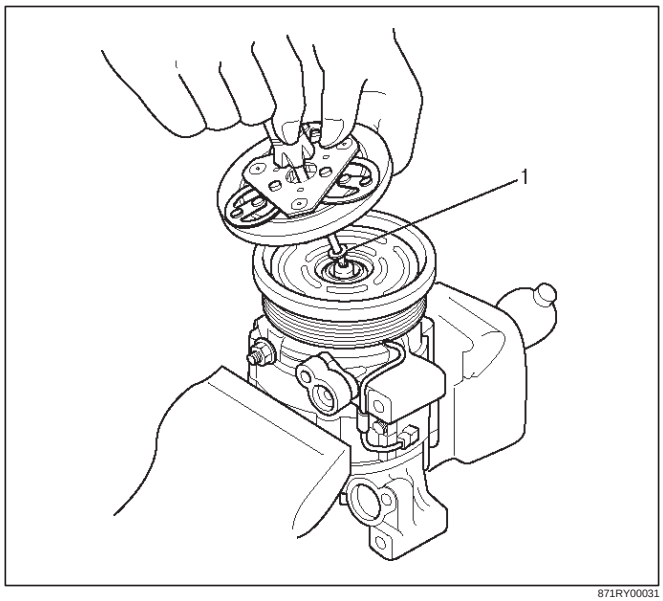
   Torque: 5N·m (44 lb in)

2. Connect the lead wire connector with the rubber hold and tighten the screw.
3. Install pulley assembly by using pulley installer J-33940-A (2) and drive handle J-8092 (1).



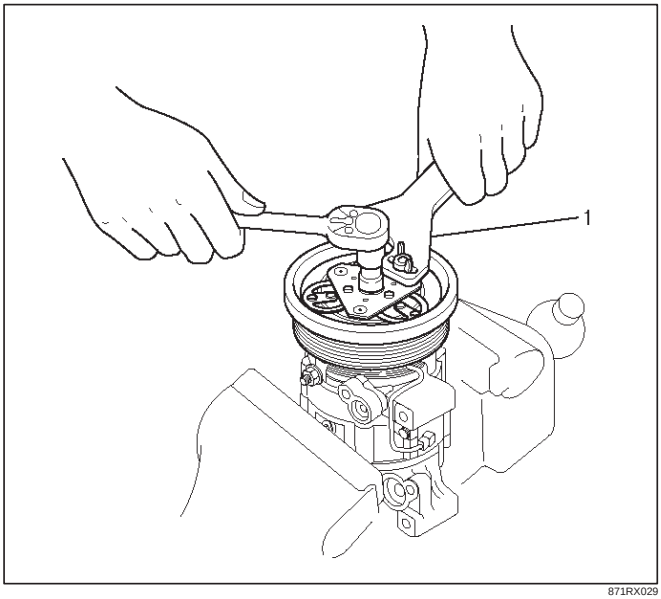
871RY00032

4. Install snap ring.
5. Install shim (s).
6. Install the drive plate to the compressor drive shaft together with the original shim(s)(1). Press the drive plate by hand.



871RY00031

7. Install drive plate bolt by using drive plate holder J-33939 (1) to prevent the drive plate from rotating.



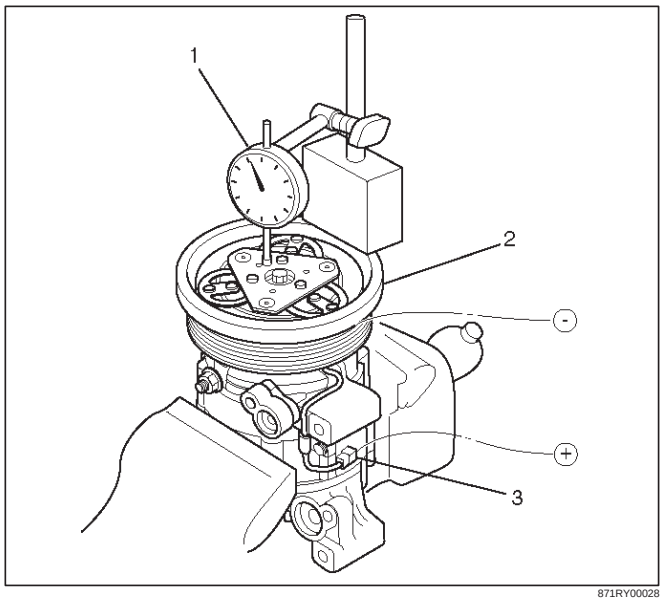
871RX029

▼Tighten the drive plate bolt to the specified torque.

Torque: 13 N·m (113 lb in)

▼After tightening the drive plate bolt, check to be sure the pulley rotates smoothly.

▼Check to be sure that the clutch clearance is between 0.3-0.6 mm (0.01-0.02 in.)



871RY00028

Legend

(1) Dial Gauge
(2) Pulley Assembly
(3) Field Coil Wire Connector

▼If necessary, install adjusting shim(s).

▼Adjusting shims are available in the following thickness.

Thickness

▼0.1 mm (0.0039 in.)
▼0.3 mm (0.0118 in.)
▼0.5 mm (0.0197 in.)

Compressor Oil

Oil Specification

- The HFC-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires a mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.
- **Always use HFC-134a Vane Rotary Type Compressor Oil (AIPDN Part No.2-90188-301-0)**

Handling of Oil

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil.
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Vane Rotary Compressor Oil absorbs moisture very easily.)
- The compressor oil must be stored in steel containers, not in plastic containers.

Compressor Oil Check

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil Capacity

Capacity total in system: 150cc (5.0 fl.oz)

Compressor (Service parts) charging amount: 150 cc (5.0 fl.oz)

Checking and Adjusting Oil Quantity for Used Compressor

1. Perform oil return operation. Refer to Oil Return Operation in this section.
2. Discharge and recover refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
4. If the amount of oil drained is much less than 90 cc (3.0 fl. oz.), some refrigerant may have leaked out. Conduct a leak tests on the connections of each system, and if necessary, repair or replace faulty parts.
5. Check the compressor oil contamination. (Refer to Contamination of Compressor Oil in this section.)
6. Adjust the oil level following the next procedure below.

(Charging Amount)	(Collected Amount)
more than 90cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90cc (3.0 fl.oz)

7. Install the compressor, then evacuate, charge and perform the oil return operation.
8. Check system operation.

When it is impossible to preform oil return operation, the compressor oil should be checked in the following order:

1. Discharge and recover refrigerant and remove the compressor.
2. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
3. Check the oil for contamination.
4. If more than 90 cc (3.0 fl. oz.) of oil is extracted from the compressor, supply the same amount of oil to the compressor to be installed.
5. If the amount of oil extracted is less than 90 cc (3.0 fl. oz.), recheck the compressor oil in the following order.
6. Supply 90 cc (3.0 fl. oz.) of oil to the compressor and install it onto the vehicle.
7. Evacuate and recharge with the proper amount of refrigerant.
8. Perform the oil return operation.
9. Remove the compressor and recheck the amount of oil.
10. Adjust the compressor oil, if necessary.

(Collected Amount)	(Charging Amount)
more than 90 cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

Checking and Adjusting for Compressor Replacement

150 cc (5.0 fl.oz.) of oil is charged in compressor (service parts). So it is necessary to drain the proper amount of oil from the new compressor.

1. Perform oil return operation.
2. Discharge and recover the refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil.
4. Check the compressor oil for contamination.
5. Adjust the oil level as required.

(Amount of oil drained from used compressor)	(Draining amount of oil from new compressor)
less than 90 cc (3.0 fl.oz)	Same as drained amount
more than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

6. Evacuate, charge and perform the oil return operation.
7. Check the system operation.

Contamination of Compressor Oil

Unlike engine oil, no cleaning agent is added to the compressor oil. Even if the compressor runs for a long period of time (approximately one season), the oil never becomes contaminated as long as there is nothing wrong with the compressor or its method of use.

Inspect the extracted oil for any of the following conditions:

- ▼ The capacity of the oil has increased.
- ▼ The oil has changed to red.
- ▼ Foreign substances, metal powder, etc., are present in the oil.

If any of these conditions exists, the compressor oil is contaminated. Whenever contaminated compressor oil is discovered, the receiver/drier must be replaced.

Oil Return Operation

There is close affinity between the oil and the refrigerant. During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to “ON” and set the fan control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

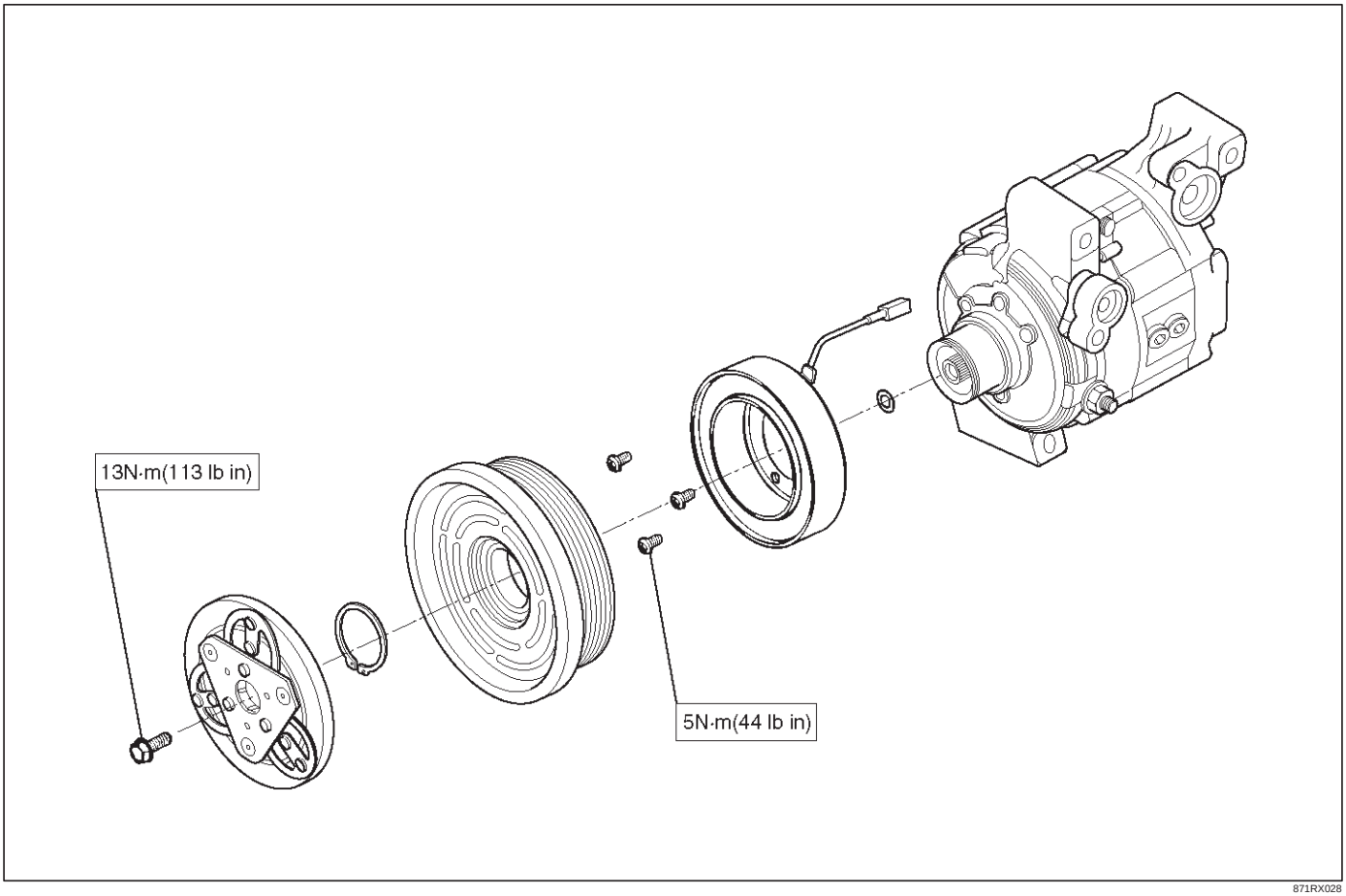
(Component parts to be installed)	(Amount of Oil)
Evaporator	50 cc (1.7 fl. oz.)
Condenser	30 cc (1.0 fl. oz.)
Receiver/dryer	30 cc (1.0 fl. oz.)
Refrigerant line (one piece)	10 cc (0.3 fl. oz.)

Main Data and Specifications

General Specifications

COMPRESSOR	
Model	DKV-14G
Type	Vane rotary type
Number of vanes	5
Rotor diameter	64 mm (2.52 in.)
Stroke	8.75 mm (0.34 in.)
Displacement	140 cc (47.3 fl.oz.)
Maximum speed	7,000 rpm (up to 8,400 rpm)
Direction of rotation	Clockwise (Front-side view)
Lubrication system	Pressure differential type
Lubricant	R-134a Vane Rotary Type Compressor Oil (AIPDN Part No.2-90188-301-0) 150 cc (5.0 fl.oz.)
Refrigerant	Refrigerant-134a (R-134a), 700 g (1.54 lbs.)
Shaft seal	Lip type
Weight	3.5 kg
MAGNETIC CLUTCH	
Type	Electromagnetic single-plate dry clutch
Rated voltage	12 Volts D.C.
Current consumption	3.7 A
Starting torque	49 N·m (36 lb·ft)
Direction of rotation	Clockwise (Front-side view)
Weight	3.0 kg (6.6 lbs.)

Torque Specifications



871RX028

Special Tools

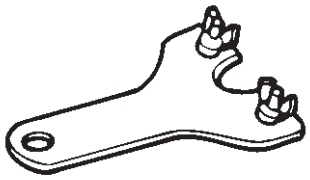
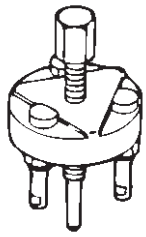
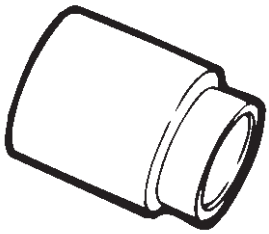
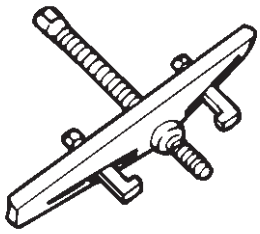
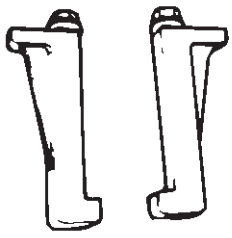
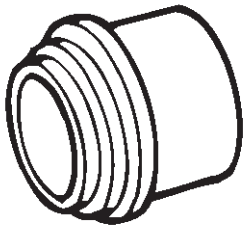
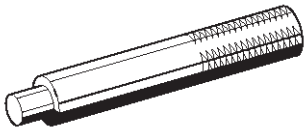
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS191	**J-33939** Drive plate holder
 901RS192	**J-33944-A** Drive plate puller
901RS193	**J-33944-4** Forcing screw
 901RS194	**J-38424** Pulley puller pilot
 901RS195	**J-8433** Pulley puller
 901RS196	**J-24092-2** Pulley puller leg

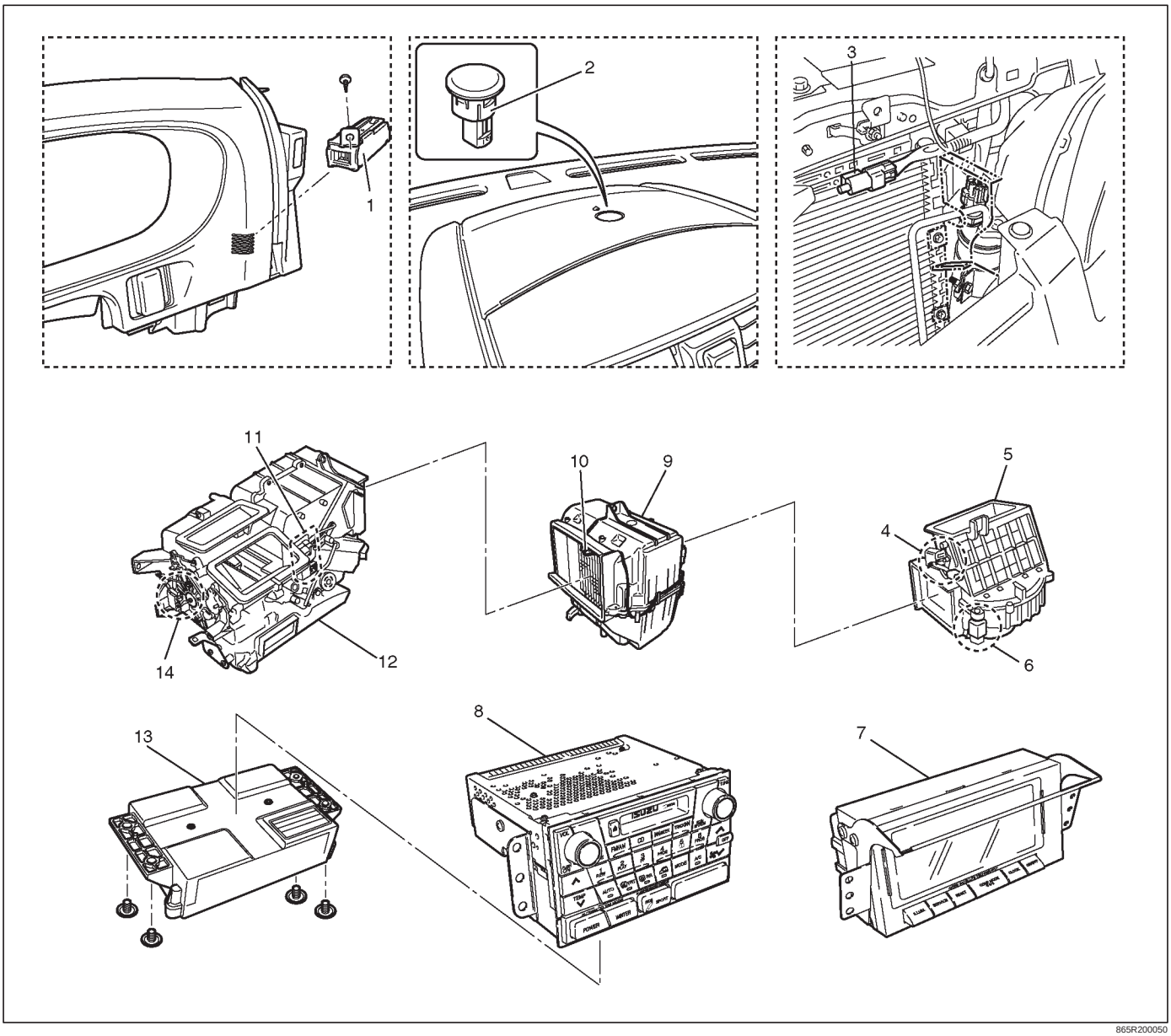
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS197	**J-33940-A** Pulley installer
 901RS218	**J-8092** Drive handle

Automatic Air Conditioning System

General Description

Using a variety of sensors, this automatic air conditioner accurately senses outside air temperature, solar radiation quantity, evaporator's blowing temperature, and interior temperature, then enters these data to the automatic air conditioner control unit (equipped with the built-in micro-computer). The data provided to the control unit enables to automatically control blow temperature and blow air quantity, turn on or off the compressor and switch the blow port as well as switching between the fresh air intake and interior air circulation.
Resetting the automatic function allows you to switch to the manual control mode.
The self-diagnoisis function of the automatic air conditioner control unit (with the built-in micro-computer) allows the unit to access and diagnose a failed part easier and quicker.

Automatic Air Conditioner Parts Configuration

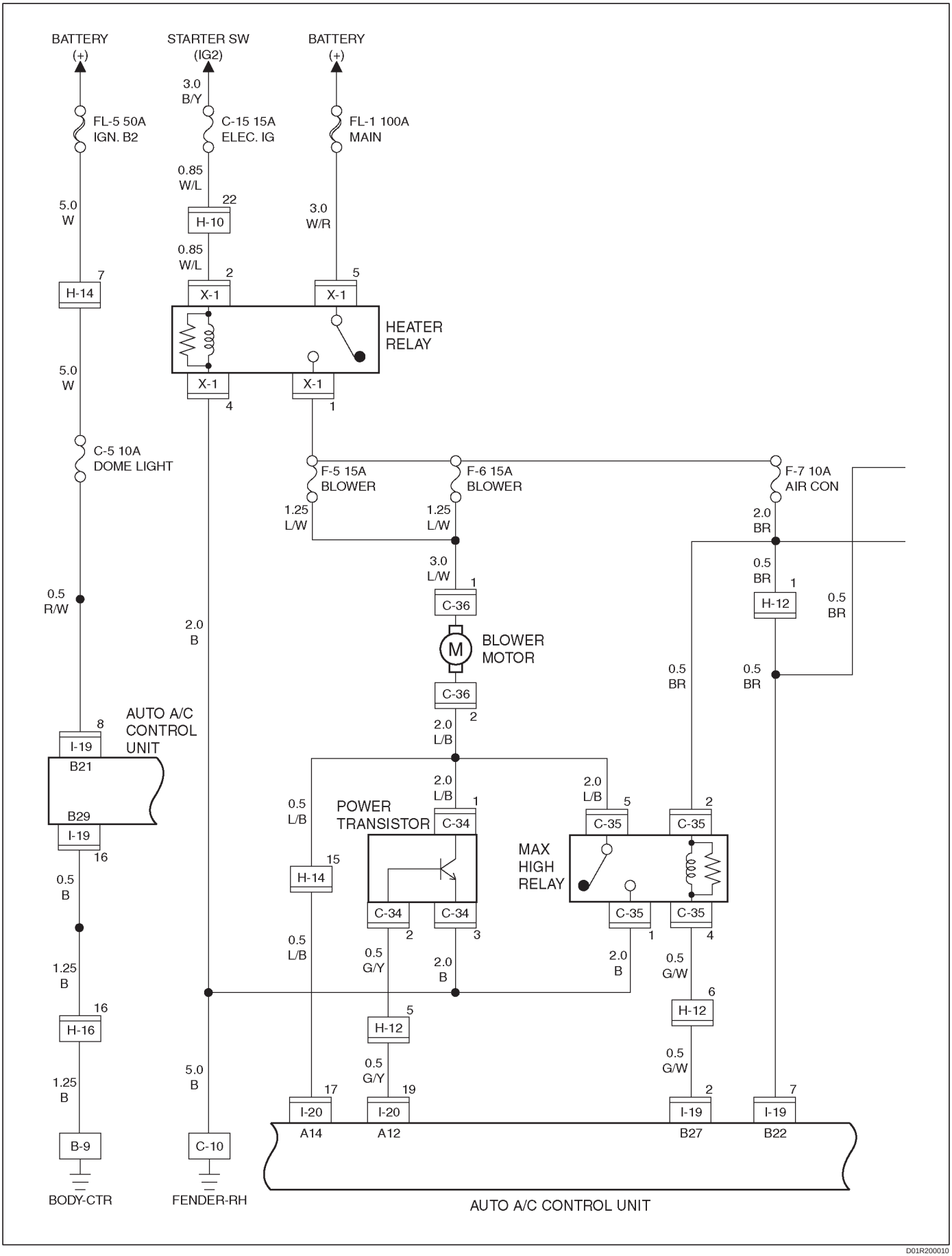


865R200050

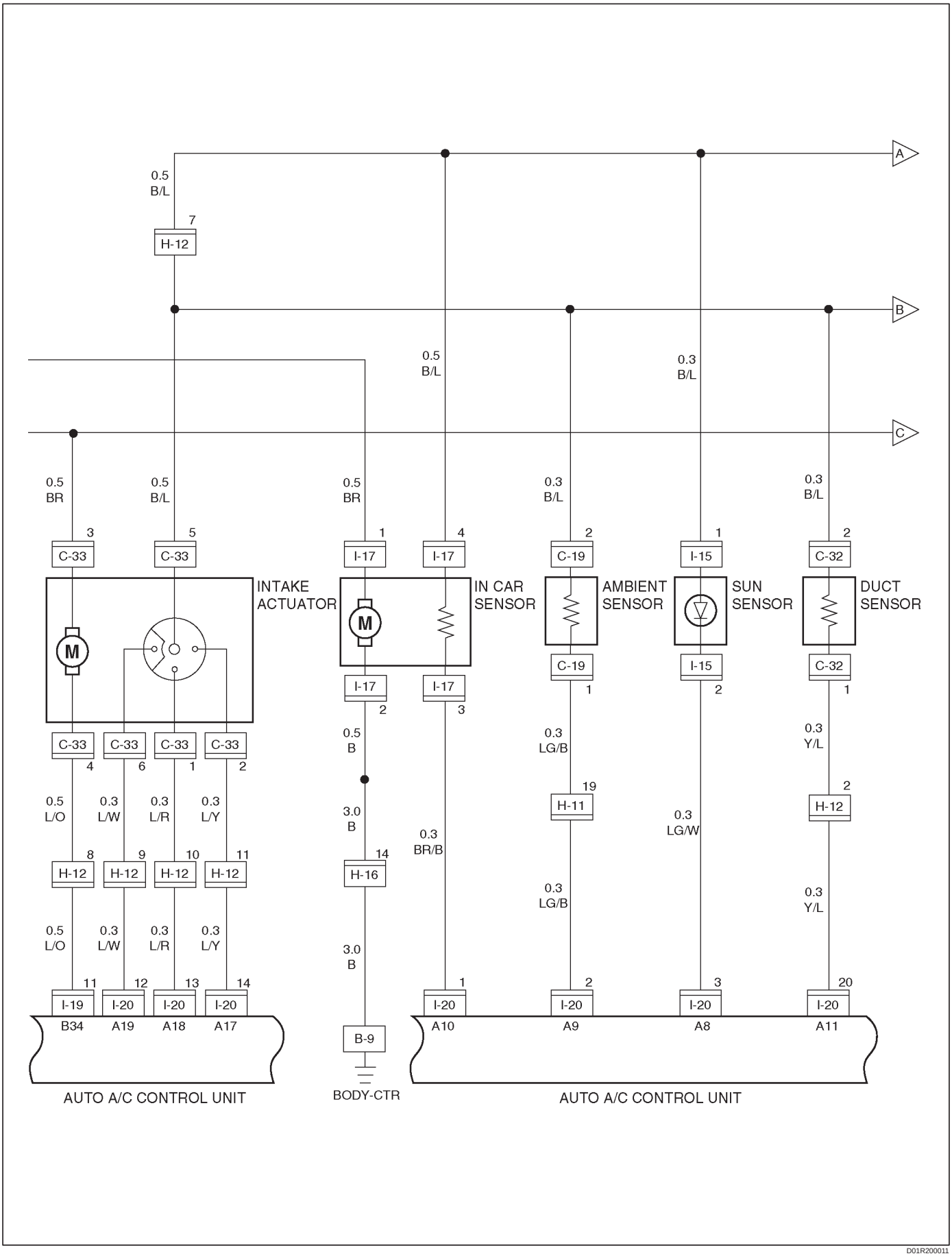
Legend

(1) In Car Sensor
(2) Sun Sensor
(3) Ambient Sensor
(4) Intake Actuator
(5) Blower Unit
(6) Max – High Relay
(7) Display
(8) Audio & Switch Assembly
(9) Evaporator Assembly
(10) Duct Sensor
(11) Mix Actuator
(12) Heater Unit
(13) Automatic Air Conditioner Control Unit
(14) Mode Actuator

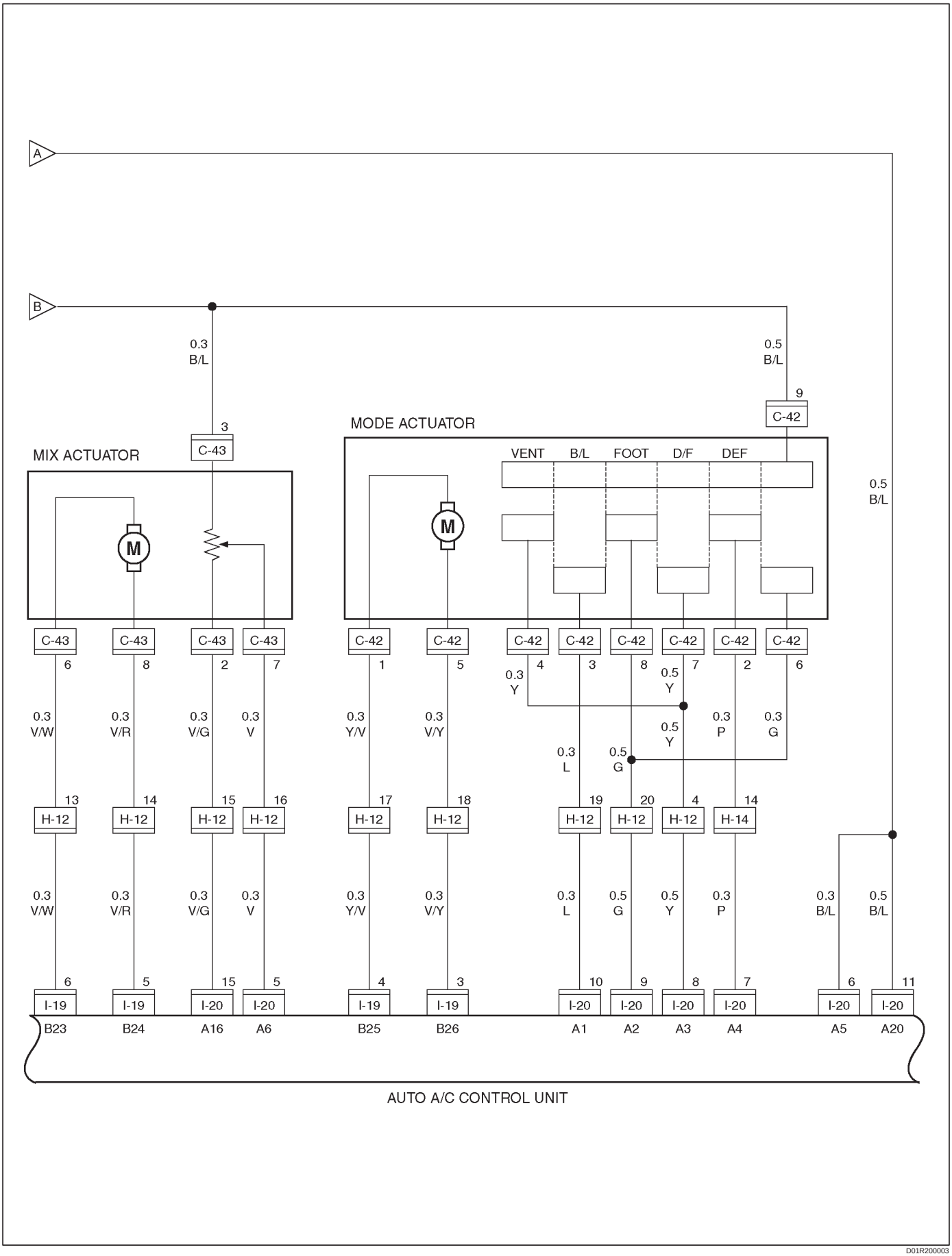
Circuit Diagram



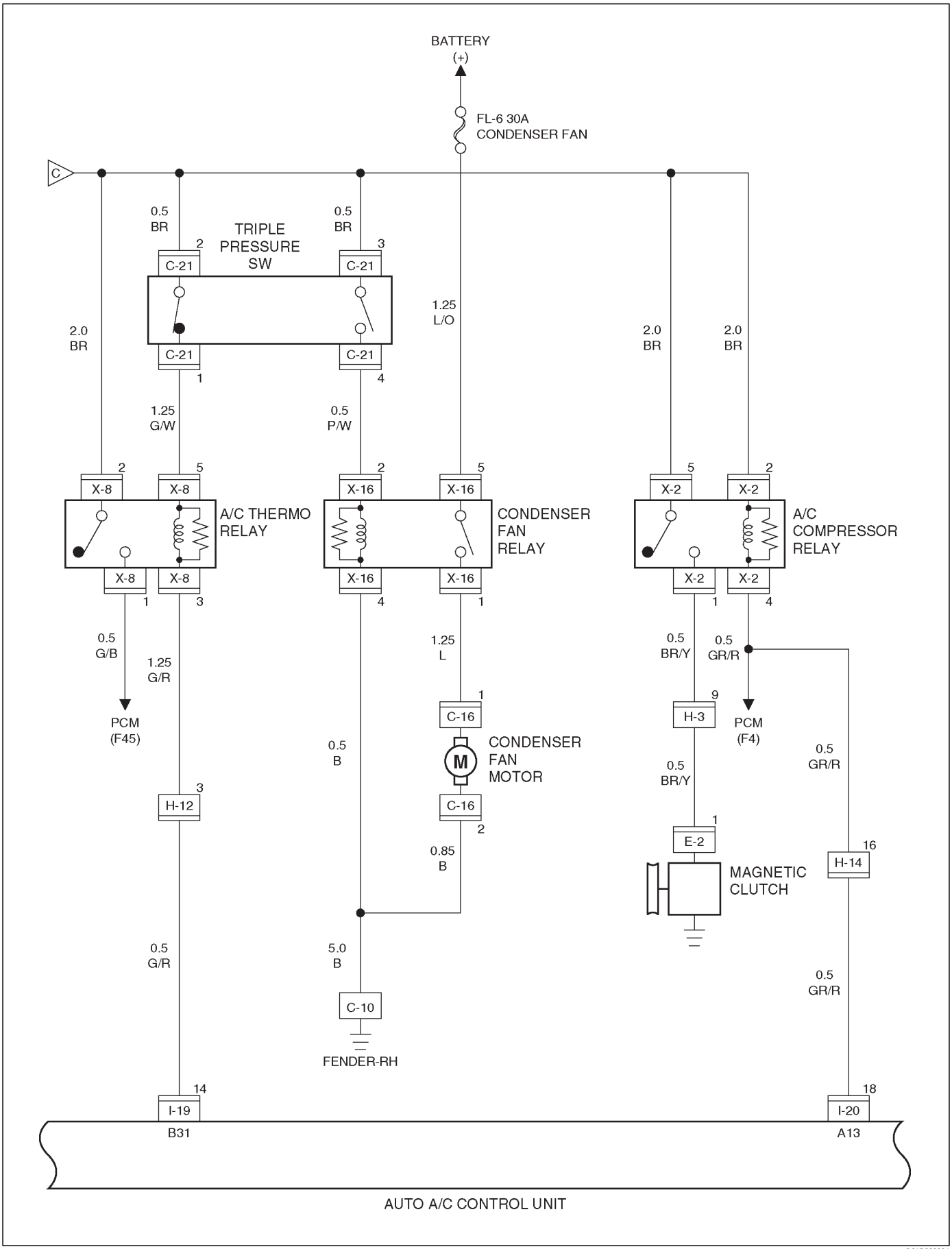
D01R200010


A
B
C
0.5 B/L
7
H-12
0.5 B/L
0.3 B/L
0.5 BR
0.5 B/L
0.5 BR
0.3 B/L
0.3 B/L
3
C-33
5
C-33
1
I-17
4
I-17
2
C-19
1
I-15
2
C-32
INTAKE ACTUATOR
M
IN CAR SENSOR
M
AMBIENT SENSOR
SUN SENSOR
DUCT SENSOR
C-33
4
C-33
6
C-33
1
C-33
2
I-17
2
I-17
3
C-19
1
I-15
2
C-32
1
0.5 L/O
0.3 L/W
0.3 L/R
0.3 L/Y
0.5 B
0.3 LG/B
0.3 Y/L
8
H-12
9
H-12
10
H-12
11
H-12
3.0 B
0.3 BR/B
14
H-16
19
H-11
2
H-12
0.3 LG/W
0.5 L/O
0.3 L/W
0.3 L/R
0.3 L/Y
0.3 LG/B
0.3 Y/L
3.0 B
11
I-19
12
I-20
13
I-20
14
I-20
1
I-20
2
I-20
3
I-20
20
I-20
B34
A19
A18
A17
B-9
A10
A9
A8
A11
AUTO A/C CONTROL UNIT
BODY-CTR
AUTO A/C CONTROL UNIT

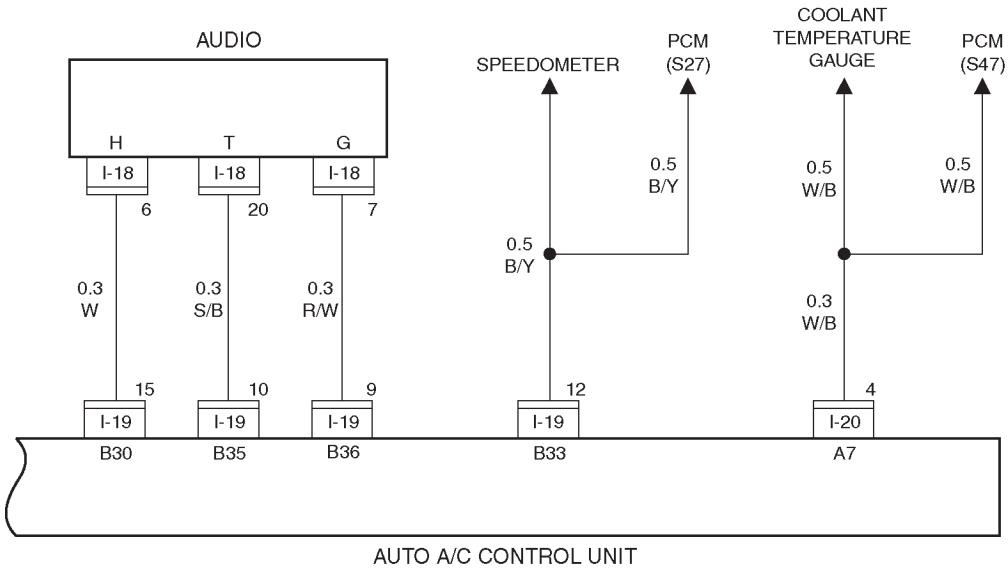
D01R200011


A
B
0.3 B/L
0.5 B/L
9
C-42
3
C-43
MIX ACTUATOR
MODE ACTUATOR
VENT
B/L
FOOT
D/F
DEF
M
M
0.5 B/L
C-43 6
C-43 8
C-43 2
C-43 7
C-42 1
C-42 5
C-42 4
C-42 3
C-42 8
C-42 7
C-42 2
C-42 6
0.3 Y
0.5 Y
0.3 V/W
0.3 V/R
0.3 V/G
0.3 V
0.3 Y/V
0.3 V/Y
0.5 Y
0.3 P
0.3 G
0.3 L
0.5 G
13 H-12
14 H-12
15 H-12
16 H-12
17 H-12
18 H-12
19 H-12
20 H-12
4 H-12
14 H-14
0.3 V/W
0.3 V/R
0.3 V/G
0.3 V
0.3 Y/V
0.3 V/Y
0.3 L
0.5 G
0.5 Y
0.3 P
0.3 B/L
0.5 B/L
6 I-19 B23
5 I-19 B24
15 I-20 A16
5 I-20 A6
4 I-19 B25
3 I-19 B26
10 I-20 A1
9 I-20 A2
8 I-20 A3
7 I-20 A4
6 I-20 A5
11 I-20 A20
AUTO A/C CONTROL UNIT

D01R200003


BATTERY
(+)
FL-6 30A
CONDENSER FAN
C
0.5
BR
TRIPLE
PRESSURE
SW
0.5
BR
2
C-21
3
C-21
C-21
1
C-21
4
1.25
L/O
2.0
BR
2.0
BR
2.0
BR
1.25
G/W
0.5
P/W
2
X-8
5
X-8
X-8
1
X-8
3
A/C THERMO
RELAY
2
X-16
5
X-16
X-16
4
X-16
1
CONDENSER
FAN
RELAY
5
X-2
2
X-2
X-2
1
X-2
4
A/C
COMPRESSOR
RELAY
0.5
G/B
1.25
G/R
PCM
(F45)
1.25
L
0.5
BR/Y
0.5
GR/R
1
C-16
9
H-3
PCM
(F4)
0.5
B
CONDENSER
FAN
MOTOR
M
0.5
BR/Y
0.5
GR/R
3
H-12
C-16
2
1
E-2
16
H-14
0.85
B
MAGNETIC
CLUTCH
0.5
G/R
5.0
B
0.5
GR/R
C-10
FENDER-RH
14
I-19
B31
18
I-20
A13
AUTO A/C CONTROL UNIT

D01R200004


AUDIO
H
T
G
I-18
I-18
I-18
6
20
7
0.3
W
0.3
S/B
0.3
R/W
15
10
9
I-19
I-19
I-19
B30
B35
B36
SPEEDOMETER
PCM
(S27)
0.5
B/Y
0.5
B/Y
12
I-19
B33
COOLANT
TEMPERATURE
GAUGE
PCM
(S47)
0.5
W/B
0.5
W/B
0.3
W/B
4
I-20
A7
AUTO A/C CONTROL UNIT

D01R200009

Functions and Features

Automatic air conditioning control unit
The control unit features a prominent control and display panel that clearly shows air conditioner operational settings (delivered air volume, air outlet location, inside/outside air circulation, and set temperature). Desired temperature can be set in –17˚C (1˚F) increments. The current setting appears on the digital display.

Automatic temperature control
Vehicle interior temperature is maintained at the set level. It is unaffected by changes in vehicle speed, outside air temperature, and number of passengers.

Maximum cooling and heating
Moving the switch to the 18˚C (65˚F) position provides maximum cooling. Moving the switch to the 32˚C (90˚F) position provides maximum heating.

Automatic air flow control
Air flow is automatically and precisely regulated in response to set temperature change and/or changes in heater unit mixing door aperture.

Automatic air outlet selection
Appropriate air outlets (VENT, BE-LEVEL, FOOT, or DEF) are selected in response to changes in outlet temperatures. The mode switch permits manual selection of the desired air outlet.

Air source (Fresh air intake from outside the vehicle or recirculation of the air inside the vehicle) selection
Automatic switching between outside air (FRESH), recirculated inside air (RECIRC), or a combination of the two (MIX) occurs in response to changes in outlet temperatures.The intake switch permits manual selection of the air source (FRESH or RECIRC). Mixing of the two sources is not possible during manual operation. When the defrost mode switch (DEF) is pressed, the system automatically switches to outside air intake.

Cooler start-up control
When the vehicle is parked in a hot area for an extended period of time, the evaporator becomes hot. When the cooler is turned on, hot air is blown into the vehicle until the evaporator cools down. The cooler start-up control prevents blower operation until the evaporator is able to provide cool air.

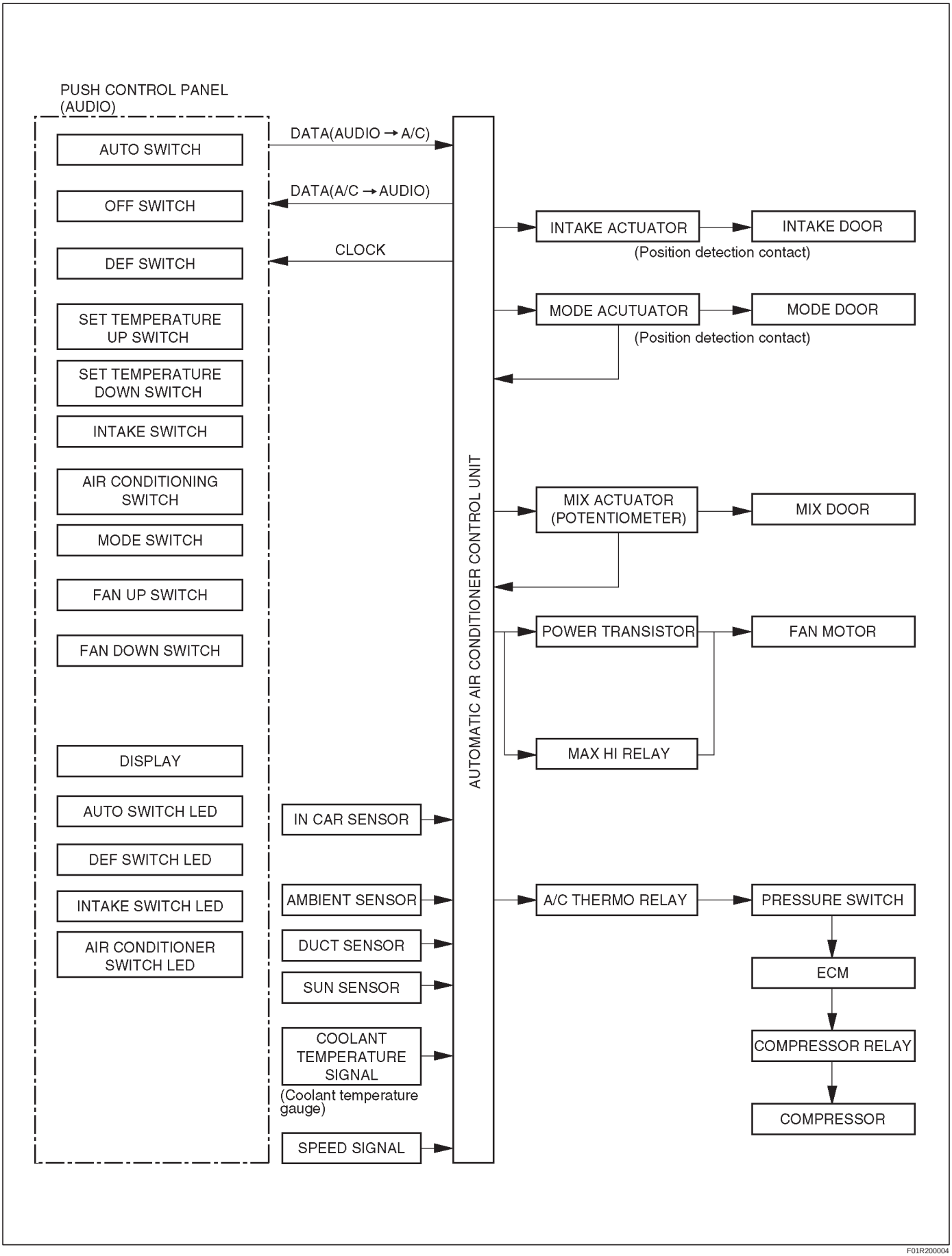
Heater start-up control
When the vehicle is parked in a cold area for an extended period of time, the heater core becomes cold. When the heater is turned on, cold air is blown into the vehicle until the heater core heats up. The heater start-up control prevents blower operation to the air outlets until the heater core is able to provide warm air. Air is delivered through the defrost outlets.

Solar radiation offset
The sun sensor uses a photodiode to precisely determine the amount of solar radiation affecting the vehicle. The cooler operates in response to this radiation to quickly correct the vehicle interior temperature.

Switch position memory
Current switch positions are stored in memory when the ignition switch is turned off. When the ignition switch is turned on again, the switches automatically return to the position they were in when the ignition switch was turned off. This simplifies the restarting procedure.

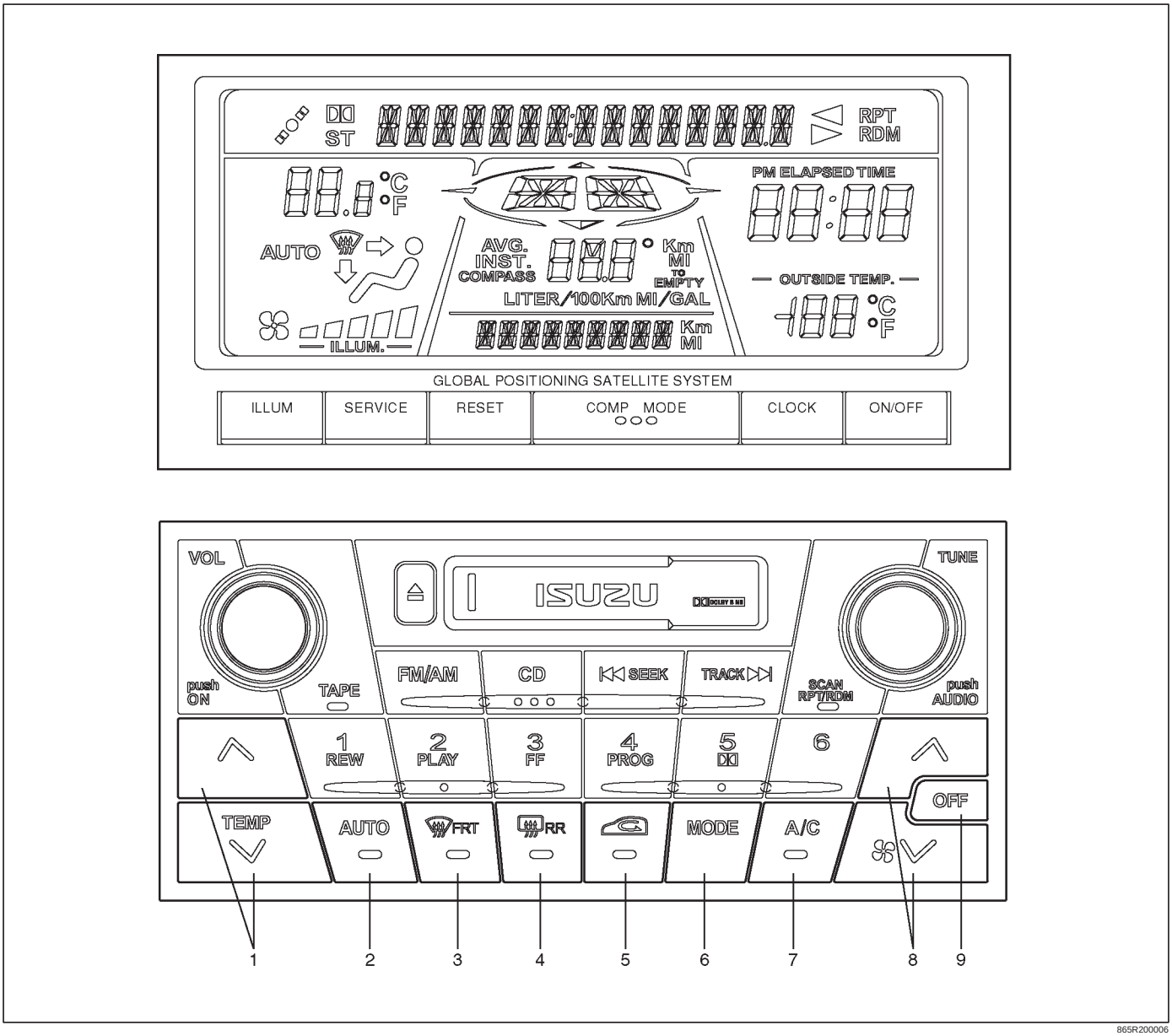
Self-diagnosis function
The self-diagnosis switches on the control panel permit easy system troubleshooting. Refer to “Self-Diagnosis” later in this Section.

Automatic Air Conditioner Block Diagram



F01R200004

Control Panel Layout

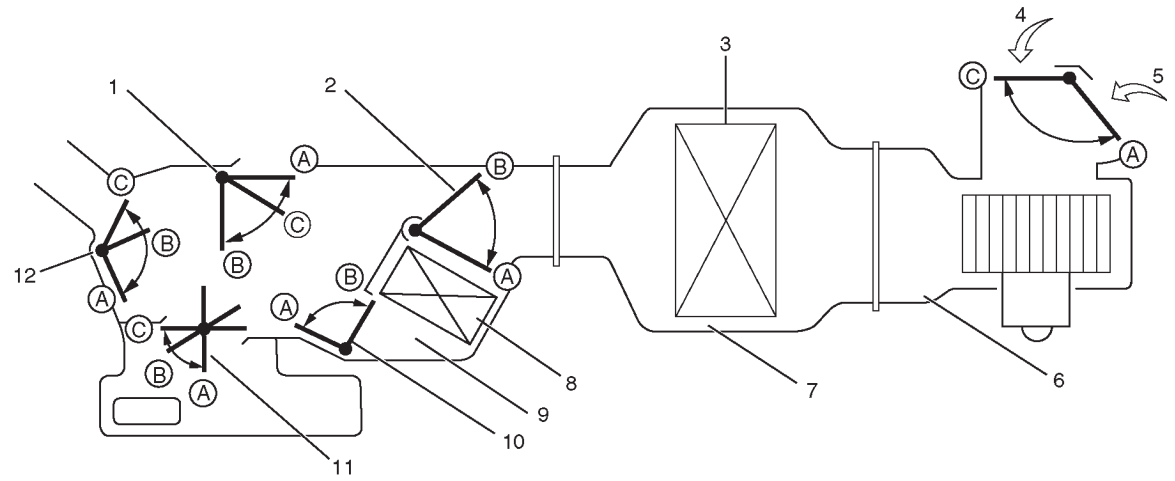


865R200006

Legend

(1) Temperature Control Switch
(2) Auto Switch
(3) DEF Mode Switch
(4) Rr DEF Mode Switch
(5) Intake Switch
(6) Mode Switch
(7) Air Conditioning Switch
(8) Fan Switch
(9) Off Switch

Air Control Functions



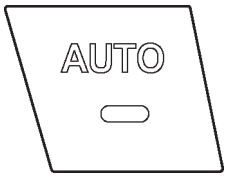
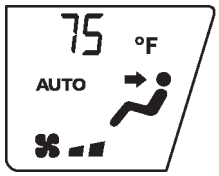
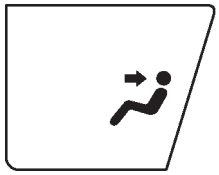
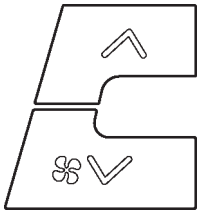
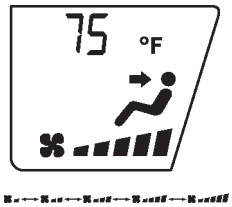
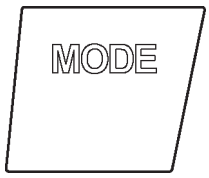
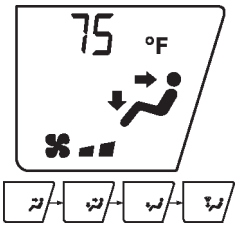
	Indication of Mode					Indication of Intake Switch LED		Set Temperature		
	VENT	BI-LEVEL	FOOT	DEF/FOOT	DEF	FRE	REC	FULL COOL 18.0°C (65°F)	18.5~31.5 (66~89)	FULL HEAT 32.0°C (90°F)
						OFF	ON			
Vent Door	Ⓐ	Ⓑ	Ⓒ	Ⓒ	Ⓒ	—	—	—	—	—
Foot Door	Ⓒ	Ⓑ	Ⓐ	Ⓑ	Ⓒ	—	—	—	—	—
DEF Door	Ⓐ	Ⓐ	Ⓐ	Ⓒ	Ⓑ	—	—	—	—	—
Intake Door	—	—	—	—	—	Ⓐ	Ⓒ	—	—	—
Air Mix Door	—	—	—	—	—	—	—	Ⓐ	Ⓐ ~ Ⓑ	Ⓑ
Sub Air Mix Door	—	—	—	—	—	—	—	Ⓑ	Ⓑ ~ Ⓐ	Ⓐ

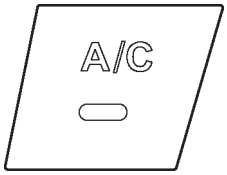
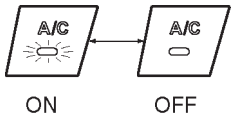
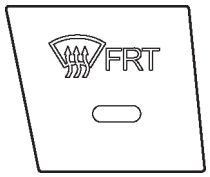
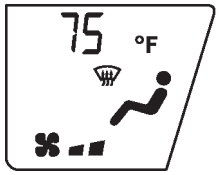
C01R200013

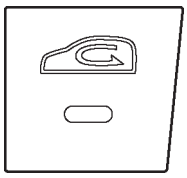
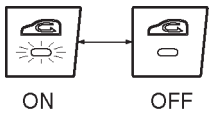
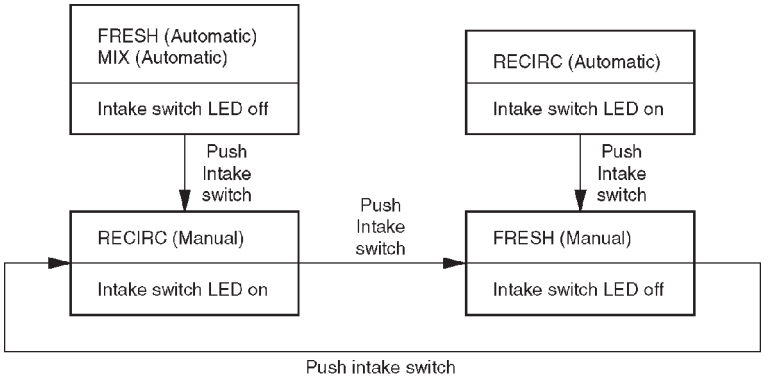
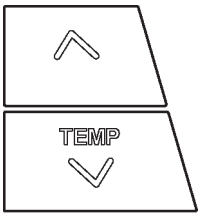
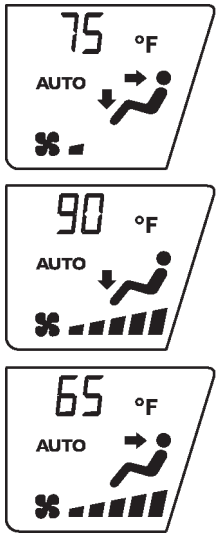
Legend

(1) DEF Door
(2) Air Mix Door
(3) Evaporator Core
(4) Fresh Air Intake
(5) Interior Air Intake
(6) Blower Unit
(7) Evaporator Unit
(8) Heater Core
(9) Heater Unit
(10) Sub Air Mix Door
(11) FOOT Door
(12) VENT Door

Control Panel Switch Operation

Switch Name		Panel Display	Switch Operation
Auto Switch			During manual outside air intake (FRESH), pressing the AUTO switch cancels manual outside air intake. The display panel shows the current set temperature, the current air outlet(s), and the blower speed. The intake switch LED shows the current air source. The A/C switch LED is on. Air volume, air outlet operation, and air source are controlled automatically. The compressor is on. During manual inside air recirculation (REC), pressing the AUTO switch does not cancel inside air recirculation. The intake switch LED is on.
Off Switch			When the OFF switch is pressed, the display panel clears except for the air outlet indication. Blower and compressor operation stop. The air source switches from automatic to outside air. During manual inside air recirculation (REC), pressing the OFF switch does not cancel inside air recirculation. The intake switch LED is on.
Fan ▲ . ▼ Switch			When the fan switch is pressed, air outlet volume (fan speed) can be manually controlled. Other control switches are unaffected. The display panel clears AUTO indication. 1. FAN switch is pressed during automatic fan control (AUTO) Fan control (AUTO)→Press ▲ fan switch→Fan speed increases from automatic set speed to HI Fan control (AUTO)→Press ▼ fan switch→Fan speed decreases from automatic set speed to LO 2. Fan switch is pressed when the fan is off. Fan (OFF)→Press ▲ fan switch→The fan operates at LO speed Fan (OFF)→Press ▼ fan switch→The fan operates at LO speed 3. Fan switch is pressed when the fan is in manual operation. Manual (LO)→Press ▲ fan switch→Manual operation (LO)→ (M1)→(M2)→(M3)→(HI) Manual (HI)→Press ▼ fan switch→Manual operation (HI)→(M3)→(M2)→(M1)→(LO)
Mode Switch			Press the mode switch to manually select the air outlet(s). Each time the switch is pressed, the air outlets change in the progression shown below. Mode switch (Automatic control of air outlets)→VENT→BI-LEVEL→FOOT→DEF/FOOT

A/C. Switch			When the A/C switch is pressed, the LED light goes out and the compressor turns off. If the switch is pressed again, the LED light turns on and the compressor begins to operate. The air conditioner will not operate if the fan switch is off. During manual DEF or D/F operation, the A/C LED will turn on or off in response to switch operation. However, the compressor remains on regardless of switch position.
DEF Mode Switch			When the defrost switch (DEF) is pressed, air flows from the defroster outlets. The compressor is on and blower speed is automatically controlled. Air intake is from outside the vehicle (FRESH). The defroster symbol appears on the display. When the defrost switch (DEF) is pressed again, the unit returns to the settings in use before the defroster was turned on.

Intake Switch			Pressing the intake switch permits manual control of air intake and/or recirculation.  If the intake switch is pressed during manual DEF or D/F, the intake switch LED briefly turns on. However, outside air intake (FRESH) continues.
Temperature Control Switch			The display panel temperature setting can be set from 18˚C (65˚F) to 32˚C (90˚F). Pressing and immediately releasing the ▲ switch increases the temperature setting in -17˚C (1˚F) increments. If the switch is pressed and held, the temperature setting increases rapidly. Pressing and immediately releasing the ▼ switch decreases the temperature setting in -17˚C (1˚F) decrements. If the switch is pressed and held, the temperature setting decreases rapidly. When the temperature setting is at 32˚C (90˚F), the unit is set to maximum heat mode. When the temperature setting is at 18˚C (65˚F), the unit is set to maximum cooling mode.

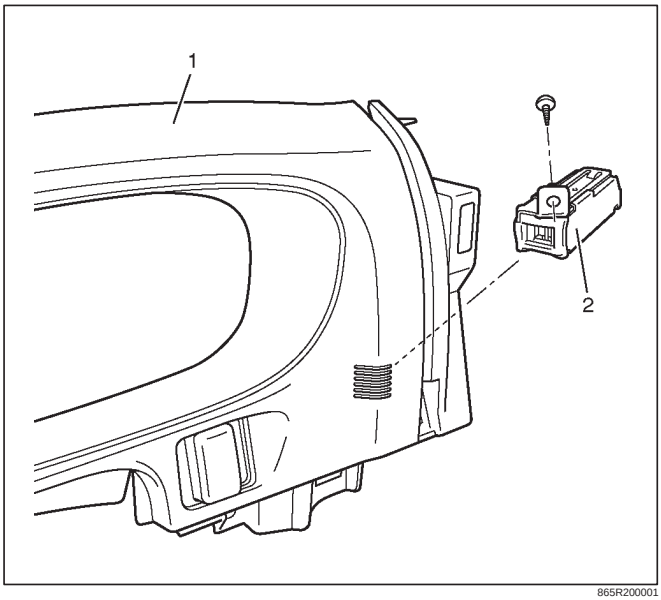
Overview of Construction, Movement and Control of Major Parts of Automatic Air Conditioner System

Automatic Air Conditioner Control Unit

Equipped with the built-in micro-computer, this control unit operates on signals from sensors and input signals from switches to offer total control of the blower fan, and actuators used for the mode door, intake door and air mix door.
Its self-diagnosis function enables quicker access to a failed part and its more accurate troubleshooting.

In Car Sensor

It is a sensor used for detecting room temperature of a vehicle. This sensor converts a given room temperature into a resistance value before entering the data to the automatic air conditioner control unit.
This in car sensor unites the power driven aspirator and the motor fan so that a small amount of room air may be constantly fed to the sensor.
This sensor is provided on the right side of meter cluster.

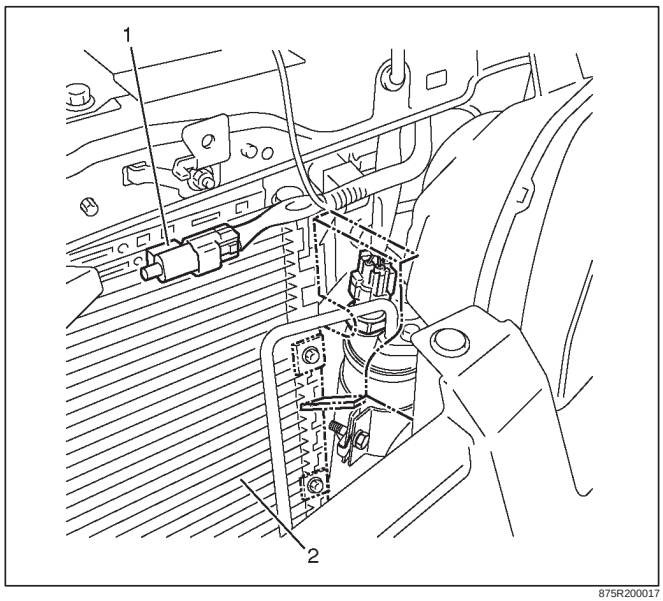


865R200001

Legend
(1) Meter Cluster
(2) In Car Sensor

Ambient Sensor

This sensor is used for detecting temperature outside the vehicle. It converts a given outside air temperature into a resistance value before entering the data to the automatic air conditioner control unit.
Thermal effects from the condenser and radiator during idling after a run can be measured and offset the automatic amplifier.
This sensor is provided on the side plate situated at upper right side of the condenser.

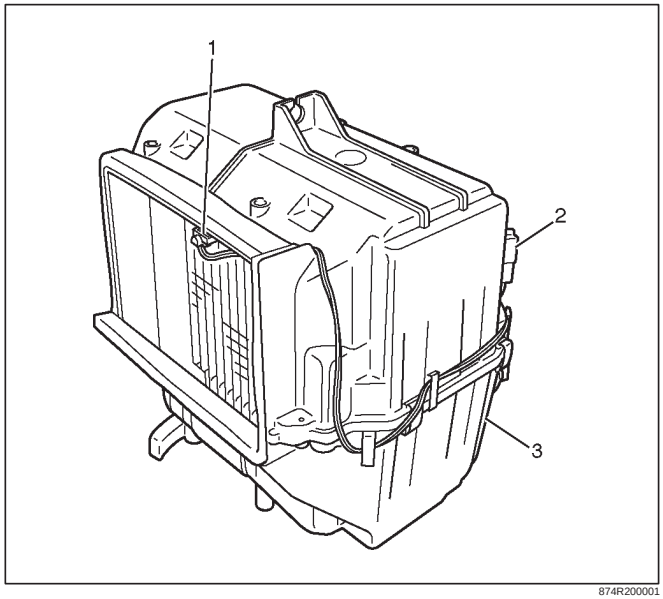


875R200017

Legend
(1) Ambient Sensor
(2) Condenser Assembly

Duct Sensor

The duct sensor is the sensor to detect temperature change of the side of evaporator blower coming by fresh recirculation of intake door or “on” “off” of compressor.
The temperature is converted to resistant rate.
And it works as thermostat to control to prevent freezing of evaporator.
This sensor is installed in the upper case of evaporator.

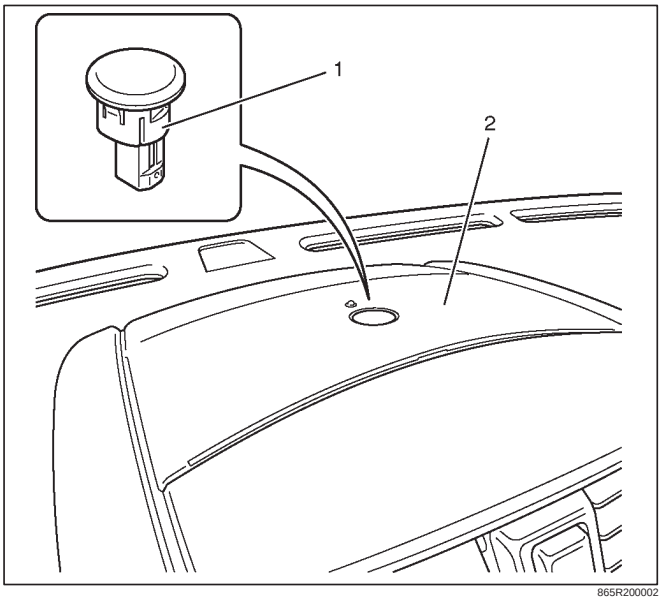


874R200001

Legend
(1) Sensor Part
(2) Duct Sensor Assembly
(3) Evaporator Assembly

Sun Sensor

It is a photodiode used for detecting quantity of solar radiation. This sensor converts the offset signal generated by changes in the interior temperature (which results from fluctuations in solar radiation) into photoelectric current to enter into the automatic air conditioner control unit.
This sensor is provided at top of the center cluster upper.



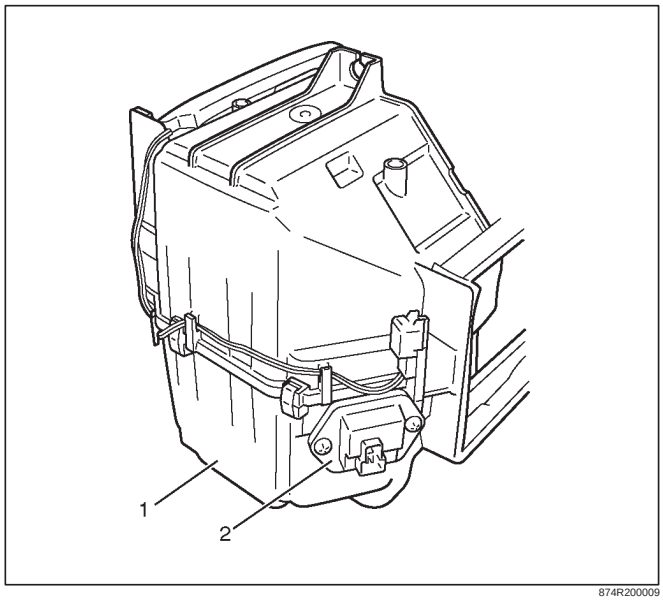
865R200002

Legend

(1) Sun Sensor
(2) Center Cluster Upper

Power Transistor

Receiving base current from the automatic air conditioner control unit, the power transistor implements stage-less speed change of the blower fan motor. This transistor is provided on the evaporator.



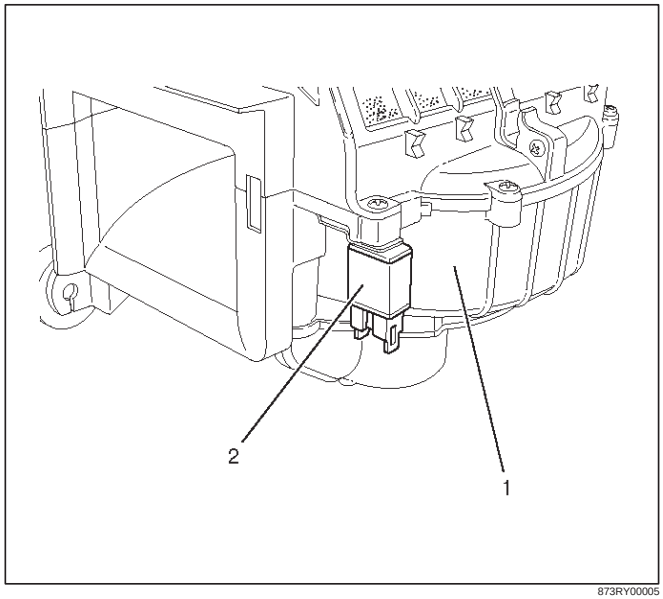
874R200009

Legend

(1) Evaporator Assembly
(2) Power Transistor

Max Hi Relay

This relay turned on or off by the signal from the automatic air conditioner control unit. As the Max Hi relay is turned on, supply voltage is directly fed to the blower fan motor to select the Max Hi mode.



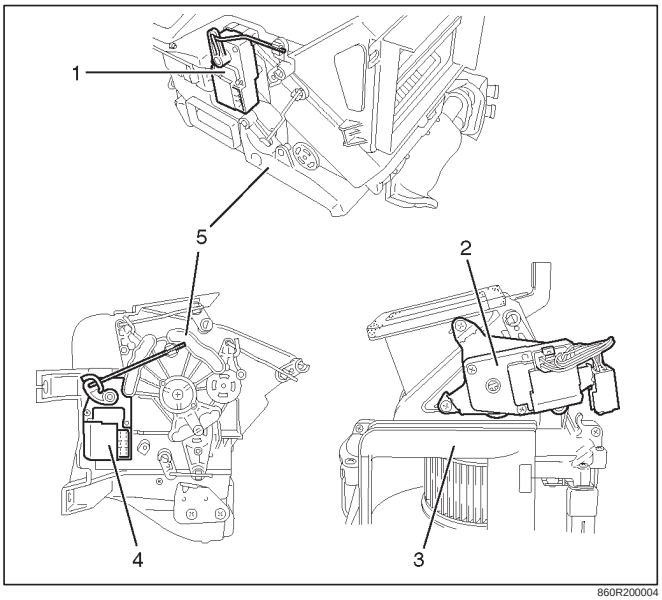
873RY00005

Legend

(1) Blower Unit
(2) Max High Relay

Actuator

The actuators are power driven type containing a small motor. Receiving output current from the automatic air conditioner control unit, actuators drive the heater and blower unit mode doors.
Actuators consist of the mode actuator used for switching the mode (blow port selection), the mix actuator used for changing aperture of the air mix door, the intake actuator used for switching the intake mode(fresh air/interior air) actuator.

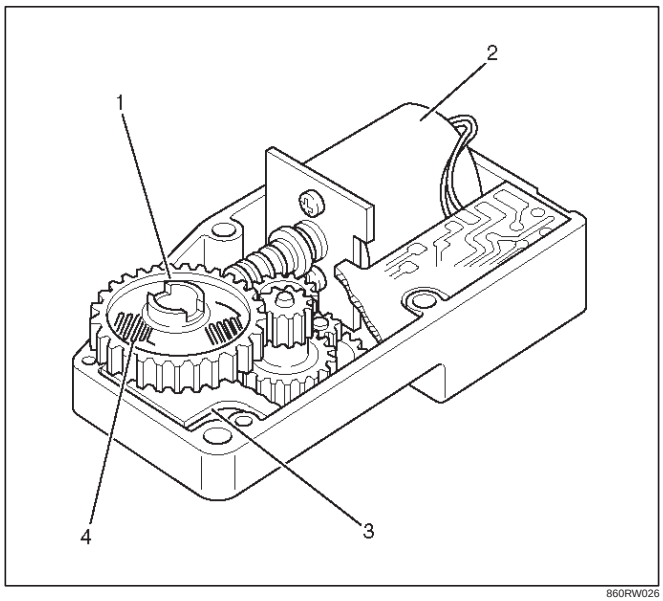


860R200004

Legend

(1) Mix Actuator
(2) Intake Actuator
(3) Blower Unit
(4) Mode Actuator
(5) Heater Unit

The actuator changes the motor speed using the gear and drives each door rotating the output axis united with the sliding contact.

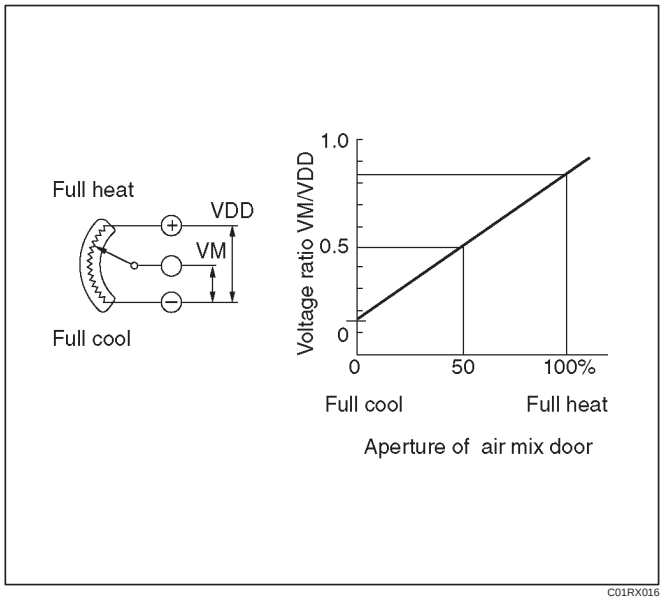


860RW026

Legend

(1) Output Axis
(2) Motor
(3) Printed Circuit Board
(4) Sliding Contact

The mode and mix actuators are common actuators with the built-in potentiometer. For the intake actuator, the contact switch type is selected.
The potentiometer is a register assembled to the printed circuit board of the mix and mode actuators. It detects the air mix door position specified by rotation of the output axis as a ratio of the variable terminal (VM) voltage against the reference voltage (VDD: 5V), then signals the value to the automatic air conditioner control unit.

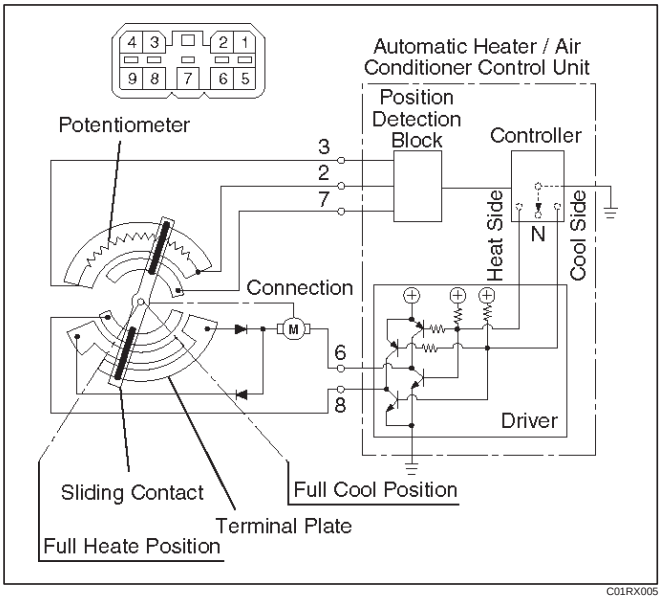


C01RX016

Movement of Mix Actuator

Position of the air mix door is determined by the controller on the automatic air conditioner control unit.
As the heat or cool side of the controller is grounded, the transistor on the driver is activated and, thus, the motor rotation is turned on. The sliding contact connected to the motor sends the position detection signal from the potentiometer to the automatic air conditioner control unit. As the set temperature and interior temperature are balanced, the controller returns to the neutral and the motor rotation is stopped.

C-43		Rotation direction	Remarks
(+) side	(-) side		
8	6	Clockwise	Full heat side
6	8	Counter clockwise	Full cool side

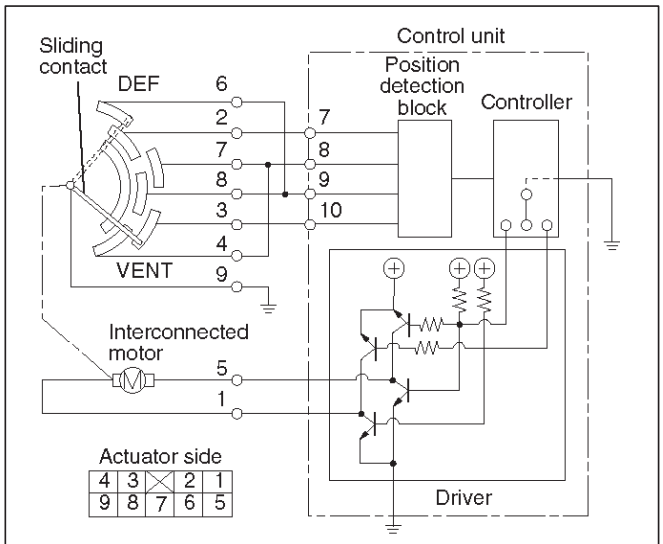


C01RX005

Movement of Mode Actuator

As target position of the mode door is decided on the controller of the control unit, the control unit reads the position detection signal from the actuator to select the clockwise or counter clockwise motor rotation direction.
Grounding the controller VENT or DEF side after the direction selection activates the transistor on the driver, thus turning on the motor rotation. Accompanying the motor rotation, the sliding contact rotates, too. When the target position is reached, the controller on the control unit returns to the neutral and the motor stops.

Conduction pin		Rotation direction	Remarks
(+) side	(-) side		
5	1	Clockwise	VENT to DEF direction
1	5	Counter clockwise	DEF to VENT direction



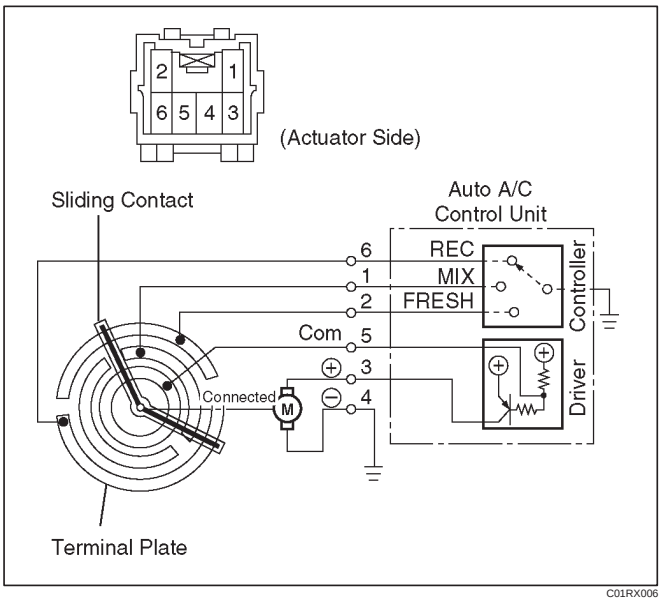
	7	8	9	10
VENT	H	L	H	L
Mid point between VENT - B/L	H	H	H	L
B/L	H	H	L	L
Mid point between B/L - FOOT	H	H	L	H
FOOT	H	L	L	H
Mid point between FOOT - D/F	H	L	H	H
D/F	L	L	H	H
Mid point between D/F - DEF	L	H	H	H
DEF	L	H	L	H

C01RX017

Movement of Intake Actuator

The controller on the automatic heater/air conditioner control unit selects an intake mode to be used.
As the Terminal No.5 C-33 is grounded via the sliding contact on the terminal plate, the transistor on the driver is activated, thus turning on the motor rotation. Then, accompanying move of the motor, the sliding contact rotates until grounding of the Terminal No.5 C-33 is removed, thus stopping the motor.

Grounding terminal	Rotation direction	Remarks
No.5 C-33	Clockwise	RE-CIRCULATION→MIX→FRESH



Overview of Automatic Control of Automatic Air Conditioner

The automatic air conditioner on this vehicle has the following features:

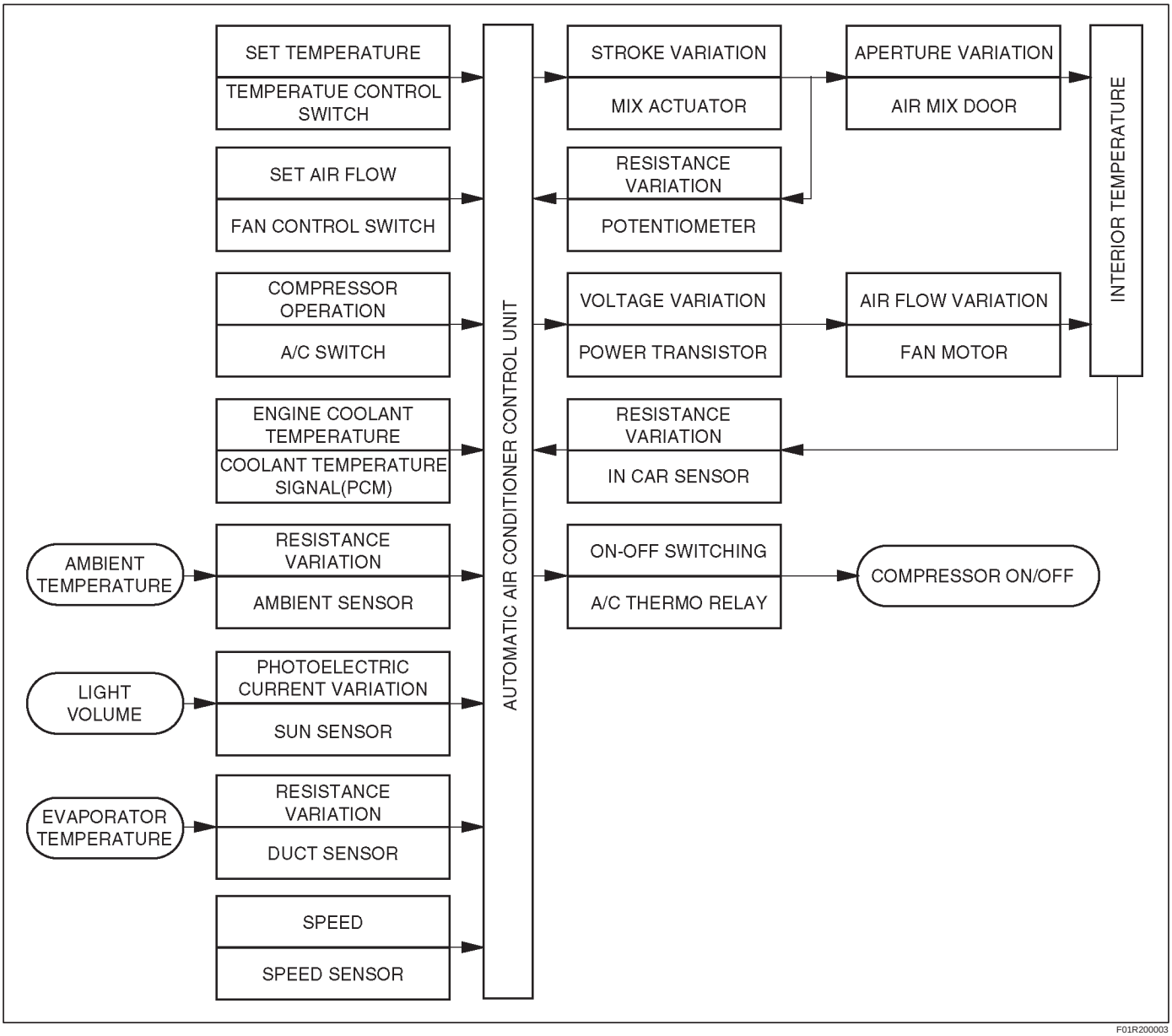
- Interior temperature control.
- Air flow control.
- Mode (blow port) control.
- Intake (switching between fresh air and interior air) control.
- Heater start timing control.
- Cooler start timing control.
- Evaporator anti-freeze control.

Automatic Air Conditioning System

System Overview (Chart)

Conditions both inside and outside the vehicle are detected by sensors (in-car temperature sensor, ambient temperature sensor, duct sensor, sun sensor, speed sensor, and water temperature sensor). These sensors send signals to the control unit.
Potentiometer position sensors send data to the control unit. Signals related to control panel settings are also sent to the control unit.

In response to the signals received, the control unit automatically adjusts air-mix door aperture (outlet air temperature), fan speed (forced air volume), and air intake (outside air, recirculated inside air, or a mixture of the two).



F01R200003

Interior Temperature Control

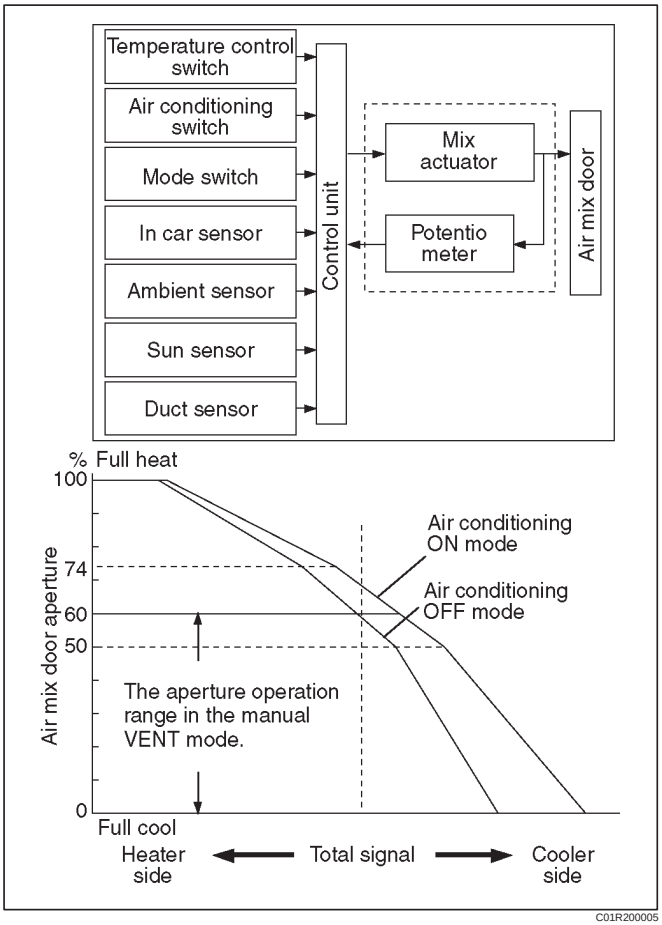
When the temperature control switch is set to a specific temperature, a signal is sent to the A/C control unit. Other signals are sent to the control unit from the various sensors. This data is analyzed by the control unit which creates a composite data signal that is compared with the signal received from the potentiometer. The result determines the direction of mix actuator rotation.

The mix actuator reacts to the composite air mix door opening angle signal. Opening angle is increased or decreased to maintain the temperature at the selected level.

When the compressor is off, the air mix door moves toward the COOL side. When the compressor turns on, the temperature of the air being discharged from the outlet vents is regulated.

When the temperature control is set to 18˚C (65˚F), the air mix door moves to the FULL COOL position. When the control is set to 32˚C (90˚F), the door moves to the FULL HOT position.

In the VENT position, the air mix door moves from FULL COOL to a 60% aperture. This prevents hot air from being discharged into the vehicle.



Air Flow Control

In the Auto Mode

- **Automatic operation**

  When the AUTO switch or the DEF switch is pressed, a signal indicating the forced air volume is sent to the A/C auto-control unit. Other signals are sent to the control unit from the various sensors. This data is analyzed by the control unit which creates a composite data signal. Based on this signal, the base voltage of the power transistor is varied to change the blower voltage. This results in a non-stepped change in blower motor speed.

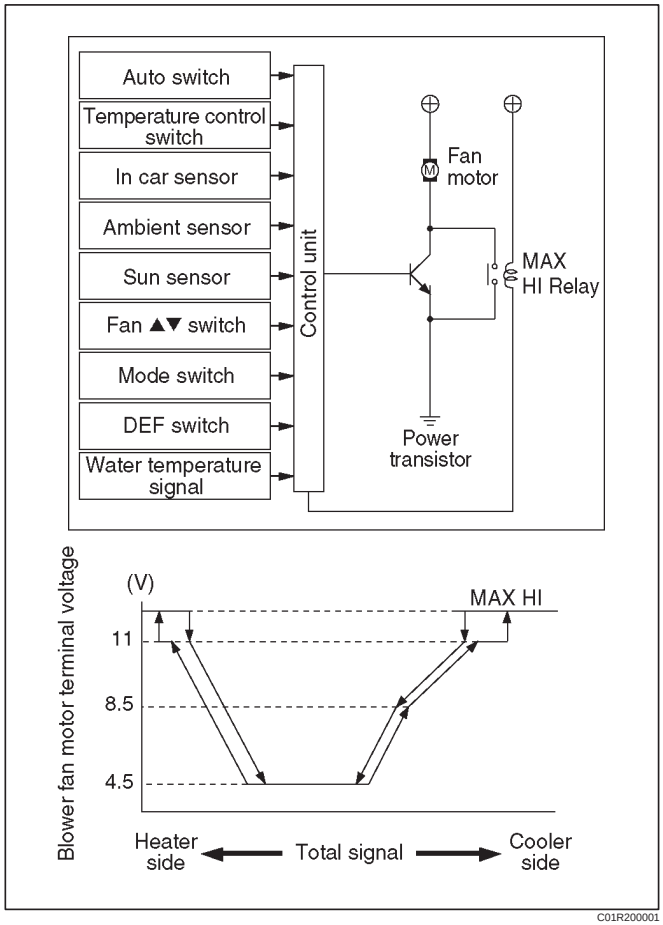
  When the temperature control switch is set to either 18˚C (65˚F) or 32˚C (90˚F), blower motor speed is in the MAX-HI mode.

In the Manual Mode

- **Manual operation**

  When the fan switch is manually set to a specified air volume, a signal is sent to the A/C auto-control-unit. In response to this signal, the auto-control unit controls the blower voltage.

  When the fan switch is set to HI, the max-hi relay operates to increase blower motor speed to the MAX-HI mode.



Mode (Blow Port) Control

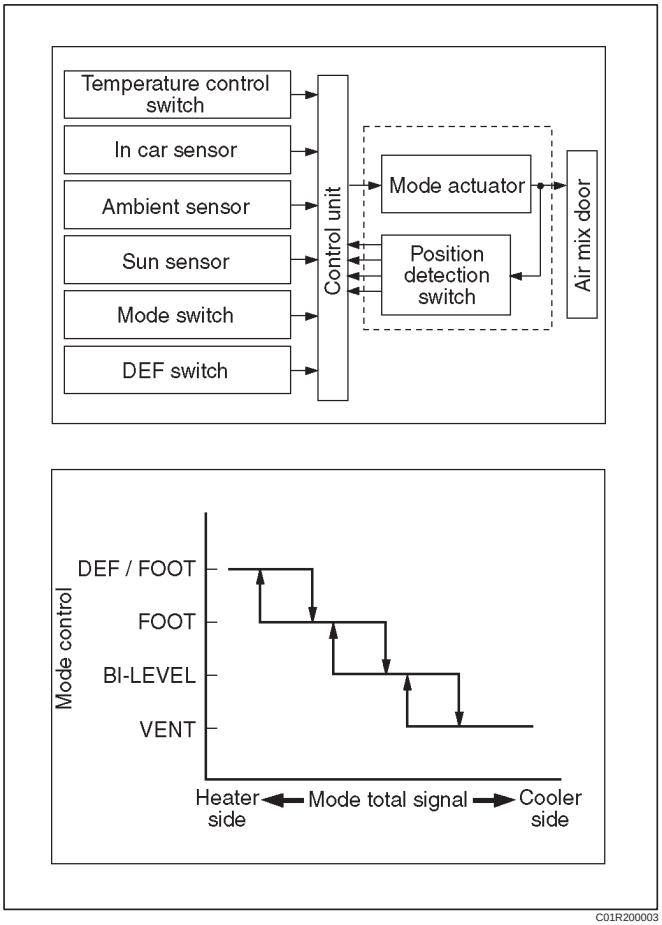
The A/C control unit receives temperature setting data as well as temperature and solar radiation level data from the various sensors. Based on this data, the control unit compiles a composite TMO signal. The TMO signal allows the outlet positions to be changed in a set pattern (VENT→BI-LEVEL→FOOT→DEFROST/FOOT).
The mode actuator acts in response to mode position. It compares data signals received from the target mode, the door position, and mode door position to determine the direction of rotation.
If the temperature is set to 18˚C (65˚F), cool air is discharged from the head outlets. If t he temperature is set to 32˚C (90˚F), warm air is discharged from the foot outlets.
In manual mode, existing air outlet settings remain unchanged when the temperature is set to 18˚C (65˚F) or 32˚C (90˚F).

<Mode switch operation>

Press the mode switch to change to the outlet mode. Blower operation (outlet mode position) can now be switched between the VENT, BI-LEVEL, FOOT, and DEF positions.

<Defroster switch operation>

The DEF position can be selected from the outlet mode.



Intake (Fresh air/interior air switching) Control

During automatic operation, the A/C control unit responds to the temperature setting signal together with signals from the various sensors to generate a general signal that controls operation in a prescribed pattern.
If either or both the fan and the cooler are off, air intake is from outside the vehicle.
If the temperature control switch is set to either 18˚C (65˚F) or 32˚C (90˚F), the air inside the vehicle is recirculated.

1. Manual switch operation

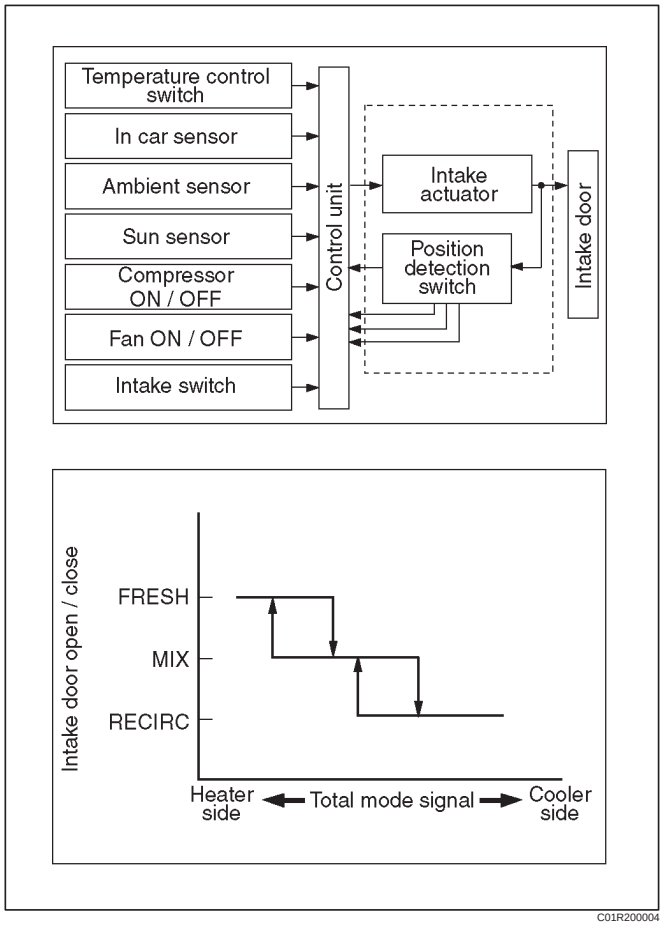
Press the intake switch to change between outside air intake and recirculated inside air.

2. Defrost switch operation

Air intake is from outside the vehicle.

3. Mode switch operation

During automatic operation, outside air intake or recirculated inside air is selected as appropriate.
During manual operation or when the DEF mode is selected, air intake is from outside the vehicle.

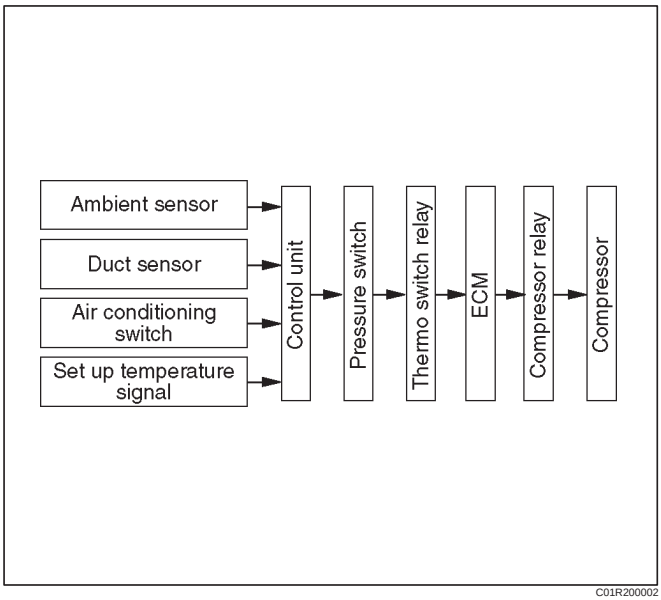


Compressor Control

In the automatic control mode, the automatic air conditioner control unit turns on or off the compressor with the evaporator anti-freeze mechanism using the evaporation sensor. And, when outside air is detected to be low through the outside air temperature sensor signal, the control unit turns off the compressor using the compressor control function.

Manual Control

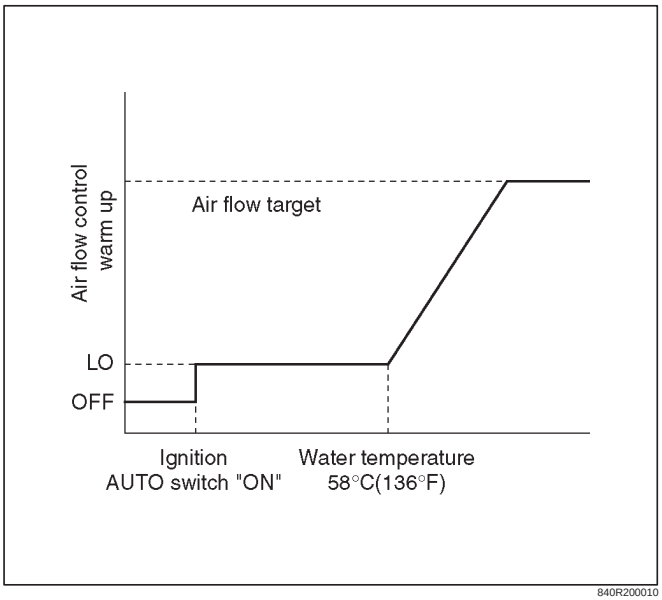
- In the automatic control mode, pressing the A/C (air conditioning) switch turns off the compressor.
- Pressing the DEF mode switch automatically turns on the compressor.



C01R200002

Heater Start-up Control

Heater start-up control occurs when the air discharge mode is in the BI=LEVEL, FOOT, or DEF/FOOT position and the heater core temperature is less than 14˚C (58˚F). Air discharge volume remains in the AUTO LO mode until the engine coolant temperature rises above 14˚C (58˚F). The volume then increases in linear increments to the pre-set level.



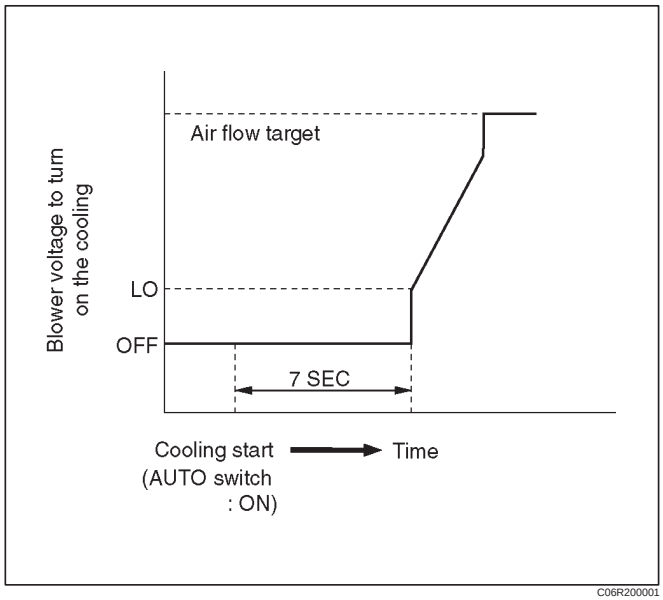
840R200010

Cooler Start-up Control

When cooler operation is started with the air discharge mode is in the VENT or B/L position and the in-car temperature higher than 26˚C (78˚F) (detected by the in-car sensor), cooler start-up control occurs.

For the first 7 seconds of cooler operation, the fan remains OFF. It then switches to AUTO LO. Air discharge volume then increases in linear increments to the pre-set level.

Cooler start-up control occurs the first time the engine is started or the cooler switch is moved from OFF to AUTO. It will not occur during subsequent switch movements.



C06R200001

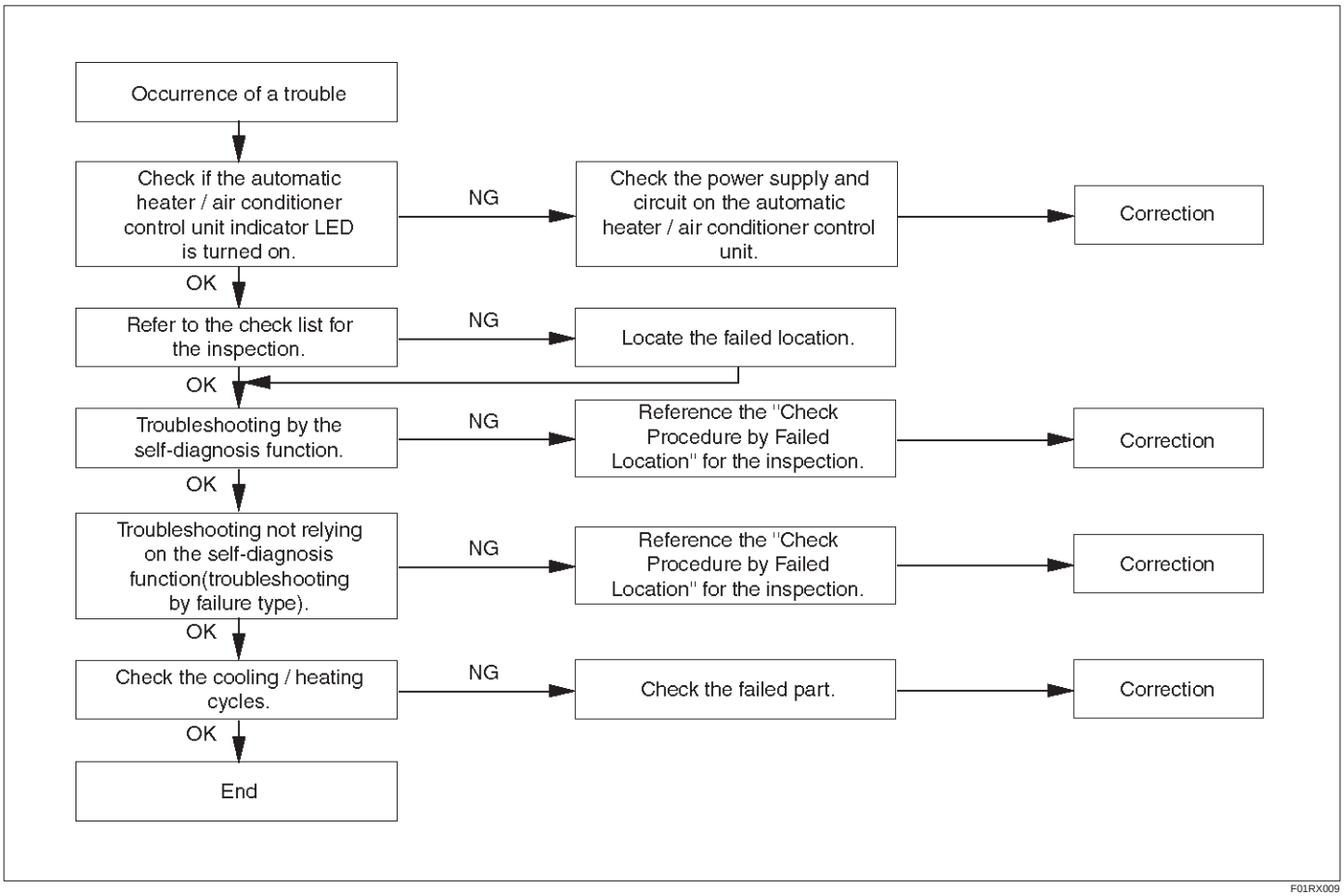
Troubleshooting

Troubleshooting, Its Overview and Procedures

The automatic air conditioner equips with the “Self-Diagnosis Function” to check its major components. This function makes access to the sensors, actuators and blower fan motor system easier when checking them up and, when a failed part is located, this function restores its original performance.

When implementing the troubleshooting, this self-diagnosis function narrows the range to be searched at the first step, then check relevant parts one by one according to the “Checking Procedures by Failed Location”. As for a location this function is unappreciable, the system accurately determines characteristics of a given trouble and checks relevant parts according to the “Checking Procedures by Failed Location”.
The following illustrates basic troubleshooting flow.

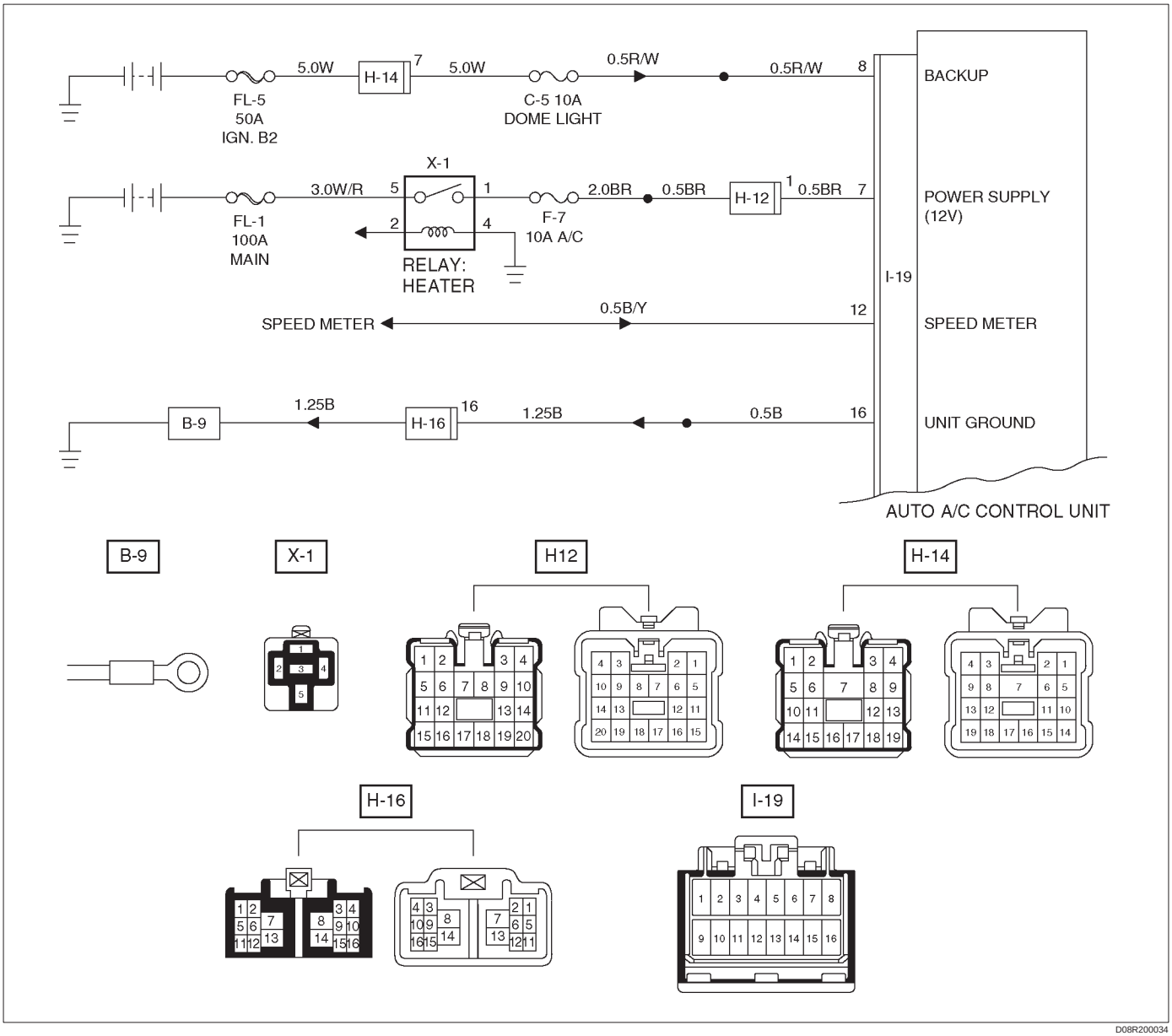
Basic Troubleshooting Flow



F01RX009

Auto Air Conditioner Control Unit Power Supply Diagnosis

This check is required because a trouble on the auto amplifier (control unit) power supply circuit or grounding circuit prevents accurate troubleshooting.



D08R200034

Condition	Possible cause	Correction
Power source does not supply to auto air conditioner control unit.	—	Refer to *Chart A*

Chart “A”: Check of Auto Amplifier Power Supply System

Step	Action	Value(s)	Yes	No
1	Is the fuse C–5 normal?	—	Go to *Step 2*	Replace the fuse
2	Is the fuse F–7 normal?	—	Go to *Step 3*	Replace the fuse
3	Disconnect the auto A/C control unit connector I–19. Is the battery voltage applied between the harness side connector terminal No.I32–8 and the ground?	Approx. 12V	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between the fuse C–5 and terminal No.I19–8. Is the action complete?	—	Go to *Step 4*	—
5	Is there continuity between the harness side connector terminal No.I19–16 and the ground?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.I19–16 and the ground No.B–9. Is the action complete?	—	Go to *Step 5*	—
7	Turn the lighting switch on. Is the battery voltage applied between the harness side connector terminal No.I19–12 and the ground?	Approx. 12V	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between the lighting switch and terminal No.I19–12. Is the action complete?	—	Go to *Step 7*	—
9	Turn the starter switch on. Is the battery voltage applied between the harness side connector terminal No.I19–7 and the ground?	Approx. 12V	—	Go to *Step 10*
10	Repair an open circuit between the fuse F–7 and terminal No.I19–7. Is the action complete?	—	Verify repair	—

Performance and Movement checklist for Automatic Air Conditioner Related Parts

Start the engine, and when the engine coolant reached 50˚C (122˚F) check performance and movement of the related parts according the following checklist.

Performance Check Using the Manual Switch

No.	Item	Procedure		Criteria
		Condition	Operation	
1	Air discharge temperature (Air–mix door operation)	Auto–switch ON	Set temperature to 18˚C (65˚F).	Cold air discharge.
			Set temperature to 32˚C (90˚F).	Hot air discharge.
2	Air discharge volume (Fan operation)	Fan switch ON	1. Set temperature to 25˚C (77˚F). 2. Press the OFF switch.	Fan does not operate. There is no air discharge.
			1. Set temperature to 25˚C (77˚F). 2. Press the fan ▲ switch.	Fan operates. Fan speed increases each time the switch is pressed (LO to HI in 5 increments).
3	Air discharge temperature (Mode door operation)	Fan in manual 5–speed operation	1. Set temperature to 25˚C (77˚F). 2. Press the mode switch. 3. Move through the 5 modes (VENT→BI–LEVEL →FOOT→DEF/FOOT→DEF).	▼Panel display lights for each mode. ▼Air discharge outlet position changes for each mode.
4	Inside/outside air mode (Intake door operation)	Auto–switch ON	1. Set temperature to 25˚C (77˚F). 2. Press the intake switch. 3. Press the fan ▲ switch. 4. Set the fan to the highest speed. 5. Press the intake switch.	▼Intake switch LED turns from on to off. ▼Air discharge sound changes.
5	Compressor	Outside air temperature above 0˚C (32˚F) and vehicle interior at normal temperature	1. Set temperature to 25˚C (77˚F). 2. Press the OFF switch. 3. Press the auto–switch. 4. Press the air conditioner switch.	▼When the auto–switch is pressed, the LED in the air conditioner switch turns on and the compressor begins operation. ▼When the air conditioner switch is pressed, the LED in the air conditioner switch turns off and the compressor stops operation.

Check of Auto Function

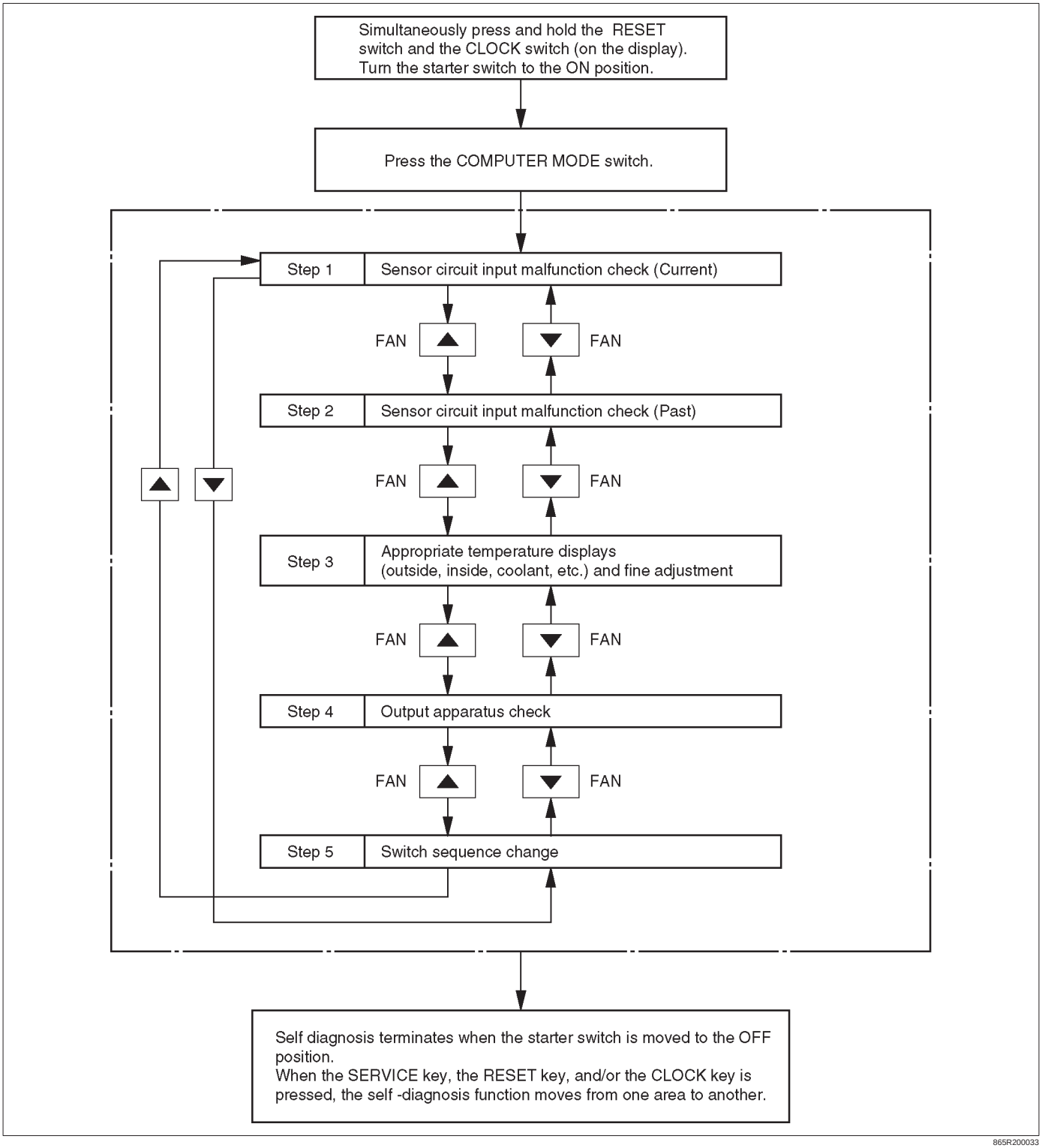
No.	Item	Procedure		Criteria
		Condition	Operation	
1	Automatic operation	Auto-switch ON	Set temperature to 18˚C (65˚F).	▼AUTO display highlighted on display panel. ▼Cold air discharge. ▼VENT mode. ▼Intake switch LED on. ▼Fan speed bar graph display at MAX6dash;HI ▼A/C switch LED on.
			Gradually increase the temperature setting from 18˚C (65˚F) to 31.5˚C (89˚F).	▼Temperature of air discharge increases with increase in setting temperature. ▼Air discharge volume changes. ▼Panel display shows VENT, BI–LEVEL, FOOT, or DEF/FOOT.
			Set temperature to 32˚C (90˚F).	▼Hot air discharge. ▼A/C bar graph display disappears. ▼Foot mode. ▼Intake LED switch off. ▼Fan speed bar graph display at MAX-HI ▼A/C switch LED on.

Troubleshooting With Self-Diagnosis Function

Overview of Self-Diagnosis Function

Sensors (input) and actuators (output) are used to check circuit function and provide essential data on these circuits. For more detailed information, refer to the [Inspection and Repair] Sections for the applicable system or component.
The Table below shows how to turn the self-diagnosis function on and off.

Self-Diagnosis Operation Procedure



865R200033

Step	Action	Value(s)	Yes	No
1	1. Allow the engine to idle until it completely warms up. 2. Turn the starter switch to the OFF position. 3. Place a 60–watt lamp approximately 15 cm from the sun sensor. NOTE: This procedure is best performed at night or in a dark, unlit area. Is the action complete?	—	Go to *Step 2*	—
2	Simultaneously press and hold the RESET key and the CLOCK key (display unit). Move the starter switch to start the engine. Does DIAG appear on the display?	—	Go to *Step 3*	Replace display unit
3	Press the COMPUTER MODE key. Does DIAG AIRCON appear on the display?	—	Go to *Step 4*	Replace audio unit
4	NOTE: A ’1’ should appear in the set temperature segment of the display. Does ’0’ appear in the outside air segment of the display?	—	Go to *Step 6*	Go to *Step 5*
5	Repair or replace damaged parts. NOTE: Refer to *Step 1 Trouble Code Table.* Is the action complete?	—	Go to *Step 1*	—
6	Press and release the ▲ fan switch (one time only). NOTE: A ’2’ should appear in the set temperature segment of the display. Does ’0’ appear in the outside air segment of the display?	—	Go to *Step 8*	Go to *Step 7*
7	Repair or replace damaged parts. NOTE: Refer to *Step 2 Trouble Code Table.* Is the action complete?	—	Go to *Step 1*	—
8	Press and release the ▲ fan switch (one time only). NOTE: ▼ Refer to *Step 3 Sensor Output Check for a sample output value.* ▼ A ’3’ should appear in the set temperature segment of the display. Does the correct sensor output value appear in the outside air segment of the display?	—	Go to *Step 10*	Go to *Step 9*
9	Repair or replace damaged parts. NOTE: Refer to *Trouble Spot Inspection.* Is the action complete?	—	Go to *Step 1*	—
10	Press and release the ▲ fan switch one time only. NOTE: Refer to *Step 4* (Operation Check) for display readings and inspection steps. Are all parts operating normally?	—	Go to *Step 12*	Go to *Step 11*

Step	Action	Value(s)	Yes	No
11	Repair or replace damaged parts. NOTE: Refer to *Trouble Spot Inspection.* Is the action complete?	—	Go to *Step 1*	—
12	1. Press and release the ▲ fan switch (one time only). 2. Press the DEF switch several times. NOTE: A '3' should appear in the set temperature segment of the display. Does the correct sequence pattern (1, 2, 1, 2) appear in the outside air segment of the display?	—	Go to *Step 15*	Go to *Step 13*
13	Perform diagnosis for DEF switch, intake actuator, and AUTO A/C control unit. Have the diagnosis procedures been completed.	—	Go to *Step 14*	—
14	1. Press and release the ▲ fan switch (one time only). 2. Press the DEF switch several times. Are all parts operating normally?	—	Go to *Step 15*	Replace display unit
15	Turn the starter switch OFF. Is the action complete?	—	—	—

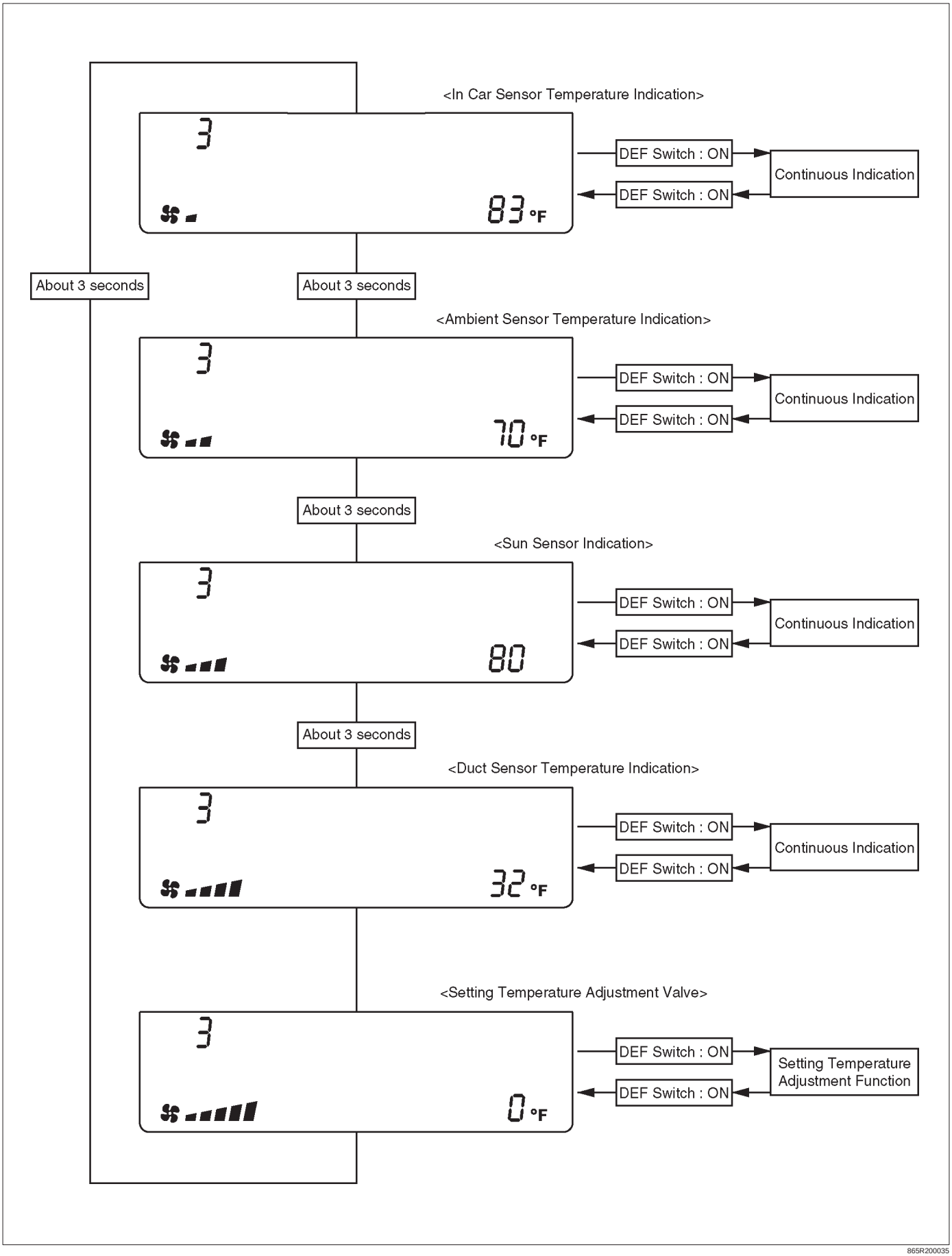
STEP 1: Trouble Code Table

Trouble Code	Defective Part	Trouble Code	Defective Part
1	In Car Sensor Open Circuit	– 1	In Car Sensor Short Circuit
2	Ambient Sensor Open Circuit	– 2	Ambient Sensor Short Circuit
3	Sun Sensor Open Circuit	– 3	Sun Sensor Short Circuit
4	Duct Sensor Open Circuit	– 4	Duct Sensor Short Circuit
5	Mix Potentiometer Open Circuit	– 5	Mix Potentiometer Short Circuit
6	Mode Encoder Open Circuit		
7	Intake Encoder Open Circuit		
0	No Defective Part		

STEP 2: Trouble Code Table

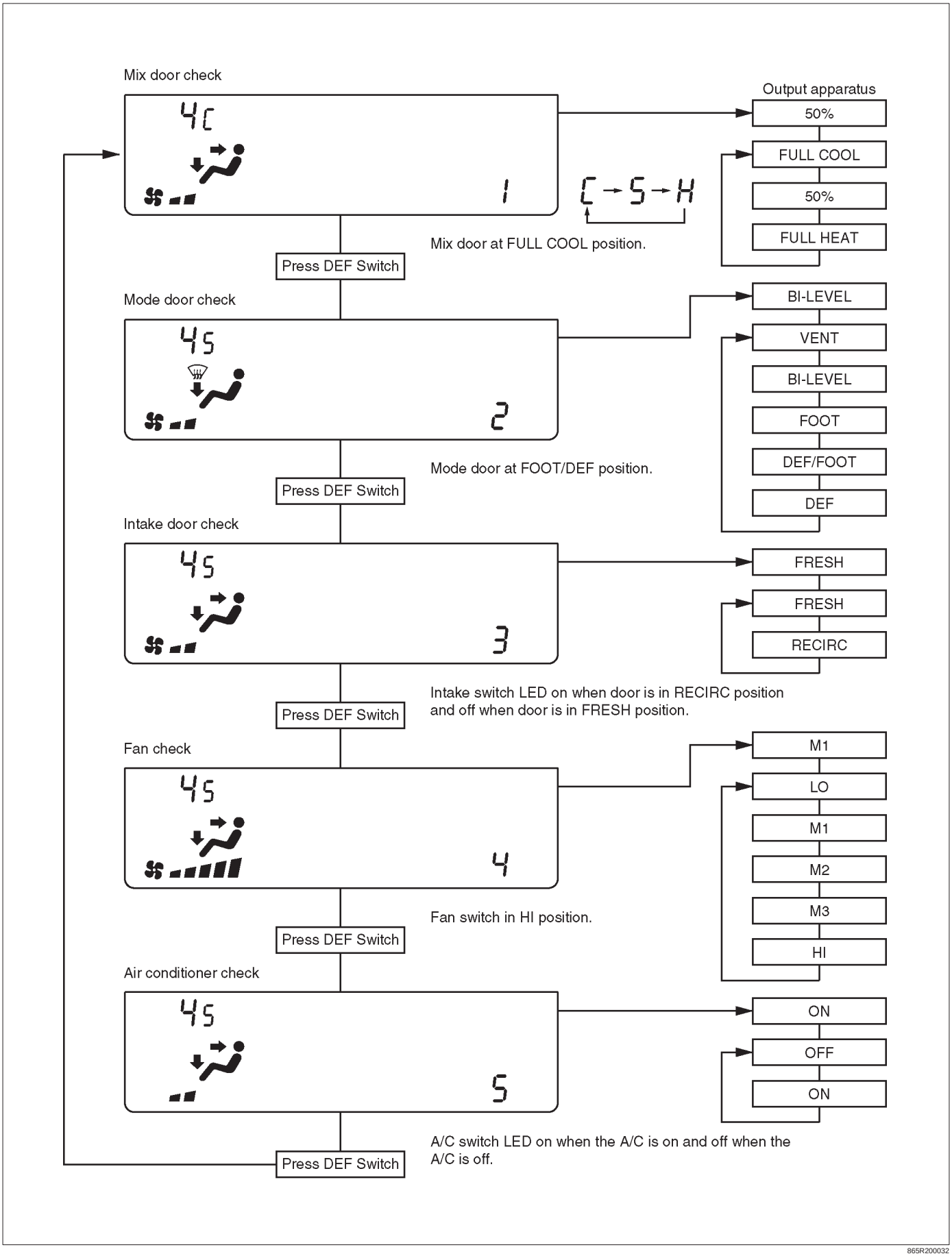
Trouble Code	Defective Part	Trouble Code	Defective Part
1	In Car Sensor Open Circuit	– 1	In Car Sensor Short Circuit
2	Ambient Sensor Open Circuit	– 2	Ambient Sensor Short Circuit
3	Not Used	– 3	Sun Sensor Short Circuit
4	Duct Sensor Open Circuit	– 4	Duct Sensor Short Circuit
5	Mix Potentiometer Open Circuit	– 5	Mix Potentiometer Short Circuit
6	Mode Encoder Open Circuit		
7	Intake Encoder Open Circuit		
0	No Defective Part		

STEP 3: Sensor Output Check



865R200035

STEP 4: Operation Check

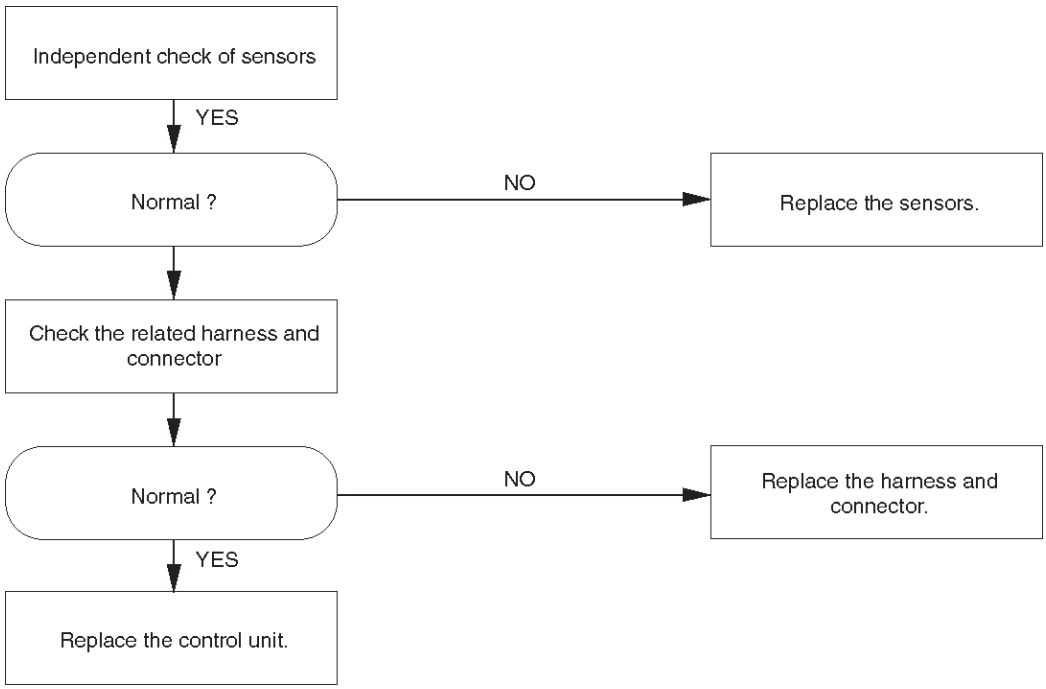


865R200032

Inspection By Failed Location

Inspection of the Sensors

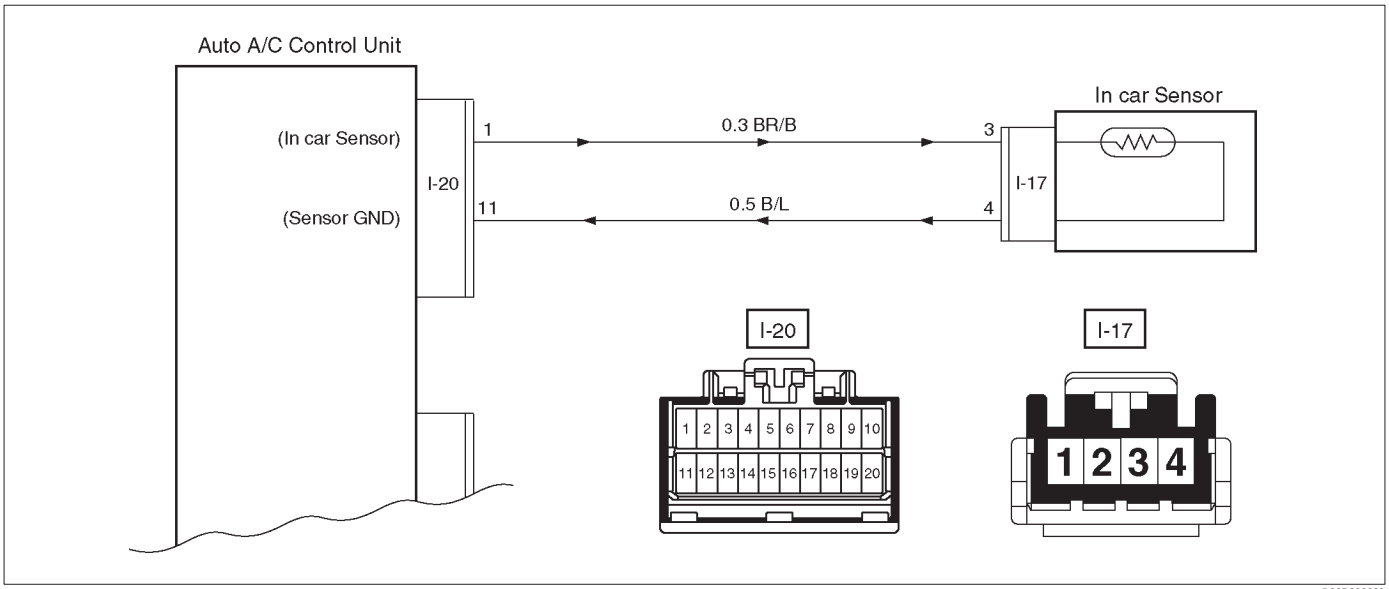
When the self-diagnosis function has determined that trouble is present on the sensors, check them according to the following flow chart.



Sensors	Allowable range	Check method
In car sensor	Refer to the sensor resistance curve.	Chart 1
Ambient sensor	Refer to the sensor resistance curve.	Chart 2
Sun sensor	100 ohms maximum in forward and 0.02 mA minimum when exposed to 60W incandescent lamp.	Chart 3

F01RY00005

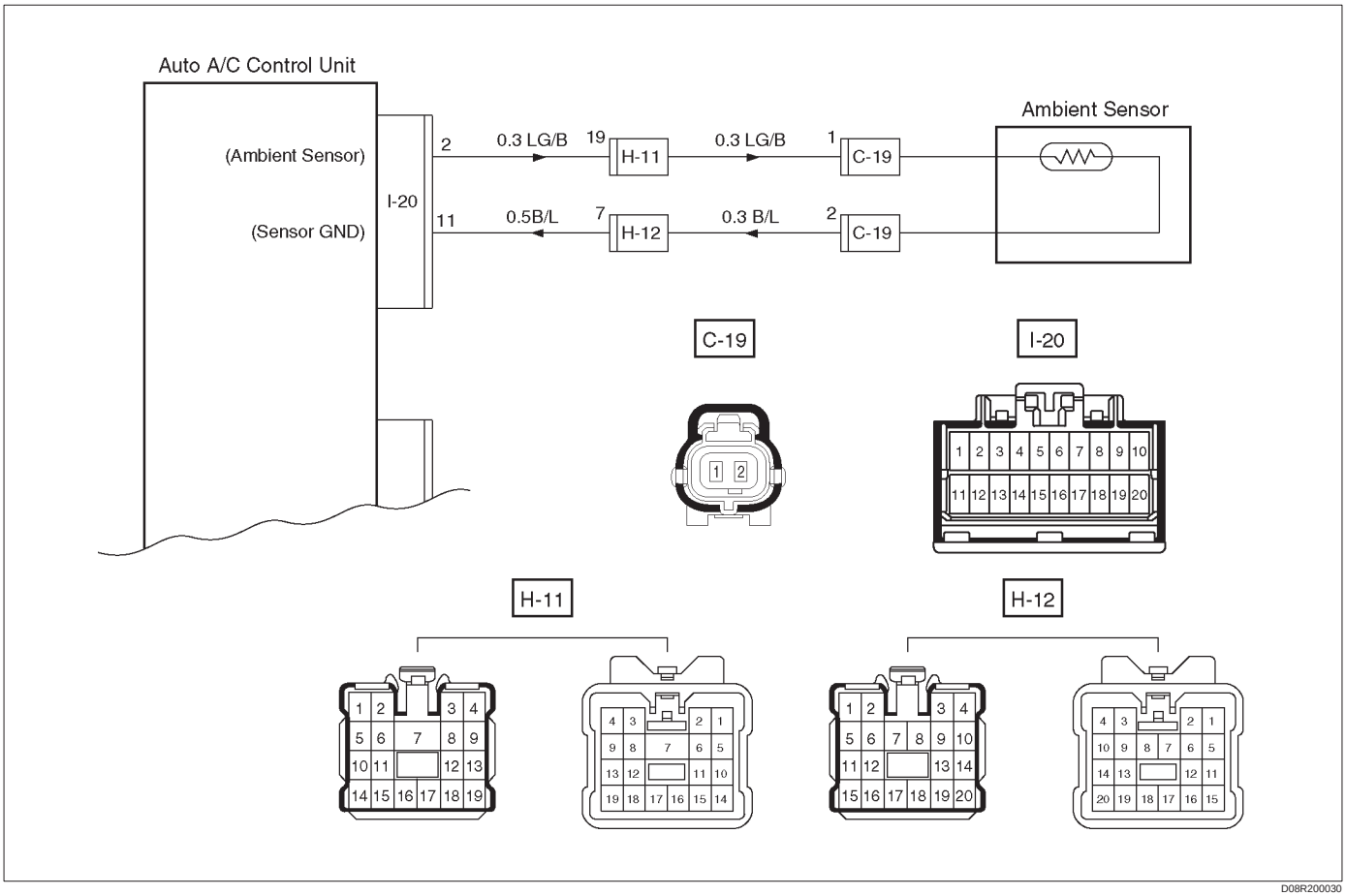
Chart 1: In Car Sensor



D08R200029

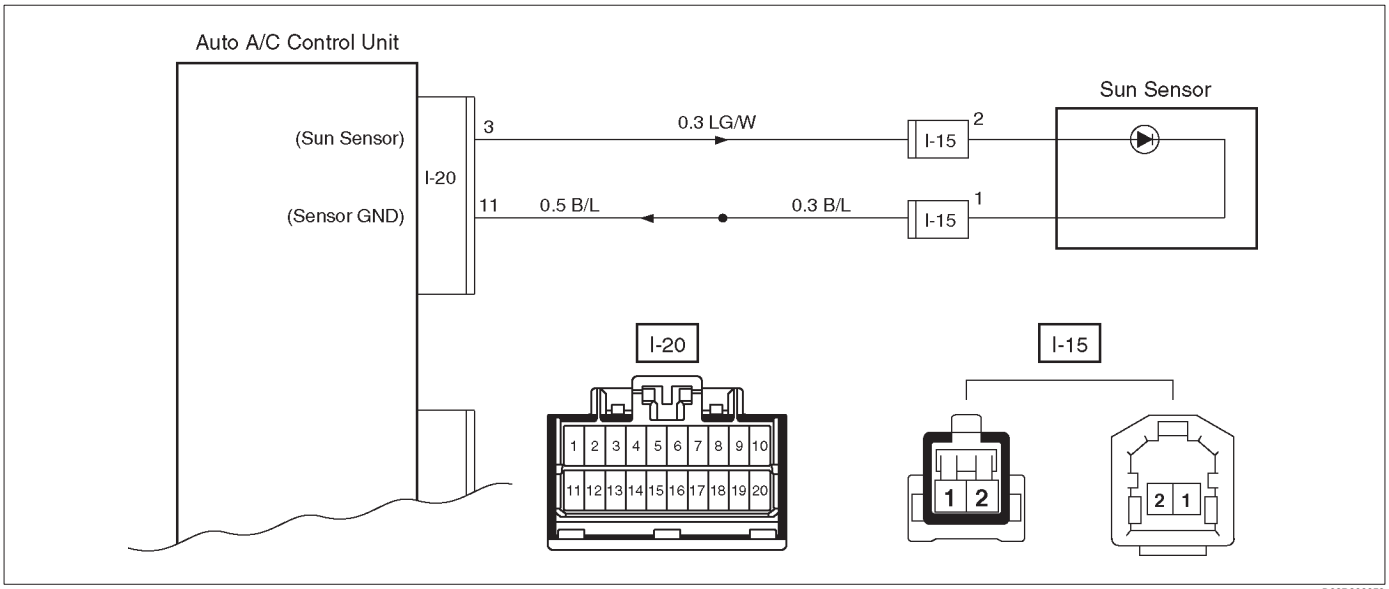
Step	Action	Value(s)	Yes	No
1	Disconnect the in car sensor connector. (No.I-17) Is performance of the sensor normal? (Refer to the *later section on "Individual Inspection"*)	—	Go to *Step 2*	Replace the in car sensor
2	Is there continuity between the harness side connector No.I20–1 and No.I17–3?	—	Go to *Step 4*	Go to *Step 3*
3	Repair an open circuit between terminal No.I20–1 and No.I17–3. Is the action complete?	—	Go to *Step 2*	—
4	Is there continuity between the harness side connector No.I20–11 and No.I17–4?	—	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit between terminal No.I20–11 and No.I17–4. Is the action complete?	—	Go to *Step 4*	—
6	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart 2: Ambient Sensor



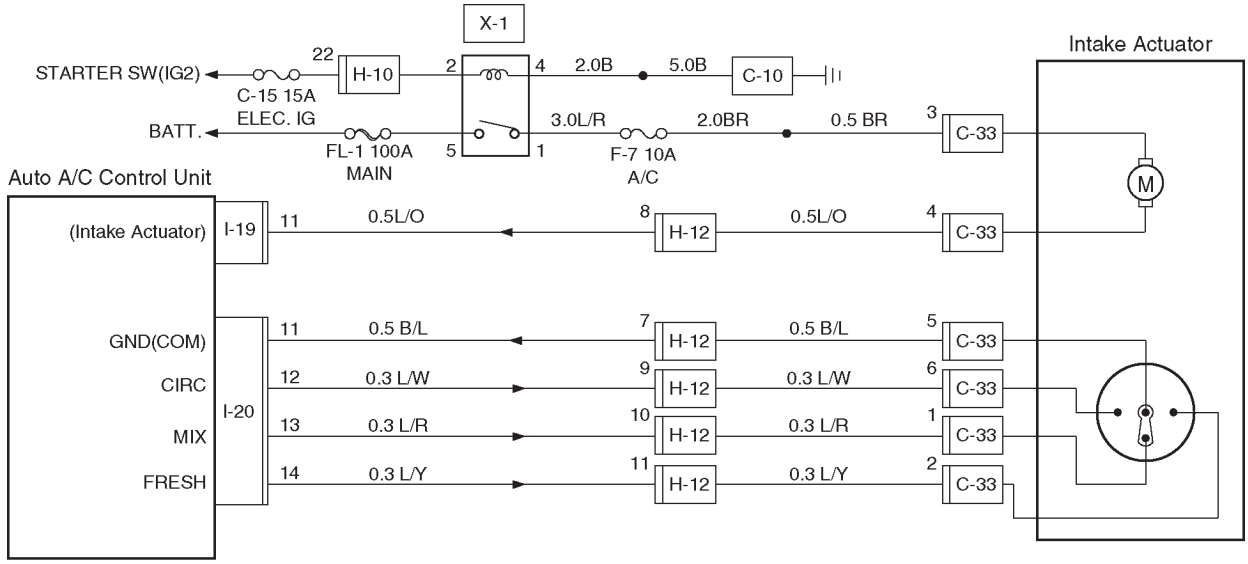
Step	Action	Value(s)	Yes	No
1	Disconnect ambient sensor connector. (No.C–19) Is performance of the ambient sensor normal? (Refer to the *later section on "Individual inspection"*)	—	Go to *Step 2*	Replace the ambient sensor
2	Connect the ambient sensor connector. Is resistance between the harness side connector No.I20–2 and No.I20–11 normal?	Refer to the *later section on "Individual inspection"*	Go to *Step 4*	Go to *Step 3*
3	Repair an open circuit between terminal No.I20–2 and No.C19–1 or No.I20–11 and No.C19–2. Is the action complete?	—	Verify repair	—
4	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

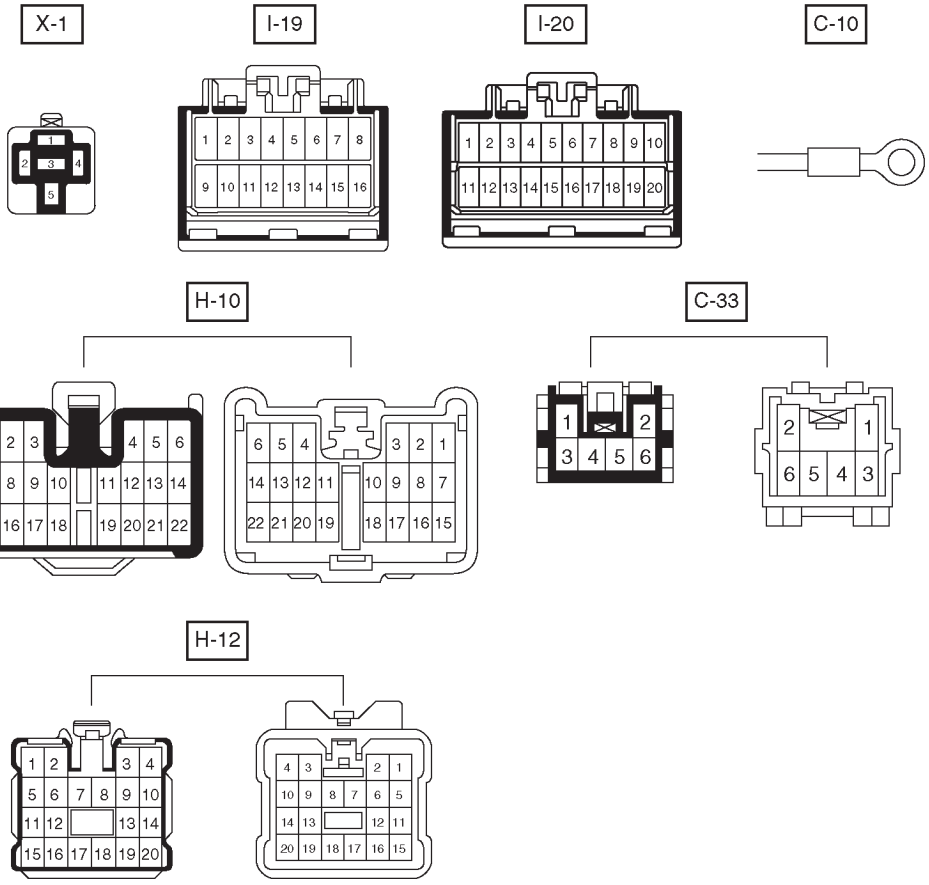
Chart 3: Sun Sensor



Step	Action	Value(s)	Yes	No
1	Disconnect the sun sensor connector. (No.I–15) Is performance of the sun sensor normal? (Refer to the *later section on individual inspection*)	—	Go to *Step 2*	Replace the sun sensor.
2	Is there continuity between the harness side connector terminal No.I20–3 and No.I15–2?	—	Go to *Step 4*	Go to *Step 4*
3	Repair an open circuit between terminal No.I20–3 and No.I15–2. Is the action complete?	—	Go to *Step 2*	—
4	Is there continuity between the harness side connector terminal No.I20–11 and No.I15–1?	—	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit between terminal No.I20–11 and I15–1. Is the action complete?	—	Go to *Step 4*	—
6	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Intake Actuator System





D08R200060

Condition	Possible cause	Correction
Does not work at all	—	Refer to *Chart A*
Control failure	—	Refer to *Chart B*

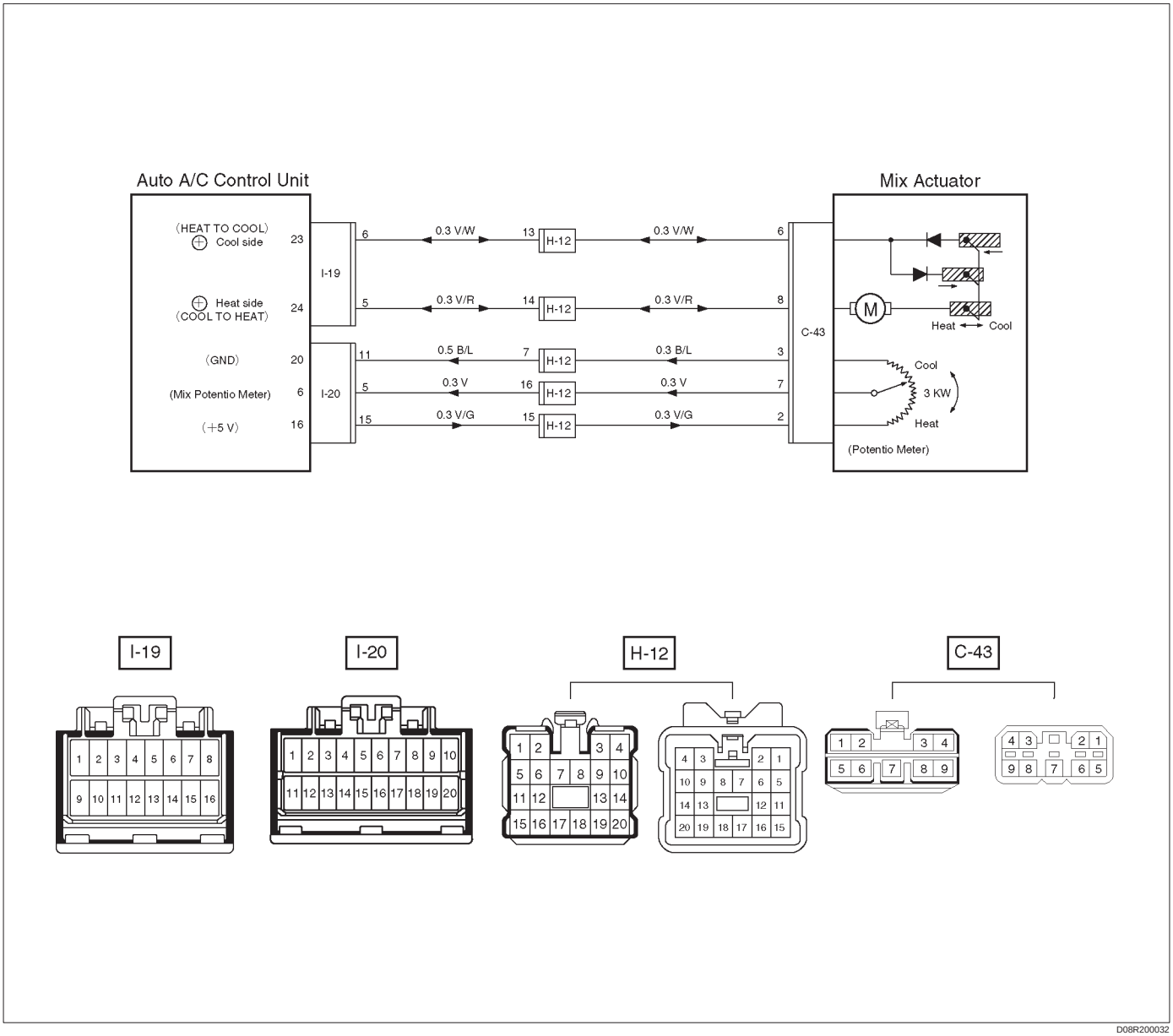
Chart A: Does Not Work At All

Step	Action	Value(s)	Yes	No
1	Is the fuse FL–1 normal?	—	Go to *Step 2*	Replace the fuse
2	Is the fuse F–7 normal?	—	Go to *Step 3*	Replace the fuse
3	Is the relay X–1 normal?	—	Go to *Step 4*	Replace the relay
4	Turn on the ignition switch. (the engine is run.) Is the battery voltage applied between the harness side connector terminal No.C33–3 and ground?	Approx 12V	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit between terminal No.C33–3 and No.X1–1. Is the action complete?	—	Go to *Step 4*	—
6	Is the battery voltage applied between the harness side connector terminal No.C33–4 and ground?	Approx 12V	Go to *Step 8*	Go to *Step 7*
7	Replace the intake actuator motor. Is the action complete?	—	Go to *Step 6*	—
8	Is there continuity between the harness side connector terminal No.I19–11 and No.C33–4?	—	Go to *Step 10*	Go to *Step 9*
9	Repair an open circuit between No.I19–11 and C33–4. Is the action complete?	—	Verify repair	—
10	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart B: Failure on the Intake Control

Step	Action	Value(s)	Yes	No
1	Is the fuse No.F–7 normal?	—	Go to *Step 2*	Replace the fuse
2	Is the relay No.X–1 normal?	—	Go to *Step 3*	Replace the relay
3	Turn on the ignition switch. (the engine is run.) Is the intake actuator stopped?	—	Go to *Step 5*	Go to *Step 4*
4	Replace or repair the auto air conditioner control unit. Is the action complete?	—	Verify repair	—
5	Is there continuity between the harness side connector terminal No.C33–5 and No.I20–11?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.C33–5 and No.I20–11. Is the action complete?	—	Go to *Step 5*	—
7	Is there continuity between the harness side connector terminal No.C33–6 and No.I20–12?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.C33–6 and No.I20–12. Is the action complete?	—	Go to *Step 7*	—
9	Is there continuity between the harness side connector terminal No.C33–1 and No.I20–13?	—	Go to *Step 11*	Go to *Step 10*
10	Repair an open circuit between terminal No.C33–1 and I20-13. Is the action complete?	—	Go to *Step 9*	—
11	Is there continuity between the harness side connector terminal No.C33–2 and No.I20–14?	—	Go to *Step 13*	Go to *Step 12*
12	Repair an open circuit between harness No.C33–2 and No.I20–14. Is the action complete?	—	Go to *Step 11*	—
13	1. Disconnect the intake actuator connector No.C33. 2. Is the battery voltage applied between harness side connector terminal No.C33–6 and ground? No.C33–2 and ground? No.C33–1 and ground?	—	Go to *Step 14*	Go to *Step 15*
14	Replace or repair the intake actuator. Is the action complete?	—	Verify repair	—
15	Replace or repair the air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Mix Actuator System



D08R200032

Condition	Possible cause	Correction
Does not work at all	—	Refer to *Chart A*
Control failure	—	Refer to *Chart B*

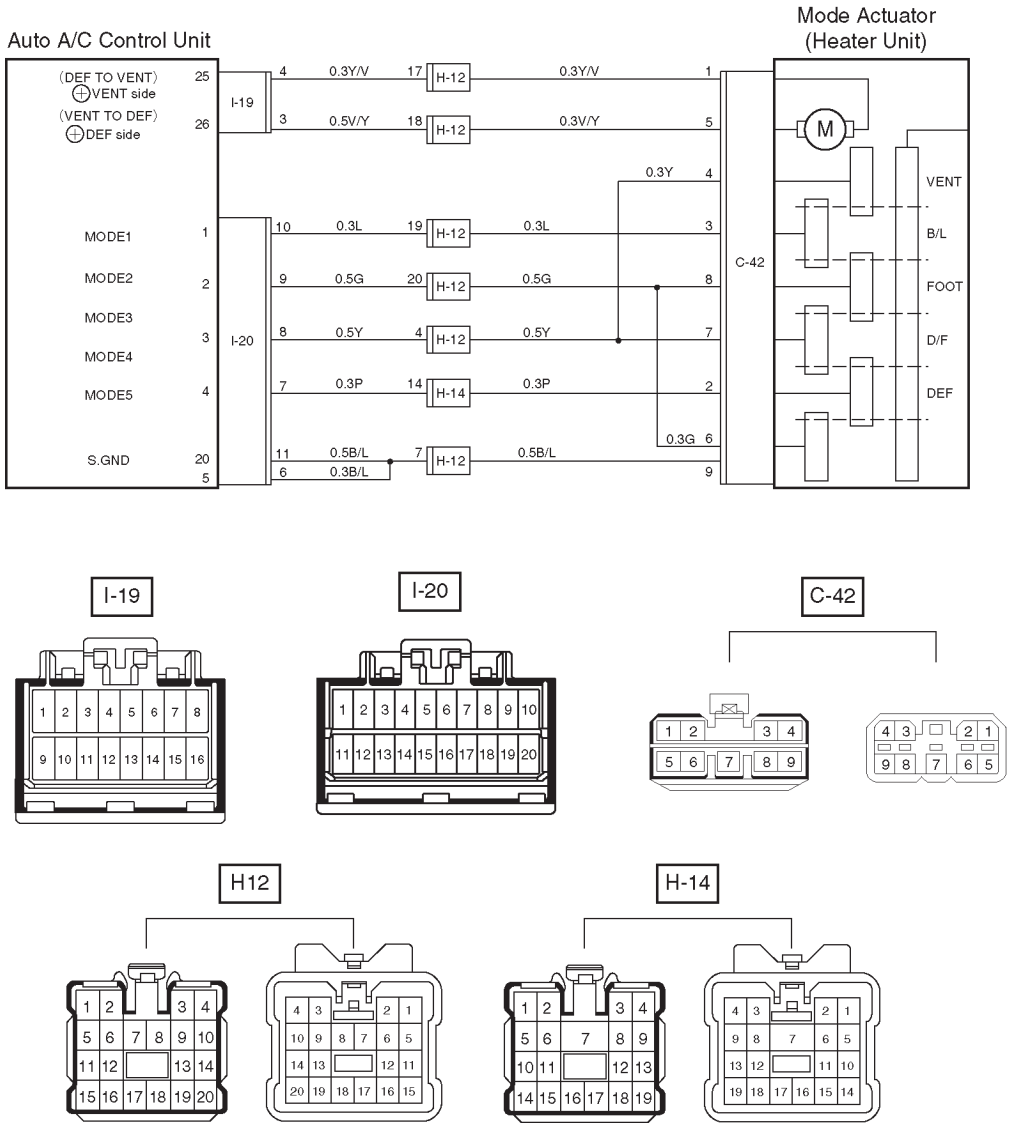
Chart A: Does Not work At All

Step	Action	Value(s)	Yes	No
1	1. Turn on the ignition switch (the engine is run). 2. Disconnect the mix actuator connector (C–43). 3. Short-circuit the chassis harness side connector terminal No.C43–3 and No.C43–7. 4. Using the temperature control switch, select 18˚C (65˚F) for the temperature. Is the battery voltage applied on a regular interval basis between the harness side connector terminal No.C43–6 (-) and No.C43–8 (+)?	—	Go to *Step 3*	Go to *Step 2*
2	Replace the auto air conditioner control unit.	—	Varify repair	—
3	Using the temperature control switch, select 32˚C (90˚F) for the temperature. Is the battery voltage applied on a regular interval basis between the harness side connector terminal No.C43–6 (+) and No.C43–8 (-)?	—	Go to *Step 5*	Go to *Step 4*
4	Replace the auto air conditioner control unit.	—	Verify repair	—
5	Is there continuity between the harness side connector terminal No.I19–6 and No.C43–6?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.I19–6 and No.C43–6. Is the action complete?	—	Go to *Step 5*	—
7	Is there continuity between the harness side connector terminal No.I19–5 and No.C43–8?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.I19–5 and No.C43–8. Is the action complete?	—	Verify repair	—
9	Replace the mix actuator. Is the action complete?	—	Verify repair	—

Chart B: Mix Actuator Control Failure

Step	Action	Value(s)	Yes	No
1	Turn the ignition switch (the engine is run). Dose the mix actuator fully stroke when 32˚C (90˚F) and 18˚C (65˚F) of the temperature control switch?	—	Go to *Step 3*	Go to *Step 2*
2	Repair or replace the air mix door or the link unit. Is the action complete?	—	Varify repair	—
3	Is there continuity between the harness side connector terminal No.C43–3 and No.I20–11?	—	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between terminal No.C43–3 and No.I20–11. Is the action complete?	—	Go to *Step 3*	—
5	Is there continuity between harness side connector terminal No.C43–7 and No.I20–5?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.C43–7 and No.I20–5. Is the action complete?	—	Go to *Step 5*	—
7	Is there continuity between the harness side connector terminal No.C43–2 and No.I20–15?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.C43–2 and No.I20–15. Is the action complete?	—	Go to *Step 7*	—
9	Is sum of the voltage between the following chassis harness side connector terminals approximately 5V? No.I20–15 and No.I20–5, No.I20–5 and No.I20–11	—	Go to *Step 11*	Go to *Step 10*
10	Replace the actuator. Is the action complete?	—	Verify repair	—
11	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Mode Actuator System



D08R200035

Condition	Possible cause	Correction
Does not work at all	—	Refer to *Chart A*
Control failure	—	Refer to *Chart B*

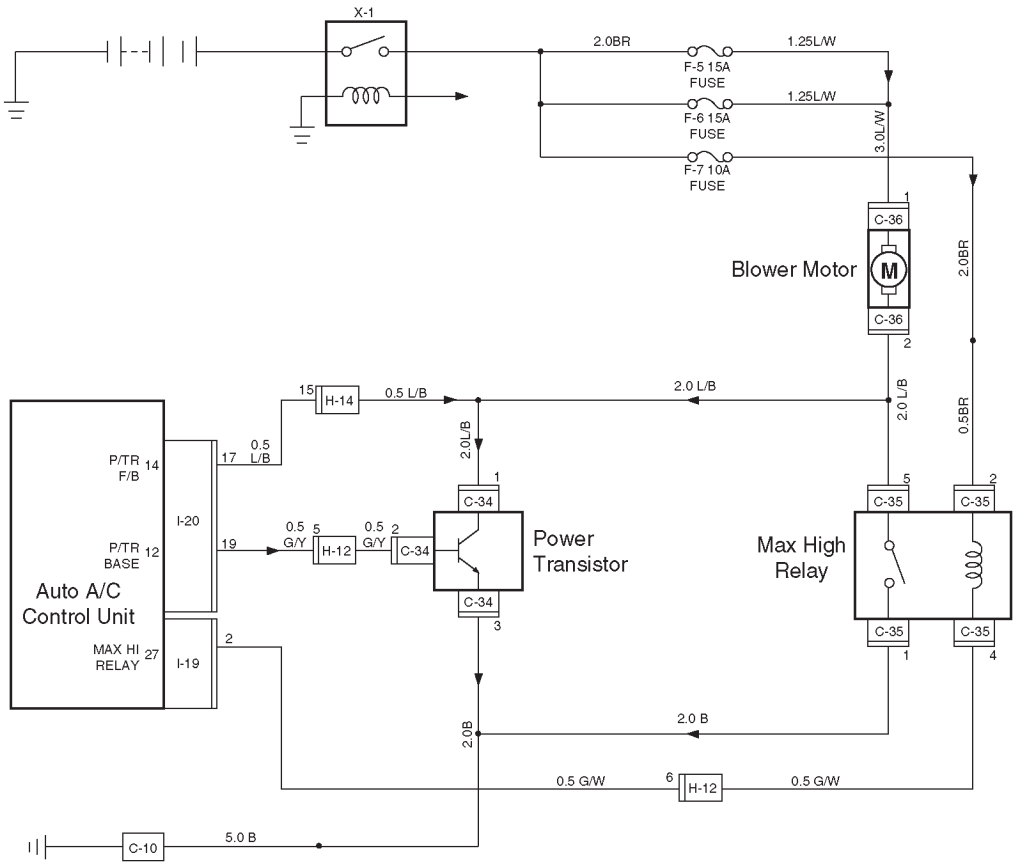
Chart A: Does Not Work At All

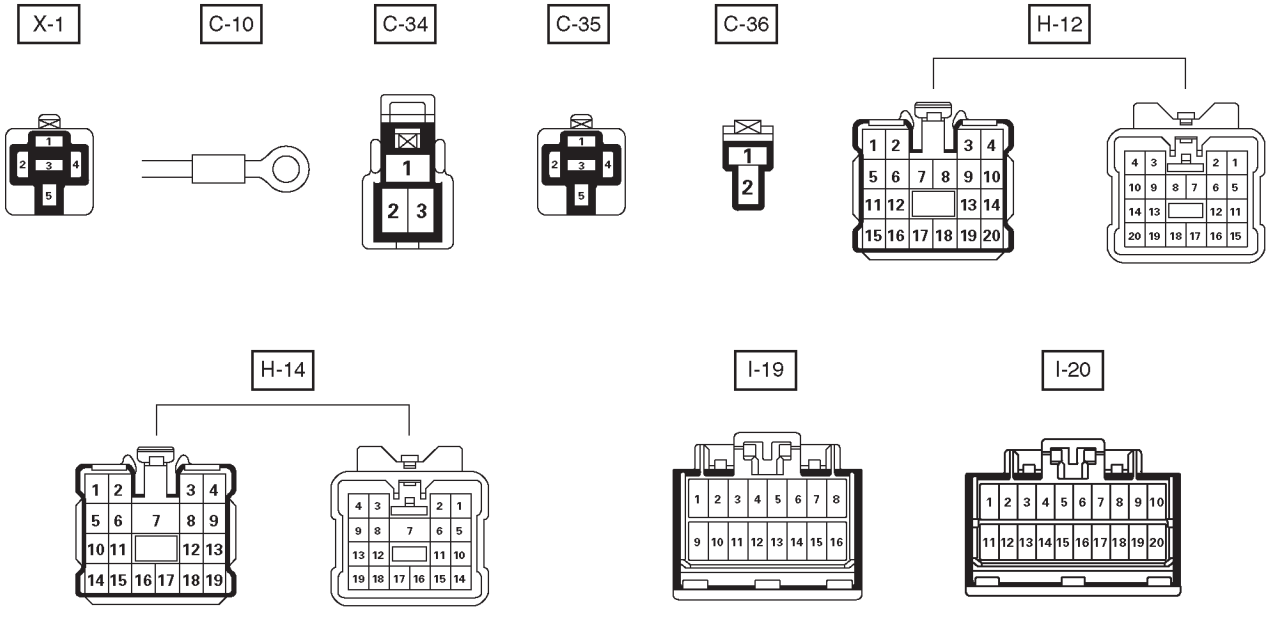
Step	Action	Value(s)	Yes	No
1	1. Turn on the ignition switch (the engine is run). 2. Disconnect the mode actuator connector (C–42) 3. Select VENT pressing the mode actuator. Is the battery voltage provided on a regular interval between the harness side connector terminal No.C42–1 (+) and No.C42–5 (-)?	—	Go to *Step 3*	Go to *Step 2*
2	Replace the auto air conditioner control unit. Is the action complete?	—	Varify repair	—
3	Turn on the DEF mode switch. Is the battery voltage provided on a regular interval between the chassis side connector terminal No.C42–5 (+) and No.C42–1 (-)?	—	Go to *Step 5*	Go to *Step 4*
4	Replace the auto air conditioner control unit.	—	Varify repair	—
5	Is there continuity between the harness side connector terminal No.C42–1 and No.I19–4?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.C42–1 and No.I19–4. Is the action complete?	—	Go to *Step 5*	—
7	Is there continuity between the harness side connector terminal No.C42–5 and No.I19–3?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.C42–5 and No.I19–3. Is the action complete?	—	Verify repair	—
9	Replace the mode actuator.	—	Verify repair	—

Chart B: Mode Actuator Control Failure

Step	Action	Value(s)	Yes	No
1	Turn on the ignition switch (the engine is run). Dose the mode actuator fully stroke when the defrost mode and the vent mode are selected?	—	Go to *Step 3*	Go to *Step 2*
2	Repair or replace the mode door or the link unit. Is the action complete?	—	Go to *Step 1*	—
3	Is there continuity between the harness side connector terminal No.C42–9 and No.I20–11?	—	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between terminal No.C42–9 and No.I20–11. Is the action complete?	—	Go to *Step 3*	—
5	Is there continuity between the harness side connector terminal No.C42–3 and No.I20–10?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.C42–3 and No.I20–10. Is the action complete?	—	Go to *Step 5*	—
7	Is there continuity between harness side connector terminal No.C42–4 and No.I20–8?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.C42–4 and No.I20–8. Is the action complete?	—	Go to *Step 7*	—
9	Is sum of the voltage between the following harness side connector terminal approximately 5V? Voltage between No.I20–8 and No.I20–10 plus voltage between No.I20–8 and No.I20–11	5V	Go to *Step 11*	Go to *Step 10*
10	Replace the actuator. Is the action complete?	—	Verify repair	—
11	Dose the mode actuator work normally through manual operation?	—	Go to *Step 13*	Go to *Step 12*
12	Replace the sensor. Is the action complete?	—	Verify repair	—
13	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Fan Motor System





D08R200058

Condition	Possible cause	Correction
The fan dose not rotate at all	—	Refer to *Chart A*
The fan dose not rotate in the MAX–HI mode	—	Refer to *Chart B*
The fan dose not rotate in any mode other than MAX–HI	—	Refer to *Chart C*
The fan dose not stop	—	Refer to *Chart D*

Chart A: Fan Does Not Rotate At All

Step	Action	Value(s)	Yes	No
1	Are the fuse No.F–5, F–6 and No.F–7 normal?	—	Go to *Step 2*	Replace the fuse
2	Are the relay No.X–1 and No.C–35 normal?	—	Go to *Step 3*	Replace the relay
3	Turn on the ignition switch (the engine is run). Is the battery voltage applied between the harness side connector terminal No.C36–1 and ground?	—	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between terminal No.C36–1 and No.F–5 and F–6 fuse. Is the action complete?	—	Go to *Step 3*	—
5	Is there continuity between the harness side connector terminal No.C36–2 and ground (No.C–10)?	—	Go to *Step 7*	Go to *Step 6*
6	Repair an open circuit between terminal No.C36–2 and ground. Is the action complete?	—	—	—
7	Is the battery voltage applied between the harness side connector terminal No.C36–2 and No.C36–1?	—	Go to *Step 8*	Go to *Step 9*
8	Replace the blower motor. Is the action complete?	—	Verify repair	—
9	Refer to *chart B and C.* Is the action complete?	—	Verify repair	—

Chart B: Fan Does Not Rotate in MAX HI Mode

Step	Action	Value(s)	Yes	No
1	Is the MAX-HI relay (C–35) normal?	—	Go to *Step 2*	Replace the relay
2	1. Turn on the ignition switch (the engine is run). 2. Set the fan switch to the MAX-HI. Is there continuity between the harness side connector terminal No.C36–2 and No.C35–5?	—	Go to *Step 4*	Go to *Step 3*
3	Repair an open circuit between terminal No.C36–2 and No.C35–5. Is the action complete?	—	Go to *Step 3*	—
4	Is there continuity between the harness side connector terminal No.C35–1 and ground (No.C–10)?	—	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit between terminal No.C35–1 and ground (No.C–10). Is the action complete?	—	Go to *Step 4*	—
6	Is the battery voltage applied between the harness side connector terminal No.C35–2 and ground?	—	Go to *Step 8*	Go to *Step 7*
7	Repair an open circuit between terminal No.C35–2 and No.F–7 fuse. Is the action complete?	—	Go to *Step 6*	—
8	Is the battery voltage applied between the harness side connector terminal No.I19–2 and ground?	—	Go to *Step 10*	Go to *Step 9*
9	Repair an open circuit between terminal No.C35–4 and No.I19–2. Is the action complete?	—	Verify repair	—
10	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart C: Fan Does Not Rotate In Any Mode Other Than MAX HI

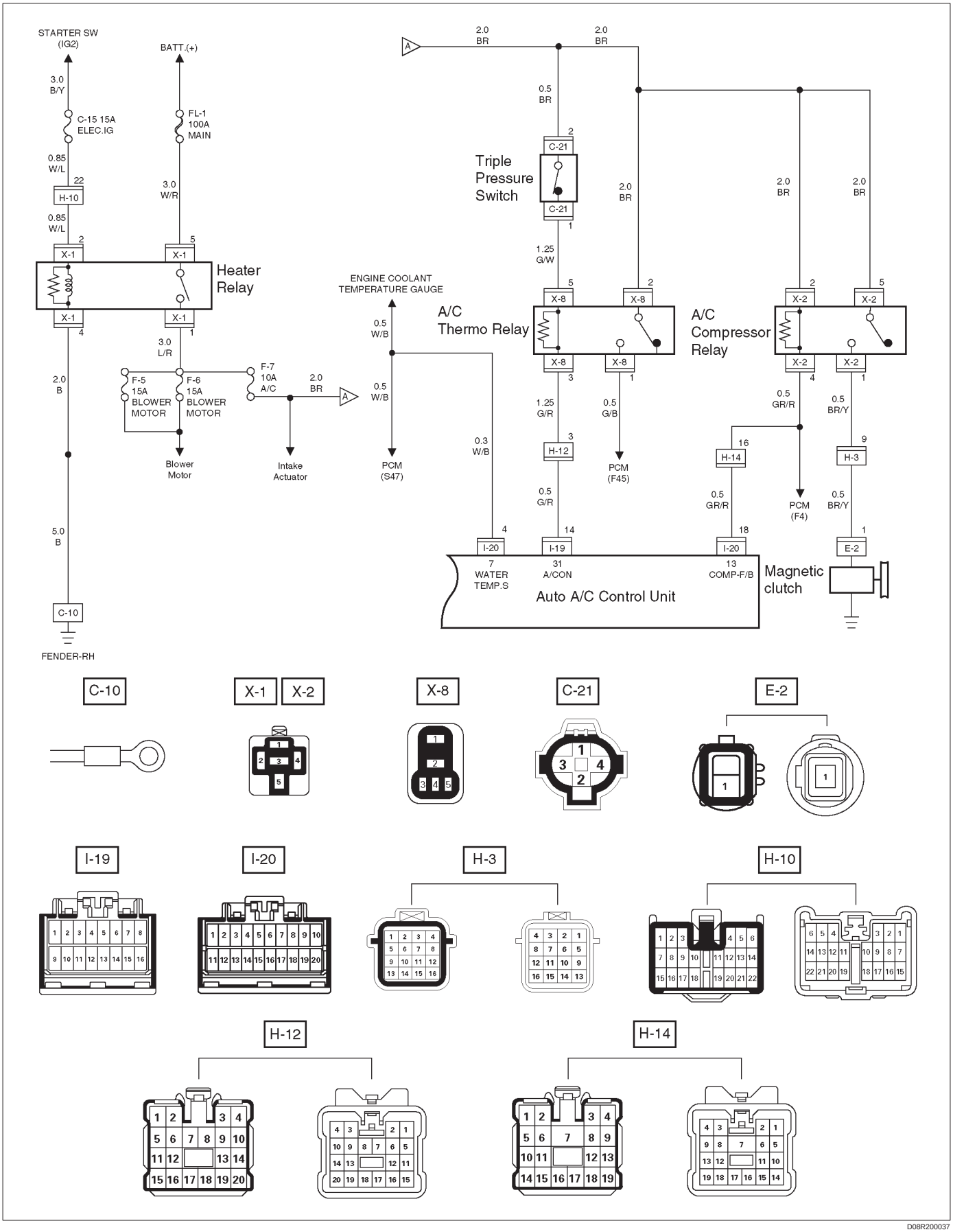
Step	Action	Value(s)	Yes	No
1	Is the power transistor performance normal? (Refer to the *later section on "individual inspection"*)	—	Go to *Step 2*	Replace the power transistor
2	Is there continuity between the harness side connector terminal No.C36–2 and No.C34–1, No.C36–2 and No.I20–17?	—	Go to *Step 4*	Go to *Step 3*
3	Repair an open circuit between terminal. No.C36–2 and C34–1 No.C36–2 and I20–17	—	Go to *Step 2*	—
4	Is there continuity between the harness side connector terminal No.C34–3 and ground (No.C–10)?	—	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit between terminal No.C34–3 and ground. Is the action complete?	—	Go to *Step 4*	—
6	Is there continuity between the harness side connector terminal No.C34–2 and No.I20–19?	—	Go to *Step 8*	Go to *Step 7*
7	Repair an open circuit between terminal No.C34–2 and No.I20–19. Is the action complete?	—	Go to *Step 6*	—
8	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart D: Fan Does Not Stop

Step	Action	Value(s)	Yes	No
1	1. Disconnect the max high relay, the power transistor connector C–34 and the auto A/C control unit connector I–20. 2. Turn on the ignition switch. Does the blower motor stop?	—	Go to *Step 3*	Go to *Step 2*
2	Repair a short circuit between connector No.C36–2 and No.C35–5, No.C36–2 and No.C34–1, or No.C36–2 and I20–17. Is the action complete?	—	Verify repair	—
3	Is the max high relay normal? (Refer to the *later section on "individual inspection".*)	—	Go to *Step 4*	Replace the relay
4	Reinstall the max high relay. Does the blower motor start operating?	—	Go to *Step 6*	Go to *Step 5*
5	Repair a short circuit between connector No.C35–4 and No.I19–2. Is the action complete?	—	Go to *Step 4*	—
6	Is the power transistor normal? (Refer to the *later section on "individual inspection".*)	—	Go to *Step 7*	Replace the power transistor
7	Reinstall the power transistor. Does the blower motor start operating?	—	Replace the auto A/C control unit	—

Inspection of the Magnetic Clutch System

6VE1 Engine



D08R200037

Condition	Possible cause	Correction
Magnetic clutch does not work	—	Refer to *Chart A*

Chart A: Magnetic Clutch Does Not work

Step	Action	Value(s)	Yes	No
1	Is the fuse No.F–7 normal?	—	Go to *Step 2*	Replace the fuse
2	Is the relay No.X–2 (compressor relay) No.X–8 (A/C thermo relay) and No.X–1 (heater relay) normal?	—	Go to *Step 3*	Replace the relay
3	Is there continuity between the pressure switch side connector terminal No.C21–1 and No.C21–2?	—	Go to *Step 5*	Go to *Step 4*
4	Pressure switch defective or refrigerant pressure improper. Pressure switch replaced or refrigerant pressure adjusted?	—	Go to *Step 3*	—
5	1. Turn the ignition switch on. (the engine is run.) 2. Turn the air conditioner switch on. Is the battery voltage applied between the harness side connector terminal No.E2–1 and the ground?	—	Go to *Step 7*	Go to *Step 6*
6	Magnetic clutch defective or earth defective. Magnetic clutch replaced or earth replaced?	—	Go to *Step 5*	—
7	Is there continuity between the harness side connector terminal No.X2–1 and No.E2–1?	—	Go to *Step 9*	Go to *Step 8*
8	Repair an open circuit between terminal No.X2–1 and No.E2–1. Is the action complete?	—	Go to *Step 7*	—
9	Is the battery voltage applied between the harness side connector terminal No.X2–5 and ground, No.X2–2 and ground?	—	Go to *Step 11*	Go to *Step 10*
10	Repair an open circuit between terminal No.X2–5 and fuse No.F–7, No.X2–2 and fuse No.F–7. Is the action complete?	—	Go to *Step 9*	—
11	Is the battery voltage applied between the harness side connector terminal No.I20–18 and ground?	—	Go to *Step 13*	Go to *Step 12*
12	Repair an open circuit between terminal No.I20–18 and No.X2–4. Is the action complete?	—	Go to *Step 11*	—
13	Is the battery voltage applied between the harness side connector terminal No.C21–2 and ground?	—	Go to *Step 15*	Go to *Step 14*
14	Repair an open circuit between terminal No.C21–2 and fuse No.F–7. Is the action complete?	—	Go to *Step 13*	—
15	Is the battery voltage applied between the harness side connector terminal No.X8–5 and ground, No.X8–2 and ground?	—	Go to *Step 17*	Go to *Step 16*
16	Repair an open circuit between terminal No.X8–5 and No.C21–1, No.X8–2 and fuse No.F–7. Is the action complete?	—	Go to *Step 15*	—

Chart A: Magnetic Clutch Does Not work (Cont'd)

Step	Action	Value(s)	Yes	No
17	Is the battery voltage applied between the harness side connector terminal No.I19–14 and ground?	—	Go to *Step 19*	Go to *Step 18*
18	Repair an open circuit between terminal No.X8–3 and I19–14. Is the action complete?	—	Go to *Step 17*	—
19	Is there continuity between the harness side connector terminal No.X8–1 and PCM (F45)?	—	Go to *Step 21*	Go to *Step 20*
20	Repair an open circuit between terminal No.X8–1 and PCM (F45). Is the action complete?	—	Go to *Step 19*	—
21	Is there continuity between the harness side connector terminal No.X2–4 and PCM (F4)?	—	Go to *Step 23*	Go to *Step 22*
22	Repair on open circuit between terminal No.X2–4 and PCM (F4). Is the action complete?	—	Go to *Step 21*	—
23	Is there continuity between the harness side connector terminal No.I20–4 and ground?	—	Go to *Step 25*	Go to *Step 24*
24	Repair an open circuit between terminal No.I20–4 and PCM (S47). Is the action complete?	—	Go to *Step 23*	—
25	1. Connect the connector of PCM. 2. Connect the connector terminal No.I19–14 which is on the harness side on the auto air conditioner control unit. Magnetic clutch works?	—	Replace the auto air conditioner control unit	Replace the PCM

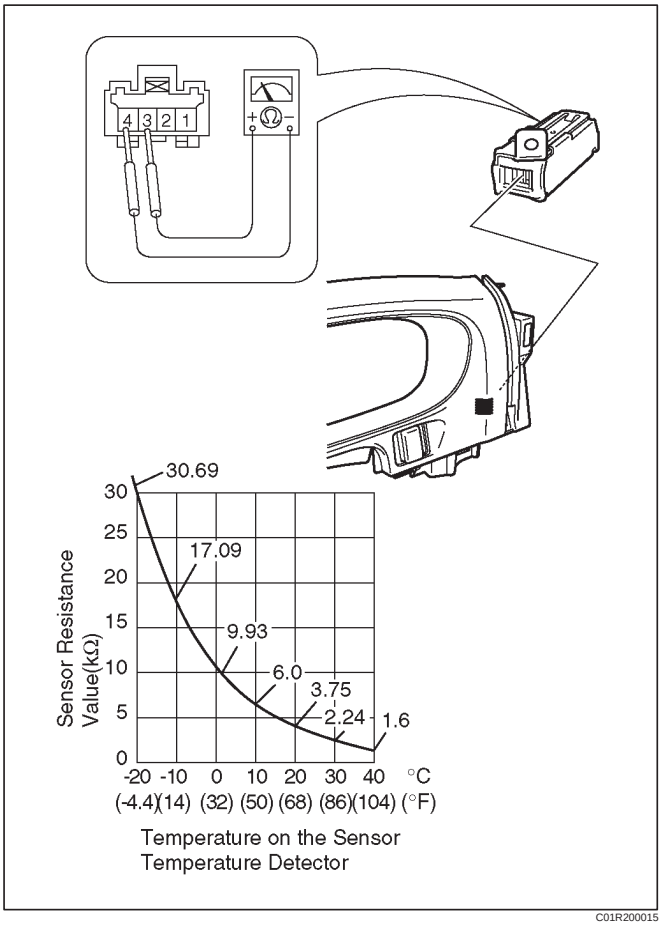
CAUTION: There are conditions which air conditioner system dose not operate except trouble as follows.

1. **The throttle is griater than 90%.**
2. **The ignition voltage is below 10.5 volts.**
3. **The engine speed greater than 4500 RPM for 5 seconds or 5400 RPM.**
4. **The engine coolant temperature (ECT) is greater than 125˚C (257˚F).**
5. **The intake air temperature (IAT) is less than 5˚C (41˚F).**
6. **The power steering pressure switch signals a high pressure condition.**

Individual Inspection

In Car Sensor

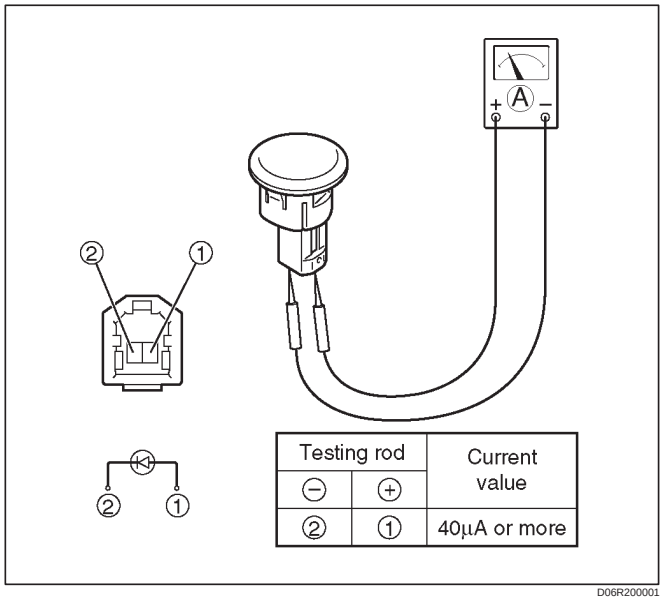
1. Disconnect the in car sensor connector (I–17).
2. Measure resistance between the in car sensor side terminal No.I17–3 and No.I17–4.



C01R200015

Sun Sensor

1. Disconnect the sun sensor connector (I–15).
2. Measure the current value on the sun sensor when placed it approximately 15 cm away from 60W incandescent lamp.

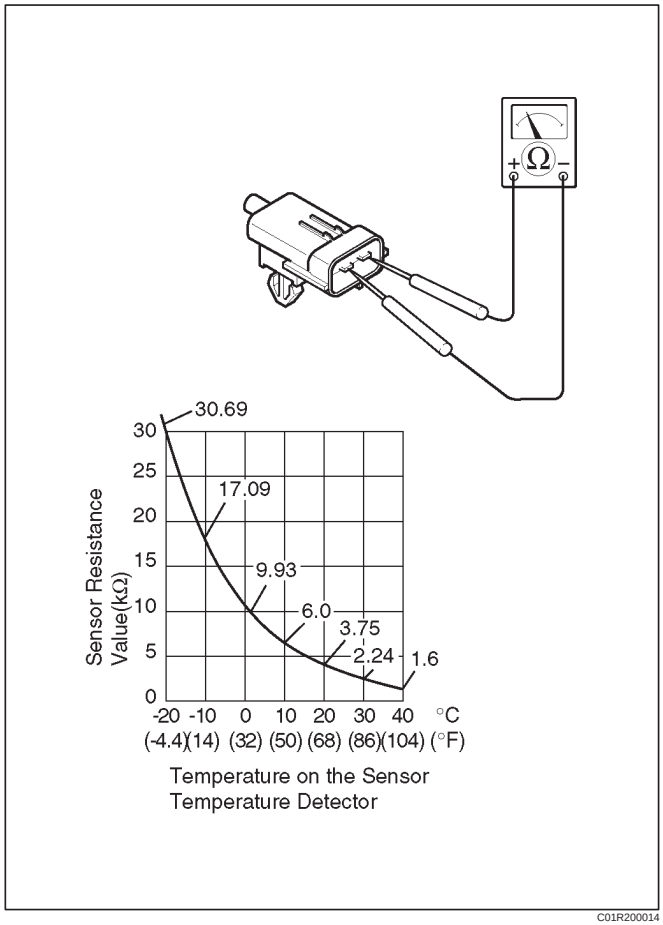


Testing rod		Current value
⊖	⊕	
②	①	40μA or more

D06R200001

Ambient Sensor

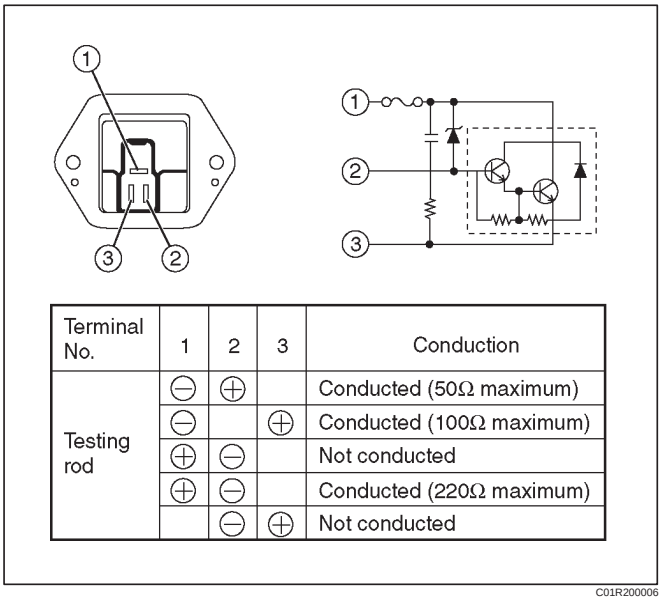
1. Disconnect the connector (C–19) on the ambient sensor.
2. Measure resistance between the ambient sensor side terminals.



C01R200014

Power Transistor

1. Remove the power transistor connector (C–34) from the evaporator assembly.
2. Check the conduction between the power transistor side terminals.

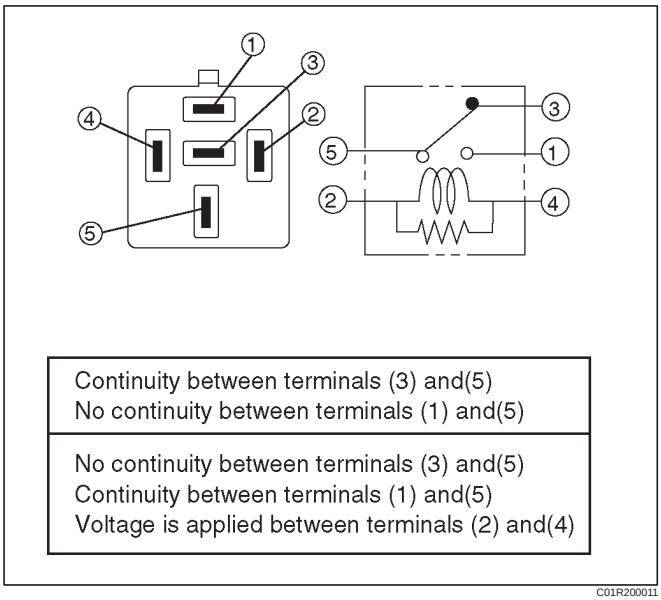


Terminal No.	1	2	3	Conduction
Testing rod	⊖	⊕		Conducted (50Ω maximum)
	⊖		⊕	Conducted (100Ω maximum)
	⊕	⊖		Not conducted
	⊕	⊖		Conducted (220Ω maximum)
		⊖	⊕	Not conducted

C01R200006

MAX HI Relay

1. Remove the MAX – HI relay connector (C–35) from the blower assembly.
2. Check the conduction between the MAX – HI relay side terminals.



Continuity between terminals (3) and(5) No continuity between terminals (1) and(5)
No continuity between terminals (3) and(5) Continuity between terminals (1) and(5) Voltage is applied between terminals (2) and(4)

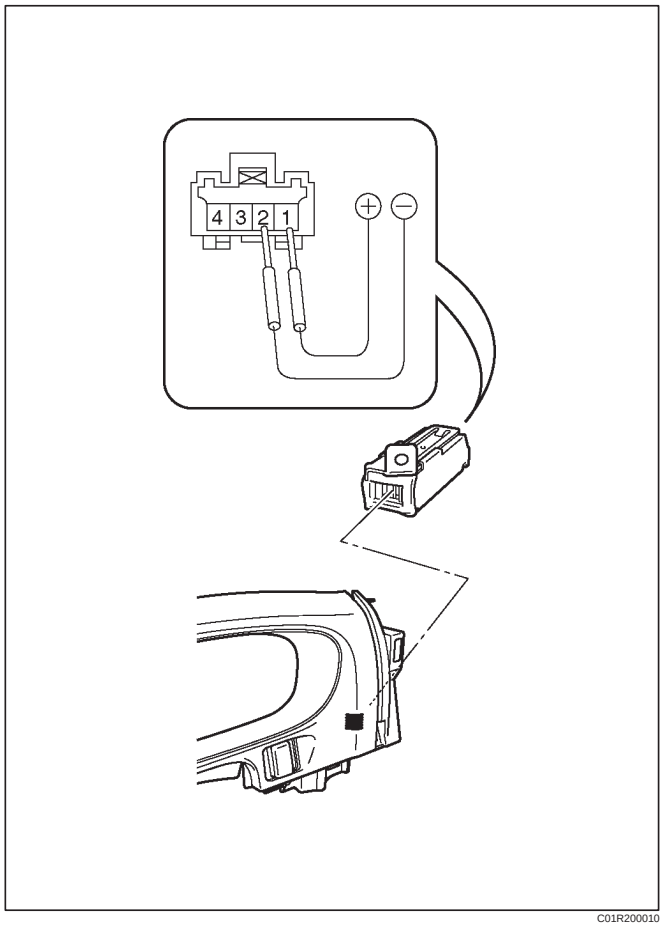
C01R200011

In Car Sensor

1. Turn on the ignition switch (the engine is started). Start the air conditioner in “Auto”.
2. Make sure that the in car sensor suctions cigarette smokes and such.

In Car Sensor

1. Dismount the in car sensor from the automatic heater/air conditioner control unit. Connect (+) end and (–) end of the battery to the aspirator motor side terminals No.I17–1 and No.I17–2, respectively, then check if the motor runs normally.

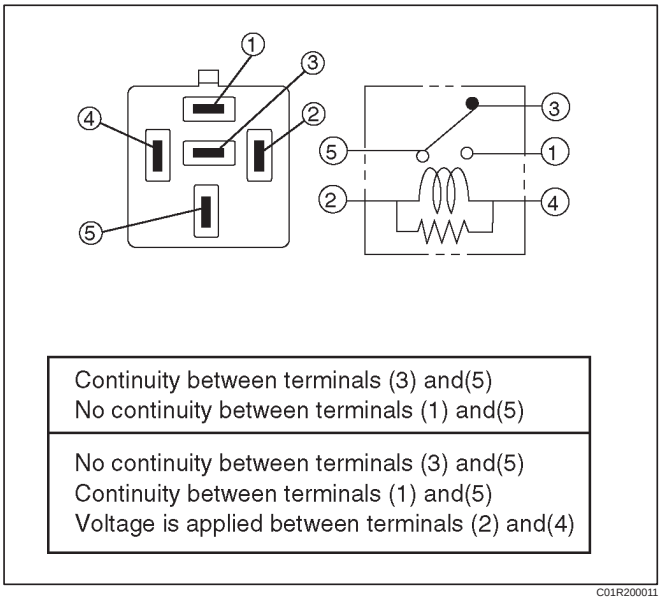


C01R200010

Heater (X–1) And Compressor (X–2) Relay

1. Disconnect relays and check for continuity and resistance between relay terminals.

   ▼For handling of these relays, refer to *Heater Relay in this section.*



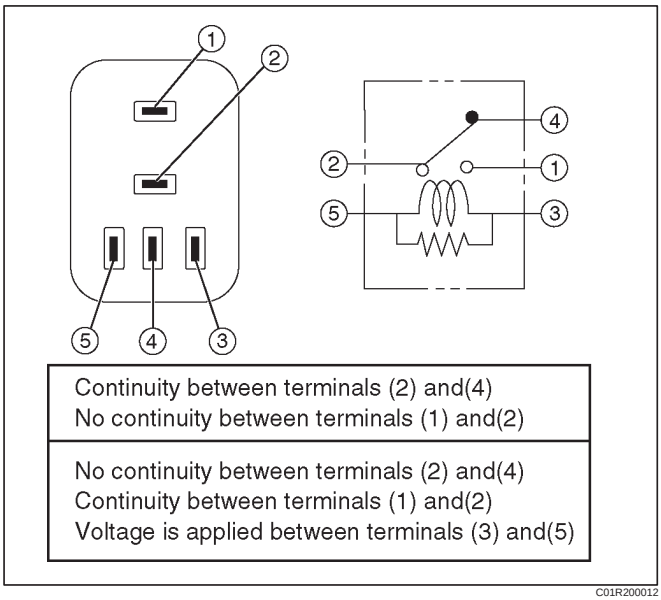
Continuity between terminals (3) and(5) No continuity between terminals (1) and(5)
No continuity between terminals (3) and(5) Continuity between terminals (1) and(5) Voltage is applied between terminals (2) and(4)

C01R200011

Thermostat (X–8) Relay

1. Disconnect relays and check for continuity and resistance between relay terminals.

   ▼For handling of these relays, refer to *Heater Relay in this section.*

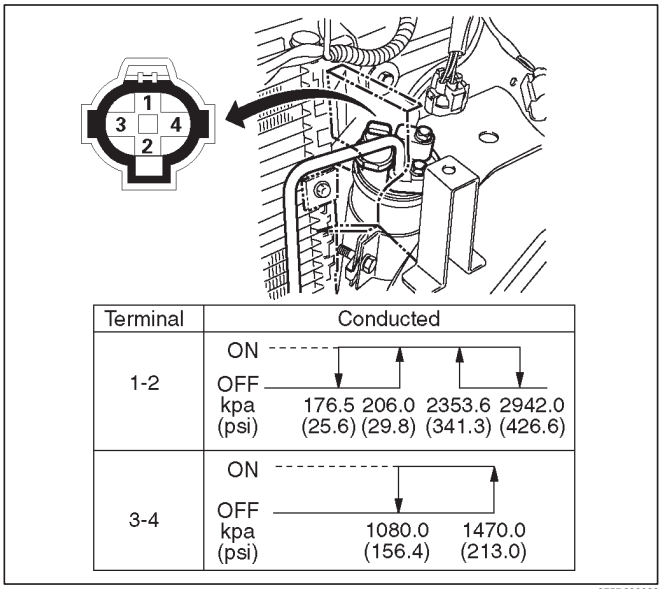


Continuity between terminals (2) and(4) No continuity between terminals (1) and(2)
No continuity between terminals (2) and(4) Continuity between terminals (1) and(2) Voltage is applied between terminals (3) and(5)

C01R200012

Triple Pressure Switch

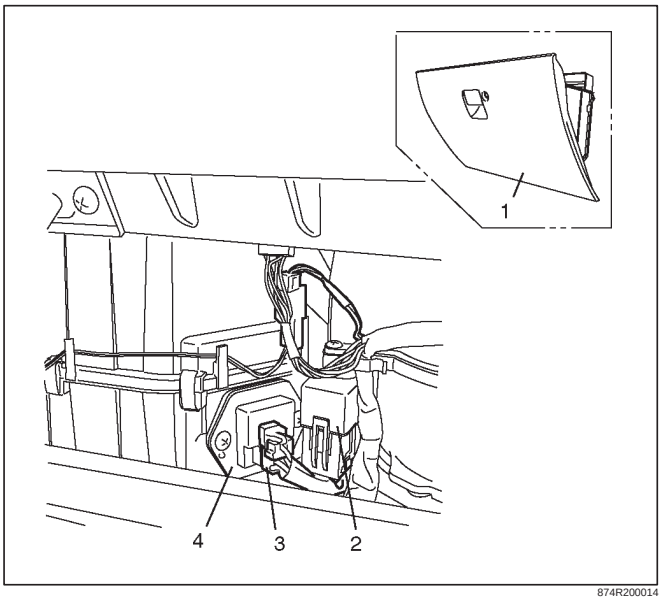
1. Disconnect the connector and check for continuity between pressure switch side connector terminals (1) and (2).
2. Reconnect the connector to activate the A/C switch, and check to see if there is continuity between the chassis side connector terminal (3) and (4) and the fan operates.



875R200020

On-Vehicle Service

Power Transistor



874R200014

Legend

(1) Glove Box
(2) MAX HI Relay
(3) Power Transistor Connector
(4) Power Transistor

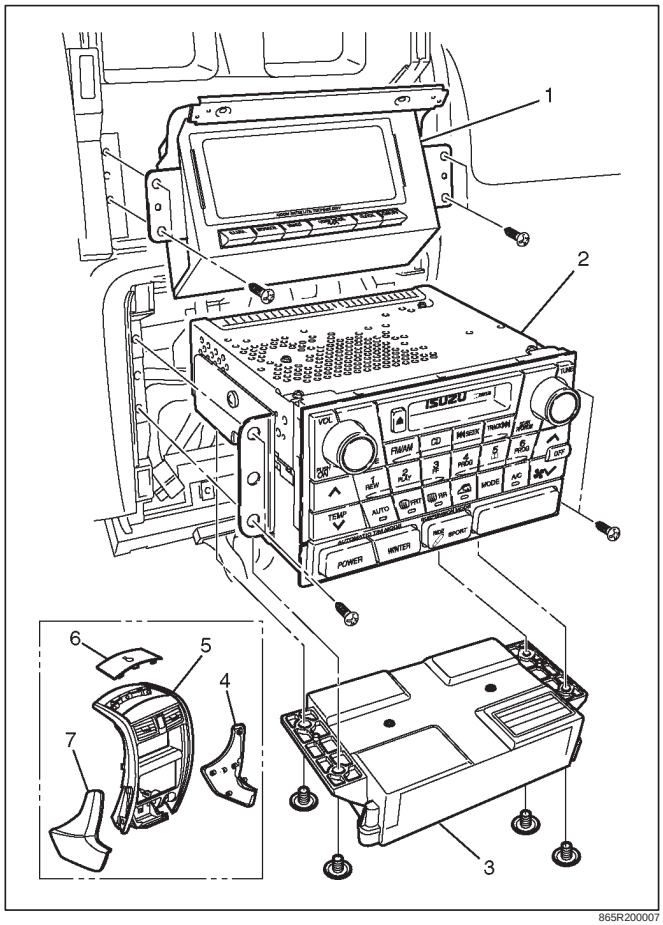
Removal

1. Remove the glove box.
2. Remove the MAX–HI relay.
3. Disconnect the power transistor connector.
4. Remove the power transistor.

Installation

To install, follow the removal step in the reverse order.

Automatic Heater/Air Conditioner Control Unit



865R200007

Legend

(1) Display
(2) Audio & Switch Assembly
(3) Automatic Air Conditioner Control Unit
(4) Knee Pad (RH)
(5) Center Cluster
(6) Center Cluster Upper
(7) Knee Pad (LH)

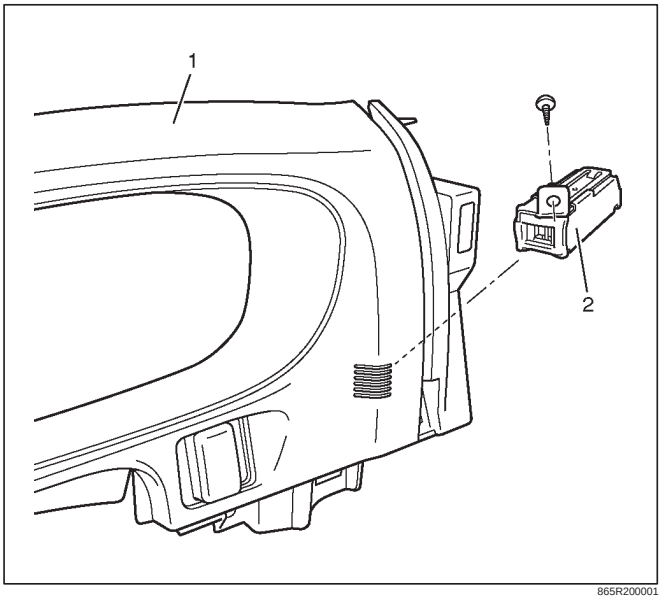
Removal

1. Disconnect the battery ground cable.
2. Remove the knee pad (R/LH).
3. Remove the center cluster upper.
4. Remove the center cluster.
   ▼Refer to *Instrument Panel Assembly in Body Stractur section.*
5. Disconnnect the six connectors.
6. Remove the automatic air conditioner control unit.

Installation

To install, follow the removal step in the reverse order.

In Car Sensor



865R200001

Legend

(1) Meter Cluster
(2) In Car Sensor

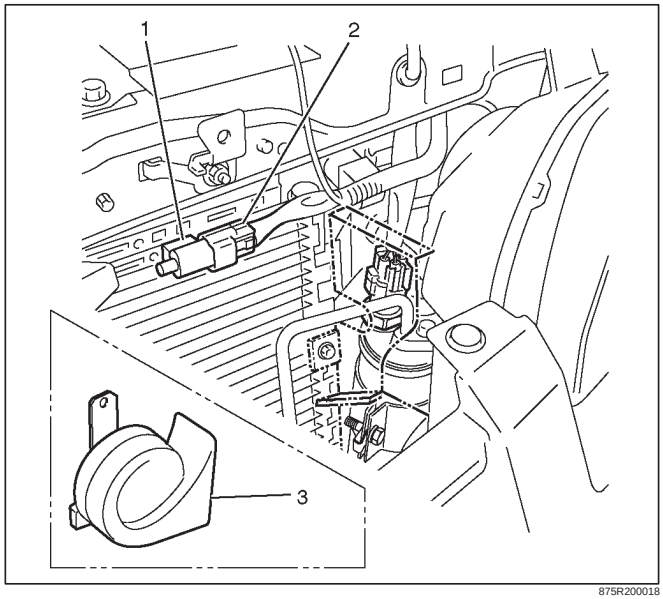
Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster.
   ▼Refer to *Instrument Panel Assembly in Body Structure section.*
3. Remove the in car sensor.

Installation

To install, follow the removal step in the reverse order.

Ambient Sensor



875R200018

Legend

(1) Ambient Sensor
(2) Ambient Sensor Connector
(3) Horn (LH)

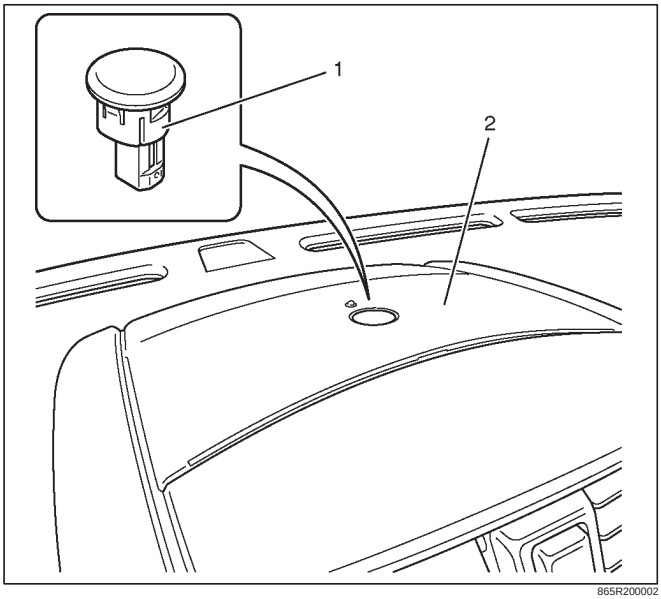
Removal

1. Disconnect the battery ground cable.
2. Remove the horn (LH).
3. Disconnect the ambient sensor connector.
4. Remove the ambient sensor.

Installation

To install, follow the removal step in the reverse order.

Sun Sensor



865R200002

Legend
(1) Sun Sensor
(2) Center Cluster Upper

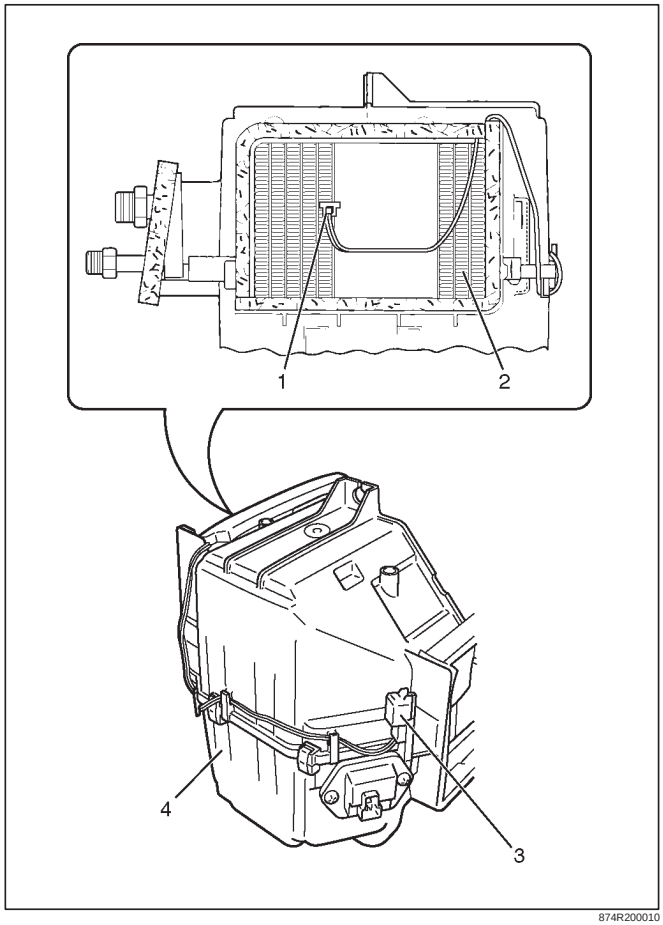
Removal

1. Disconnect the battery ground cable.
2. Remove the center cluster upper.
3. Disconnect the sun sensor connector.
4. Remove the sun sensor.

Installation

To install, follow the removal step in the reverse order.

Duct Sensor



874R200010

Legend
(1) Sensor Part
(2) Evaporator Core
(3) Duct Sensor Assembly
(4) Evaporator Assembly

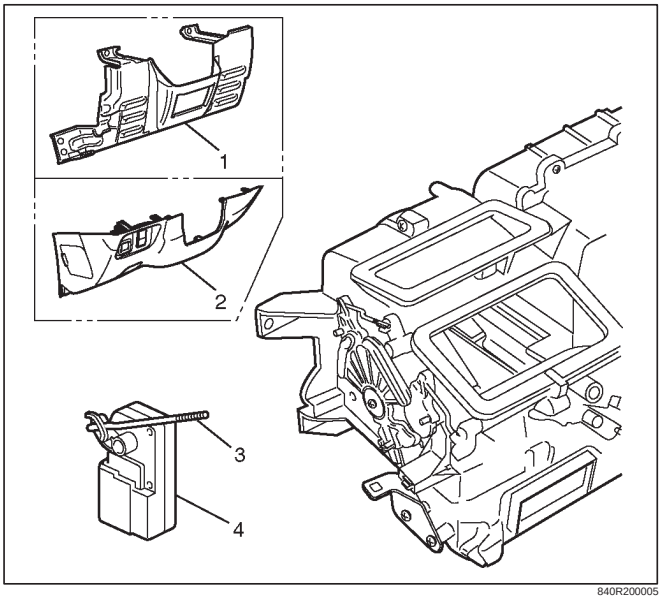
Removal

1. Disconnect the battery ground cable.
2. Remove the evaporator assembly.
   ▼Refer to *evaporator assembly in this section.*
3. Remove the duct sensor assembly.

Installation

To install, follow the removal step in the reverse order.

Mode Actuator



840R200005

Legend

(1) Driver Knee Bolster Assembly
(2) Instrument Panel Driver Lower Cover Assembly
(3) Actuator Rod
(4) Mode Actuator

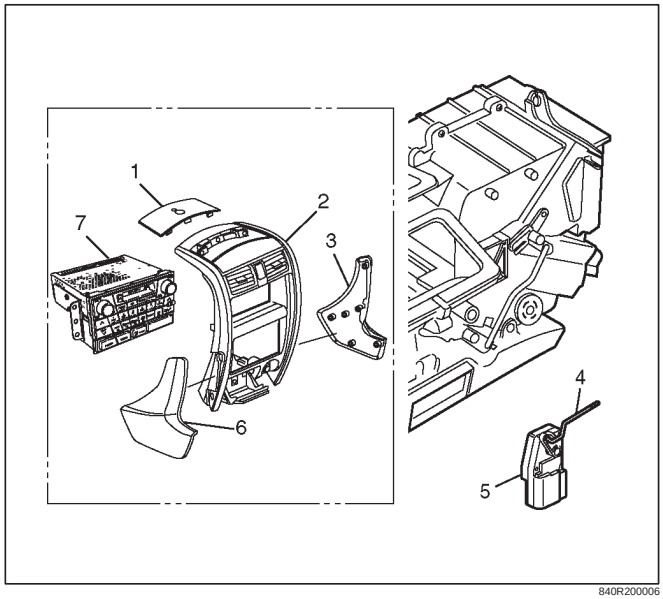
Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel driver lower cover assembly.
3. Remove the driver knee bolster assembly.
   ▼Refer to the *Instrument Panel Assembly in Body Structure section.*
4. Remove the actuator rod.
5. Remove the mode actuator.

Installation

To install, follow the remove step in the reverse order.

Mix Actuator



840R200006

Legend

(1) Center Cluster Upper
(2) Center Cluster
(3) Knee Pad (RH)
(4) Actuator Rod
(5) Mix Actuator
(6) Knee Pad (LH)
(7) Audio & Switch Assembly

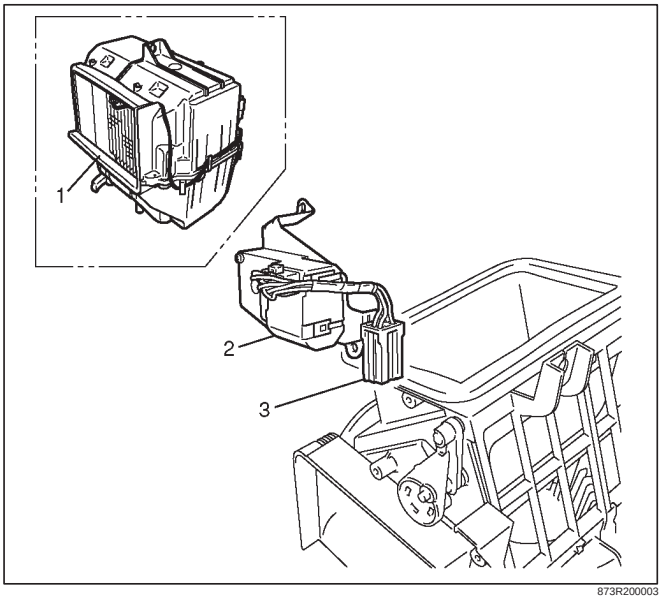
Removal

1. Disconnect the battery ground cable.
2. Remove the knee pad (R/RH).
3. Remove the center cluster upper.
4. Remove the center cluster.
   ▼Refer to the *Instrument Panel Assembly in Body Structure section.*
5. Disconnect the six connectors.
6. Remove the Audio & Switch Assembly.
7. Remove the actuator rod.
8. Remove the mix actuator.

Installation

To install, follow the remove step in the reverse order.

Intake Actuator



873R200003

Legend

(1) Evaporator Assembly
(2) Intake Actuator
(3) Intake Actuator Connector

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   ▼Refer to *Refrigerant Recovery in this section.*
3. Remove the evaporator assembly.
   ▼Refer to *Evaporator Assembly section.*
4. Disconnect the intake actuator connector.
5. Remove the intake actuator.

Installation

To install, follow the remove step in the reverse order.

AXIOM

STEERING

POWER-ASSISTED STEERING SYSTEM

CONTENTS

Service Precaution 2A–2
Diagnosis 2A–2
General Description 2A–8
Power Steering System Test 2A–10
Maintenance 2A–11
Fluid Level 2A–11
Bleeding The Power Steering System 2A–11
Bleeding Procedure 2A–11
Flushing The Power Steering System 2A–11
Steering Wheel Free Play Inspection 2A–12
Front End Alignment Inspection and Adjustment 2A–12
Main Data and Specifications 2A–16
Special Tools 2A–17
Power Steering Unit 2A–18
Power Steering Unit and Associated Parts 2A–18
Removal 2A–18
Installation (4×2 Model) 2A–19
Installation (4×4 Model) 2A–19
Power Steering Unit Disassembled View . . 2A–20
Disassembly 2A–21
Inspection and Repair 2A–21
Reassembly 2A–21
Main Data and Specifications 2A–22
Special Tools 2A–22
Power Steering Pump 2A–23
Power Steering Pump and Associated Parts 2A–23
Removal 2A–23
Installation 2A–23
Power Steering Pump Disassembled View 2A–24
Disassembly 2A–24
Inspection and Repair 2A–25
Reassembly 2A–25
Main Data and Specifications 2A–27
Transfer Gear Assembly 2A–28
Transfer Gear Assembly and Associated Parts 2A–28
Removal 2A–28
Inspection and Repair 2A–28
Installation 2A–28
Supplemental Restraint System Steering Wheel & Column 2A–29
Service Precaution 2A–29
SRS Connectors 2A–29
Inflator Module 2A–31
Inflator Module and Associated Parts 2A–31
Removal 2A–31
Inspection and Repair 2A–32
Installation 2A–32
Steering Wheel 2A–33
Steering Wheel and Associated Parts 2A–33
Removal 2A–33
Installation 2A–35
Combination Switch 2A–36
Combination Switch and Associated Parts 2A–36
Removal 2A–36
Installation 2A–38
Lock Cylinder 2A–40
Lock Cylinder and Associated Parts 2A–40
Removal 2A–40
Installation 2A–42
System Inspection 2A–43
Steering Column 2A–44
Steering Column and Associated Parts . . . 2A–44
Removal 2A–44
Inspection 2A–46
Installation 2A–48
System Inspection 2A–49
Supplemental Restraint System Steering Wheel & Column and Associated Parts 2A–50
Main Data and Specifications 2A–50
Special Tools 2A–50

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnosis

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To identify the symptom, always road test the vehicle first. Proceed with the following preliminary inspections and correct any defects which are found.

1. Inspect tires for proper pressure and uneven wear.
2. Raise vehicle on a hoist, then inspect front and rear suspension and steering linkage for loose or damaged parts.
3. Spin the front wheels. Inspect for out-of-round tires, out-of-balance tires, loose and/or rough wheel bearings.

General Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.

Condition	Possible cause	Correction
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel run–out.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial run–out of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower end ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to *Power steering system diagnosis*
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower end ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.

Power Steering System

There is some noise in all power steering systems. One of the most common is a hissing sound when the steering wheel is fully turned and the car is not moving. This noise will be most evident when the steering wheel is operated while the brakes are applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the “hissing” noise is extremely objectionable. A replacement valve will also have a slight noise, and is not always a cure for the condition.

Condition	Possible cause	Correction
Rattle or Chucking Noise	Pressure hose touching other parts of vehicle.	Adjust hose position. Do not bend tubing by hand.
	Tie rod ends loose.	Tighten or replace tie rod end.
	Loose steering unit mounting.	Tighten steering unit mounting.
Poor Return of Steering Wheel to Center	Improper front wheel alignment.	Adjust front wheel alignment.
	Wheel bearing worn.	Replace front wheel bearing.
	Tie rod end binding.	Replace tie rod end.
	Ball joint binding.	Replace ball joint.
	Tight or frozen steering shaft bearing.	Replace steering assembly.
	Sticky or plugged steering unit valve.	Flush or replace steering unit.
	Entry of air in the power steering system.	Bleed the system.
Momentary Increase In Effort When Turning Wheel Fast To Right or Left	High internal leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Steering Wheel Surges or Jerks When Turning Especially During Parking	Insufficient pump pressure.	Repair pump assembly.
	Sticky steering unit valve.	Flush or replace steering unit.
	Power steering fluid level low.	Replenish fluid.
Excessive Wheel Kick Back or Loose Steering	Air in system.	Bleed hydraulic system.
	Tie rod end loose.	Tighten tie rod end.
	Wheel bearing worn.	Replace wheel bearing.
Hard Steering or Lack or Power Assist	Sticky steering unit valve.	Flush or replace steering unit.
	Insufficient pump pressure.	Repair pump assembly.
	Excessive internal pump leakage.	Repair pump assembly.
	Excessive internal steering gear leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Unstable Engine Idling or Stalling When Turning	Pressure switch of the power steering pump or its harness is faulty.	Repair or replace.

Power Steering Pump

Foaming milky power steering fluid, low fluid level, and possible low pressure can be caused by air in the fluid, or loss of fluid due to internal pump leakage. Check for leak and correct. Bleed the system. Extremely cold temperatures will cause air bubbles in the system if the fluid level is low. If the fluid level is correct and the pump still foams, remove the pump from the vehicle and check housing for cracks. If the housing is cracked, replace the pump housing.

Condition	Possible cause	Correction
Low Pressure Due to Steering Pump	Relief valve sticking or inoperative.	Replace relief valve.
	Side plate not flat against cam ring.	Replace side plate.
	Extreme wear of cam ring.	Replace cam ring.
	Scored side plate or rotor.	Replace side plate or rotor.
	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Cracked or broken side plate.	Replace side plate.
	High internal leakage.	Repair internal leakage.
Low Pressure Due to Steering Gear	Scored housing bore.	Replace housing.
Growling Noise In Steering Pump	Excessive back pressure in hoses or steering unit caused by restriction.	Repair steering unit or pump.
	Scored side plate or rotor.	Replace side plate or rotor.
	Worn cam ring.	Replace cam ring.
Groaning Noise In Steering Pump	Air in the fluid.	Bleed hydraulic system.
	Low fluid level.	Replenish fluid.
	Pump mounting loose.	Tighten mounting bolt.
Rattling Noise In Steering Pump	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Vane improperly installed.	Repair rotor and vane.
Swishing Noise In Steering Pump	Damaged relief valve.	Replace relief valve.
Whining Noise In Steering Pump	Scored side plate and vanes.	Replace side plate and vanes.

Steering Column Lock System

Condition	Possible cause	Correction
Will Not Unlock	Damaged lock cylinder.	Replace lock cylinder.
	Damaged park lock cable.	Replace park lock cable.
Will Not Lock	Lock spring broken or worn.	Replace lock cylinder.
	Damaged lock cylinder.	Replace lock cylinder.
	Ignition switch stuck.	Repair or replace ignition switch.
	Park lock cable damaged.	Replace park lock cable.
Key Cannot be Removed in “OFF-LOCK”	Ignition switch is not set correctly.	Correct ignition switch.
	Damaged lock cylinder.	Replace lock cylinder.
	Faulty shift lock mechanism.	Repair or replace the shift lock mechanism.

Column

Condition	Possible cause	Correction
Noise in Column	Universal joint loose.	Tighten joint.
	Shaft lock snap ring not seated.	Place snap ring in proper position.

Turn Signal Switch

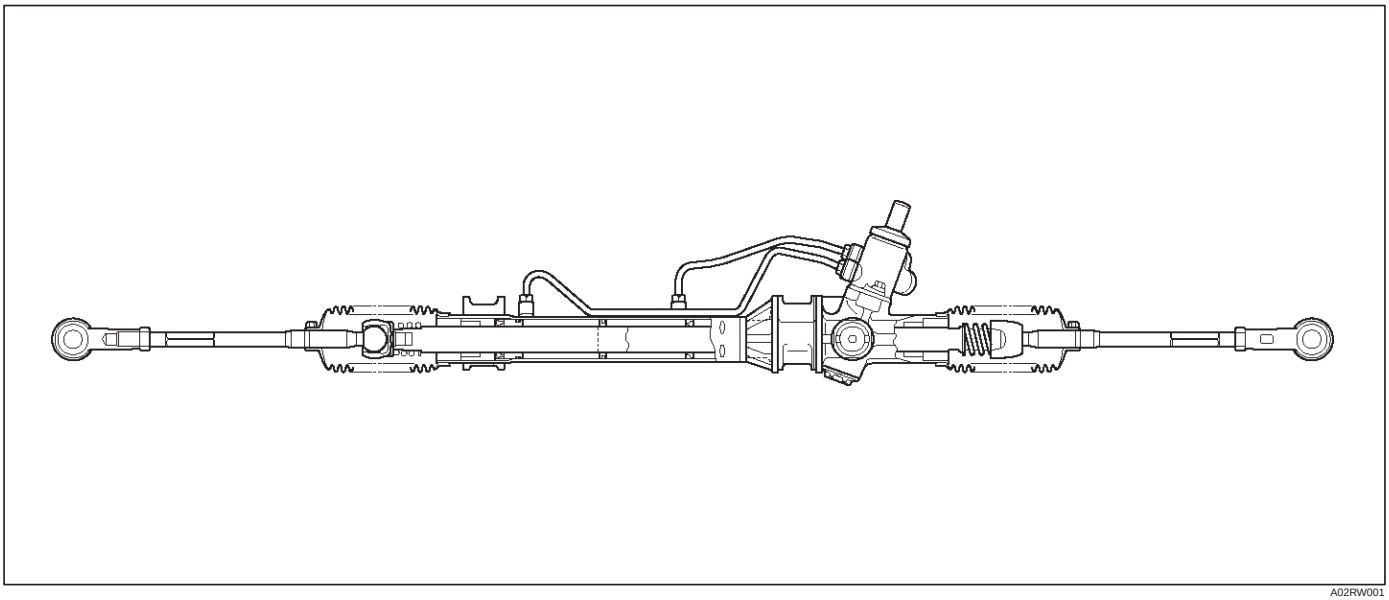
This diagnosis covers mechanical problems only. Refer to *Turn Signal Switch in Electrical section for electrical diagnosis.*

Condition	Possible cause	Correction
Turn Signal Will Not Stay In Turn Position	Foreign material or loose parts preventing movement of yoke.	Repair or replace signal switch.
	Broken or missing detent or canceling spring.	Replace signal switch.
Turn Signal Will Not Cancel	Loose switch mounting screws.	Tighten mounting screws.
	Switch or anchor bosses broken.	Replace turn signal switch.
	Broken, missing or out of position detent, return or canceling spring.	Replace turn signal switch.
	Worn canceling cam.	Replace turn signal switch.
Turn Signal Difficult To Operate	Turn signal switch arm loose.	Tighten arm screw.
	Broken or distorted yoke.	Replace turn signal switch.
	Loose or misplaced springs.	Replace turn signal switch.
	Foreign parts and/or material.	Repair turn signal switch.
	Loose turn signal switch mounting screws.	Tighten mounting screws.
Turn Signal Will Not Indicate Lane Change	Broken lane change pressure pad or spring hanger.	Replace turn signal switch.
	Broken, missing or misplaced lane change spring.	Replace turn signal switch.
	Base of wire damaged.	Replace turn signal switch.
Hazard Switch Cannot Be Turned Off	Foreign material between hazard switch to turn signal switch body.	Repair or replace hazard switch.
No Turn Signal Lights	Electrical failure in chassis harness.	Refer to *Electrical* section.
	Inoperative turn signal flasher unit.	Replace flasher unit.
	Loose chassis harness connector.	Repair loose connector.
Front or Rear Turn Signal Lights Not Flashing	Burned-out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Repair bulb socket.
	Loose chassis harness connector.	Repair loose connector.

General Description

The hydraulic power steering system consists of a pump, an oil reservoir, a steering unit, a pressure hose and a return hose.

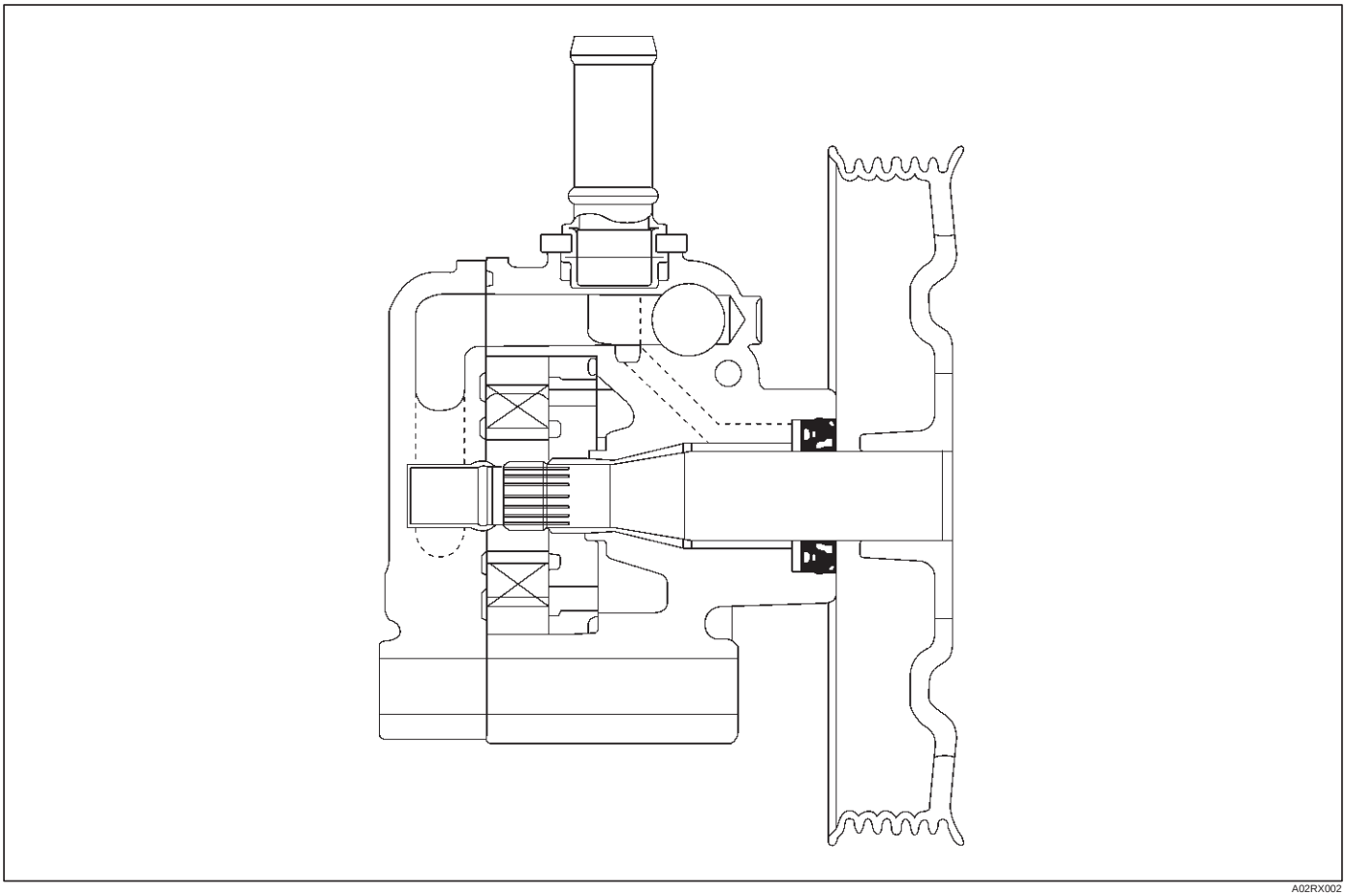
Power Steering Unit



A02RW001

The power steering unit is rack and pinion type.
The toe–in angle can be adjusted by turning the rod on each side.
The steering housing cannot be disassembled.

Hydraulic Pump



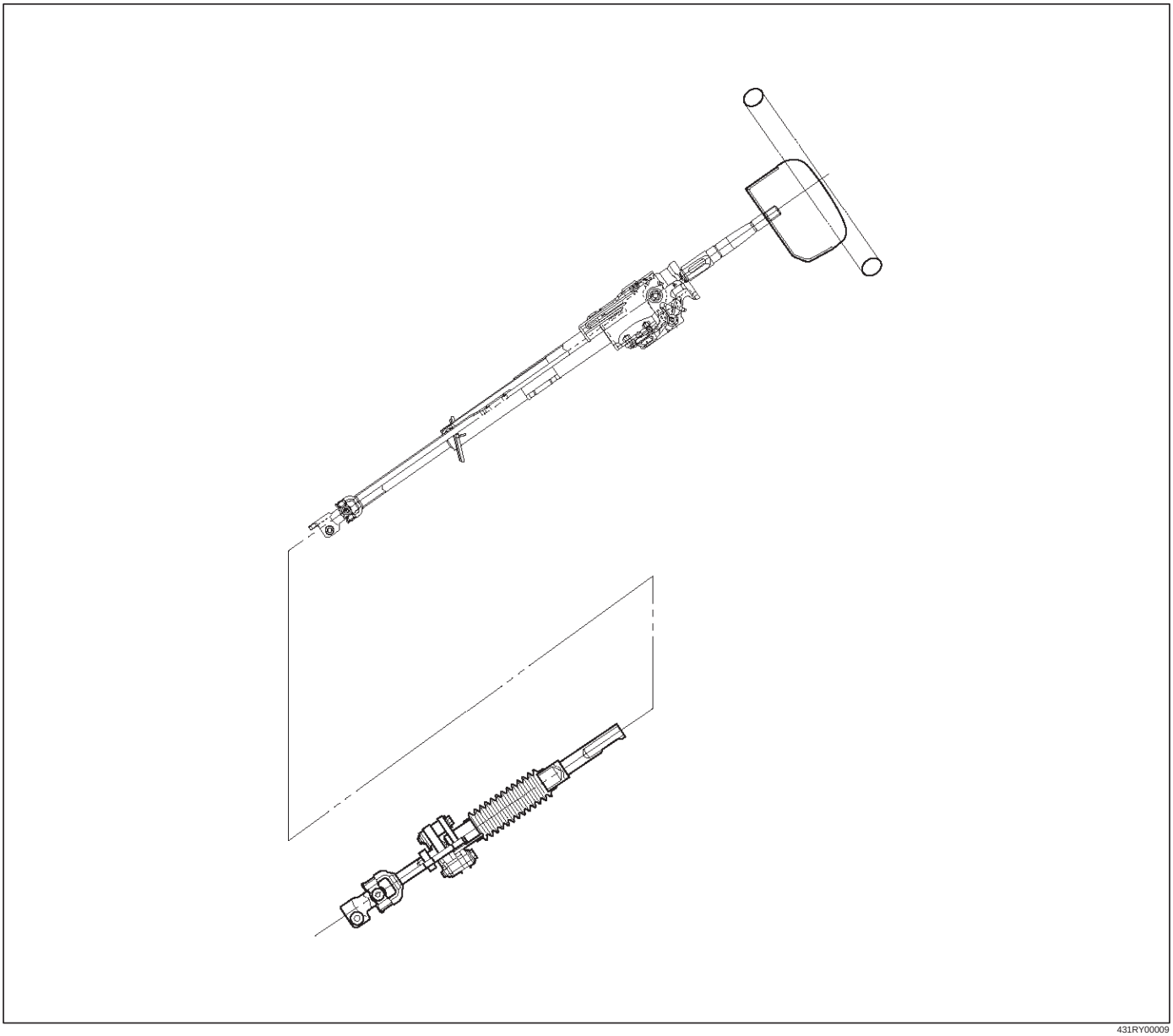
A02RX002

The hydraulic pump is vane-type design. The submerged pump has housing and internal parts that are inside the reservoir and operate submerged in oil. There are two bore openings at the rear of the pump housing. The larger opening contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve and spring.
The flow control orifice is part of the pressure line union. The pressure relief valve inside the flow control valve limits the pump pressure.

Pressure Switch

When hydraulic pressure reaches 3430 kPa (500 psi), the pressure switch of the power steering pump closes causing the Powertrain Control Module (PCM) to actuate the throttle valve, which increases the engine rpm to prevent the overload-induced engine speed slow down. The switch opens when hydraulic pressure drops to 2940 kPa (430 psi).

Steering Column



431RY00009

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLE-SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTION IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.
For detailed explanation about SRS, refer to *Restraints* section.

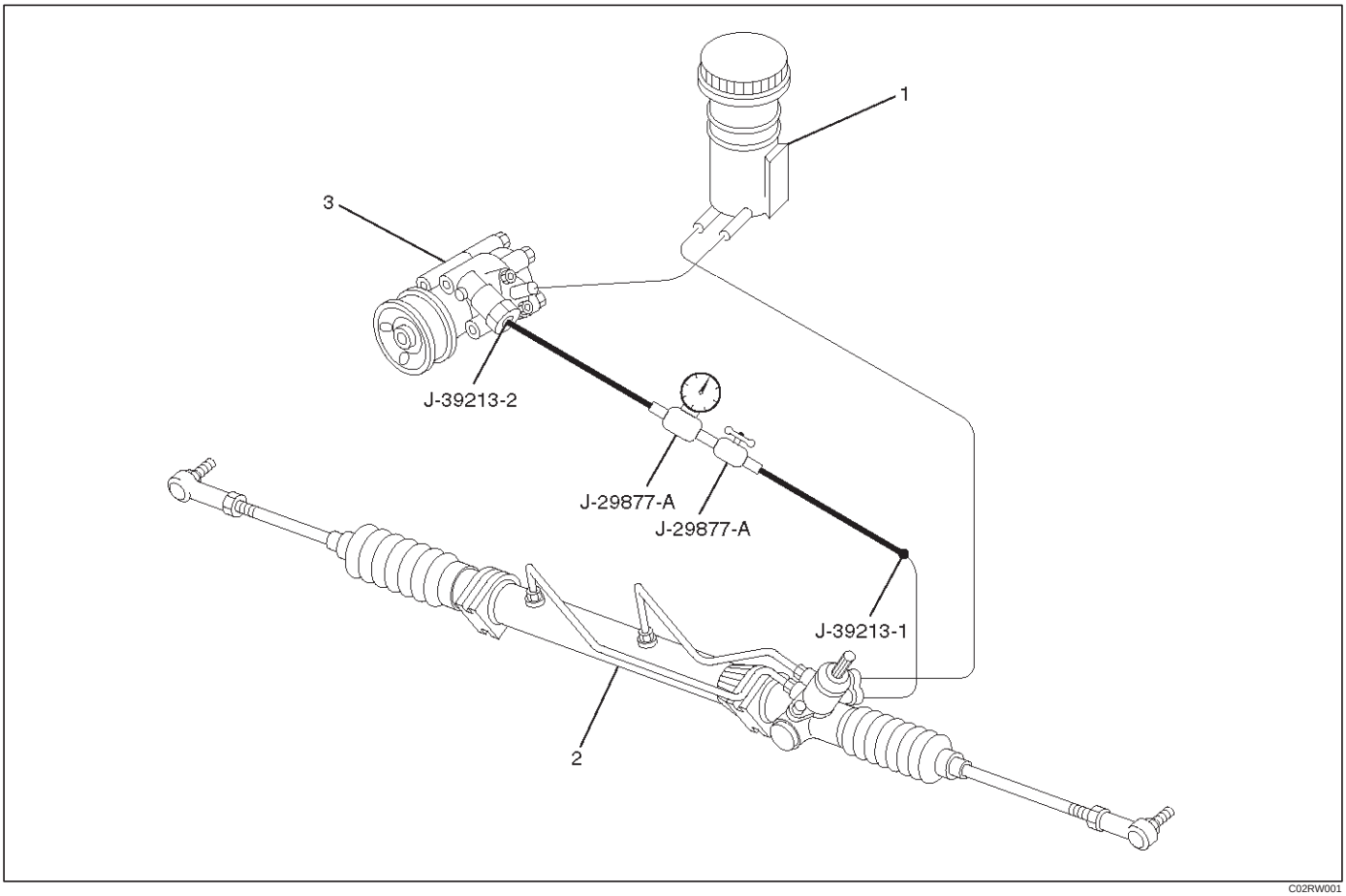
The steering column has three important features in addition to the steering function:

1. The column is energy absorbing, designed to compress in a front-end collision to minimize the possibility of injury to the driver of the vehicle.
2. The ignition switch and lock are mounted conveniently on the column.
3. With the column mounted lock, the ignition and steering operation can be locked to prevent theft of the vehicle.

The column can be disassembled and reassembled. However, to insure the energy absorbing action, use only the specified screws, bolts and nuts as designated, and tighten them to the specified torque.
Handle the column with care when it is removed from the vehicle. A sharp blow on the end of steering shaft or shift lever, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.

Power Steering System Test

Test Procedure



C02RW001

Legend
(1) Fluid Reservoir
(2) Power Steering Unit
(3) Power Steering Pump

Test of fluid pressure in the power steering system is performed to determine whether or not the oil pump and power steering unit are functioning normally.
The power steering system test is used to identify and isolate hydraulic circuit difficulties. Prior to performing this test, the following inspections and corrections, if necessary, must be made.

- ▼ Inspect pump reservoir for proper fluid level.
- ▼ Inspect pump belt for proper tension.
- ▼ Inspect pump driver pulley condition.

1. Place a container under the pump to catch the fluid when disconnecting or connecting the hoses.
2. With the engine NOT running, disconnect the pressure hose at the power steering pump and install power steering tester J-29877-A. The gage must be between the shutoff valve and pump. Open the shutoff valve.
3. Check the fluid level. Fill the reservoir with power steering fluid, to the “Full” mark. Start the engine, then turn the steering wheel and momentarily hold it against a stop (right or left). Turn the engine off and check the connections at tester for leakage.

4. Bleed the system. Refer to *Bleeding the Power Steering System* in this section.
5. Start the engine and check the fluid level. Add power steering fluid if required. When the engine is at normal operating temperature, increase engine speed to 1500 rpm.

CAUTION: Do not leave shutoff valve fully closed for more than 5 seconds, as the pump could become damaged internally.

6. Fully close the shutoff valve. Record the highest pressures.
   - ▼If the pressure recorded is within 9300–9800 kPa (1350–1420 psi), the pump is functioning within its specifications.
   - ▼If the pressure recorded is higher than 9800 kPa (1420 psi), the valve in the pump is defective.
   - ▼If the pressure recorded is lower than 9300 kPa (1350 psi), the valve or the rotating group in the pump is defective.
7. If the pump pressures are within specifications, leave the valve open and turn (or have someone else turn) the steering wheel fully in both directions. Record the highest pressures and compare with the maximum pump pressure recorded in step 6. If this pressure cannot be built in either side of the power steering unit, the power steering unit is leaking internally and must be replaced.
8. Shut the engine off, remove the testing gauge.
9. Reconnect the pressure hose, check the fluid level and make the needed repairs.
10. If the problem still exists, the steering and front suspension must be thoroughly examined.

Maintenance

The hydraulic system should be kept clean and fluid level in the reservoir should be checked at regular intervals and fluid added when required. Refer to *Recommended Fluids and Lubricants in General Information* section for the type of fluid to be used and the intervals for filling.
If the system contains some dirt, flush it as described in this section. If it is exceptionally dirty, the pump must be completely disassembled before further usage. (The steering unit cannot be disassembled.)
All tubes, hoses, and fittings should be inspected for leakage at regular intervals. Fittings must be tight. Make sure the clips, clamps and supporting tubes and hoses are in place and properly secured.
Power steering hoses and lines must not be twisted, kinked or tightly bent. Air in the system will cause spongy action and noisy operation. When a hose is disconnected or when fluid is lost, for any reason, the system must be bled after refilling. Refer to *Bleeding the Power Steering System* in this section.

- ▼Inspect belt for tightness.
- ▼Inspect pulley for looseness or damage. The pulley should not wobble with the engine running.
- ▼Inspect hoses so they are not touching any other parts of the vehicle.
- ▼Inspect fluid level and fill to the proper level.

Fluid Level

1. Run the engine until the power steering fluid reaches normal operating temperature, about 55˚C (130˚F), then shut the engine off.
2. Check the level of fluid in the reservoir.
3. If the fluid level is low, add power steering fluid as specified in General Information to the proper level and install the receiver cap.
4. When checking the fluid level after the steering system has been serviced, air must be bled from the system. Refer to *Bleeding the Power Steering System* in this section.

Bleeding The Power Steering System

When a power steering pump or unit has been installed, or an oil line has been disconnected, the air that has entered the system must be bled out before the vehicle is operated. If air is allowed to remain in the power steering fluid system, noisy and unsatisfactory operation of the system may result.

Bleeding Procedure

When bleeding the system, and any time fluid is added to the power steering system, be sure to use only power steering fluid as specified in General Information.

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Start the engine and let it run for a few seconds. Do not turn the steering wheel. Then turn the engine off.
3. Add fluid if necessary.
4. Repeat the above procedure until the fluid level remains constant after running the engine.
5. Raise and support the front end of the vehicle so that the wheels are off the ground.
6. Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.
7. Add power steering fluid if necessary.
8. Lower the vehicle, set the steering wheel at the straight forward position after turning it to its full steer positions 2 or 3 times, and stop the engine.
9. Check the fluid level and refill as required.
10. If the fluid is extremely foamy, allow the vehicle to set a few minutes, then repeat the above procedure.

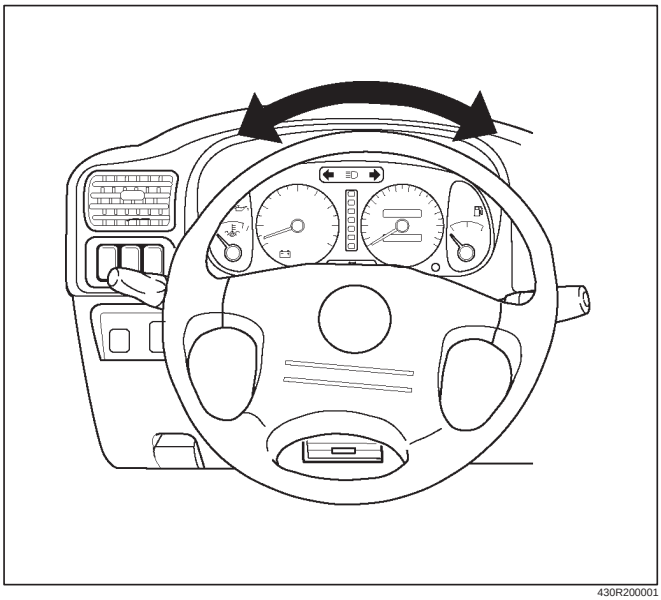
Flushing The Power Steering System

1. Raise and support the front end of the vehicle off the ground until the wheels are free to turn.
2. Remove the fluid return line at the pump inlet connector and plug the connector port on the pump. Position the line toward a large container to catch the draining fluid.
3. While running the engine at idle, fill the reservoir with new power steering fluid. Turn the steering wheel in both directions. Do not contact or hold the steering wheel to the wheel stops. This will cause the pump to go to pressure relief mode, which may cause a sudden fluid overflow at the reservoir.

4. Install all the lines and hoses. Fill the system with new power steering fluid and bleed the system as described in Bleeding The Power Steering System. Operate the engine for about 15 minutes.

   Remove the pump return line at the pump inlet and plug the connection on the pump. While refilling the reservoir, check the draining fluid for contamination. If foreign material is still evident, replace all lines, disassemble and clean or replace the power steering system components. Do not re-use any drained power steering fluid.

Steering Wheel Free Play Inspection



430R200001

1. With the tires in the straight-ahead position, check the amount of steering wheel play by turning the wheel in both directions until the tires begin to move.

NOTE: The wheel free play should be checked with the engine running.

Free play: 0 – 30 mm (0 – 1.18 in)

2. Also check the steering wheel for play and looseness in the mount by moving it back and forth and sideways. When test driving, check for hard steering, steering shimmy and tendency to pull to one side.

Front End Alignment Inspection and Adjustment

General Description

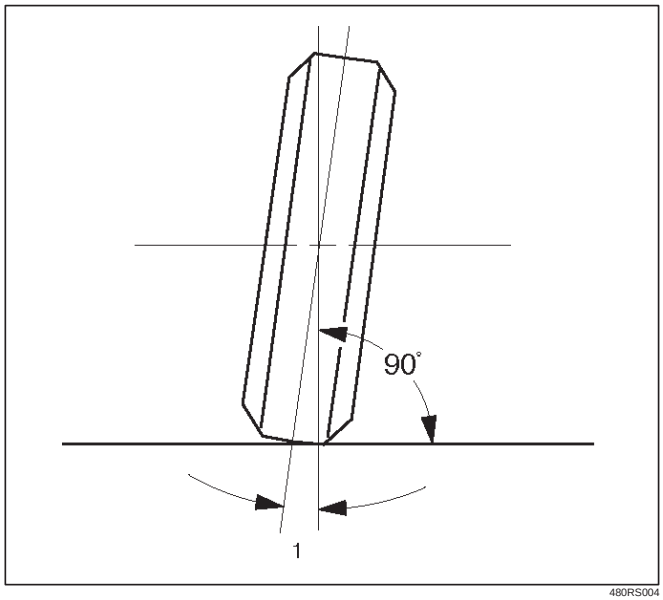
"Front End Alignment" refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground.

Proper front end alignment must be maintained in order to insure efficient steering, good directional stability and to prevent abnormal tire wear.

The most important factors of front end alignment are wheel toe-in, wheel camber and axle caster.

Camber:

This illustration shows view from the front of the vehicle.

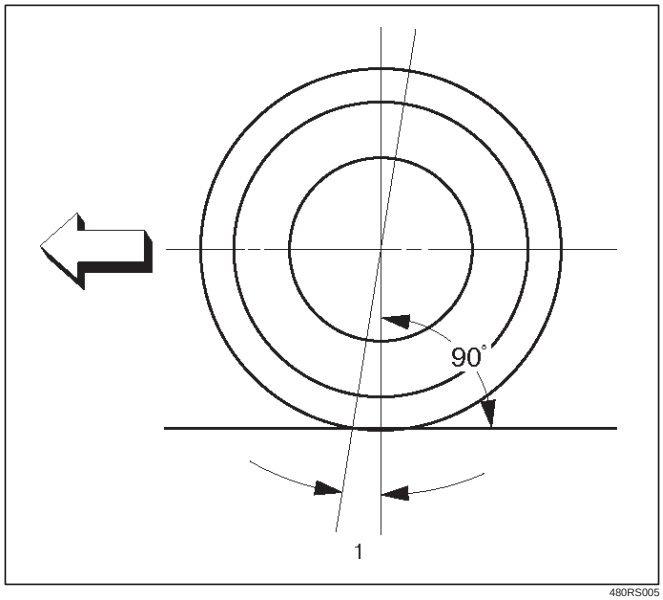


480RS004

Camber is the vertical tilting inward or outward of the front wheels. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward at the top, the camber is negative (-). The amount of tilt measured in degrees from the vertical is called the camber angle (1). If camber is extreme or unequal between the wheels, improper steering and excessive tire wear will result. Negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside.

Caster:

This illustration shows view from the side of the vehicle.

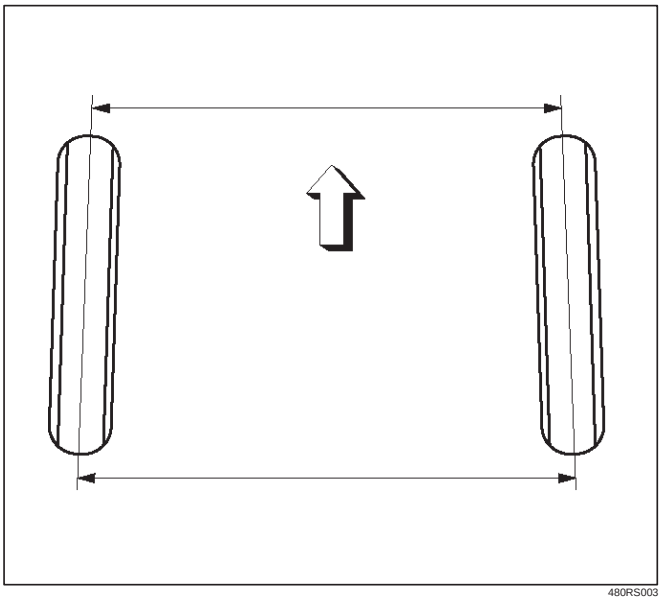


480RS005

Caster (1) is the vertical tilting of the wheel axis either forward or backward (when viewed from the side of the vehicle). A backward tilt is positive (+) and a forward tilt is negative (-). On the short and long arm type suspension you cannot see a caster angle without a special instrument, but if you look straight down from the top of the upper control arm to the ground, the ball joints do not line up (fore and aft) when a caster angle other than 0 degree is present. With a positive angle, the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line.

Toe-in:

This illustration shows view from the top of the vehicle.



480RS003

Toe-in is the measured amount the front wheels are turned in. The actual amount of toe-in is normally a fraction of a degree. Toe-in is measured from the center of the tire treads or from the inside of the tires. The purpose of toe-in is to insure parallel rolling of the front wheels and to offset any small deflections of the wheel support system which occurs when the vehicle is rolling forward. Incorrect toe-in results in excessive toe-in and unstable steering. Toe-in is the last alignment to be set in the front end alignment procedure.

Inspection

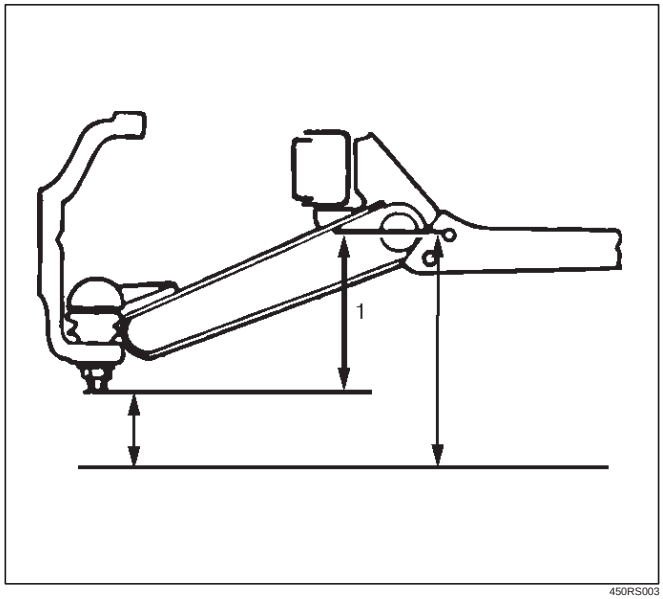
Before making any adjustments affecting caster, camber or toe-in, the following front end inspection should be made.

1. Inspect the tires for proper inflation pressure. Refer to *Main Data and Specifications in Wheel and Tire System* section.
2. Make sure that the vehicle is unladen condition (With no passenger or loading).
3. Make sure that the spare tire is installed at the normal position.
4. Inspect the front wheel bearings for proper adjustment. Refer to *Front Hub and Disc Overhaul in Suspension* section.
5. Inspect the ball joints and tie rod ends. If excessive looseness is noted, correct before adjusting. Refer to *Steering Linkage* in this section.
6. Inspect the wheel and tires for run-out. Refer to *Wheel Replacement in Wheel and Tire System* section.
7. Inspect the trim height. If not within specifications, the correction must be made before adjusting caster.
8. Inspect the steering unit for looseness at the frame.
9. Inspect shock absorbers for leaks or any noticeable noise. Refer to *Shock Absorber in Suspension* section.
10. Inspect the control arms or stabilizer bar attachment for looseness. Refer to *Suspension* section.
11. Inspect the front end alignment using alignment equipment. Follow the manufacturer's instructions.
12. Park the vehicle on a level surface.

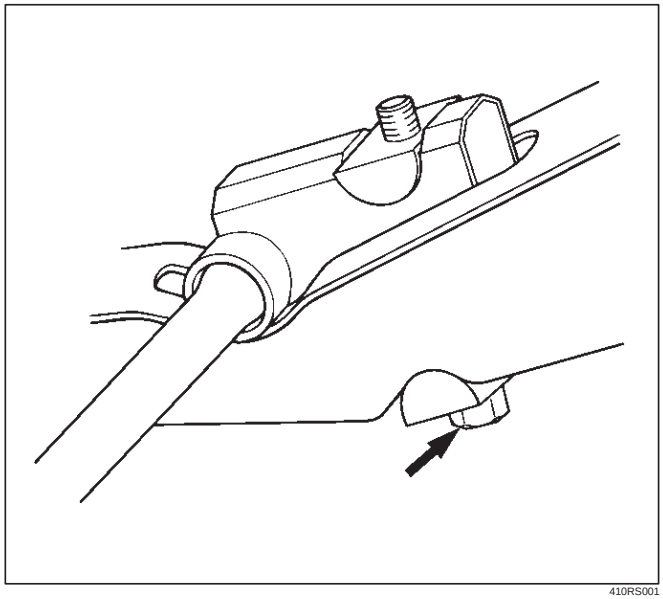
Trim Height Adjustment

Adjust the trim height (1) by means of the adjusting bolt on the height control arms.

CAUTION: When adjusting front end alignment, be sure to begin with trim height first, as it may change other adjusted alignments.



450RS003



410RS001

1. Check and adjust the tire inflation pressures.
2. Park the vehicle on a level ground and move the front of the vehicle up and down several times to settle the suspension.
3. Make necessary adjustment with the adjusting bolt on the height control arms.

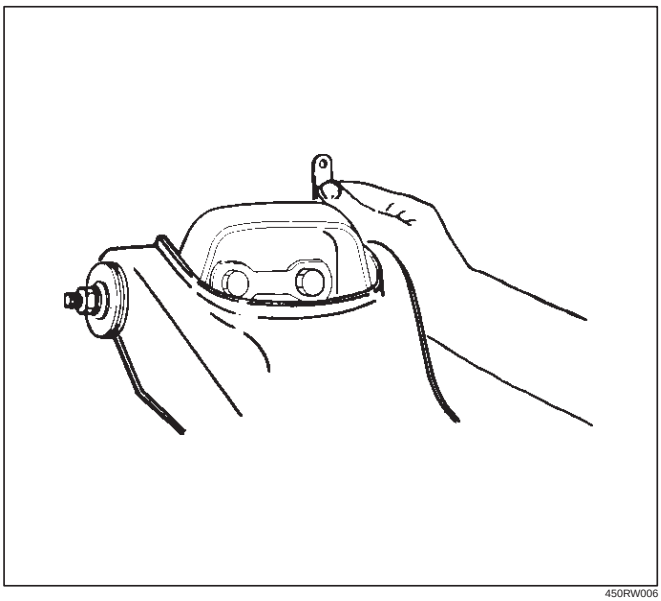
Trim height: 119 ± 5 mm (4.69 ± 0.2 in)

Caster Adjustment

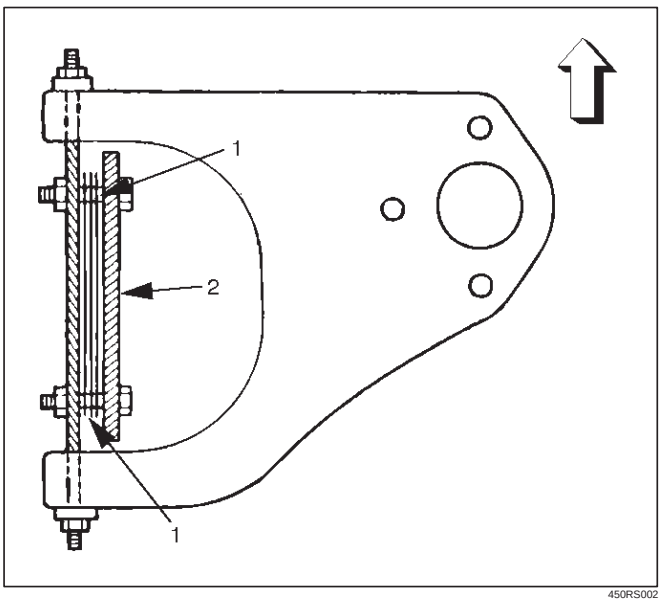
The caster angle can be adjusted by means of the caster shims (1) installed between the chassis frame (2) and fulcrum pins.

Caster angle: 2˚30' ± 1˚

CAUTION: Left and right side must be equal within 30'.



450RW006



450RS002

NOTE: Difference of the caster shim front/rear thickness should be 3.6 mm (0.142 in) or less. Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

Torque: 152 N·m 112 (lb ft)

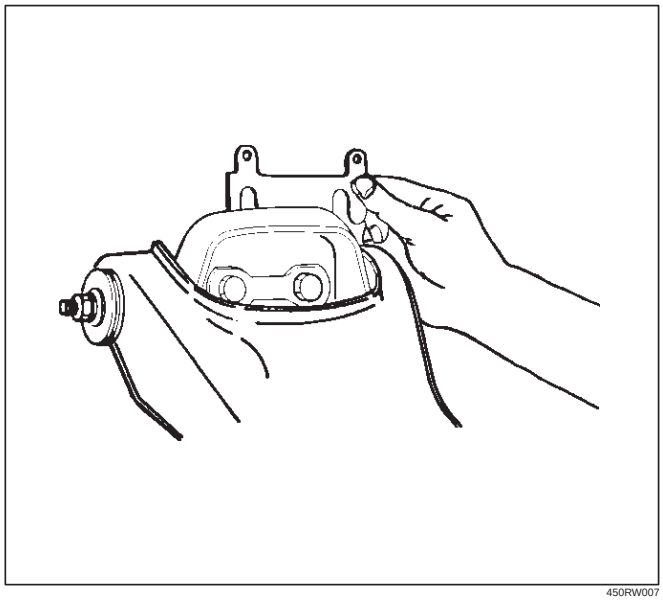
Camber Adjustment

The camber angle can be adjusted by means of the camber shims (2) installed in position between the chassis frame (1) and fulcrum pins

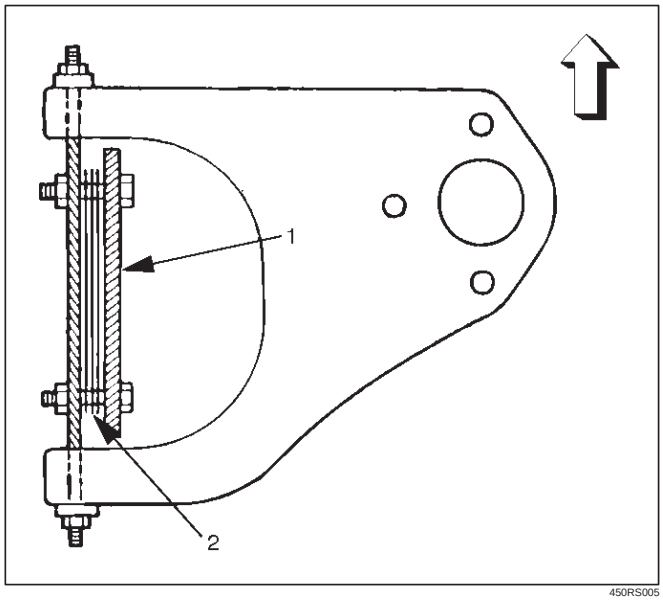
Camber angle: 0˚ ± 30'

King pin inclination: 12˚30' ± 30'

CAUTION: Left and right side must be equal within 30'.



450RW007



450RS005

NOTE: Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

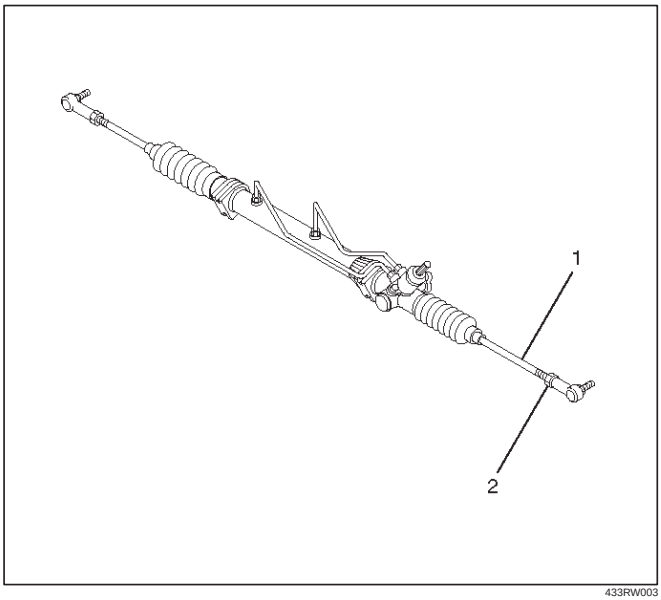
Torque: 152 N·m (112 lb ft)

	Position of shims		Camber angle	Caster angle
	Front side	Rear side		
Caster shim	When added	When removed	Decreases	Decreases
	When removed	When added	Increases	Increases
	—	When removed	Unchanged	Decreases
	—	When added	Unchanged	Increases
Camber shim	When added		Decreases	Unchanged
	When removed		Increases	Unchanged

Toe-in Adjustment

1. To adjust the toe-in angle, loosen the lock nuts (2) on the tie rod (1) and turn the tie rod. Turn both rods the same amount, to keep the steering wheel centered .

Toe-in: 0 to +2 mm (0 to +0.08 in)



2. Tighten the lock nut to the specified torque.

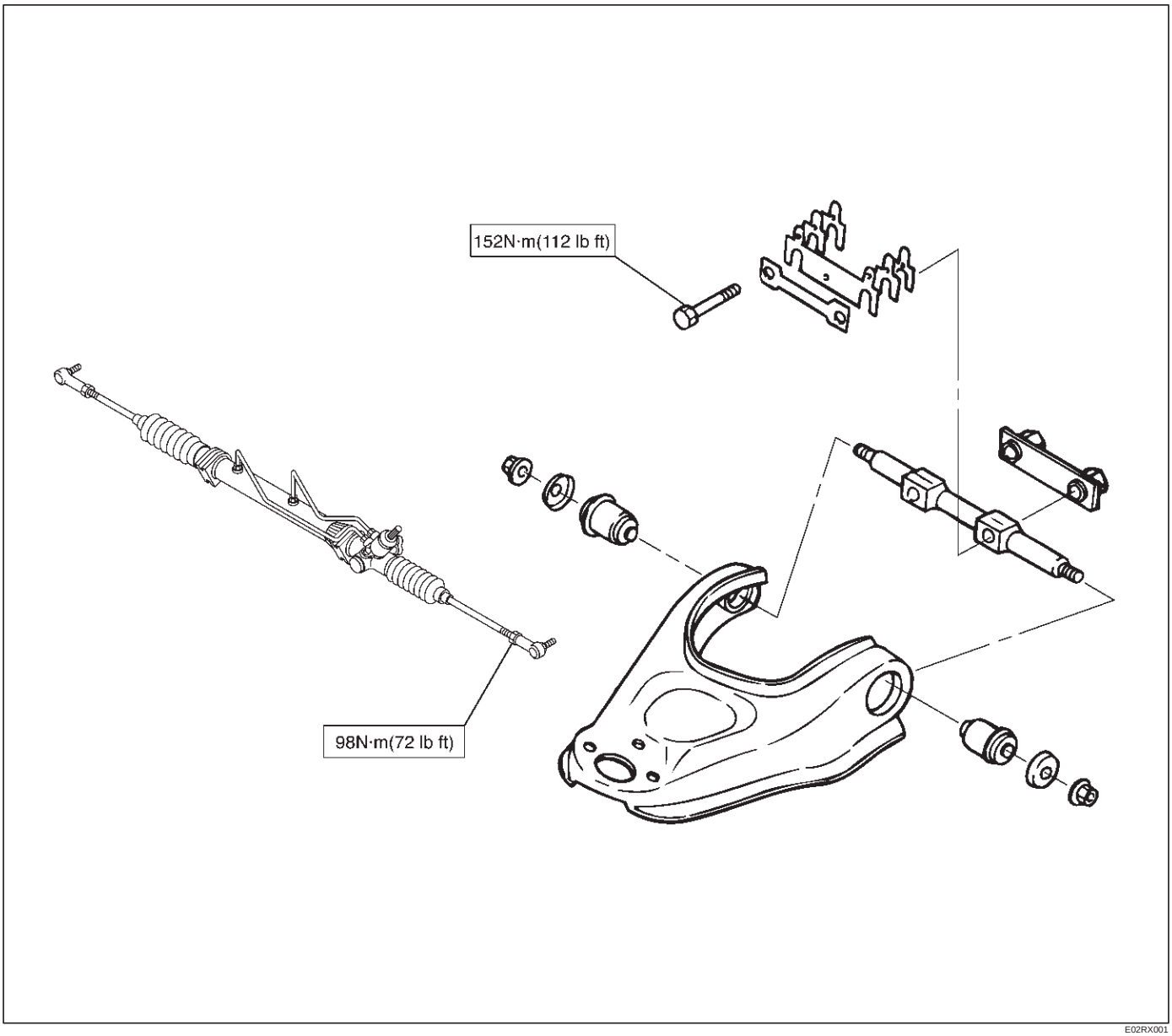
Torque: 98 N·m (72 lb ft)

Main Data and Specifications

General Specification

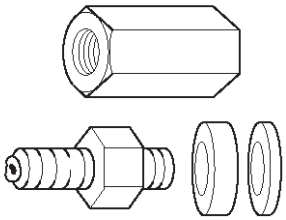
Caster		2˚30’ ± 1˚
Camber		0˚ ± 30’
King pin inclination		12˚30’ ± 30’
Toe-in		0 to +2 mm (0 to +0.08 in)
Max. steering angle	inside	32.6˚ (+0˚30’ to –2˚30’)
	outside	31.8˚

Torque Specification



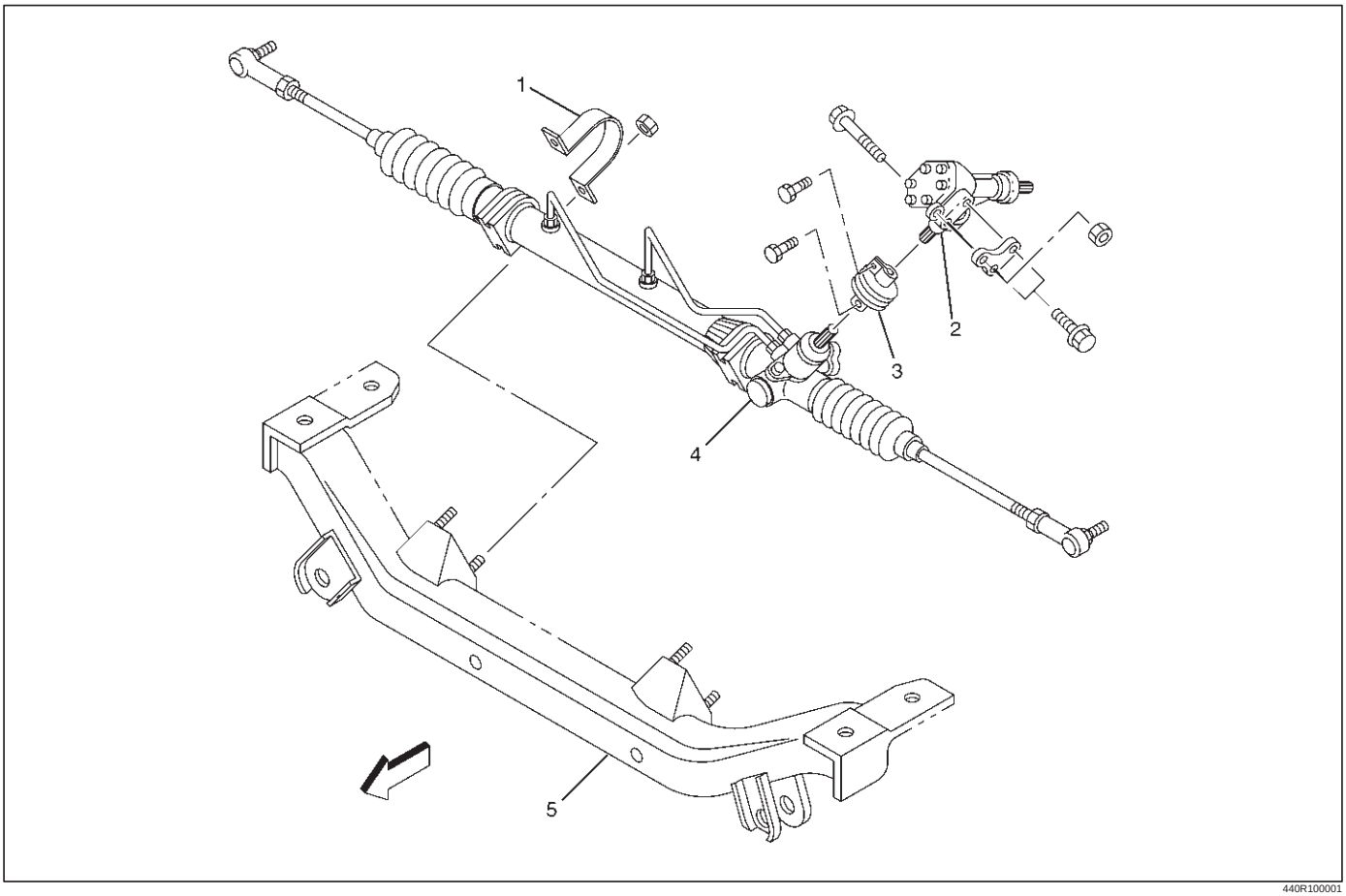
E02RX001

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS276	**J–29877–A** Tester; Power steering
 901RS278	**J–39213** Adapter; Power steering tester

Power Steering Unit

Power Steering Unit and Associated Parts



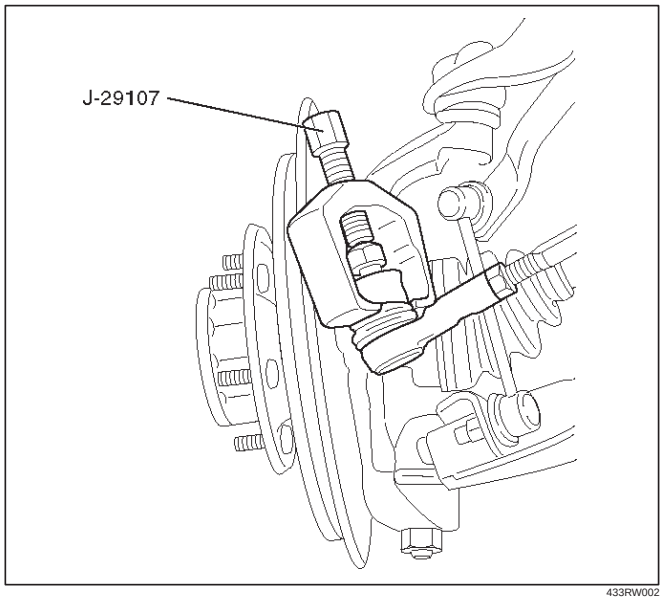
440R100001

Legend

(1) Bracket
(2) Transfer Gear Assembly
(3) Universal Joint Assembly
(4) Power Steering Unit Assembly
(5) Crossmember

Removal

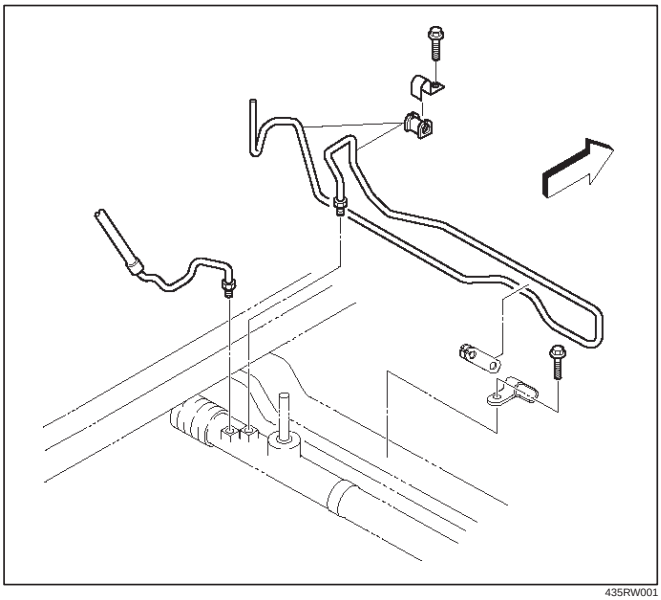
1. Remove the stone guard.
2. Remove the transfer gear assembly and universal joint assembly.
   Make a setting mark across the coupling flange and transfer gear assembly to ensure reassembly of the parts in the original position.
3. Drain power steering fluid.
4. Remove the tie rod end assembly from knuckle.
   Use tie rod end remover J–29107.



433RW002

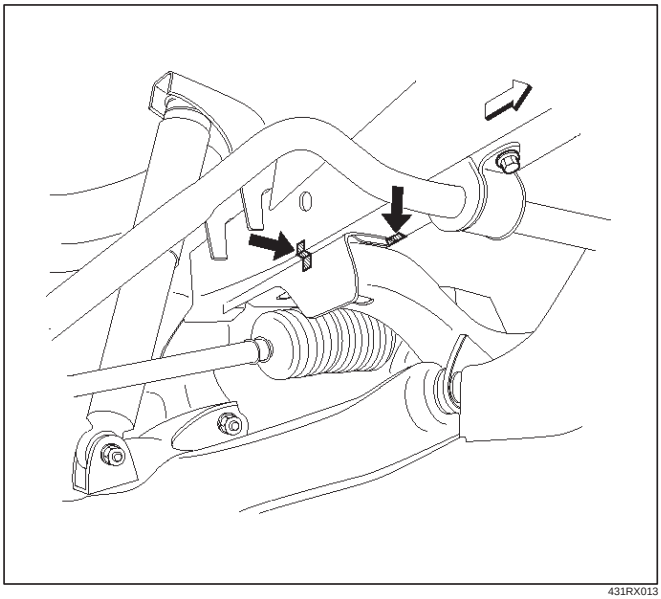
5. Disconnect the feed line and return line from steering unit.
   Remove the clips on the crossmember and frame.
   Wire the power steering line to frame.

NOTE: Take care to prevent foreign matter from entry when disconnect the power steering line.


435RW001

4×4 model:

1. Remove the torsion bar. Refer to *Front Suspension in Suspension* section.
2. Remove the lower control arm bolt (Frame side).
   Refer to *Front Suspension in Suspension* section.
3. Apply a setting mark across the crossmember and frame so parts can be reassembled in their original position.


431RX013

4. Remove the crossmember fixing bolt.
5. Remove the power steering unit with the crossmember.
6. Remove the power steering unit.

4×2 model:

1. Remove the power steering unit from the crossmember.

Installation (4×2 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
3. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)
4.
   a. Align the setting marks made at removal.
      Install the universal joint assembly to the transfer gear assembly.
      Temporary tighten the universal joint bolt.
   b. Install the universal joint assembly to the power steering unit assembly.
      Temporary tighten the universal joint bolt.
   c. Install the transfer gear assembly with the shim to frame.

   Torque: 54 N·m (40 lb ft)
   d. Tighten the universal joint bolt to the specified torque.

   Torque: 31 N·m (23 lb ft)
5. Install the stone guard.
6. Bleed the system.
   Refer to *Bleeding the Power Steering System* in this section.

Installation (4×4 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Install power steering unit with crossmember to frame by aligning the setting marks made when removing.
   Tighten crossmember mounting bolt to specified torque.

   Torque: 173 N·m (128 lb ft)
3. Install lower control arm bolt.
   Refer to *Front Suspension in Suspension* section.
4. Install torsion bar.
   Refer to *Front Suspension in Suspension* section.
5. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
6. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)

7.
   a. Align the setting marks made at removal.
      Install the universal joint assembly to the transfer gear assembly.
      Temporary tighten the universal joint bolt.
   b. Install the universal joint assembly to the power steering unit assembly.
      Temporary tighten the universal joint bolt.
   c. Install the transfer gear assembly with the shim to frame.

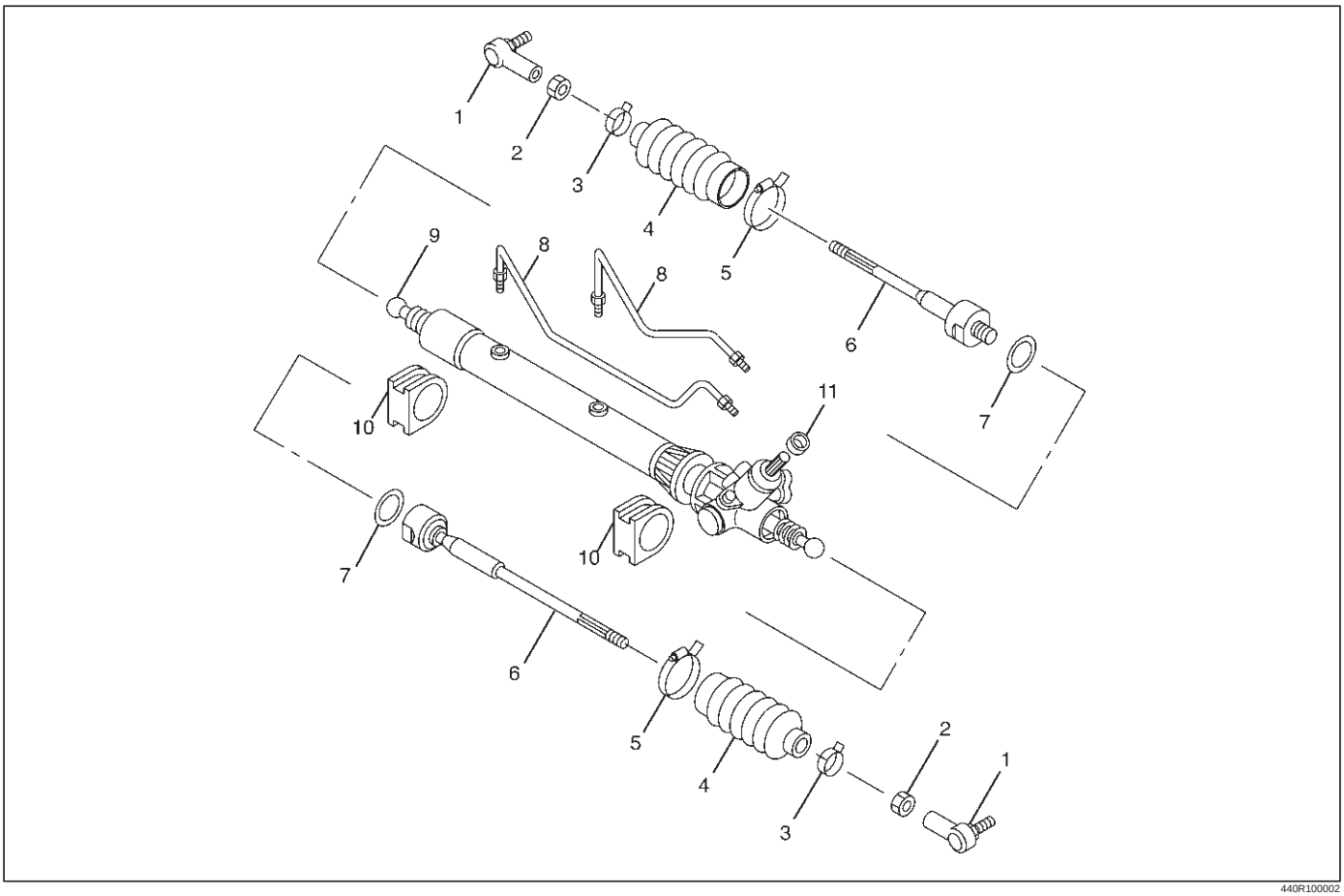
Torque: 54 N·m (40 lb ft)

   d. Tighten the universal joint bolt to the specified torque.

Torque: 31 N·m (23 lb ft)

8. Install the stone guard.
9. Bleed the system.
   Refer to *Bleeding the Power Steering System* in this section.

Power Steering Unit Disassembled View



440R100002

Legend

(1) Tie-rod End
(2) Lock Nut
(3) Clip
(4) Bellows
(5) Band
(6) Tie-rod Assembly
(7) Tab Washer
(8) Oil Line
(9) Valve Housing Assembly
(10) Mounting Rubber
(11) Dust Cover

Disassembly

NOTE: The valve housing is made of aluminum and care should be exercised when clamping in a vise, etc. to prevent distortion or damage.

1. Loosen lock nut and remove tie–rod end.
2. Remove clip (3) and band (5), then remove bellows (4).
3. Remove tie-rod assembly.
   To remove, move the boot toward the tie-rod end, then remove tab washer.
4. Remove oil line, mounting rubber and dust cover.

Inspection and Repair

Inspect the following parts for wear, damage or any abnormal conditions.

Tie-rod End

If looseness or play is found when checked by moving the end of ball joint at tie-rod end, replace tie-rod end.

Tie-rod Assembly

If the resistance is insufficient or play is felt when checked by moving the ball on the tie-rod, replace the tie-rod assembly.

Rubber Parts

If wear or damage is found through inspection, replace with new ones.

Reassembly

1. Install mounting rubber and dust cover (If removed).
2. Install oil line.

   Torque: 13 N· m (113 lb in)
3. Install tie-rod assembly with tab washer.
   Apply grease to ball joint, install tie-rod and tab washer, then tighten to specified torque.

   Torque: 83 N·m (61 lb ft)

   After tightening, bend tab washer against width across flat of inner ball joint.
4. Apply a thin coat of grease to the shaft for smooth installation. Then install bellows.
5. Install band and clip.
6. Install tie-rod end and tighten lock nut.

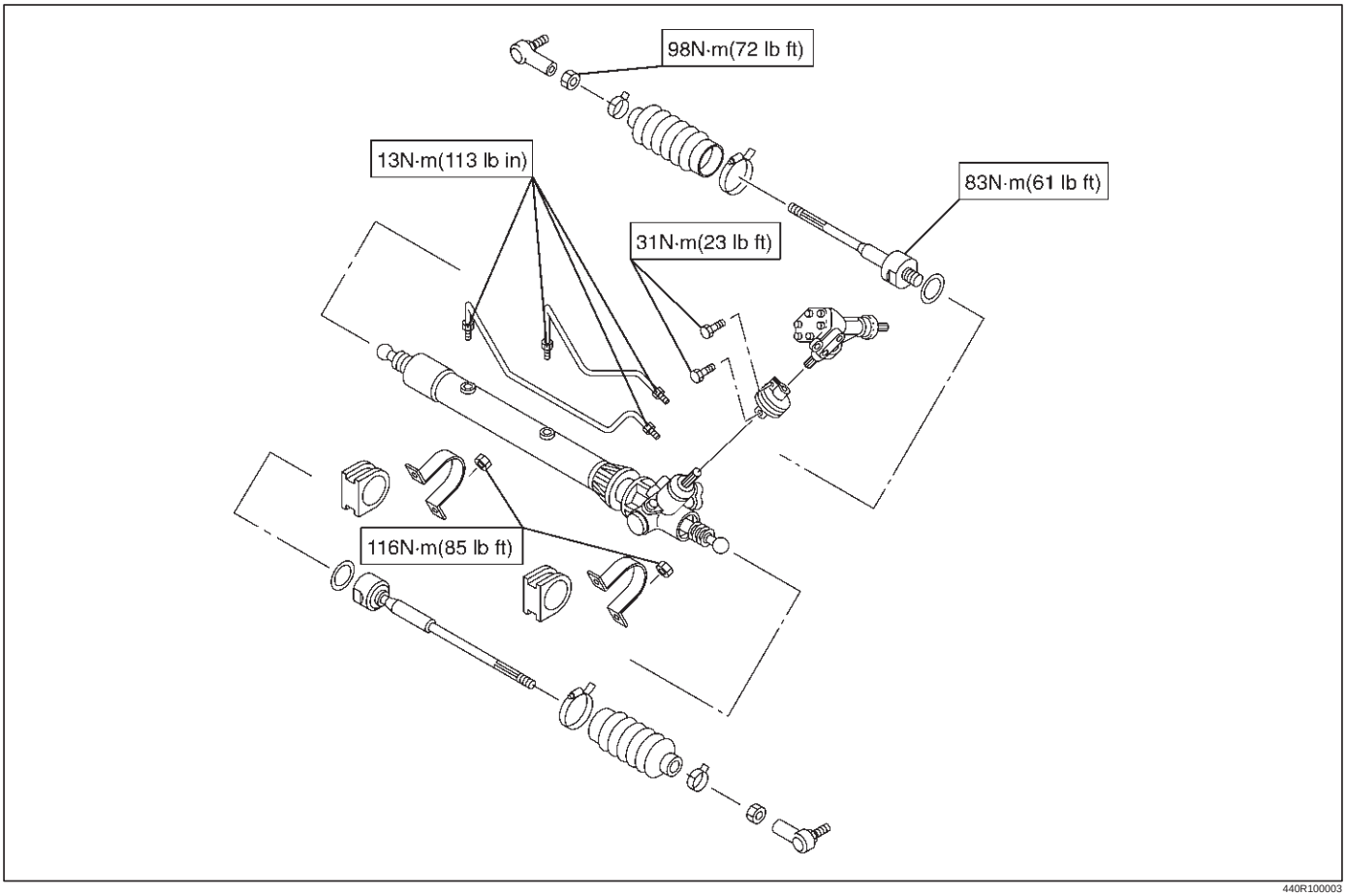
   Torque: 98 N·m (72 lb ft)

Main Data and Specifications

General Specifications

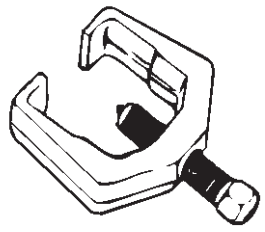
Power Steering unit	Type	Rack and pinion
	Rack stroke	152 mm (5.98 in)
	Lock to lock	3.64

Torque Specifications



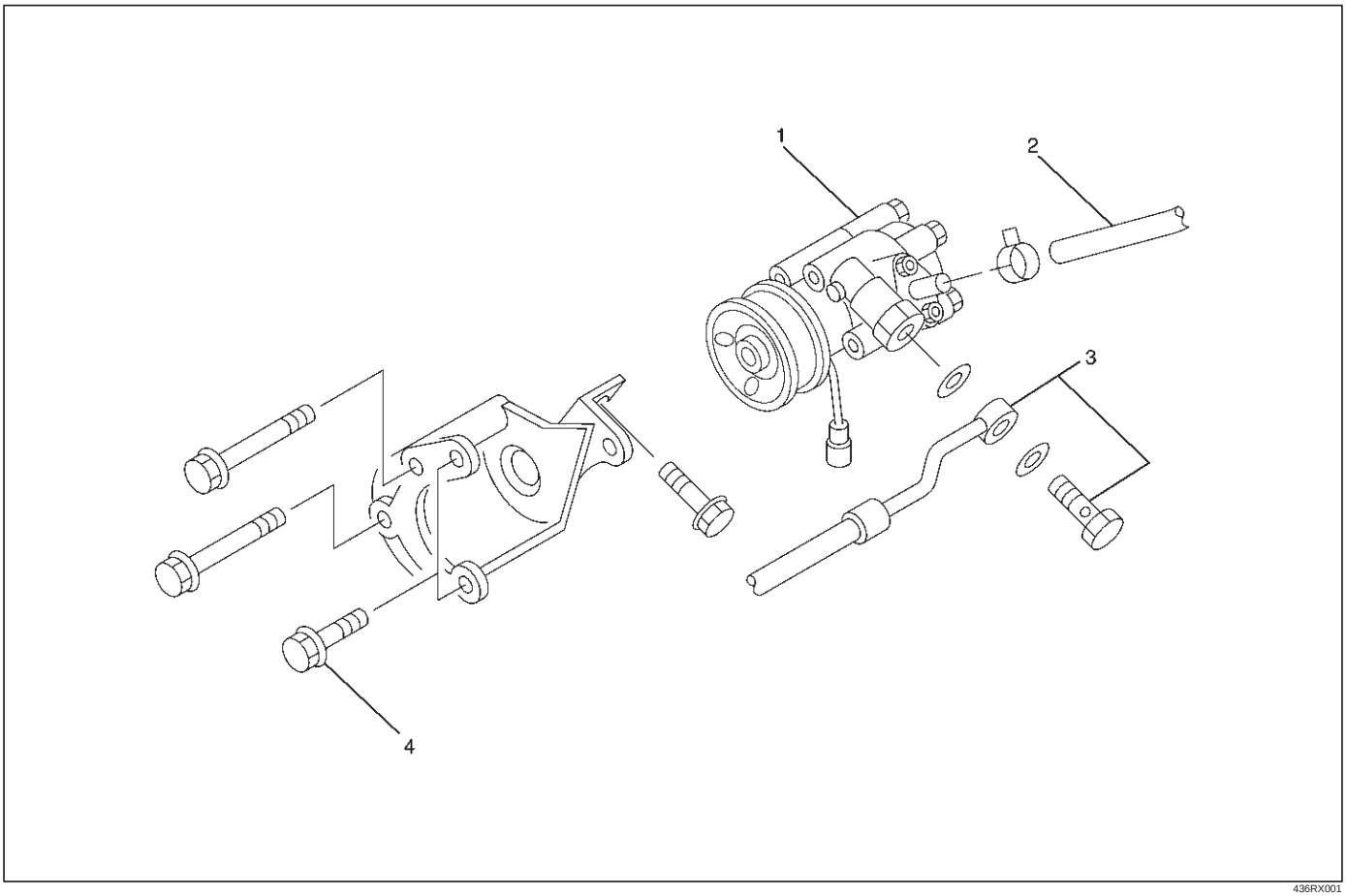
440R100003

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS279	**J–29107** Tie rod end remover

Power Steering Pump

Power Steering Pump and Associated Parts



436RX001

Legend

(1) Pump Assembly
(2) Hose, Suction
(3) Hose, Flexible
(4) Bolt

Removal

1. Remove the drive belt.
2. Place a drain pan below the pump.
3. Disconnect the suction hose.
4. Disconnect the flexible hose.
5. Remove the power steering fixing bolt and remove the pump assembly.

Installation

1. Install the pump assembly to the pump braket, tighten the fixing bolt to the specified torque.

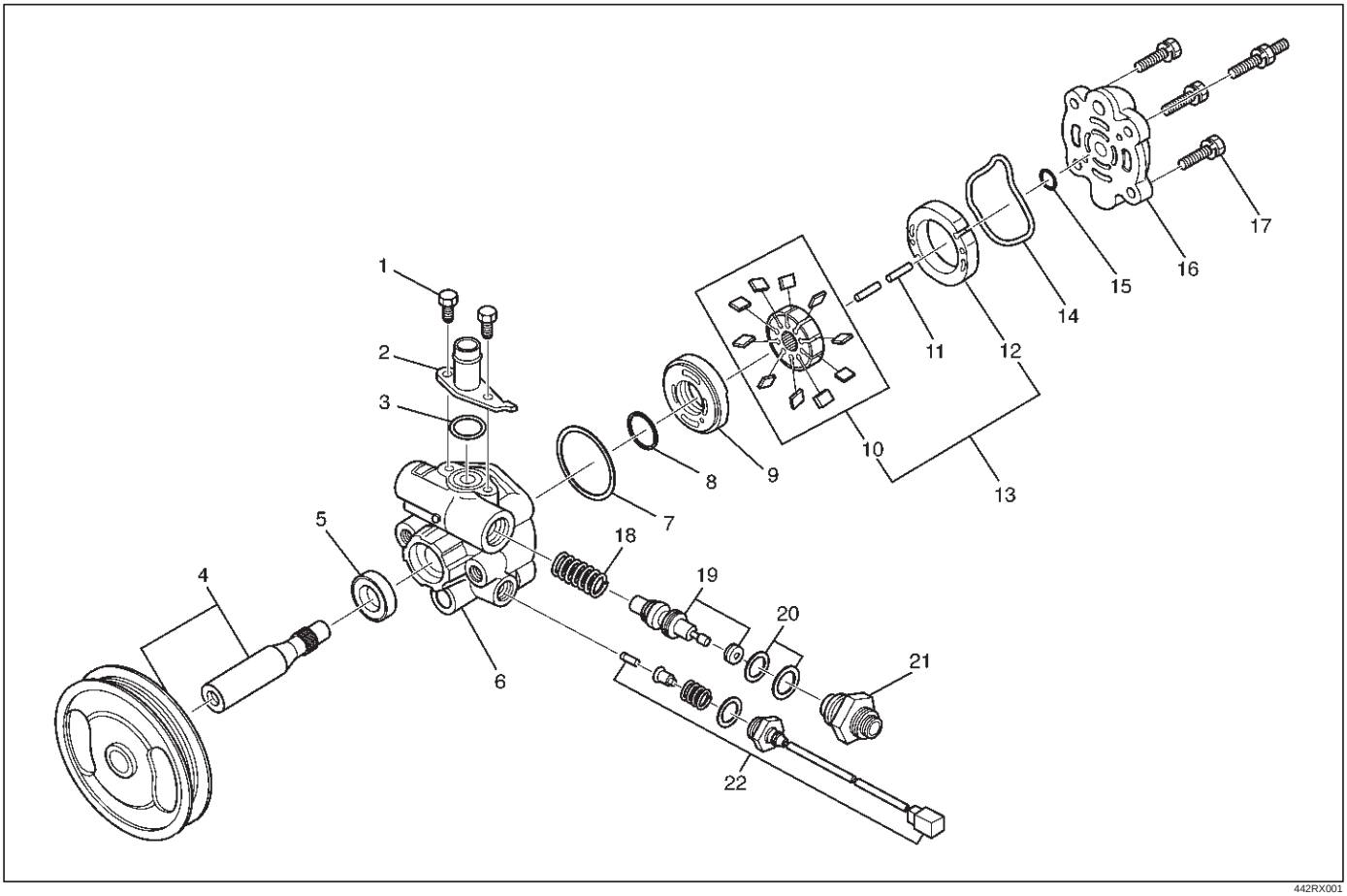
   Torque: 46 N·m (34 lb ft)

2. Install the flexible hose.
   Tighten the eye bolt to specified torque.

   Torque: 54 N·m (40 lb ft)

3. Install the drive belt.
4. Connect the suction hose, then fill and bleed system. Refer to *Bleeding the Power Steering System* in this section.

Power Steering Pump Disassembled View



442RX001

Legend

(1) Bolt
(2) Suction Pipe
(3) O-ring
(4) Shaft Assembly
(5) Oil Seal
(6) Front Housing
(7) O-ring
(8) O-ring
(9) Side Plate
(10) Rotor and Vane
(11) Pin
(12) Cam
(13) Pump Cartridge Assembly
(14) O-ring
(15) Snap Ring
(16) Rear Housing
(17) Bolt
(18) Spring
(19) Relief Valve
(20) O-ring
(21) Connector
(22) Pressure Switch Assembly

Disassembly

1. Clean the oil pump with solvent (plug the discharge and suction ports to prevent the entry of solvent).
   Be careful not to expose the oil seal of shaft assembly to solvent.
2. Remove the bolt, suction pipe and O-ring.
3. Remove the connector, O-ring, relief valve and spring.
4. Remove the pressure switch assembly.
5. Remove the bolt, rear housing and O-ring.
6. Remove the snap ring.
7. Remove the shaft assembly.
8. Remove the oil seal.

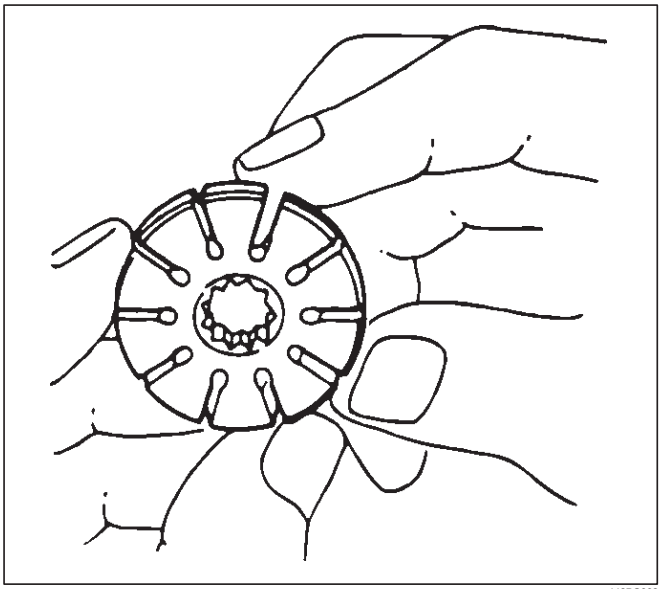
CAUTION: When removing the oil seal, be careful not to damage the housing.

9. Remove the pump cartridge assembly from the front housing.
10. Remove two O-rings.

Inspection and Repair

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

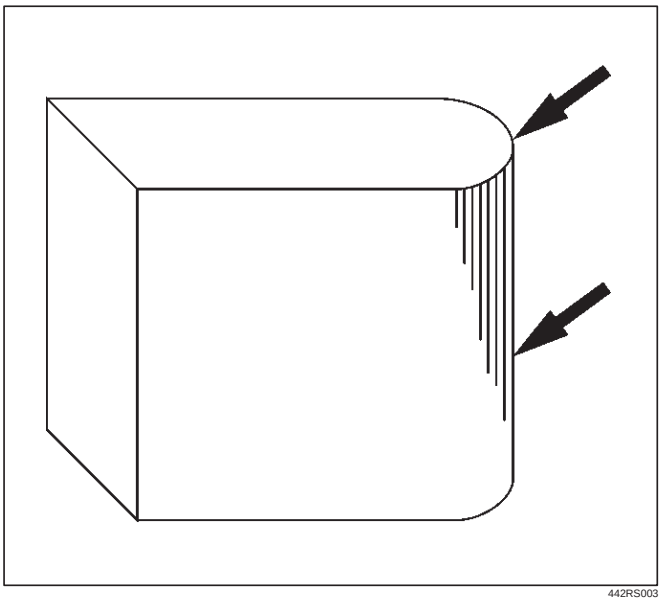
Rotor



442RS002

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Vane



442RS003

Sliding faces of the vane should be free from wear. (Particularly the curved face at the tip that contact with the cam should be free from wear and distortion). When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Cam

The inner face of the arm should have a uniform contact pattern without a sign of step wear. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Side Plate

The sliding faces of parts must be free from step wear (more than 0.01 mm), which can be felt by the finger nail. The parts with minor scores may be reused after lapping the face.

Relief Valve

The sliding face of the valve must be free from burrs and damage. The parts with minor scores may be reused after smoothing with emery cloth (#800 or finer).

Shaft

Oil seal sliding faces must be free from a step wear which can be felt by the finger nail. Bushing fitting face must be free from damage and wear.

O-ring, Oil Seal, Snap Ring

Be sure to discard used parts, and always use new parts for installation. Prior to installation, lubricate all seals and rings with power steering fluid.

Pressure Switch

Check the switch operation as follows:
With engine idling and A/C on, turn the steering wheel fully to the left; compressor should interrupt and engine idle speed will increase. Shut off A/C and again turn steering fully to the left; engine idle will increase. If system fails to function properly, disconnect connector at the pressure switch and repeat system check while testing continuity across disconnected SW connector.

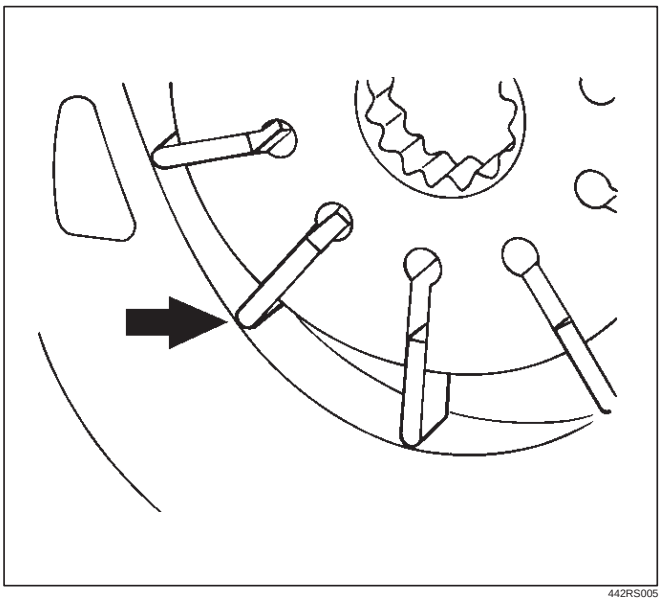
Reassembly

1. Install oil seal to front housing. Be sure to discard used oil seal, and always use new parts for installation.

CAUTION: When installing the oil seal, be careful not to damage the oil seal contacting surface of the housing.

2. Install shaft assembly.

3. Install the vanes to roter with curved face in contact with the inner wall of cam.



442RS005

4. Install rotor and vanes to cam.
5. Install pin to front housing.
6. Install two new O-rings to front housing. Be sure to discard used O-ring.
7. Install side plate.

CAUTION: When installing side plate, be careful not to damage its inner surface. Damaged side plate may cause poor pump performance, pump seizure or oil leakage.

8. Install pump cartridge assembly to front housing.
9. Install snap ring to shaft end.
10. Install rear housing with a new O-ring. Be sure to discard used O-ring. Then install bolt and tighten it to specified torque.

    Torque: 24 N·m (17 lb ft)

11. Install suction pipe with a new O-ring. Be sure to discard used O-ring. Then install bolt and tighten it to specified torque.

    Torque: 10 N·m (87 lb in)

12. Install relief valve and spring.
13. Install connector with a new O-ring. Be sure to discard used O-ring. Tighten the connector to specified torque.

    Torque: 59 N·m (43 lb ft)

14. Install pressure switch assembly and tighten it to specified torque.

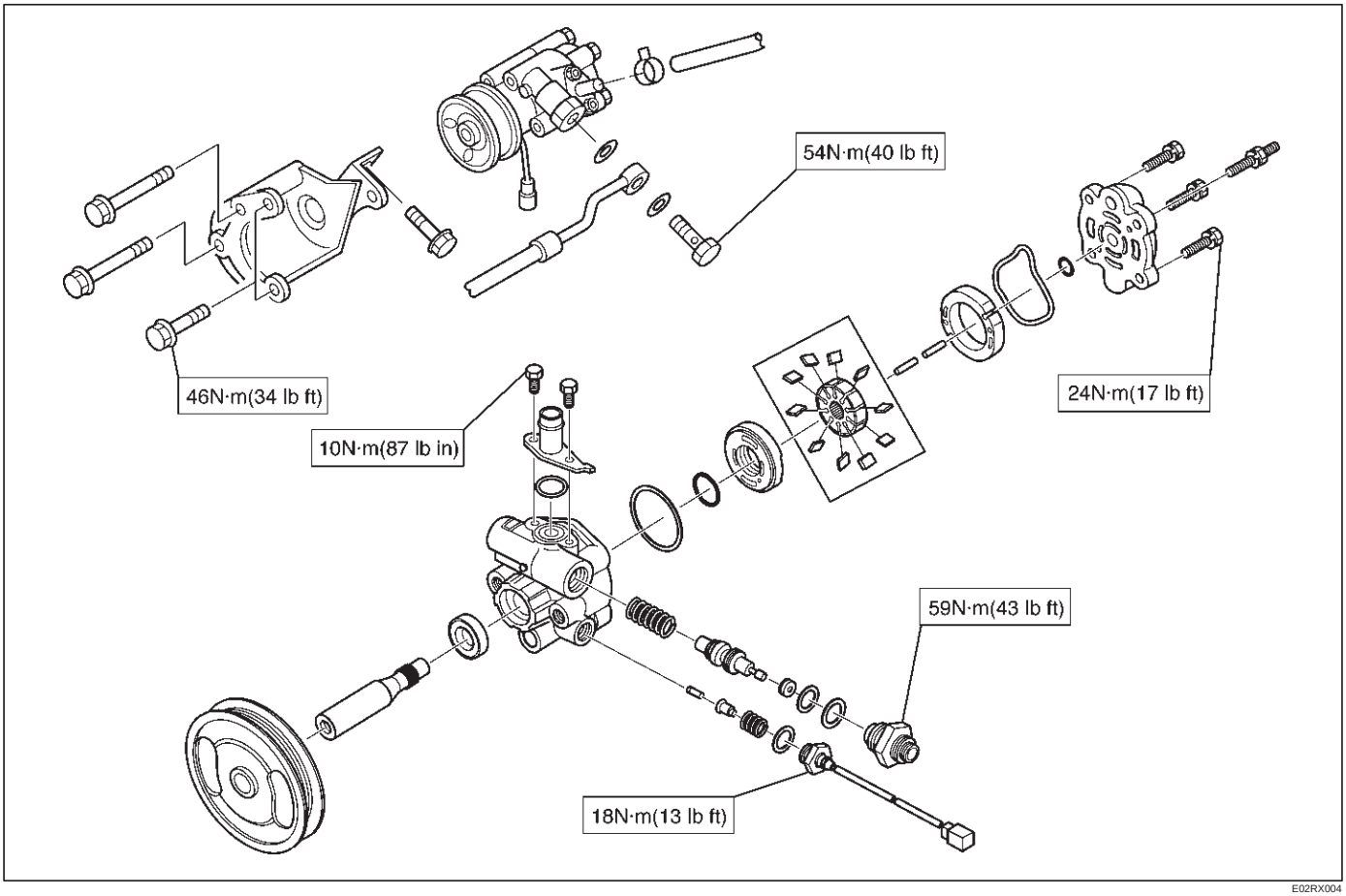
    Torque: 18 N·m (13 lb ft)

Main Data and Specifications

General Specifications

Oil pump	Type	Vane
	Operating fluid	ATF DEXRON®–III

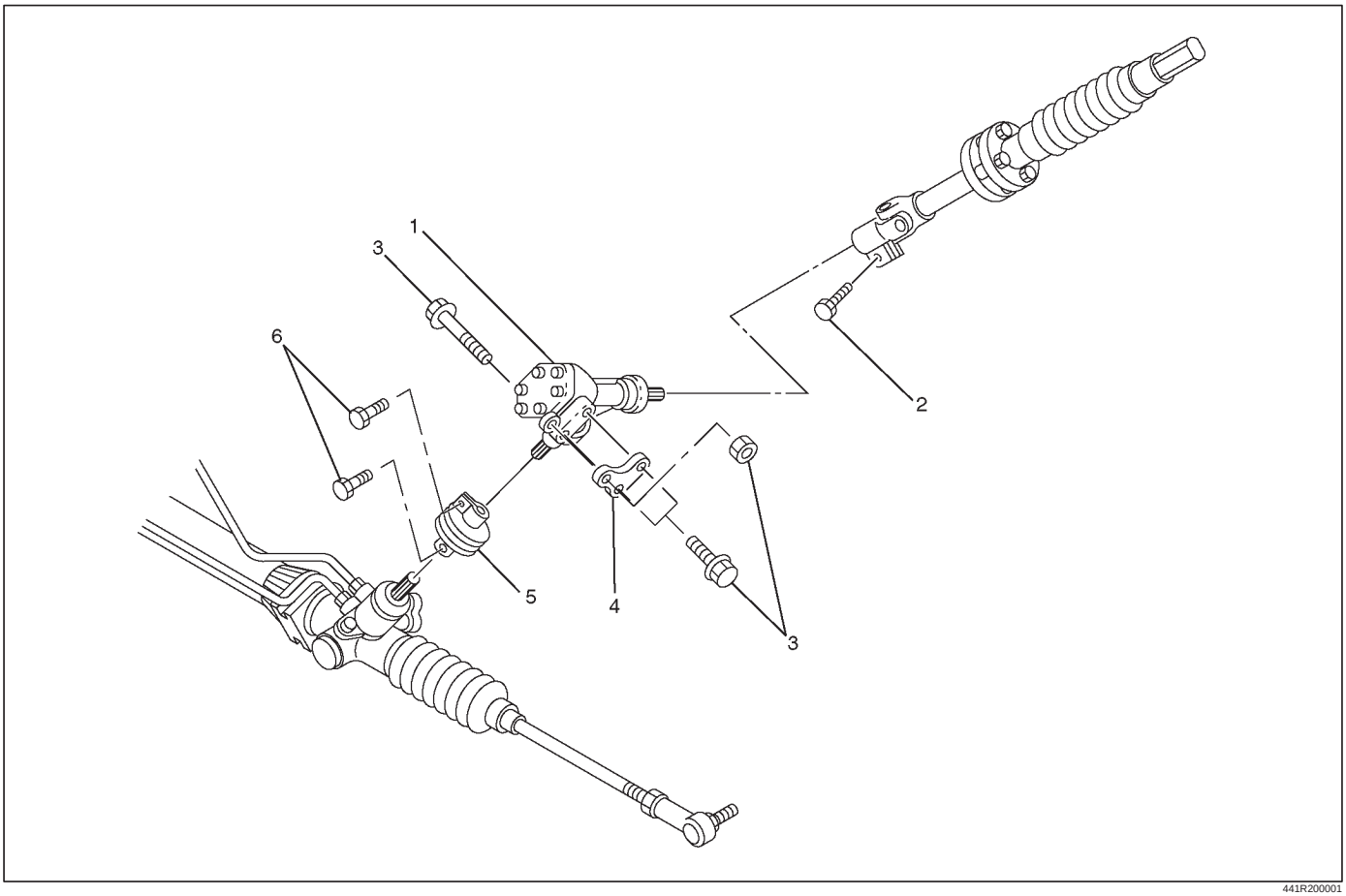
Torque Specifications



E02RX004

Transfer Gear Assembly

Transfer Gear Assembly and Associated Parts



441R200001

Legend

(1) Transfer Gear Assembly
(2) Bolt, Universal Joint (Steering Shaft Side)
(3) Fixing Bolt Nut
(4) Shim
(5) Universal Joint Assembly
(6) Bolt, Universal Joint (Steering Unit Side)

Removal

1. Apply a setting mark across the universal joint (steering shaft side) and transfer gear assembly to reassemble the parts in their original position.
2. Remove universal joint bolt (steering shaft side).
3. Apply a setting mark across the universal joint assembly and the transfer gear assembly to reassemble the parts in their original position.
4. Remove universal joint bolts (both of transfer gear assembly side and power steering unit assembly side).
5. Loosen fixing bolts and nut and remove transfer gear assembly with shim.

Inspection and Repair

The transfer gear assembly cannot be disassembled. If damage or abnormal condition are found, replace the entire transfer gear assembly.

Installation

1. Install the transfer gear assembly to the universal joint (steering shaft side) align the setting marks made at removal.
   Then tighten the universal joint bolt.
2. Install the universal joint assembly to the power steering unit assembly align the setting marks made at removal.
   Then temporary tighten the universal joint bolt (both of transfer gear assembly side and power steering unit assembly side).
3. Install the transfer gear assembly with the shim to frame.

   Torque: 54 N·m (40 lb ft)
4. Tighten the universal joint bolts to the specified torque.

   Torque: 31 N·m (23 lb ft)

Supplemental Restraint System Steering Wheel & Column

Service Precaution

This steering wheel and column repair section covers the Supplemental Restraint System (SRS) steering column. The following repair procedures are specific to SRS components. When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.
For detailed explanation about SRS, refer to *Restraints* section.

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

SAFE HANDLING OF INFLATOR MODULES REQUIRES FOLLOWING THE PROCEDURES DESCRIBED BELOW FOR BOTH LIVE AND DEPLOYED MODULES.

SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY (AIR BAG). AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AN AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

SRS Connectors

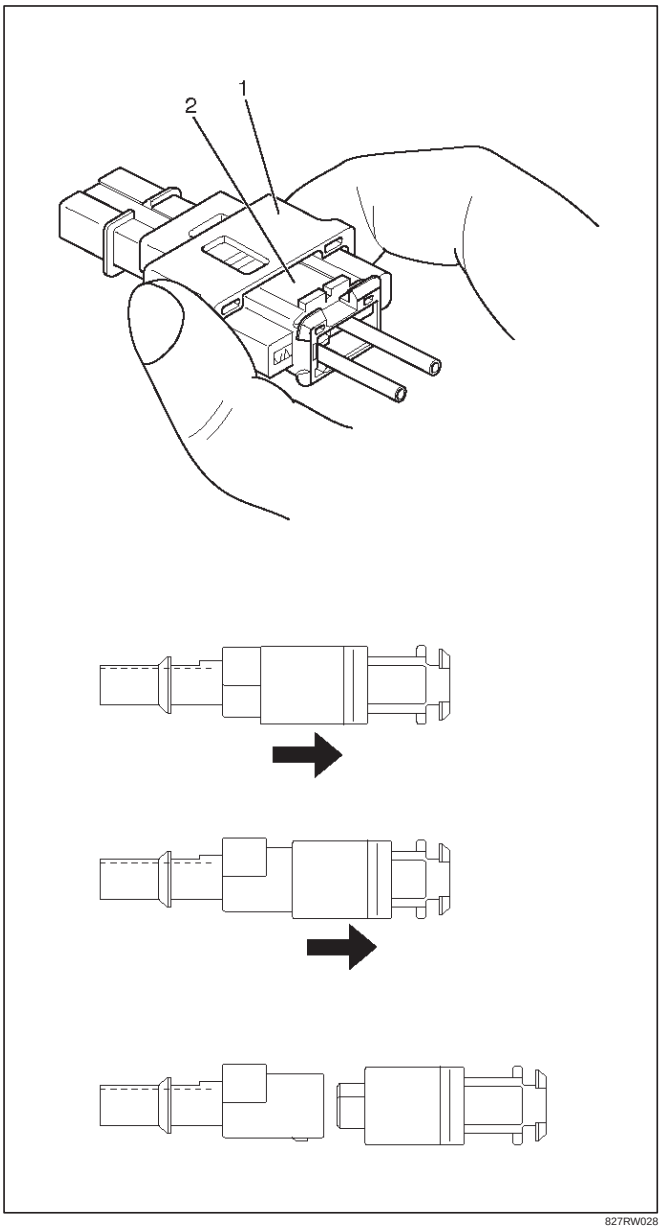
CAUTION: The special yellow color connectors are used for supplemental restraint system-air bag circuit.

When removing the cable harness disconnect the connector by unlocking at two places, outside (1) and inside (2). Do not pull the wires or disconnection may occur.

When connecting the double lock type SRS connector, insert the connector completely then lock the connector. Imperfect locking may cause the SRS circuit to malfunction.

Removal

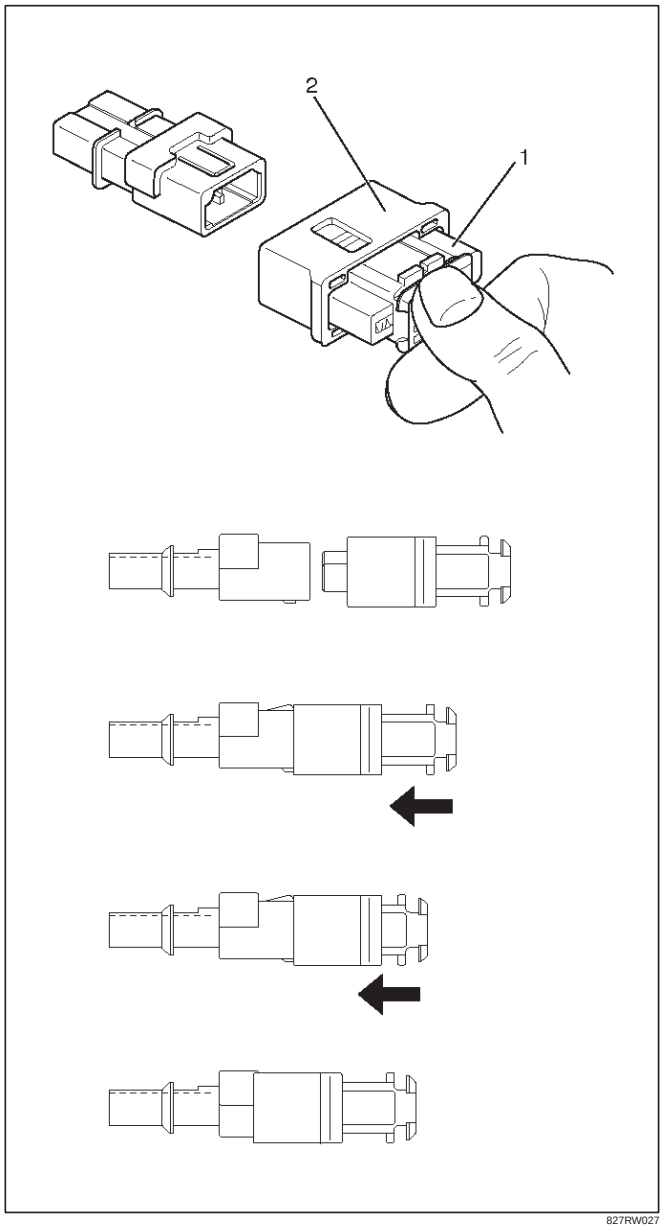
To remove the connector, hold the cover insulator(1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator(2).



827RW028

Installation

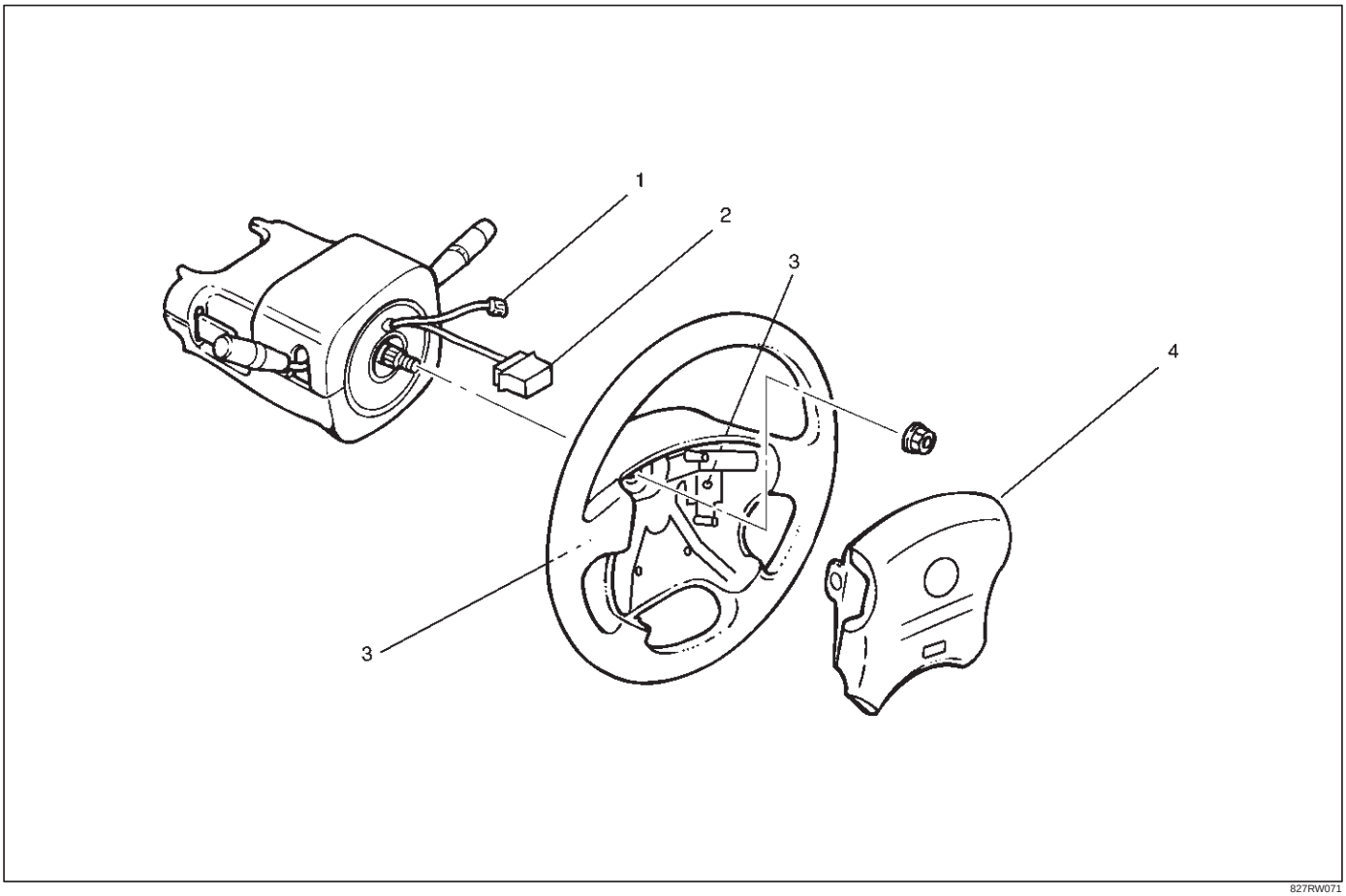
To install the connector, hold the soket insulator(1) and insert it. The cover insulator slides and connector will be locked.
Do not hold the cover insulator(2).



827RW027

Inflator Module

Inflator Module and Associated Parts



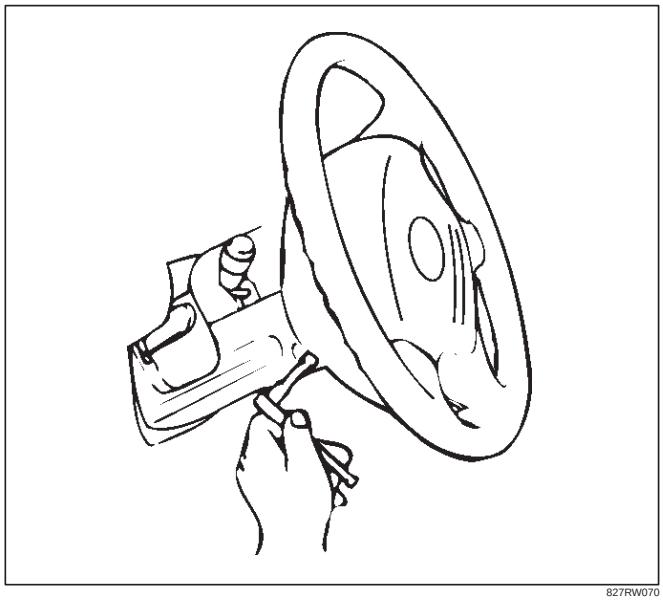
827RW071

Legend

(1) Horn Lead
(2) SRS Connector
(3) Fixing Bolt
(4) Inflator Module

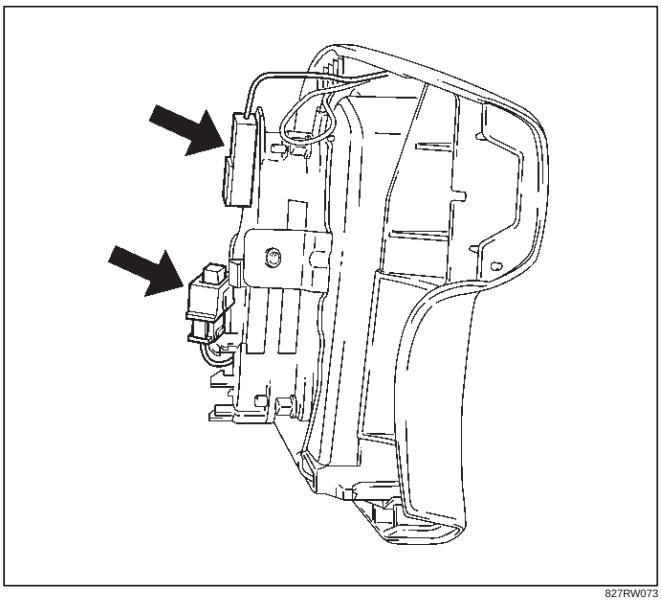
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly .



827RW070

6. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.

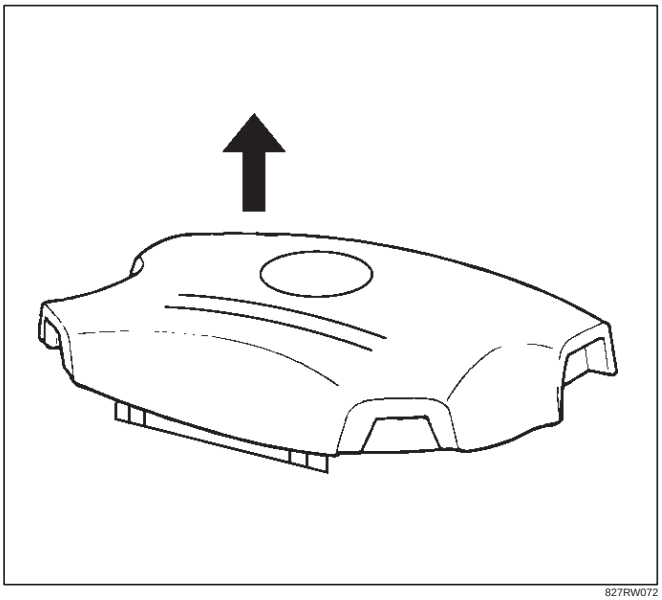


827RW073

7. Remove inflator module.

Inspection and Repair

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT .



827RW072

The inflator module consists of a cover, air bag, inflator, and retainer. Inspect the inflator module mainly for the following:

- ▼Check for holes, cracks, severe blemishes and deformation on the cover.
- ▼Check that the retainer is not deformed.
- ▼Check for defects such as damage and breakage in the lead wire for the igniter.

Replace the inflator module if a defect is found during inspection.

Installation

1. Install inflator module.
2. Support the module and carefully connect the module connector and horn lead.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

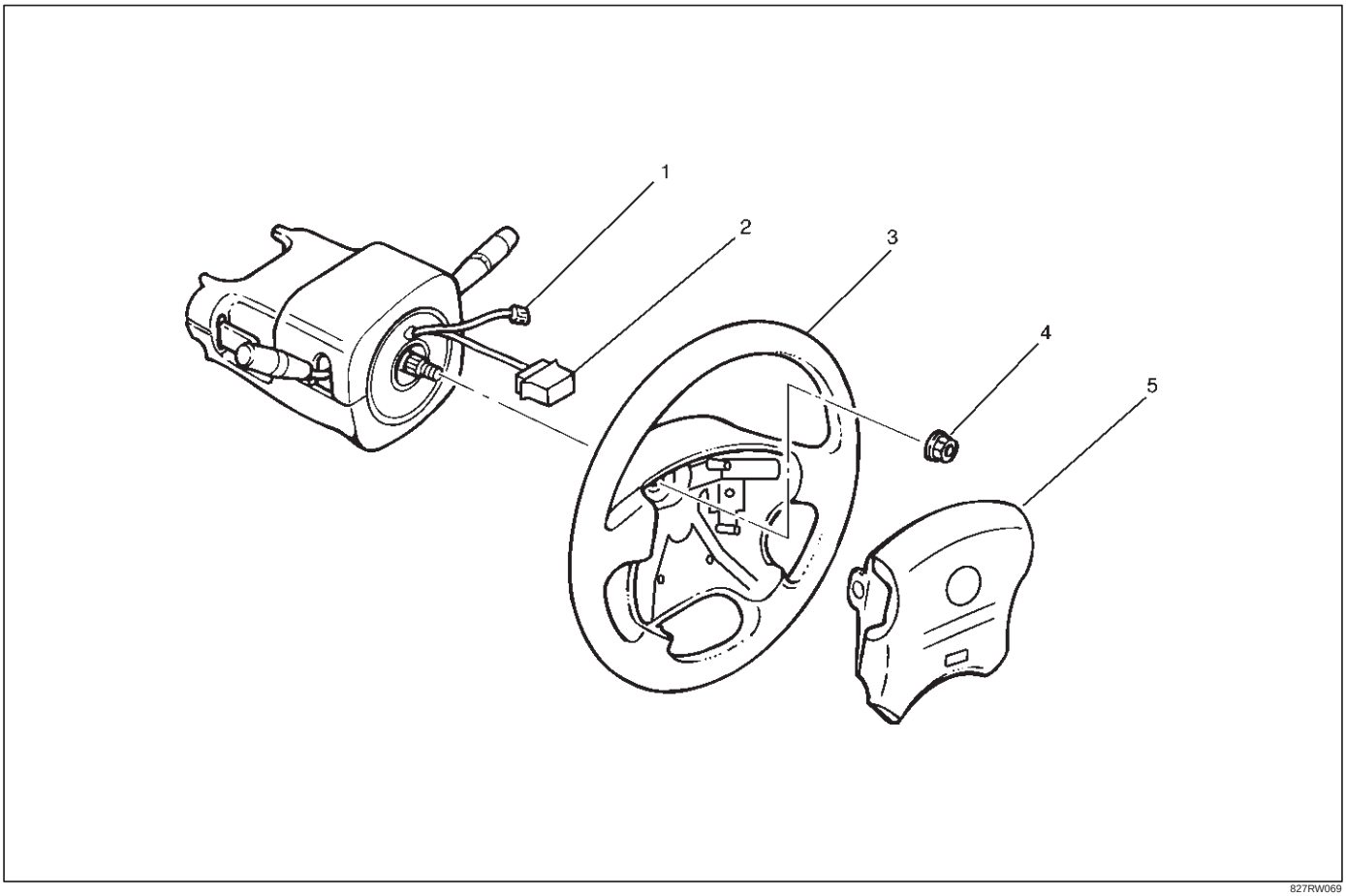
3. Tighten bolts to specified torque.

   Torque: 9 N·m (78 lb in)

4. Connect the yellow 2-way SRS connector located under the steering column.
5. Connect the battery “–” terminal cable.
6. Set ignition to “ON” while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to *Restraints* section.

Steering Wheel

Steering Wheel and Associated Parts



827RW069

Legend

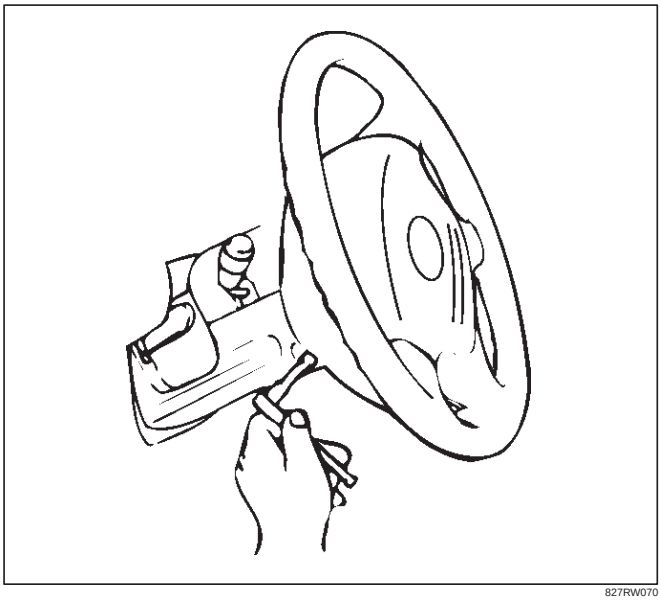
(1) Horn Lead
(2) SRS Connector
(3) Steering Wheel
(4) Steering Wheel Fixing Nut
(5) Inflator Module

CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the slide block which maintains column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon, as hammering could loosen the slide block which maintains column rigidity.

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery ground cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

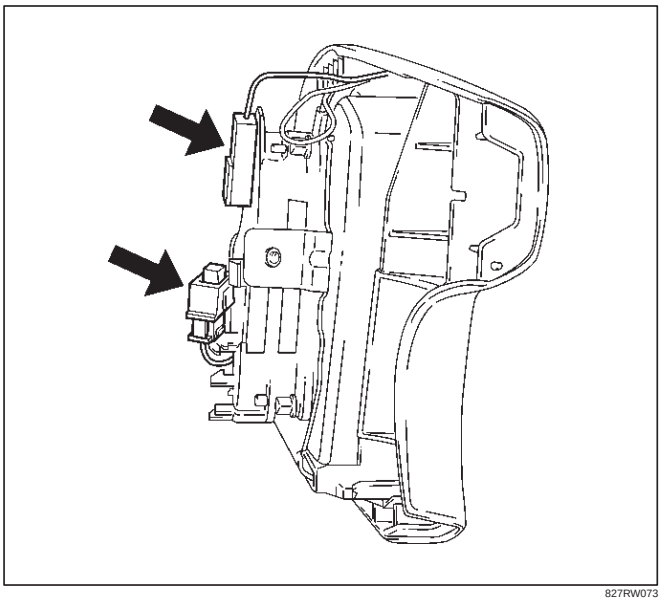
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RW070

6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

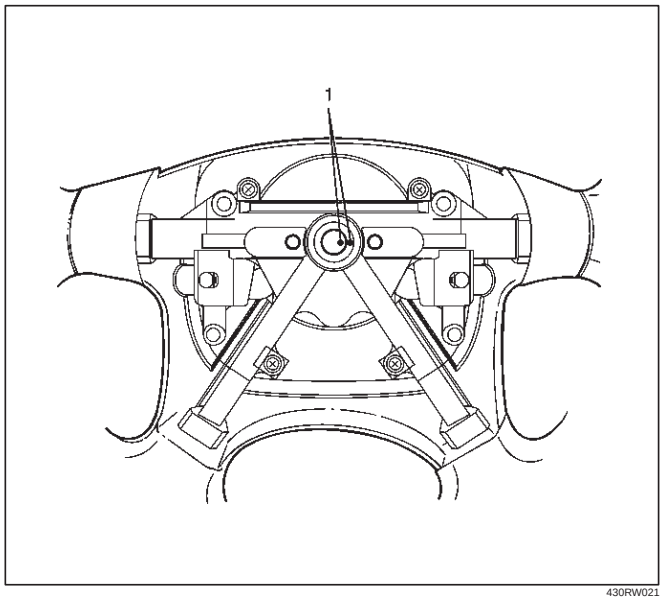
WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RW073

7. Disconnect horn lead.

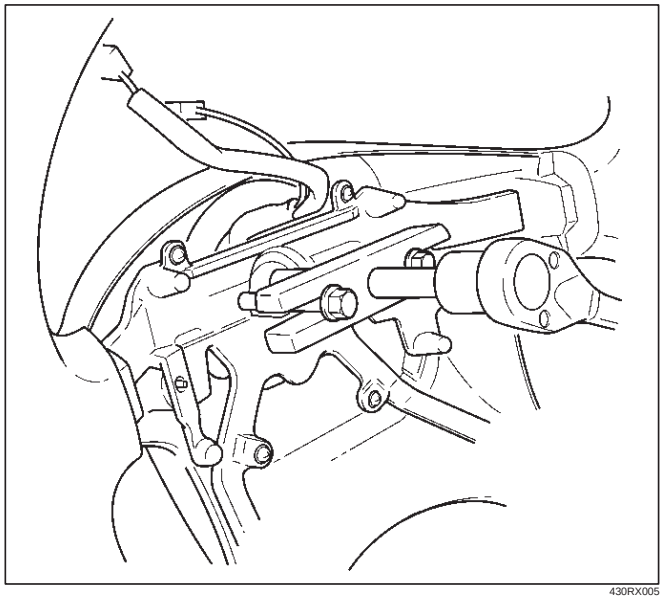
8. Remove steering wheel fixing nut.
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position, then remove steering wheel.



430RW021

10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RX005

Installation

1. Install steering wheel by aligning the setting marks made when removing.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

2. Tighten the steering wheel fixing nut to the specified torque.

   Torque: 34 N·m (25 lb ft)

3. Connect horn lead.
4. Support the module and carefully connect the SRS connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinches.

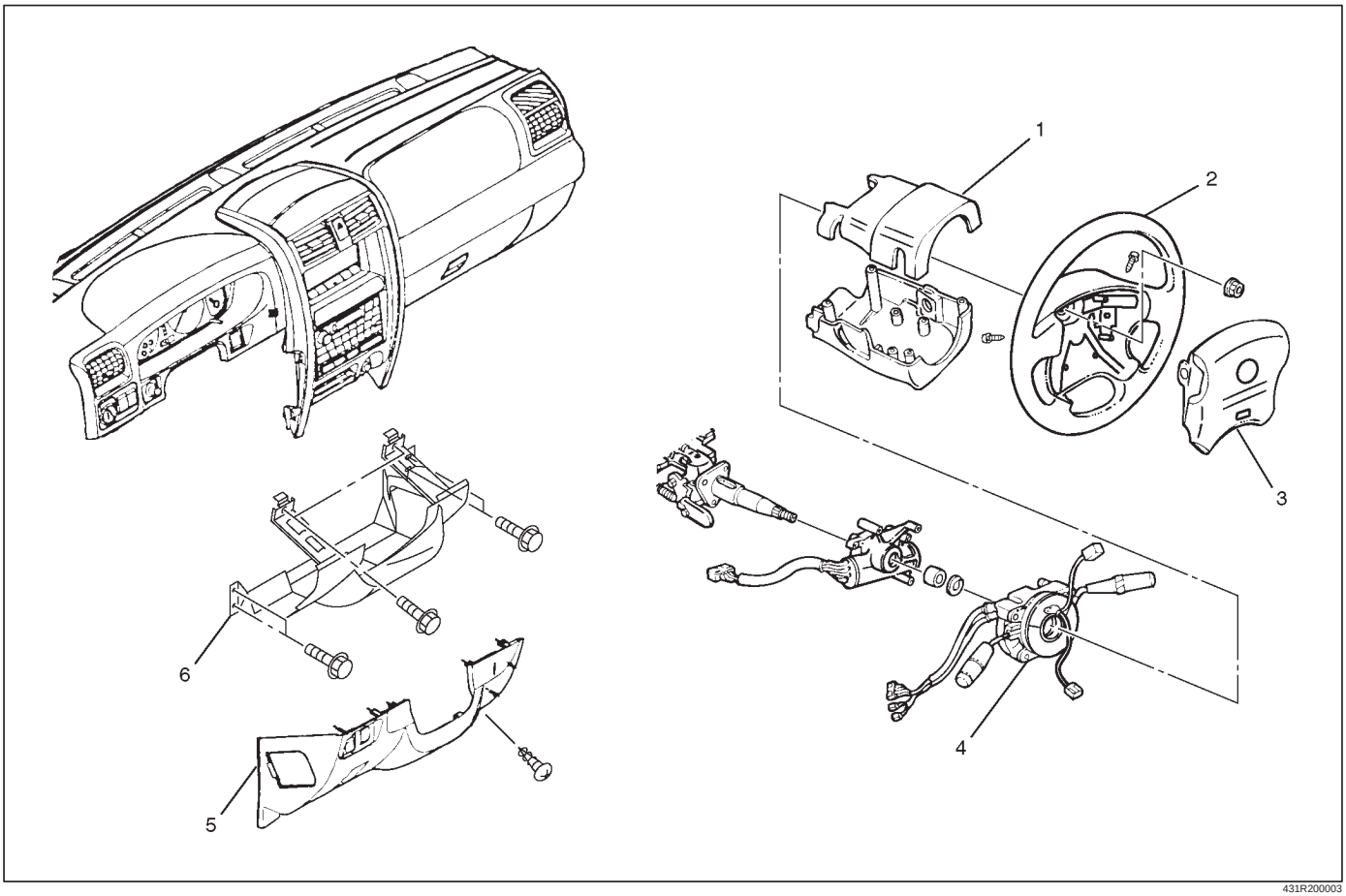
5. Tighten bolts to specified torque.

   Torque: 9 N·m (78 lb in)

6. Connect the yellow 2-way SRS connector located under the steering column.
7. Connect the battery “–” terminal cable.
8. Turn the ignition switch to the “ON” position and observe the warning lamp. The lamp should flash 7 times. If the lamp does not operate correctly, refer to *Restraints* section.

Combination Switch

Combination Switch and Associated Parts



431R200003

Legend

(1) Steering Column Cover
(2) Steering Wheel
(3) Inflator Module
(4) Combination Switch and SRS Coil Assembly
(5) Instrument Panel Lower Cover
(6) Driver Knee Bolster (reinforcement)

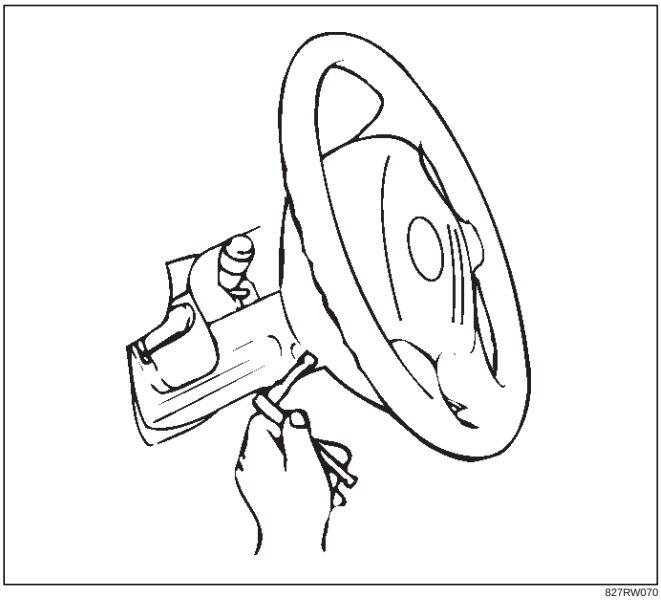
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery ground cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

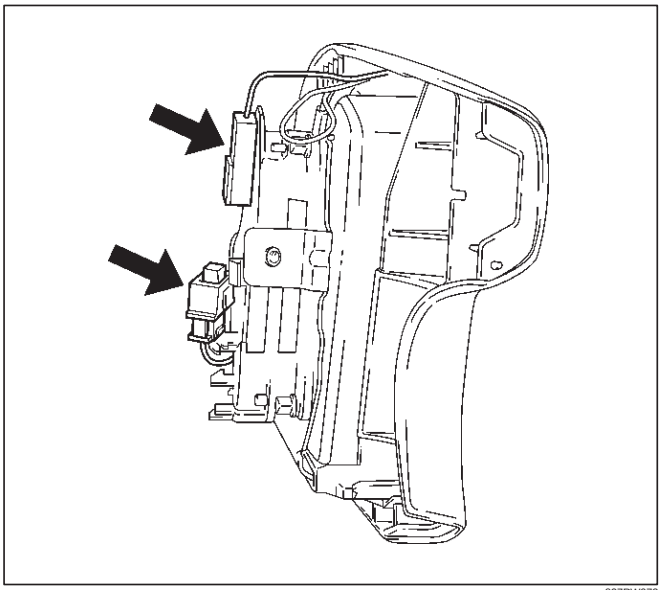
CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

5. Remove the engine hood opening lever, then remove instrument panel lower cover.
6. Remove the driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module, then remove inflator module.

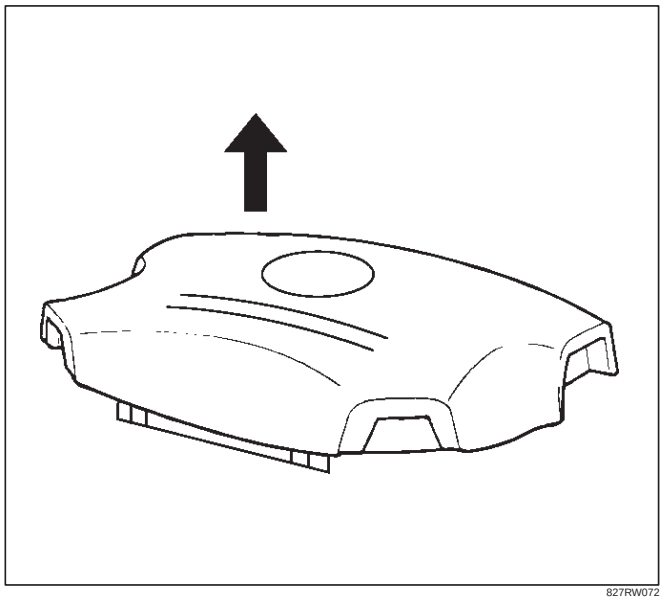


827RW070



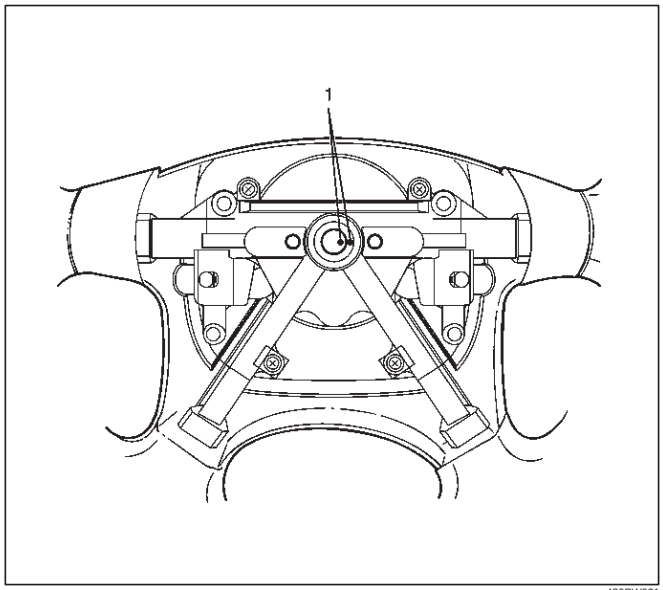
827RW073

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



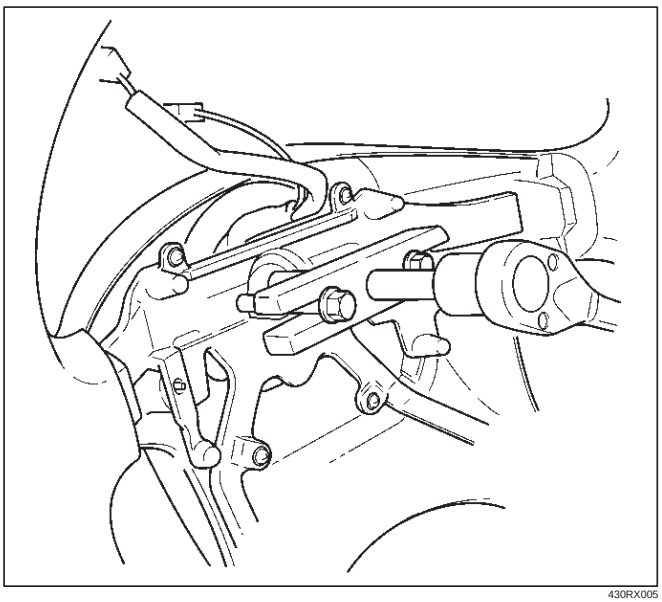
827RW072

8. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



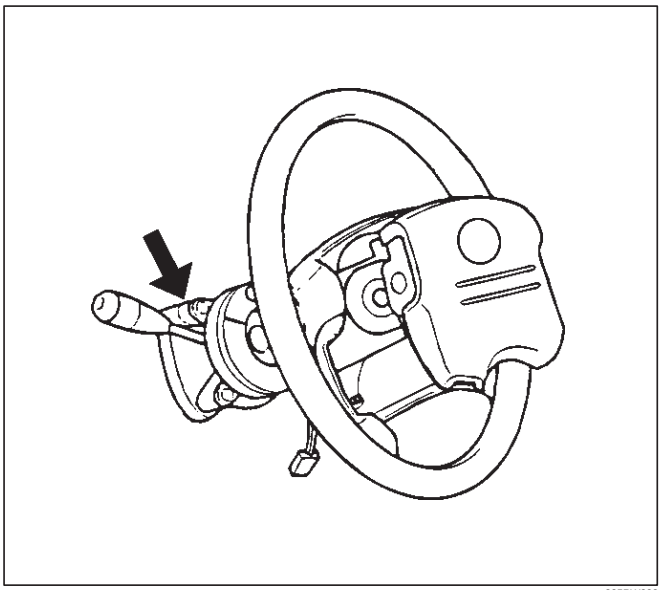
430RW021

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RX005

9. Remove steering column cover.
10. Disconnect the wiring harness connectors located under the steering column then remove combination switch and SRS coil assembly.

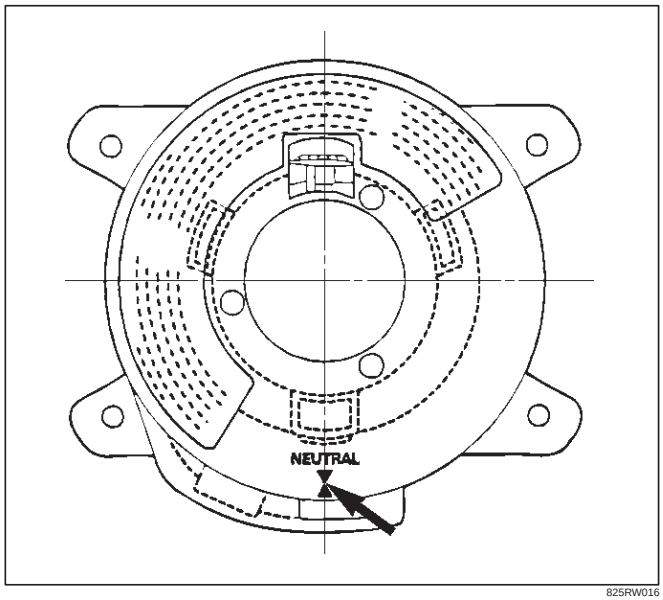


825RW288

Installation

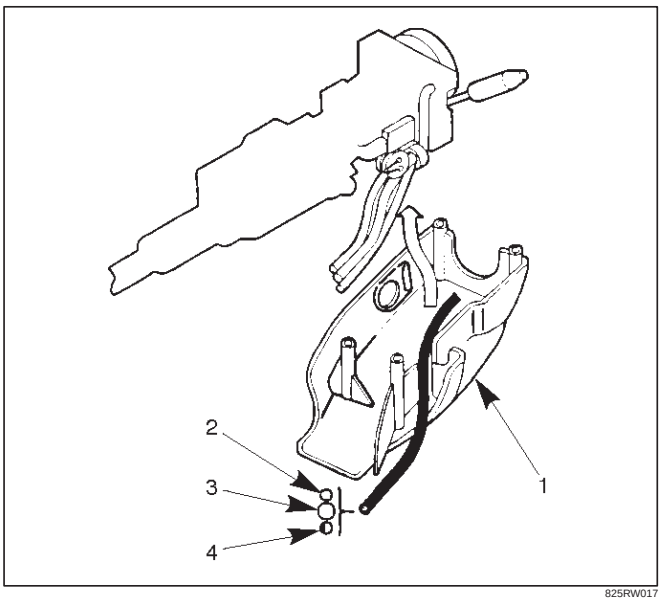
1. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column. Then turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: Turn the SRS coil counter clockwise until some resistance is felt, or damage may occur to the SRS coil.



825RW016

2. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

3. Align the setting marks made when removing then install steering wheel.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

4. Tighten the steering wheel fixing nut to the specified torque.

   Torque: 34 N·m (25 lb ft)

5. Support the inflator module and carefully connect the SRS connector and horn lead.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

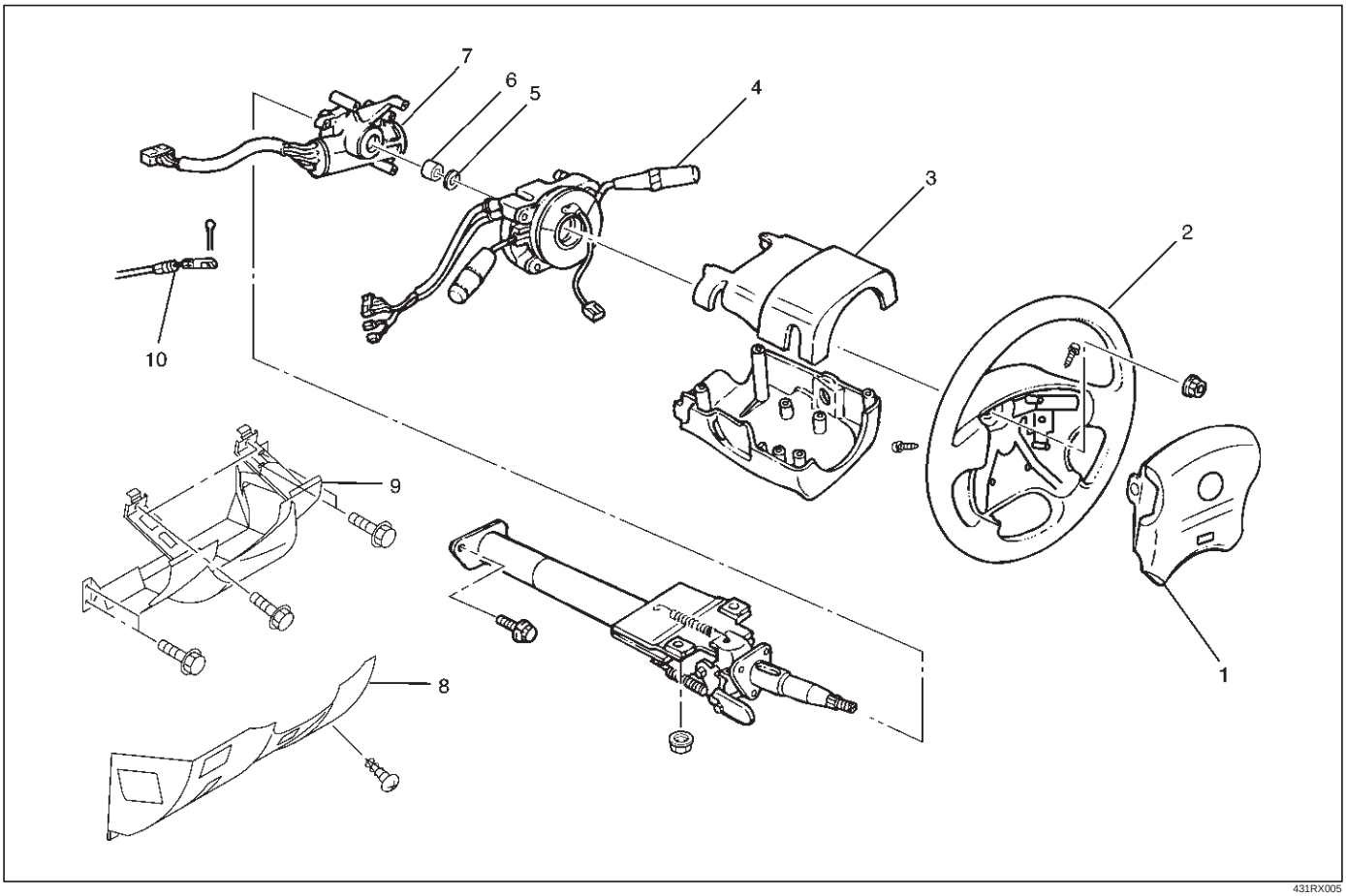
6. Tighten bolts to specified torque.

   Torque: 9 N·m (78 lb in)

7. Install driver knee bolster (reinforcement).
8. Install instrument panel lower cover then Install the engine hood opening lever.
9. Connect the SRS connector.
10. Connect the battery “-” terminal cable.
11. Turn the ignition switch to the “ON” position and observe the warning lamp. The lamp should flash 7 times. If the lamp does not operate correctly, refer to *Restraints* section.

Lock Cylinder

Lock Cylinder and Associated Parts



431RX005

Legend

(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Instrument Panel Lower Cover
(9) Driver Knee Bolster (reinforcement)
(10) Shift Lock Cable (for A/T)

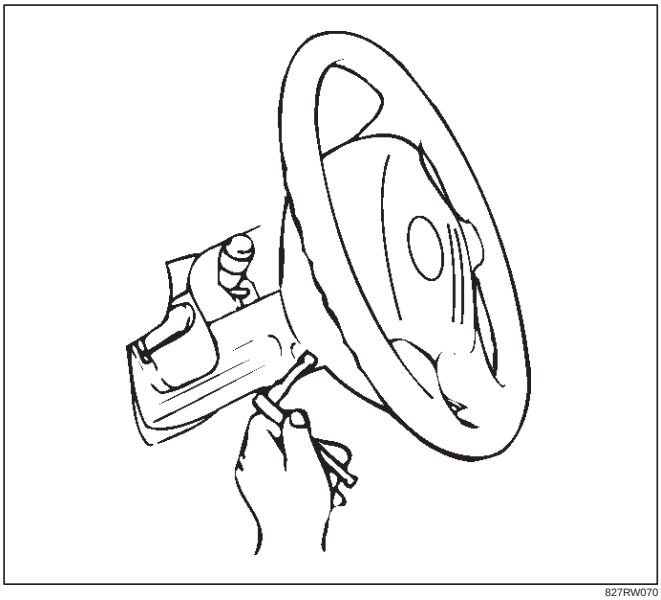
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery ground cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

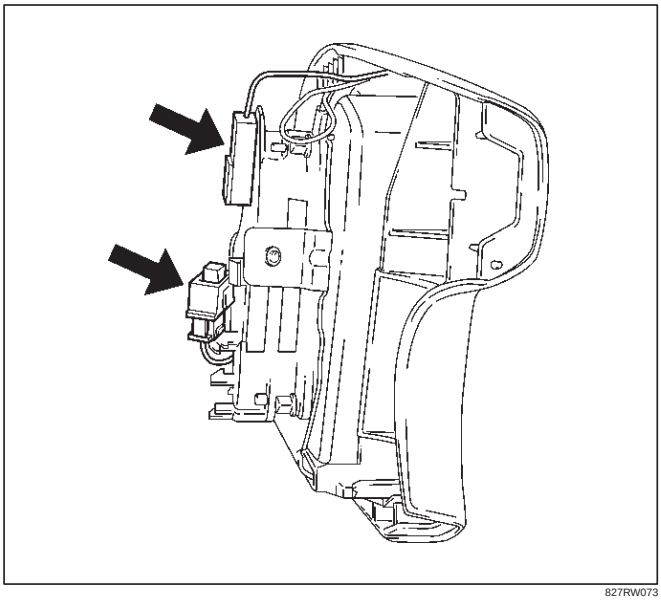
5. Remove the engine hood opening lever and steering lower cover.
6. Remove driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



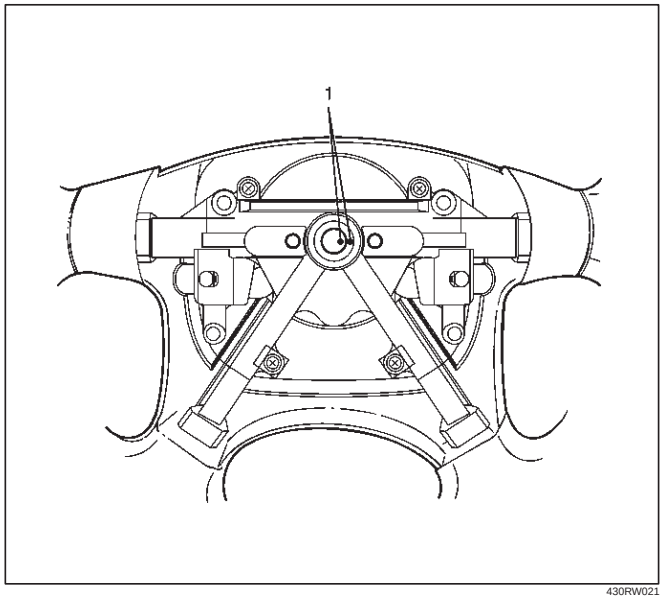
827RW070

8. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.



827RW073

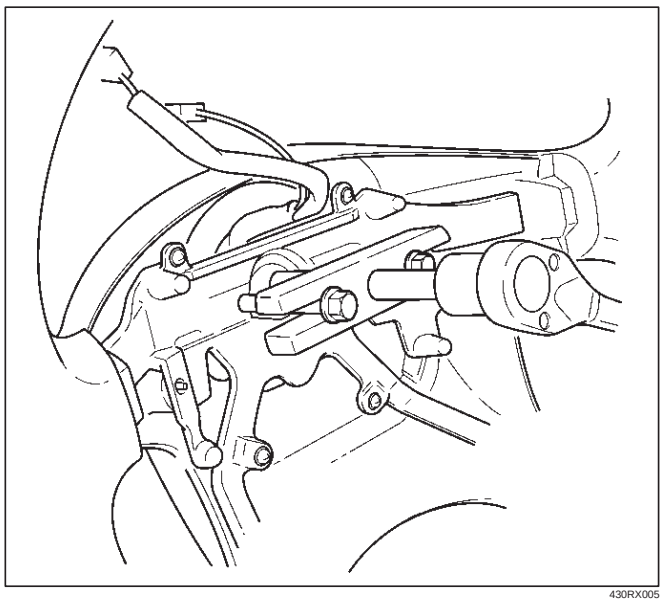
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position.



430RW021

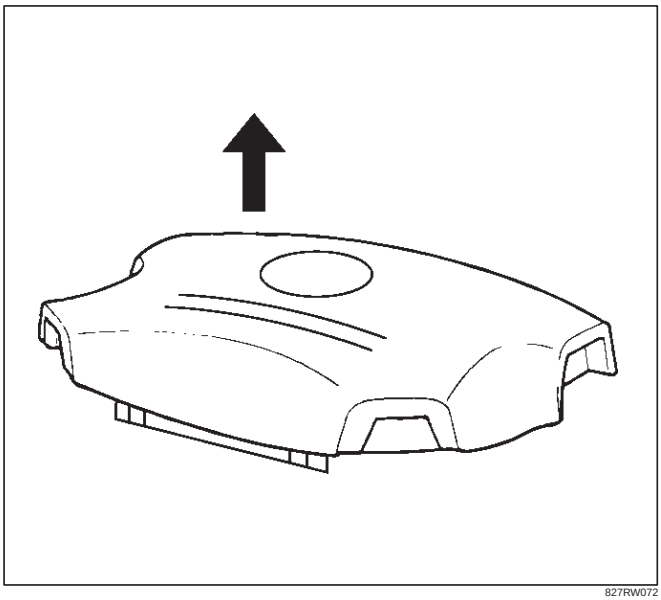
10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



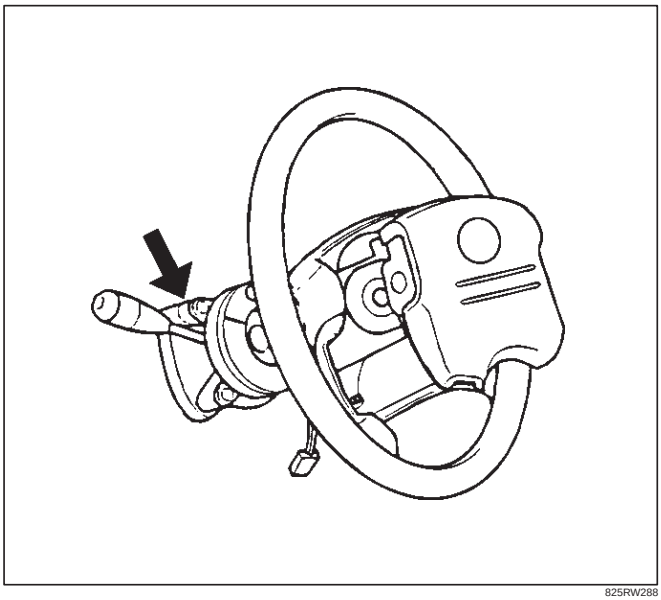
430RX005

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RW072

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.
13. Remove the combination switch assembly with SRS coil.



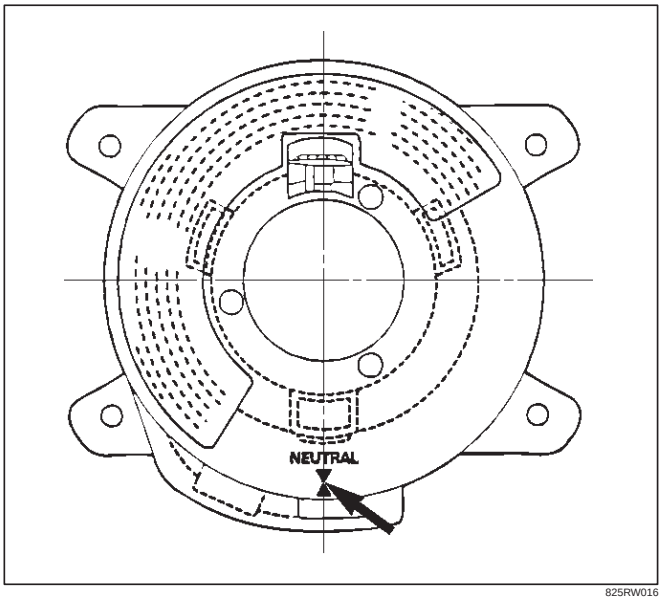
825RW288

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (for A/T).
17. Disconnect the starter switch harness connector located under the steering column then remove lock cylinder assembly.

Installation

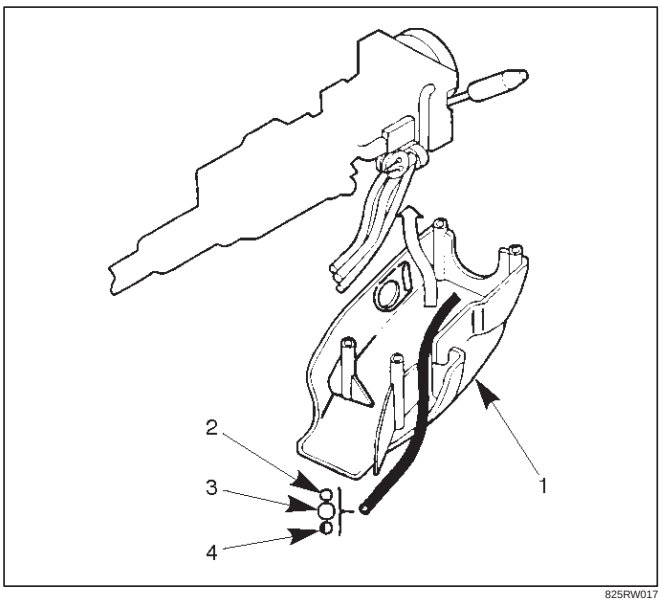
1. Install lock cylinder assembly.
2. Install shift lock cable (for A/T).
3. Install cushion rubber.
4. Install snap ring.
5. Install Combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
6. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: Turn the SRS coil counter clockwise until some resistance is felt, or damage may occur to the SRS coil.



825RW016

7. When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

8. Install steering wheel by aligning the setting marks made during removal.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

10. Support inflator module and carefully connect the SRS connector and horn lead, then install inflator module.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

11. Tighten fixing bolts to specified torque.

Torque: 9 N·m (78 lb in)

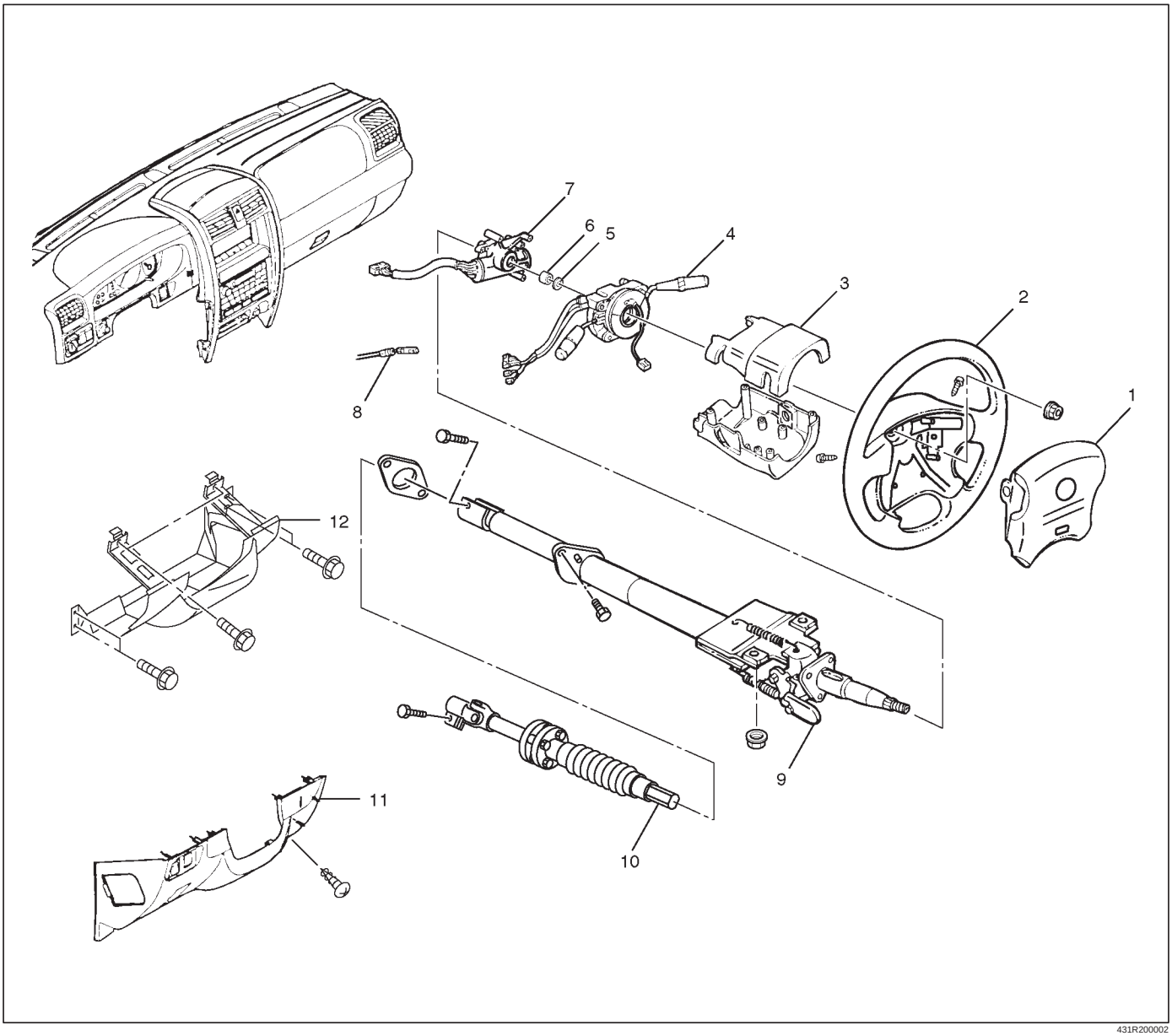
12. Install driver knee bolster (reinforcement).
13. Install instrument panel lower cover, then install the engine hood opening lever.
14. Connect the yellow 2-way SRS connector located under the steering column.
15. Connect the battery ground cable.

System Inspection

Turn the ignition switch to the “ON” position and observe the warning lamp. The lamp should flash 7 times. If the lamp does not operate correctly, refer to *Restraints* section.

Steering Column

Steering Column and Associated Parts



431R200002

Legend

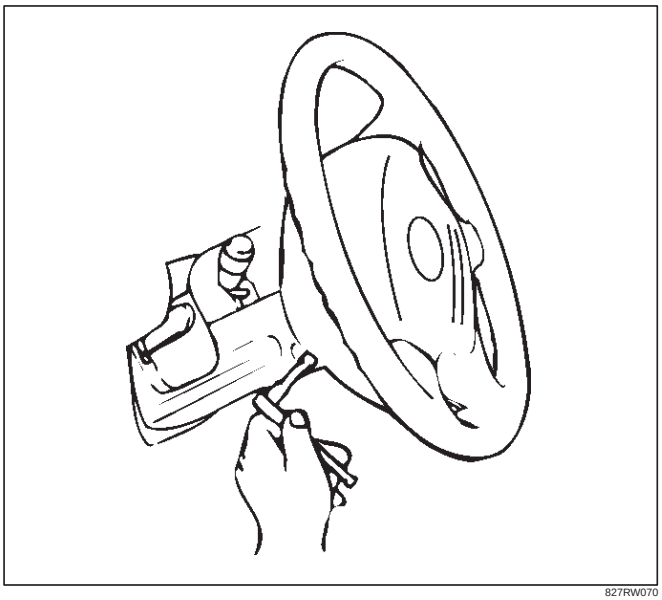
(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Shift Lock Cable (For A/T)
(9) Steering Column Assembly
(10) Second Steering Shaft
(11) Instrument Panel Lower Cover
(12) Driver Knee Bolster (reinforcement)

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery ground cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

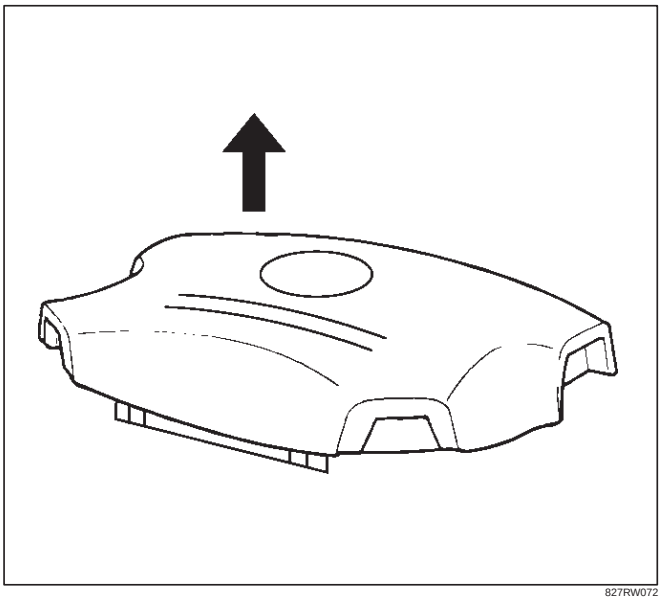
CAUTION: The wheel of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering column from the steering gear. Failure to do so will cause the SRS coil assembly to become uncentered which will cause damage to the SRS coil assembly.

5. Remove the engine hood opening lever, then remove instrument panel lower cover.
6. Remove driver knee bolster (reinforcement).
7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.

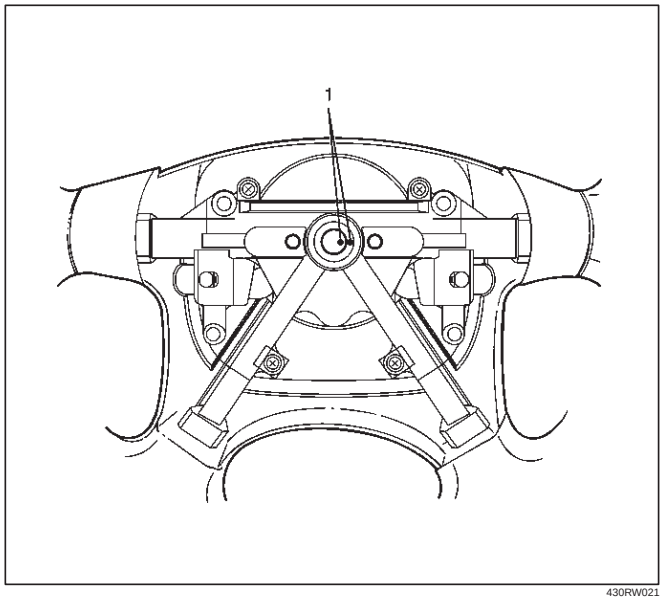

827RW070

8. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.
9. Remove inflator module.

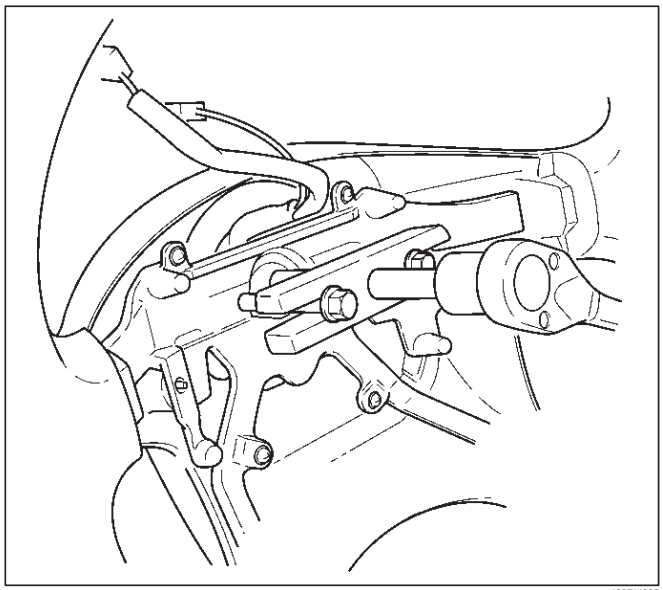
WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.


827RW072

10. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

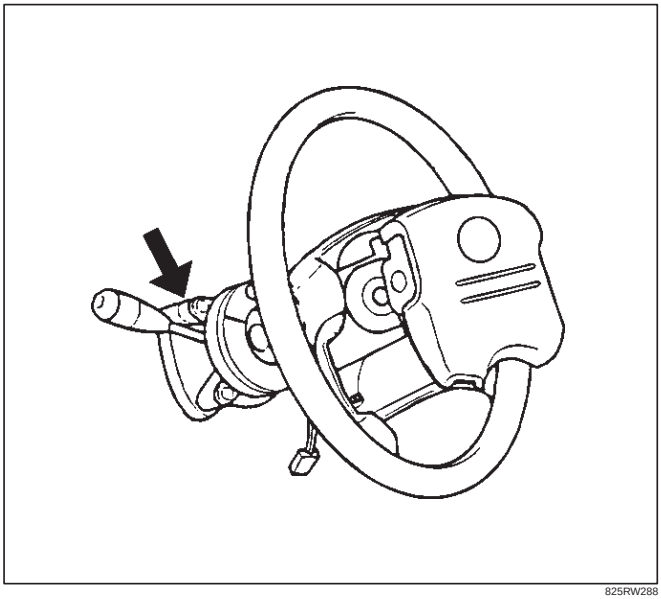


430RW021


430RX005

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.

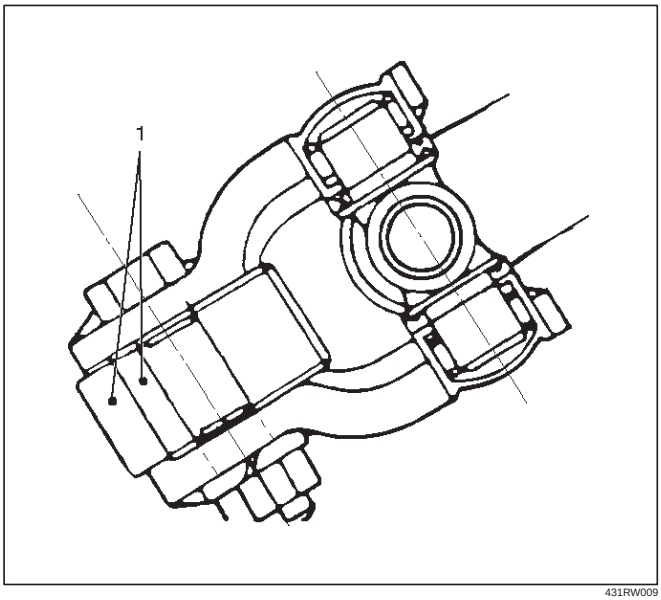
13. Remove the combination switch assembly with SRS coil.



825RW288

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (For A/T).
17. Disconnect the starter switch harness connector located under the steering column, then remove lock cylinder assembly.
18. Apply a setting mark across the second steering shaft and transfer gear assembly to reassemble the parts in their original position, then remove the steering column assembly and second steering shaft.

NOTE: A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.



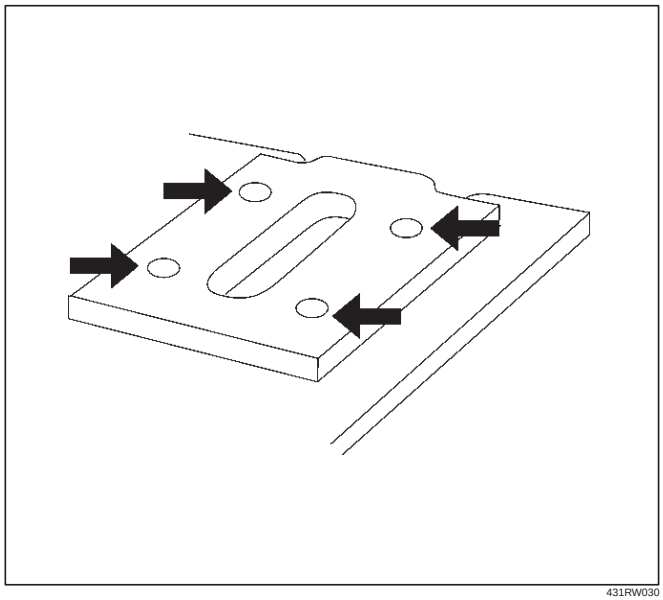
431RW009

Inspection

If the abnormal conditions are found through inspection, replace the steering column assembly.

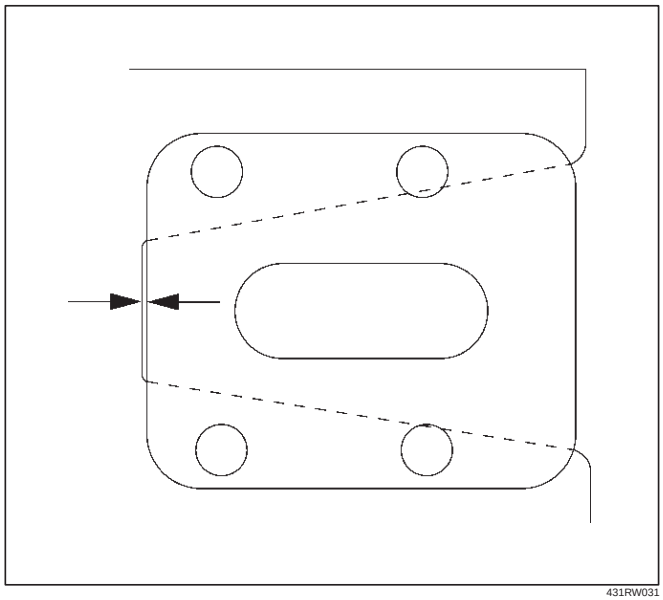
Column Capsule

Check capsules on steering column bracket assembly; all must be securely seated in bracket slots and checked for any loose conditions when pushed or pulled by hand.



431RW030

Check clearance between capsule and bracket. If must be within 1mm (0.039 in).

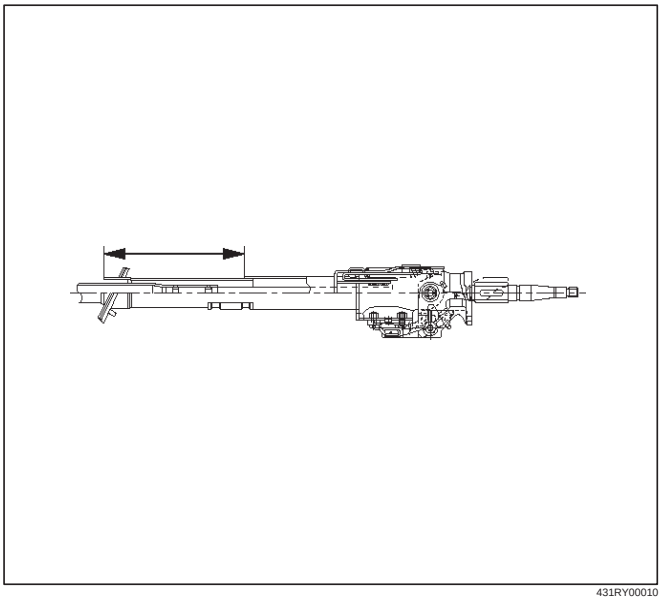


431RW031

Column Tube

Check for collapse by measuring the distance as shown in the figure.

Standard distance: 162.2-165.8 mm (6.386-6.528 in)



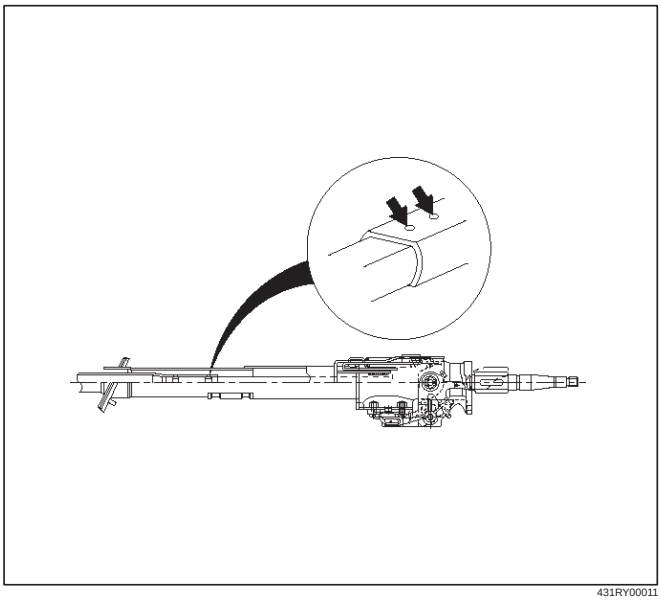
431RY00010

Column Universal Joint for Tilt Mechanism

Check steering column assembly for any resistance by rotating the universal joint. If resistance is felt then replace the steering column assembly.

Sheared Injected Plastic Pin

Check the sheared injected plastic pins for any loose conditions or damage.



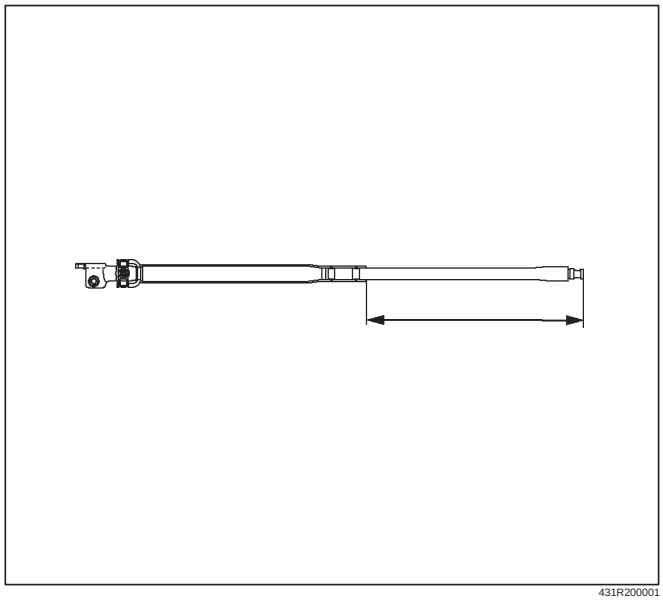
431RY00011

Shaft Length

Check the shaft length from the upper end of the slide joint to the end of the shaft. If column length is not in specifications, steering column should be replaced.

Standard length:

291.7 – 295.7 mm (11.484 – 11.642 in)



431R200001

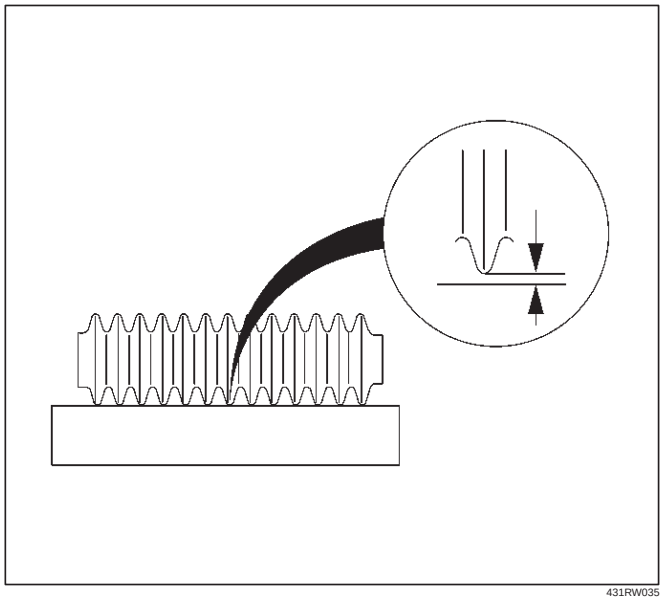
Shaft Universal Joint (Lower End)

If the resistance is felt when checked by rotate the joint, replace the steering column assembly.

Shaft Bellows Pipe

Use a straightedge to inspect the shaft bellows pipe for straightness. Replace if the clearance is more than the specifications.

Standard: Less than 1mm (0.039 in)



431RW035

Tilt Mechanism

Tilt mechanism should moves smoothly.
While locked the tilt mechanism, be sure the steering column latch securely by pushing the steering wheel upward and downward.

Installation

1. Pass through the steering column assembly to the dash panel hole.
   Temporary tightening the steering column bolt(cross beam).
2. Tighten the steering column bolts(dash panel) to the specified torque.

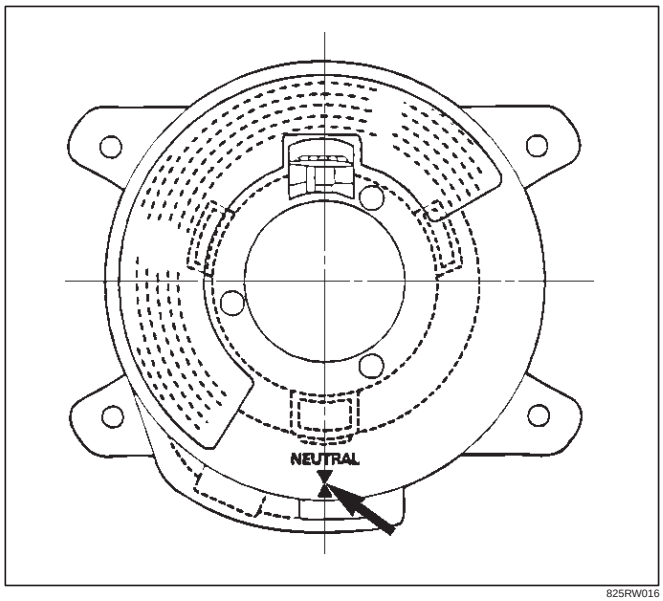
   Torque: 20 N·m (14 lb ft)
3. Tighten the steering column nuts (cross beam) to the specified torque.

   Torque: 17 N·m (12 lb ft)
4. Install the universal joint assembly to the transfer gear assembly align the setting marks made at removal.
   Then tighten the universal joint bolt.

   Torque: 31 N·m (23 lb ft)
5. Install the second steering shaft to the universal joint assembly, then tighten the universal joint bolt to the specified torque.

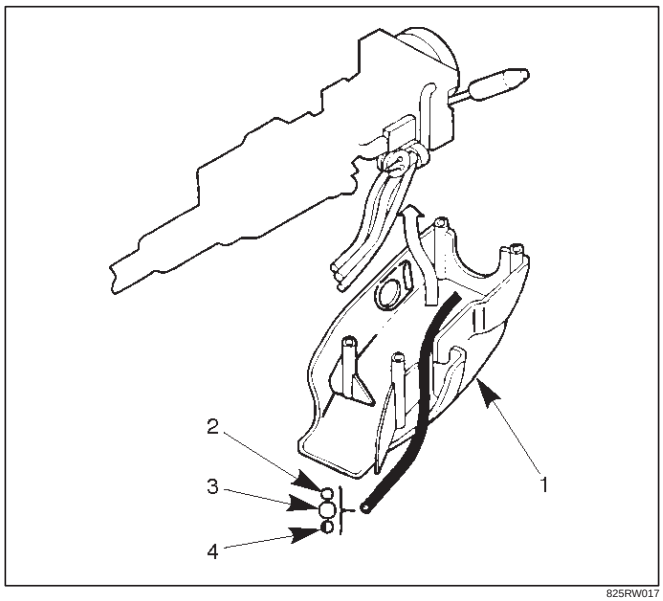
   Torque: 31 N·m (23 lb ft)
6. Install lock cylinder assembly.
7. Install shift lock cable (For A/T).
8. Install cushion rubber.
9. Install snap ring.
10. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
11. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: Turn the SRS coil counter clockwise until a resistance is felt or damage to the SRS coil may occur from over turning.



825RW016

12. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

13. Install steering wheel and align the setting marks made when removing.

CAUTION: Never apply force to the steering wheel shaft using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Tighten the steering wheel fixing nut to the specified torque.

    Torque: 34 N·m (25 lb ft)

15. Support the module and carefully connect the module connector and horn lead, then install inflator module.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

16. Tighten bolts to specified torque.

    Torque: 9 N·m (78 lb in)

17. Install driver knee bolster (reinforcement).
18. Install instrument panel lower cover.
19. Install the engine hood opening lever.
20. Connect the yellow 2-way SRS connector and horn lead located under the steering column.
21. Connect the battery ground cable.

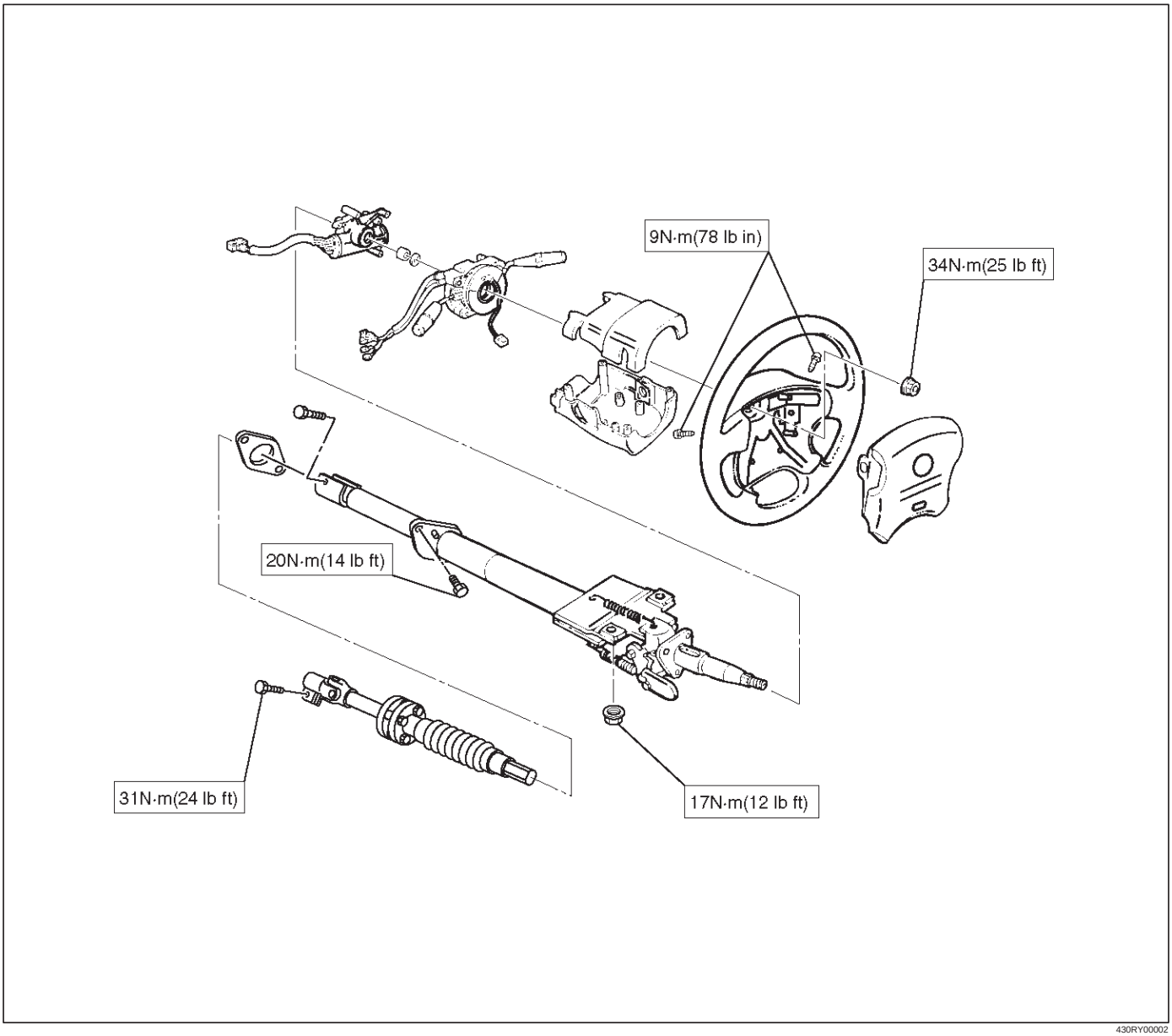
System Inspection

Turn the ignition switch “ON” and observe if the warning lamp flashes 7 times. If the warning lamp does not operate correctly, refer to *Restraints* section.

Supplemental Restraint System Steering Wheel & Column and Associated Parts

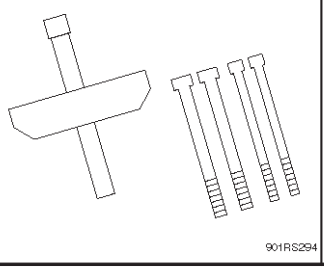
Main Data and Specifications

Torque Specifications



430RY00002

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–29752** Steering wheel remover

AXIOM

SUSPENSION

CONTENTS

Front Suspension 3C–1
Rear Suspension 3D–1
Wheel and Tire System 3E–1
Intelligent Suspension Control 3F–1

FRONT SUSPENSION

CONTENTS

Service Precaution 3C–1
General Description 3C–2
Diagnosis 3C–2
Shock Absorber 3C–5
Shock Absorber and Associated Parts 3C–5
Removal 3C–5
Inspection and Repair 3C–5
Installation 3C–5
Stabilizer Bar 3C–6
Stabilizer Bar and Associated Parts 3C–6
Removal 3C–6
Inspection and Repair 3C–6
Installation 3C–6
Torsion Bar 3C–7
Torsion Bar and Associated Parts 3C–7
Removal 3C–7
Inspection and Repair 3C–8
Installation 3C–8
Knuckle 3C–10
Knuckle and Associated Parts 3C–10
Removal 3C–10
Inspection and Repair 3C–11
Installation 3C–11
Upper Control Arm 3C–13
Upper Control Arm and Associated Parts . 3C–13
Removal 3C–13
Inspection and Repair 3C–14
Installation 3C–14
Lower Control Arm 3C–16
Lower Control Arm and Associated Parts . 3C–16
Removal 3C–16
Inspection and Repair 3C–17
Installation 3C–18
Upper Ball Joint 3C–19
Upper Ball Joint and Associated Parts 3C–19
Removal 3C–19
Inspection and Repair 3C–20
Installation 3C–20
Lower Ball Joint 3C–21
Lower Ball Joint and Associated Parts 3C–21
Removal 3C–21
Inspection and Repair 3C–22
Installation 3C–22
Main Data and Specifications 3C–23
Special Tools 3C–25

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The front suspension is designed to allow each wheel to compensate for changes in the road surface level without greatly affecting the opposite wheel. Each wheel is independently connected to the frame by a steering knuckle, ball joint assemblies, and upper and lower control arms. The front wheels are held in proper relationship to each other by two tie-rods which are connected to steering arms on the knuckles, and to a steering unit.

All models have a front suspension system consisting of control arms, stabilizer bar, shock absorber and a torsion bar. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into a height control arm at the crossmember. Vehicle trim height is controlled by adjusting this arm.

Shock absorbers are mounted between the brackets on the frame and the lower control arms. The lower portion of each shock absorber is attached to the lower control arm. The upper portion of each shock absorber extends through a frame bracket and is secured with two rubber bushings, two retainers and a nut.

Ball joint assemblies are bolted to the outer end of the upper and lower control arm and are attached to the steering knuckle.

The inner ends of the upper control arm have pressed in bushings. Bolts, passing through the bushing, attach the control arm to the frame. The inner ends of the lower control arm are attached to the frame by bolts passing through the bushings.

Side roll of the front suspension is controlled by a spring steel stabilizer bar. It is mounted in rubber bushings, which are held to the frame by brackets. The ends of the stabilizer bar are connected to the lower control arms by links.

Diagnosis

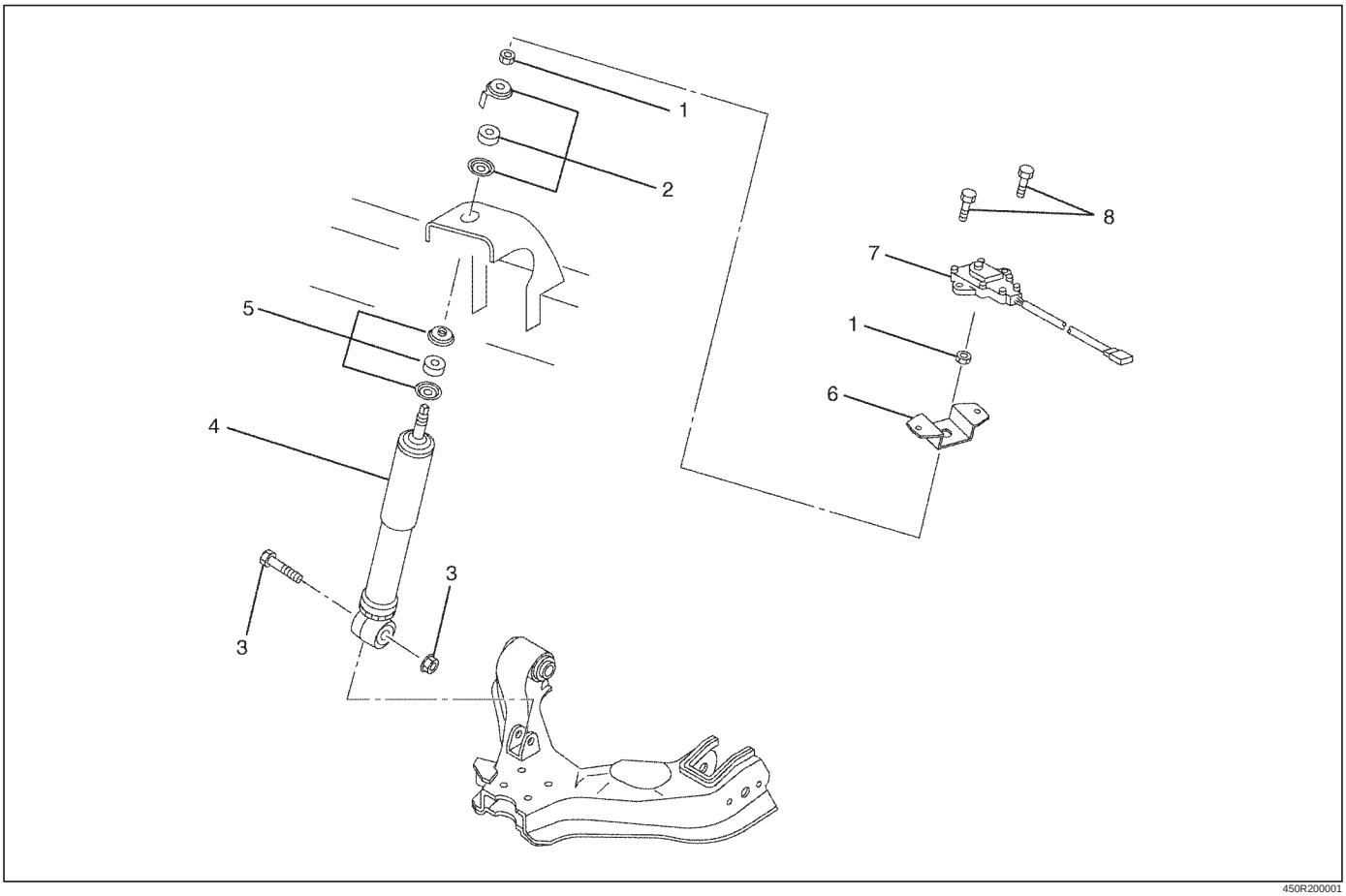
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.

Condition	Possible cause	Correction
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to *Steering section.*
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Shock Absorber

Shock Absorber and Associated Parts



450R200001

Legend

(1) Nut
(2) Rubber Bushing and Washer
(3) Bolt and Nut
(4) Shock Absorber
(5) Rubber Bushing and Washer
(6) Actuator Bracket
(7) Actuator
(8) Screw

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel Replacement in this section.*
3. Remove bolt and nut.
4. Remove ISC Actuator and Bracket. Refer to *Intelligent Suspension.*
5. Remove nut.
6. Remove rubber bushing and washer.
7. Remove shock absorber.
8. Remove rubber bushing and washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts :

▼ Shock absorber
▼ Rubber bushing

Installation

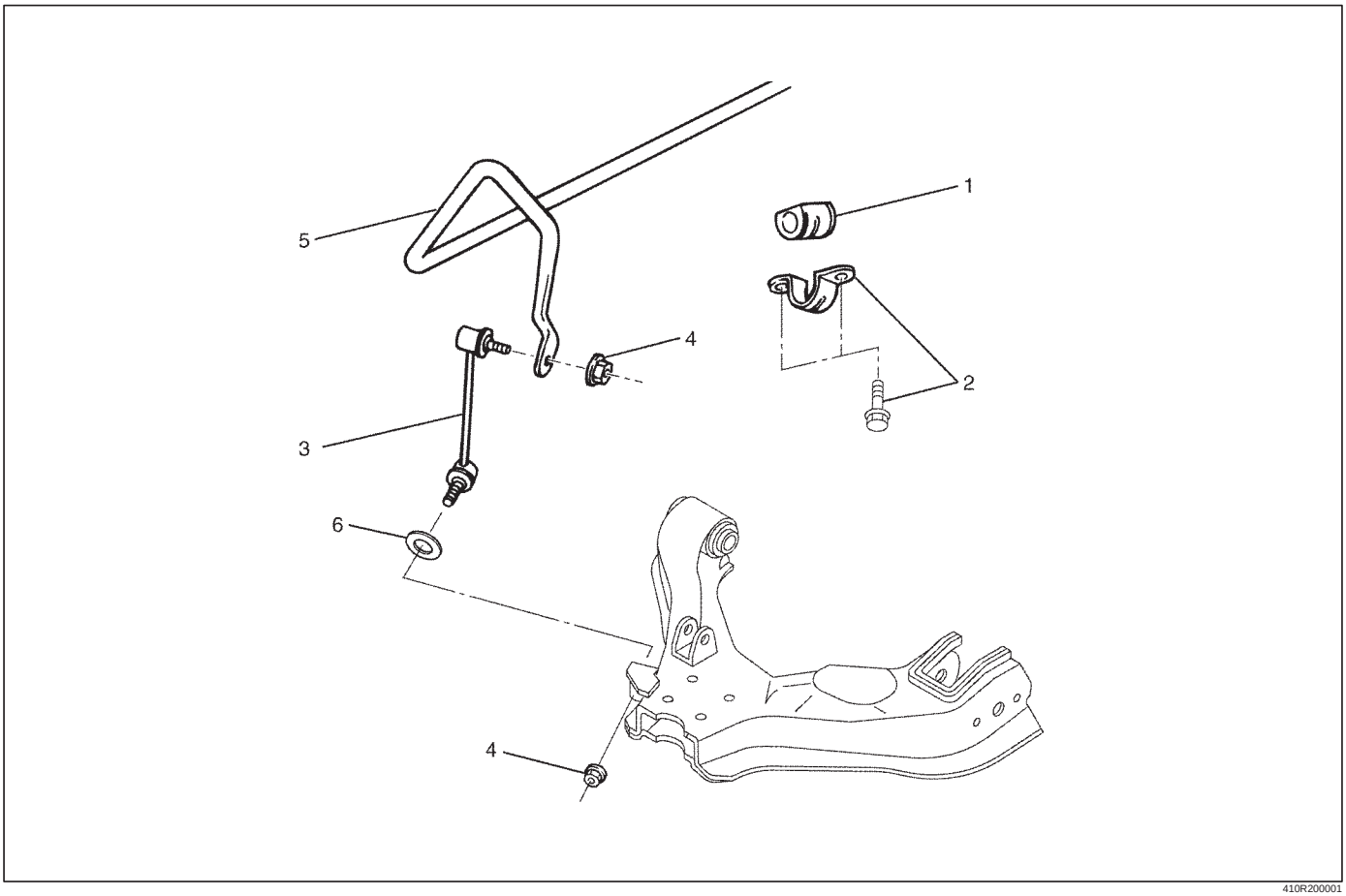
1. Install rubber bushing and washer.
2. Install shock absorber.
3. Install rubber bushing and washer.
4. Install nut, then tighten it to the specified torque.

   Torque: 20 N·m (14 lb ft)
5. Install ISC Actuator and Bracket. Refer to *Intelligent Suspension.*
6. Install bolt and nut, then tighten to the specified torque.

   Torque: 93 N·m (69 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



410R200001

Legend

(1) Rubber Bushing
(2) Bracket and Bolt
(3) Link
(4) Nut
(5) Stabilizer Bar
(6) Washer

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the stone guard.
3. Remove wheel and tire assembly. Refer to *Wheel Replacement in this section.*
4. Remove nut.

CAUTION: Be careful not to break the ball joint boot.

5. Remove link.
6. Remove bracket.
7. Remove stabilizer bar.
8. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

Check the following parts :

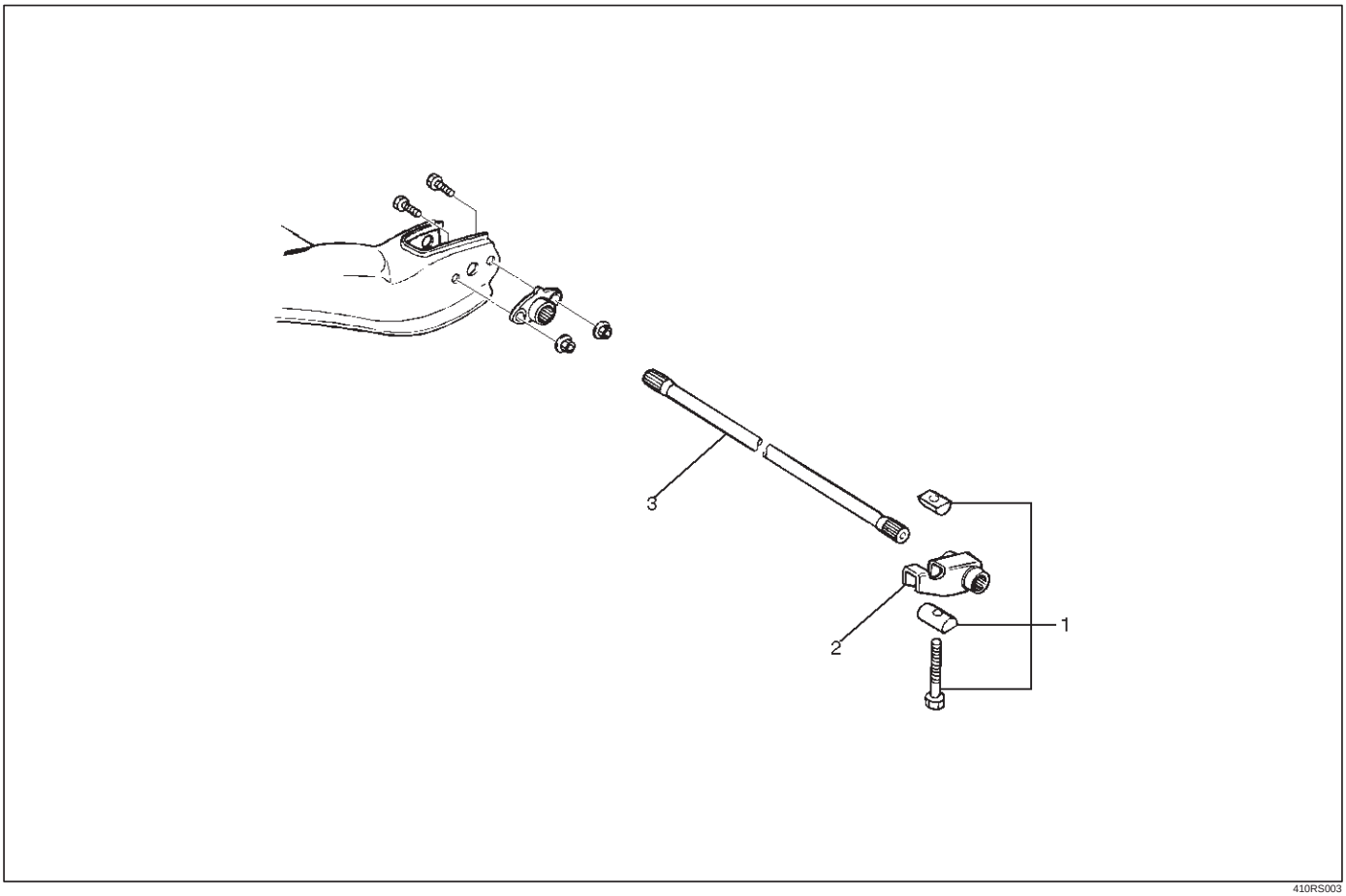
- ▼ Stabilizer bar
- ▼ Rubber bushing
- ▼ Link ball joint

Installation

1. Install rubber bushing.
2. Install stabilizer bar.
3. Install bracket, then tighten it to the specified torque.
   Torque: 25 N·m (18 lb ft)
4. Install link and Washer.
5. Install nut, then tighten it to the specified torque.
   Torque: 50 N·m (37 lb ft)

Torsion Bar

Torsion Bar and Associated Parts



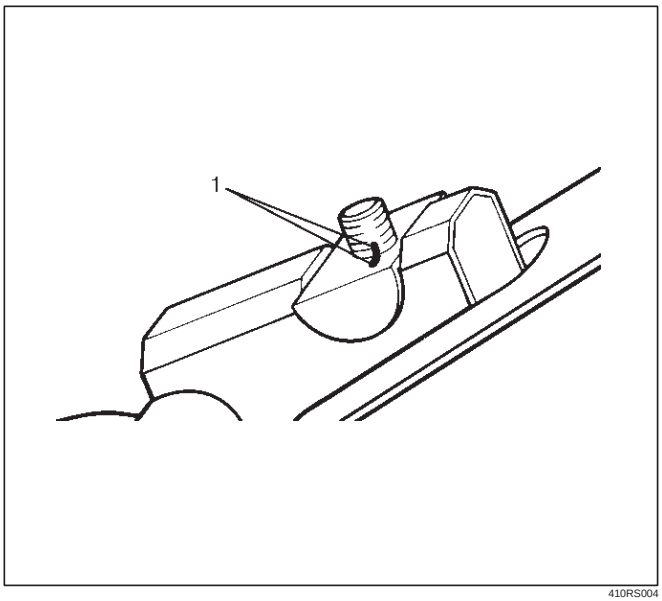
410RS003

Legend

(1) Adjust Bolt, End Piece and Seat
(2) Height Control Arm
(3) Torsion Bar

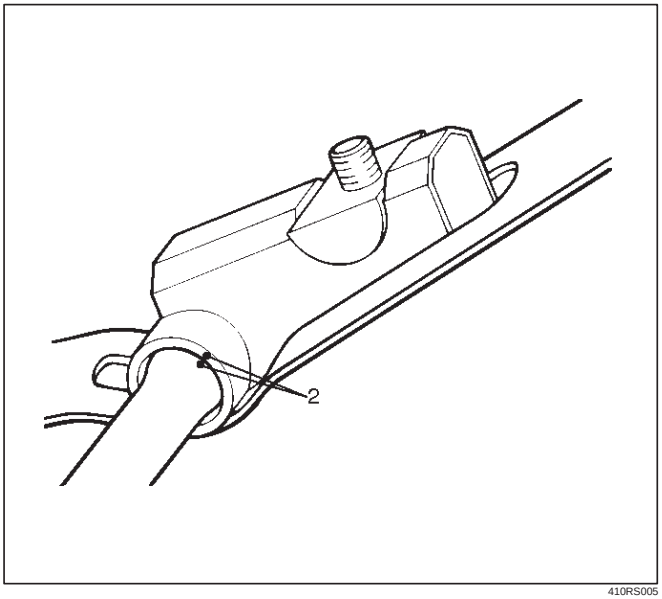
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Apply the setting marks(1) to the adjust bolt and end piece, then remove adjust bolt, end piece and seat.



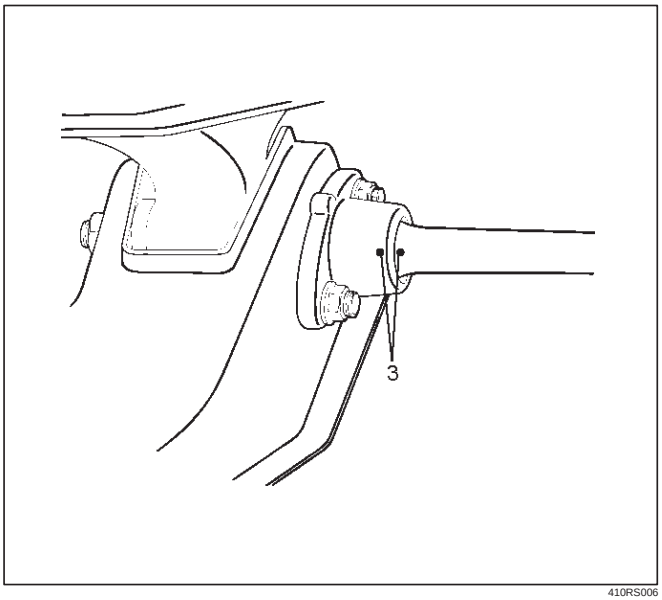
410RS004

3. Apply the setting marks(2) to the height control arm and torsion bar, then remove height control arm.



410RS005

4. Apply the setting marks(3) to the torsion bar and lower control arm, then remove torsion bar.



410RS006

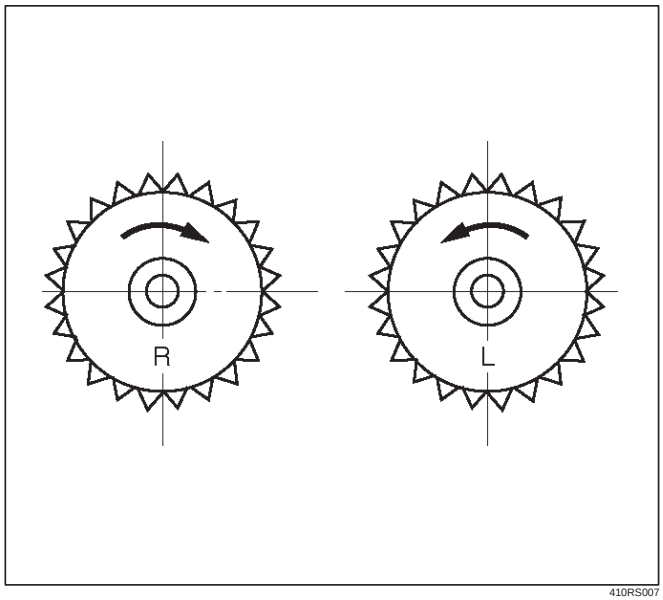
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

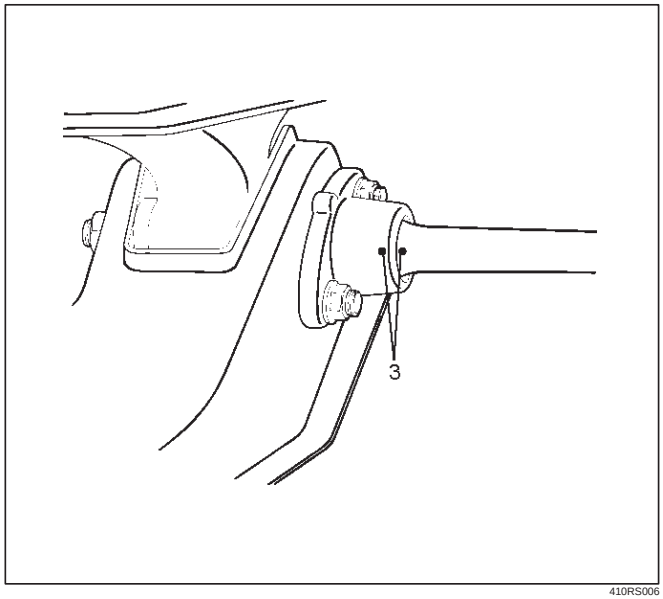
- ▼ Torsion bar
- ▼ Height control arm
- ▼ Adjust bolt
- ▼ Rubber seat

Installation

1. Apply grease to the serrated portions, then install torsion bar. Make sure the bars are on their correct respective sides and align the setting marks(3).

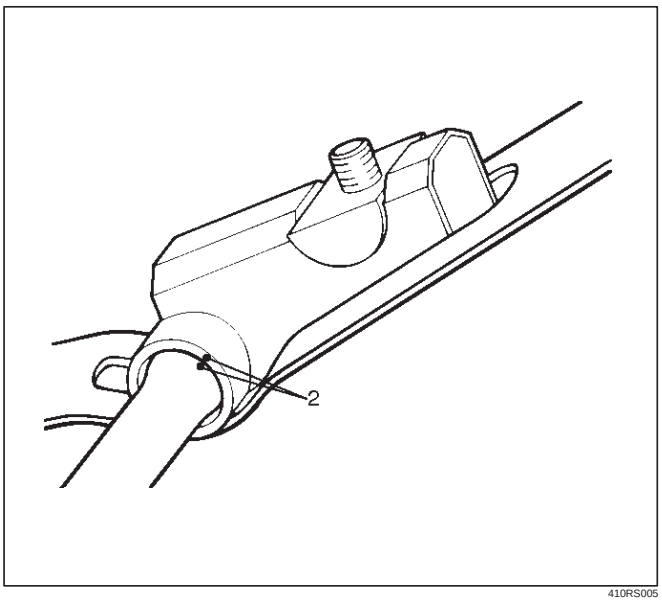


410RS007



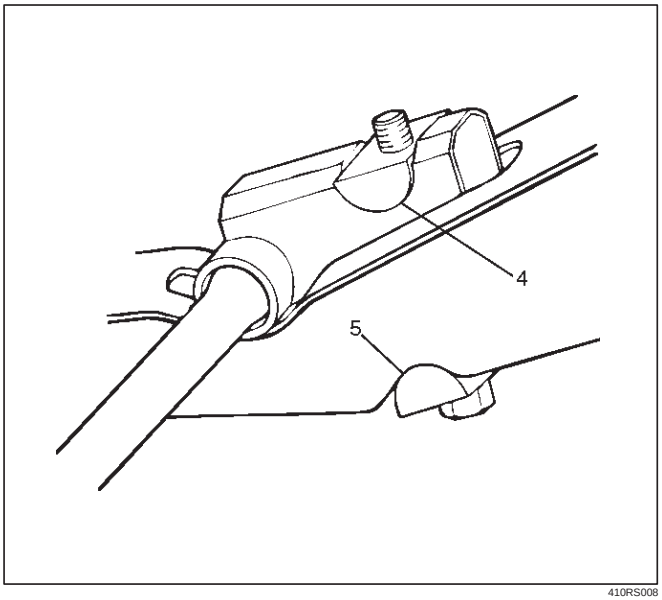
410RS006

2. Apply grease to the portion that fits into the bracket then install height control arm and align the setting marks(2).



410RS005

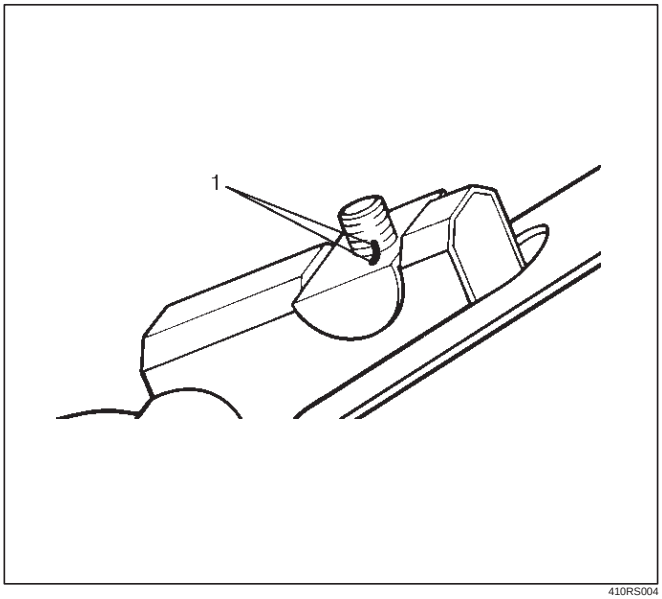
3. Apply grease to the bolt portion of the end piece(4). Apply grease to the portion of the seat(5) that fits into the bracket.



410RS008

4. Apply grease to the serrated portions.
5. Install adjust bolt and seat, then turn the adjust bolt to the setting mark(1) applied during disassembly.

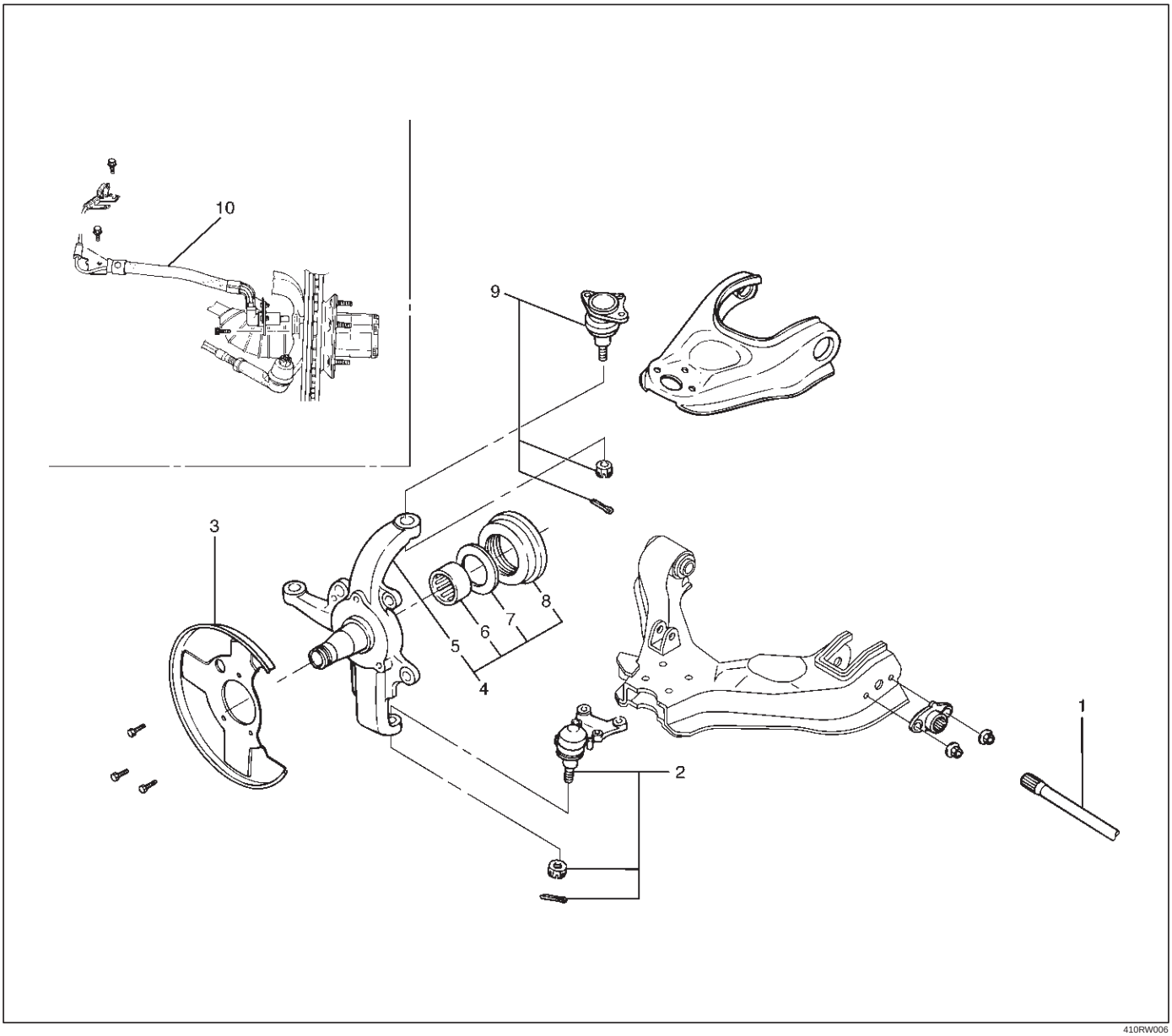
NOTE: Adjust the trim height. Refer to *Front End Alignment Inspection and Adjustment in Steering section.*



410RS004

Knuckle

Knuckle and Associated Parts



410RW006

Legend

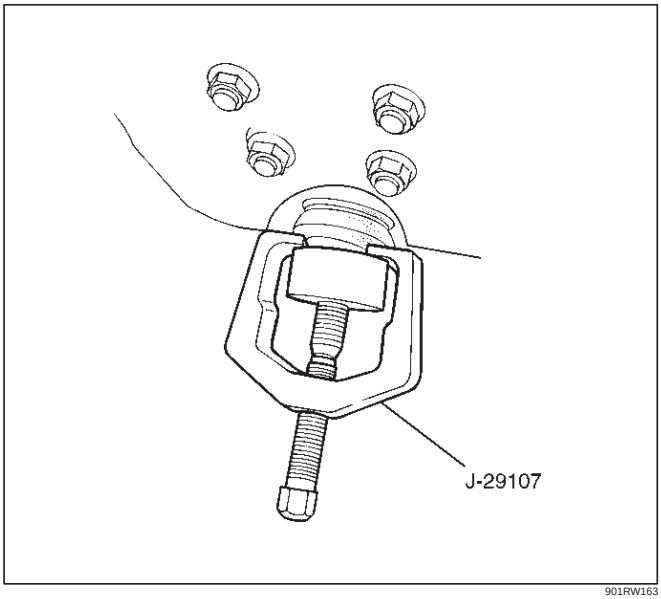
(1) Torsion Bar
(2) Lower Ball Joint, Nut and Cotter Pin
(3) Back Plate
(4) Knuckle Assembly
(5) Knuckle
(6) Needle Bearing (4WD MODEL)
(7) Thrust Washer (4WD MODEL)
(8) Oil Seal (4WD MODEL)
(9) Upper Ball Joint, Nut and Cotter Pin
(10) Wheel Speed Sensor

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel in this section.*
3. Remove the brake caliper. Refer to *Disc Brakes in Brake section.*
4. Remove the hub assembly. Refer to *Front Hub and Disk in this section.*
5. Remove tie–rod end from the knuckle. Refer to *Power Steering Unit in Steering section.*
6. Remove the speed sensor from the knuckle.
7. Loosen torsion bar by height control arm adjust bolt, then remove torsion bar. Refer to *Torsion Bar in this section.*
8. Remove wheel speed sensor.

9. Remove back plate.
10. Remove lower ball joint by using remover J–29107.

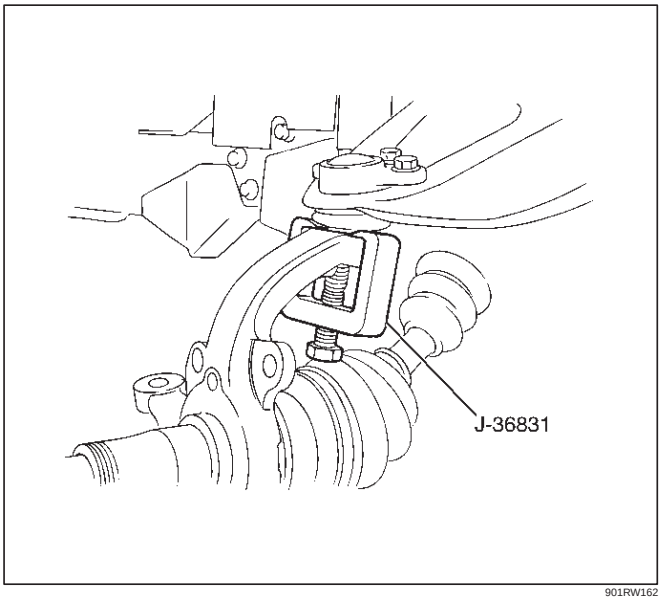
CAUTION: Be careful not to damage the ball joint boot.



901RW163

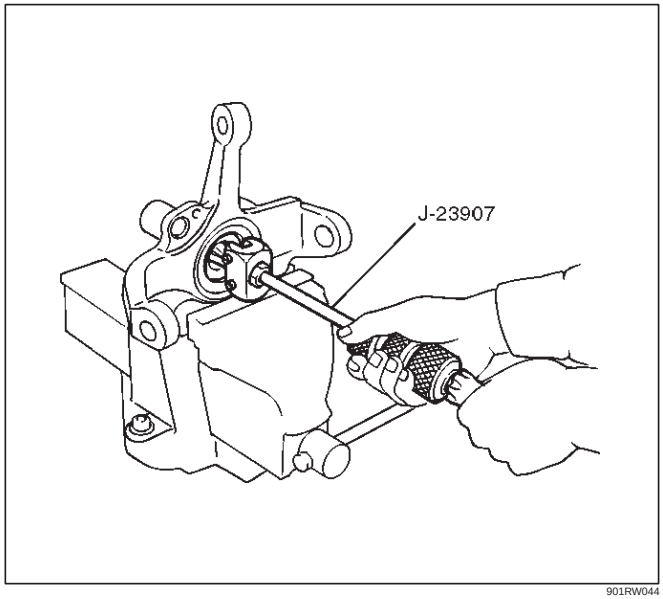
11. Remove upper ball joint by using remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.



901RW162

12. Remove knuckle assembly.
13. Remove oil seal (Except 2WD model).
14. Remove washer (Except 2WD model).
15. Remove needle bearing by using remover J–23907 (Except 2WD model).



901RW044

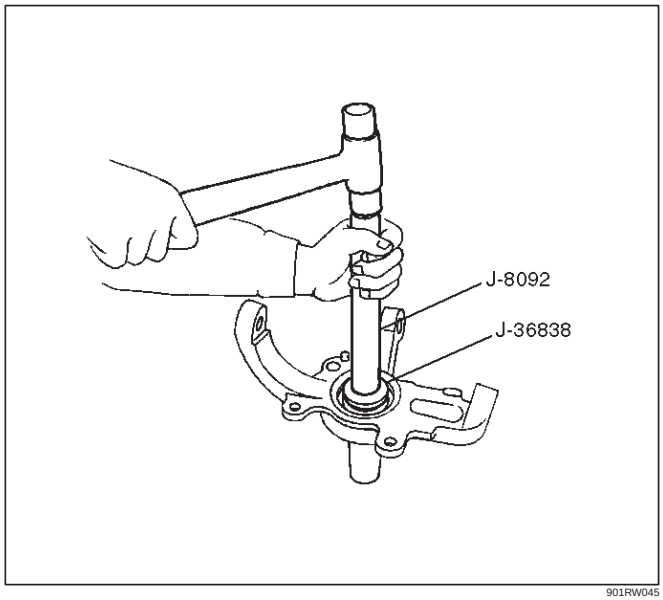
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼Knuckle
- ▼Knuckle arm
- ▼Needle bearing
- ▼Thrust washer

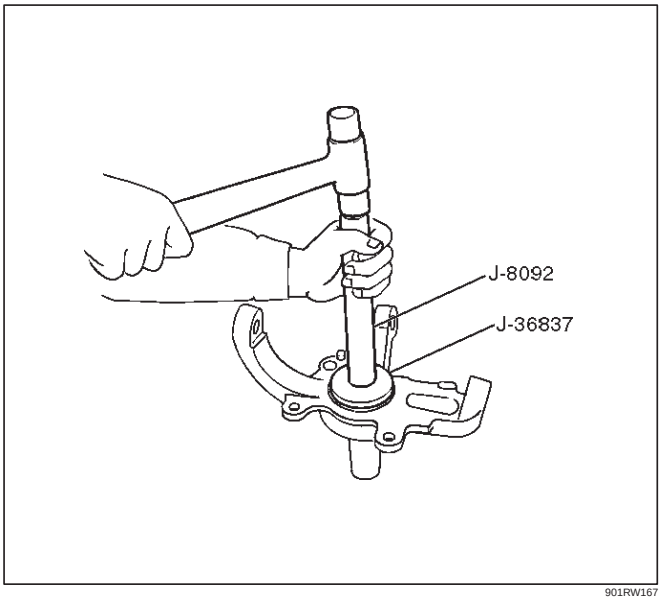
Installation

1. Apply appropriate amount of multipurpose type grease to the new bearing (Approx. 5 g) and install needle bearing by using installer J–36838 and J–8092 (Except 2WD model).



901RW045

2. Apply multipurpose type grease to the thrust washer, and install washer with chamfered side facing knuckle (Except 2WD model).
3. Use a new oil seal, and apply multipurpose type grease to the area surrounded by the lip (approx. 2 g). Then use installer J–36837 and J–8092 to install oil seal. After fitting the oil seal to the installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer (Except 2WD model).



901RW167

4. Install knuckle assembly.
5. Install upper ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

6. Install lower ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

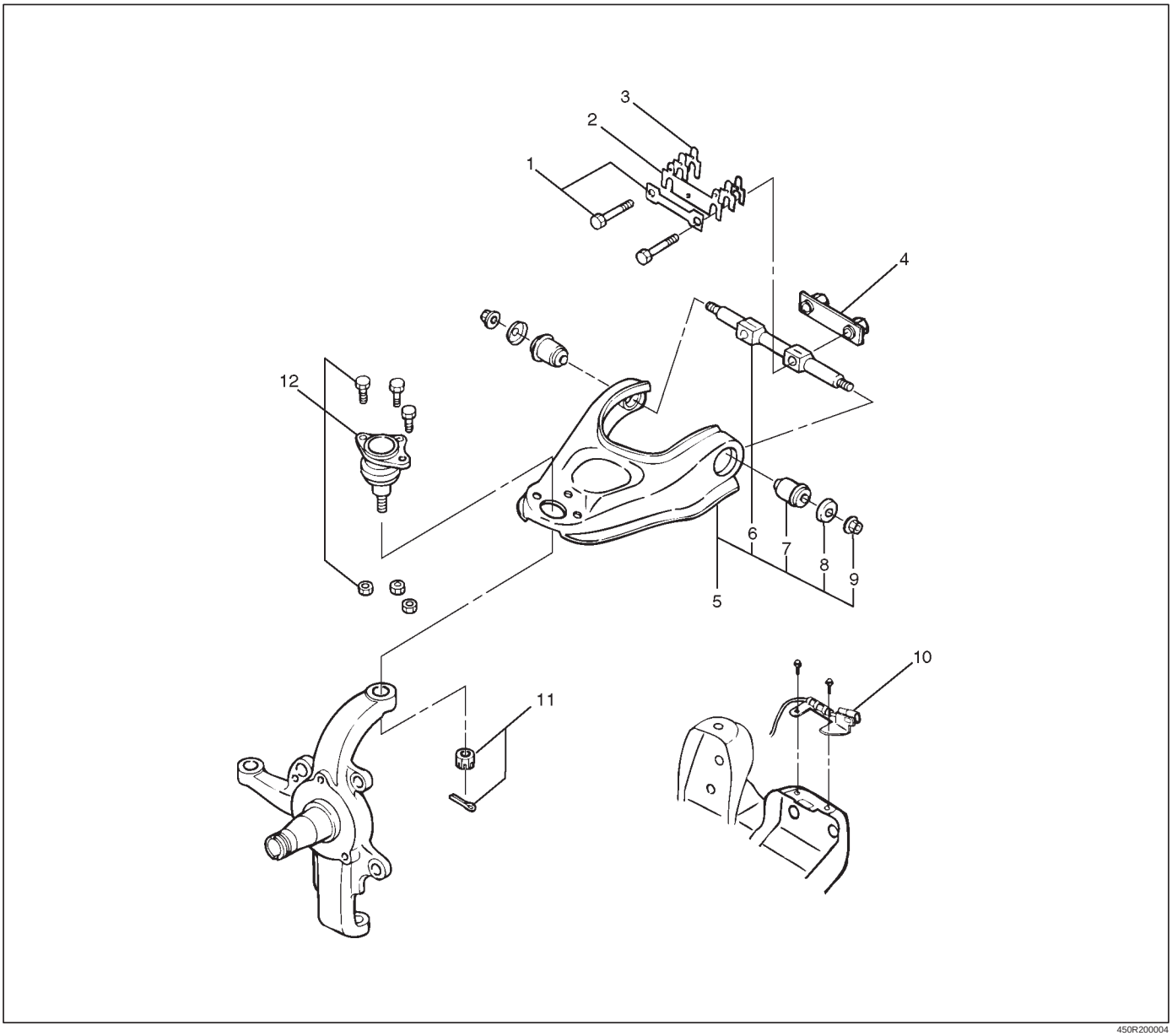
Torque: 147 N·m (108 lb ft)

7. Install back plate.
8. Install wheel speed sensor.
9. Install torsion bar, refer to *Torsion Bar in this section.*

NOTE: Adjust the trim height. Refer to *Front End Alignment Inspection and Adjustment in Steering.*

Upper Control Arm

Upper Control Arm and Associated Parts



450R200004

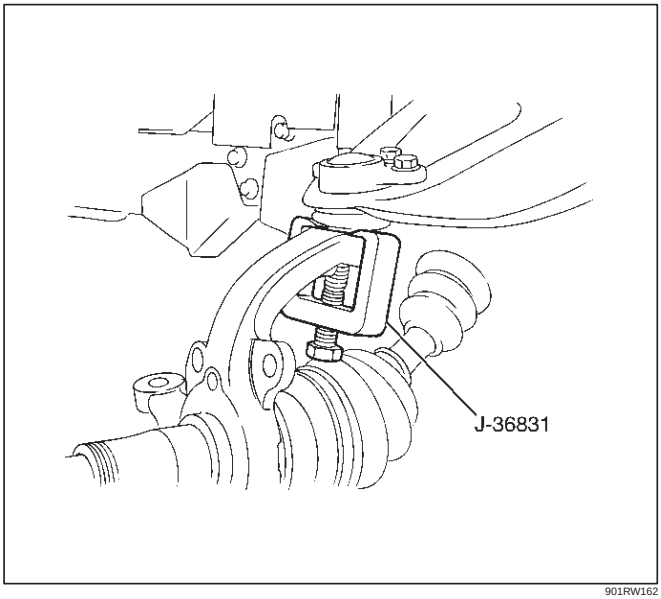
Legend

(1) Bolt and Plate
(2) Camber Shims
(3) Caster Shims
(4) Nut Assembly
(5) Upper Control Arm Assembly
(6) Fulcrum Pin
(7) Bushing
(8) Plate
(9) Nut
(10) Speed Sensor Cable
(11) Nut and Cotter Pin
(12) Upper Ball Joint

Removal

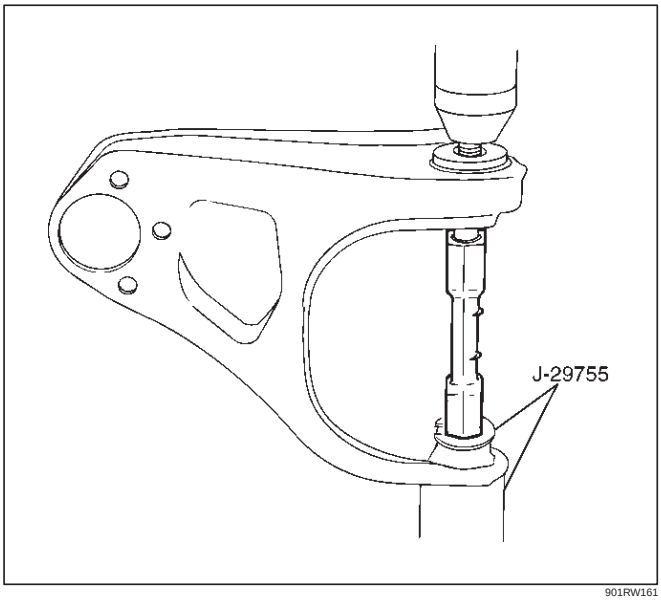
1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel in this section.*
3. Remove the brake caliper and disconnect brake pipe. Refer to *Disc Brakes in Brake section.*
4. Support lower control arm with a jack.
5. Remove speed sensor cable.
6. Remove nut and cotter pin then use remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.

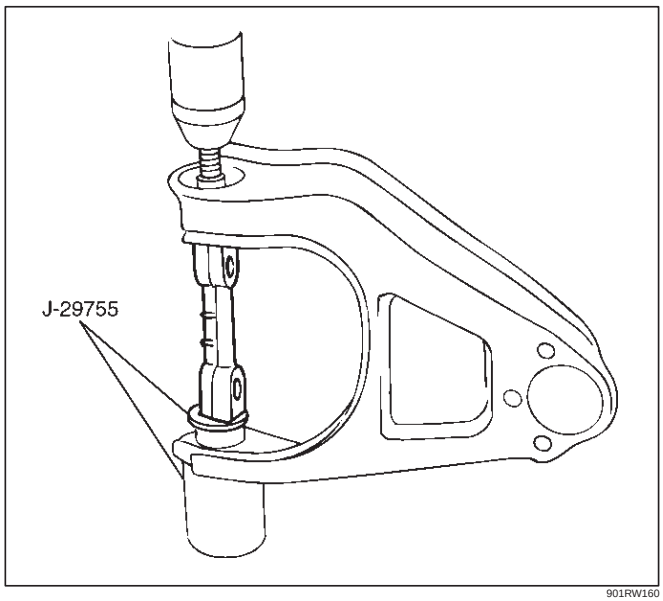


901RW162

7. Remove upper ball joint.
8. Remove bolt and plate.
9. Remove nut assembly.
10. Remove camber shims and note the positions and number of shims.
11. Remove caster shims and note the positions and number of shims.
12. Remove upper control arm assembly.
13. Remove nut.
14. Remove plate.
15. Remove bushing by using remover J–29755.



901RW161



901RW160

16. Remove fulcrum pin.

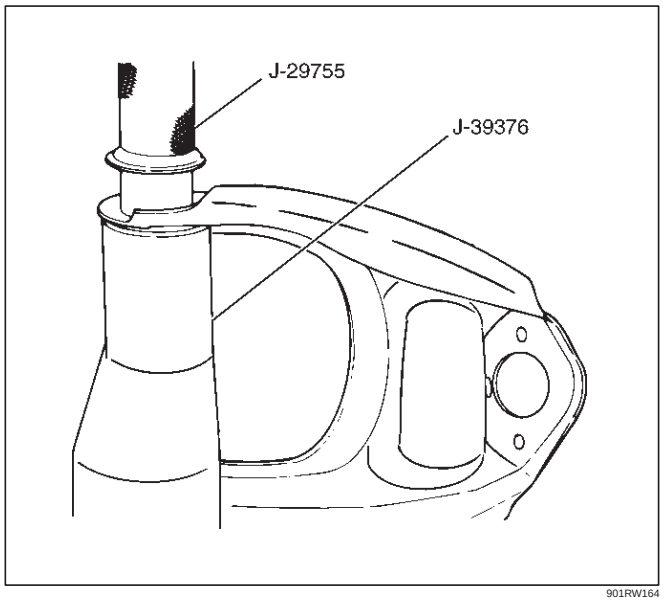
Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

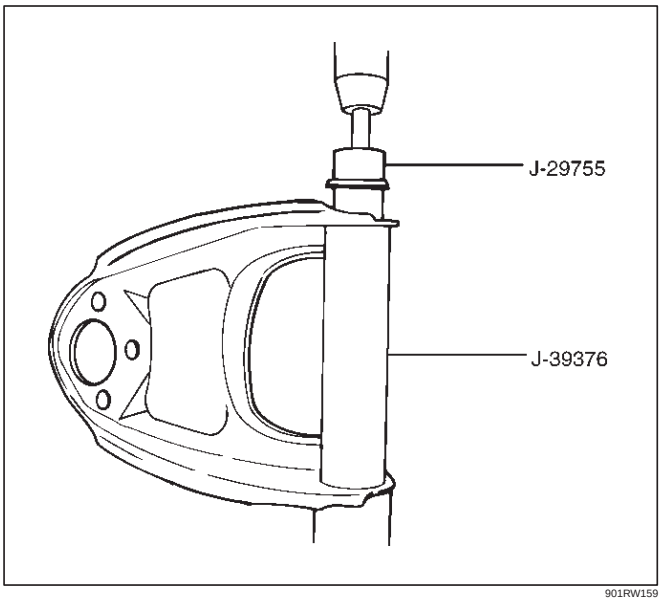
- ▼ Upper control arm
- ▼ Bushing
- ▼ Fulcrum pin

Installation

1. Install fulcrum pin.
2. Install bushing by using installer J–29755 and J–39376.



901RW164



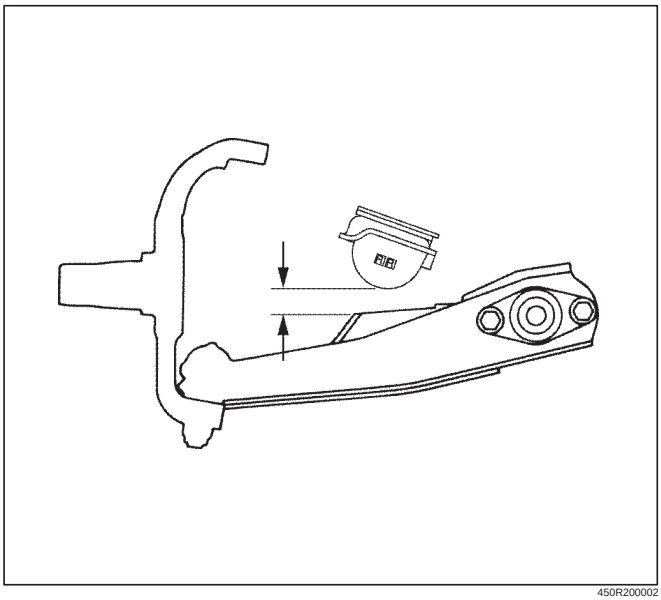
901RW159

3. Install plate.
4. Install nut and tighten fulcrum pin nut finger–tight.

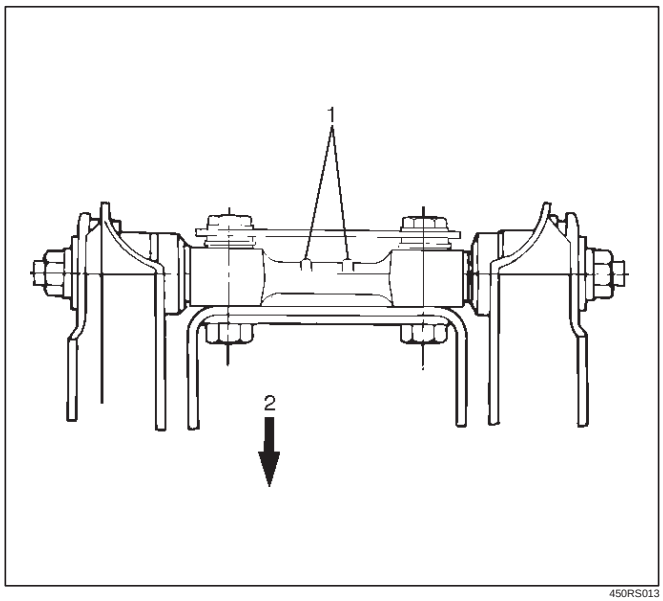
NOTE: Torque fulcrum pin nut after adjusting buffer clearance.

Buffer clearance: 15 mm (0.59 in)

Torque: 108 N·m (80 lb ft)


450R200002

5. Install upper control arm assembly with the fulcrum pin projections turned inward.

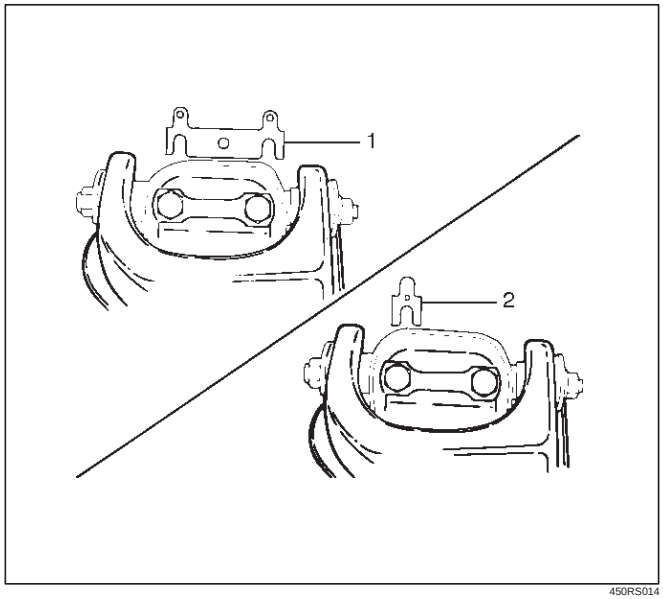


450RS013

Legend

(1) Projection
(2) Outward

6. Install the caster shims(2) between the chassis frame and fulcrum pin.
7. Install the camber shims(1) between the chassis frame and fulcrum pin.



450RS014

8. Install nut assembly.
9. Install bolt and plate, then tighten the bolt to the specified torque.

Torque: 152 N·m (112 lb ft)

10. Install upper ball joint and tighten it to the specified torque.

Torque: 57 N·m (42 lb ft)

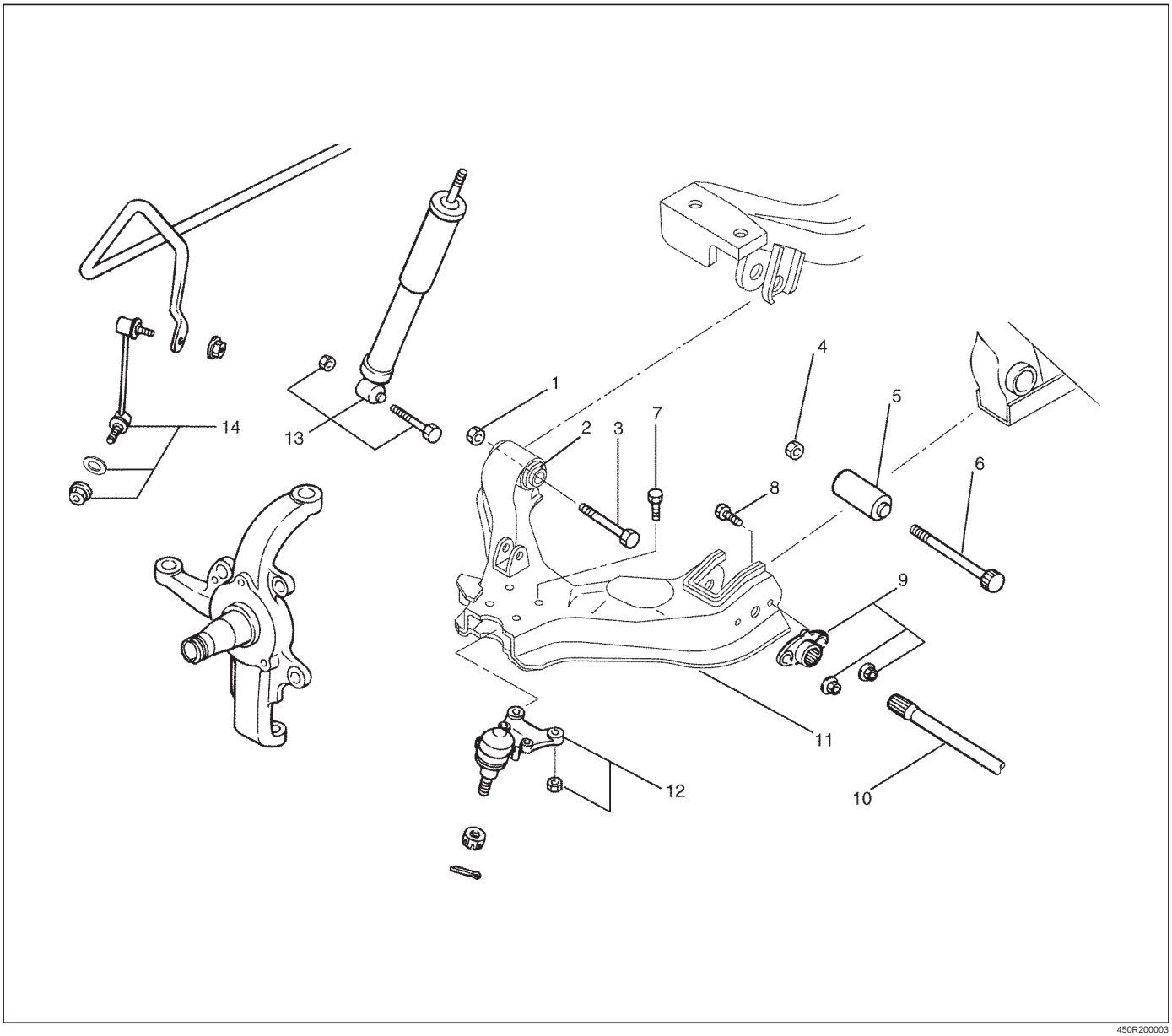
11. Install nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

12. Install speed sensor cable.

Lower Control Arm

Lower Control Arm and Associated Parts



450R200003

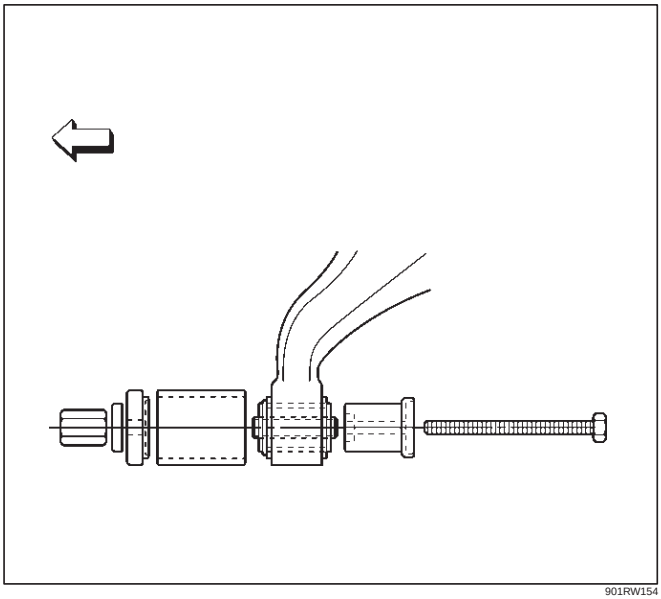
Legend

(1) Nut, Front
(2) Bush, Front
(3) Bolt, Front
(4) Nut, Rear
(5) Bush, Rear
(6) Bolt, Rear
(7) Bolt, Lower Ball Joint
(8) Bolt, Torsion Bar Arm
(9) Torsion Bar Arm Bracket and Nut
(10) Torsion Bar
(11) Lower Control Arm
(12) Lower Ball Joint and Nut
(13) Shock Absorber
(14) Stabilizer Link

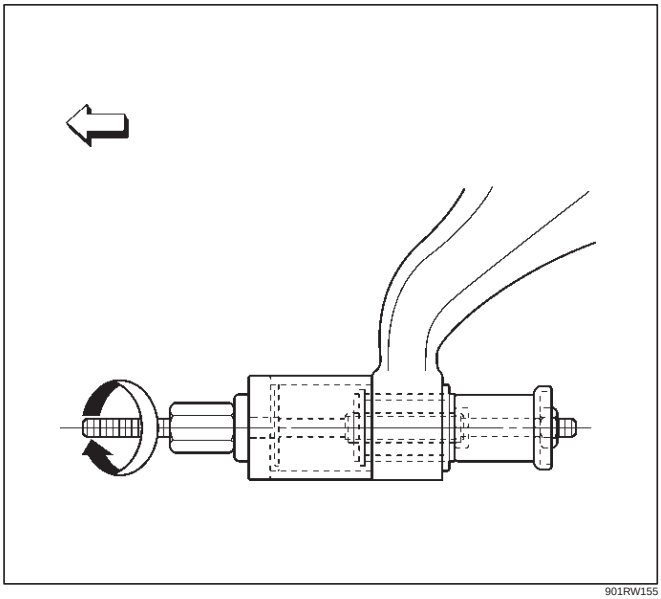
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel in this section.*
3. Remove the tie-rod end from the knuckle. Refer to *Power Steering Unit in Steering section.*
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to *Front Hub and Disc in Driveline/Axle section.*
5. Support lower control arm with a jack.

6. Remove front nut.
7. Remove rear nut.
8. Remove torsion bar, refer to *Torsion Bar in this section.*
9. Remove torsion bar arm bracket.
10. Disconnect the stabilizer link at the lower control arm.
11. Remove the shock absorber lower end from the lower control arm.
12. Remove the lower ball joint from the lower control arm.
13. Remove front bolt.
14. Remove rear bolt.
15. Remove lower control arm.
16. Remove torsion bar arm bolt.
17. Remove lower ball joint bolt.
18. Remove front bushing by using remover J–36833.

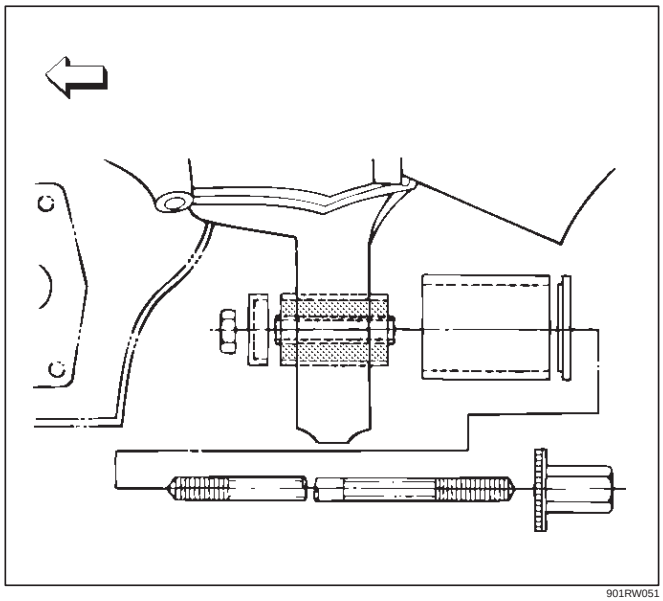


901RW154

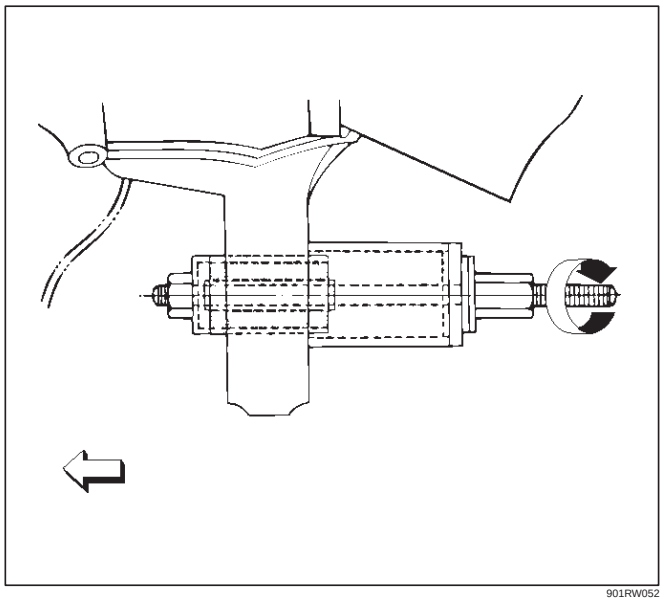


901RW155

19. Remove rear bushing by using remover J–36834.



901RW051



901RW052

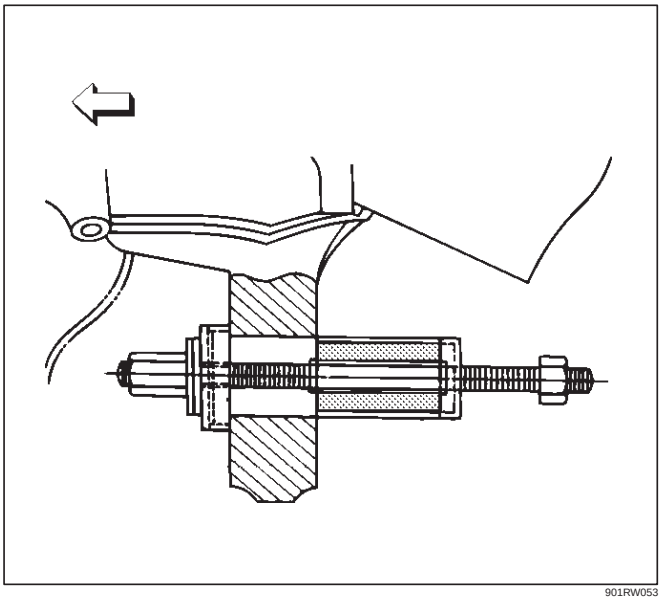
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼Lower control arm
- ▼Bushing

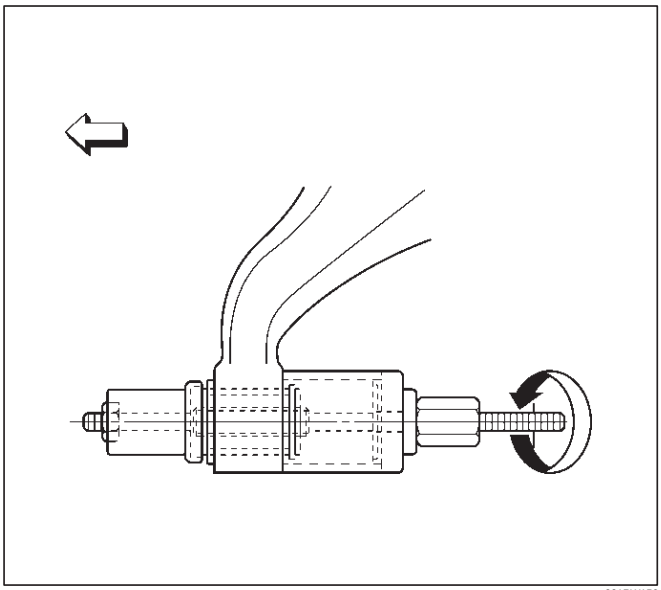
Installation

1. Install rear bushing by using installer J–36834.



901RW053

2. Install front bushing by using installer J–36833.



901RW156

3. Install lower ball joint bolt.
4. Install torsion bar arm bolt.
5. Install lower control arm.
6. Install rear bolt.
7. Install front bolt.
8. Install lower ball joint and tighten it to the specified torque.

   Torque: 116 N·m (85 lb ft)
9. Install shock absorber and tighten it to the specified torque.

   Torque: 93 N·m (69 lb ft)
10. Install stabilizer link and tighten it to the specified torque.

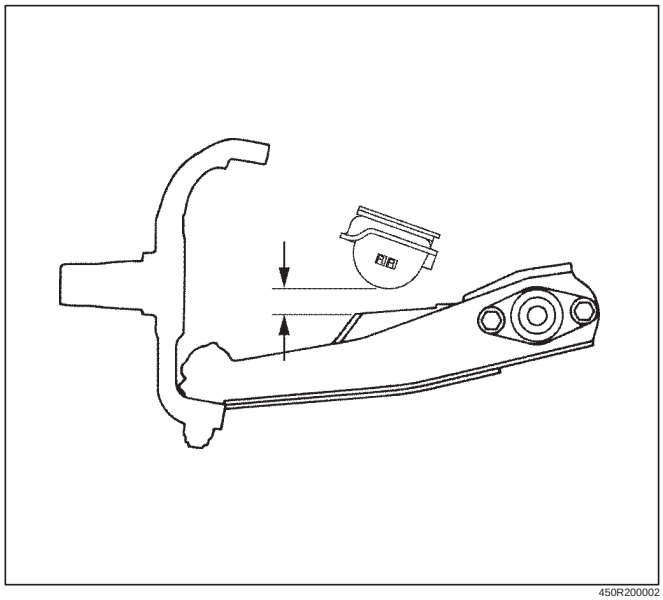
    Torque: 50 N·m (37 lb ft)
11. Install torsion bar arm bracket and tighten it to the specified torque.

    Torque: 116 N·m (85 lb ft)
12. Install Torsion bar, refer to *Torsion Bar in this section.*
13. Install rear nut and tighten lower link nut finger–tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance.

Buffer clearance: 15 mm (0.59 in)

Torque: 235 N·m (174 lb ft)



450R200002

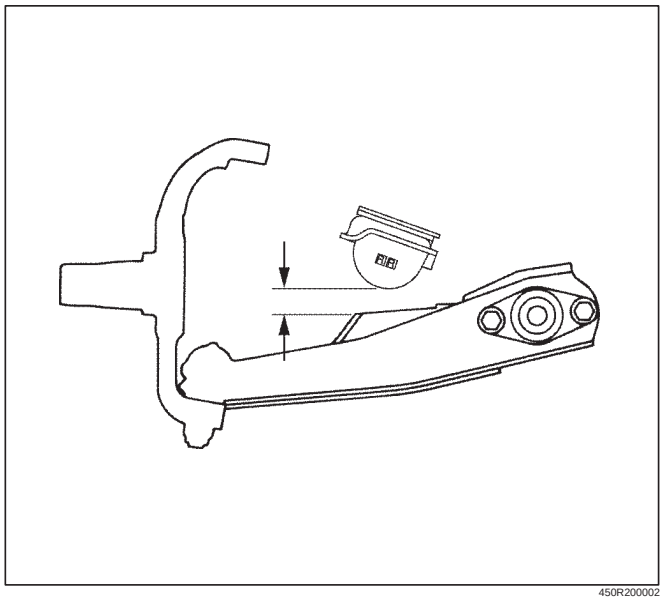
14. Install front nut then tighten lower link nut finger-tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance .

Buffer clearance: 15 mm (0.59 in)

Torque: 186 N·m (137 lb ft)

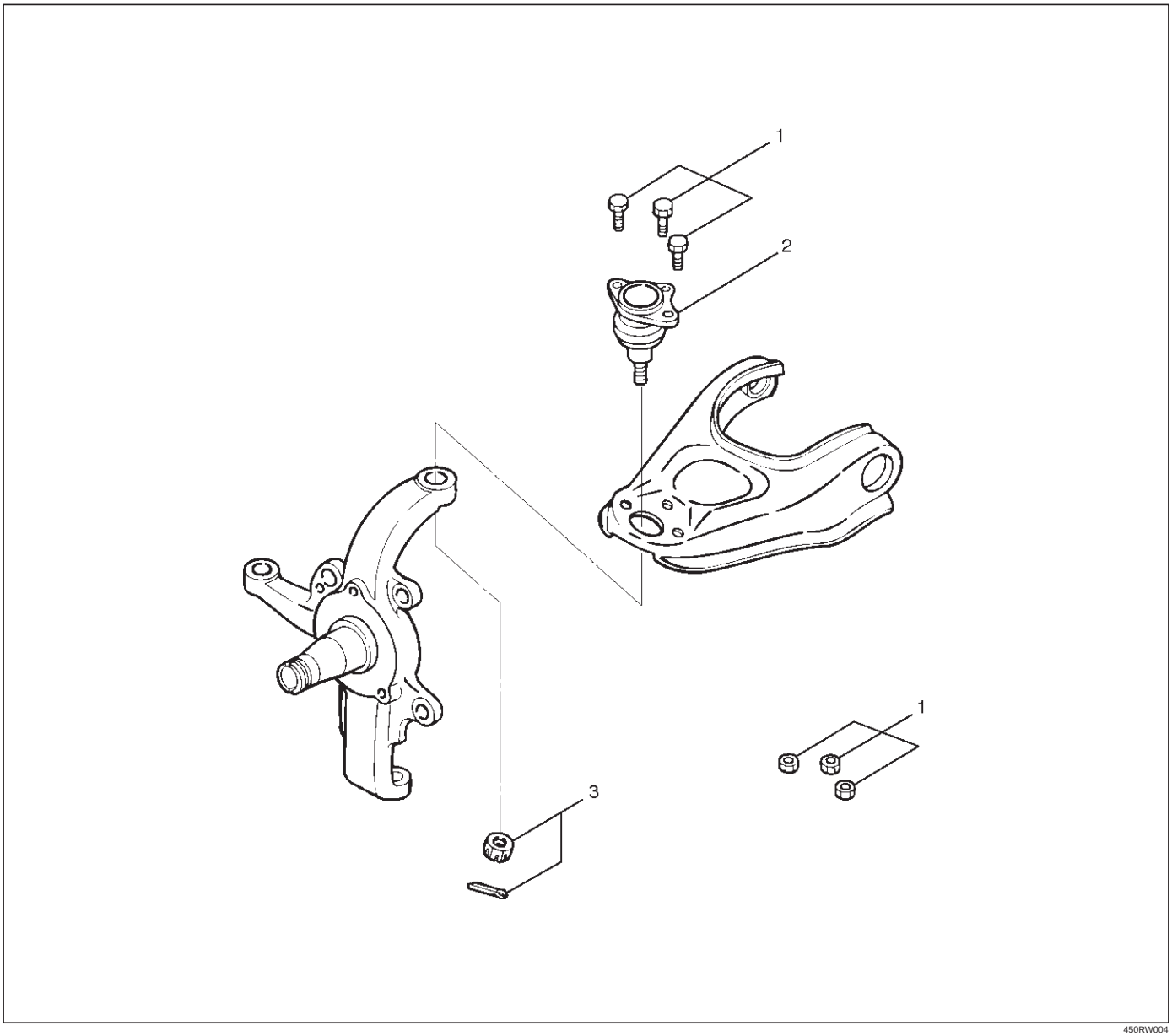
NOTE: Adjust the trim height. Refer to *Front End Alignment Inspection and Adjustment in Steering section.*



450R200002

Upper Ball Joint

Upper Ball Joint and Associated Parts



450RW004

Legend

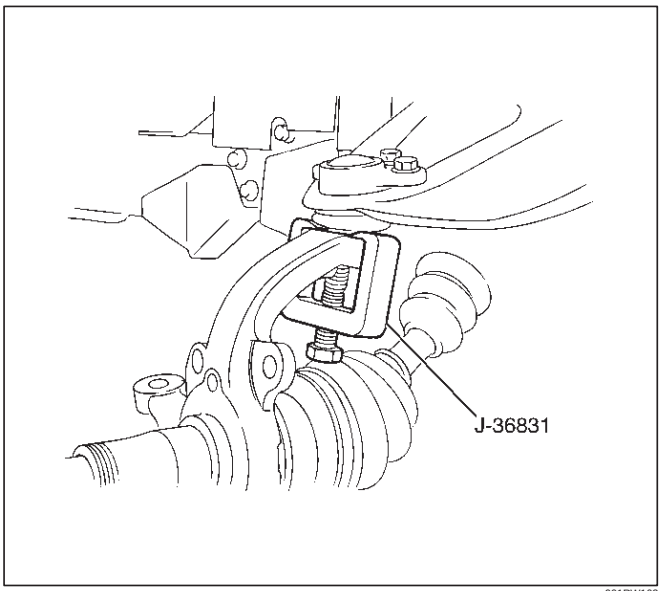
(1) Bolt and Nut
(2) Upper Ball Joint
(3) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the speed sensor from the knuckle.

3. Remove upper ball joint nut and cotter pin, then use remover J–36831 to remove the upper ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



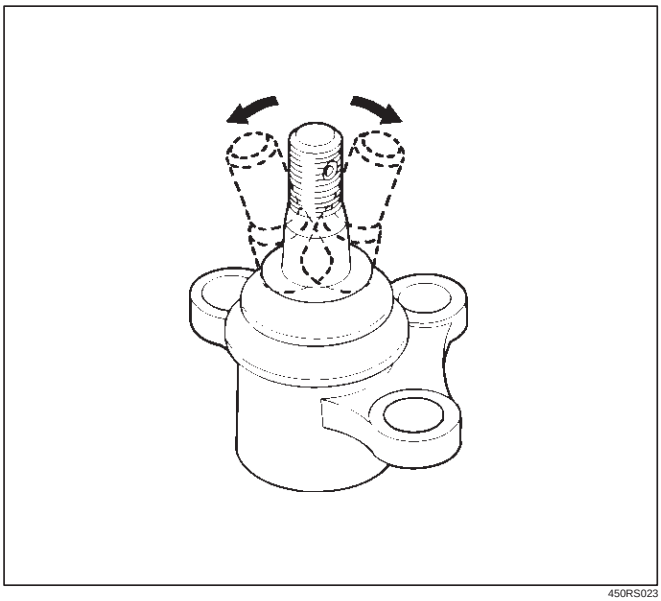
901RW162

4. Remove bolt and nut.
5. Remove upper ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

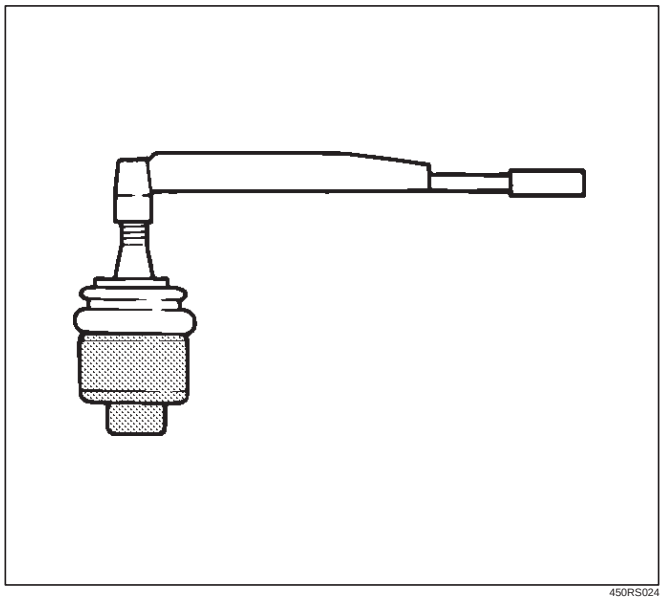
- ▼ Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.
- ▼ Inspect screw/taper area of ball for damage.
- ▼ If any defects are found by the above inspections, replace the ball joint assembly with a new one.



450RS023

- ▼ After moving the ball joint 4 or 5 times, attach nut then measure the preload.

Starting torque: 0.5 –3.2 N·m (0.4–2.4 lb ft)



450RS024

If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install upper ball joint.
2. Install bolt and nut, then tighten them to the specified torque.

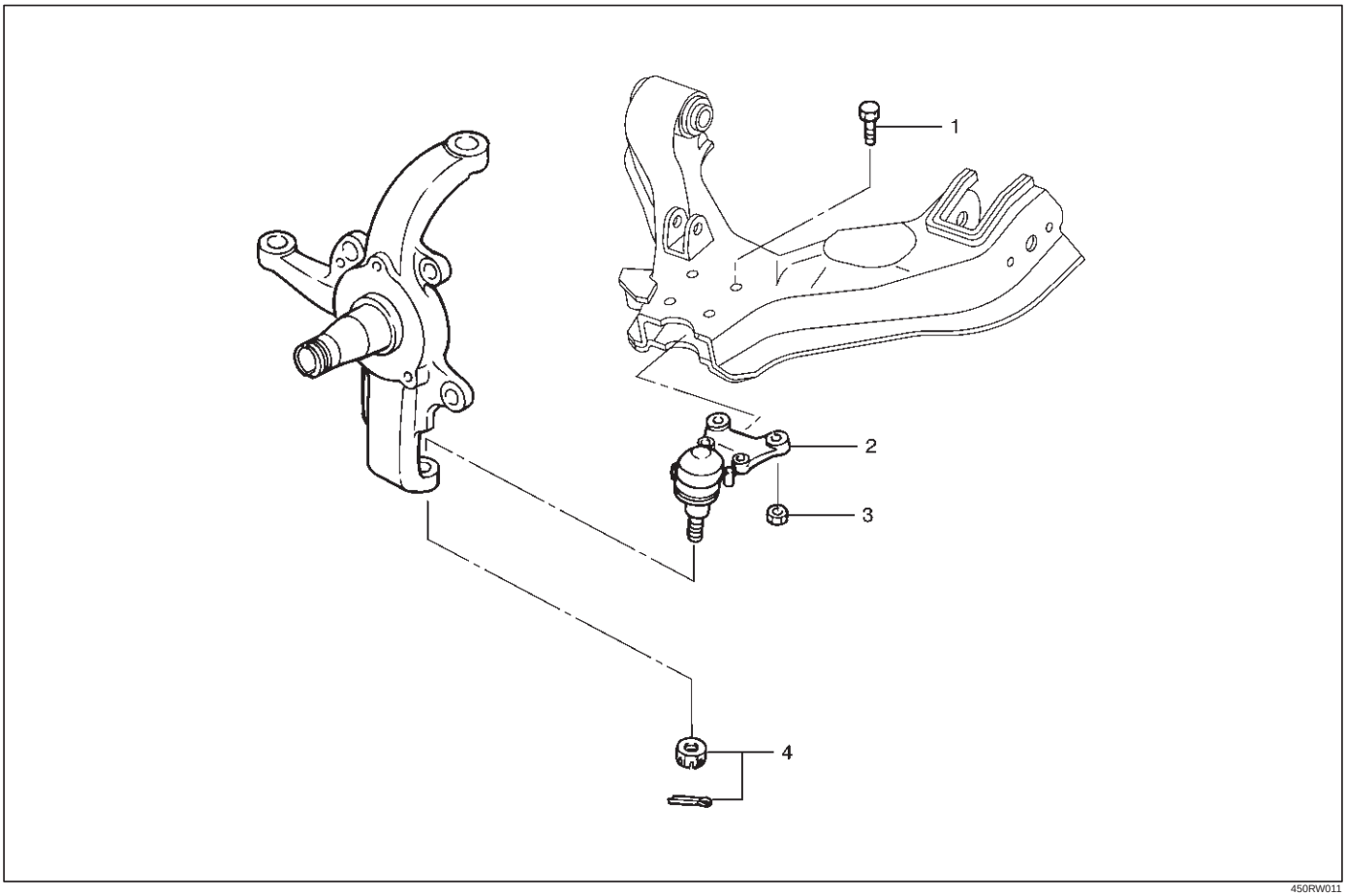
Torque: 57 N·m (42 lb ft)

3. Install nut and cotter pin, then tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

Lower Ball Joint

Lower Ball Joint and Associated Parts



450RW011

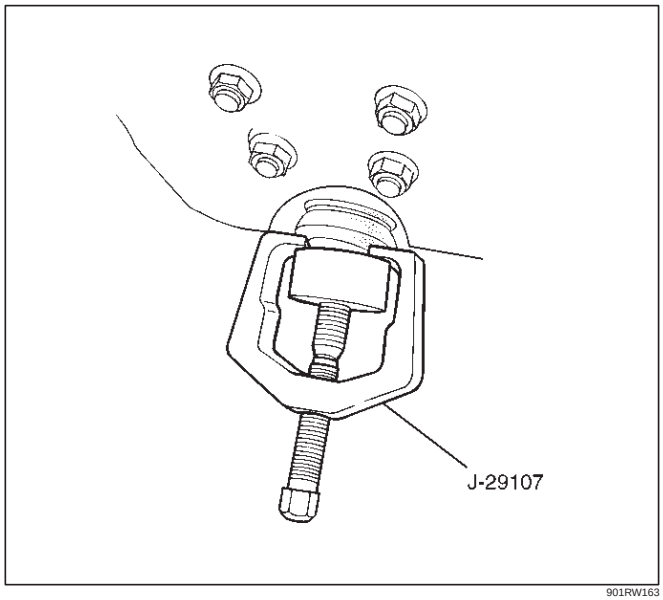
Legend

(1) Bolt
(2) Lower Ball Joint
(3) Nut
(4) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel in this section.*
3. Remove the tie-rod end from the knuckle. Refer to *Power Steering Unit in Steering section.*
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to *Front Hub and Disc in Driveline/Axle section.*
5. Support lower control arm with a jack.
6. Remove lower ball joint nut and cotter pin, then use remover J–29107 to remove the lower ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



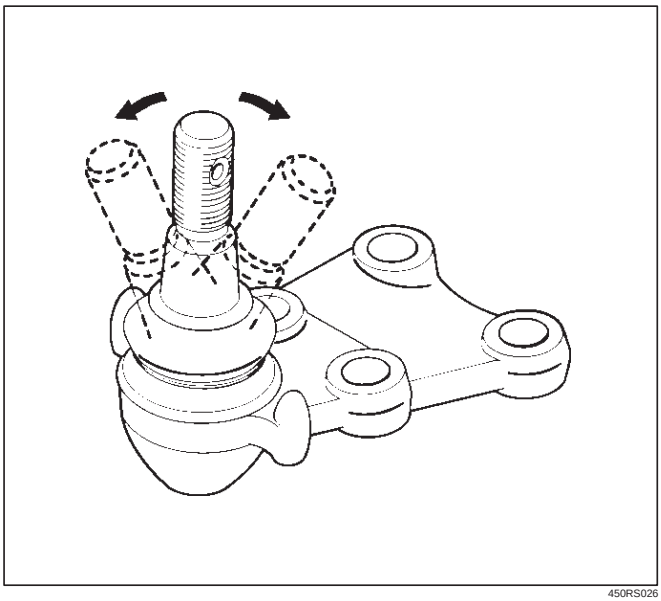
901RW163

7. Remove nut.
8. Remove bolt.
9. Remove lower ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

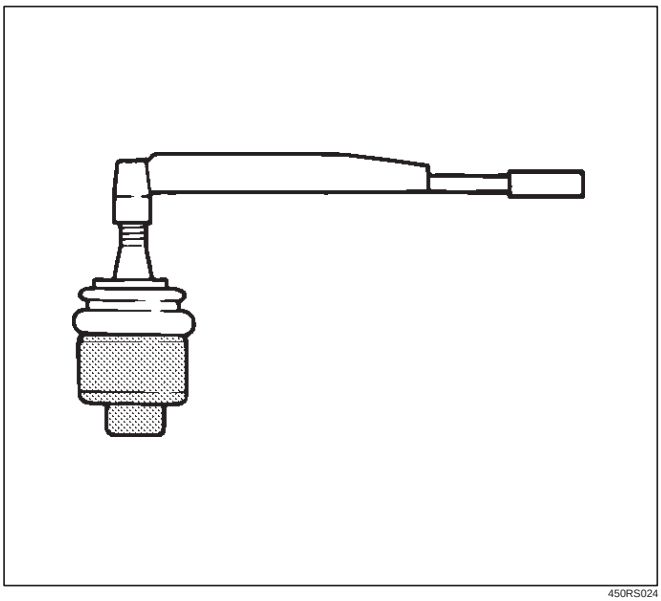
- ▼ Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement .
- ▼ Inspect screw/taper area of ball for damage.
- ▼ If any defects are found by the above inspections, replace the ball joint assembly with a new one.



450RS026

- ▼ After moving the ball joint 4 or 5 times, attach nut the measure the preload.

Starting torque: 0.5–6.4 N·m (0.4–4.7 lb ft)



450RS024

- ▼ If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install lower ball joint.
2. Install bolt.
3. Install nut and tighten it to the specified torque.

   Torque: 116 N·m (85 lb ft)
4. Install ball joint nut, then tighten it to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

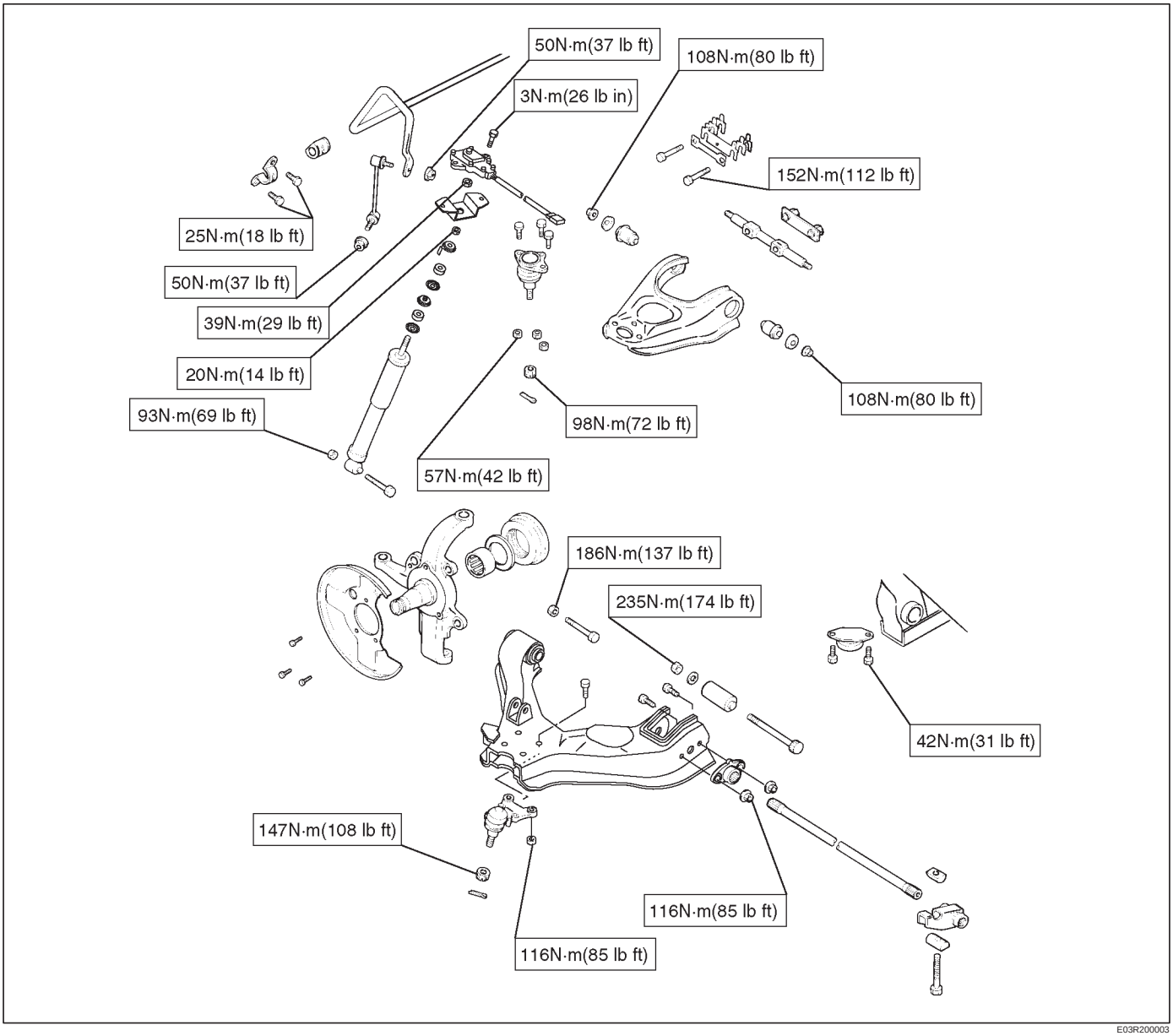
   Torque: 147 N·m (108 lb ft)

Main Data and Specifications

General Specifications

Front suspension	Type	Independent wishbone arms, torsion bar spring with stabilizer bar.
Torsion bar spring	Length	1142 mm (45.0 in)
	Diameter	29.0 mm (1.14 in)
Front shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30.0 mm (1.18 in)
	Stroke	115.0 mm (4.53 in)
	Compressed length	255.0 mm (10.04 in)
	Extended length	370.0 mm (14.57 in)
Stabilizer bar	Diameter	25.0 mm (0.98 in)

Torque Specifications



E03R200003

Special Tools

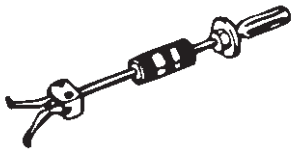
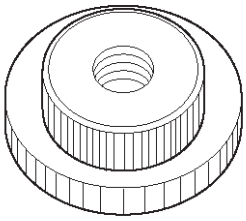
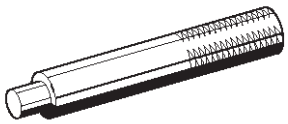
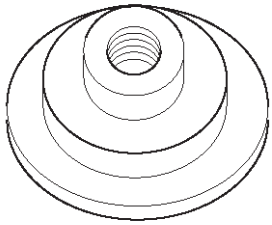
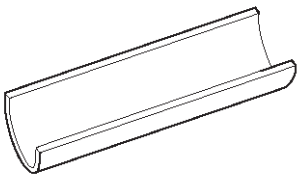
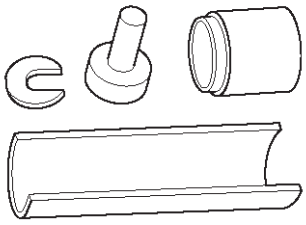
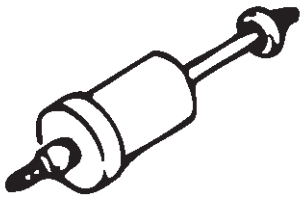
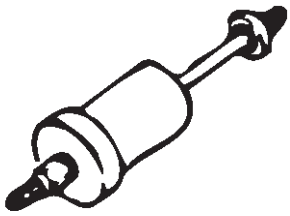
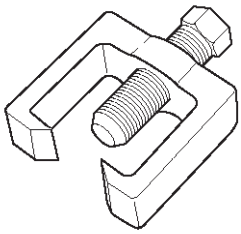
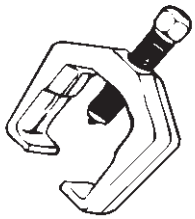
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS283	**J–23907** Remover;Needle bearing
 901RS284	**J–36838** Installer; Needle bearing
 901RS285	**J–8092** Grip
 901RS162	**J–36837** Installer; Oil seal
 901RS286	**J–39376** Installer; Upper arm bushing
 901RS287	**J–29775** Remover and Installer Upper arm bushing

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS288	**J–36833** Remover and Installer kit; Lower arm front bushing
 901RS289	**J–36834** Remover and Installer kit; Lower arm rear bushing
 901RS290	**J–36831** Ball joint remover
 901RS279	**J–29107** Tie-rod end remover

AXIOM (Vehicles Produced Before July/31/2001)

SUSPENSION

REAR SUSPENSION

CONTENTS

Service Precaution 3D–1
General Description 3D–1
Diagnosis 3D–2
Coil Spring 3D–5
Coil Spring and Associated Parts 3D–5
Removal 3D–5
Inspection and Repair 3D–6
Installation 3D–6
Shock Absorber 3D–7
Shock Absorber and Associated Parts 3D–7
Removal 3D–7
Inspection and Repair 3D–7
Installation 3D–7
Trailing Link 3D–8
Trailing Link and Associated Parts 3D–8
Removal 3D–8
Inspection and Repair 3D–8
Installation 3D–9
Upper Link 3D–10
Upper Link and Associated Parts 3D–10
Removal 3D–10
Inspection and Repair 3D–10
Installation 3D–11
Lateral Rod 3D–12
Lateral Rod and Associated Parts 3D–12
Removal 3D–12
Inspection and Repair 3D–12
Installation 3D–13
Stabilizer Bar 3D–14
Stabilizer Bar and Associated Parts 3D–14
Removal 3D–14
Inspection and Repair 3D–14
Installation 3D–15
Main Data and Specifications 3D–16
Special Tools 3D–18

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear suspension is a 5-link, coil spring type suspension with a stabilizer bar, consisting of two trailing links, two upper links, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in improved stability, riding comfort, and rough road maneuverability.

Each link connects the axle housing with the frame through a runner bushing. The axle housing is supported by the trailing links and upper links longitudinally and by the lateral rod latitudinally.

Diagnosis

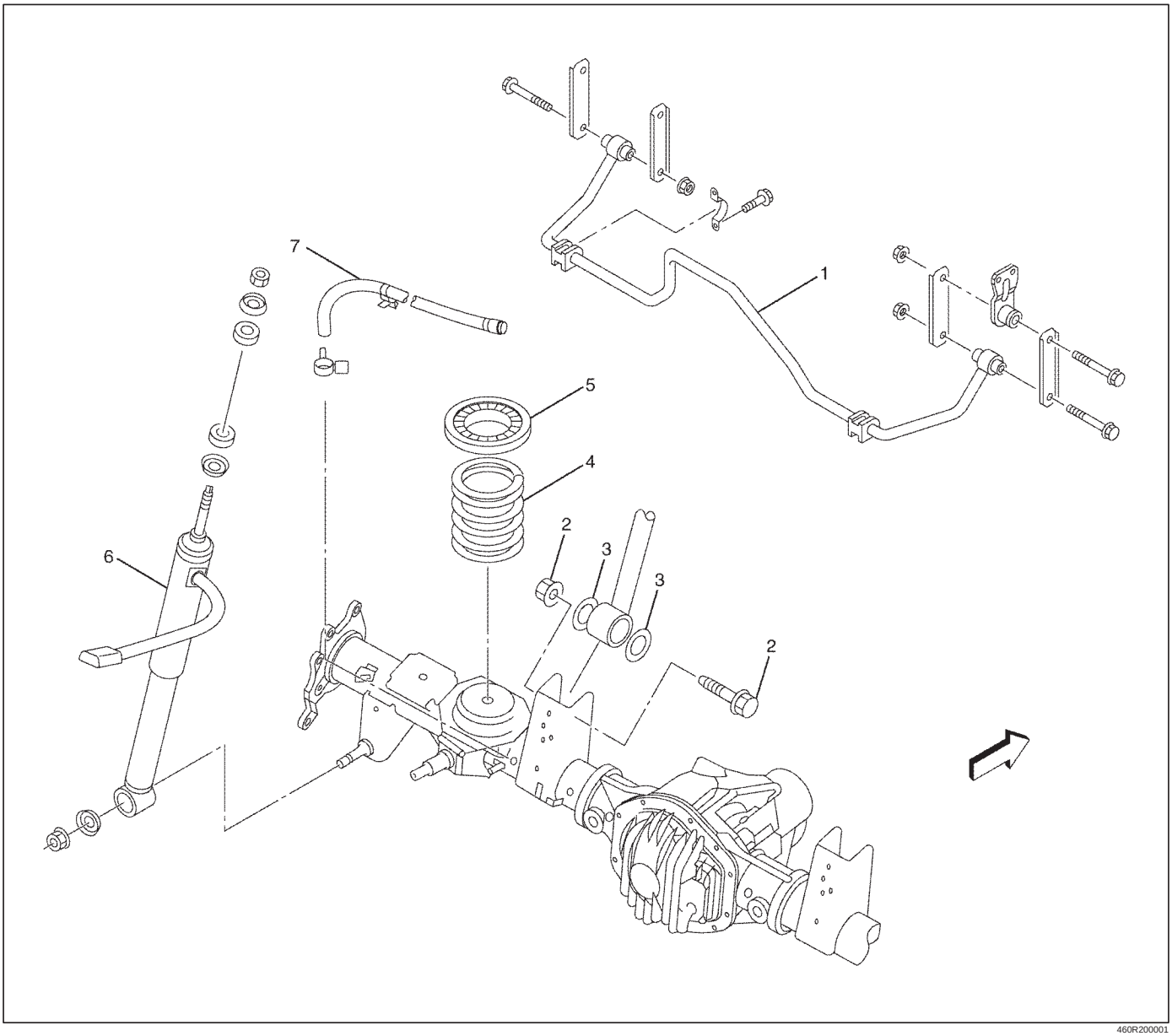
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to *Steering section.*
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (In pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Coil Spring

Coil Spring and Associated Parts



460R200001

Legend

(1) Stabilizer Bar
(2) Upper Link Fixing Bolt and Nut
(3) Rubber Plate
(4) Coil Spring
(5) Insulator
(6) Shock Absorber
(7) Breather Hose

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Support the rear axle case with a jack.
3. Disconnect brake hose at the crossmember.
4. Remove breather hose.
5. Remove upper link fixing bolt, nut and rubber plate on the rear axle case (left-side only).
6. Disconnect the stabilizer bar at the stabilizer link.
7. Remove the shock absorber from the axle case.
8. Remove spring insulator.
9. Remove the insulator and coil spring while lowering the rear axle case.

CAUTION: Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.

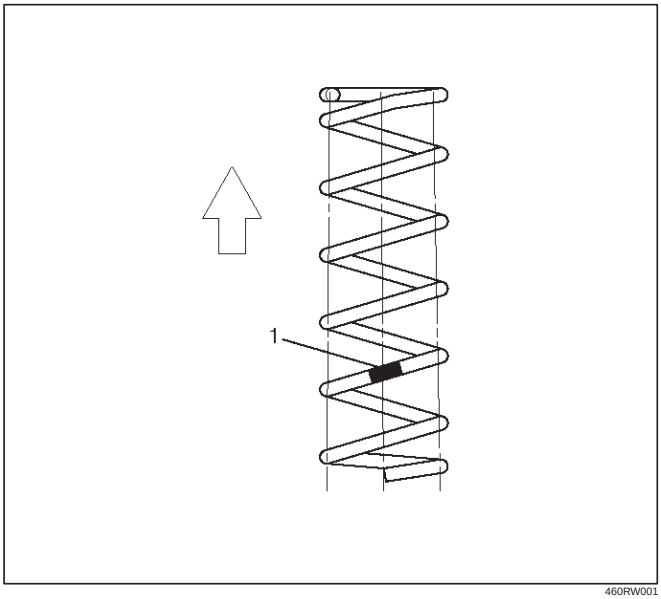
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼ Coil spring
- ▼ Insulator

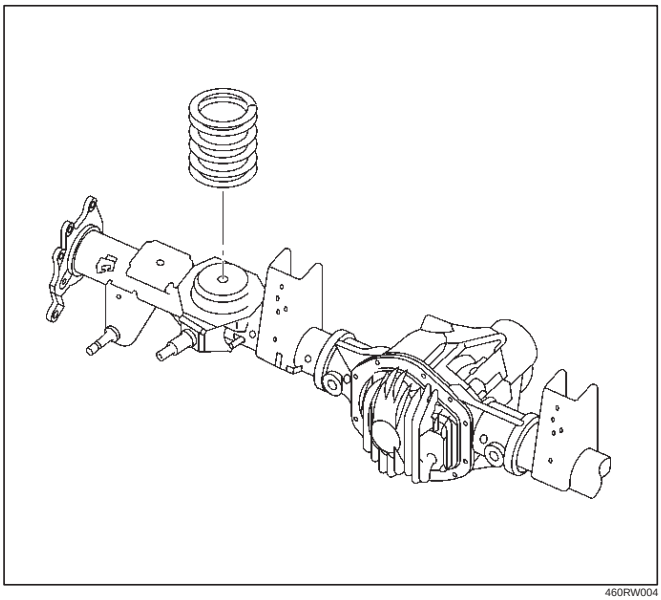
Installation

1. Install coil spring and make sure that the coil spring is installed in the proper position. Paint mark(1) should be downward.

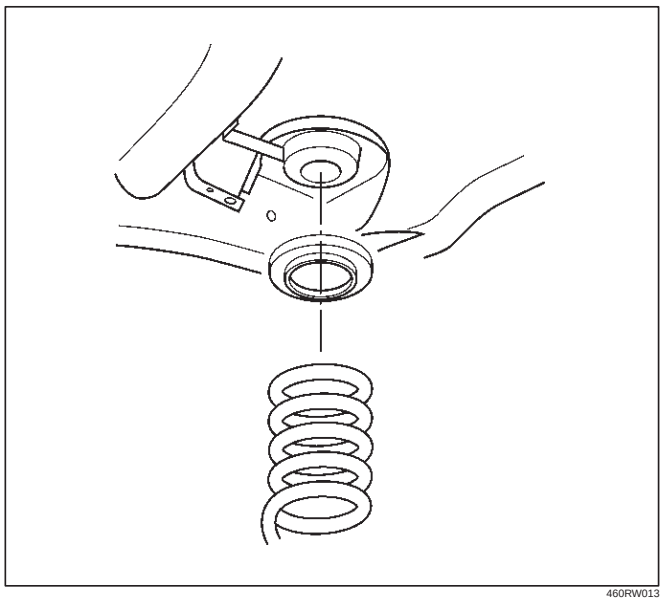


460RW001

2. Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.


460RW004

3. Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring set to the spring seat on the frame side.


460RW013

4. Install shock absorber and make sure that installed in the proper position. (Refer to *Intelligent Suspension*) Tighten the nut lightly, then retighten it to the specified torque after the vehicle is at curb height.

NOTE: When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Torque: 78 N·m (58 lb ft)

5. Install stabilizer bar.

Torque: 31 N·m (23 lb ft)

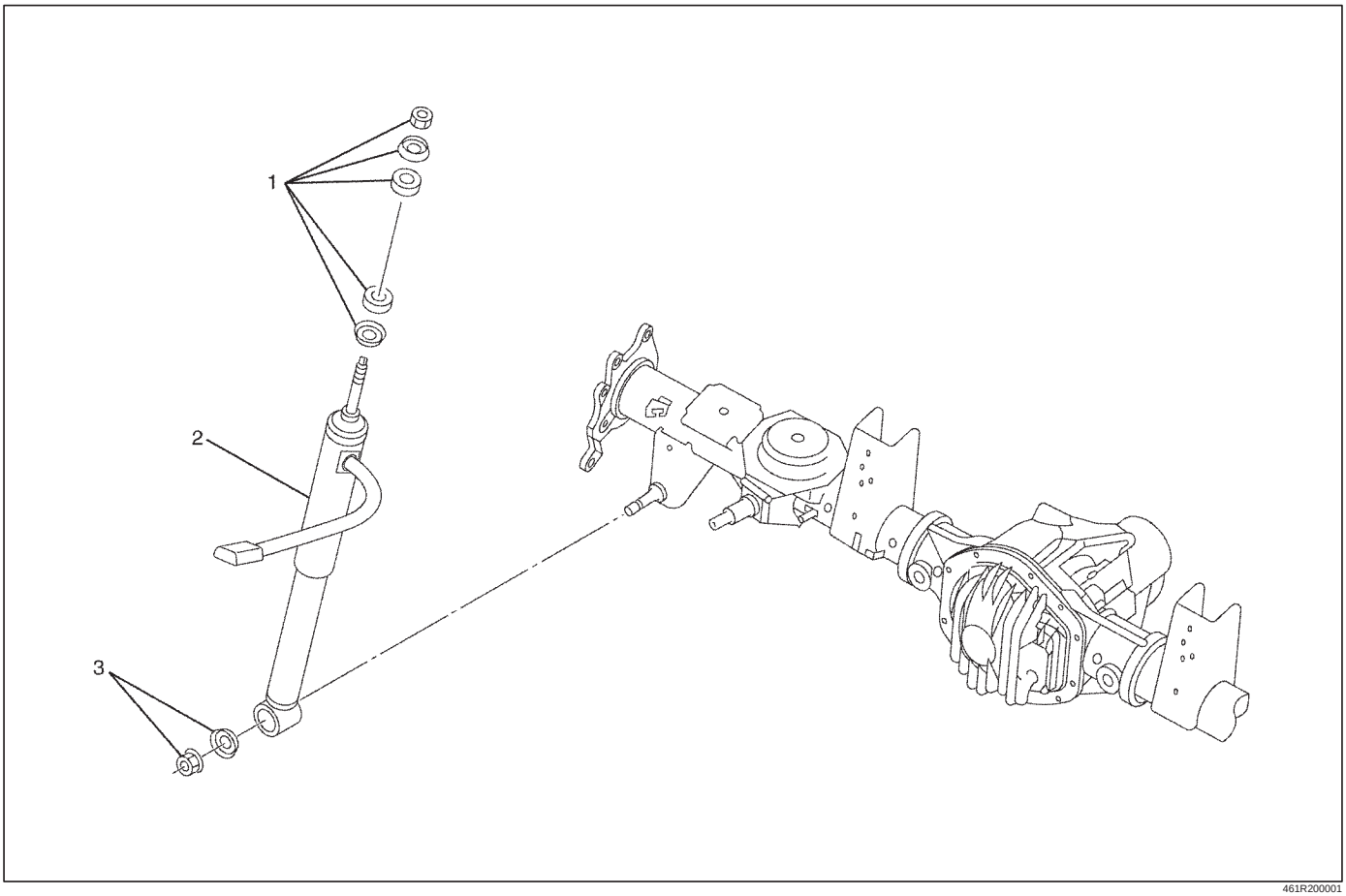
6. Install upper link with rubber plate and tighten fixing bolt.

Torque: 137 N·m (101 lb ft)

7. Install breather hose.
8. Connect brake hose and bleed the brake system. Refer to *Bleeding the Brake Hydraulic System in Brake section.*

Shock Absorber

Shock Absorber and Associated Parts



Legend

(1) Nut, Bush and Washer
(2) Shock Absorber
(3) Nut and Washer

Removal

1. Remove shock absorber fixing nut, bush and washer (upper side).
2. Remove shock absorber fixing nut and washer (lower side).
3. Remove shock absorber.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼ Shock absorber
- ▼ Rubber bushing

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

Installation

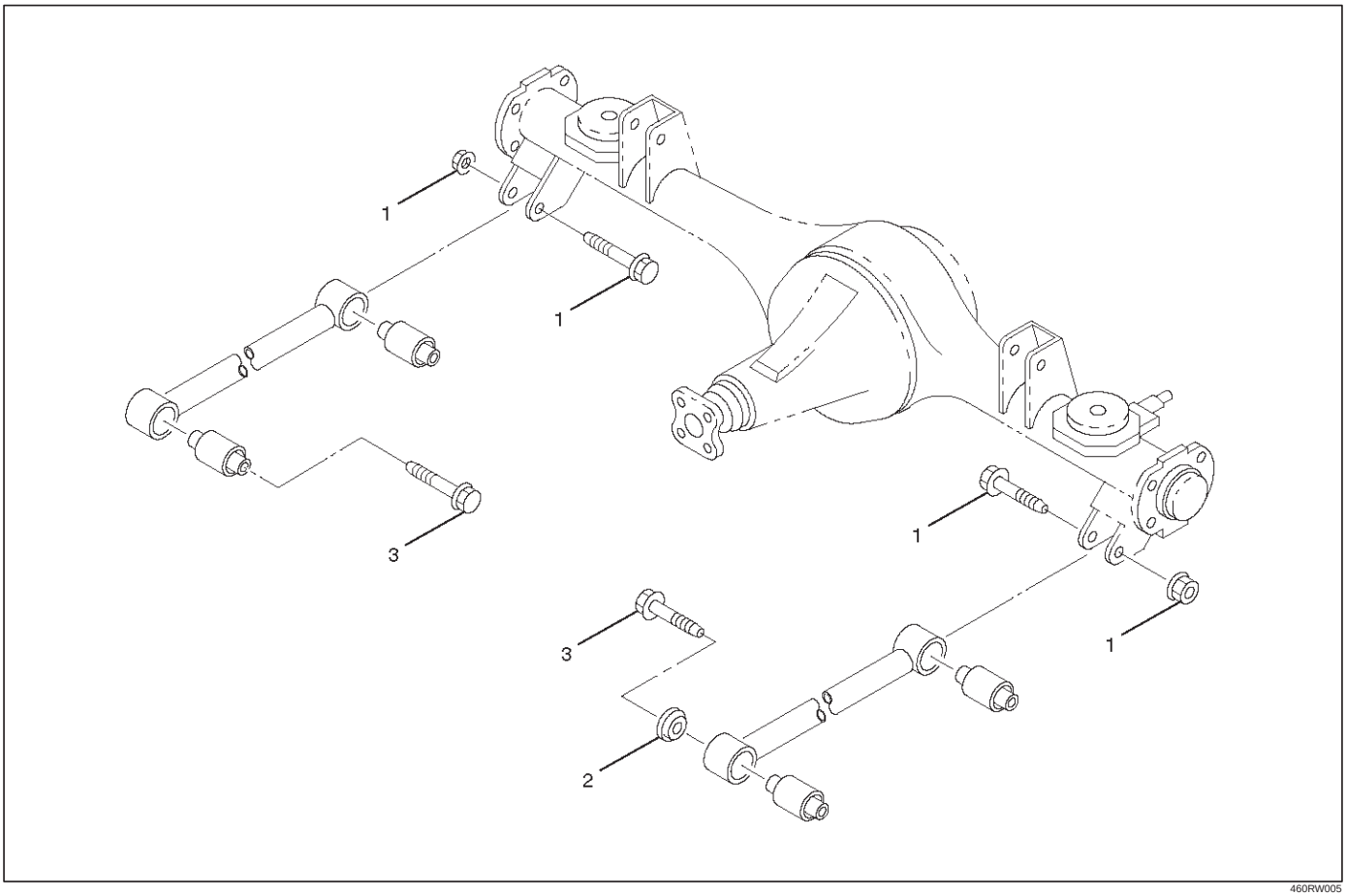
1. Install shock absorber. When mounting shock absorber, make sure to be installed in the proper position and not to use grease on bushings or any other nearby part. (Refer to *Intelligent Suspension*)
2. Install nut and washer (lower side), then tighten the nut lightly. Retighten to the bolt and nut specified torque after the vehicle is at curb height.

   Torque: 78 N·m (58 lb ft)
3. Install nut, bush and washer (upper side), then tighten the nut lightly. Retighten to the nut specified torque after the vehicle is at curb height.

   Torque: 20 N·m (14 lb ft)

Trailing Link

Trailing Link and Associated Parts



460RW005

Legend

(1) Bolt and Nut (Axle side)
(2) Protector (Left side only)
(3) Bolt (Frame side)

Removal

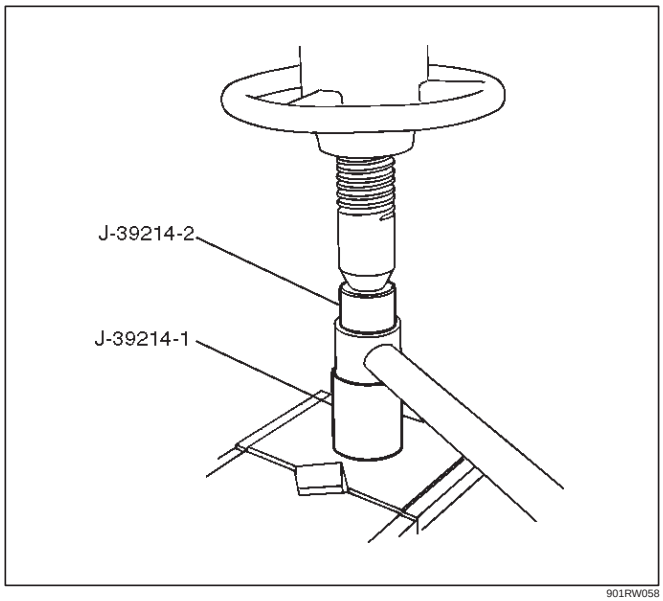
1. Remove the parking brake cable from the trailing link.
2. Remove the trailing link fixing bolt, nut and protector.
3. Remove trailing link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Trailing link
2. Rubber bushing

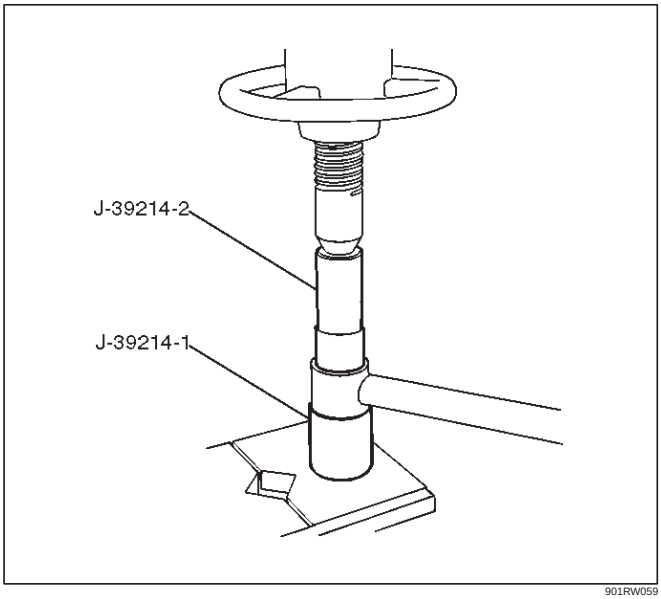
▼Remove the rubber bushing by using remover J–39214.



901RW058

▼Install the rubber bushing by using installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

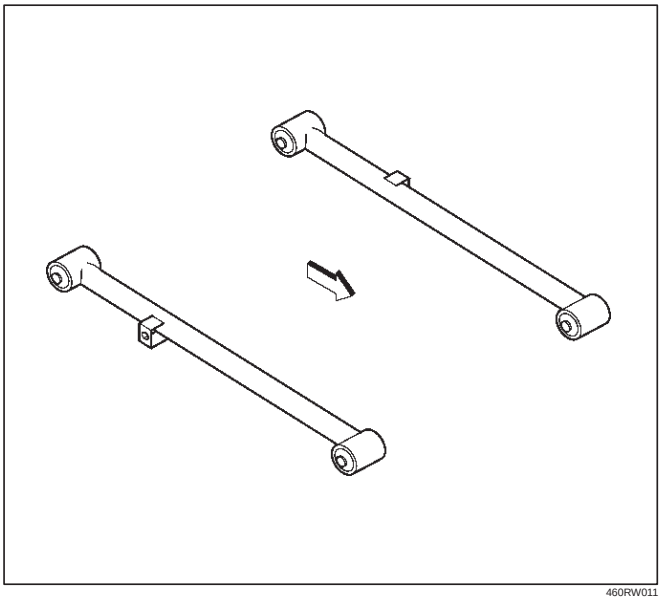


901RW059

Installation

1. Install trailing link. Make sure that the trailing link is in its correct position.

NOTE: When mounting trailing link, be sure not to use grease on bushings or any other nearby part.


460RW011

2. Install bolt, nut and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

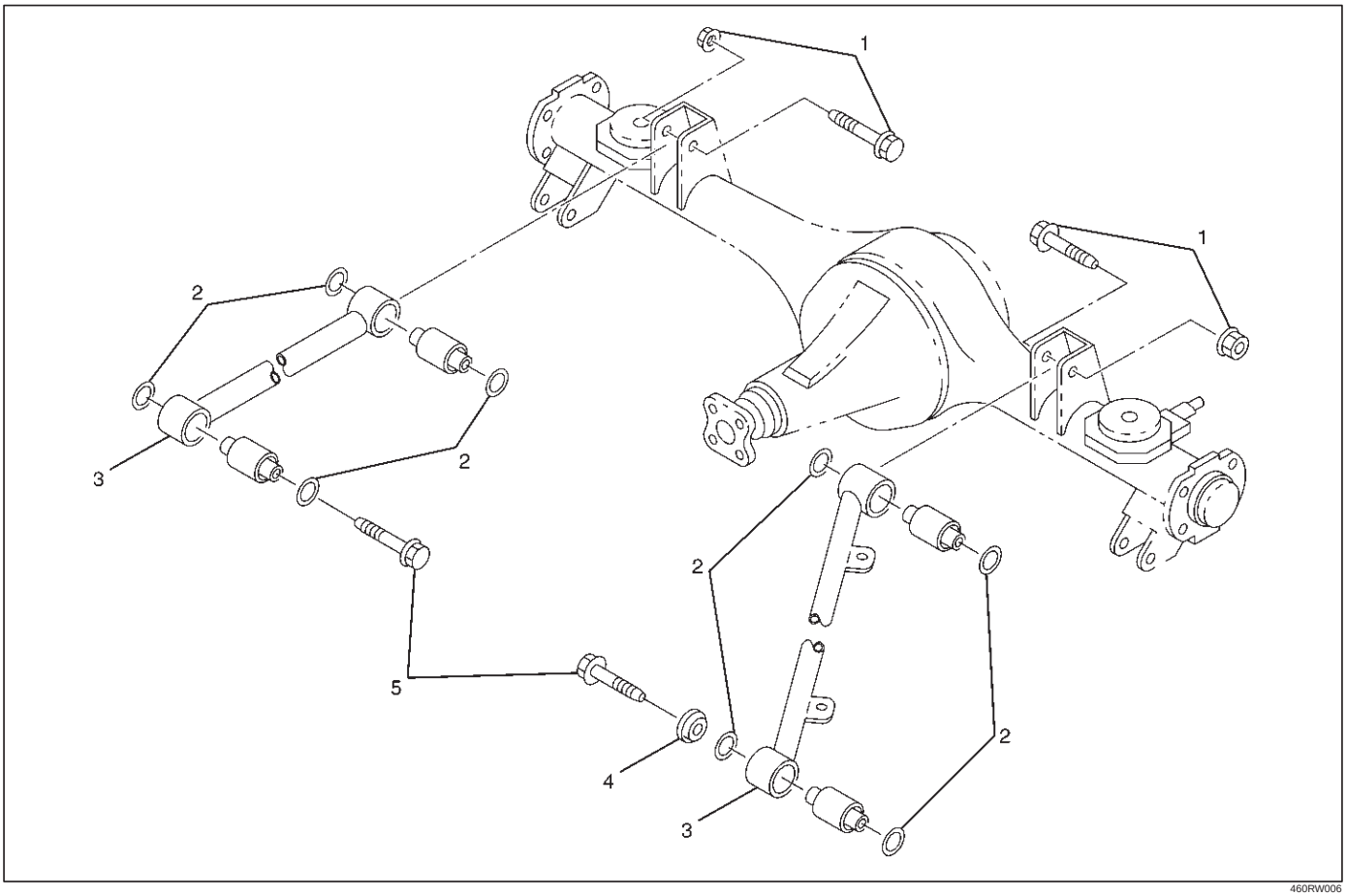
   Torque: 137 N·m (101 lb ft)

3. Install parking brake cable.

CAUTION: The parking brake cable should not be overstrained or slackened.

Upper Link

Upper Link and Associated Parts



460RW006

Legend

(1) Bolt and Nut (Axle side)
(2) Rubber Plate
(3) Upper Link
(4) Protector (Left side only)
(5) Bolt (Frame side)

Removal

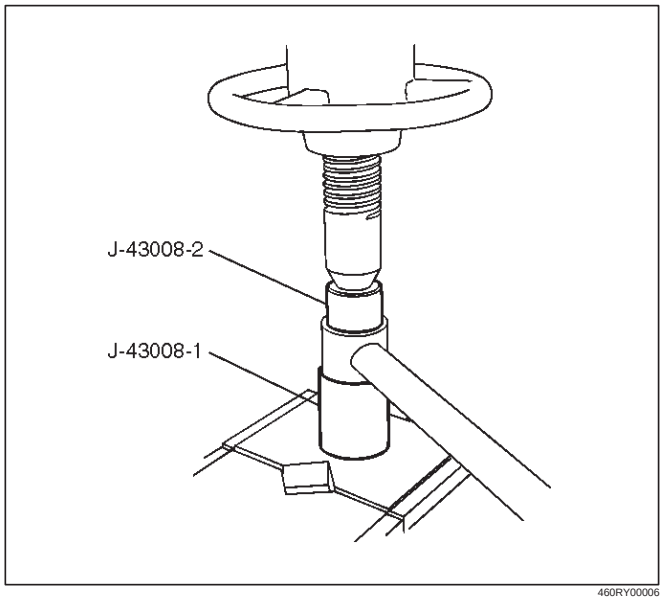
1. Remove fuel tank. Refer to *Engine Fuel in Engine section.*
2. Remove the speed sensor cable from the upper link.
3. Remove bolt, nut, rubber plate and protector.
4. Remove upper link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Upper link
2. Rubber bushing

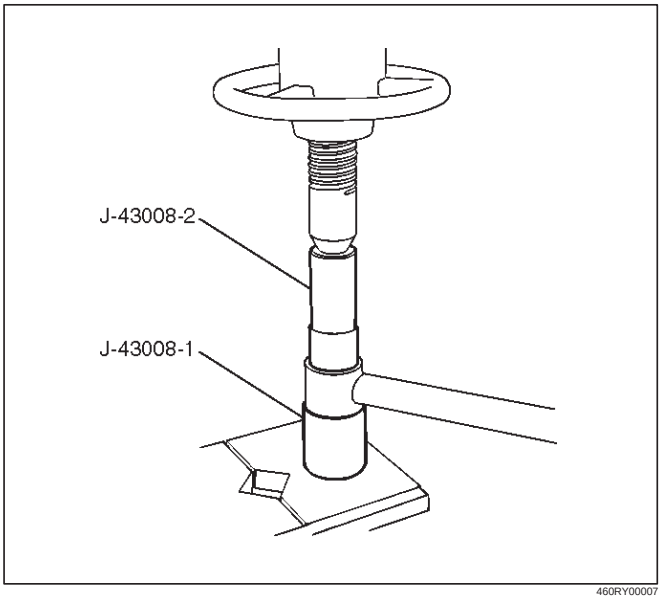
▼Remove the rubber bushing by using remover J–43008.



460RY00006

▼Install the rubber bushing by using to installer J–43008.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

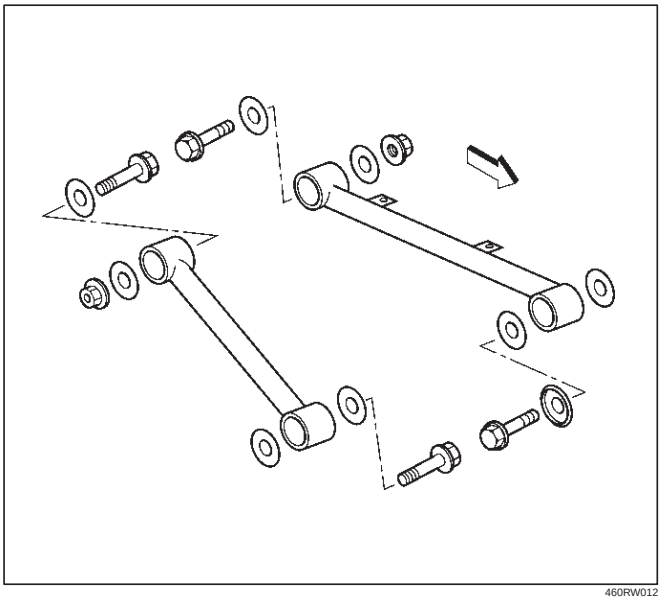


460RY00007

Installation

1. Install upper link. Make sure that the upper link is in its correct position.

NOTE: When mounting upper link, be sure not to use grease bushings or any other nearby part.


460RW012

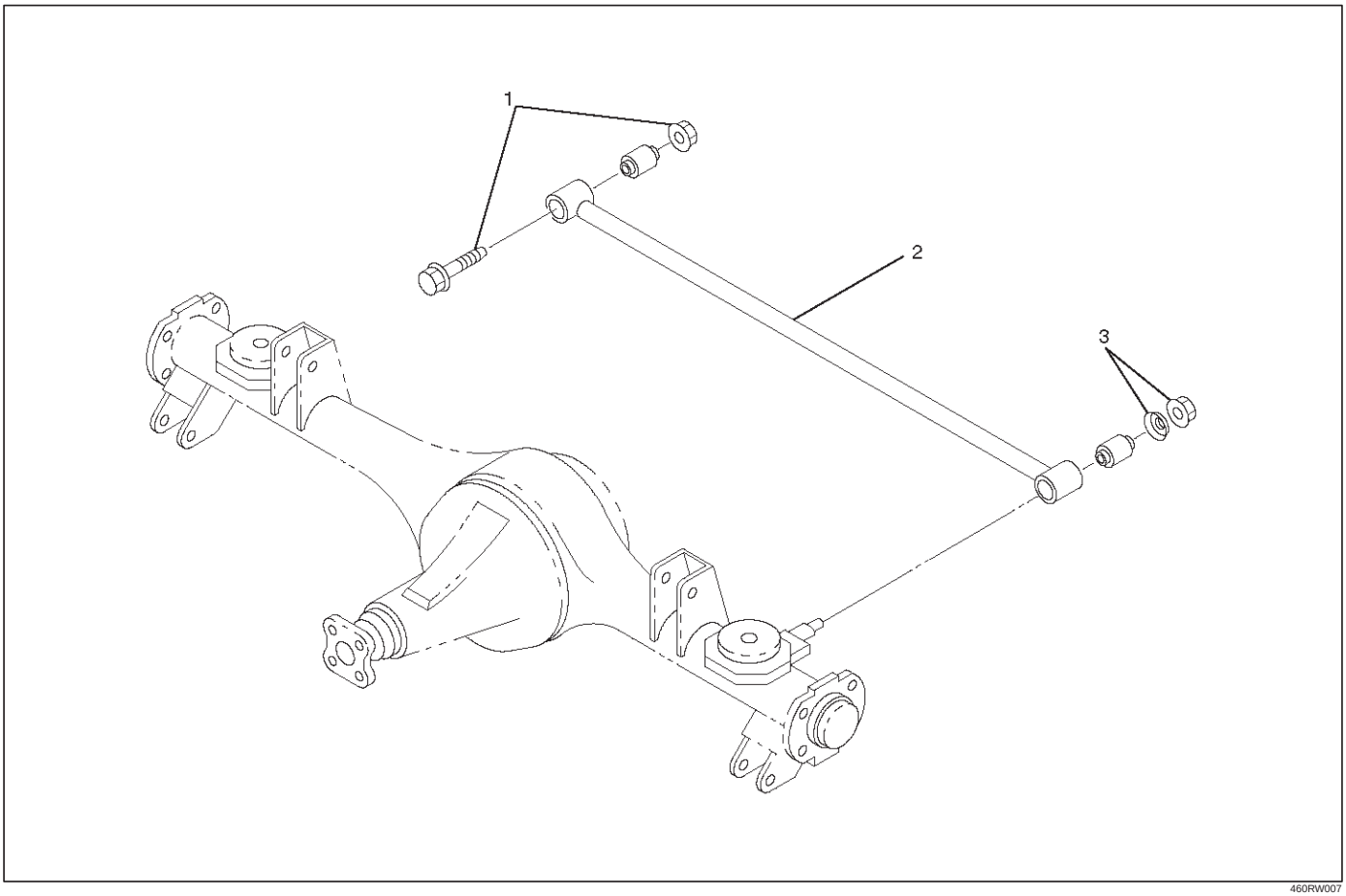
2. Install bolt, nut, rubber plate and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

   Torque: 137 N·m (101 lb ft)

3. Install speed sensor cable.
4. Install fuel tank.

Lateral Rod

Lateral Rod and Associated Parts



460RW007

Legend

(1) Bolt and Nut (Frame side)
(2) Lateral Rod
(3) Nut and Washer (Axle side)

Removal

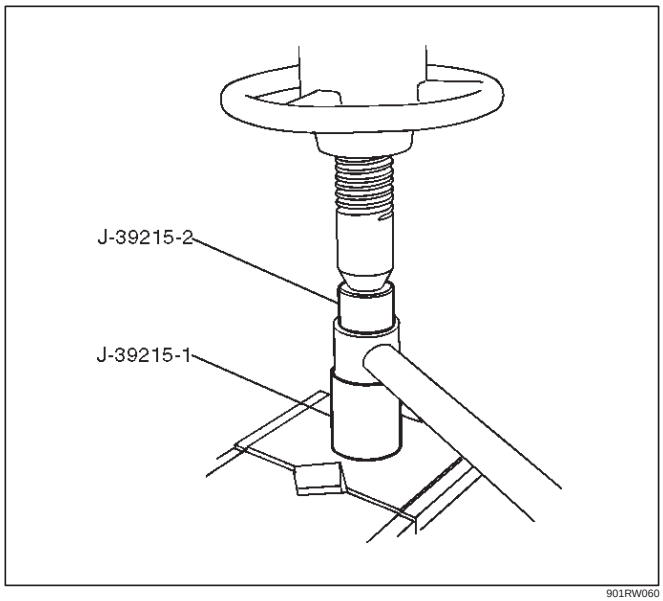
1. Remove nut and washer.
2. Remove bolt and nut.
3. Remove lateral rod.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Lateral rod
2. Rubber bushing (Frame side)

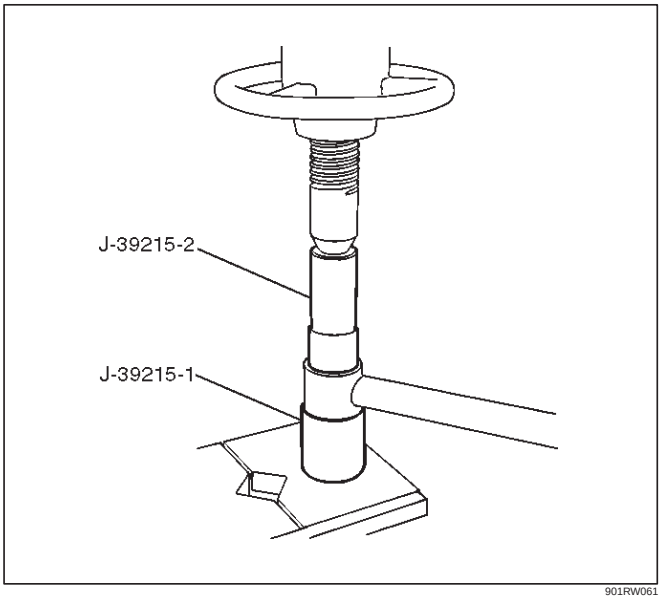
▼Remove the rubber bushing (Frame side) by using remover J–39215.



901RW060

▼Install the rubber bushing (Frame side) by using Installer J–39215.

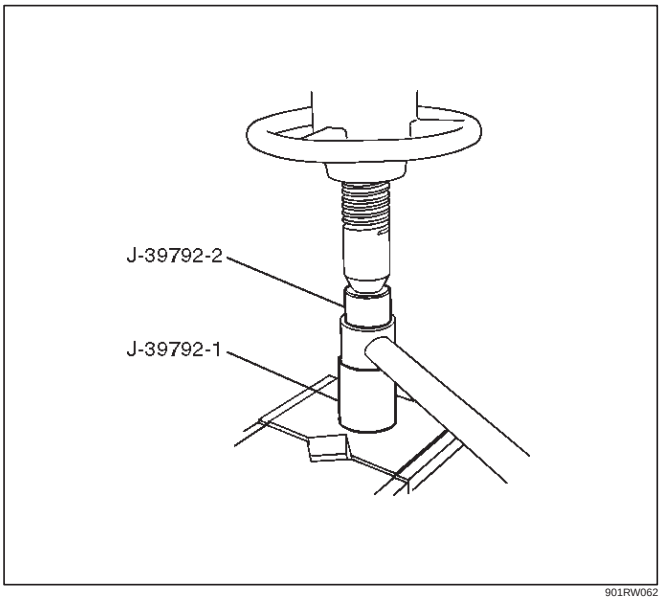
NOTE: When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



901RW061

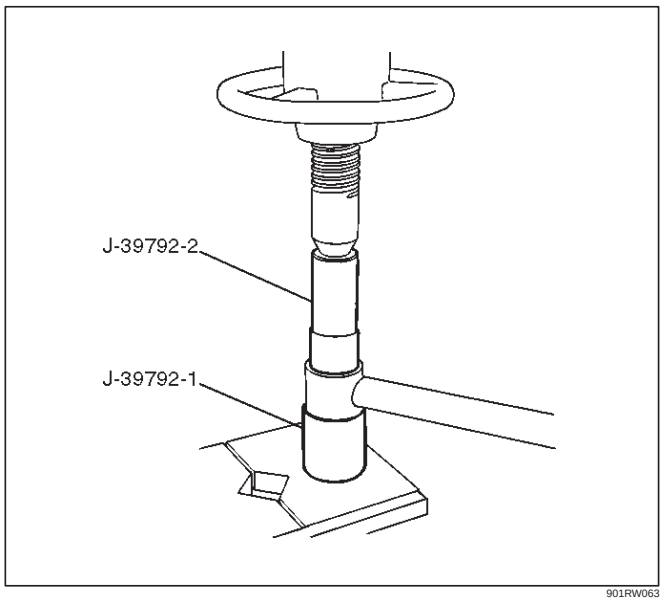
3. Rubber bushing (Axle side)

▼Remove the rubber bushing (Axle side) by using remover J–39792.



901RW062

▼Install the rubber bushing (Axle side) by using installer J–39792.

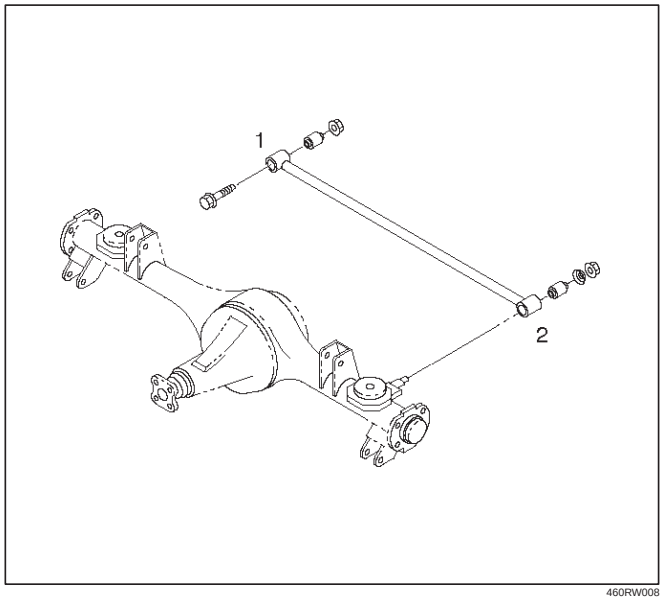


901RW063

Installation

1. Install lateral rod and make sure that the lateral rod is in its correct position.

NOTE: When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.



460RW008

Legend

(1) Frame Side
(2) Axle Side

2. Install bolt and nut (Frame side). Tighten the bolt and nut lightly, then retighten them to the specified torque after the vehicle is at curb height.

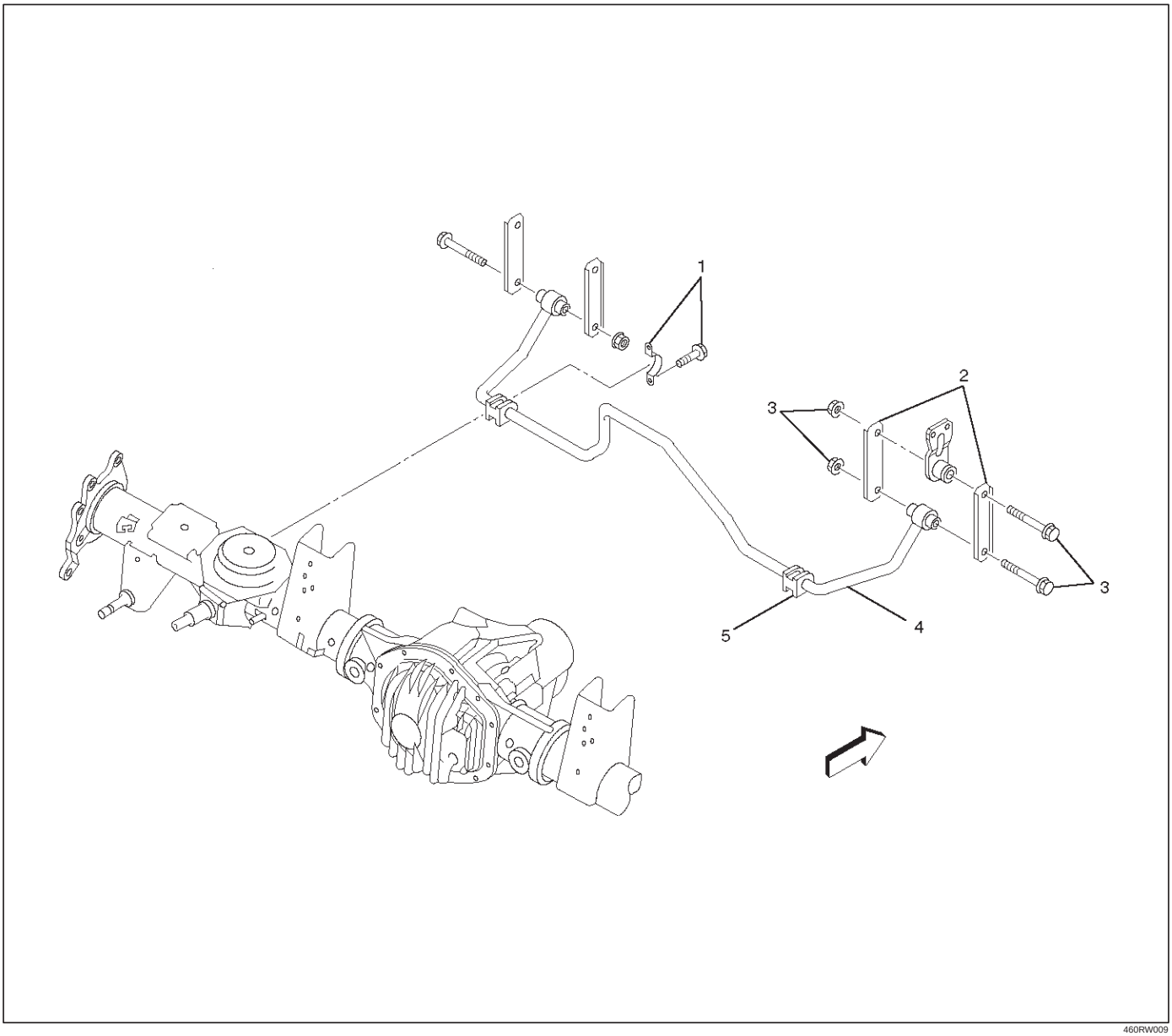
Torque: 137 N·m (101 lb ft)

3. Install nut and washer (Axle side). Tighten the nut lightly, then retighten the nut to the specified torque after the vehicle is at curb height.

Torque: 78 N·m (58 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



460RW009

Legend

(1) Bracket and Bolt
(2) Link
(3) Bolt and Nut
(4) Stabilizer Bar
(5) Rubber Bushing

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel in this section.*
3. Remove bolt and nut.
4. Remove link.
5. Remove bracket.
6. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

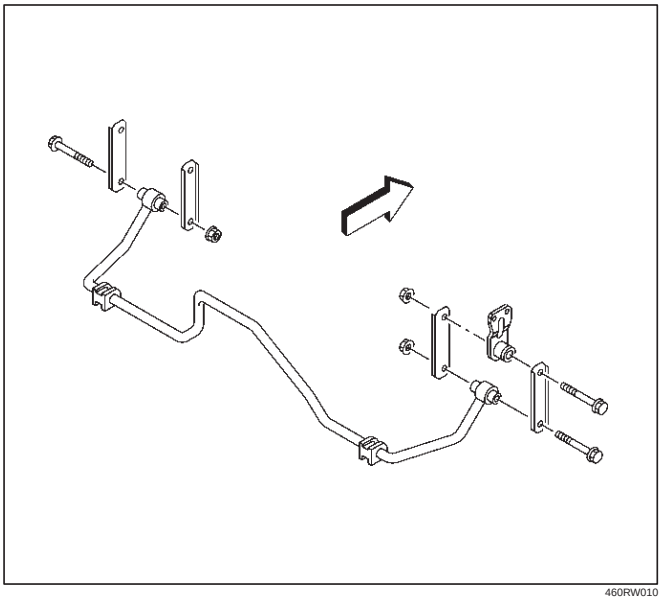
- ▼ Stabilizer bar
- ▼ Rubber bushing
- ▼ Link

Installation

1. Install rubber bushing.
2. Install bracket to axle housing and tighten to the specified torque.

   Torque: 25 N·m (19 lb ft)
3. Install link.
4. Install bolt and nut, then tighten the nut to the specified torque.

   Torque: 31 N·m (27 lb ft)



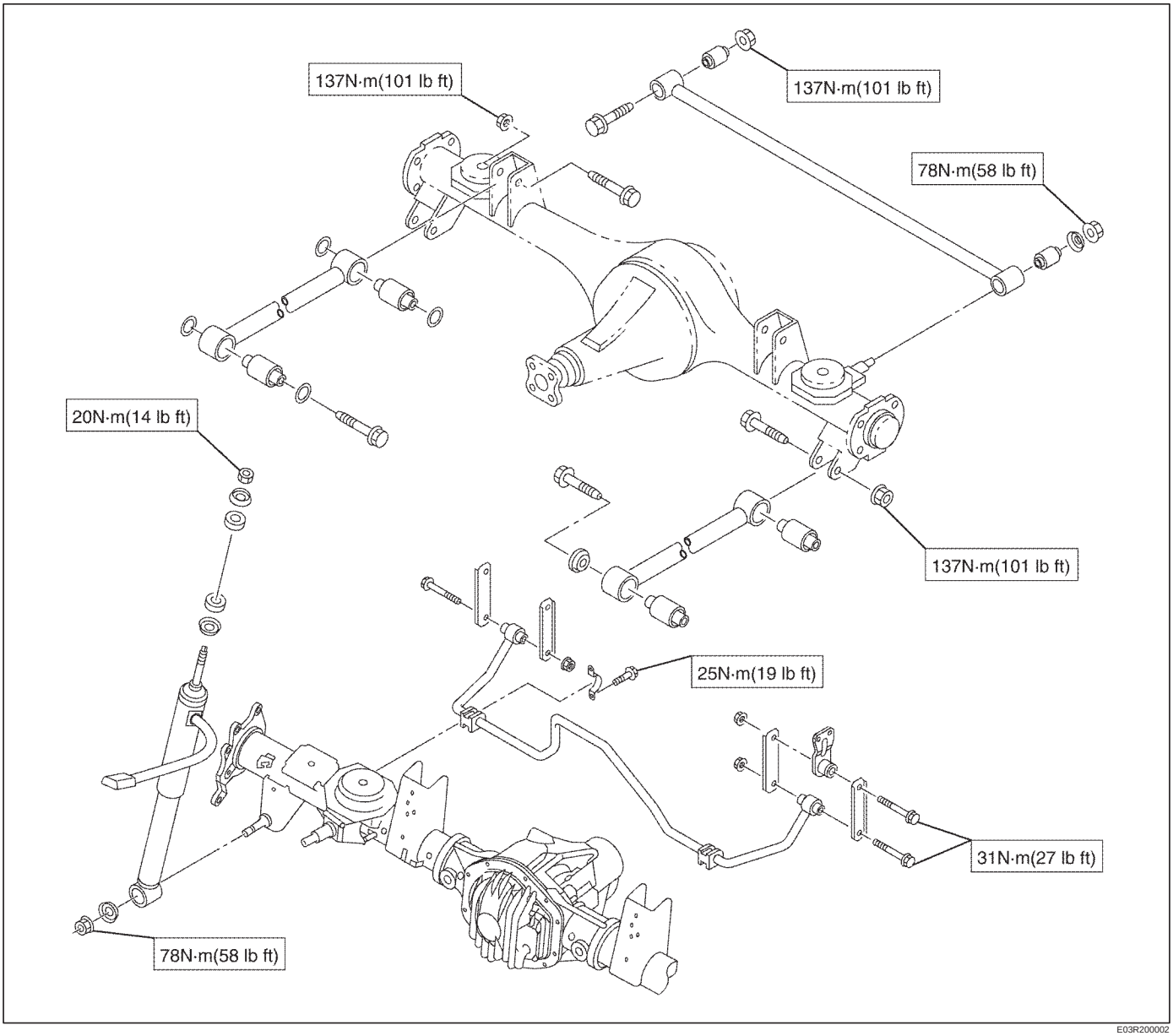
460RW010

Main Data and Specifications

General Specifications

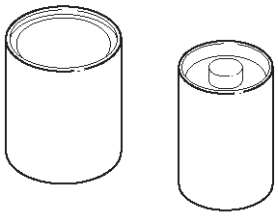
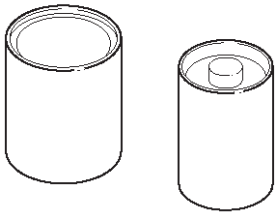
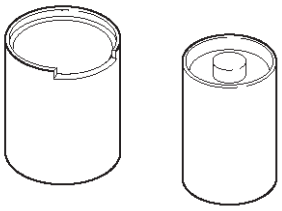
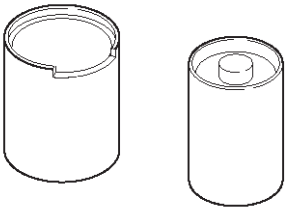
Rear suspension	Type	5–Link, coil spring type with stabilizer bar.
Coil spring	Free length	370.5 mm (14.59 in)
	Spring diameter	12.4 mm (0.49 in)
	Coil diameter (inner)	105 mm (4.13 in)
	Effective No. of turns	5.21
	Total No. of turns	6.71
Shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30 mm (1.18 in)
	Stroke	159 mm (6.26 in)
	Extended length	518 mm (20.39 in)
	Compressed length	359 mm (14.13 in)
Stabilizer bar	Diameter	18 mm (0.71 in)

Torque Specifications



E03R200002

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS291	**J–39214** Remover and Installer; Trailing link bushing
 901RS291	**J–43008** Remover and Installer; Upper link bushing
 901RS292	**J–39792** Remover and Installer; Lateral rod bushing (Axle side)
 901RS293	**J–39215** Remover and Installer; Lateral rod bushing (Frame side)

AXIOM (Vehicles Produced After Aug./1/2001)

REAR SUSPENSION

CONTENTS

Service Precaution 3D–19
General Description 3D–19
Diagnosis 3D–20
Coil Spring 3D–23
Coil Spring and Associated Parts 3D–23
Removal 3D–23
Inspection and Repair 3D–24
Installation 3D–24
Shock Absorber 3D–25
Shock Absorber and Associated Parts 3D–25
Removal 3D–25
Inspection and Repair 3D–25
Installation 3D–25
Trailing Link 3D–26
Trailing Link and Associated Parts 3D–26
Removal 3D–26
Inspection and Repair 3D–26
Installation 3D–27
Upper Link 3D–28
Upper Link and Associated Parts 3D–28
Removal 3D–28
Inspection and Repair 3D–28
Installation 3D–29
Lateral Rod 3D–30
Lateral Rod and Associated Parts 3D–30
Removal 3D–30
Inspection and Repair 3D–30
Installation 3D–31
Stabilizer Bar 3D–32
Stabilizer Bar and Associated Parts 3D–32
Removal 3D–32
Inspection and Repair 3D–32
Installation 3D–33
Main Data and Specifications 3D–34
Special Tools 3D–36

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE *SRS COMPONENT AND WIRING LOCATION VIEW* IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE *SRS SERVICE INFORMATION.* FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear suspension is a 5-link, coil spring type suspension with a stabilizer bar, consisting of two trailing links, two upper links, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in improved stability, riding comfort, and rough road maneuverability.

Each link connects the axle housing with the frame through a runner bushing. The axle housing is supported by the trailing links and upper links longitudinally and by the lateral rod latitudinally.

Diagnosis

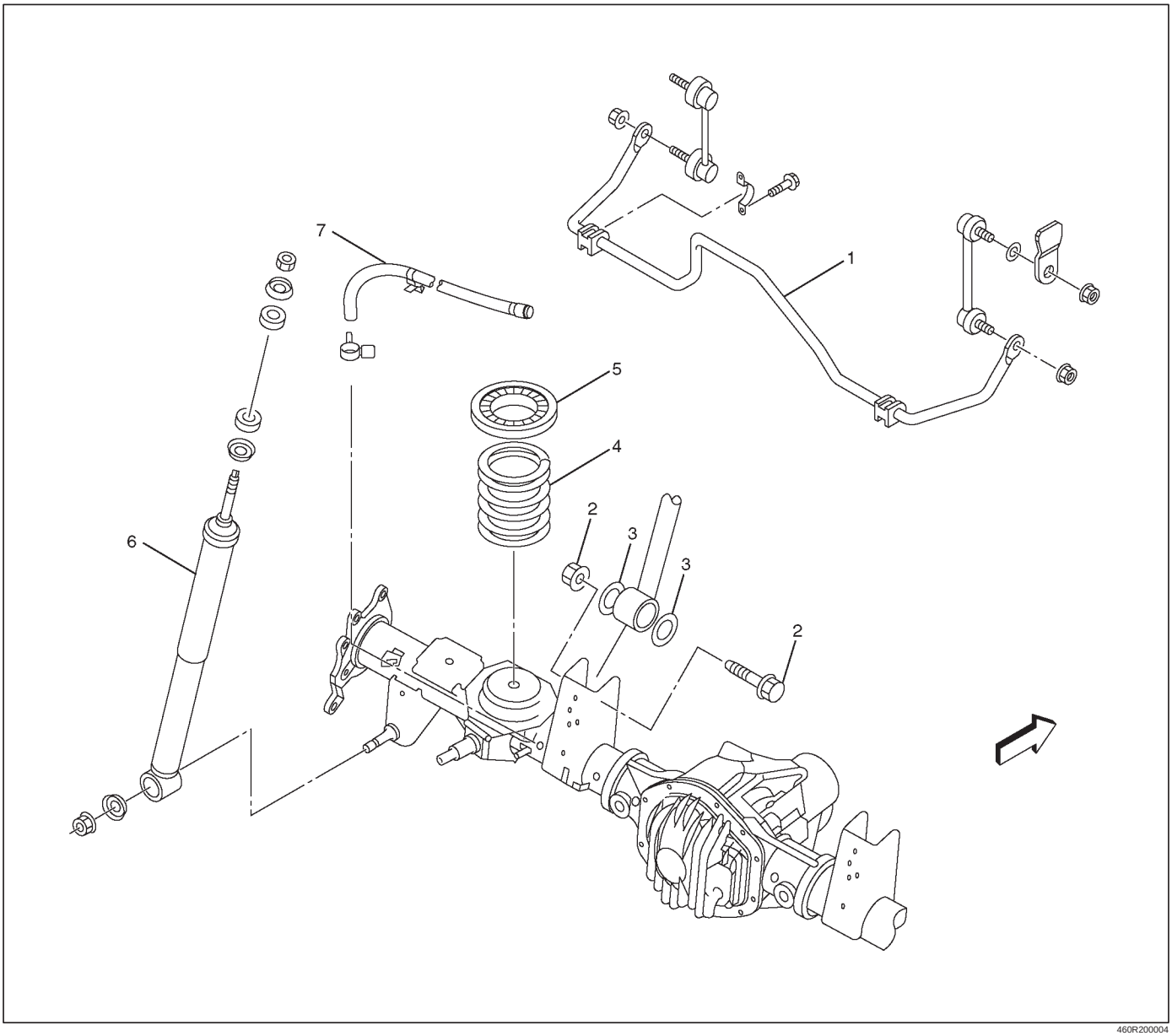
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to *Steering* section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
	Misassemble Transfer Gear ASM	Reassemble Transfer Gear to proper portion
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
	Trim Height out of spec	Adjust Trim height
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Trim Height out of spec	Adjust Trim height
	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Coil Spring

Coil Spring and Associated Parts



460R200004

Legend

(1) Stabilizer Bar
(2) Upper Link Fixing Bolt and Nut
(3) Rubber Plate
(4) Coil Spring
(5) Insulator
(6) Shock Absorber
(7) Breather Hose

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Support the rear axle case with a jack.
3. Disconnect brake hose at the crossmember.
4. Remove breather hose.
5. Remove upper link fixing bolt, nut and rubber plate on the rear axle case (left-side only).
6. Disconnect the stabilizer bar at the stabilizer link.
7. Remove the shock absorber from the axle case.
8. Remove spring insulator.
9. Remove the insulator and coil spring while lowering the rear axle case.

CAUTION: Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.

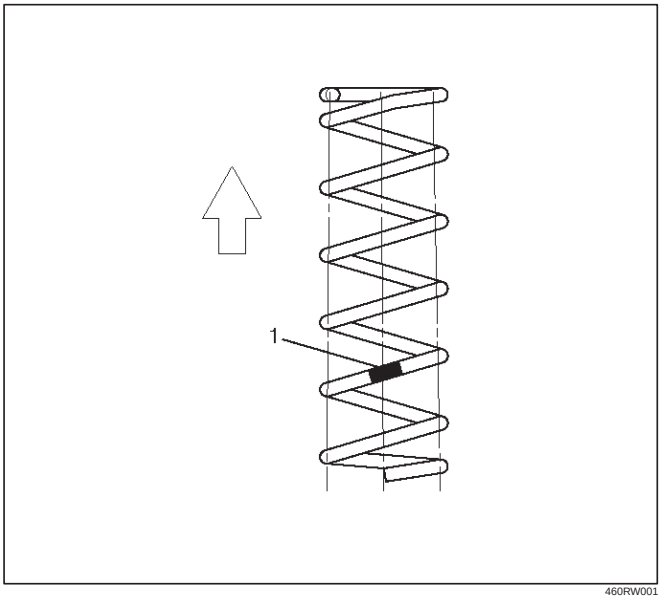
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼ Coil spring
- ▼ Insulator

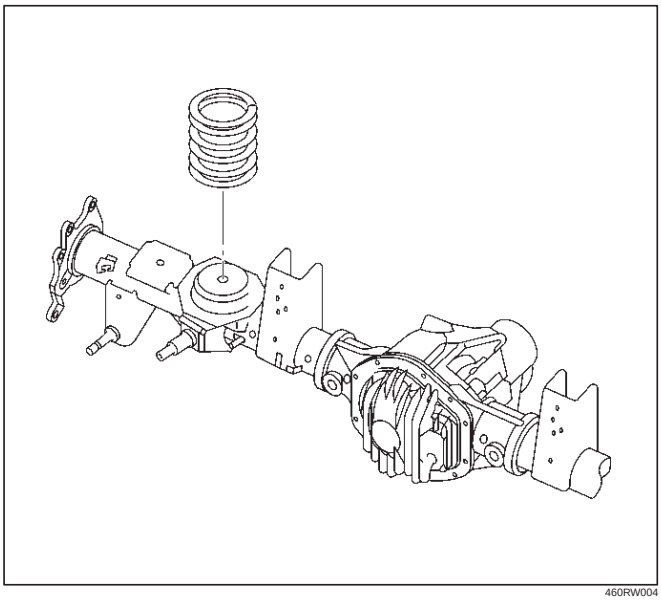
Installation

1. Install coil spring and make sure that the coil spring is installed in the proper position. Paint mark(1) should be downward.

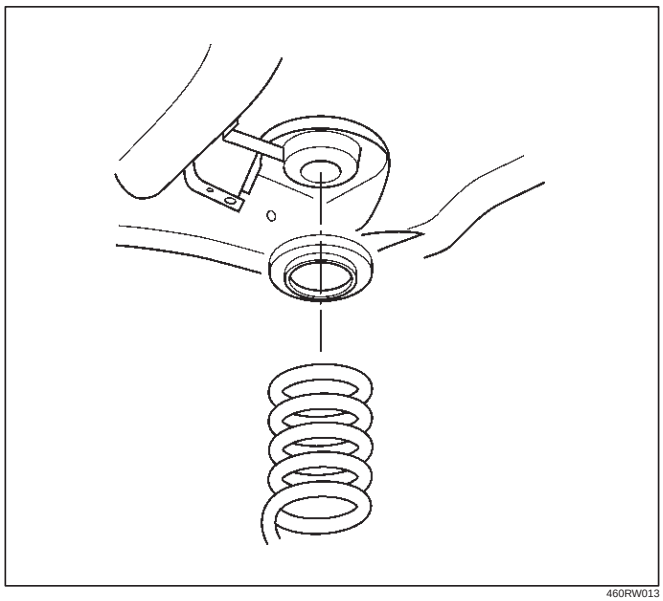


460RW001

2. Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.


460RW004

3. Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring set to the spring seat on the frame side.


460RW013

4. Install shock absorber and tighten the nut lightly, then retighten it to the specified torque after the vehicle is at curb height.

NOTE: When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Torque: 78 N·m (58 lb ft)

5. Install stabilizer bar at the stabilizer link.

Torque: 31 N·m (23 lb ft)

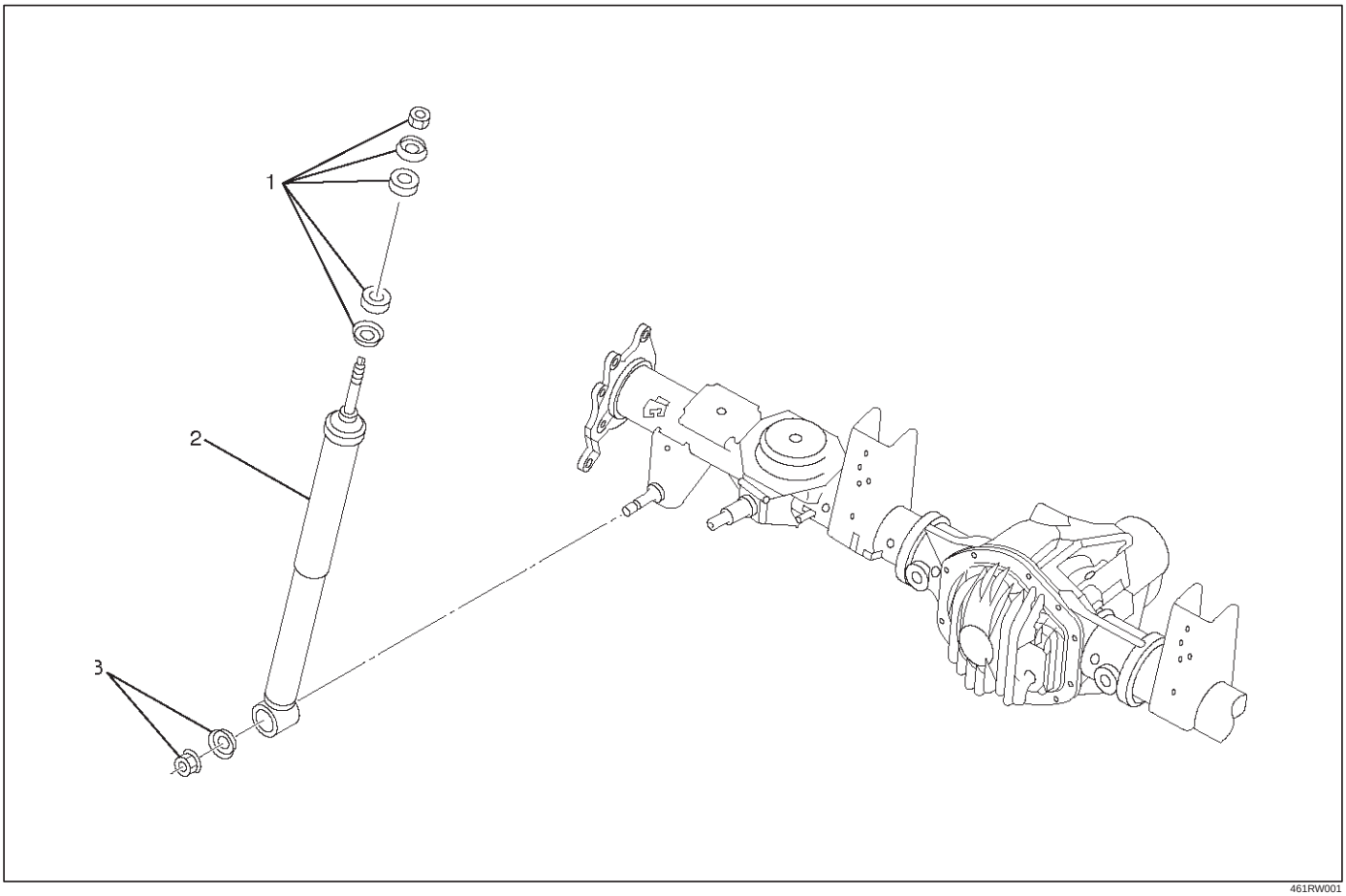
6. Install upper link with rubber plate and tighten fixing bolt.

Torque: 137 N·m (101 lb ft)

7. Install breather hose.
8. Connect brake hose and bleed the brake system.
   Refer to *Bleeding the Brake Hydraulic System in Brake* section.

Shock Absorber

Shock Absorber and Associated Parts



Legend

(1) Nut, Bush and Washer
(2) Shock Absorber
(3) Nut and Washer

Removal

1. Remove shock absorber fixing nut, bush and washer (upper side).
2. Remove shock absorber fixing nut and washer (lower side).
3. Remove shock absorber.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- ▼ Shock absorber
- ▼ Rubber bushing

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

Installation

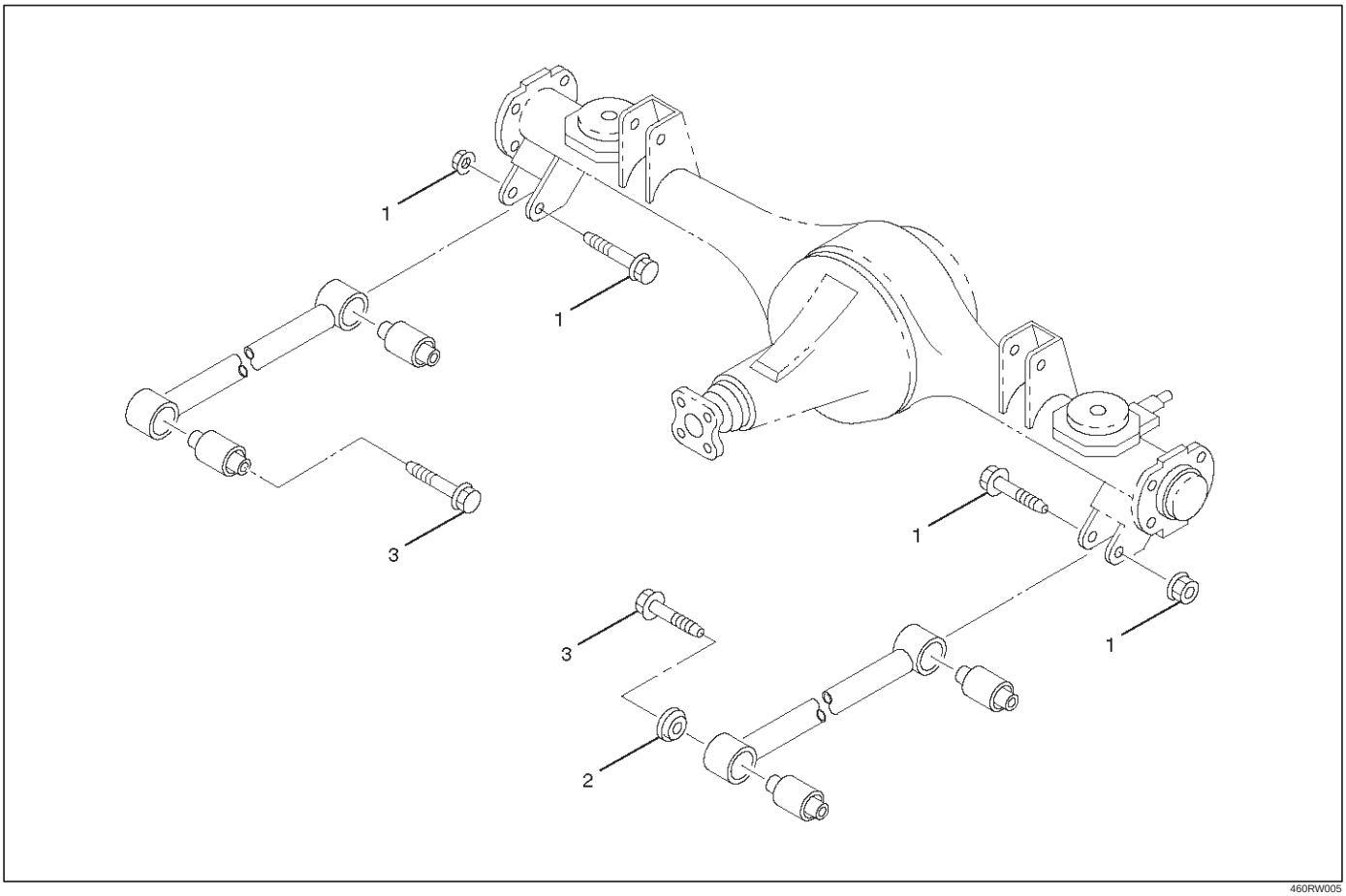
1. Install shock absorber. When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.
2. Install nut and washer (lower side), then tighten the nut lightly. Retighten to the bolt and nut specified torque after the vehicle is at curb height.

   Torque: 78 N·m (58 lb ft)
3. Install nut, bush and washer (upper side), then tighten the nut lightly. Retighten to the nut specified torque after the vehicle is at curb height.

   Torque: 20 N·m (14 lb ft)

Trailing Link

Trailing Link and Associated Parts



460RW005

Legend

(1) Bolt and Nut (Axle side)
(2) Protector (Left side only)
(3) Bolt (Frame side)

Removal

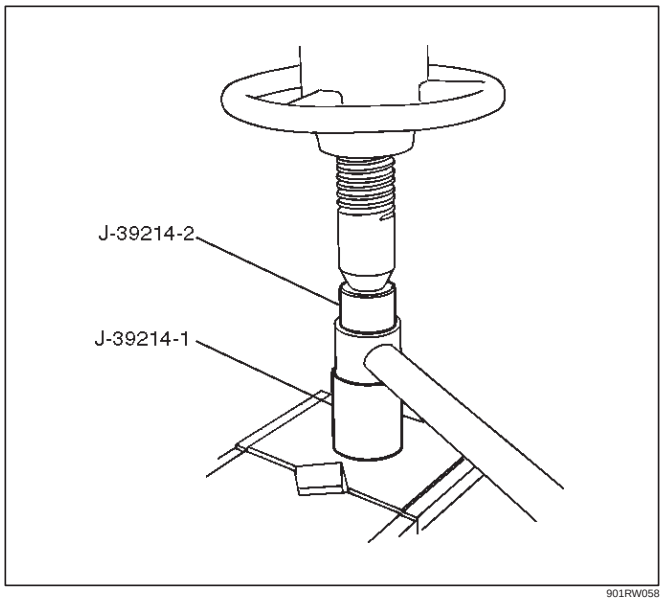
1. Remove the parking brake cable from the trailing link.
2. Remove the trailing link fixing bolt, nut and protector.
3. Remove trailing link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Trailing link
2. Rubber bushing

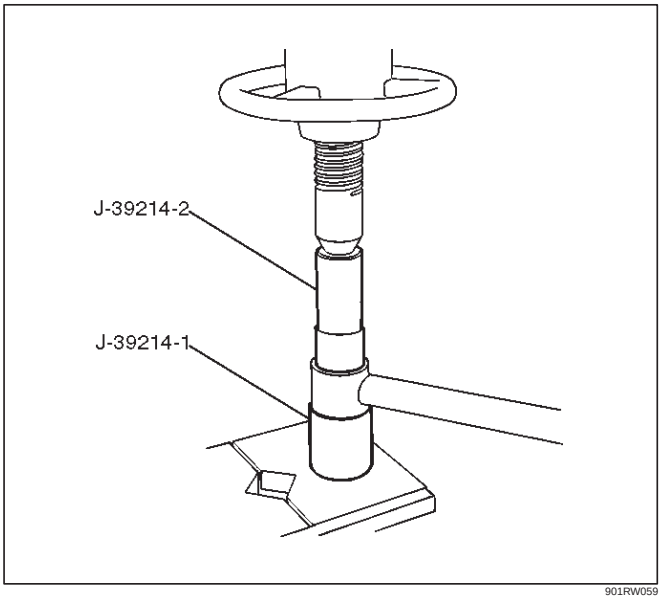
▼Remove the rubber bushing by using remover J–39214.



901RW058

▼Install the rubber bushing by using installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

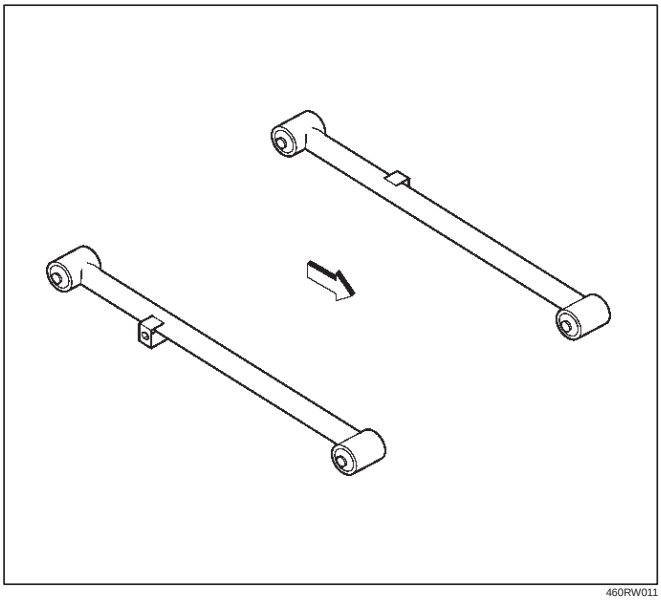


901RW059

Installation

1. Install trailing link. Make sure that the trailing link is in its correct position.

NOTE: When mounting trailing link, be sure not to use grease on bushings or any other nearby part.


460RW011

2. Install bolt, nut and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

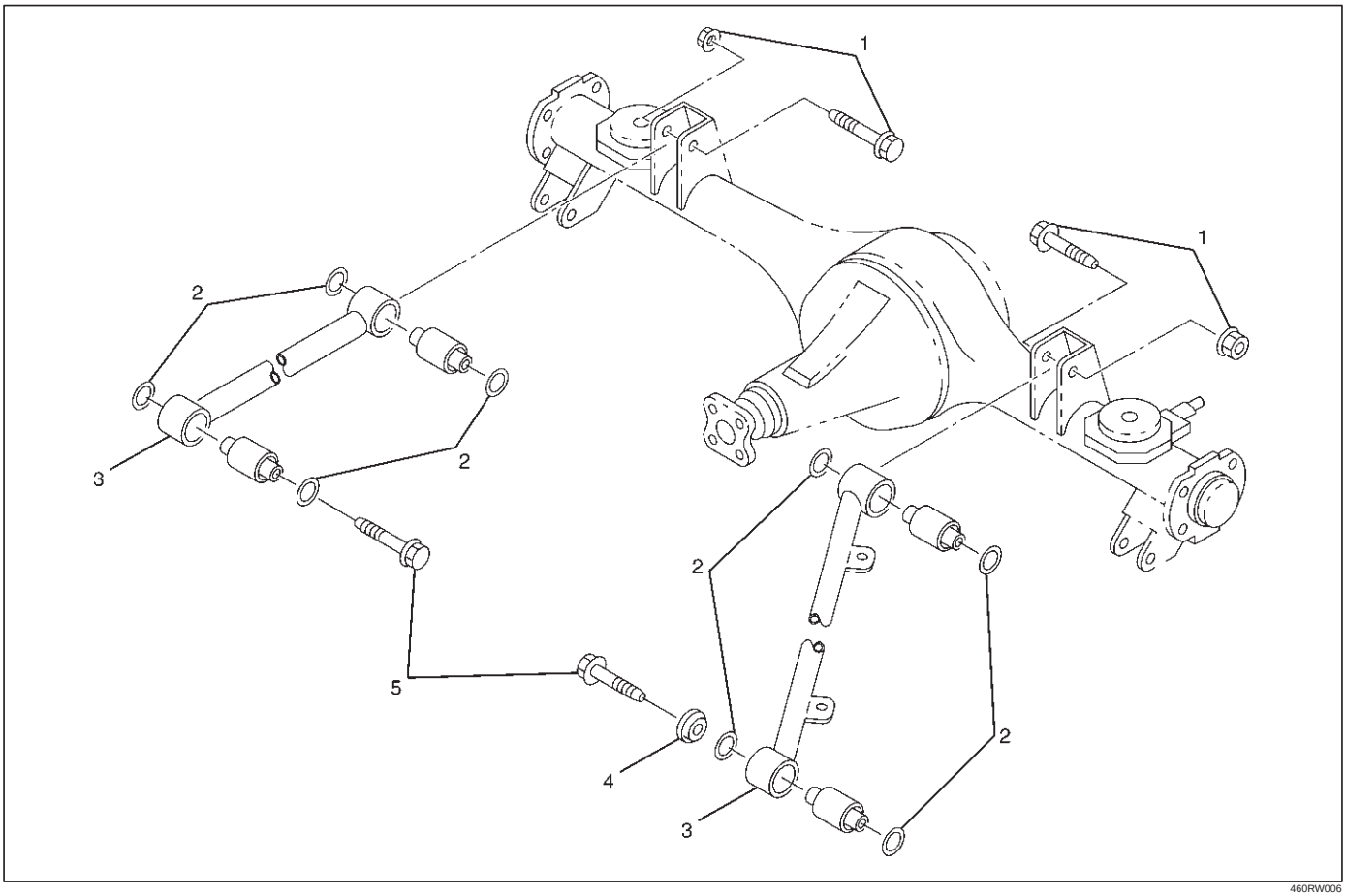
   Torque: 137 N·m (101 lb ft)

3. Install parking brake cable.

CAUTION: The parking brake cable should not be overstrained or slackened.

Upper Link

Upper Link and Associated Parts



460RW006

Legend

(1) Bolt and Nut (Axle side)
(2) Rubber Plate
(3) Upper Link
(4) Protector (Left side only)
(5) Bolt (Frame side)

Removal

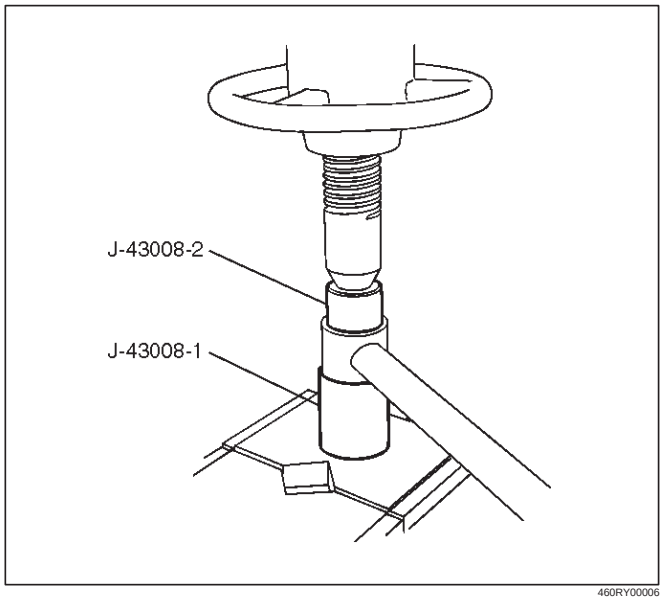
1. Remove fuel tank. Refer to *Engine Fuel in Engine* section.
2. Remove the speed sensor cable from the upper link.
3. Remove bolt, nut, rubber plate and protector.
4. Remove upper link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Upper link
2. Rubber bushing

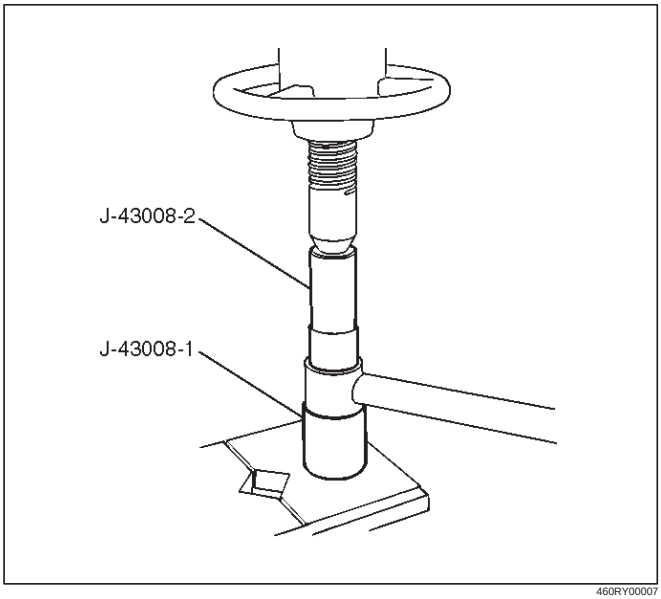
▼Remove the rubber bushing by using remover J–43008.



460RY00006

▼Install the rubber bushing by using to installer J–43008.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

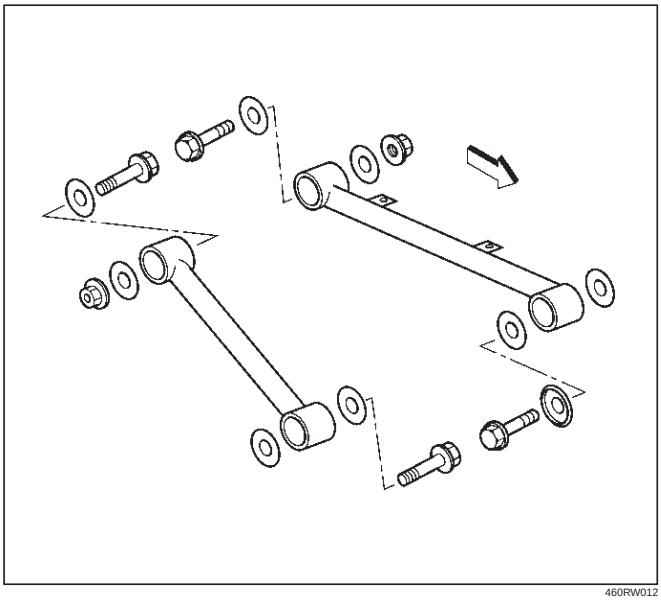


460RY00007

Installation

1. Install upper link. Make sure that the upper link is in its correct position.

NOTE: When mounting upper link, be sure not to use grease bushings or any other nearby part.


460RW012

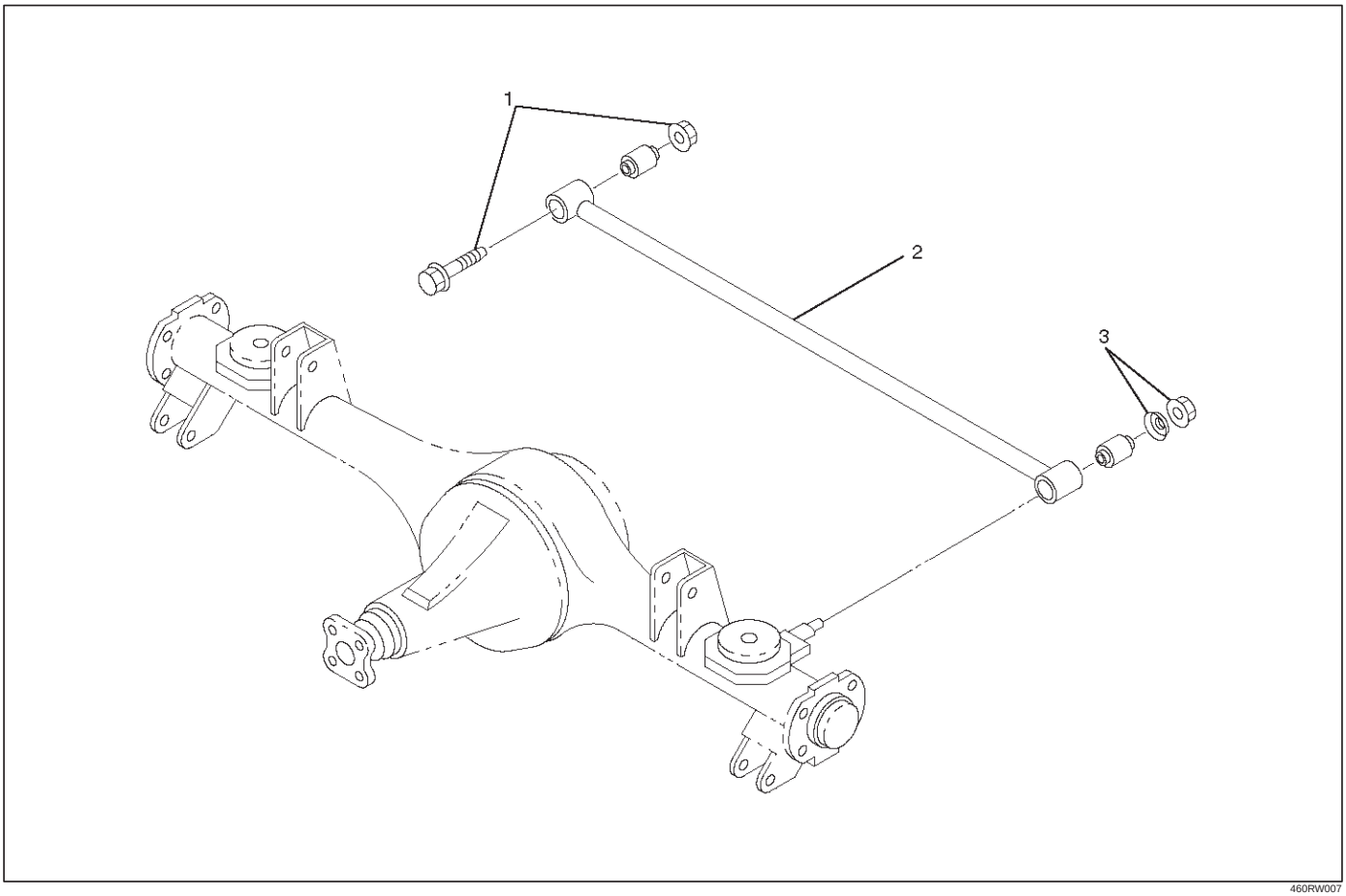
2. Install bolt, nut, rubber plate and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

   Torque: 137 N·m (101 lb ft)

3. Install speed sensor cable.
4. Install fuel tank.

Lateral Rod

Lateral Rod and Associated Parts



460RW007

Legend

(1) Bolt and Nut (Frame side)
(2) Lateral Rod
(3) Nut and Washer (Axle side)

Removal

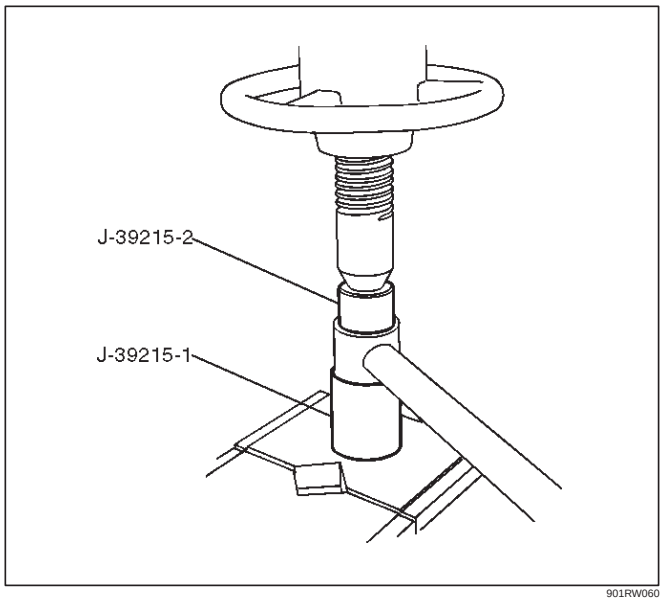
1. Remove nut and washer.
2. Remove bolt and nut.
3. Remove lateral rod.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Lateral rod
2. Rubber bushing (Frame side)

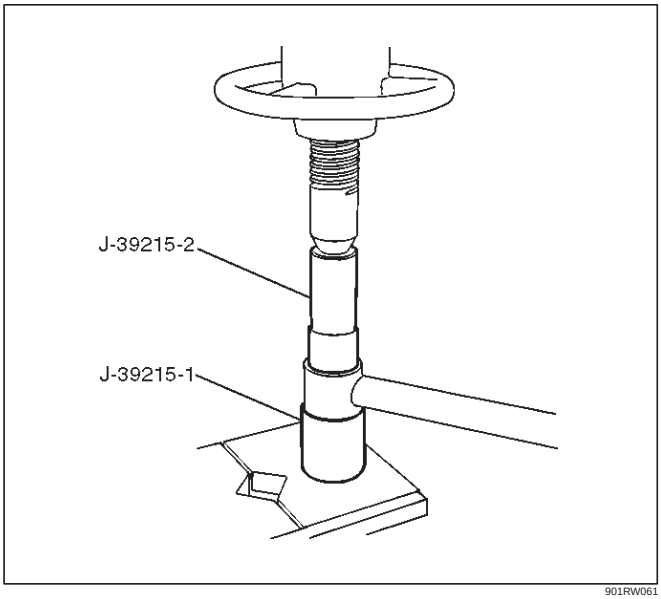
▼Remove the rubber bushing (Frame side) by using remover J–39215.



901RW060

▼Install the rubber bushing (Frame side) by using Installer J–39215.

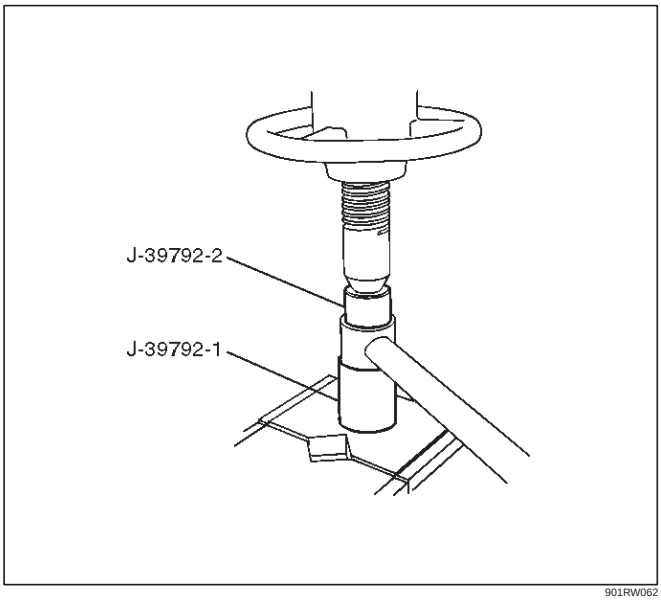
NOTE: When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



901RW061

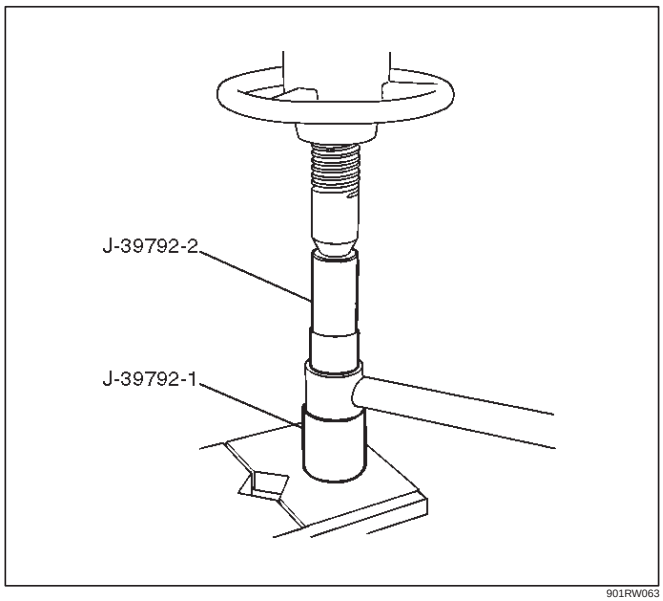
3. Rubber bushing (Axle side)

▼Remove the rubber bushing (Axle side) by using remover J–39792.



901RW062

▼Install the rubber bushing (Axle side) by using installer J–39792.

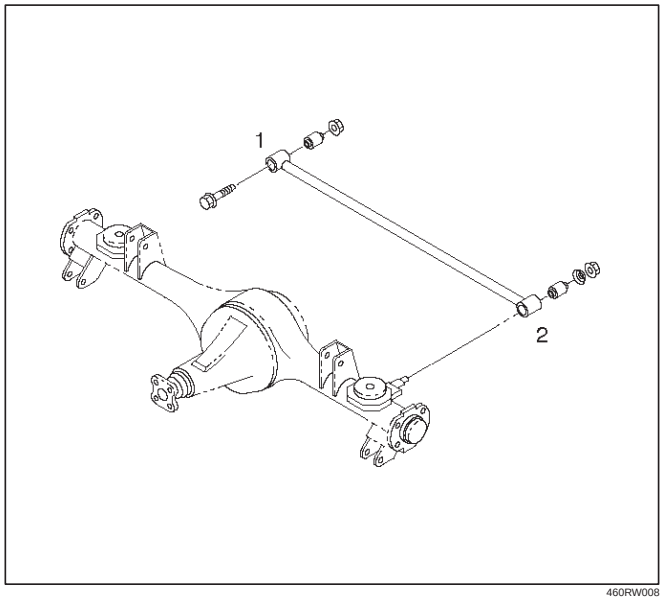


901RW063

Installation

1. Install lateral rod and make sure that the lateral rod is in its correct position.

NOTE: When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.



460RW008

Legend

(1) Frame Side
(2) Axle Side

2. Install bolt and nut (Frame side). Tighten the bolt and nut lightly, then retighten them to the specified torque after the vehicle is at curb height.

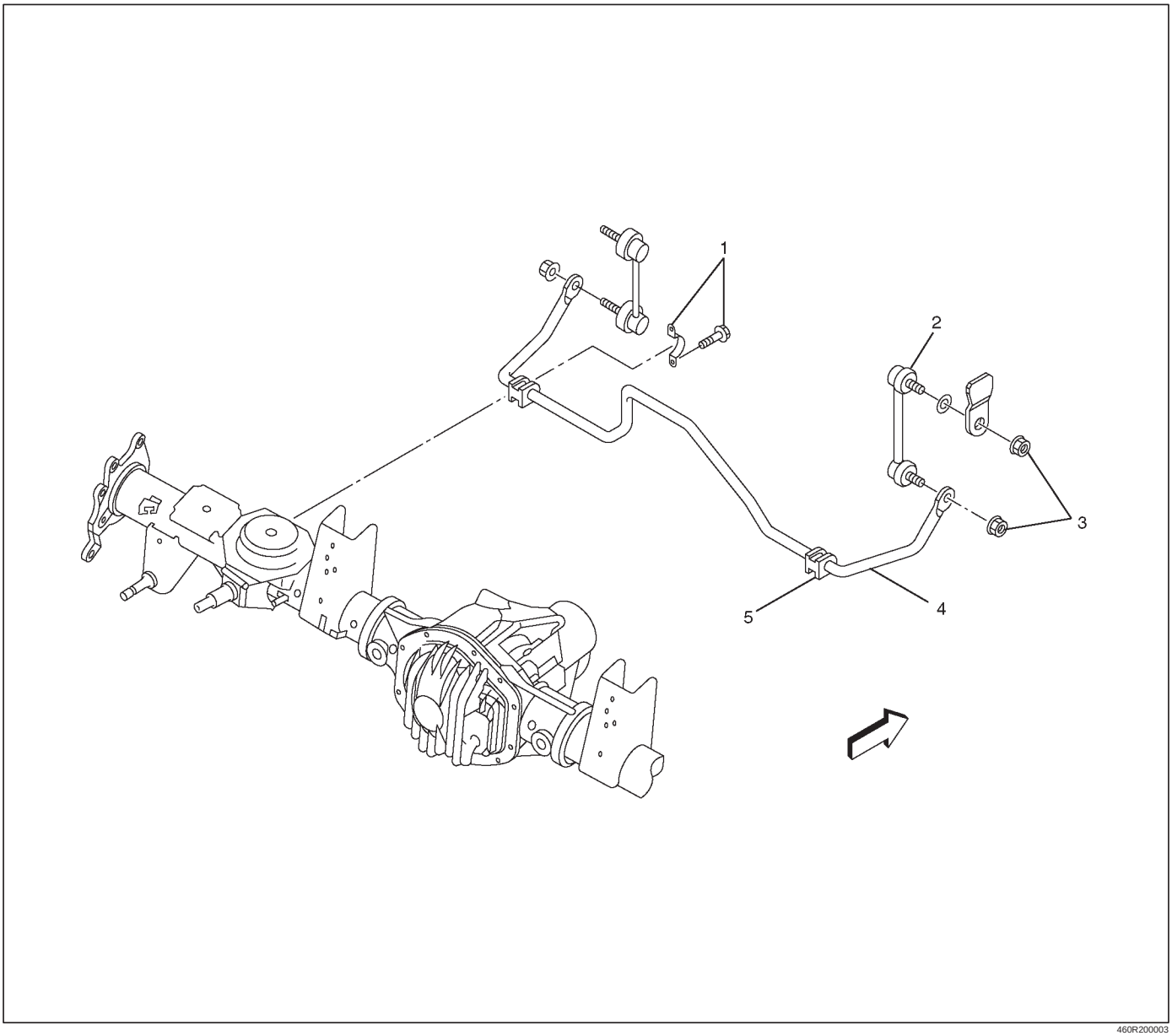
Torque: 137 N·m (101 lb ft)

3. Install nut and washer (Axle side). Tighten the nut lightly, then retighten the nut to the specified torque after the vehicle is at curb height.

Torque: 78 N·m (58 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



460R200003

Legend

(1) Bracket and Bolt
(2) Link
(3) Nut
(4) Stabilizer Bar
(5) Rubber Bushing

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to *Wheel* in this section.
3. Remove nut.
4. Remove link.
5. Remove bracket.
6. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

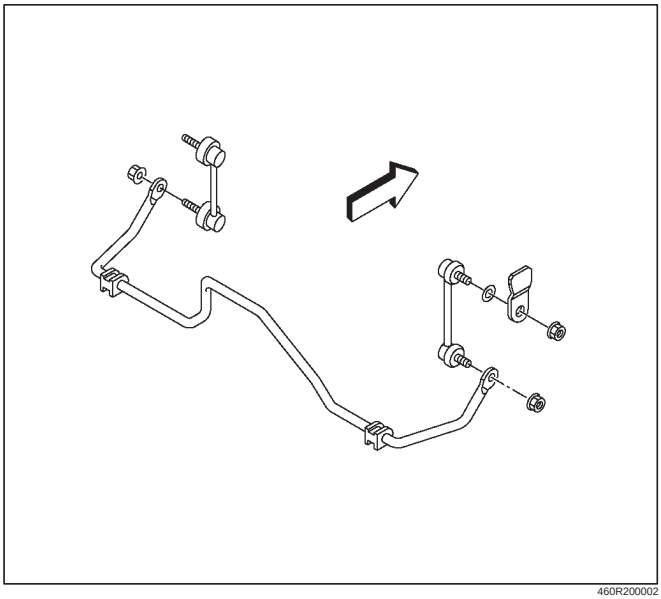
- ▼ Stabilizer bar
- ▼ Rubber bushing
- ▼ Link

Installation

1. Install rubber bushing.
2. Install bracket to axle housing and tighten to the specified torque.

   Torque: 25 N·m (18 lb ft)
3. Install link.
4. Install nut, then tighten the nut to the specified torque.

   Torque: 50 N·m (37 lb ft)



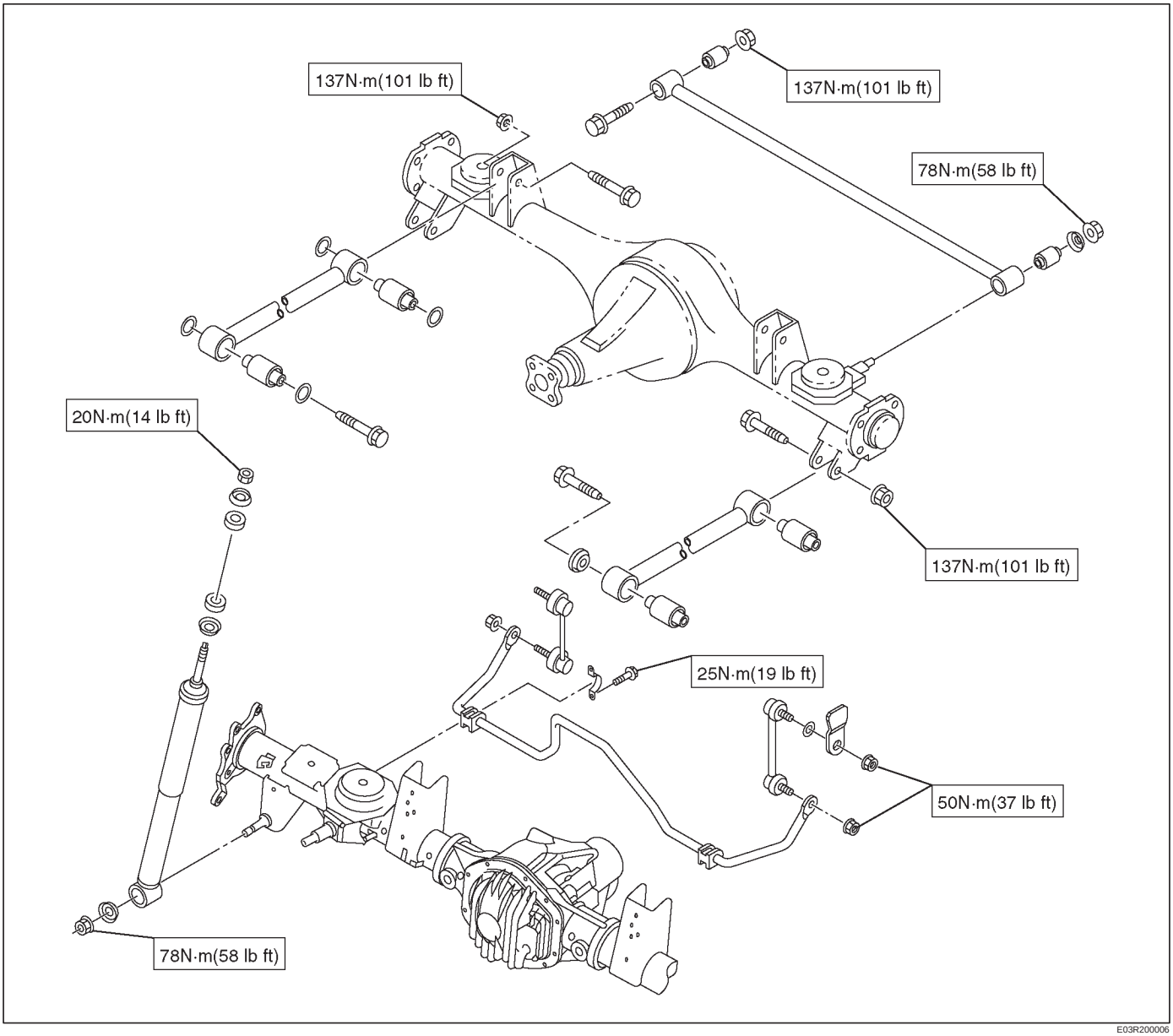
460R200002

Main Data and Specifications

General Specifications

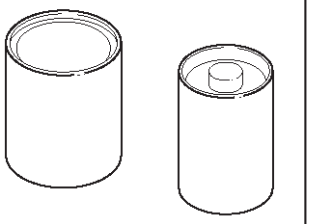
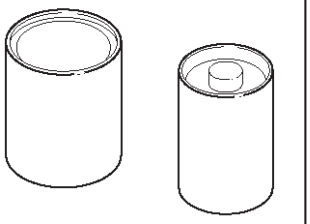
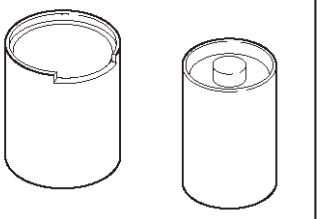
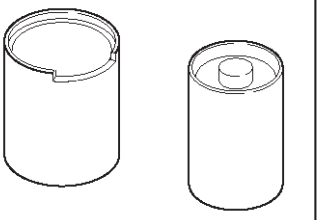
Rear suspension	Type	5–Link, coil spring type with stabilizer bar.
Coil spring	Free length	370.5 mm (14.59 in)
	Spring diameter	12.4 mm (0.49 in)
	Coil diameter (inner)	105 mm (4.13 in)
	Effective No. of turns	5.21
	Total No. of turns	6.71
Shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30 mm (1.18 in)
	Stroke	159 mm (6.26 in)
	Extended length	518 mm (20.39 in)
	Compressed length	359 mm (14.13 in)
Stabilizer bar	Diameter	18 mm (0.71 in)

Torque Specifications



E03R200006

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS291	**J–39214** Remover and Installer; Trailing link bushing
 901RS291	**J–43008** Remover and Installer; Upper link bushing
 901RS292	**J–39792** Remover and Installer; Lateral rod bushing (Axle side)
 901RS293	**J–39215** Remover and Installer; Lateral rod bushing (Frame side)

AXIOM

SUSPENSION

WHEEL AND TIRE SYSTEM

CONTENTS

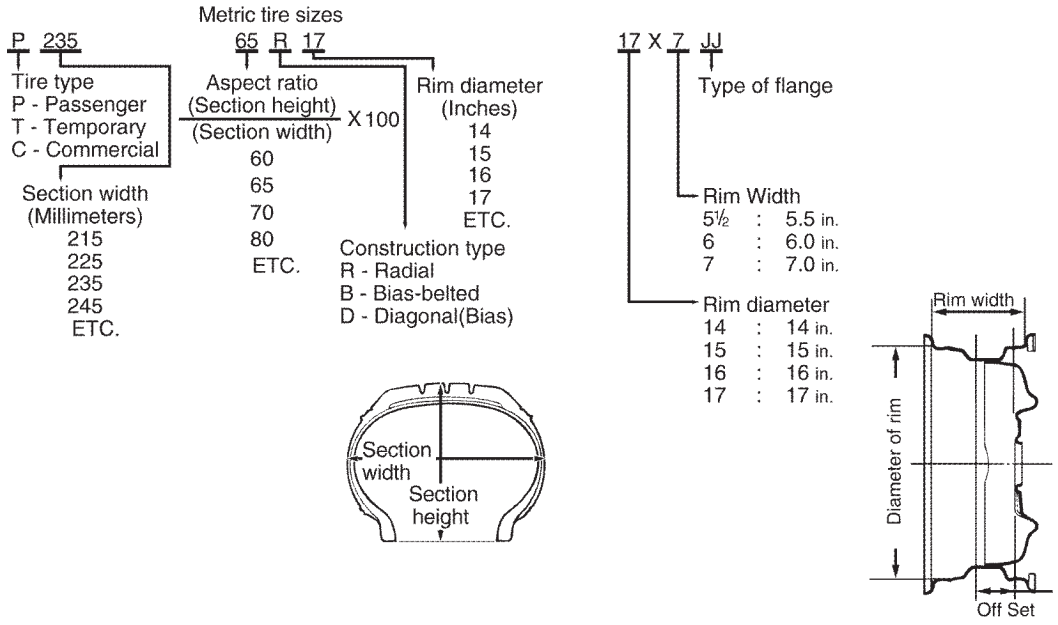
Service Precaution 3E–1
General Description 3E–2
Diagnosis 3E–3
Wheel 3E–11
Wheel and Associated Parts 3E–11
Removal 3E–11
Installation 3E–11
Tire 3E–12
Tire Replacement 3E–12
General Balance Procedure 3E–12
Balancing Wheel and Tire 3E–13
Main Data and Specifications 3E–14

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



METRIC TIRE SIZE FORMAT

RIM SIZE FORMAT

480R200001

Replacement wheels or tires must be equivalent to the originals in load capacity, specified dimension and mounting configuration. Improper size or type may affect bearing life, brake performance, speedometer/odometer calibration, vehicle ground clearance and tire clearance to the body and chassis. All models are equipped with metric sized tubeless steel belted radial tires. Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase premature and uneven wear.

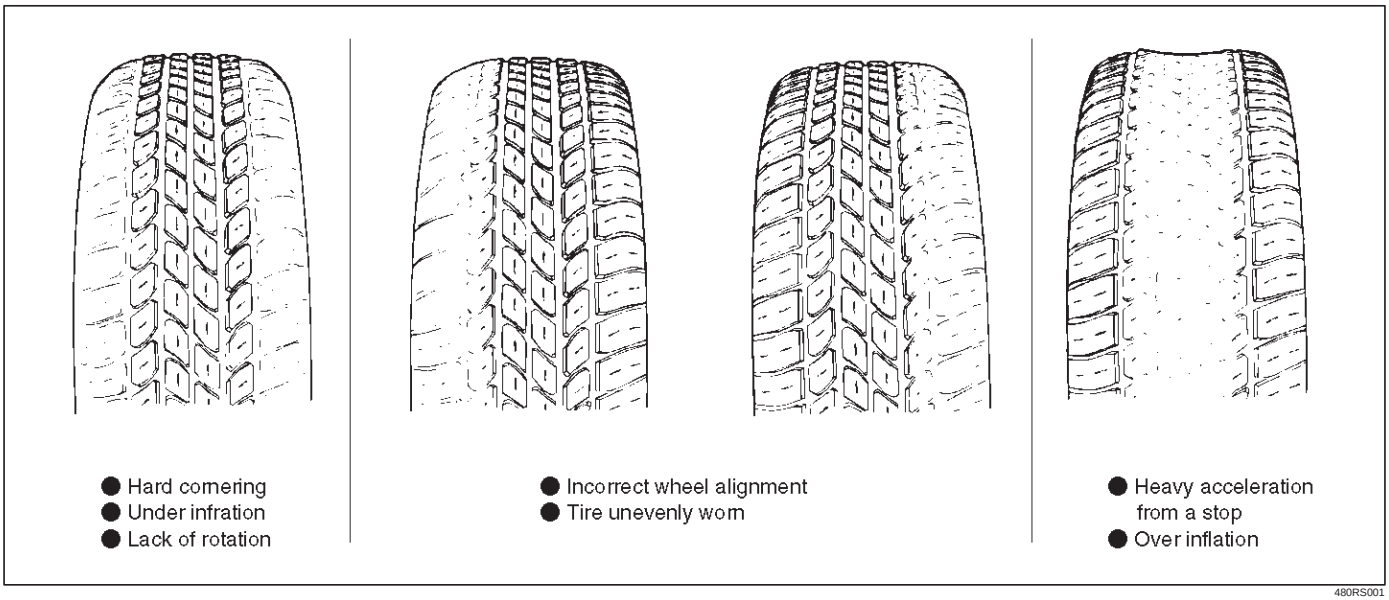
Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to *Steering section.*
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Irregular and Premature Wear

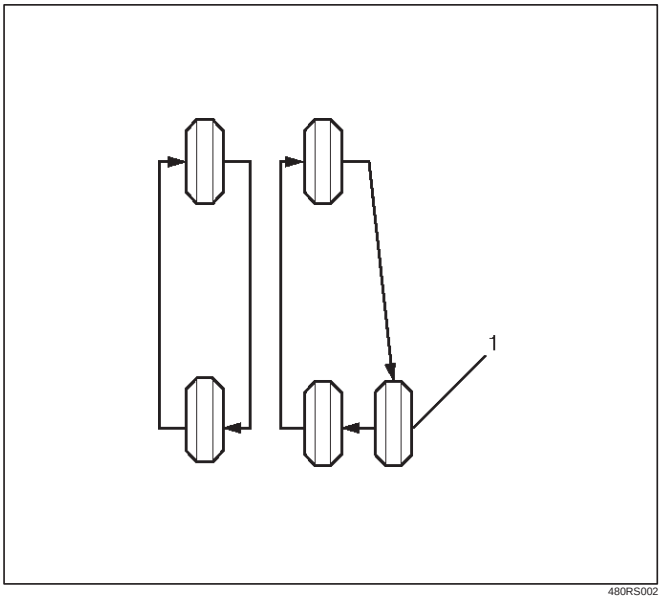


Irregular and/or premature wear has many causes. Some of them are incorrect inflation pressures, lack of tire rotation, poor driving habits or improper wheel alignment. Incorrect inflation is common cause of tire premature wear.

NOTE: Due to their design, radial tires tend to wear faster in the shoulder area, particularly on the front tires. This makes regular rotation especially necessary. After rotation, be sure to check wheel nut torque, and set tire pressures.

Tire Rotation

Tire rotation is recommended to equalize wear for longer tire life.



480RS002

Legend

(1) Spare Tire

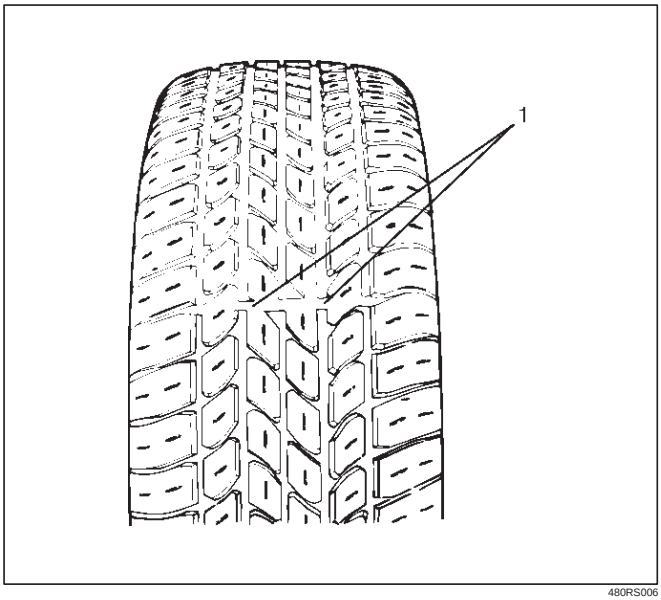
If the following conditions are noted, rotate the tires:

- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Left and right front tire wear is unequal.
- Left and right rear tire wear is unequal.

Check wheel alignment if the following conditions are noted:

- Left and right front tire wear is unequal.
- Wear is uneven across the tread of any front tire.
- Front tire treads have a scuffed appearance with "feather" edges on one side of the tread ribs or blocks.

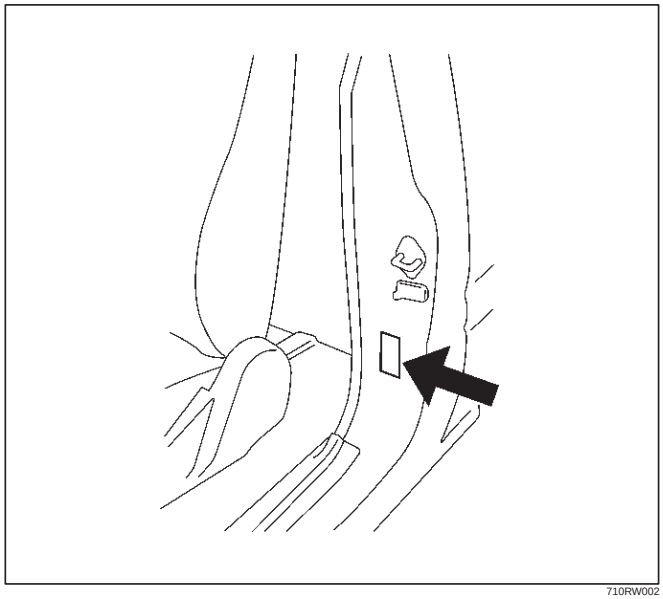
Tread Wear Indicators



480RS006

The original equipment tires have built-in tread wear indicators(1) to show when tires need replacement. These indicators may appear as wide bands. When the indicators appear in two or more grooves at three locations, tire replacement is recommended.

Inflation of Tires



710RW002

Tire pressure, in cold condition (after vehicle has set for three hours or more, and driven less than one mile), should be checked monthly or before any extended trip. Tire pressure increases approximately 15% when the tires become hot during driving. Tire pressure specification is shown on the label located on the left door lock pillar.

NOTE: Check the tire pressure whenever irregular wear is found. Tire inflation greatly affects tire wear. If the alignment check does not reveal any alignment problems, check the condition of the shock absorbers and wheel/tire balance.

Diagnosis List

If the following conditions are noted, rotation is required.

1. Front tire wear is different from rear.
2. Uneven wear exists across the tread of any tire.
3. Left and right front tire wear is unequal.
4. Left and right rear tire wear is unequal.

If the following conditions are noted, check the wheel alignment.

1. Left and right front tire wear is unequal.
2. Uneven wear exists across the tread of any tire.
3. Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.
4. There is cupping, flat spotting etc.

Higher than recommended pressure can cause:

1. Hard ride.
2. Poor steering stability.
3. Rapid and uneven wear at center of the tread.

Lower than recommended pressure can cause:

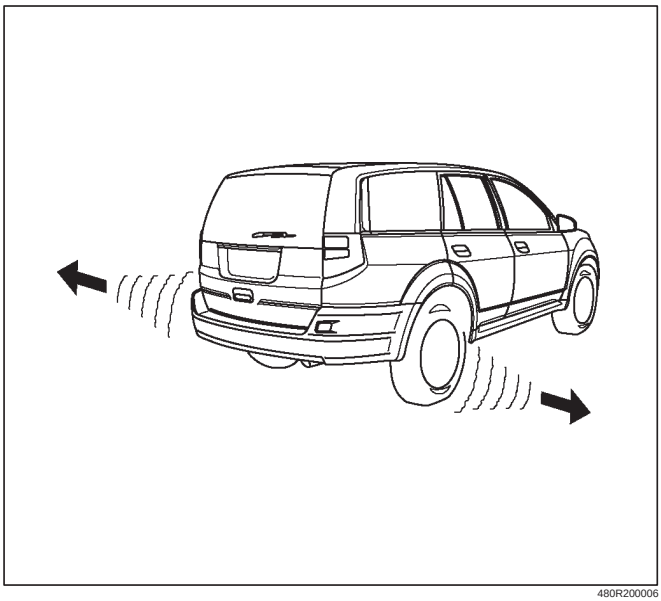
1. Tire squeal on turns.
2. Hard steering.
3. Rapid and uneven wear on the edges of the tread.
4. Tire rim bruises and rupture.

5. Tire cord breakage.
6. High tire temperatures.
7. Reduced handling.
8. Reduced fuel economy.

Unequal pressure on same axle can cause:

1. Uneven braking.
2. Steering lead.
3. Reduced handling.
4. Swerve on acceleration.

Radial Tire Waddle



480R200006

Waddle is side-to-side movement at the front and/or rear of the car. It can be caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel. It is most noticeable at low speed, about 8 to 48 km/h (5 to 30 mph). It may also cause rough ride at 80 to 113 km/h (50 to 70 mph).

The car can be road tested to see which end of the car has the faulty tire. If the tire causing the waddle is on the rear, the rear end of the car will “waddle”. From the driver’s seat, it feels as if someone is pushing on the side of the car.

If the faulty tire is on the front, the waddle is more easily seen. The front sheet metal appears to be moving back and forth. It feels as if the driver’s seat is the pivot point in the car.

Another more time-consuming method of determining the faulty tire is substituting tire and wheel assemblies that are known to be good. Follow these steps:

1. Drive the car to determine if the waddle is coming from the front or rear.
2. Install tire and wheel assemblies known to be good (from a similar car) in place of those on the end of the car which is waddling. If the waddle cannot be isolated to front or rear, start with the rear tires.
3. Road test again. If improvement is noted, install the original tire and wheel assemblies one at a time until the faulty tire is found. If no improvement is noted, install tires known to be good in place of all four. Then, install the originals one at a time until the faulty tire is found.

Radial Tire Lead/Pull

“Lead/Pull” is vehicle deviation from a straight path, on a level road with no pressure on the steering wheel.

Lead is usually caused by:

1. Poorly manufactured radial tires.
2. Uneven brake adjustment.
3. Wheel alignment.

The way in which a tire is built can produce lead in a car. An example of this is placement of the belt. Off-center belts on radial tires can cause the tire to develop a side force while rolling straight down the road and the tire will tend to roll like a cone.

The “Radial Tire Lead/Pull Correction” chart should be used to make sure that front wheel alignment is not mistaken for tire lead.

Rear tires will not cause lead/pull.

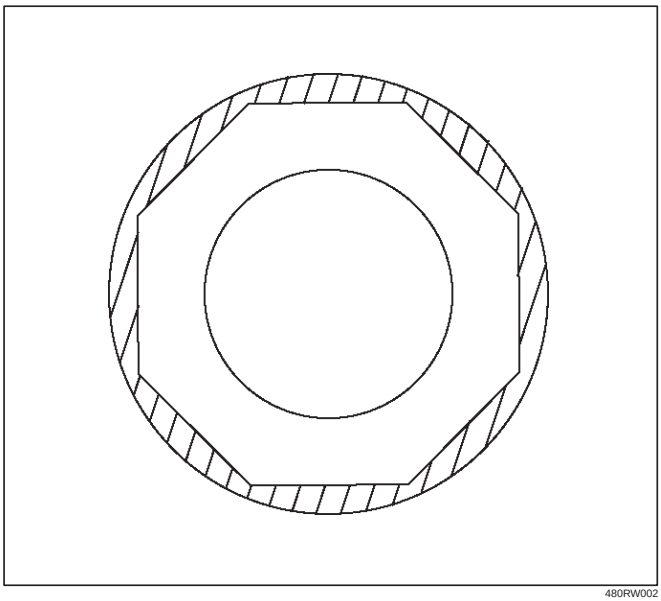
Radial Tire Lead/Pull Correction Chart

Step	Action	Yes	No
1	1. Inflate tires to recommended pressure. 2. Road test vehicle on level uncrowned road. Was a problem corrected?	End.	Go to *Step 2*
2	Switch front tires side to side and road test again. Was a problem corrected?	If roughness results,replace tires.	Go to *Step 3*
3	Did the vehicle lead in same direction?	Go to *Step 4*	Go to *Step 5*
4	Put tires back in original position and check alignment. Was a problem corrected?	End.	Go to *Step 5*
5	Install known good tire on one front side. Was a problem corrected?	Replace tire.	Install a known good tire in place of other front tire. If lead corrected, replace tire.

Typical examples of abnormal tire ahead wear and major causes:

CAUTION: Similar wear patterns can be caused by worn suspension parts, misalignment of wheels and tires, and other suspension related problems.

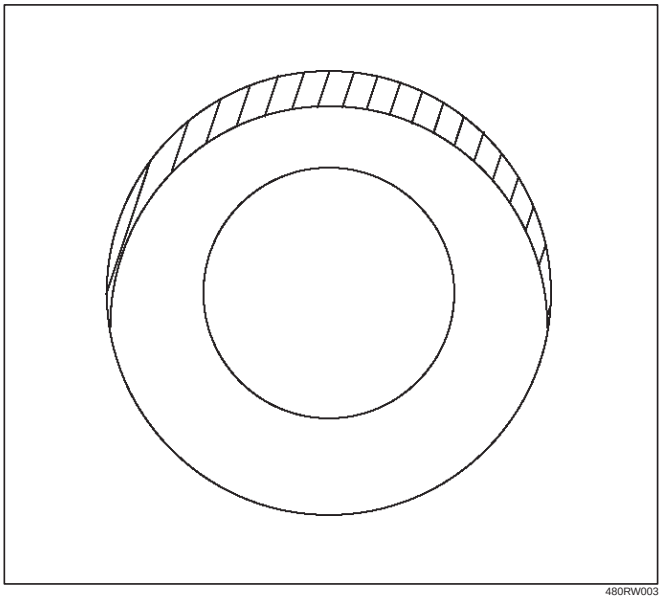
Spotty wear – wear localized on shoulder sections, and in an extreme cases, the tire becomes polygonal in shape.



480RW002

1. Tire or wheel out of round or distorted.
2. Hub or knuckle out of round or distorted.
3. Play in hub bearings or ball joint.
4. Rotating parts out of balance.

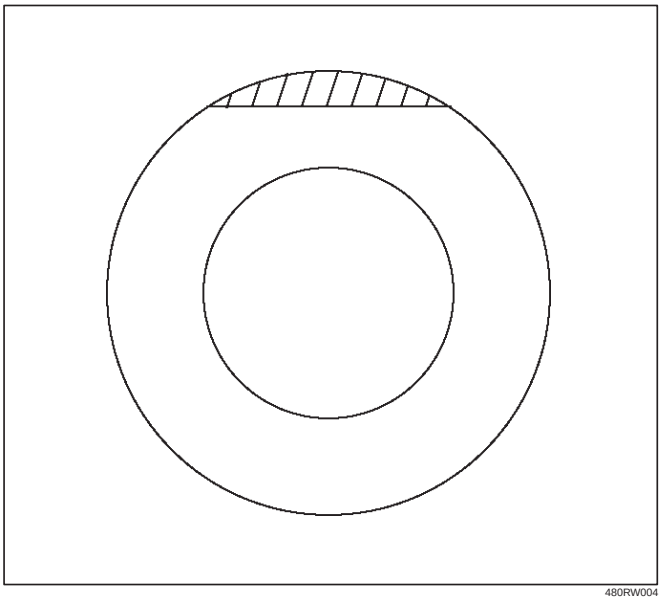
Tread wear one-sided.



480RW003

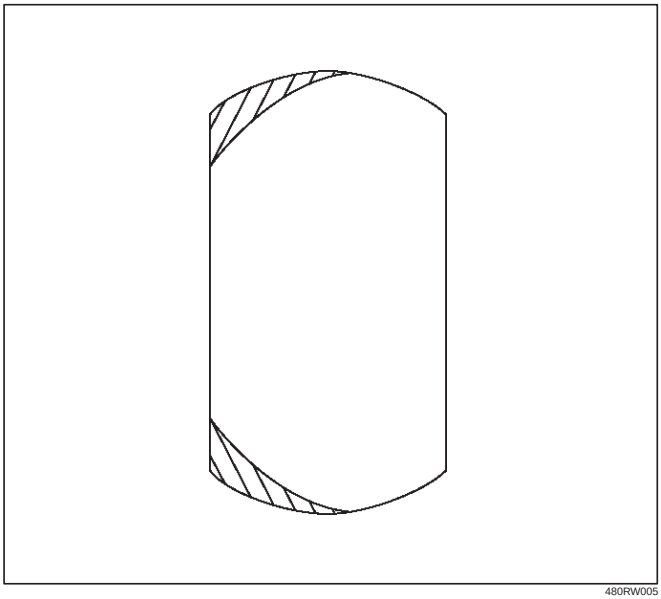
1. Rotating parts out of balance.
2. Tire or wheel out of round.
3. Hub or knuckle out of round or distorted.

Localized tread wear.



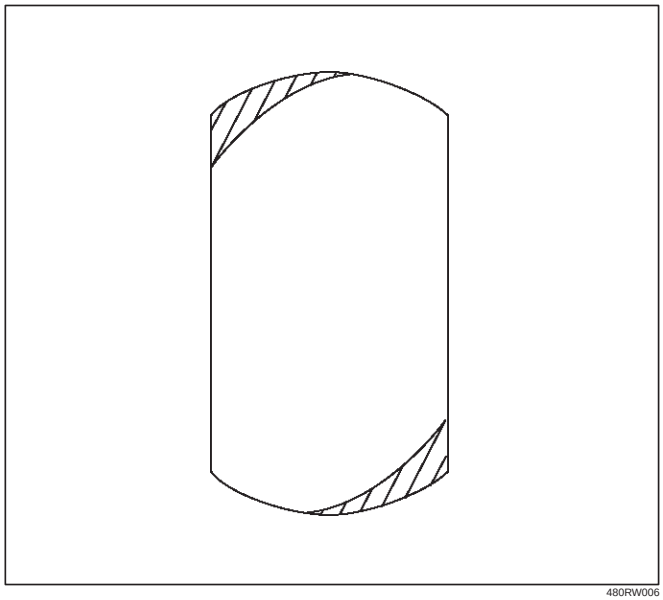
1. Once spotty wear develops in tread due to hard braking or abrupt starting, localized wear tends to be promoted.

Shoulder wear (generally wear develops in outer shoulder):



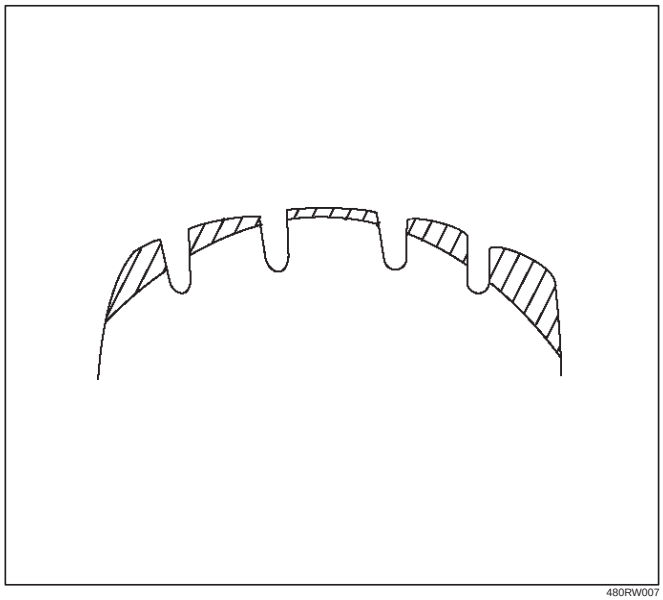
1. Camber or toe-in incorrect.
2. Shoulder wear caused by repeated hard-cornering.

Wear in shoulders at points opposed to each other.



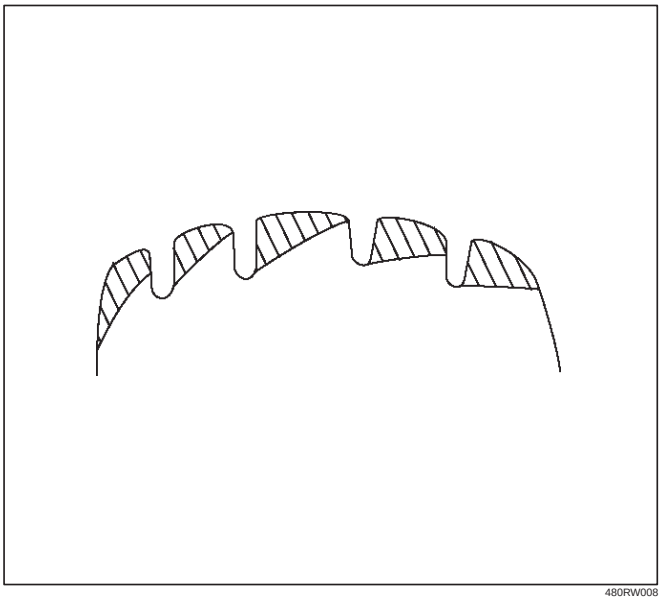
1. Tire or wheel out of round or distorted.
2. Play in bearings or ball joint.

Premature wear in shoulders.



1. Flexing of tire excessive due to under-inflation.

One sided feather edging.

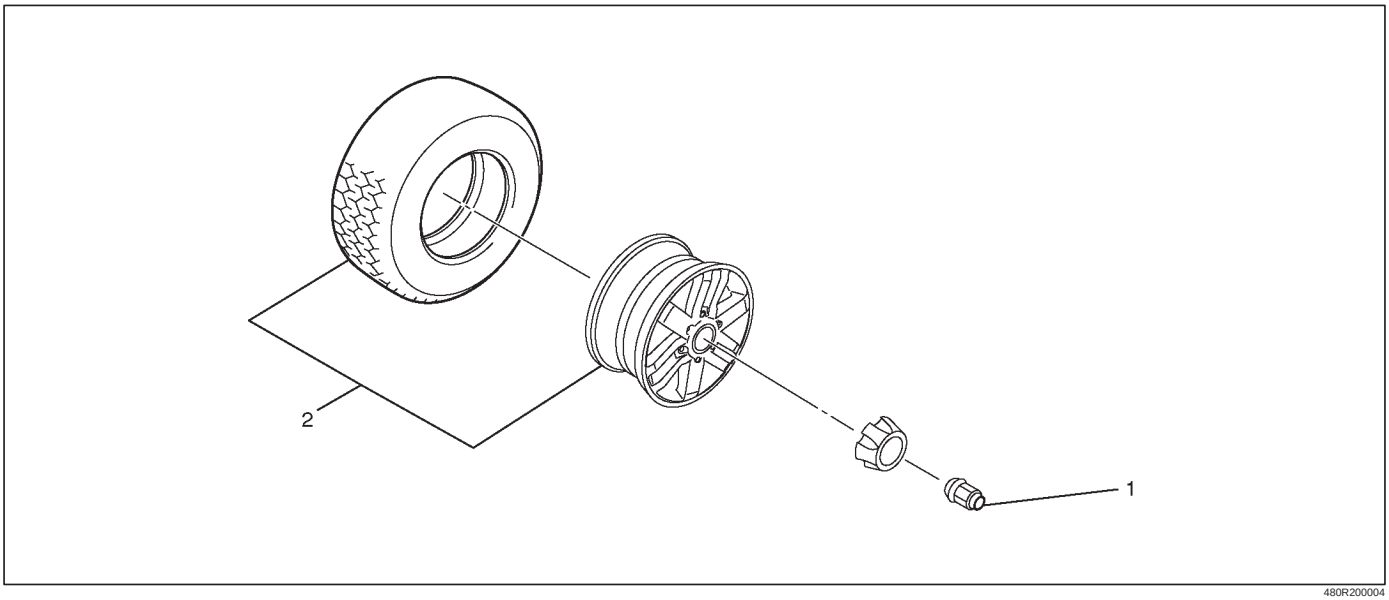


480RW008

1. Wear caused by repeated hard cornering.
2. Camber or toe-in incorrect.

Wheel

Wheel and Associated Parts



480R200004

Legend
(1) Wheel Lug Nut
(2) Alumi Wheel and Tire

Removal

1. Loosen wheel lug nut by approximately 180° (half a rotation), then raise the vehicle and remove the nuts.
2. Remove wheel and tire.

NOTE: Never use heat to loosen a tight wheel lug nut. The application of heat to the hub can shorten the life of the wheel and may cause damage to wheel bearings.

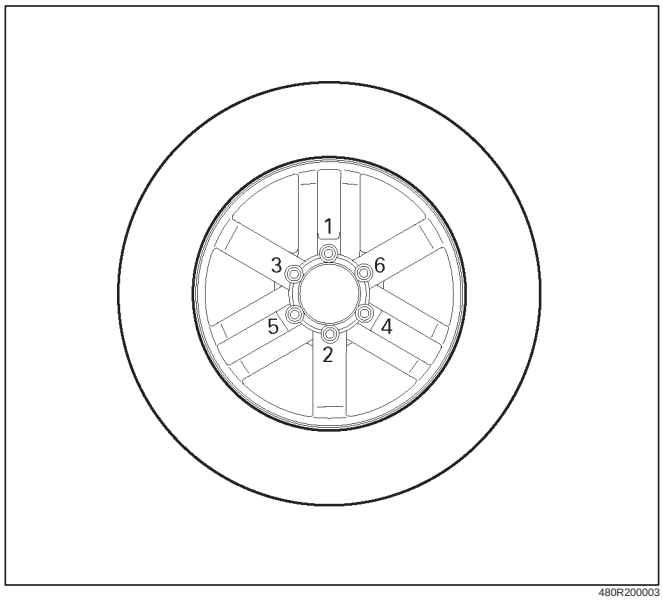
Installation

1. Install wheel and tire.
2. Install wheel lug nut, and lower the vehicle. Tighten the wheel lug nuts to the specified torque in numerical order.

Torque: 118 N·m (87 lb ft)

CAUTION: Before installing wheels, remove any build-up of corrosion on the wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving.

NOTE: Valve caps should be on the valve stems to keep dust and water out.



480R200003

Tire

Tire Replacement

When replacement is necessary, the original metric tire size should be used. Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with tire having the most tread, to equalize braking traction.

CAUTION: Do not mix different types of tires such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

Tire Dismounting

Remove valve cap on valve step and deflate the tire. Then use a tire changing machine to mount or dismount tires. Follow the equipment manufacturer's instruction. Do not use hand tools or tire lever alone to change tires as they may damage the tire beads or wheel rim.

Tire Mounting

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, and light rust. Before mounting a tire, the bead area should be well lubricated with an approved tire lubricant.
After mounting, inflate the tire to 196kPa (28 psi) so that beads are completely seated. Inflate the air to specified pressure and install valve cap to the stem.

WARNING: NEVER STAND OVER TIRE WHEN INFLATING. BEAD MAY BREAK WHEN BEAD SNAPS OVER RIM'S SAFETY HUMP AND CAUSE SERIOUS PERSONAL INJURY.

NEVER EXCEED 240 KPA (35 PSI) PRESSURE WHEN INFLATING. IF 240 KPA (35 PSI) PRESSURE WILL NOT SEAT BEADS, DEFLATE, RE-LUBRICATE AND RE-INFLATE. OVER INFLATION MAY CAUSE THE BEAD TO BREAK AND CAUSE SERIOUS PERSONAL INJURY.

Tire Repair

There are many different materials on the market used to repair tires.
Manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from the tire manufacturer if they are not included with the repair kit.

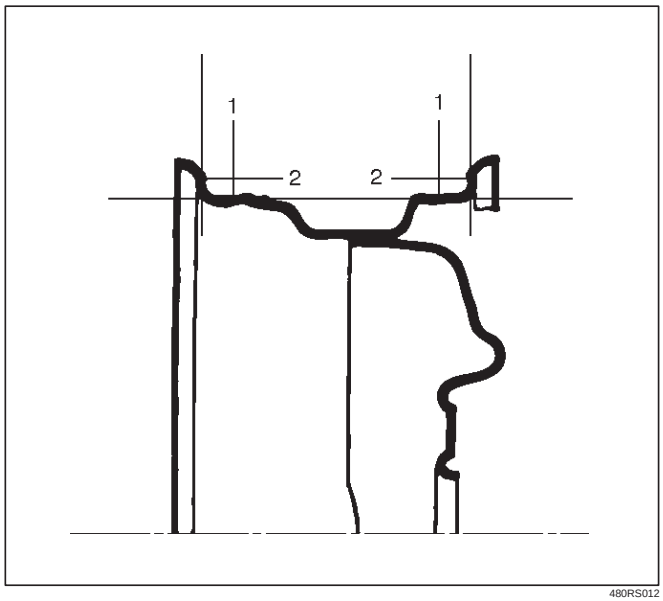
Wheel Inspection

Damaged wheels and wheels with excessive run-out must be replaced.
Wheel run out at rim (Base on hub Bore):

Aluminum

1– Vertical play: Less than 0.55 mm (0.022 in)

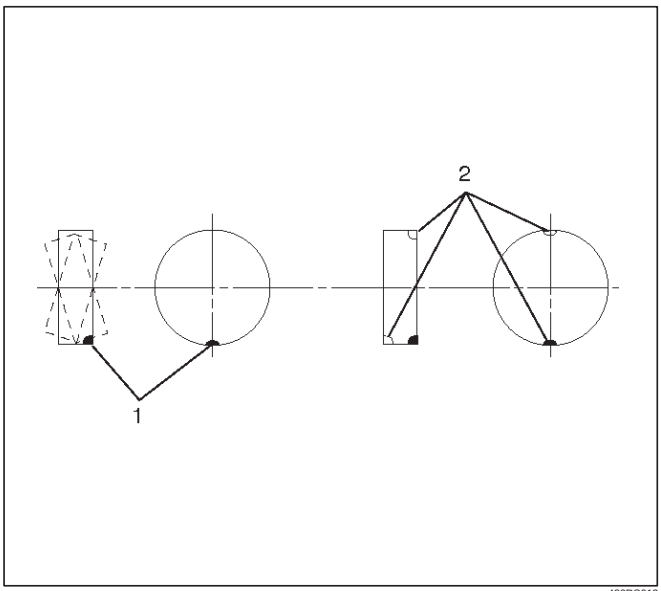
2– Horizontal play: Less than 0.55 mm (0.022 in)



480RS012

General Balance Procedure

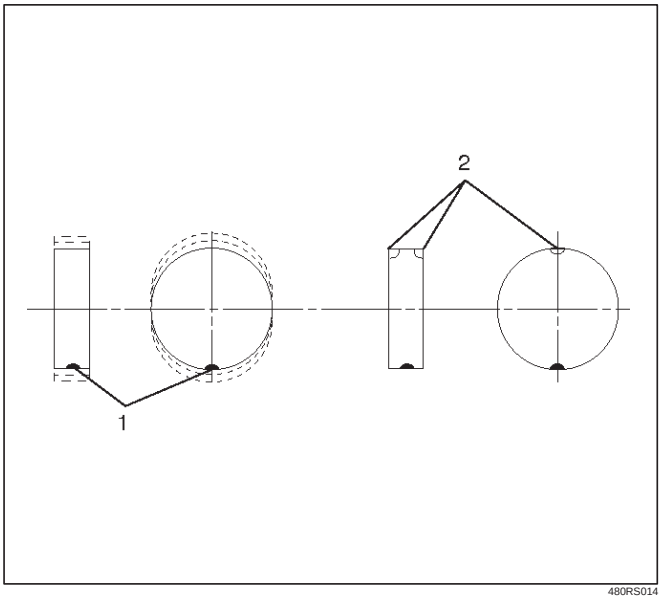
Deposits of mud, etc. must be cleaned from the inside of the rim.
The tire should be inspected for the following: match mount paint marks, bent rims, bulges, irregular tire wear, proper wheel size and inflation pressure. Then balance according to the equipment manufacturer's recommendations.
There are two types of wheel and tire balance.
Static balance is the equal distribution of weight around the wheel.
Assemblies that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



480RS013

Legend
(1) Heavy Spot Wheel Shimmy
(2) Add Balance Weights Here

Dynamic balance is the equal distribution of weight on each side of the wheel center-line so that when the tire spins there is no tendency for the assembly to move from side to side. Assemblies that are dynamically unbalanced may cause shimmy.



480RS014

Legend
(1) Heavy Spot Wheel Hop
(2) Add Balance Weights Here

WARNING: STONES SHOULD BE REMOVED FROM THE TREAD TO AVOID OPERATOR INJURY DURING SPIN BALANCING AND TO OBTAIN A GOOD BALANCE.

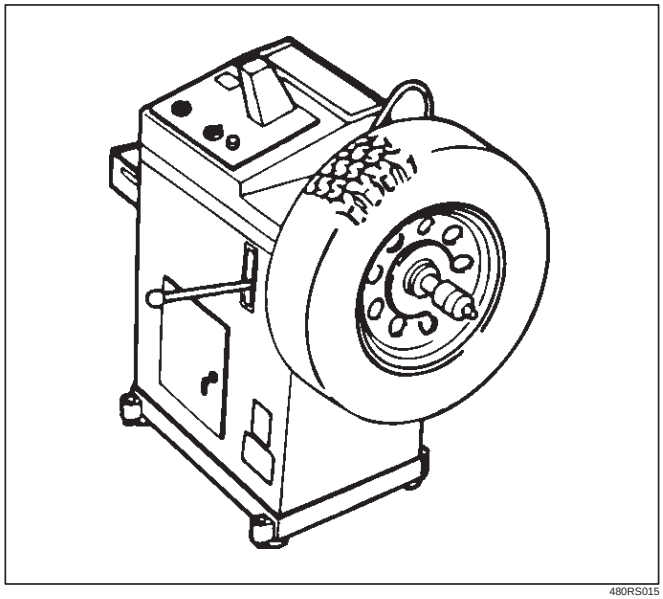
Balancing Wheel and Tire

On-vehicle Balancing

On-Vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

Off-vehicle Balancing

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic balance. Although they do not correct for drum or disc unbalance (as on- vehicle spin balancing does), they are very accurate.

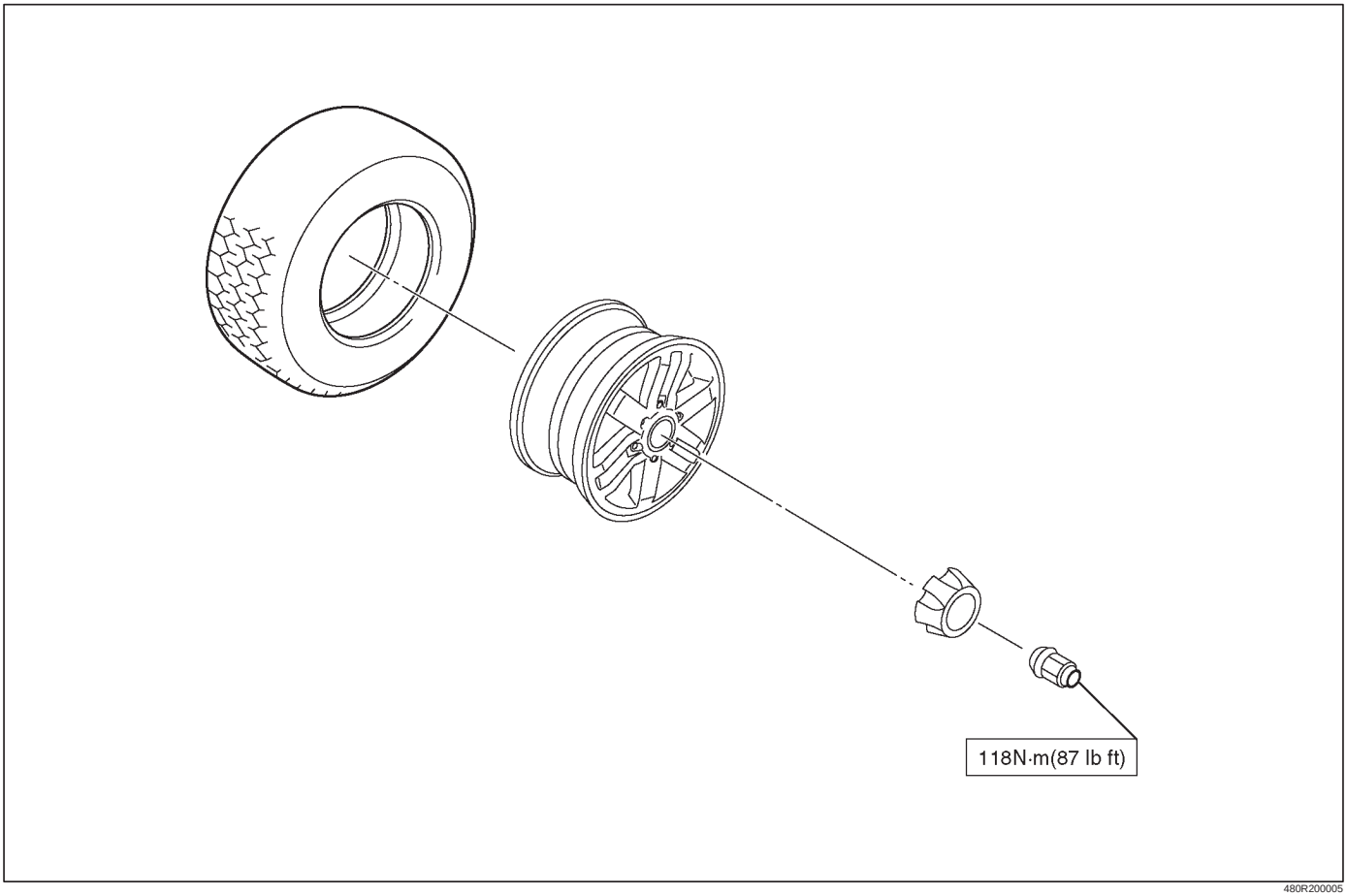

480RS015

Main Data and Specifications

General Specifications

Wheels	Size	17 × 7JJ
	Offset	38.0 mm (1.50 in)
	P.C.D., wheel studs	139.7 mm (5.50 in)
Standard tire	Size	P235/65R17
	Pressure(Front)	180 kPa (26 psi)
	Pressure(Rear)	180 kPa (26 psi)

Torque Specifications



480R200005

AXIOM

SUSPENSION

INTELLIGENT SUSPENSION CONTROL

CONTENTS

Service Precaution 3F–2
General Description 3F–2
PIN ASSIGNMENT TABLE 3F–4
System Components 3F–4
Control Unit 3F–4
Actuator 3F–4
Adjustable Damping Force Shock Absorber 3F–4
Warning Lamp 3F–4
Vertical G-Sensor 3F–5
Lateral G-Sensor 3F–5
Acronyms and Abbreviations 3F–5
General Diagnosis 3F–5
General Information 3F–5
Service Precautions 3F–5
Computer System Service Precautions . . . 3F–5
General Service Precautions 3F–5
Parts Handling 3F–5
FLASHING CODES 3F–6
CLEAR DTC 3F–7
INTERMITTENT CONDITIONS 3F–8
BULB CHECK 3F–8
DTC CHECK 3F–8
Connector List 3F–14
Diagnostic Trouble Code (DTC) Identification 3F–16
DTC2 Actuator Coil Over Current 3F–17
Circuit Description 3F–17
Diagnostic Aids 3F–17
DTC3 Actuator Coil/Position Sensor Open Circuit or Short 3F–19
Circuit Description 3F–19
Diagnostic Aids 3F–19
DTC4 G-Sensor Open Circuit or Short 3F–22
Circuit Description 3F–22
Diagnostic Aids 3F–22
DTC5 Vehicle Speed Sensor Open Circuit or Short 3F–23
Circuit Description 3F–23
Diagnostic Aids 3F–23
DTC6 Stop Lamp Switch Open Circuit or Short 3F–25
Circuit Description 3F–25
Diagnostic Aids 3F–25
DTC7 Engine Speed Signal Open Circuit or Short 3F–27
Circuit Description 3F–27
Diagnostic Aids 3F–27
DTC9 Control Unit Abnormality 3F–28
Control Unit 3F–32
Removal 3F–33
Installation 3F–33
Front Actuator 3F–34
Removal 3F–35
Inspection and Repair 3F–35
Installation 3F–35
Rear Shock Absorber 3F–36
Removal 3F–37
Inspection and Repair 3F–37
Installation 3F–37

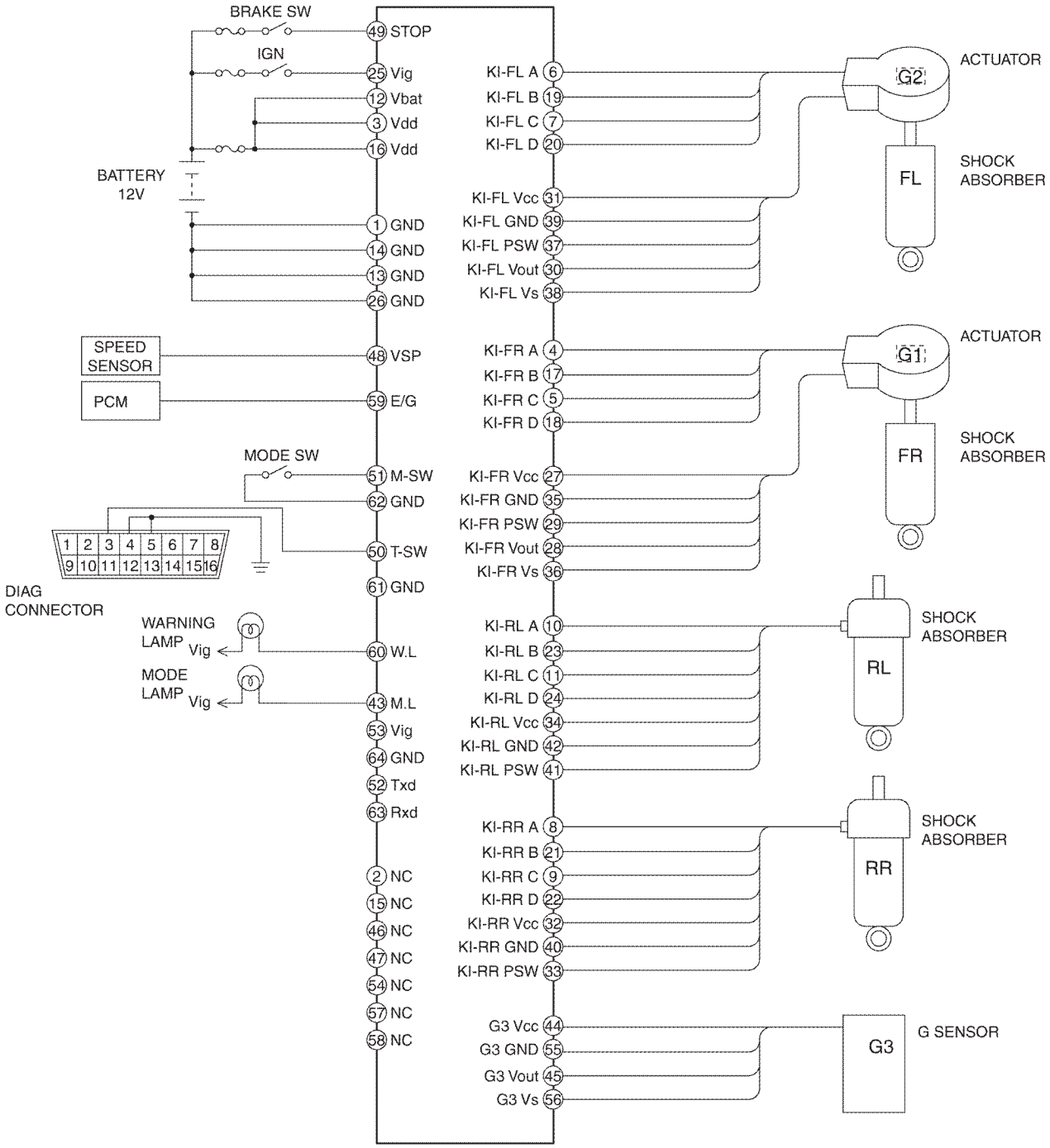
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Intellignet suspension control uses a microcomputer as a control unit to judge running conditions including engine revolution from Powertrain Control Module, vehicle speed from vehicle speed sensor, a brake switch signal, and vertical and lateral G-sensor signal, then sets optimum damping force so that best running stability can be achieved.



CONTROL UNIT PIN ASSIGNMENT

| | | |

PIN ASSIGNMENT TABLE

PIN No.	NAME	PIN No.	NAME	PIN No.	NAME	PIN No.	NAME
1	GND	17	KI-FR B	33	KI-RR PSW	49	STOP
2	NC	18	KI-FR D	34	KI-RL Vcc	50	T-SW
3	Vdd	19	KI-FL B	35	KI-FR GND	51	M-SW
4	KI-FR A	20	KI-FL D	36	KI-FR Vs	52	Txd
5	KI-FR C	21	KI-RR B	37	KI-FL PSW	53	Vig
6	KI-FL A	22	KI-RR D	38	KI-FL Vs	54	NC
7	KI-FL C	23	KI-RL B	39	KI-FL GND	55	G3 GND
8	KI-RR A	24	KI-RL D	40	KI-RR GND	56	G3 Vs
9	KI-RR C	25	Vig	41	KI-RL PSW	57	NC
10	KI-RL A	26	GND	42	KI-RL GND	58	NC
11	KI-RL C	27	KI-FR Vcc	43	M.L	59	E/G
12	Vbat	28	KI-FR Vout	44	G3 Vcc	60	W.L
13	GND	29	KI-FR PSW	45	G3 Vout	61	GND
14	GND	30	KI-FL Vout	46	NC	62	GND
15	NC	31	KI-FL Vcc	47	NC	63	Rxd
16	Vdd	32	KI-RR Vcc	48	VSP	64	GND

NC: NO CONNECTION

System Components

Control Unit, 3 Vertical G-sensors, Lateral G-sensor, 4 Actuators, 4 Adjustable Damping Force Shock Absorbers, and Warning Lamp.

Control Unit

The Control Unit consists of Adjustable Damping Force Shock Absorber control circuits, fault detector, and a fail-safe. It drives the actuator according to the signal from each sensor.
The Control Unit has a self-diagnosing function which can indicate faulty circuits during diagnosis.
The Control Unit is mounted in the center of the instrument panel.

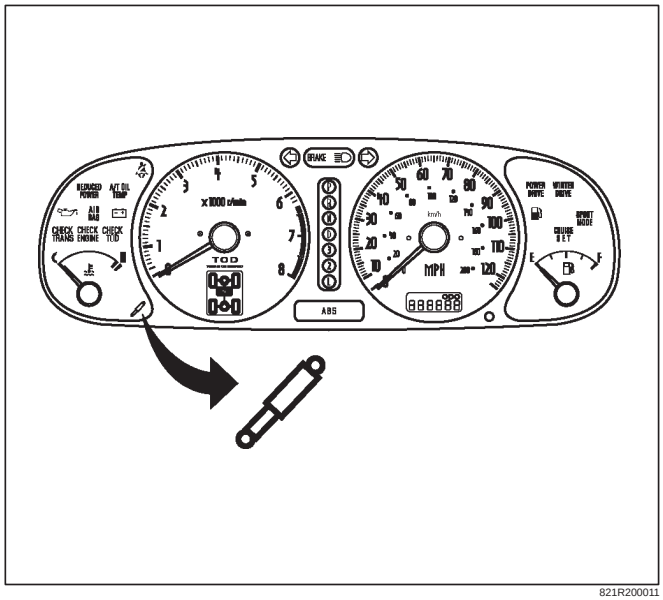
Actuator

Front actuators installed on front shock absorbers and rear actuator installed inside rear shock absorbers control damping force of shock absorber by the Control Unit signal.

Adjustable Damping Force Shock Absorber

This type shock absorber is used in front and rear intelligent suspension. According to running condition the Control Unit changes shock absorber damping force and obtains good running stability.

Warning Lamp



821R200011

Vehicles equipped with the Intelligent Suspension Control have an amber warning lamp in the instrument panel. The warning lamp will illuminate if a malfunction in the Intelligent Suspension Control is detected by the Control Unit. In case of an important electronic malfunction, the Control Unit will turn“ON” the warning lamp.

Vertical G-Sensor

Front G-sensors installed inside front actuators and the rear G-sensor installed on the rear left frame side detect the vehicle vertical gravity and send a signal to the Control Unit.

Lateral G-Sensor

The G-sensor installed inside the Control Unit detects the vehicle turning speed and sends a signal to the Control Unit.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

BATT
Battery

DLC
Data Link Connector

DTC
Diagnostic Trouble Code

FL
Front Left

FR
Front Right

GND
Ground

HARN
Harness

IG
Ignition

PCM
Powertrain Control Module

RL
Rear Left

RR
Rear Right

SW
Switch

W/L
Warning Lamp

Vout
Voltage output

General Diagnosis

General Information

Intelligent Suspension Control troubles can be classified into two types, those which can be detected by the warning lamp and those which can be detected as a vehicle abnormality by the driver.
In either case, locate the fault in accordance with the“BASIC DIAGNOSTIC FLOWCHART” and repair.
Please refer to *Section 3 for the diagnosis of mechanical troubles such as abnormal noise, vehicle pulls, excessive tire wear, wheel hop and shimmy, shake or vibration.*

Service Precautions

Required Tools and Items:

- ▼ Box Wrench
- ▼ Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Intelligent Suspension Control interfaces directly with the Control Unit which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However care must be taken to avoid overloading any of the Control Unit circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the “ON” position.Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the“OFF” position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Intelligent Suspension Control and/or other vehicle systems. Failure to observe these precautions may result in Intelligent Suspension Control damage.

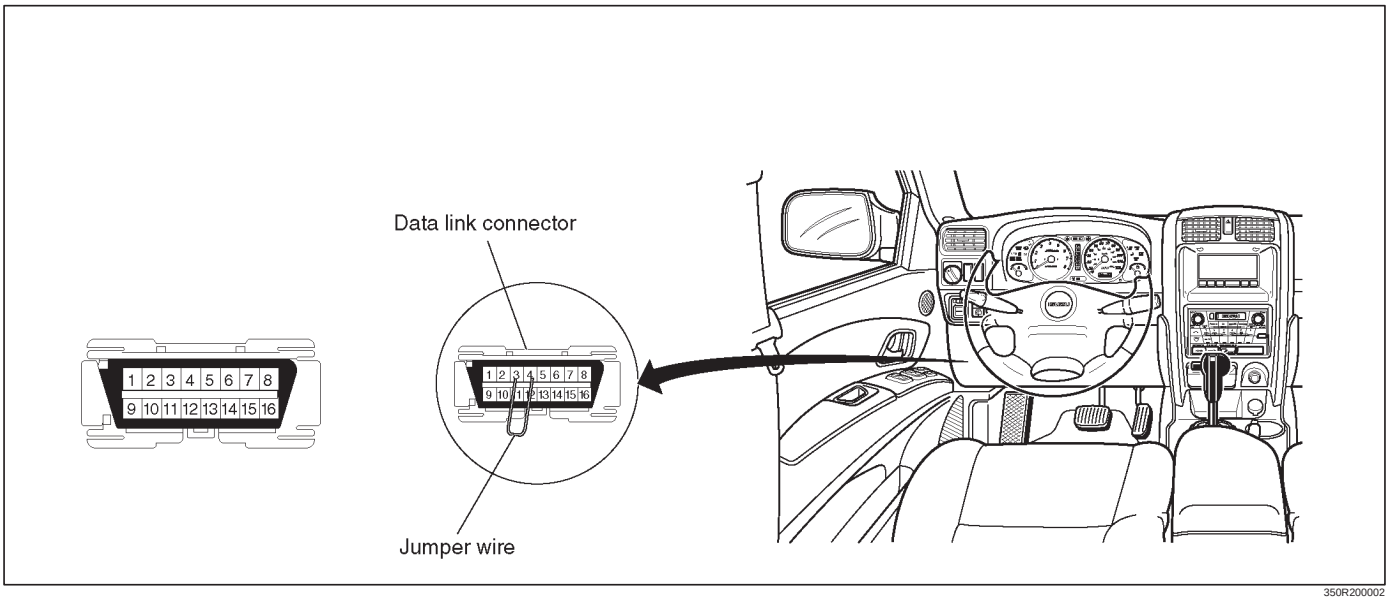
- ▼ If welding work is to be performed on the vehicle using an electric arc welder, the Control Unit connectors should be disconnected before the welding operation begins.
- ▼ The Control Unit connectors should never be connected or disconnected with the ignition“ON”.

Parts Handling

Be careful when handling the actuator, control unit, or G-sensor. They should not be dropped or thrown, because the semi-conductor G-sensor tip damage may result.

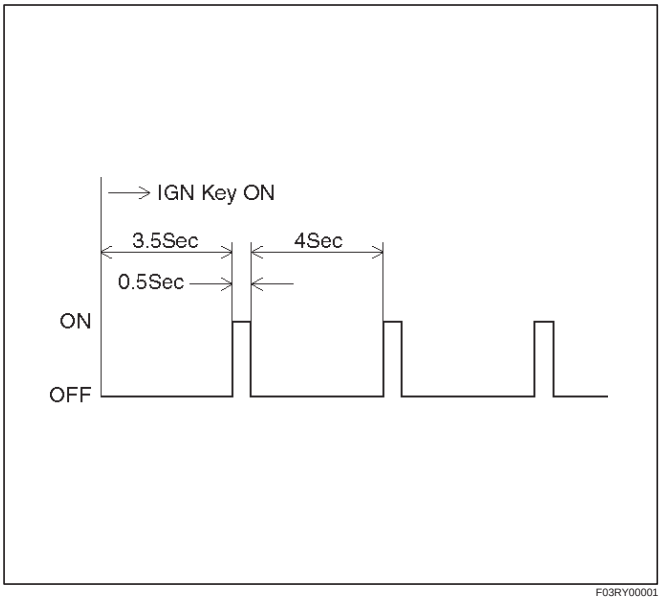
FLASHING CODES

1. ON BOARD DIAGNOSIS (SELF-DIAGNOSIS)
   1. The Control Unit conducts a self-test of most of the wiring and components in the system each time the key is turned ON. If a fault is detected the Control Unit will store a Diagnostic Trouble Code (DTC) in memory. It's a number that corresponds to a specific problem.
   2. When the problem detected is important: the warning lamp turns on until the fault is repaired and the Control Unit memory is cleared.
2. DIAGNOSTIC TROUBLE CODES (DTC)
   1. DTC can be expressed by flashing times of warning lamp by shorting together terminals 3 and 4 or 5 of the Diagnosis Connector (C-39) located left side of instrument panel.



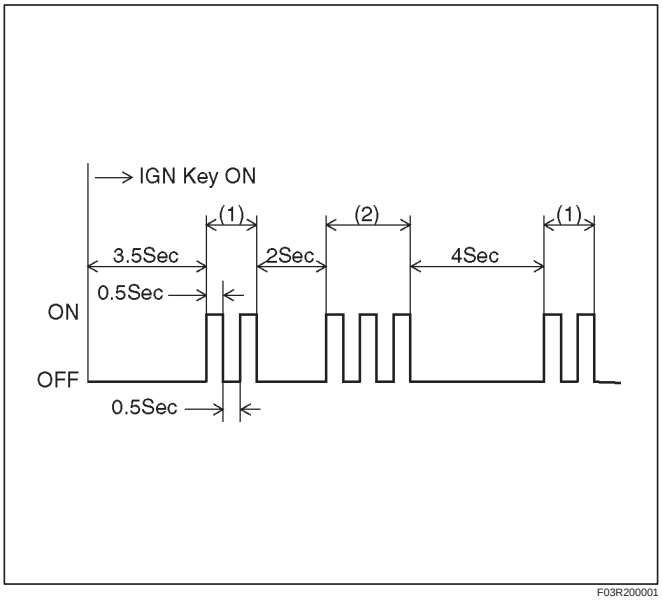
350R200002

Normal



F03RY00001

Abnormal

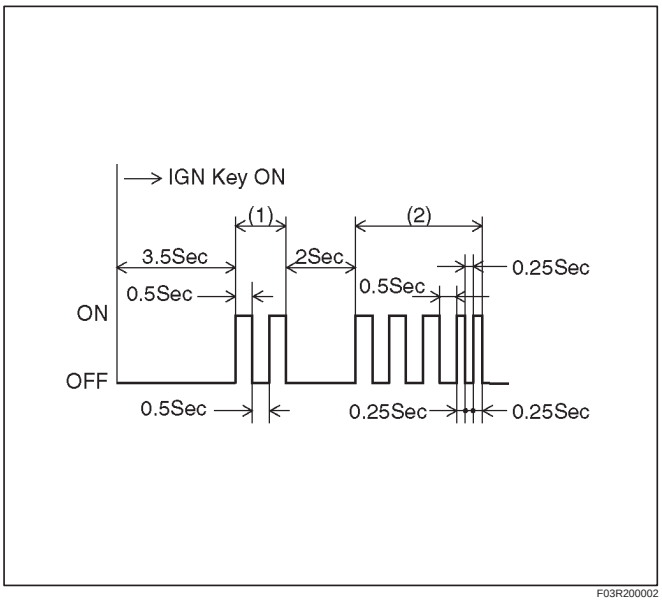


F03R200001

Legend

(1) Diagnostic Trouble Code 2
(2) Diagnostic Trouble Code 3

It depends below in the case that the code that also, shows a malfunction place is added.



F03R200002

Legend

(1) Diagnostic Trouble Code 2
(2) Diagnostic Trouble Code 3 + Position Code 2
Position Code
1: Actuator Front RH, G-sensor Front RH
2: Actuator Front LH, G-sensor Front LH
3: Actuator Rear RH, G-sensor Rear
4: Actuator Rear LH, Lateral G-sensor

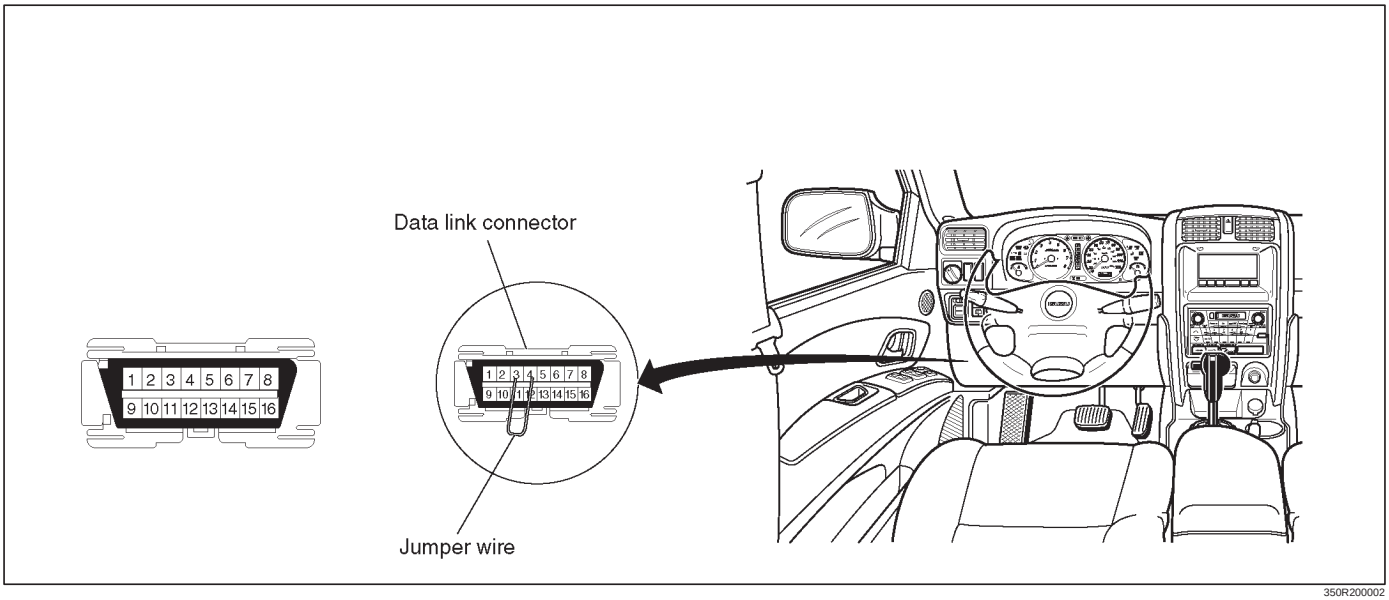
2. After this, the warning lamp will be OFF for 3.5 seconds and then will flash each DTC.
   a. When there are more than 9 flashes this means that the indicator is constantly flashing, OFF for 4 seconds ON for 0.5 seconds. In this case there is no DTC stored in memory.
   b. When there are less than 9 flashes you will see DTC codes in ascending order.

CLEAR DTC

Remark: If you clear the DTC (Diagnosis Trouble Codes) you will not be able to read any codes recorded during the last Trouble.
Remark: To be able to use the DTC again to identify a problem you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. Short the Diagnosis Connector C-39 terminal 3 to terminal 4 or 5 (ground).

▼ IF it is flashing and the flash is 0.5 seconds ON and 4 seconds OFF without interruption, this means that there is no DTC. The DTCs are already cleared.



350R200002

2. IF a code is flashed, wait until the lamp is flashing.
3. Conduct brake switch ON/OFF 6 or more times on condition that one operation is within 2 seconds.

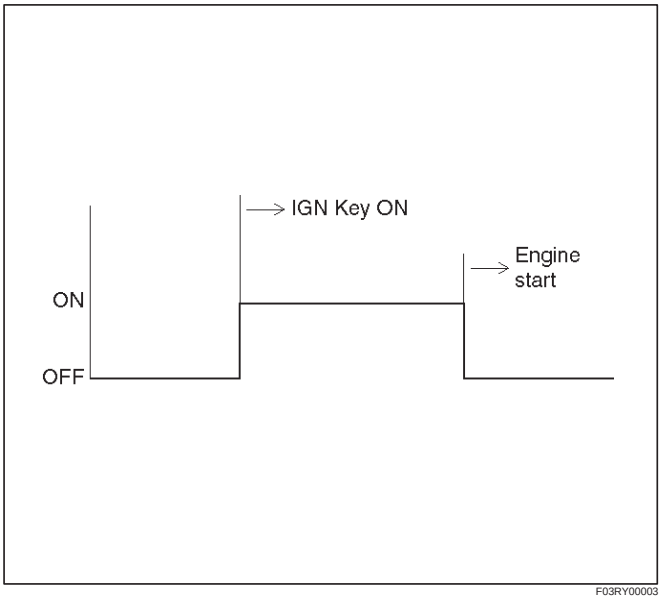
INTERMITTENT CONDITIONS

If the Warning Lamp flashes a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present: the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the Control Unit.
Use the DTC information to understand which wires and sensors are involved.
When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:
   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro-Magnetic Interference (EMI):
   HINT: Check that all wires are properly routed away from spark plug wires, distributor wires, coil, and generator. Also check for improperly installed electrical options, such as lights, 2-way radios, etc.

BULB CHECK

When the starter switch is turned on in the normal state, the Control Unit turns on the Warning Lamp to check the bulb. After the engine starts, the Warning Lamp turns off.

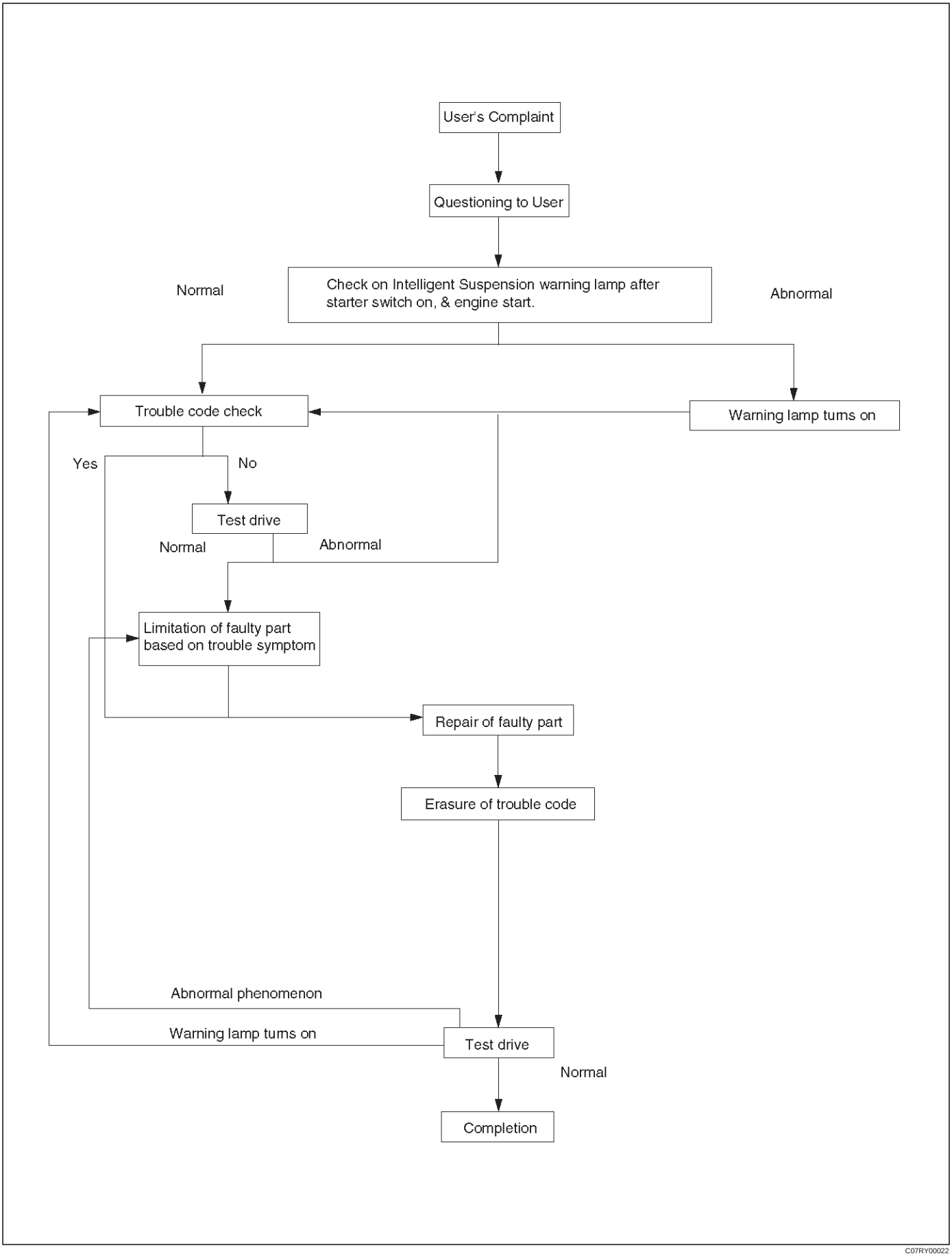


F03RY00003

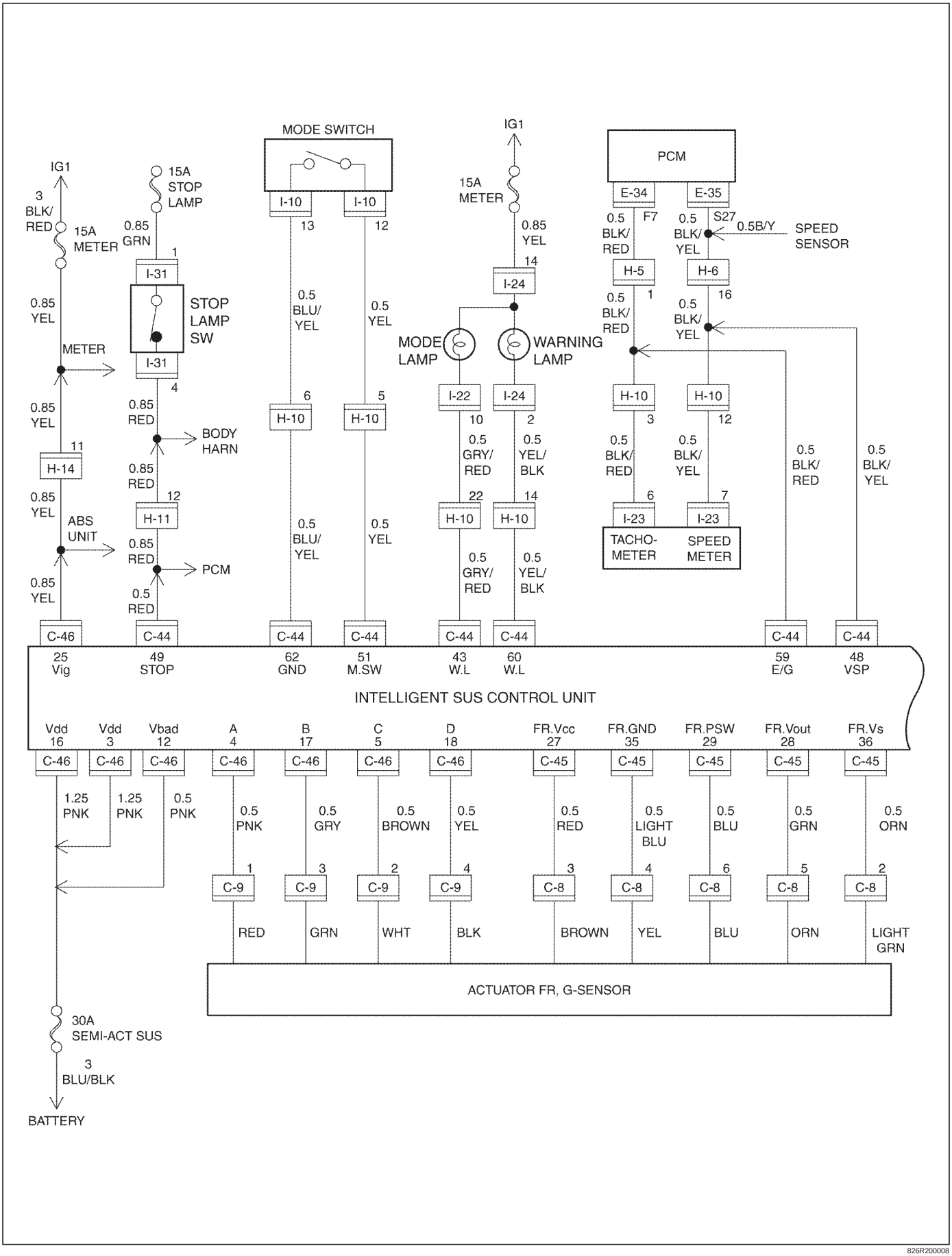
DTC CHECK

1. Diagnosis Trouble Codes (DTC) have been identified by FLASHING CODES.
2. You have written the list of the DTC. The order of the malfunctions has no meanings for this Control Unit. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTC are sorted by number:
   DIAGNOSTIC TROUBLE CODES.

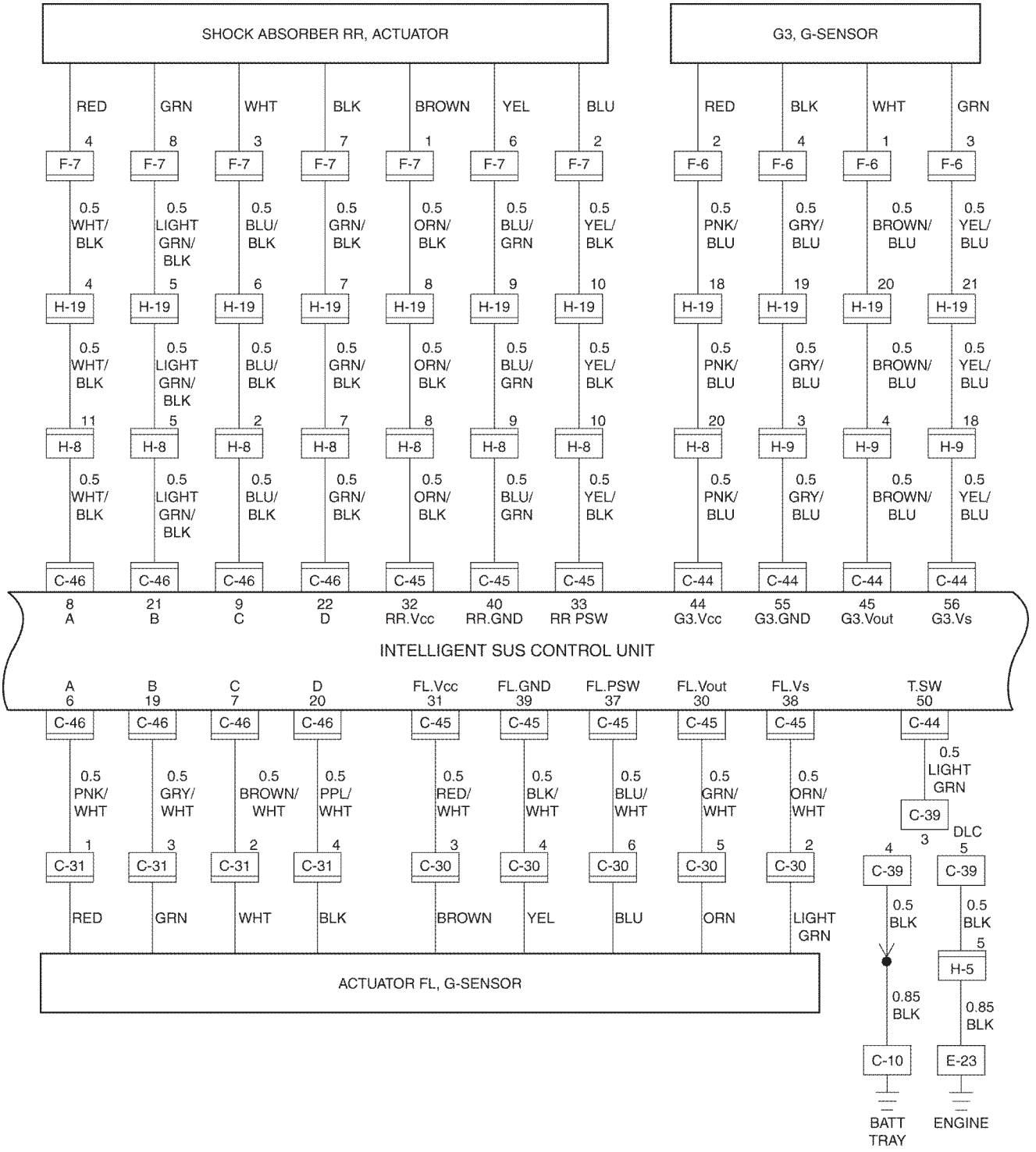
Basic Diagnosis Flow



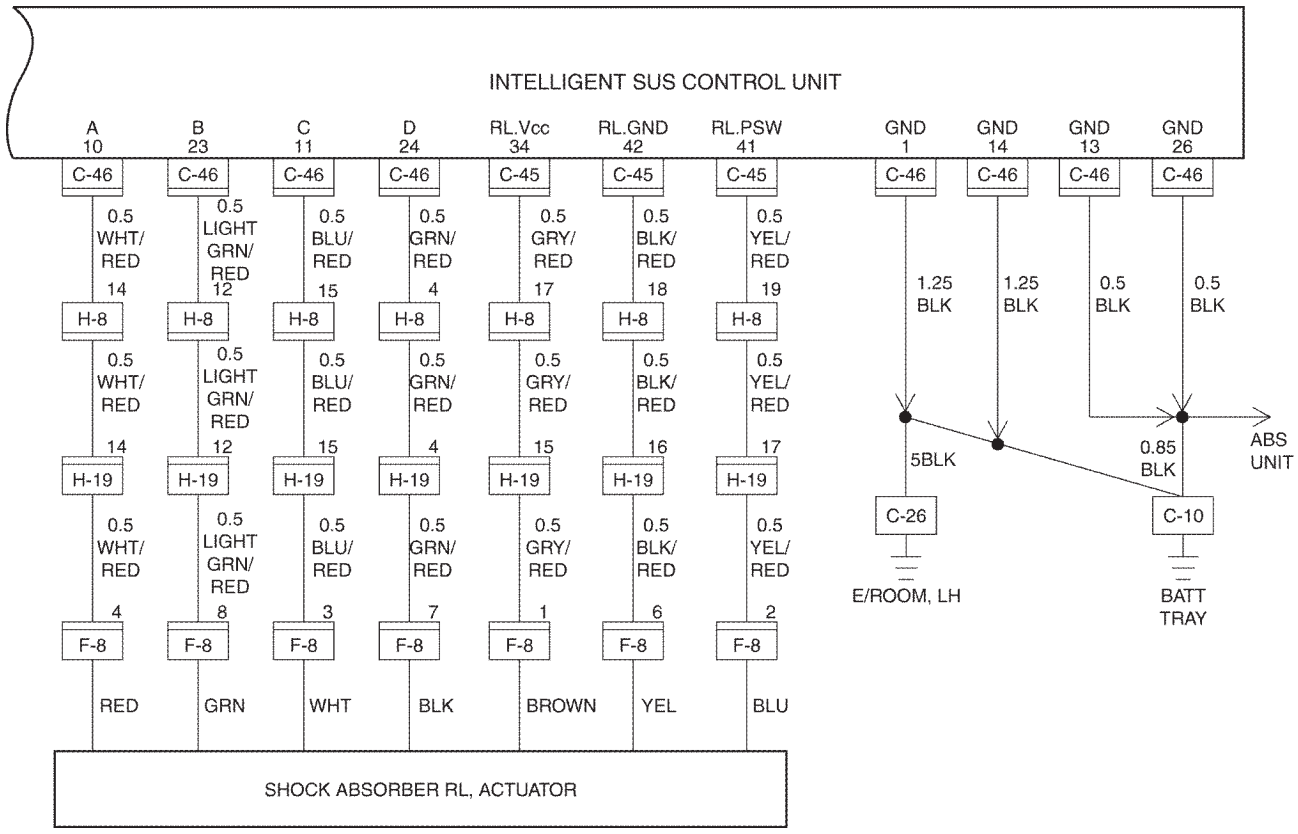
Circuit Diagram



826R200008

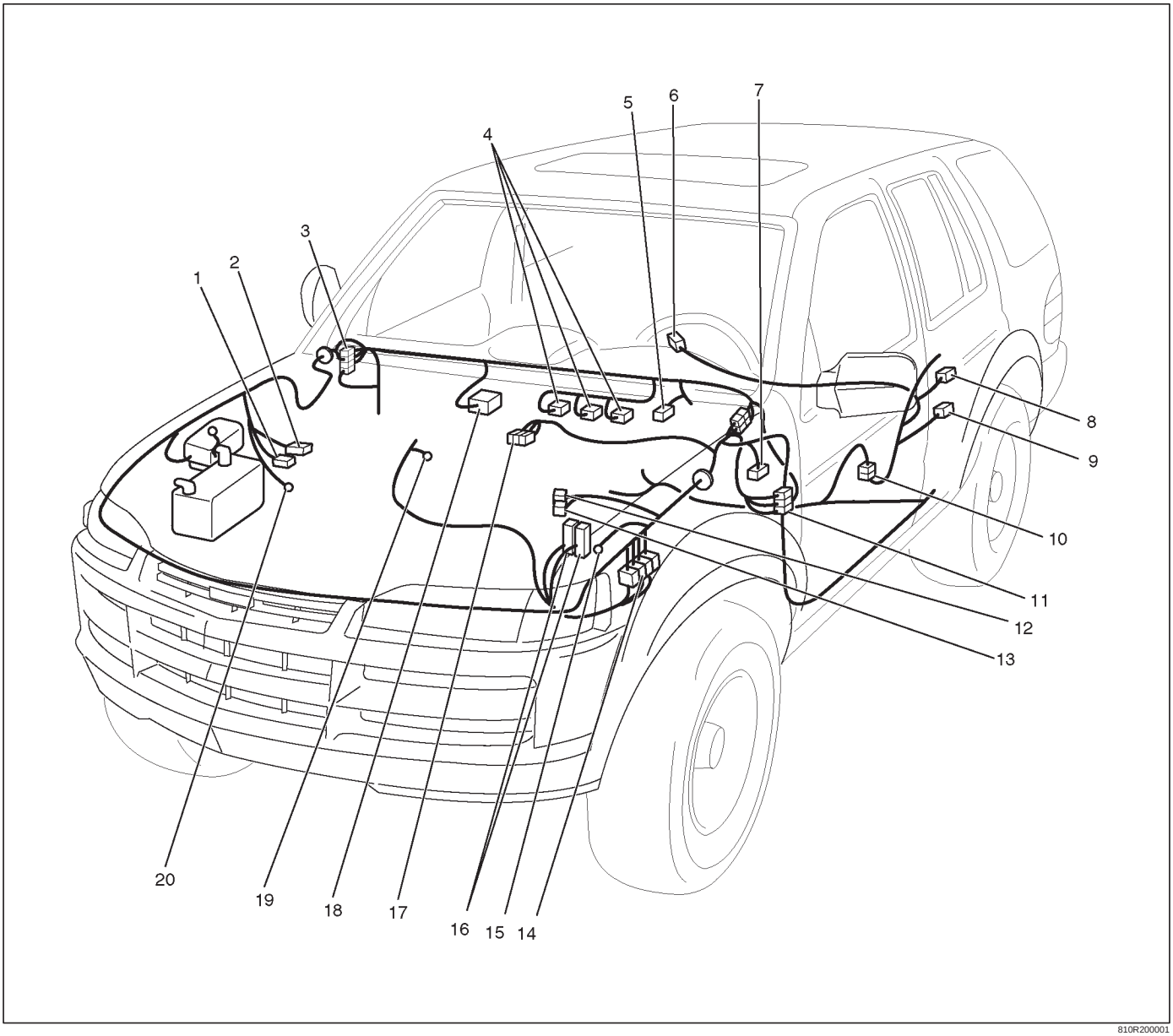

SHOCK ABSORBER RR, ACTUATOR
G3, G-SENSOR
RED GRN WHT BLK BROWN YEL BLU
RED BLK WHT GRN
F-7 F-6
0.5 WHT/BLK
0.5 LIGHT GRN/BLK
0.5 BLU/BLK
0.5 GRN/BLK
0.5 ORN/BLK
0.5 BLU/GRN
0.5 YEL/BLK
0.5 PNK/BLU
0.5 GRY/BLU
0.5 BROWN/BLU
0.5 YEL/BLU
H-19
H-8
H-9
C-46 C-45 C-44
8 A
21 B
9 C
22 D
32 RR.Vcc
40 RR.GND
33 RR PSW
44 G3.Vcc
55 G3.GND
45 G3.Vout
56 G3.Vs
INTELLIGENT SUS CONTROL UNIT
A B C D FL.Vcc FL.GND FL.PSW FL.Vout FL.Vs T.SW
6 19 7 20 31 39 37 30 38 50
0.5 PNK/WHT
0.5 GRY/WHT
0.5 BROWN/WHT
0.5 PPL/WHT
0.5 RED/WHT
0.5 BLK/WHT
0.5 BLU/WHT
0.5 GRN/WHT
0.5 ORN/WHT
0.5 LIGHT GRN
C-31 C-30 C-39
RED GRN WHT BLK BROWN YEL BLU ORN LIGHT GRN
DLC
0.5 BLK
0.85 BLK
H-5
C-10 E-23
BATT TRAY
ENGINE
ACTUATOR FL, G-SENSOR

826R200009


INTELLIGENT SUS CONTROL UNIT
A 10
B 23
C 11
D 24
RL.Vcc 34
RL.GND 42
RL.PSW 41
GND 1
GND 14
GND 13
GND 26
C-46
C-45
0.5 WHT/ RED
0.5 LIGHT GRN/ RED
0.5 BLU/ RED
0.5 GRN/ RED
0.5 GRY/ RED
0.5 BLK/ RED
0.5 YEL/ RED
14
12
15
4
17
18
19
H-8
H-19
16
F-8
RED
GRN
WHT
BLK
BROWN
YEL
BLU
SHOCK ABSORBER RL, ACTUATOR
1.25 BLK
0.5 BLK
5BLK
0.85 BLK
ABS UNIT
C-26
C-10
E/ROOM, LH
BATT TRAY

826R200010

Parts Location

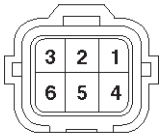
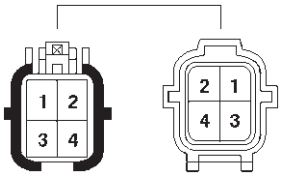
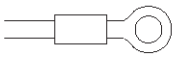
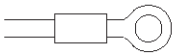
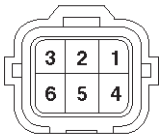
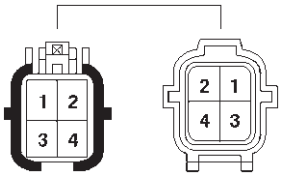
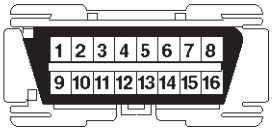
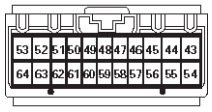
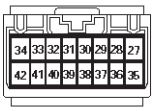


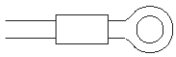
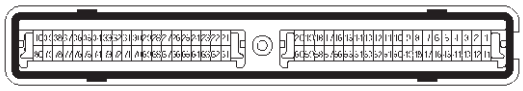
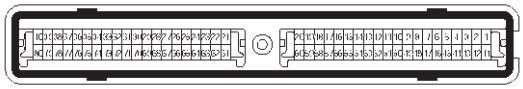
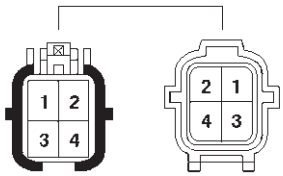
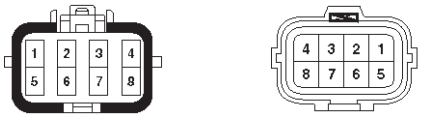
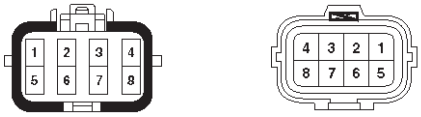
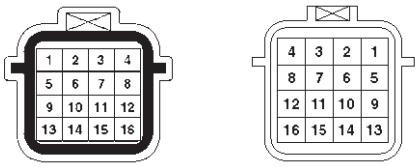
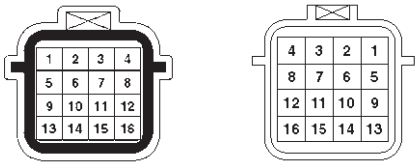
810R200001

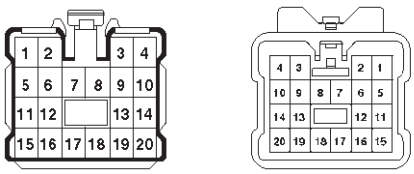
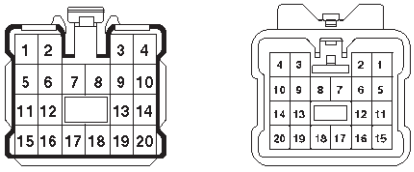
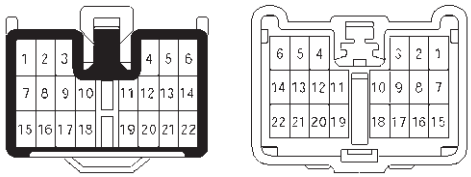
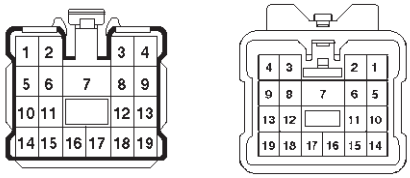
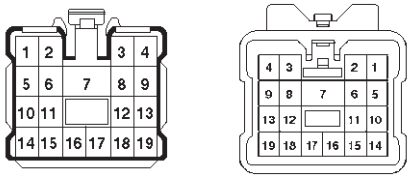
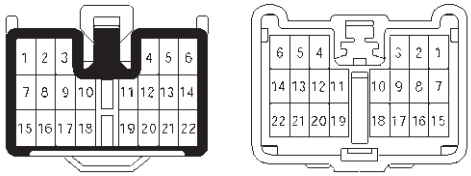
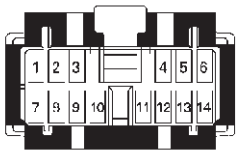
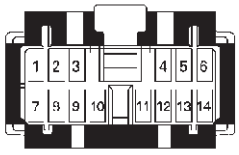
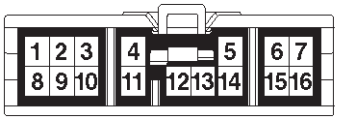
Legend

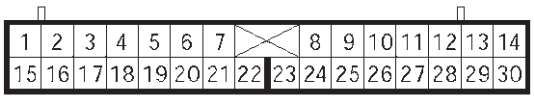
(1) C–9
(2) C–8
(3) H–8, H–11, H–14
(4) I–24, I–23 , I–22
(5) I–31
(6) F–7
(7) C–39
(8) F–8
(9) F–6
(10) H–19
(11) H–9, H–10
(12) C–30
(13) C–31
(14) H–5, H–6
(15) C–26
(16) E–34, E–35
(17) C–46, C–45, C–44
(18) I–10
(19) E–23
(20) C–10

Connector List

No.	Connector face
C–8	
C–9	
C–10	
C–26	
C–30	
C–31	
C–39	
C–44	
C–45	

No.	Connector face
C–46	
E–23	
E–34	
E–35	
F–6	
F–7	
F–8	
H–5	
H–6	

No.	Connector face
H–8	
H–9	
H–10	
H–11	
H–14	
H–19	
I–10	
I–22	
I–23	

No.	Connector face
I–24	
I–31	

Diagnostic Trouble Code (DTC) Identification

DTC No.	DTC NAME	CODE MEMORY	WARNING LAMP
2	Actuator Coil Over Current	Yes	OFF
3	Actuator Coil/Position Sensor Open Circuit or Short	Yes	ON
4	G–Sensor Open Circuit or Short	Yes	ON
5	Vehicle Speed Sensor Open Circuit or Short	Yes	OFF
6	Stop Lamp Switch Open Circuit, Short or Contact Point Trouble	Yes	OFF
7	Engine Speed Signal Open Circuit or Short	Yes	OFF
9	Control Unit Abnormality	Yes	OFF

DTC2 Actuator Coil Over Current

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5˚ step feed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 24 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC2 Actuator Coil Over Current

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–31, C–9, F–8, and F–7. 3. Measure the resistance between the actuator side connector C–9 terminals 1 and 2. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–9 terminals 3 and 4. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	1. Measure the resistance between the actuator side connector C–31 terminals 1 and 2. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 5*	Go to *Step 6*
5	1. Measure the resistance between the actuator side connector C–31 terminals 3 and 4. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	1. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 8*	Go to *Step 9*
8	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—
10	1. Measure the resistance between the shock absorber side connector F–8 terminals 3 and 4. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 11*	Go to *Step 12*
11	1. Measure the resistance between the shock absorber side connector F–8 terminals 7 and 8. Is the resistance within the specified value?	6.4–7.2Ω	Go to *Step 13*	Go to *Step 12*

DTC2 Actuator Coil Over Current (Cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the rear shock absorber RL.	—	Go to *Step 16*	—
13	If all steps are correct, check the continuity between the control unit connector C–46 terminal 1 and connector terminal C46–4, C46–17, C46–5, C46–18, C46–6, C46–19, C46–7, C46–20, C46–8, C46–21, C46–9, C46–22, C46–10, C46–23, C46–11, and C46–24. Is there continuity?	—	Go to *Step 15*	Go to *Step 14*
14	Repair the circuit.	—	Go to *Step 16*	—
15	Replace the control unit.	—	Go to *Step 16*	—
16	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 16*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5˚ step feed.
The PSW is actuator position signal and detects relative angles between the piston–rod and the control-rod. The actuator outputs the PSW to the control unit.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 16 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–46, C–31, C–9, F–8, and F–7. Is there continuity between the connector C–9 terminals 1 and 2?	—	Go to *Step 2*	Go to *Step 3*
2	Is there continuity between the connector C–9 terminals 3 and 4?	—	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	Is there continuity between the connector C–31 terminals 1 and 2?	—	Go to *Step 5*	Go to *Step 6*
5	Is there continuity between the connector C–31 terminals 3 and 4?	—	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	Is there continuity between the connector F–7 terminals 3 and 4?	—	Go to *Step 8*	Go to *Step 9*
8	Is there continuity between the connector F–7 terminals 7 and 8?	—	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—
10	Is there continuity between the connector F–8 terminals 3 and 4?	—	Go to *Step 11*	Go to *Step 12*
11	Is there continuity between the connector F–8 terminals 7 and 8?	—	Go to *Step 13*	—
12	Replace the rear shock absorber RL.	—	Go to *Step 13*	—
13	Is there continuity between the connector C–9 terminal 1 and connector C–46 terminal 4?	—	Go to *Step 14*	Go to *Step 15*
14	Is there continuity between the connector C–9 terminal 3 and connector C–46 terminal 17?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the circuit.	—	Go to *Step 16*	—

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
16	Is there continuity between the connector C–9 terminal 2 and connector C–46 terminal 5?	—	Go to *Step 17*	Go to *Step 18*
17	Is there continuity between the connector C–9 terminals 4 and connector C–46 terminal 18?	—	Go to *Step 19*	Go to *Step 18*
18	Repair the circuit.	—	Go to *Step 19*	—
19	Is there continuity between the connector C–31 terminal 1 and connector C–46 terminal 6?	—	Go to *Step 20*	Go to *Step 21*
20	Is there continuity between the connector C–31 terminal 3 and connector C–46 terminal 19?	—	Go to *Step 22*	Go to *Step 21*
21	Repair the circuit.	—	Go to *Step 22*	—
22	Is there continuity between the connector C–31 terminal 2 and connector C–46 terminal 7?	—	Go to *Step 23*	Go to *Step 24*
23	Is there continuity between the connector C–31 terminal 4 and connector C–46 terminal 20?	—	Go to *Step 25*	Go to *Step 24*
24	Repair the circuit.	—	Go to *Step 25*	—
25	Is there continuity between the connector F–7 terminal 4 and connector C–46 terminal 8?	—	Go to *Step 26*	Go to *Step 27*
26	Is there continuity between the connector F–7 terminal 8 and connector C–46 terminal 21?	—	Go to *Step 28*	Go to *Step 27*
27	Repair the circuit.	—	Go to *Step 28*	—
28	Is there continuity between the connector F–7 terminal 3 and connector C–46 terminal 9?	—	Go to *Step 29*	Go to *Step 30*
29	Is there continuity between the connector F–7 terminal 7 and connector C–46 terminal 22?	—	Go to *Step 31*	Go to *Step 30*
30	Repair the circuit.	—	Go to *Step 31*	—
31	Is there continuity between the connector F–8 terminal 4 and connector C–46 terminal 10?	—	Go to *Step 32*	Go to *Step 33*
32	Is there continuity between the connector F–8 terminal 8 and connector C–46 terminal 23?	—	Go to *Step 34*	Go to *Step 33*
33	Repair the circuit.	—	Go to *Step 34*	—
34	Is there continuity between the connector F–8 terminal 3 and connector C–46 terminal 11?	—	Go to *Step 35*	Go to *Step 36*
35	Is there continuity between the connector F–8 terminal 7 and connector C–46 terminal 24?	—	Go to *Step 37*	Go to *Step 36*
36	Repair the circuit.	—	Go to *Step 37*	—
37	1. Disconnect the terminals C–45, C–8, C–30, F–7, and F–8. Is there continuity between the connector–terminal C45–29 and C8–6, C45–37 and C30–6, C45–33 and F7–2, C45–41 and F8–2?	—	Go to *Step 38*	Go to *Step 41*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
38	Is there continuity between the connector C–46 terminal 1 (GND) and the connector C–45 terminals 29, 33, 37, and 41?	—	Go to *Step 41*	Go to *Step 39*
39	Is there the continuity between connector-terminal C45–27 and C45–35, C45–31 and C45–39, C45–32 and C45–40, and C45–34 and C45–42?	—	Go to *Step 41*	Go to *Step 40*
40	Is there the continuity between connector C–46 terminal 1 and connector C–45 terminals 27, 31, 32, and 34?	—	Go to *Step 41*	Go to *Step 42*
41	Repair the circuit.	—	Go to *Step 44*	—
42	1. If all steps are correct, replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) actuator FR, 2) actuator FL, rear shock absorber, 3) RR and 4) RL. Does the DTC3 remain?	—	Go to *Step 43*	Go to *Step 44*
43	Replace the control unit.	—	Go to *Step 44*	—
44	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 44*

DTC4 G-Sensor Open Circuit or Short

Circuit Description

The G-sensor sends the voltage (Vout) corresponding to the vehicle vertical gravity to the control unit.
The control unit supplies DC 5V power (Vcc) to each G-sensor.
The control unit watches the G-sensor operation through Vcc signal.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit connectors and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC4 G-Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the connectors C–45, C–44, C–8, C–30, and F–6. Is there the continuity between the connector-terminal C45–28 and C8–5, C45–30 and C30–5, and C44–45 and F6–1?	—	Go to *Step 2*	Go to *Step 5*
2	Is there continuity between the connector-terminal C45–27 and C8–3, C45–31 and C30–3, and C44–44 and F6–2?	—	Go to *Step 3*	Go to *Step 5*
3	Is there the continuity between the connector-terminal C45–36 and C8–2, C45–38 and C30–2, and C44–56 and F6–3?	—	Go to *Step 4*	Go to *Step 5*
4	1. Disconnect the connectors C–46, C–45, and C–44. Is there the continuity between the connector-terminal C45–28 and C45–35, C45–30 and C45–39, C44–45 and C44–55, C45–27 and C45–35, C45–31 and C45–39, C44–44 and C44–55, C45–36 and C45–35, C45–38 and C45–39, and C44–56 and C44–55?	—	Go to *Step 5*	Go to *Step 7*
5	Repair the circuit.	—	Go to *Step 6*	—
6	Replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) G3-sensor 2) Actuator FL 3) Actuator FR 4) Control Unit	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow."*	Go to *Step 7*

DTC5 Vehicle Speed Sensor Open Circuit or Short

Circuit Description

Output speed information is provided to the control unit by the vehicle speed sensor. The vehicle speed sensor produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The control unit then converts the pulsing voltage to vehicle speed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 48 way connector and the speed sensor connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC5 Vehicle Speed Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Jack up and support the rear axle on the stand. 2. Change the transfer mode to 2WD, using TOD switch on instrument panel. 3. Shift the transmission lever in a forward position and rotate the rear wheels. Does the speedo-meter operate?	—	Go to *Step 2*	Go to *Step 3*
2	1. Open the throttle and rev up engine speed. 2. Using a volt meter, measure the voltage between the meter B connector I–23 terminals 7 and 16 (GND). Does the voltage change alternately at the specified values?	0V and 12V	Go to *Step 7*	Go to *Step 5*
3	1. Turn off the starter switch and disconnect the control connectors C–46 and C–44. 2. Check the continuity between the vehicle speed sensor connector terminal 3 and meter B connector I–23 terminal 7. Is there continuity?	—	Go to *Step 4*	Go to *Step 6*
4	1. Check the continuity between the control unit connector C–46 terminal 1 and control unit connector C–44 terminal 48. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair or replace the vehicle speed sensor.	—	Go to *Step 8*	—
6	Repair the circuit between the vehicle speed sensor connector terminal 3 and the meter B connector I–23 terminal 7 or the circuit between the control unit connector C–44 terminal 48 and the speed sensor connector terminal 3.	—	Go to *Step 8*	—

DTC5 Vehicle Speed Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the circuit between the connector H–6 terminal 16 and the control unit connector C–44 terminal 48 or replace the control unit.	—	Go to *Step 8*	—
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow."*	Go to *Step 8*

About the vehicle speed sensor connector termainal 3,
Refer to section *Wiring System in Body and Accessories*.

DTC6 Stop Lamp Switch Open Circuit or Short

Circuit Description

The brake switch is used to indicate brake pedal status. The normally opened brake switch signal voltage circuit is opened.
Brake switch supplies a B+ signal on circuit RED to the control unit when the brakes are applied. The control unit uses this signal to work dive control when the brakes are applied.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

DTC6 Stop Lamp Switch Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. With the engine “off”, turn the ignition switch “on”. If ABS code is set, check applicable fuse. 2. Apply then release the brake pedal. Does the brake lamp come on when the brake pedal is applied and does it come off when the brake pedal is released?	—	Go to *Diagnostic Aids*	Go to *Step 2*
2	1. Connect the test light to ground. 2. Back probe ignition feed circuit terminal I–31 terminal 1 at the brake switch. Is the test light “on”?	—	Go to *Step 3*	Go to *Step 4*
3	1. Connect the test light to ground. 2. Back probe circuit terminal I–31 terminal 4 at the brake switch. Is the test light “off”?	—	Go to *Step 7*	Go to *Step 5*
4	Repair the open in battery feed circuit terminal I–31 terminal 1 to the brake switch. If fuse is open, check circuit terminal I–31 terminal 4 for a short to ground. Is the replacement complete?	—	Go to *Step 13*	—
5	Disconnect brake switch connector I–31 and ignition switch “on”. Is the test light “on”?	—	Go to *Step 8*	Go to *Step 6*
6	Check the brake switch short (I–31 terminal 1 and I–31 terminal 4). Was a problem found?	—	Go to *Step 9*	Go to *Step 10*
7	Check circuit terminal I–31 terminal 4 for a short to voltage. Ignition switch “on”. Is the test light “on”?	—	Go to *Step 8*	Go to *Step 10*
8	1. Disconnect the control unit connector C–44. 2. Check circuit terminal I–31 terminal 4 for a short to voltage. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*

DTC6 Stop Lamp Switch Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the brake switch. Is the replacement complete?	—	Go to *Step 13*	—
10	1. Turn the ignition "off". 2. Reconnect the control unit connector C–44 Turn the ignition "on". Does the brake lamp come on when the brake pedal is applied and does it come off when the brake pedal is released?	—	Go to *Diagnostic Aids*	Go to *Step 11*
11	Check the control unit for faulty or intermittent connections. Was a problem found and corrected?	—	Go to *Step 13*	Go to *Step 12*
12	Replace the control unit. Is the replacement complete?	—	Go to *Step 13*	—
13	1. After the repair is complete, clear the DTC. 2. Conduct a test drive. 3. Review the DTC. Has the last test failed or is the current DTC displayed?	—	Begin diagnosis again Go to *Step 1*	Go to *Repair verified*

DTC7 Engine Speed Signal Open Circuit or Short

Circuit Description

PCM (Powertrain Control Module) converts signals from the crankshaft position sensor into the engine speed signals (pulse) and sends these to the control unit and tachometer.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit connector. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit BLK/RED.

DTC7 Engine Speed Signal Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	NOTE: Confirm that DTC P0336 or P0337 does not exist. If either exists, warning lamps, “CHECK ENGINE” and “CHECK TRANS” are turned on. Repair the engine, referring to section 6E *Driveability and Emission*. 1. Turn on the starter switch. 2. Start the engine. 3. Open the throttle and rev up engine speed. Does the tachometer operate according to engine speed?	—	Go to *Step 3*	Go to *Step 2*
2	Repair the tachometer, referring to section 8D *Wiring System in Body and Accessories*.	—	Go to *Step 6*	—
3	1. Turn off the starter switch. 2. Check continuity between the control unit connector C–44 terminal 59 and PCM connector E–34 terminal F7. Is there continuity ?	—	Go to *Step 4*	Go to *Step 5*
4	Replace the control unit.	—	Go to *Step 6*	—
5	Repair the circuit.	—	Go to *Step 6*	—
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. 3. Conduct a test drive. Has the last test failed or does the current DTC exist?	—	Begin diagnosis again Go to *Step 1*	Repair verified

DTC9 Control Unit Abnormality

Replace the control unit.

DTC9–1 Control Unit Blown Fuse for FR Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–9. 3. Measure the resistance between the actuator side connector C–9 terminals 1 and 2. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–9 terminals 3 and 4. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–46 terminal 1 and connector-terminal C46–4, C46–17, C46–5, C46–18. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis FLow".*	Go to *Step 7*

DTC9–2 Control Unit Blown Fuse for FL Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–31. 3. Measure the resistance between the actuator side connector C–31 terminals 1 and 2. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–31 terminals 3 and 4. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–46 terminal 1 and connector-terminal C46–6, C46–19, C46–7, C46–20. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–3 Control Unit Blown Fuse for RR Shock Absorber

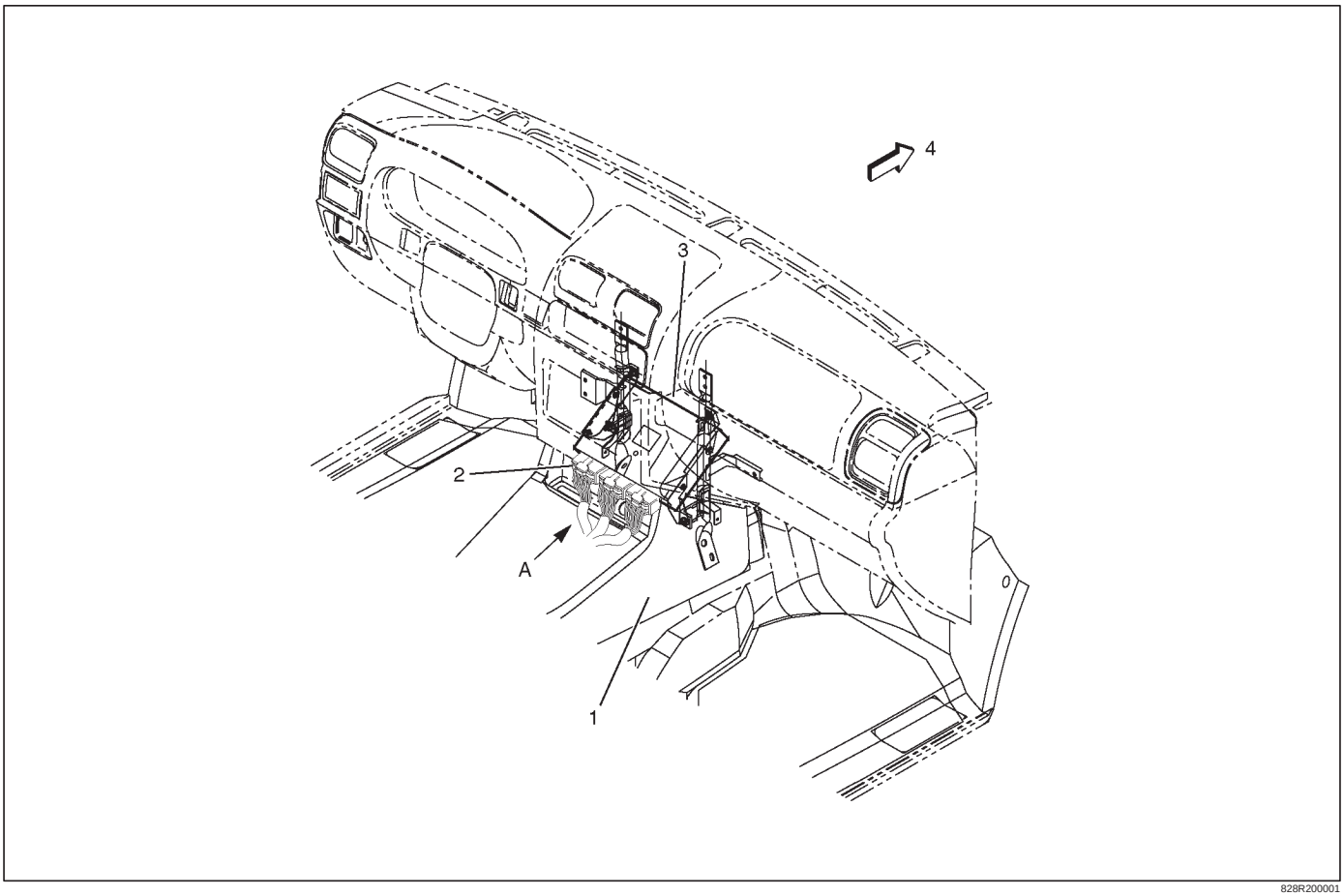
Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–7. 3. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–46 terminal 1 and connector-terminal C46–8, C46–21, C46–9, C46–22. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis FLow".*	Go to *Step 7*

DTC9–4 Control Unit Blown Fuse for RL Shock Absorber

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–8. 3. Measure the resistance between the shock absorber side connector F–8 terminals 3 and 4. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–8 terminals 7 and 8. Is the resistance within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–46 terminal 1 and connector-terminal C46–10, C46–23, C46–11, C46–24. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

Control Unit

Control Unit and Associated Parts



828R200001

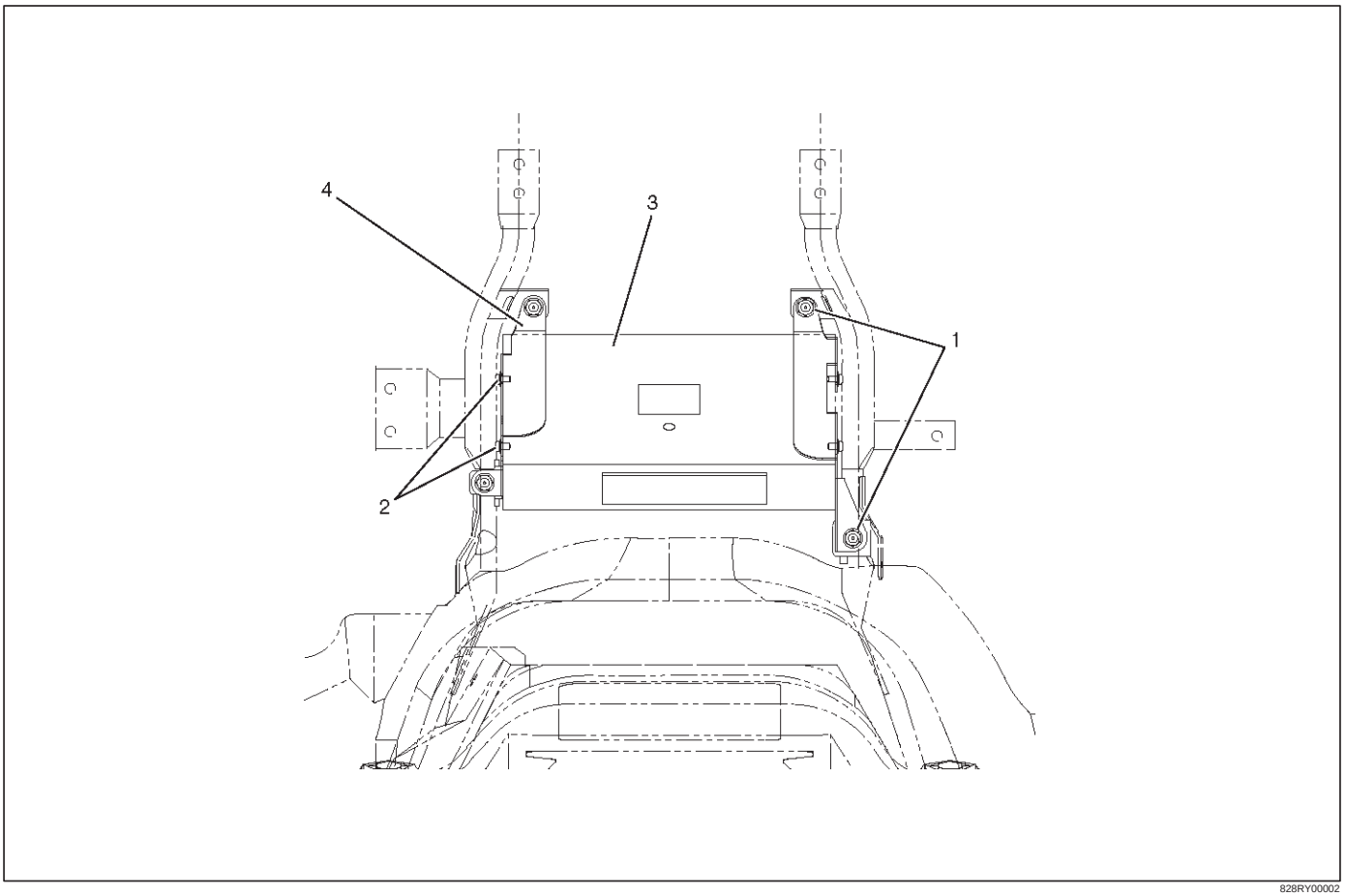
Legend

(1) Front Console
(2) Connector
(3) Control Unit
(4) Front

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   Refer to *Consoles in Body and Accessories section.*
3. Disconnect the connector from the control unit.

View A



828RY00002

Legend

(1) Nut
(2) Screw
(3) Control Unit
(4) Bracket

4. Remove 4 nuts.
5. Disconnect the control unit with brackets.
6. Remove 4 screws.
7. Disconnect the control unit from brackets.

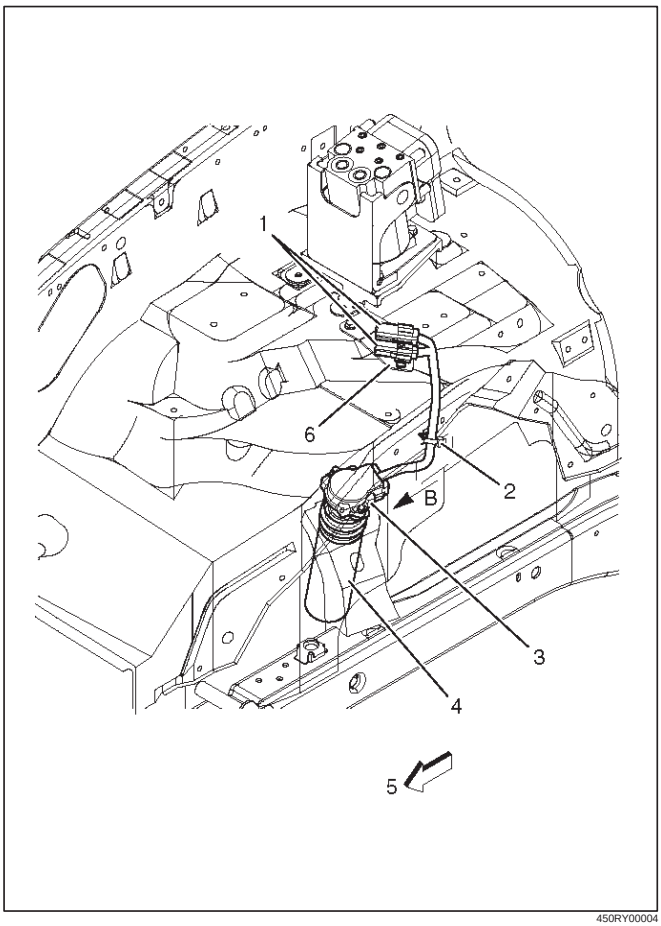
Installation

To install, follow the removal steps in the reverse order, noting the following points.
Torque:
Nut (1) 8N·m (69 lb in)

Front Actuator

Front Actuator and Associated Parts

RH

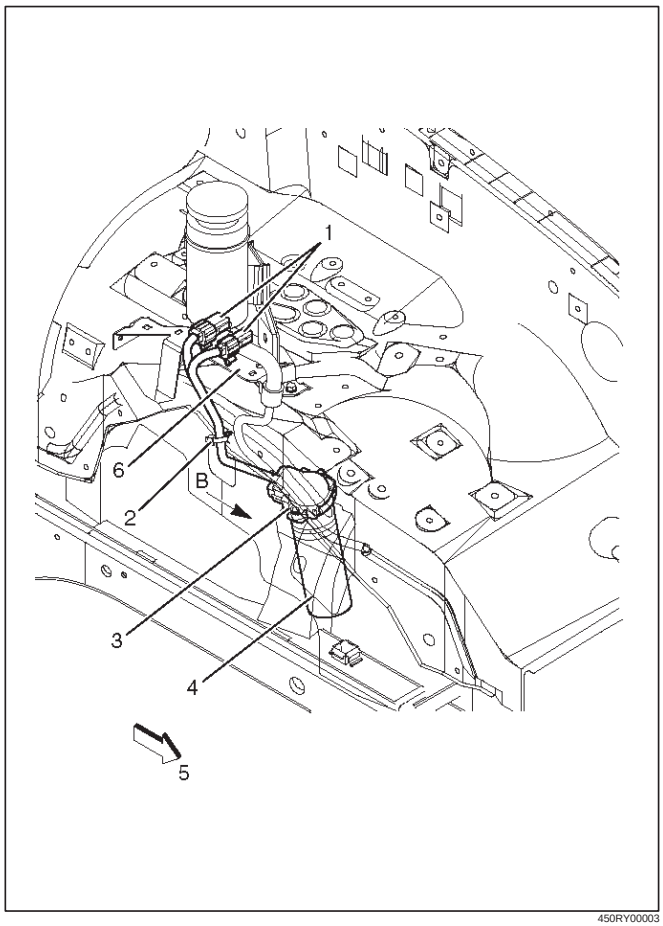


450RY00004

Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

LH



450RY00003

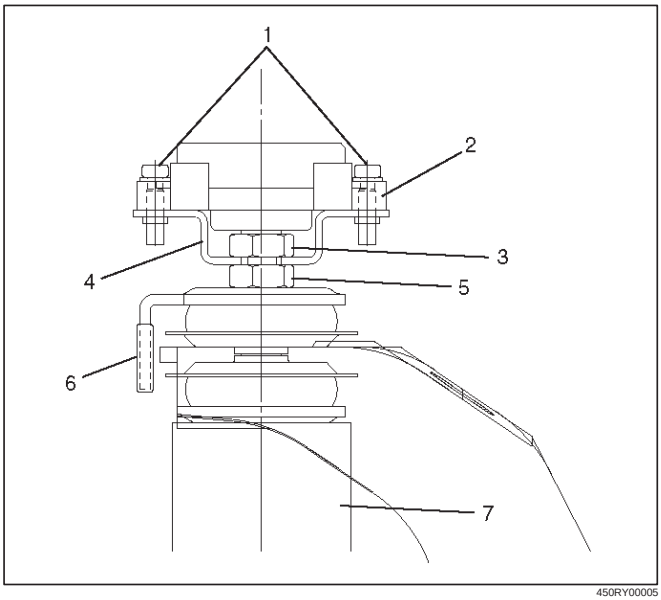
Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector from the harness and remove the connector from the bracket.
3. Remove the clip.

View B



450RY00005

Legend

(1) Screw
(2) Actuator
(3) Nut
(4) Bracket
(5) Nut
(6) Washer
(7) Shock Absorber

1. Remove 2 screws.
2. Remove the actuator.
3. Remove the nut (3).
4. Disconnect bracket.
5. Remove the nut (5).
6. Disconnect the washer.
7. Remove the shock absorber.
   Refer to *Shock Absorber in this section.*

Inspection and Repair

Refer to *shock Abosorber in this section.*

Installation

1. Install the shock absorber.
   Refer to *Shock Absorber in this section.*
2. Install the washer and nut (5), then tighten it to the specified torque.
   Torque: 15 N·m (11 lb ft)
3. Install the bracket and nut (3), then tighten it to the specified torque.
   Torque: 39 N·m (29 lb ft)

NOTE: Fix the lower nut with wrench not to turn and tighten upper nut.

4. Fit the top of the shock absorber rod in the connection part of the actuator.

NOTE:

The mating section is width fitting across flats.

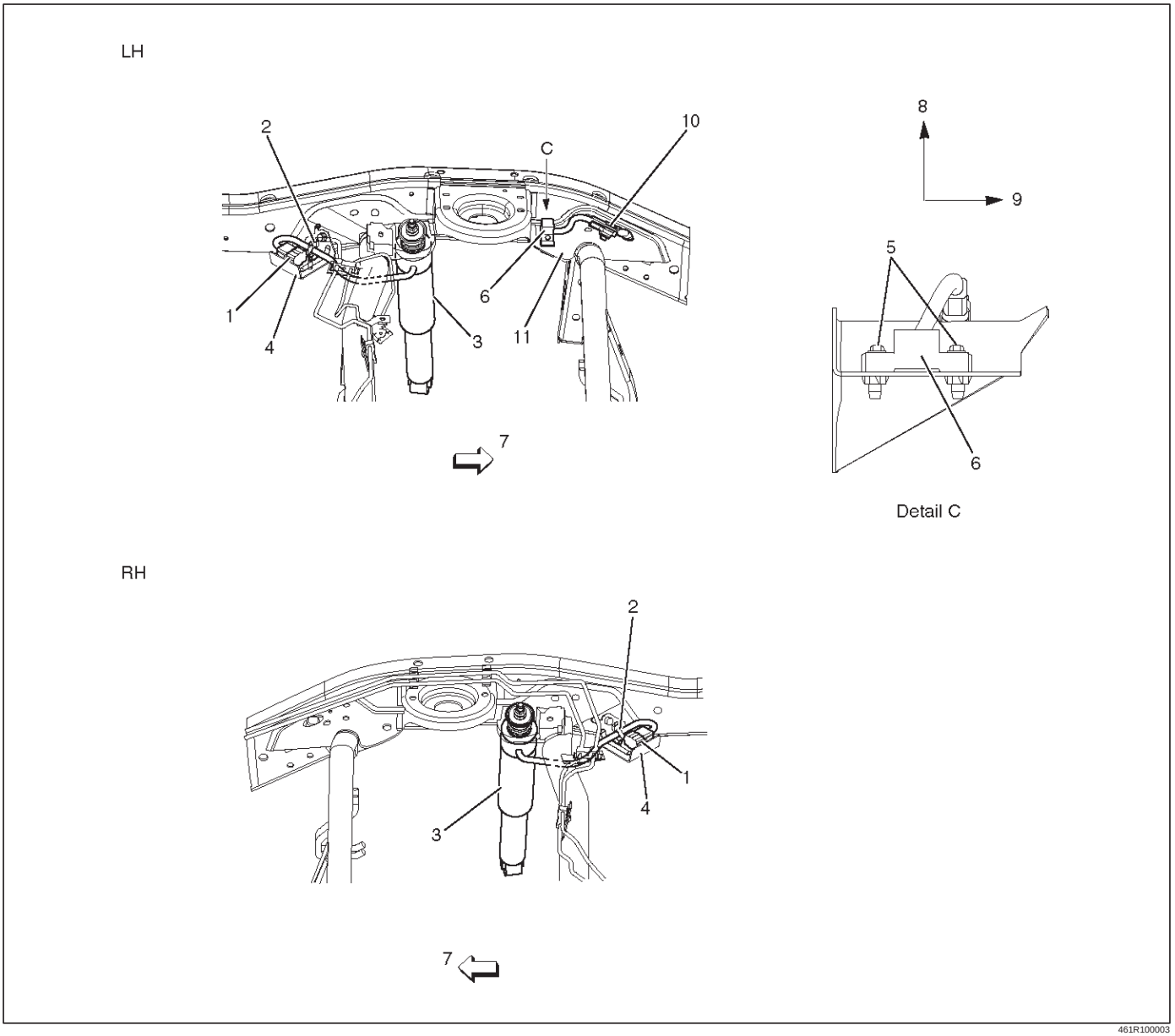
If these normally fit, the distance between the actuator lower face and the bracket upper face is about 1 mm.

5. Install 2 screws then tighten it to the specified torque.
   3 N·m (26 lb in)
6. Connect the connector to the harness and insert the connector to the bracket.
7. Connect the actuator harness with the clip.
8. Connect the battery ground cable.

Rear Shock Absorber

Rear Shock Absorber and Associated Parts

LH



Legend

(1) Connector
(2) Clip
(3) Rear Shock Absorber
(4) Bracket
(5) Bolt
(6) G-Sensor
(7) Front
(8) Upper
(9) Right
(10) Connector
(11) Gusset

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector (1) from the harness and remove the connector (1) from the bracket (4).
3. Remove the clip (2).
4. Remove the rear shock absorber (3).
   Refer to *Shock Absorber in this section.*
5. Disconnect the connector (10) from the harness and remove the connector (10) from the gusset (11).
6. Remove the 2 bolts (5).
7. Disconnect the G-sensor (6).

Inspection and Repair

Refer to Shock Absorber in this section.

Installation

1. Set the G-sensor on the gusset (11).
2. Install 2 bolts (5) then tighten it to the specified torque.
   Torque: 7 N·m (61 lb in)
3. Connect the connector (10) to the harness and insert the connector (10) to the gusset (11).
4. Install the rear shock absorber (3).
   Refer to *Shock Absorber in this section.*
5. Connect the connector (1) to the harness and insert the connector (1) to the bracket (4).
6. Insert the clip (2) to the bracket (4).
7. Connect the battery ground cable.

AXIOM

DRIVELINE/AXLE

CONTENTS

Differential (Front) 4A1
Differential (Rear) 4A2
Driveline Control System 4B1
Driveline Control System (TOD) 4B2
Drive Shaft System 4C
Transfer Case (TOD) 4D2

Differential (Front)

CONTENTS

Service Precaution 4A1–1
Front Drive Axle 4A1–2
Diagnosis 4A1–2
Pinion Shaft Oil Seal 4A1–3
Pinion Shaft Oil Seal and Associated Parts 4A1–3
Removal 4A1–3
Inspection and Repair 4A1–4
Installation 4A1–4
Front Drive Axle Assembly 4A1–5
Front Drive Axle Assembly and Associated Parts 4A1–5
Removal 4A1–6
Installation 4A1–6
Differential Assembly 4A1–8
Disassembled View 4A1–8
Disassembly 4A1–9
Reassembly 4A1–11
Differential Cage Assembly 4A1–20
Disassembled View 4A1–20
Disassembly 4A1–20
Inspection and Repair 4A1–21
Reassembly 4A1–21
Main Data and Specifications 4A1–23
Special Tools 4A1–25

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFOMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

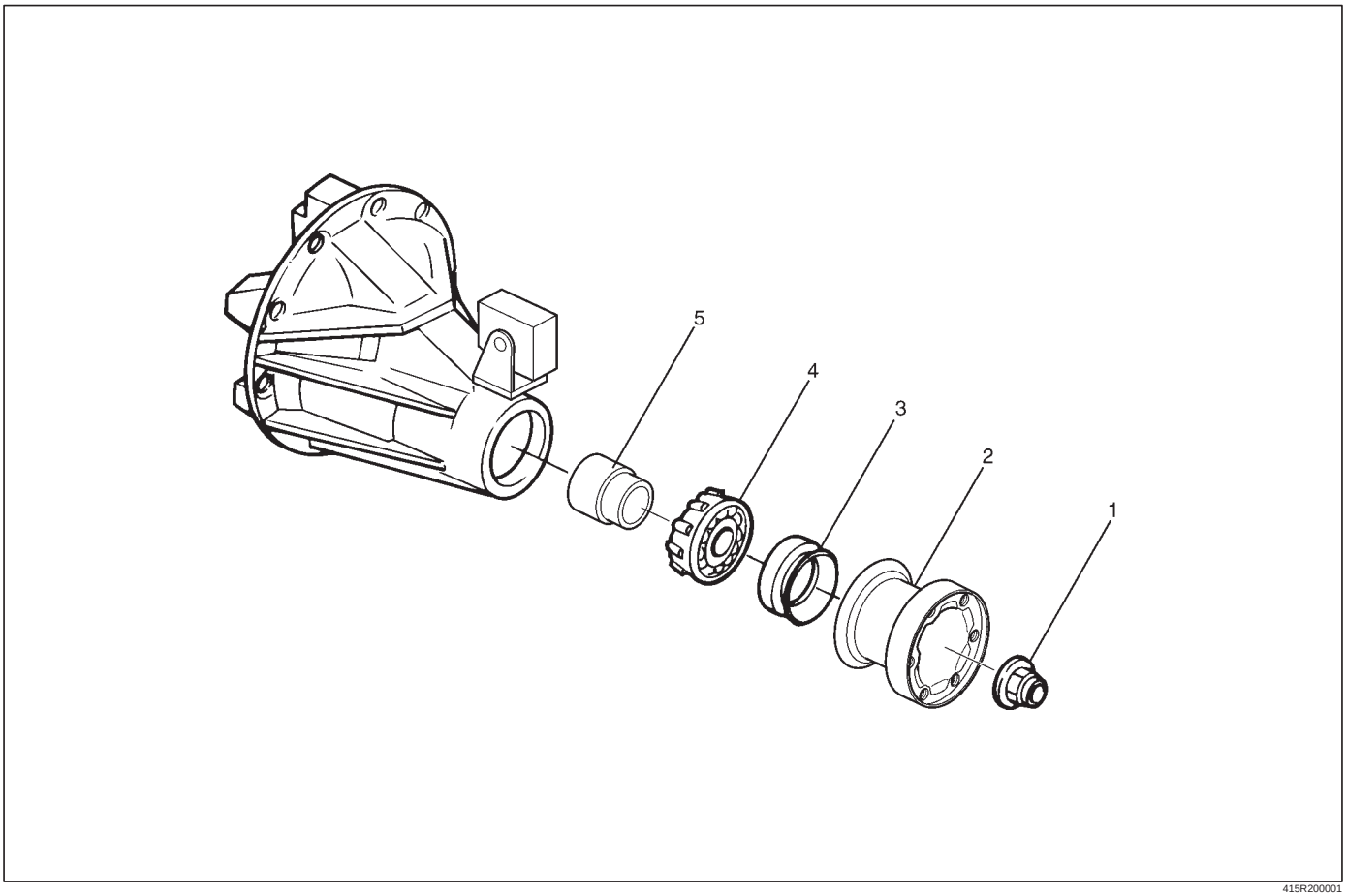
Front Drive Axle

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Pinion Shaft Oil Seal

Pinion Shaft Oil Seal and Associated Parts



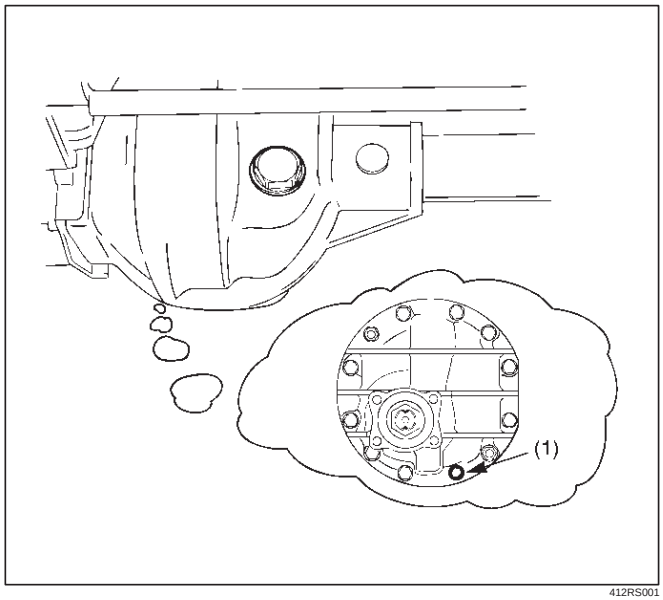
415R200001

Legend

(1) Flange Nut
(2) Flange
(3) Oil Seal
(4) Outer Bearing
(5) Collapsible Spacer

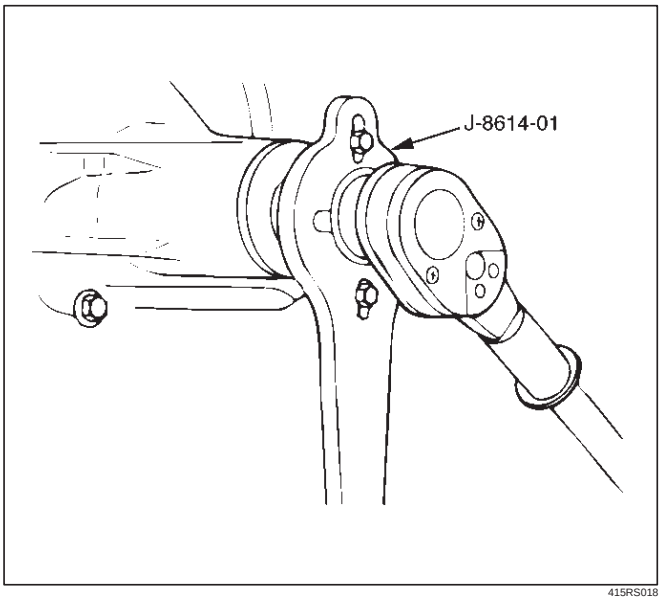
Removal

1. Raise the vehicle and support it at the frame.
   The hoist must remain under the front axle housing.
2. Drain the front axle oil by loosening the drain plug(1).



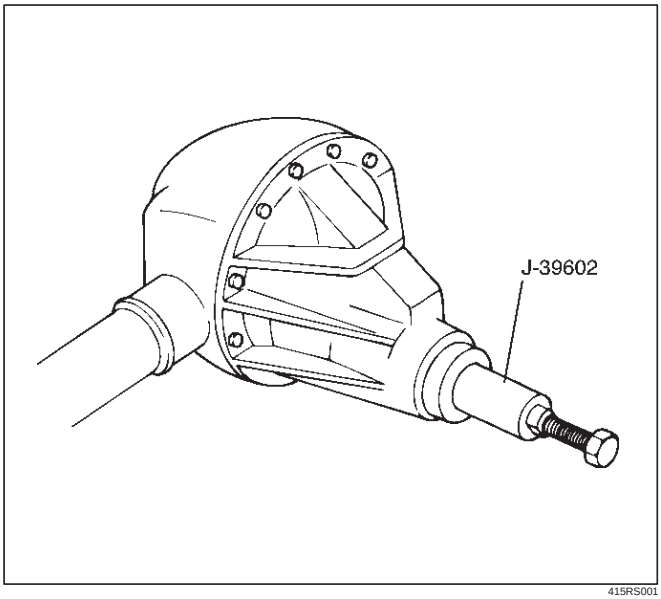
412RS001

3. Remove the front propeller shaft. Refer to *Front Propeller Shaft* in this section.
4. Remove flange nut by using pinion flange holder J–8614–01.



415RS018

5. Remove flange.
6. Remove oil seal.
7. Remove outer bearing by using remover J–39602.



415RS001

8. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

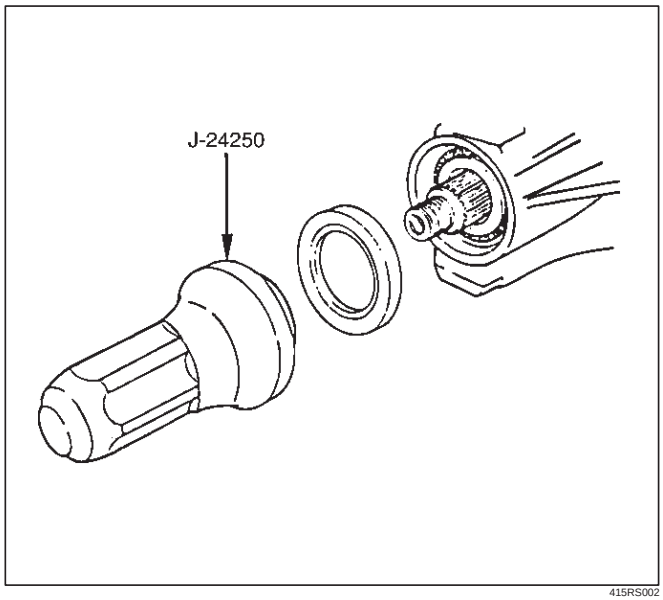
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer. Discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. Install oil seal, use oil seal installer J–24250 to install a new oil seal that has been soaked in axle lubricant.



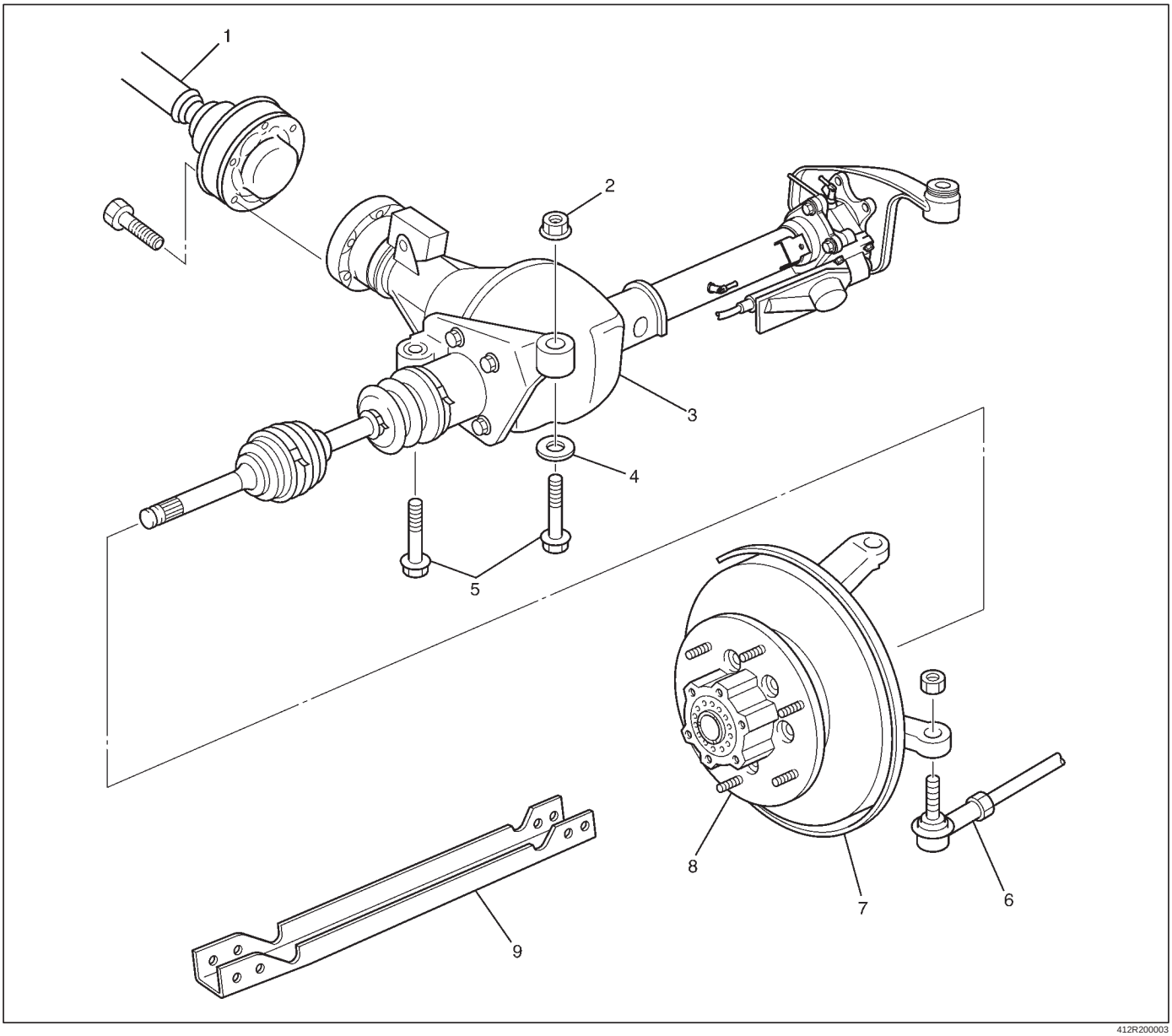
415RS002

4. Install flange.
5. Install flange nut, refer to *Differential Assembly Overhaul for flange nut reassembly* in this section.

NOTE: Discard the used nut and install a new one.

Front Drive Axle Assembly

Front Drive Axle Assembly and Associated Parts



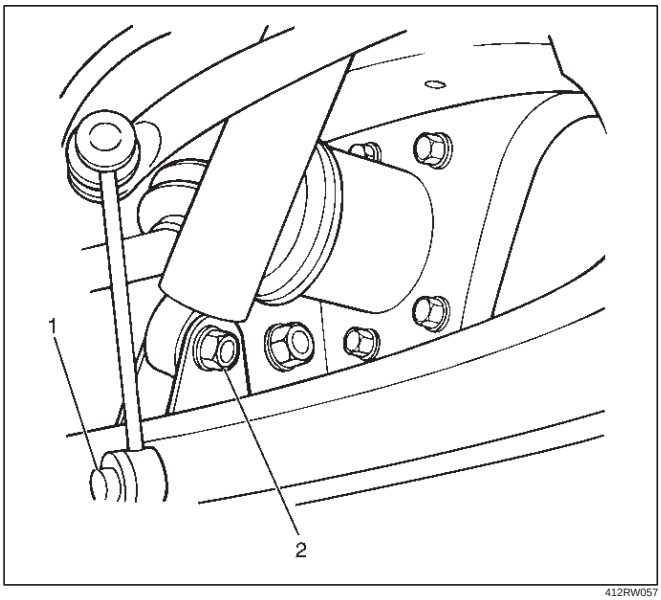
412R200003

Legend

(1) Propeller Shaft
(2) Mounting Nut
(3) Front Axle Case Assembly and Front Drive Shaft Assembly
(4) Washer
(5) Mounting Bolt
(6) Tie–rod End; Power Steering Unit
(7) Knuckle and Back Plate
(8) Hub and Disc Assembly
(9) Suspension Crossmember

Removal

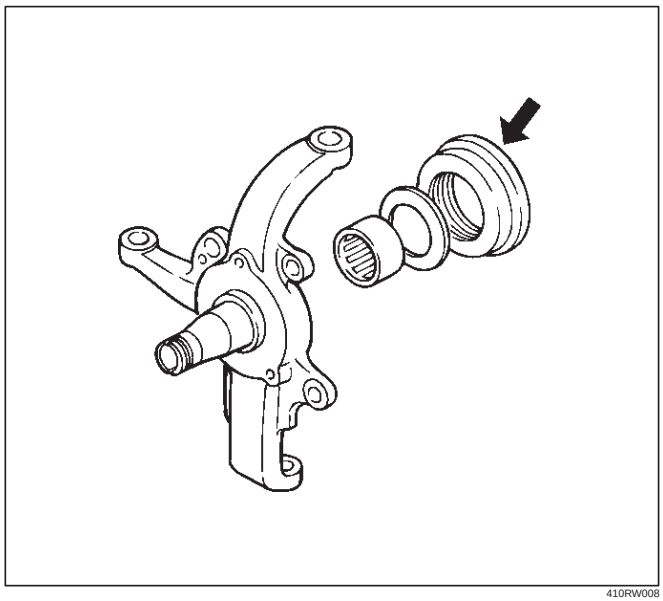
1. Jack up the vehicle and support it using jack stand.
2. Remove the tire and wheel.
3. Remove the stone guard.
4. Remove the brake caliper fixing bolt and hang the caliper. Refer to *Disc Brakes in Brake* section.
5. Remove the antilock brake system speed sensor. Refer to *Front Wheel Speed Sensor in Brake* section.
6. Remove the hub and disc assembly. Refer to *Front Hub and Disc* in this section.
7. Remove the propeller shaft, refer to *Front Propeller Shaft* in this section.
8. Loosen the height control arm of the torsion bar, then remove the torsion bar from lower control arm. Refer to *Torsion Bar in Suspension* section.
9. Remove the suspension crossmember.
10. Remove the lower nut (1) of the stabilizer link.
11. Remove the lower bolt and nut (2) of the shock absorber.



412RW057

12. Remove the tie-rod end from the knuckle. Refer to *Power Steering Unit* in Steering Section.
13. Disconnect the hose of the shift on the fly.
14. Disconnect the actuator connector.
15. Remove the bolts and nuts of the lower control arm (Frame side), then disconnect the lower control arm from frame.
16. Disconnect between the right side upper control arm and the knuckle, then remove the knuckle with lower control arm.

CAUTION: When removing the knuckle, be careful not to damage the oil seal inside of the knuckle.


410RW008

17. Support the differential case by the jack.
18. Remove the front axle mounting bolts and nuts, lower the jack slowly. Remove the left side drive shaft end from the knuckle, then lower the axle assembly from the vehicle.

CAUTION:

1. **Make sure the axle assembly is supported securely when performing repairs.**
2. **Do not damage the power steering unit when performing the repairs.**
3. **Do not damage the shift–on–the fly hose bracket when performing the repairs.**

Installation

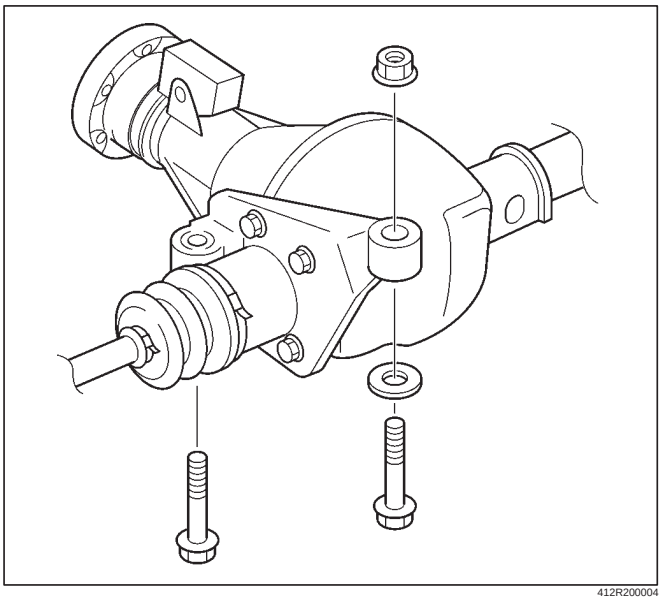
1. Support the differential case with a jack.
2. Jack up the front drive axle assembly, install the left side drive shaft to the knuckle, then install the mount bolts and nuts.

CAUTION:

1. **Do not damage the power steering unit when performing the repairs.**
2. **Do not damage the shift–on–the fly hose bracket when performing the repairs.**
3. **When installing the drive shaft to the knuckle, be careful not to damage the oil seal inside of the knuckle.**

3. Tighten the mounting bolts and nuts to the specified torque.

   Torque: 168 N·m (124 lb ft)


412R200004

4. Install the right side knuckle with lower control arm to the upper control arm.
   Refer to *Knuckle in Suspension* section.

CAUTION: Carefully insert the drive shaft into the knuckle, to avoid damaging the oil seal.

5. Align the bolt hole of the lower control arm, then install the bolts and nuts.

NOTE: Adjust the buffer clearance before tightening the bolts and nuts of the lower control arm.

6. Install the hose of the shift on the fly.
7. Install the actuator connector of the shift on the fly.
8. Install the tie-rod end of the power steering unit to the knuckle, tighten the nut to the specified torque.

   Torque: 118 N·m (87 lb ft)

9. Install lower bolts and nuts of the shock absorber, tighten it to the specified torque.

   Torque: 93 N·m (69 lb ft)

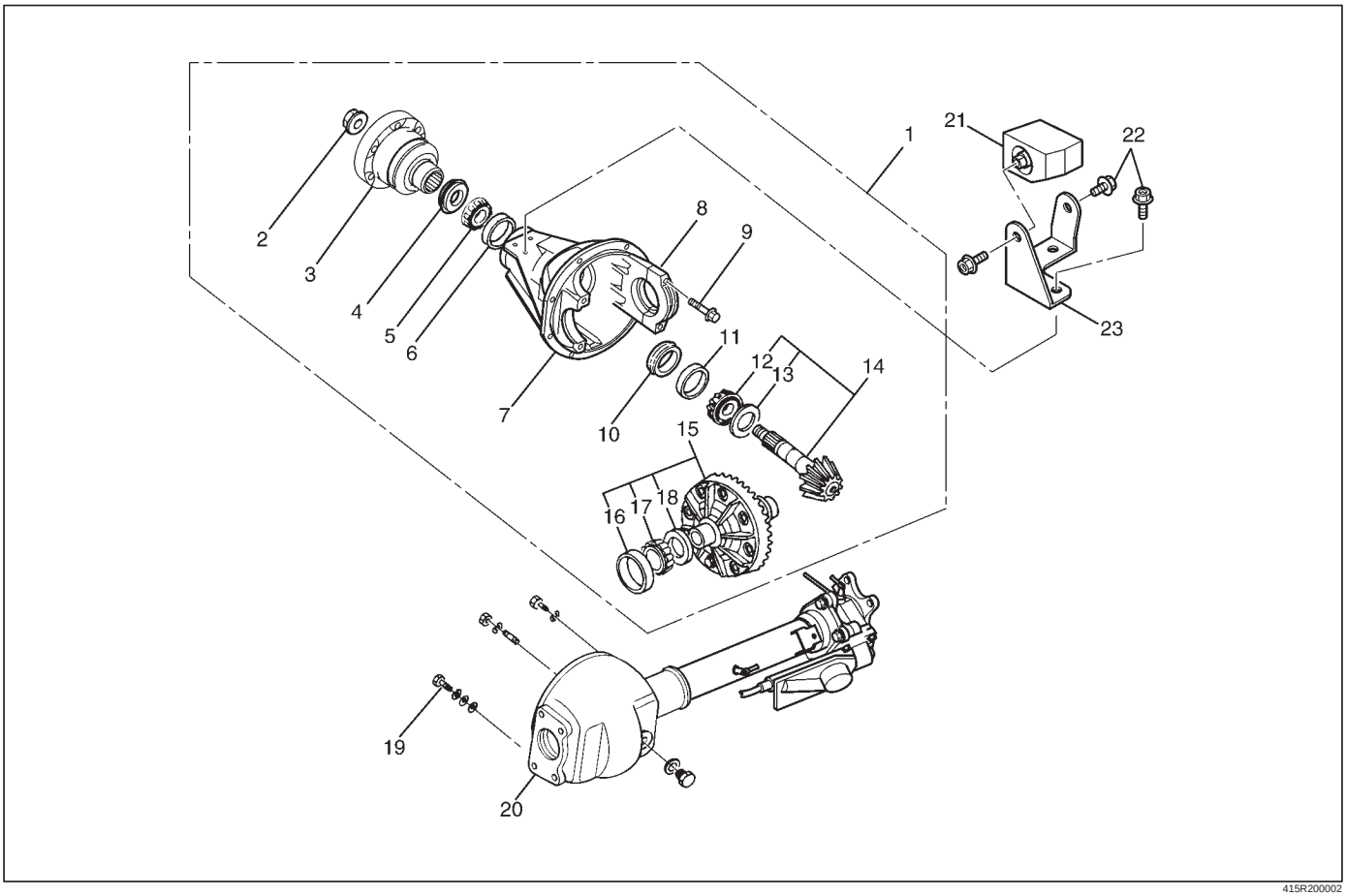
10. Install lower nuts of the stabilizer link, tighten it to the specified torque.
11. Install the suspension crossmember.
12. Install the torsion bar.
    Refer to *Torsion Bar in Suspension* section.
13. Install the front propeller shaft.
    Refer to *Front Propeller Shaft* in this section.
14. Install the hub and disc assembly and adjust the bearing preload.
    Refer to *Front Hub and Disc* in this section.
15. Install the wheel speed sensor of the antilock brake system.
16. Install the brake caliper. Tighten the bolt of the caliper bracket to the specified torque.

    Torque: 50 N·m (37 lb ft)

17. Install the stone guard.
18. Install the tire and wheel.
19. Lower the vehicle, adjust the trim height.
    Refer to *Trim Height Adjustment in Steering* section.
20. Tighten the bolts and nuts of the lower control arm to the specified torque.
    Refer to *Lower Control Arm in Suspension* section.

Differential Assembly

Disassembled View



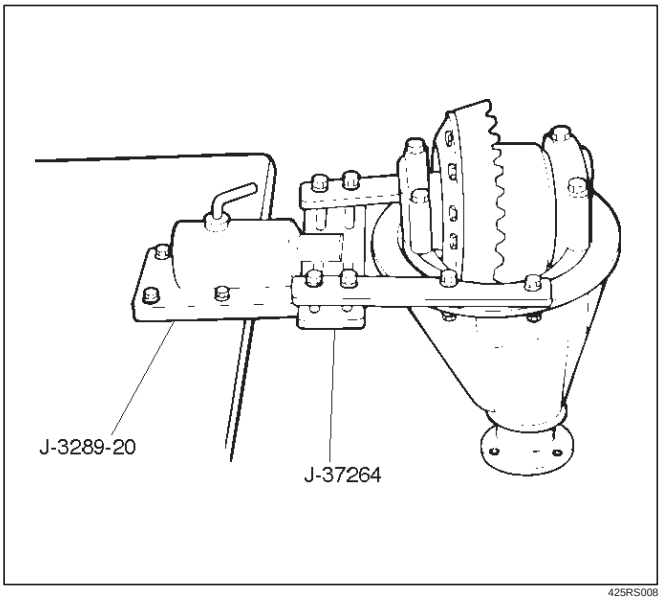
415R200002

Legend

(1) Differential Assembly
(2) Flange Nut
(3) Flange
(4) Oil Seal
(5) Outer Bearing
(6) Outer Bearing Outer Race
(7) Differential Carrier
(8) Bearing Cap
(9) Bolt
(10) Collapsible Spacer
(11) Inner Bearing Outer Race
(12) Inner Bearing
(13) Adjust Shim
(14) Pinion Gear
(15) Diff Cage Assembly
(16) Side Bearing Outer Race
(17) Side Bearing
(18) Adjust Shim
(19) Bolt
(20) Axle Case
(21) Final Drive Damper
(22) Damper Bolt
(23) Damper Bracket

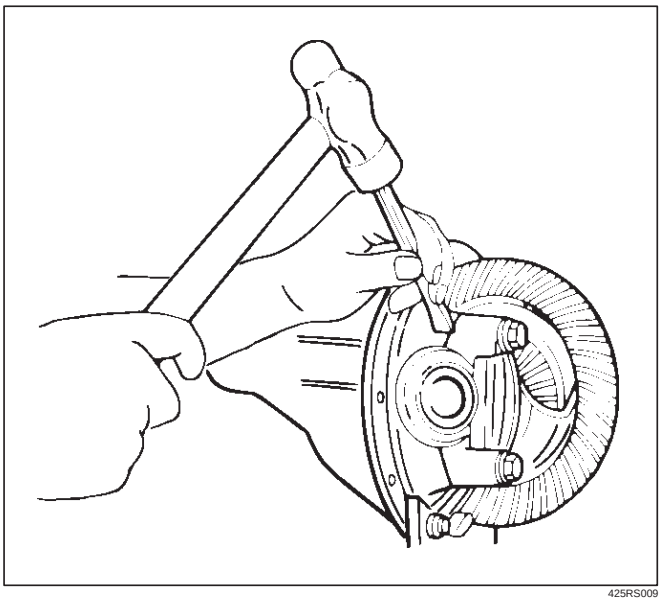
Disassembly

1. Remove differential carrier fixing bolt.
2. Remove differential assembly.
3. Using holding fixture J–37264 and holding fixture base J–3289–20, fix the differential assembly to the bench.



425RS008

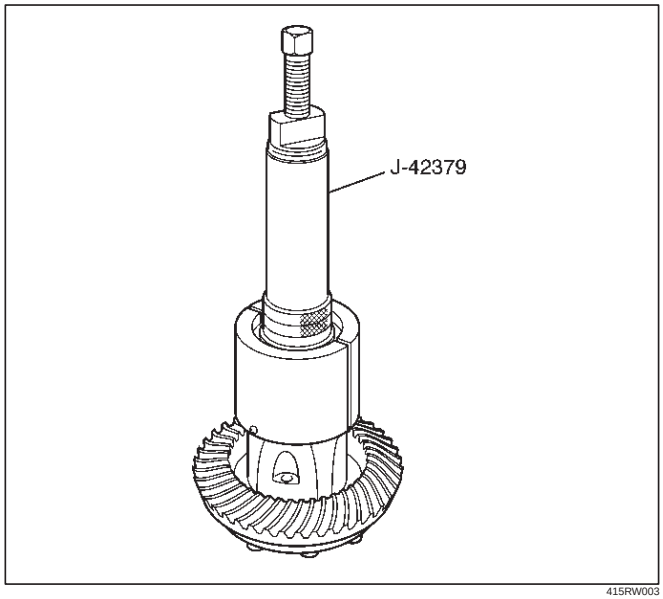
4. Remove bearing cap bolt.
5. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



425RS009

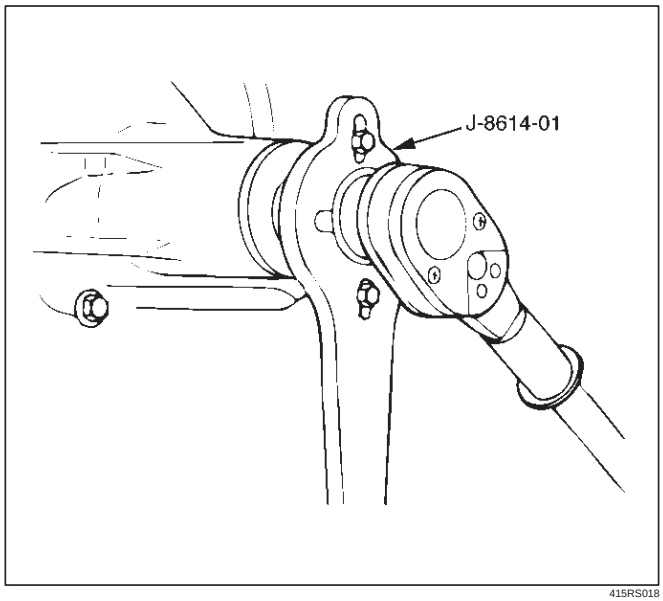
6. Remove differential cage assembly.
7. Remove side bearing outer race, after removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.
8. Remove side bearing, using remover J–42379 and adapter J–8107–2.

   ▼Select insert; 303173 and collet halves; 44801 in remover kit J–42379.



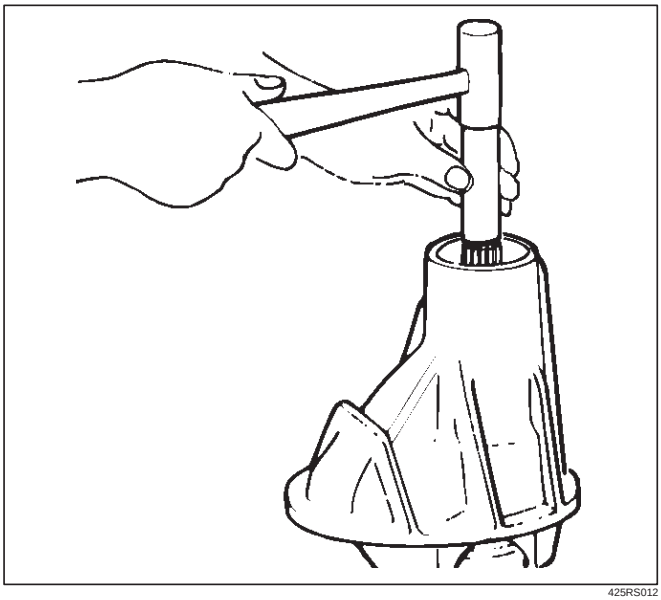
415RW003

9. Remove adjust shim, note the thickness and position of the shims removed.
10. Remove the flange nut using holding wrench J–8614–01.

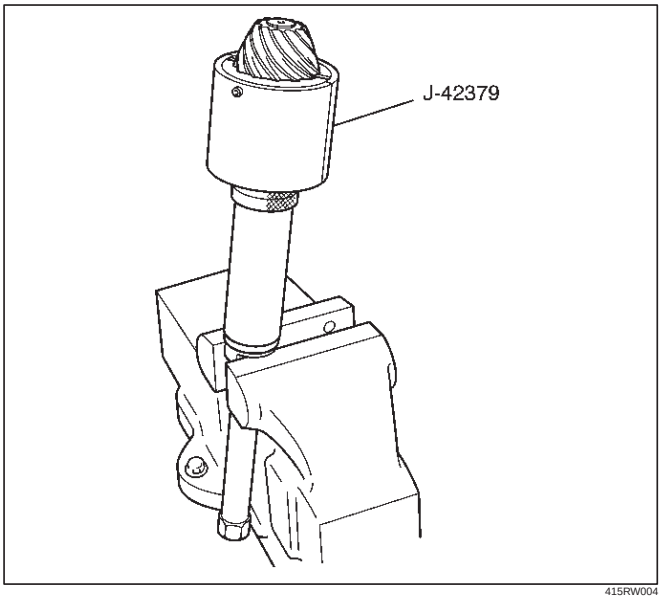


415RS018

11. Remove flange using a universal puller.
12. Remove the drive pinion assembly using a soft metal rod and a hammer.

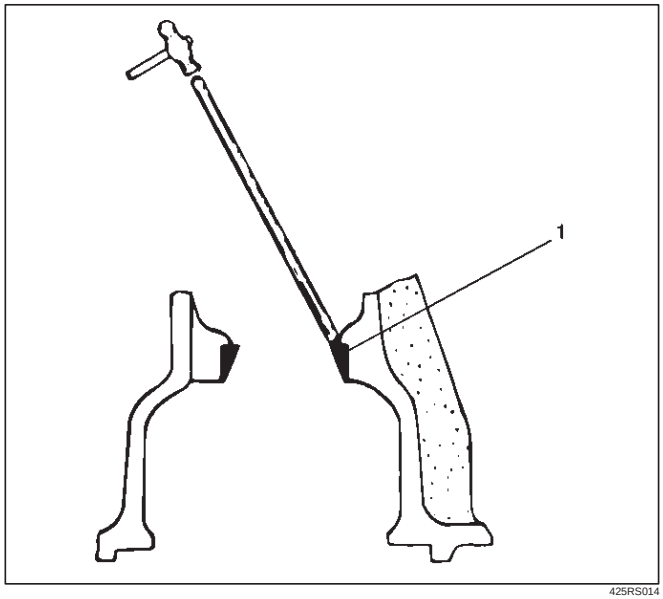

425RS012

13. Remove collapsible spacer.
14. Remove the inner bearing using remover J–42379.
    ▼Select insert; 303173 and collet halves; 44801 in remover kit J–42379.

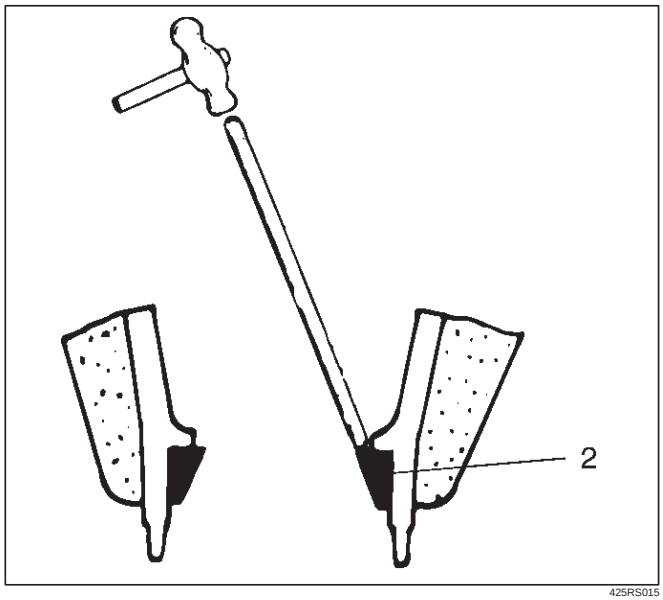


415RW004

15. Remove adjust shim.
16. Remove oil seal.
17. Remove outer bearing.
18. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.

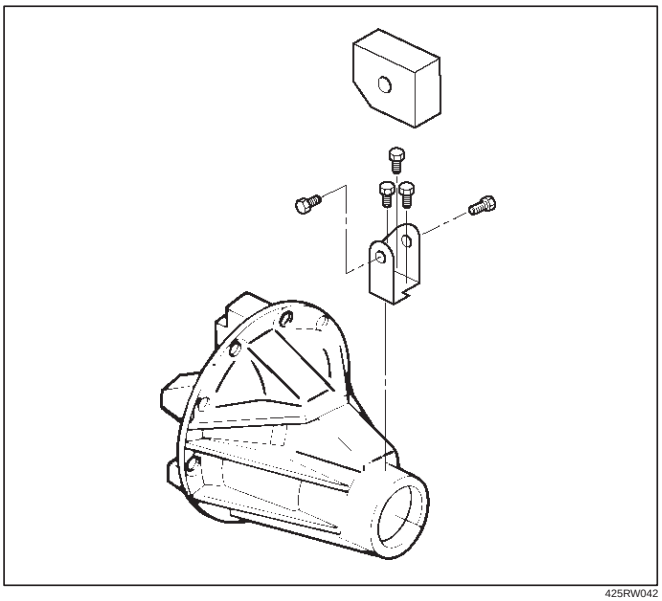


425RS014



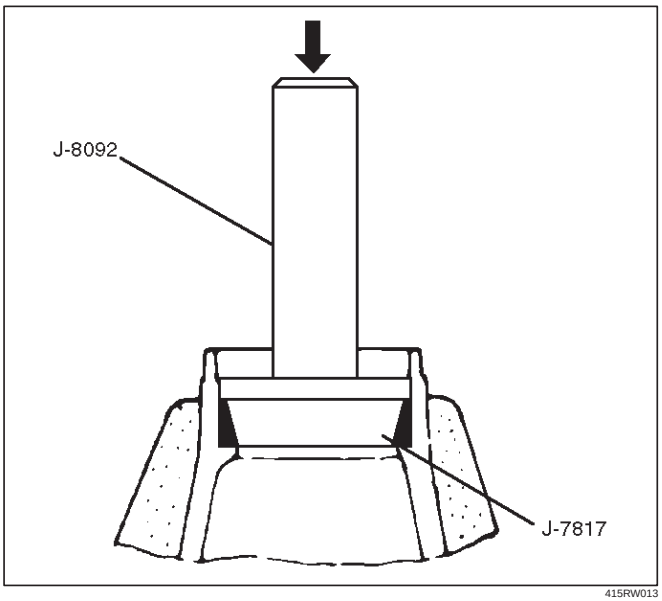
425RS015

19. Remove damper and bracket.


425RW042

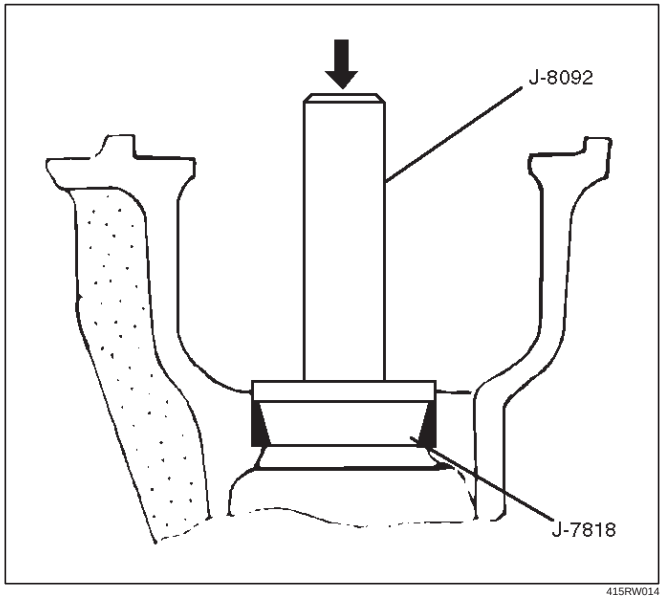
Reassembly

1. Using installer J–7817 and grip J–8092, install outer bearing outer race.



415RW013

2. Using installer J–7818 and grip J–8092, install Inner bearing outer race.

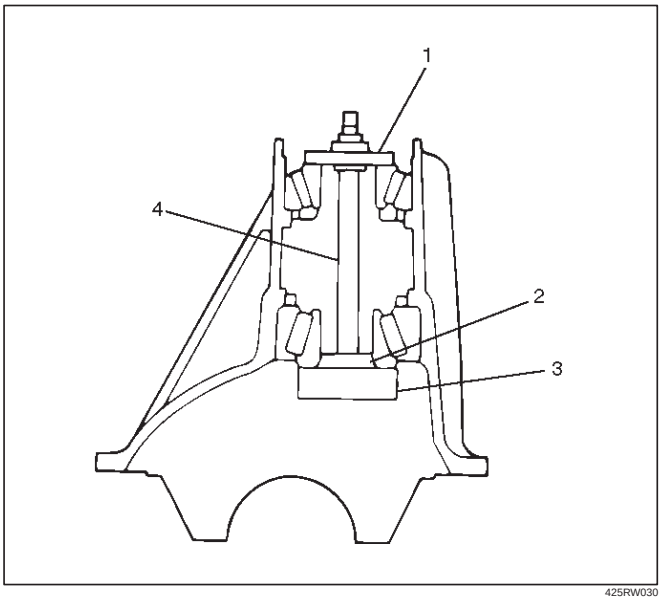


415RW014

3. Install adjust shim and adjust drive pinion mounting distance:
   1. Apply gear oil to the inner and outer drive pinion bearing.
      Clean the pinion setting gauge set.
      Then install the gauge set together with the inner and outer bearings.

2. Tighten the nut to the specified torque.

Torque: 2.3 N·m (20 lb in)



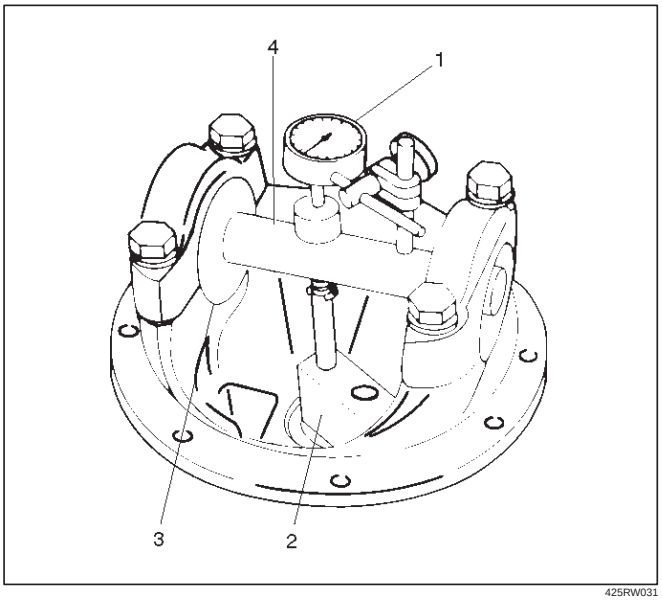
425RW030

Legend

(1) Pilot : J–21777–42
(2) Pilot : J–42479–2
(3) Gauge Plate : J–42479–1
(4) Nut and Stud : J–21777–43

3. Clean the side bearing bores. Install the dial indicator with the discs and arbor. Install and tighten the bearing caps to the specified torque.

Torque: 97 N·m (72 lb ft)

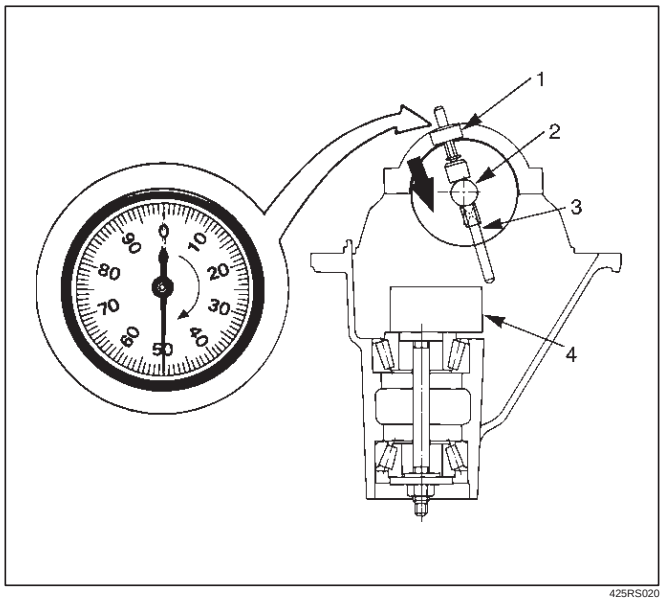


425RW031

Legend

(1) Dial Indicator: J–8001
(2) Gauge Plate: J–42479–1
(3) Disc (2 pcs.): J–23597–8
(4) Arbor: J–23597–1

4. Set the dial indicator to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.



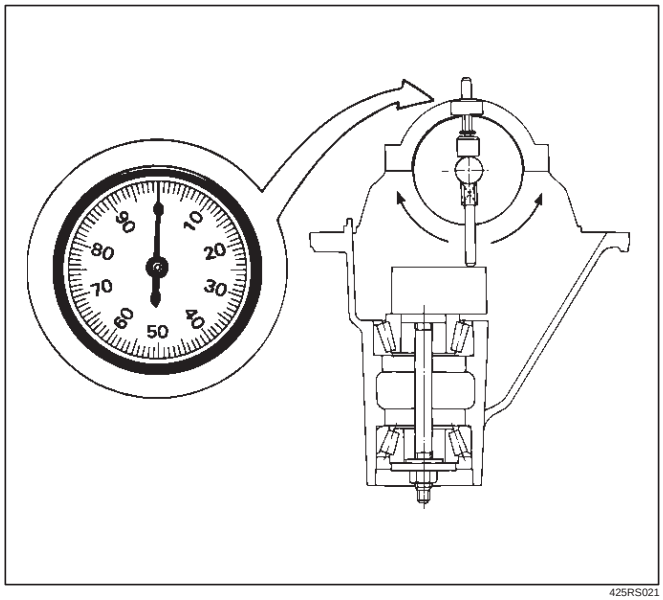
425RS020

Legend

(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gauge Plate

5. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”.

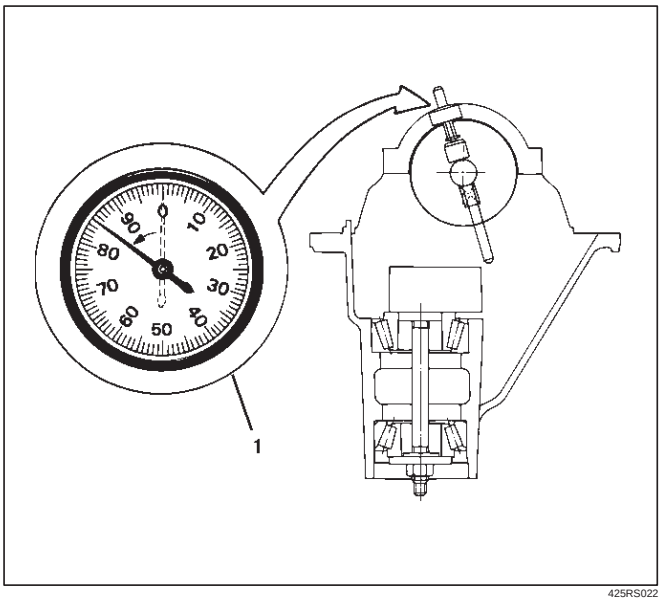
Repeat the procedure to verify the “0” setting.



425RS021

6. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.

   Record the number the dial indicator needle points to.



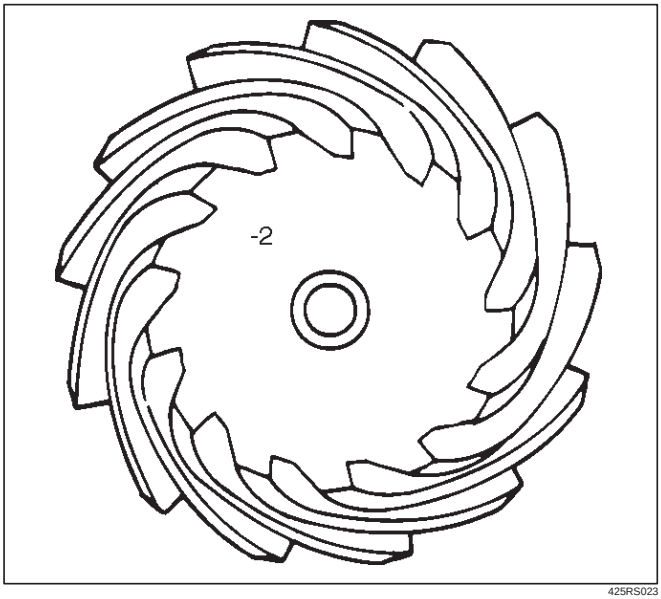
425RS022

Legend

(1) Example=Dial indicator reading of 0.085

7. Record the pinion depth code on the head of the drive pinion.

   The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



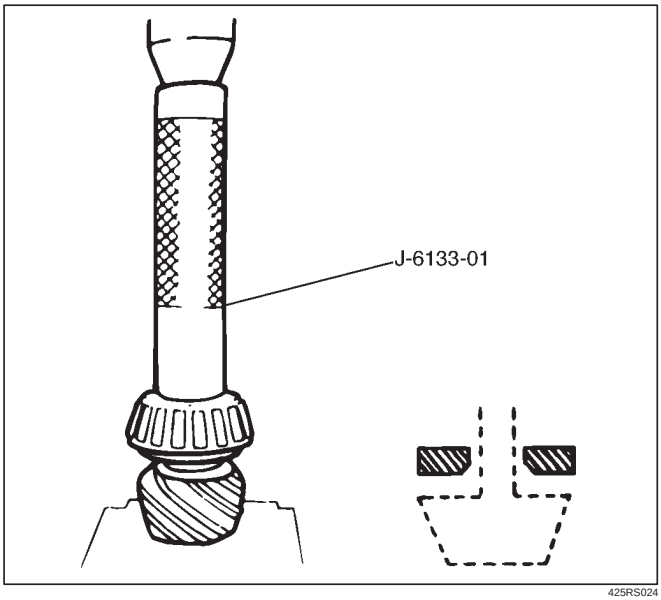
425RS023

8. Select the shim using chart;

Pinion marking / Dial indicator reading (Inches)	+7	+6	+5	+4	+3	+2	+1	0	–1	–2	–3	–4	–5	–6	–7
0.023															0.030
0.024														0.030	0.030
0.025													0.030	0.030	0.032
0.026												0.030	0.030	0.032	0.032
0.027											0.030	0.030	0.032	0.032	0.034
0.028										0.030	0.030	0.032	0.032	0.034	0.034
0.029									0.030	0.030	0.032	0.032	0.034	0.034	0.036
0.030								0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036
0.031							0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038
0.032						0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038
0.033					0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040
0.034				0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040
0.035			0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042
0.036		0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042
0.037	0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044
0.038	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044
0.039	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046
0.040	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046
0.041	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048
0.042	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048
0.043	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050
0.044	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050
0.045	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052
0.046	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052
0.047	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052	
0.048	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052		
0.049	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052			
0.050	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052				
0.051	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052					
0.052	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052						
0.053	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052							
0.054	0.046	0.048	0.048	0.050	0.050	0.052	0.052								
0.055	0.048	0.048	0.050	0.050	0.052	0.052									
0.056	0.048	0.050	0.050	0.052	0.052										
0.057	0.050	0.050	0.052	0.052											
0.058	0.050	0.052	0.052												
0.059	0.052	0.052													
0.060	0.052														

4. Place the shim on the drive pinion. Install the inner bearing onto the pinion using an installer J–6133–01 and a press.

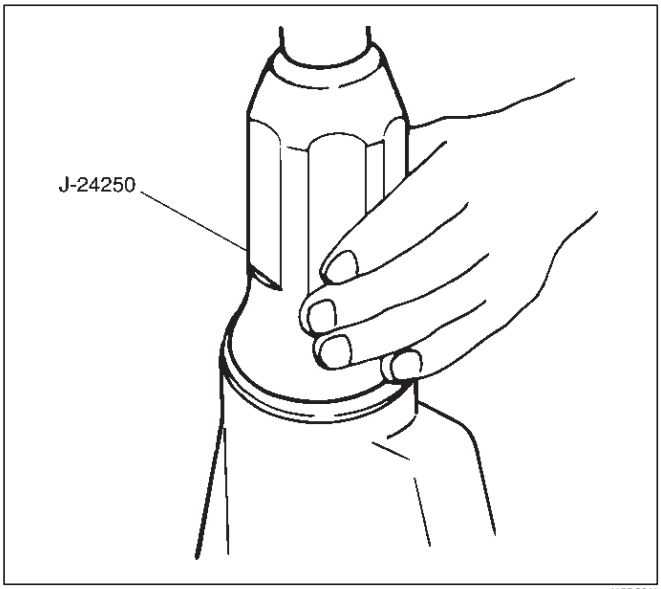
NOTE: Do not apply pressure to the roller cage and apply pressure only to the inner race.



425RS024

5. Discard the used collapsible spacer and install a new one.
6. Install pinion gear.
7. Install outer bearing.
8. Use oil seal installer J–24250 to install a new oil seal that has been soaked in front axle lubricant.

NOTE: Take care to use a front differential oil seal, NOT the rear differential oil seal.

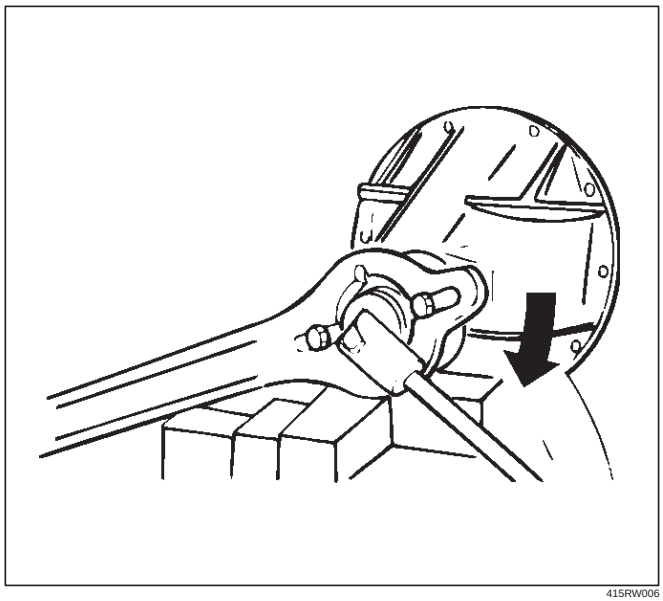


415RS011

9. Install flange.
10. Install flange nut.
    1. Apply lubricant to the pinion threads.
    2. Tighten the nut to the specified torque using the pinion flange holder J–8614–01.

Torque: 177–275N·m (130–203 lb ft)

NOTE: Discard used flange nut and install new one and do not over tighten the flange nut.


415RW006

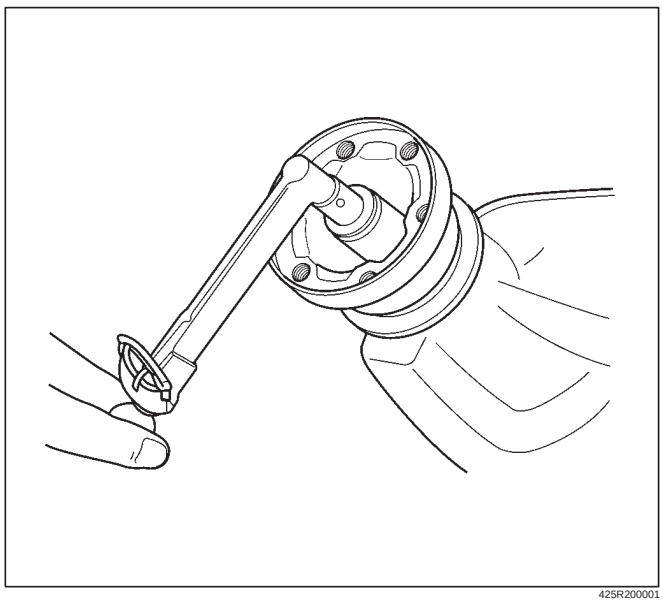
3. Adjust pinion bearing preload.
    a. Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
    b. Continue tightening flange nut until the specified starting torque is obtained.

Starting torque:

New bearing 0.7–1.1 N·m (5.64–9.98 lb in)

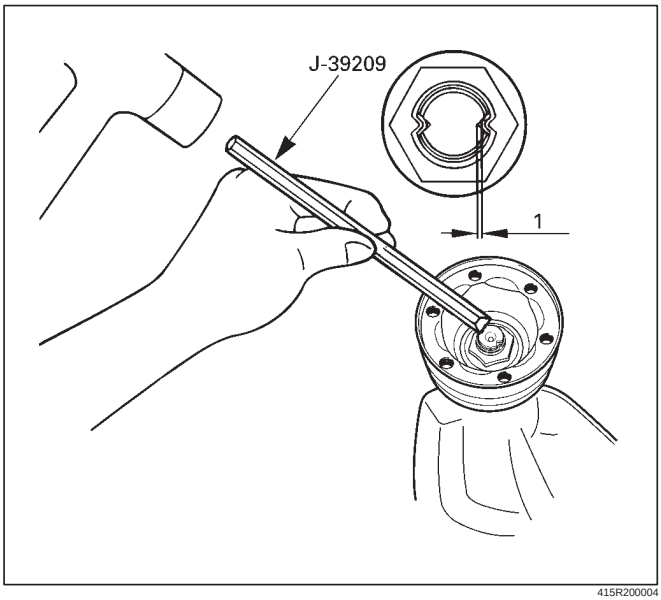
Used bearing 0.4–0.5 N·m (2.86–4.94 lb in)

NOTE: Do not tighten the flange nut more than 678 N·m(500 lb ft).


425R200001

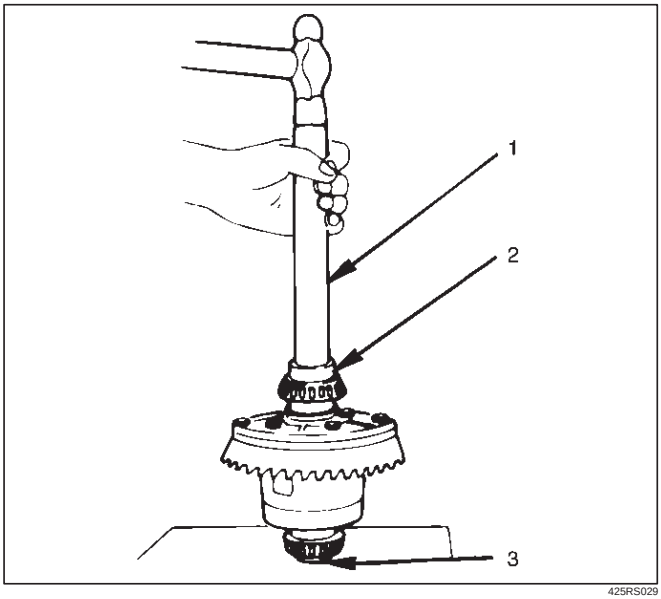
4. Using punch J–39209, stake the flange nut at two points.

NOTE: When staking, be sure to turn the nut to insure that there is no change in bearing preload. Make sure of preload again as instructed in 3.



415R200004

11. Install adjust shim.
    1. Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.

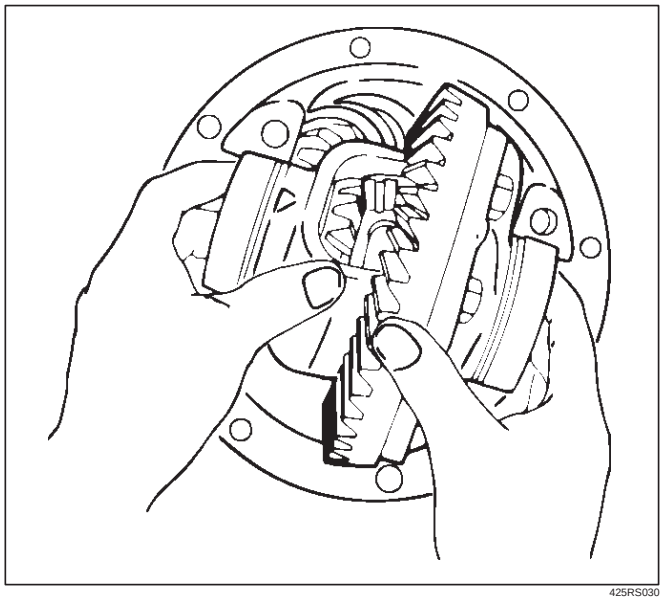


425RS029

Legend

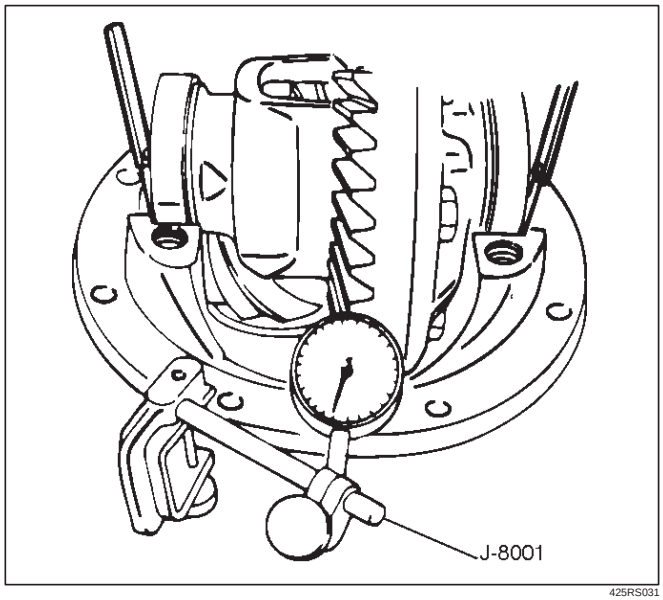
(1) Drive handle:J–8092
(2) Installer:J–24244
(3) Pilot:J–8107–2

2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.


425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

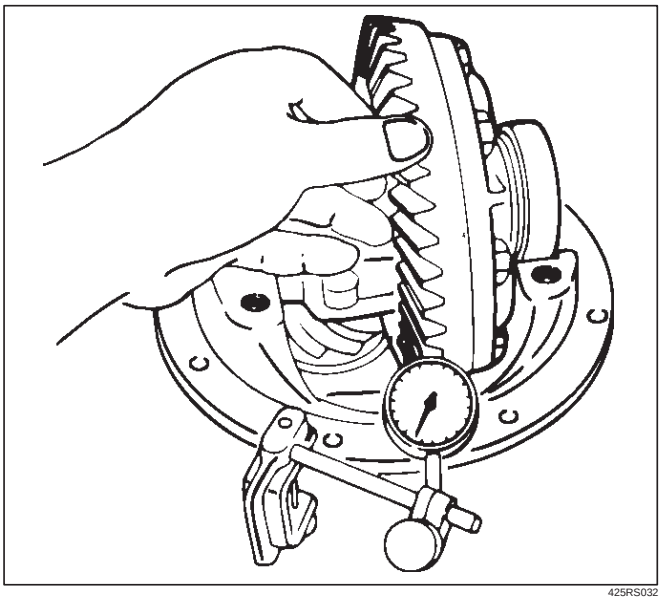
   Mount the dial indicator J–8001 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.



425RS031

4. Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

Backlash: 0.13–0.20 mm(0.005 –0.008 in)

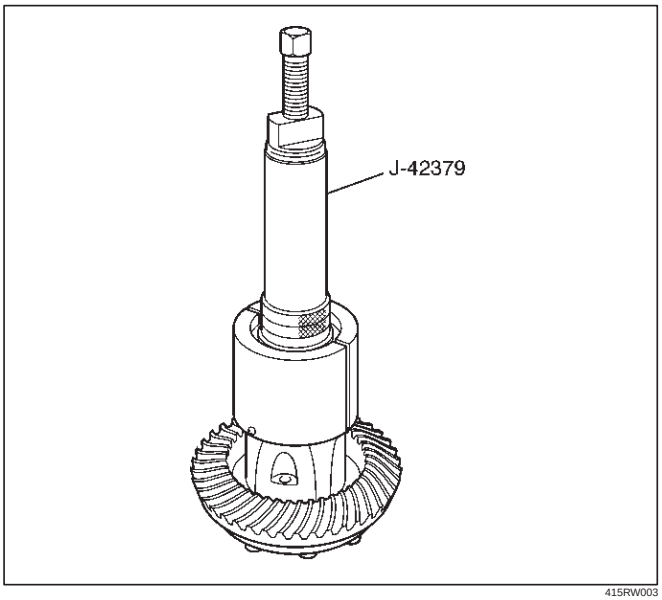


425RS032

With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.025 mm (0.001 in) to each shim pack to provide side bearing preload. Always use new shims.

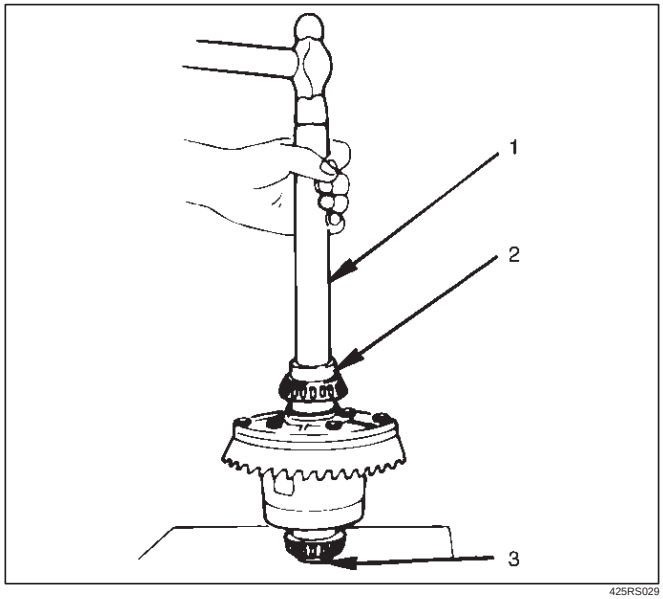
5. Use bearing remover J–42379 and pilot J–8107–2 to remove side bearing.

▼Select insert; 303173 and collet halves;44801 in remover kit J–42379.



415RW003

12. Install the side bearings together with the selected shims.

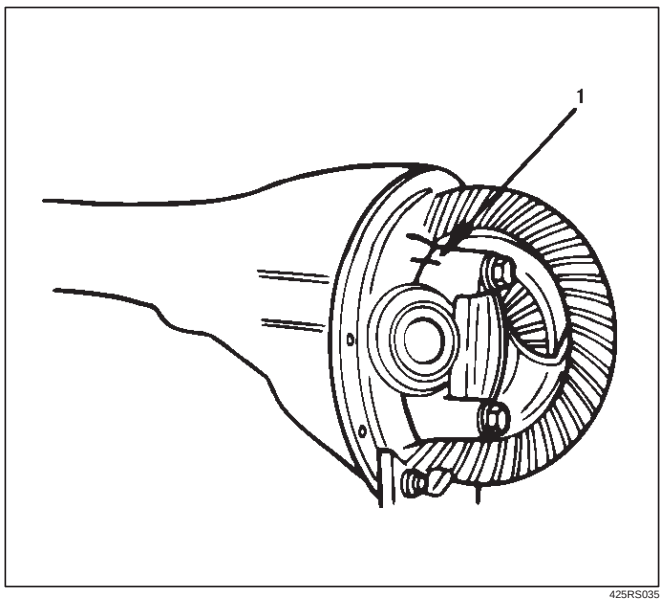


425RS029

Legend

(1) Drive Handle:J–8092
(2) Installer: J–24244
(3) Pilot: J–8107–2

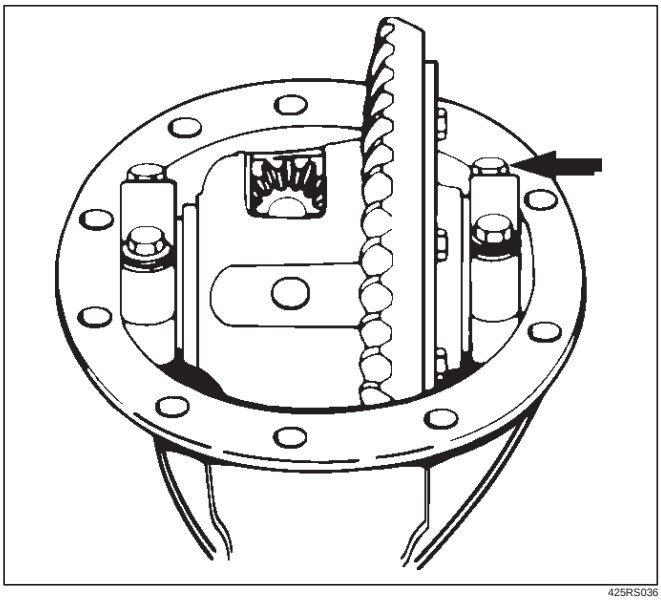
13. Install side bearing outer race.
14. Install differential cage assembly.
15. Install bearing cap then align the setting marks(1) applied at disassembly.



425RS035

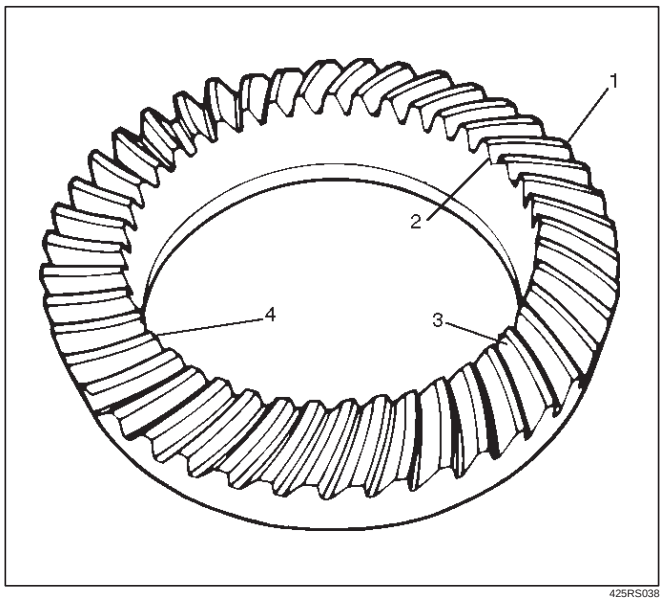
16. Tighten the cap bolt to the specified torque.

Torque: 97 N·m (72 lb ft)



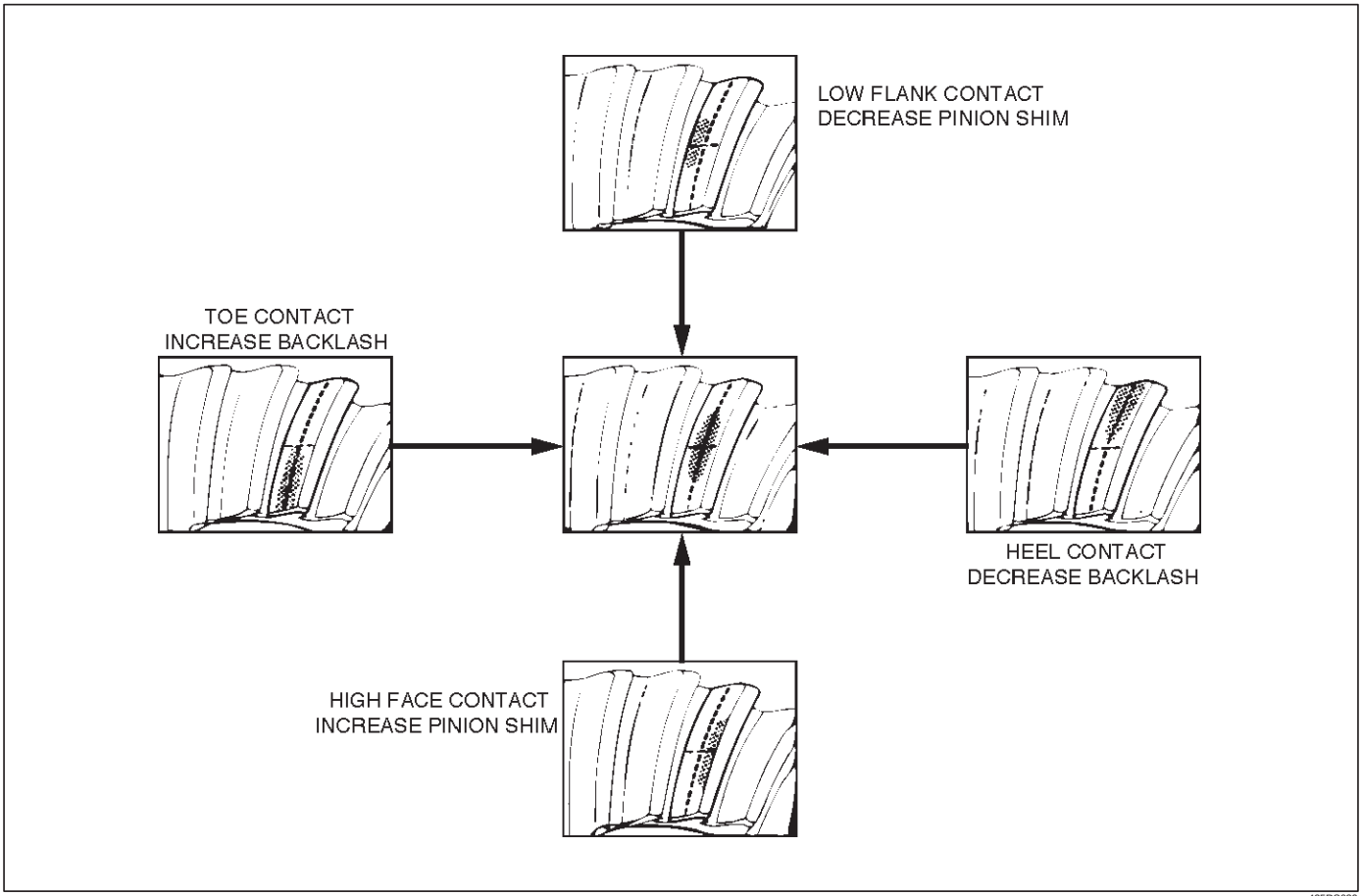
Gear Tooth Contact Pattern Check and Adjustment

1. Apply a thin coat of prussian blue or equivalent to at least 7–8 ring gear teeth. Rotate the ring gear and inspect the contact point of the impressions and make the necessary adjustments as described in the next page.



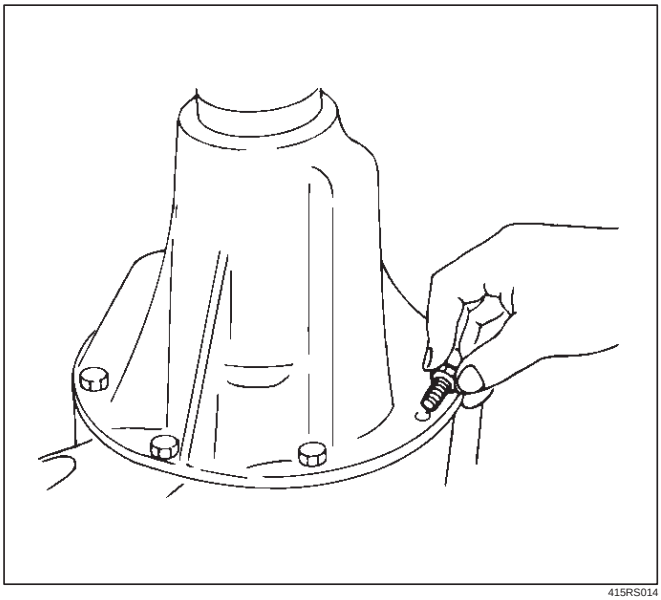
Legend

(1) Heel
(2) Toe
(3) Concave Side(Coast)
(4) Convex Side(Drive)



17. Install differential assembly.
    1. Clean the faces of the front axle case and differential carrier.
       Apply Three Bond TB1215 or equivalent to the sealing side of the axle case and the carrier.
    2. Attach the differential case and the carrier assembly to the front axle case and tighten the nuts and bolts.

    Torque: 25 N·m (19 lb ft)



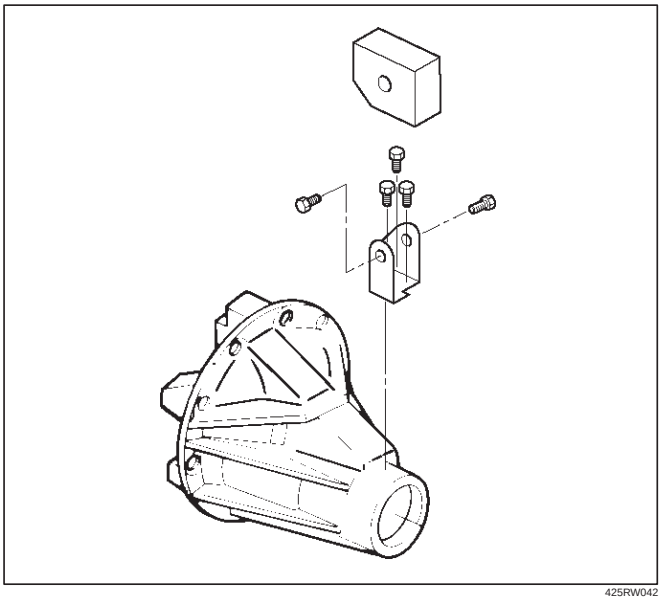
415RS014

    3. Fill the axle case with hypoid gear lubricant, up to the base of the filler hole.

    Lubricant capacity: 1.25 liter(1.32 US qt)

18. Install damper.
    1. Clean the faces and bolt thread hole of differential carrier.
    2. Install the bracket with new bolts.
    3. Install the damper to the bracket with new bolts.

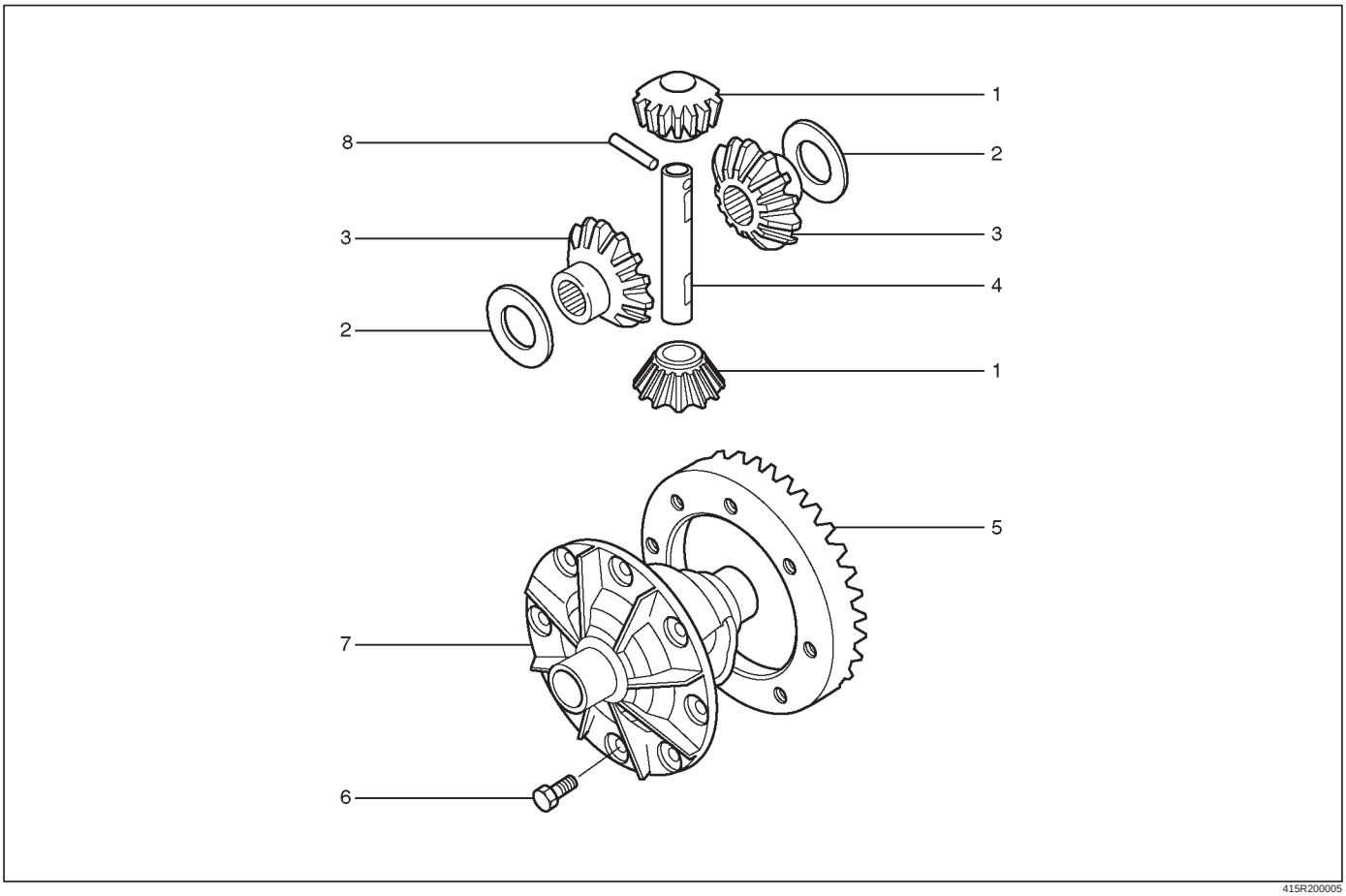
    Torque: 25 N·m (19 lb ft)



425RW042

Differential Cage Assembly

Disassembled View



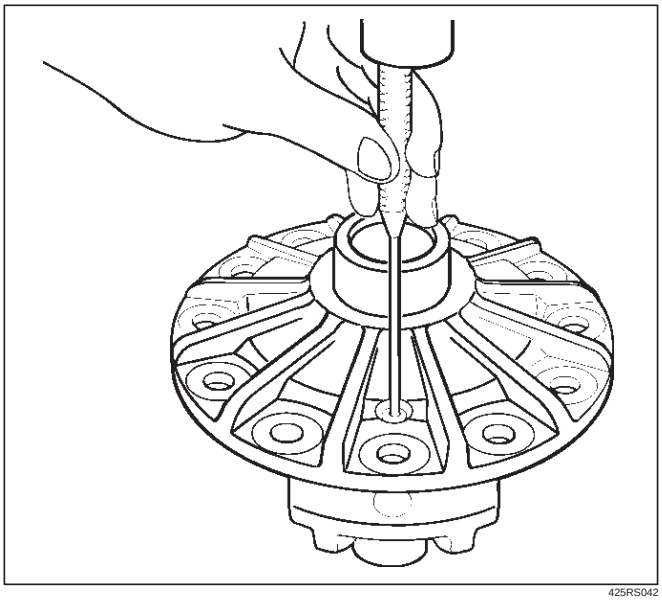
415R200005

Legend

(1) Pinion Gear
(2) Thrust Washer
(3) Side Gear
(4) Cross Pin
(5) Ring Gear
(6) Bolt
(7) Differential Cage
(8) Lock Pin

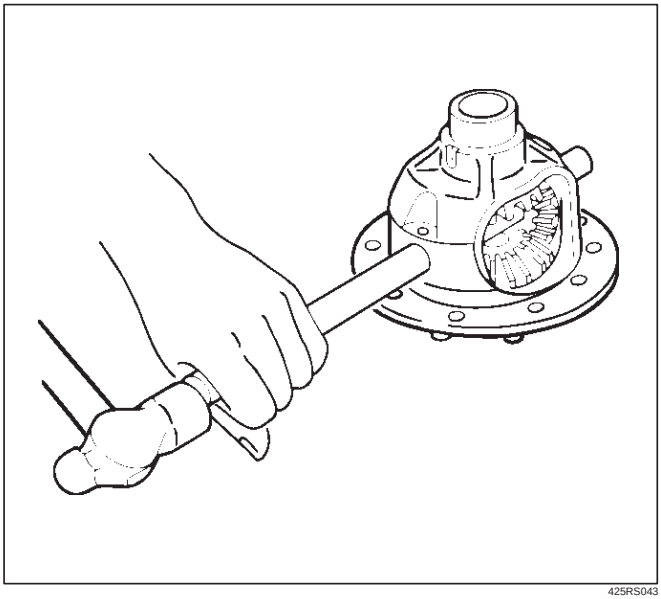
Disassembly

1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin.



425RS042

4. Remove the cross pin, using a soft metal rod and a hammer.



425RS043

5. Remove pinion gear.
6. Remove side gear.
7. Remove thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

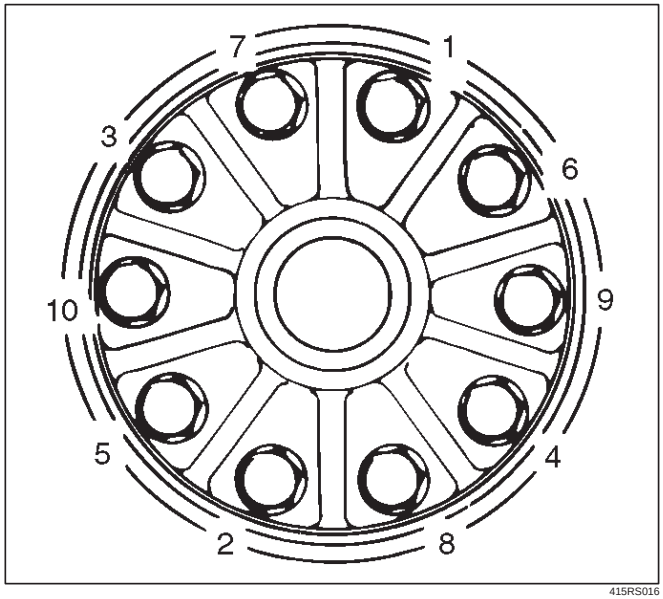
1. Ring gear, pinion gear
2. Bearing
3. Side gear, pinion gear, cross pin
4. Differential cage, carrier
5. Thrust washer
6. Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Discard used bolts and install new ones.

Torque: 108 N·m (80 lb ft)

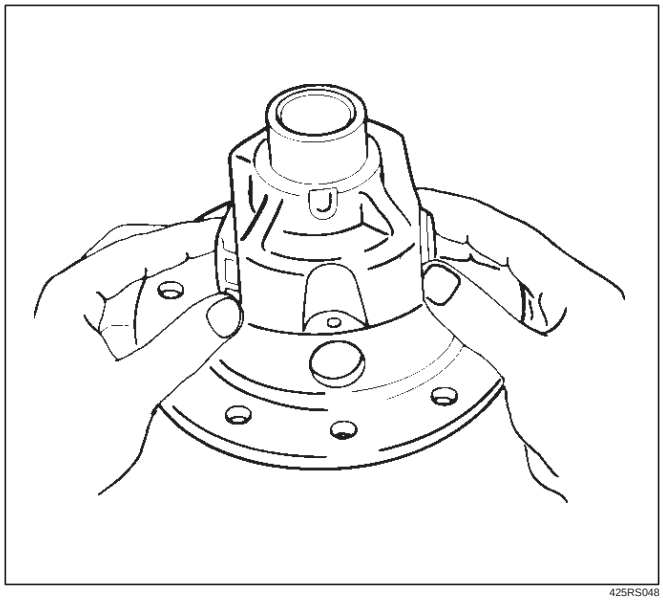
3. Tighten the fixing bolts in a diagonal sequence as illustrated.



415RS016

Reassembly

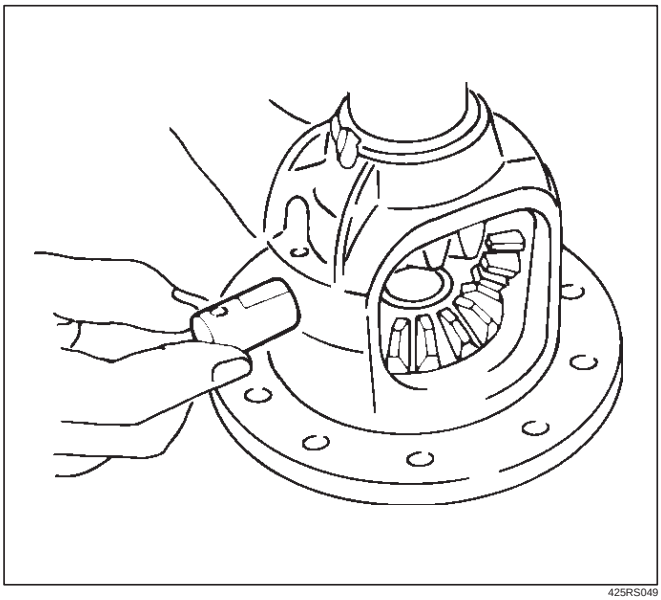
1. Install thrust washer.
2. Install side gear.
3. Install the pinion gear with thrust washer by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.



425RS048

4. Install cross pin.

▼Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.

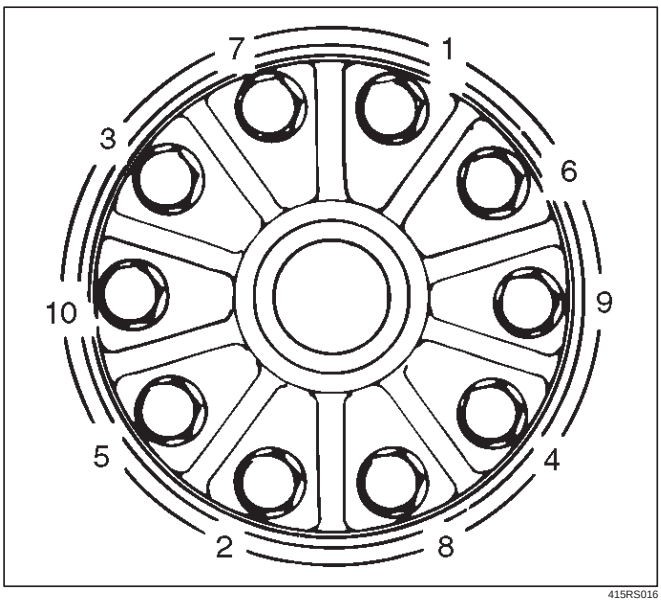


425RS049

5. Install lock pin. After lock pin installation, stake the cage to secure the lock pin.
6. Install ring gear and tighten the bolts in diagonal sequence as illustrated.

Torque: 108 N·m (80 lb ft)

NOTE: Discard used bolts and install new ones.



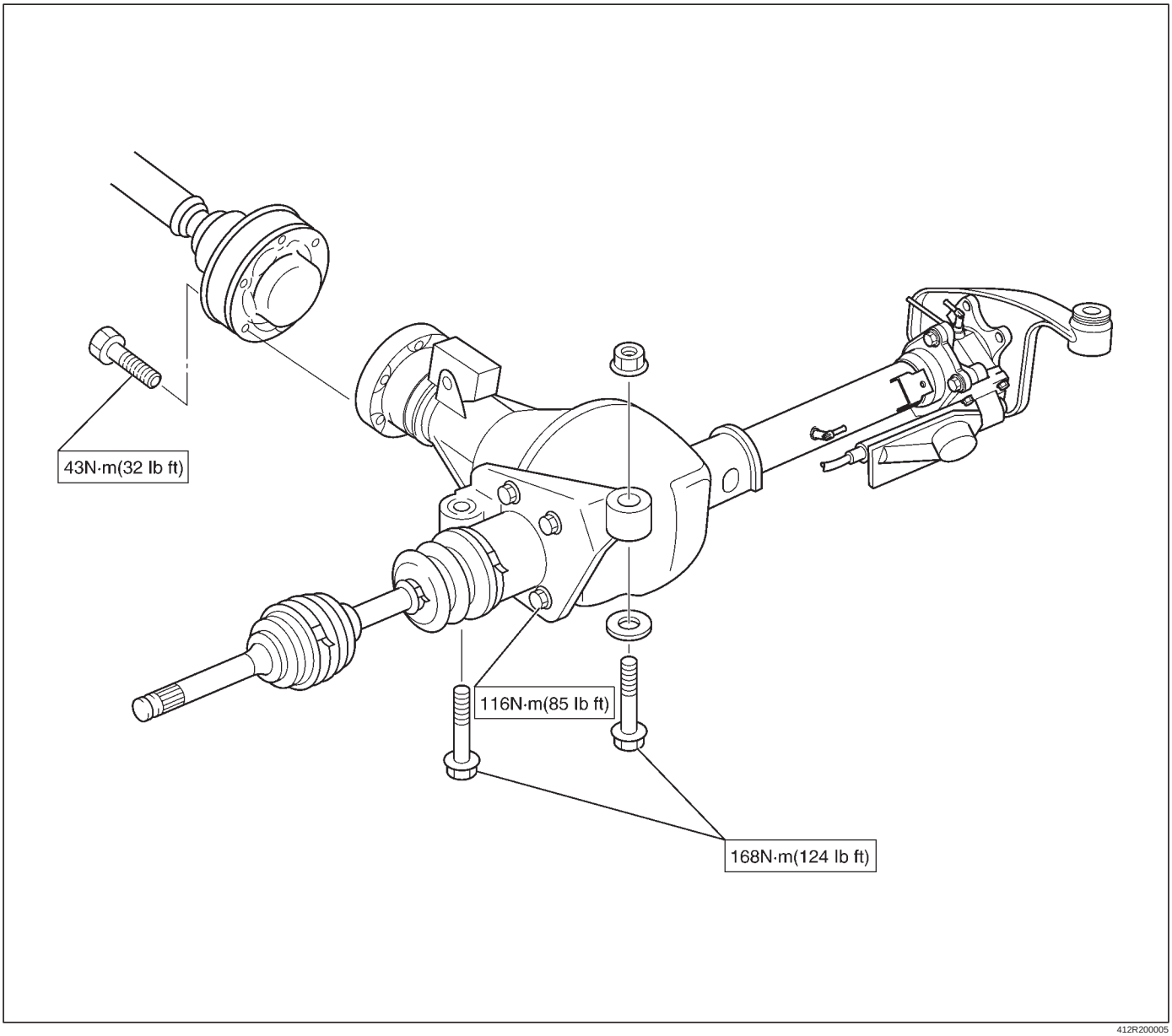
415RS016

Main Data and Specifications

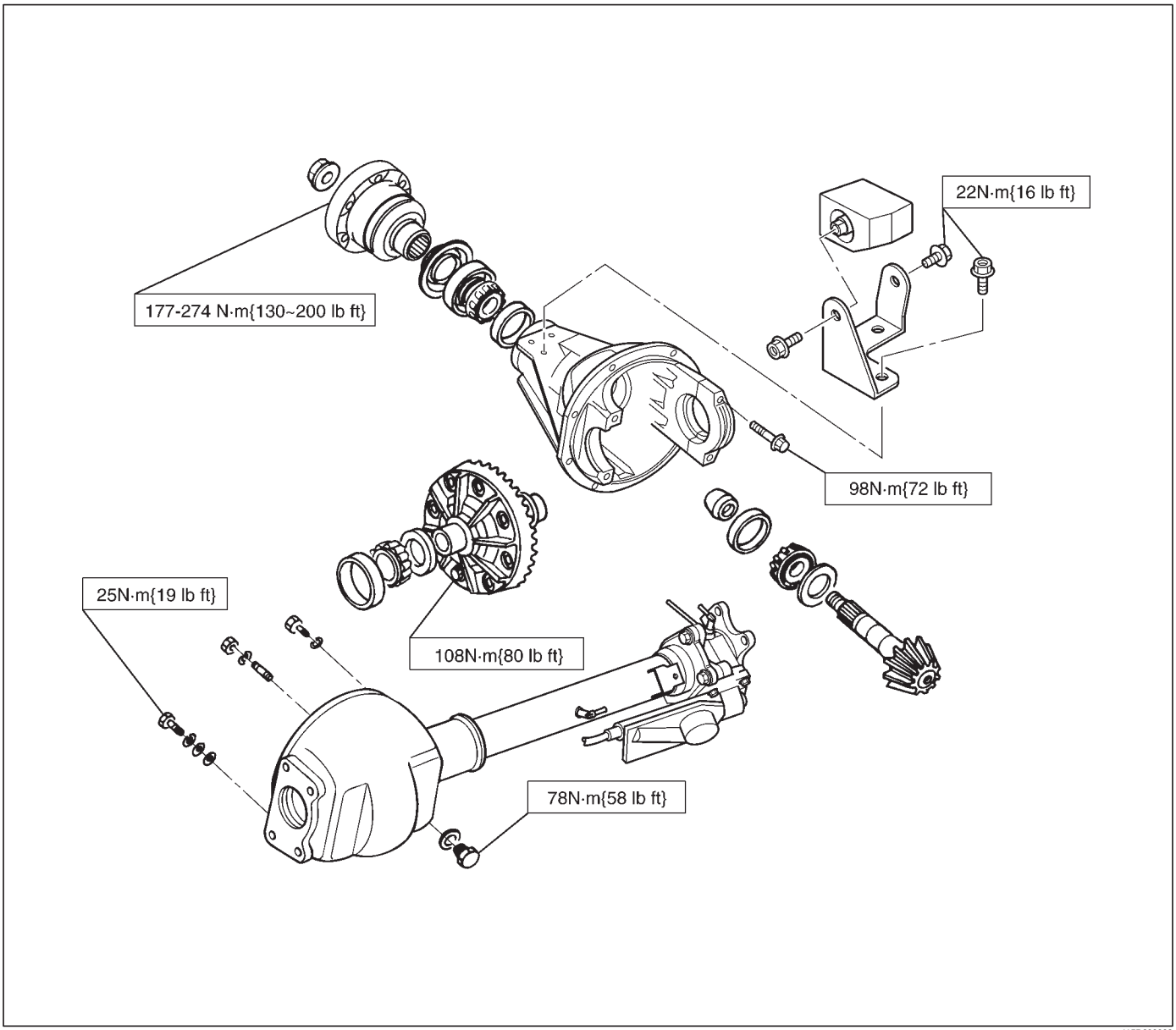
General Specifications

Axle tube Type		It consists of a duct, a cast iron housing and an axle tube.
Gear type		Hypoid
Gear ratio		4.300
Differential type		Two pinion
Oil capacity	liter (US qt)	1.25 (1.32) (Differential) 0.12 (0.13) (Actuator Housing: Shift on the fly)
Type of lubricant		GL–5 (75W–90)
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint)
Hub locking Type		Rigid

Torque Specifications



412R200005


22N·m{16 lb ft}
177-274 N·m{130~200 lb ft}
98N·m{72 lb ft}
25N·m{19 lb ft}
108N·m{80 lb ft}
78N·m{58 lb ft}
415R200003

Special Tools

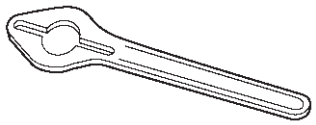
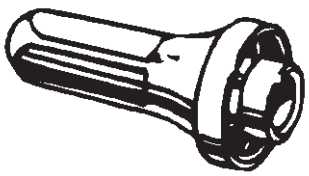
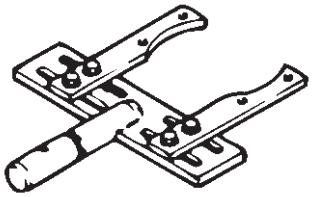
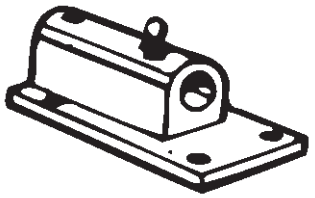
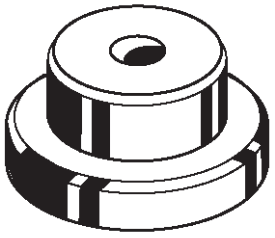
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901HW071	**J–8614–01** Holder; Pinion flange
 901RS232	**J–24250** Installer; Oil seal
 901RS212	**J–37264** Differential holding fixture (Use with J–3289–20 base)
 901RS213	**J–3289–20** Holding fixture base
901RW039	**J–42379** Remover; Side/Pinion bearing
 901RS238	**J–8107–2** Adapter; Side bearing plug

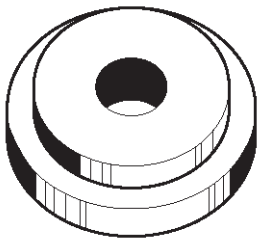
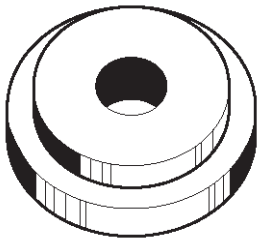
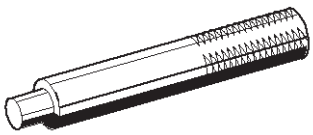
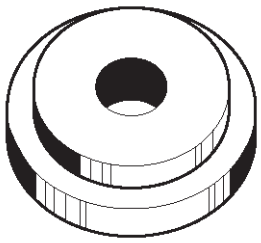
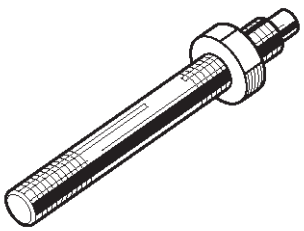
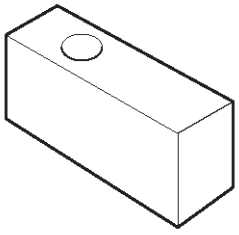
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS220	**J–7817** Installer; Outer bearing outer race
 901RS220	**J–7818** Installer; Inner bearing outer race
 901RS24	**J–8092** Driver handle
 901RS220	**J–21777–42** Pilot
 901RS221	**J–21777–43** Nut and stud
 901RS223	**J–42479–1** Gauge plate

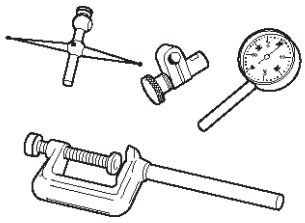
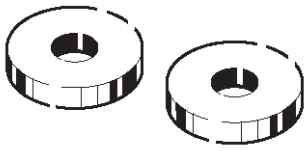
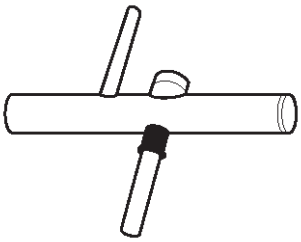
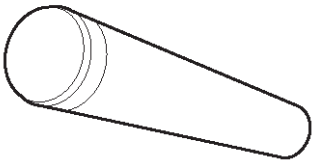
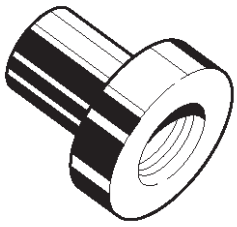
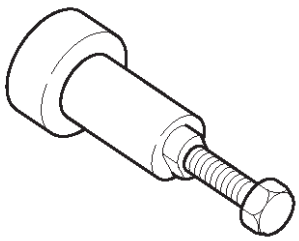
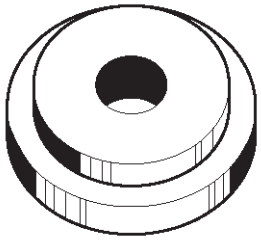
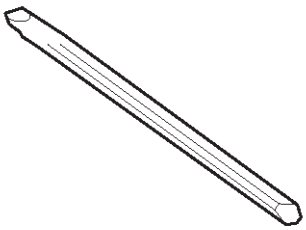
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS224	**J–8001** Dial indicator
 901RS244	**J–23597–8** Disc
 901RS226	**J–23597–1** Arbor
 901RS227	**J–6133–01** Installer; Pinion bearing
 901RS245	**J–24244** Installer; Side bearing
 901RS290	**J–39602** Remover; Outer bearing

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS220	**J–42479–2** Pilot
 901RS228	**J–39209** Punch; End nut lock

AXIOM

DRIVELINE/AXLE

Differential (Rear)

CONTENTS

Service Precaution 4A2–1
General Description 4A2–2
Diagnosis 4A2–3
Axle Housing 4A2–5
Axle Housing and Associated Parts 4A2–5
Removal 4A2–5
Installation 4A2–7
Axle Shaft, Oil Seal and Bearing 4A2–7
Axle Shaft and Associated Parts 4A2–7
Removal 4A2–8
Inspection 4A2–8
Installation 4A2–8
Pinion Oil Seal 4A2–10
Pinion Oil Seal and Associated Parts 4A2–10
Removal 4A2–10
Inspection and Repair 4A2–11
Installation 4A2–11
Differential Assembly 4A2–13
Disassembled View 4A2–13
Inspecting the Axle Before Disassembly . . 4A2–14
Disassembly 4A2–14
Inspection and Repair 4A2–16
Reassembly 4A2–16
Side Bearing Preload Adjustment 4A2–20
Pinion Installation 4A2–21
Determination of Backlash & Preload Shims 4A2–22
Backlash Adjustment 4A2–23
Gear Tooth Pattern Check 4A2–23
Adjustments Affecting Tooth Contact 4A2–24
Differential Case Assembly 4A2–25
Disassembled View 4A2–25
Disassembly 4A2–26
Inspection and Repair 4A2–26
Reassembly 4A2–26
Limited Slip Differential Assembly 4A2–27
Disassembled View 4A2–27
Disassembly 4A2–27
Inspection and Repair 4A2–29
Reassembly 4A2–29
Main Data And Specifications 4A2–31
Special Tools 4A2–32

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFOMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear axle assembly is of the semi–floating type in which the vehicle weight is carried on the axle housing . The center line of the pinion gear is below the center line of the ring gear (hypoid drive).
All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a salisbury type axle housing (a carrier casting with tubes pressed and welded into the carrier). A removable aluminum cover at the rear of the axle housing permits rear axle service without removal of the entire assembly from the vehicle.
The 8.9 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this driving force at a 90 degree angle from the propeller shaft to the drive shafts.
The axle shafts are supported at the wheel end of the shaft by a roller bearing.
The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.
The ring gear is bolted onto the differential case with 10 bolts.
The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using selective shims and spacers between the bearing and the differential case. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which are pressed onto the differential case. Two bearing caps are used to hold the differential into the rear axle housing.
The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.
The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a liquid gasket between the rear cover and the axle housing.

Limited Slip Differential (LSD)

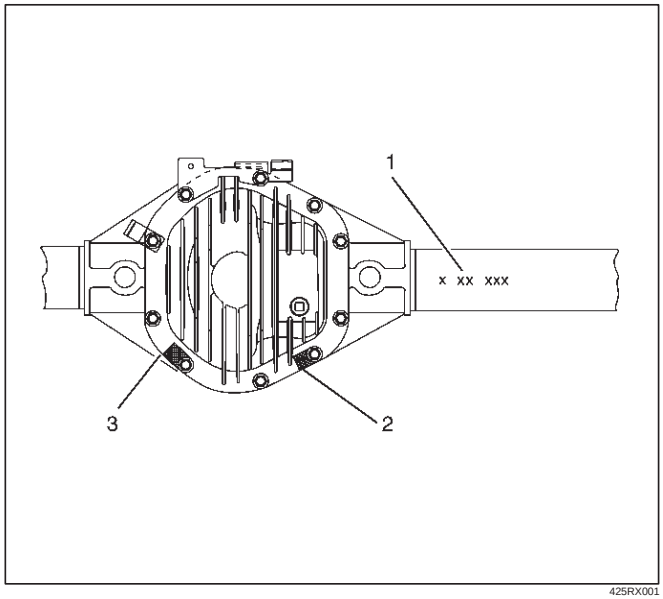
The axle assembly may be equipped with an limited slip differential (LSD). It is similar to the standard differential except that part of the torque from the ring gear is transmitted through clutch packs between the side gears and differential case.
The LSD construction permits differential action when required for turning corners and transmits equal torque to both wheels when driving straight ahead. However, when one wheel tries to spin due to a patch of ice, etc., the clutch packs automatically provide more torque to the wheel which is not trying to spin.
In diagnosing customer complaints, it is important to recognize two things:

1. If, both wheels slip, with unequal traction, the LSD has done all it can possibly do.
2. In extreame cases of differences in traction, the wheel with the least traction may spin after the LSD has transferred as much torque as possible to the non-slipping wheel.

Limited Slip Differntials impose additional requirements on lubricants, and require a special lubricant or lubricant additive. Use 80W90 GL–5 LSD lubricant.

Rear Axle Identification

The Bill of Material and build date information(1) is stamped on the right axle tube on the rearward side.
The axle ratio is identified by a tag(3) which is secured by a cover bolt. If the axle has limited-slip differntial, it also will be identified with a tag(2) secured by a cover bolt.



425RX001

Diagnosis

Many noises that seem to come from the rear axle actually originate from other sources such as tires, road surface, wheel bearings, engine, transmission, muffler, or body drumming. Investigate to find the source of the noise before disassembling the rear axle. Rear axles, like any other mechanical device, are not absolutely quiet but should be considered quiet unless some abnormal noise is present.

To make a systematic check for axle noise, observe the following:

1. Select a level asphalt road to reduce tire noise and body drumming.
2. Check rear axle lubricant level to assure correct level, and then drive the vehicle far enough to thoroughly warm up the rear axle lubricant.
3. Note the speed at which noise occurs. Stop the vehicle and put the transmission in neutral. Run the engine speed slowly up and down to determine if the noise is caused by exhaust, muffler noise, or other engine conditions.
4. Tire noise changes with different road surfaces; axle noises do not. Temporarily inflate all tires to 344 kPa (50 psi) (for test purposes only). This will change noise caused by tires but will not affect noise caused by the rear axle.

   Rear axle nose usually stops when coasting at speeds under 48 km/h (30 mph); however, tire noise continues with a lower tone. Rear axle noise usually changes when comparing pull and coast, but tire noise stays about the same.

   Distinguish between tire noise and rear axle noise by noting if the noise changes with various speeds or sudden acceleration and deceleration. Exhaust and axle noise vary under these conditions, while tire noise remains constant and is more pronounced at speeds of 32 to 48 km/h (20 to 30 mph). Further check for tire noise by driving the vehicle over smooth pavements or dirt roads (not gravel) with the tires at normal pressure. If the noise is caused by tires, it will change noticeably with changes in road surface.
5. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing drive and coast. Light application of the brake while holding vehicle speed steady will often cause wheel bearing noise to diminish. Front wheel bearings may be checked for noise by jacking up the wheels and spinning them or by shaking the wheels to determine if bearings are loose.
6. Rear suspension rubber bushings and spring insulators dampen out rear axle noise when correctly installed. Check to see that there is no link or rod loosened or metal–to–metal contact.
7. Make sure that there is no metal–to–metal contact between the floor and the frame.

After the noise has been determined to be in the axle, the type of axle noise should be determined, in order to make any necessary repairs.

Gear Noise

Gear noise (whine) is audible from 32 to 89 km/h (20 to 55 mph) under four driving conditions.

1. In drive under acceleration or heavy pull.
2. Driving under load or under constant speed.
3. When using enough throttle to keep the vehicle from driving the engine while the vehicle slows down gradually (engine still pulls slightly).
4. When coasting with the vehicle in gear and the throttle closed. The gear noise is usually more noticeable between 48 and 64 km/h (30 and 40 mph) and 80 and 89 km/h (50 and 55 mph).

Bearing Noise

Bad bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise frequently “wow–wows” at bearing rpm, indicating a bad pinion or rear axle side bearing. This noise can be confused with rear wheel bearing noise.

Rear Wheel Bearing Noise

Rear wheel bearing noise continues to be heard while coasting at low speed with transmission in the neutral. Noise may diminish by gentle braking. Jack up the rear wheels, spin them by hand and listen for noise at the hubs. Replace any faulty wheel bearings.

Knock At Low Speeds

Low speed knock can be caused by worn universal joints or a side gear hub counter bore in the cage that is worn oversize. Inspect and replace universal joints or cage and side gears as required.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by a worn rear axle pinion shaft, a worn cage, excessive clearance between the axle and the side gear splines, excessive clearance between the side gear hub and the counterbore in the cage, worn pinion and side gear teeth, worn thrust washers, or excessive drive pinion and ring gear backlash. Remove worn parts and replace as required. Select close–fitting parts when possible. Adjust pinion and ring gear backlash.

Rear Axle Noise

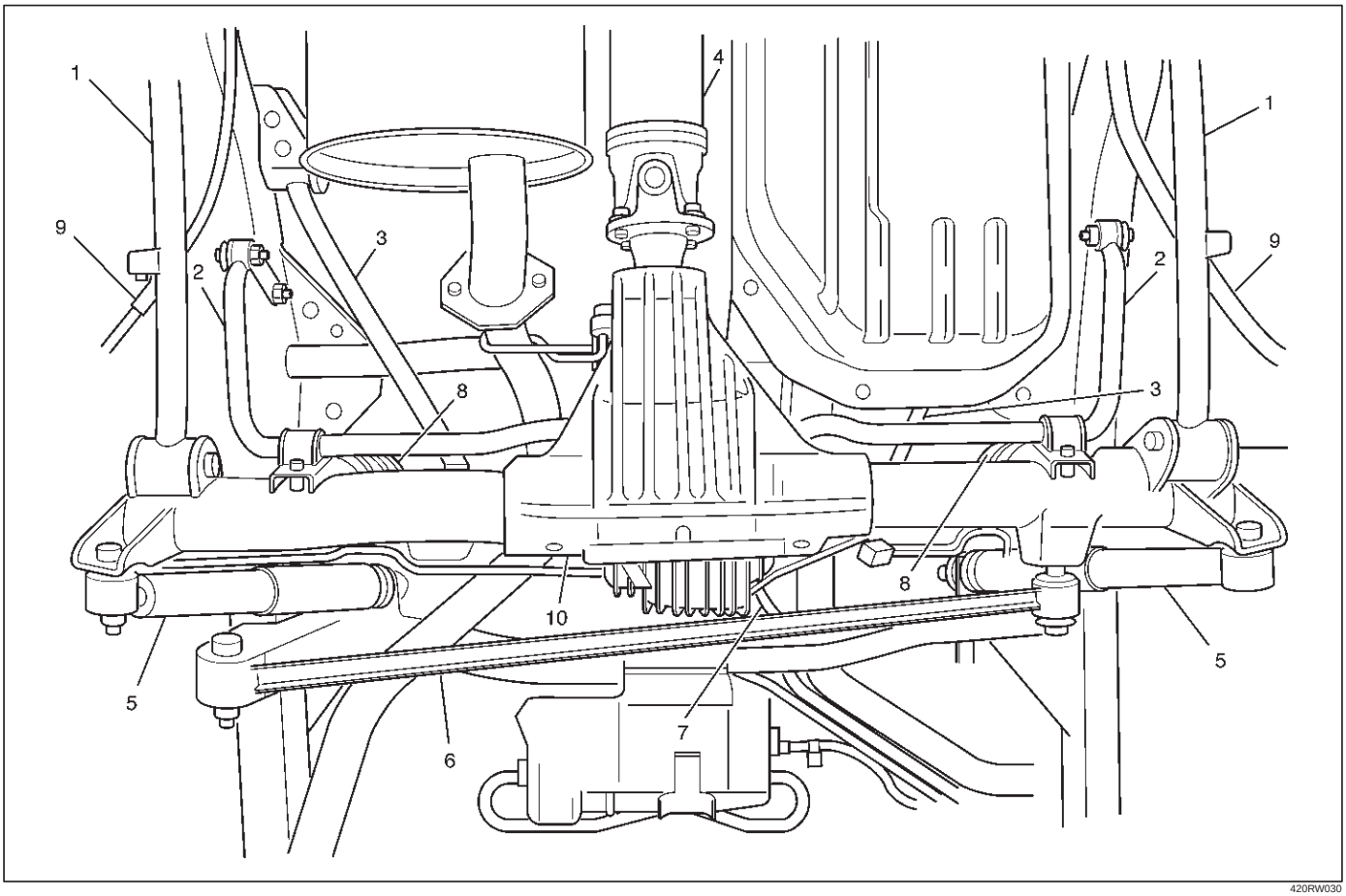
Condition	Possible cause	Correction
Noise in Drive	Excessive pinion to ring gear backlash.	Adjust.
	Worn pinion and ring gear.	Replace
	Worn pinion .bearings.	Replace.
	Loose pinion bearings.	Adjust.
	Excessive pinion end play.	Adjust.
	Worn side bearings.	Replace.
	Loose side bearings.	Adjust.
	Excessive ring gear run-out.	Replace.
	Low oil level.	Replenish.
	Wrong or poor grade oil.	Replace.
	Bent axle housing.	Replace.
Noisy when coasting	Axle noise heard when driving will usually be heard also on coasting, although not as loud.	Adjust or replace.
	Pinion and ring gear too tight (audible when slowing down and disappears when driving).	Adjust.
Intermittent noise	Warped bevel ring.	Replace.
	Loose differential case bolts.	Tighten.
Constant noise	Flat spot on pinion or ring gear teeth.	Replace.
	Flat spot on bearing.	Replace.
	Worn pinion splines.	Replace.
	Worn axle shaft dowel holes.	Replace.
	Worn hub studs.	Replace.
	Bent axle shaft.	Replace.
Noisy on turns	Worn differential side gears and pinions.	Replace.
	Worn differential shaft.	Replace.
	Worn axle shaft splines.	Replace.

Limited Slip Differential

Condition	Possible cause	Correction
Does not lock	Broken clutch plates.	Replace the clutch plates.
Chatters in turns	Lubricant contaminated.	Drain lube when hot. Wipe carrier clean. Refill with lube specified in Main Data and Specifications at the end of this section.
	Clutch plates dateriorated.	Replace clutch plates.
Noise (in addition to normal clutch engagement)	Broken clutch plates.	Replace clutch plates.
	Damaged case.	Replace unit.
	Broken differential gears.	Replace gears.

Axle Housing

Axle Housing and Associated Parts



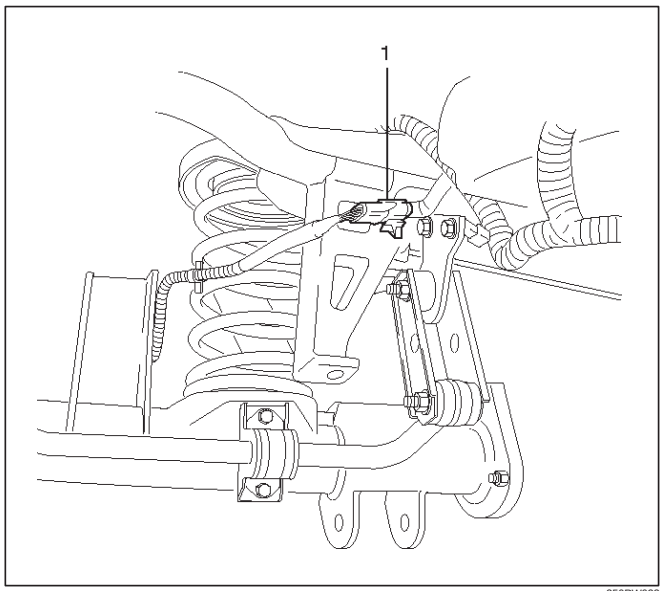
420RW030

Legend

(1) Lower Link
(2) Stabilizer
(3) Upper Link
(4) Rear Propeller shaft
(5) Shock Absorber
(6) Lateral Rod
(7) Brake Hose
(8) Coil Spring
(9) Parking Cable
(10) Axle Assembly

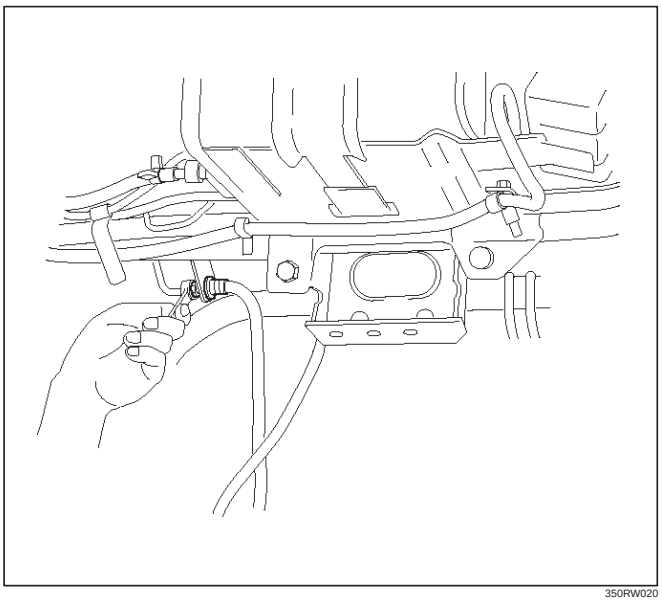
Removal

1. Raise the vehicle and support it with suitable safety stands.
   The hoist must remain under the rear axle housing.
2. Take out brake fluid. Refer to *Hydraulic Brakes in Brake* section.
3. Remove rear wheels and tires. Refer to *Wheel Replacement in Suspension* section.
4. Remove propeller shaft. Refer to *Rear Propeller Shaft* in this section.
5. Drain the rear axle oil into a proper container.
6. Remove parking brake cable, release the connection between the cable fixing clip equalizer. Refer to *Parking Brakes in Brake* section.
7. Move the clip aside and pull out the breather hose.
8. Disconnect the ABS connectors (1) and remove the brackets attached to the frame and center link.



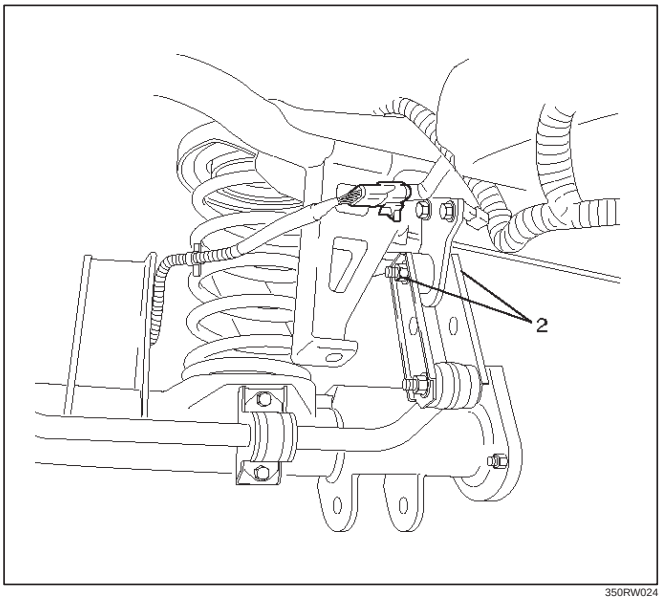
350RW023

9. Loosen the brake tube flare nut, remove the clip and take out the brake tube.



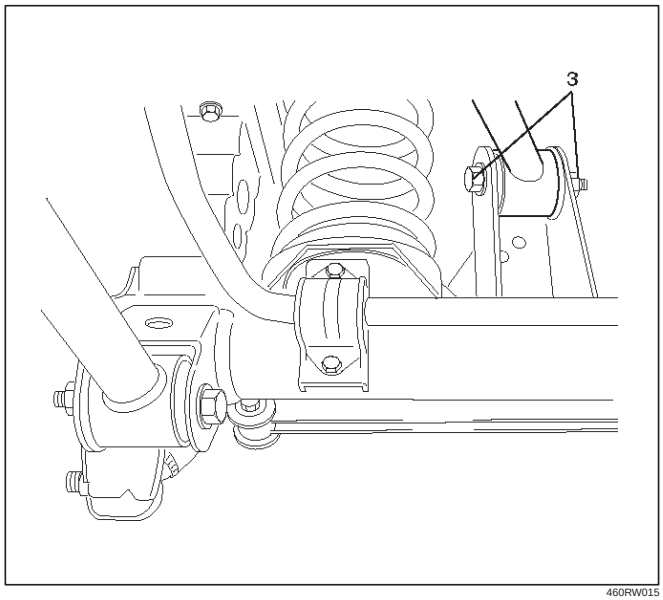
350RW020

10. Remove the shock absorber.
11. Remove the stabilizer linkage mounting bolts and nuts (2) from the frame side.



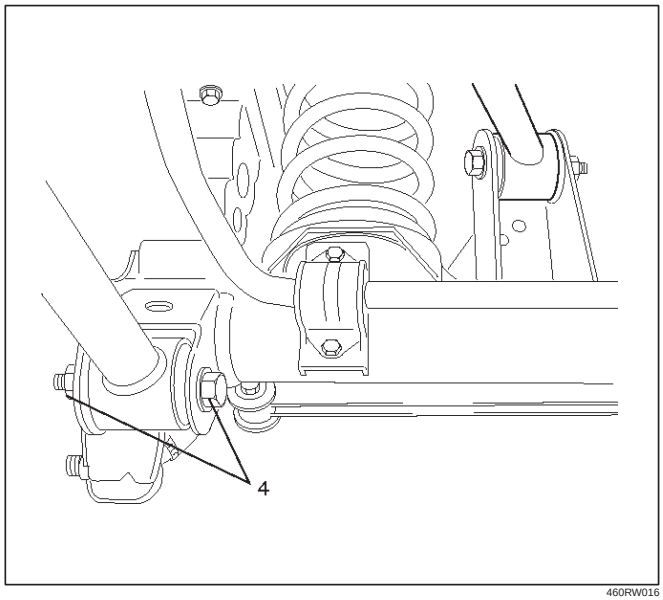
350RW024

12. Remove the lateral rod fixing bolt and nut from the frame.
13. Remove the upper link mounting bolt and nut (3) from the axle housing.



460RW015

14. Remove the lower link fixing bolt and nut (4) from the axle housing.



460RW016

15. Jack down and remove the coil spring and insulator.
16. Axle housing assembly can be separated from the vehicle upon completion of steps 1 – 15.
17. Remove the brake caliper fixing bolt, loosen the flare nut, release the clip and take out the brake caliper together with the flexible hose.
18. Remove brake disc.
19. Remove antilock brake system speed sensor fixing bolt and the clip and bracket on the axle housing.
20. Remove the brake pipe clip and fixing bolt on the axle housing and take out the brake pipe.

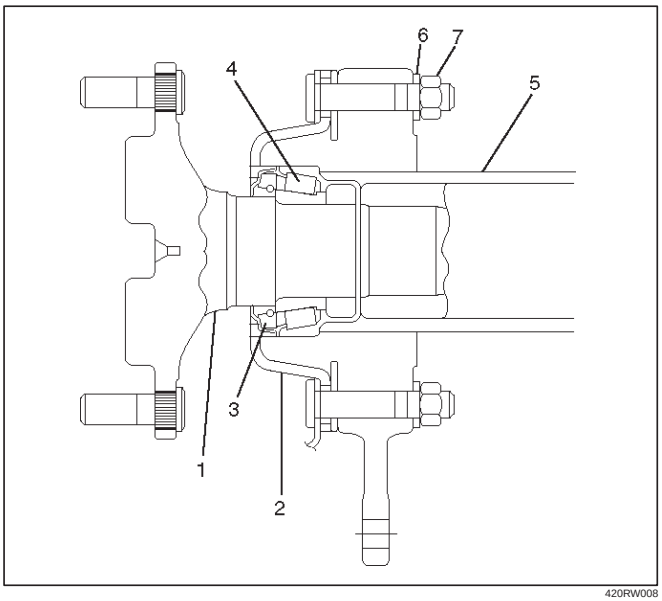
Installation

1. Install brake pipe.
2. Connect Antilock brake system (ABS) speed sensor and harness, refer to *4–Wheel Anti–Lock Brake System (ABS) in Brake* section.
3. Install brake disc.
4. Install brake caliper. Refer to *Disk Brakes in Brake* section.
5. Install axle housing assembly.
6. Install coil spring and insulator.
7. Install the lower link fixing bolt and nut to the axle housing. For the procedures in items 7–11, refer to *Suspension* section.
8. Install the upper link bolt and nut to the axle housing.
9. Install the lateral rod fixing nut and bolt to the frame side.
10. Install the stabilizer linkage mounting nut and bolt to the frame side.
11. Install the shock absorber.
12. Install brake tube flare nut, Refer to *Disk Brakes in Brake* section.
13. Install ABS connector and bracket.
14. Connect breather hose.
15. Install parking brake cable, Refer to *Parking Brakes in Brake* section.
16. Bleed brakes. Refer to *Hydraulic Brakes in Brake* section.

Axle Shaft, Oil Seal and Bearing

Axle Shaft and Associated Parts

Disc Brake Model

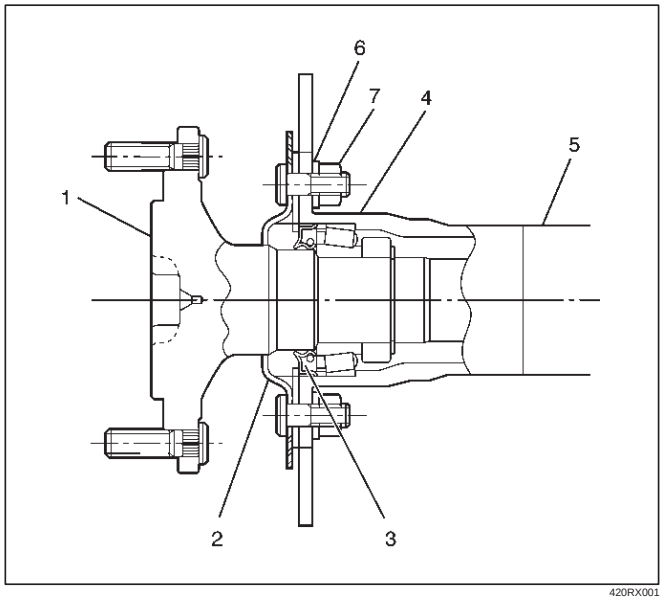


420RW008

Legend

(1) Axle Shaft
(2) Backing Plate
(3) Oil Seal
(4) Bearing
(5) Axle Housing
(6) Lock Washer
(7) Nut

Drum Brake Model



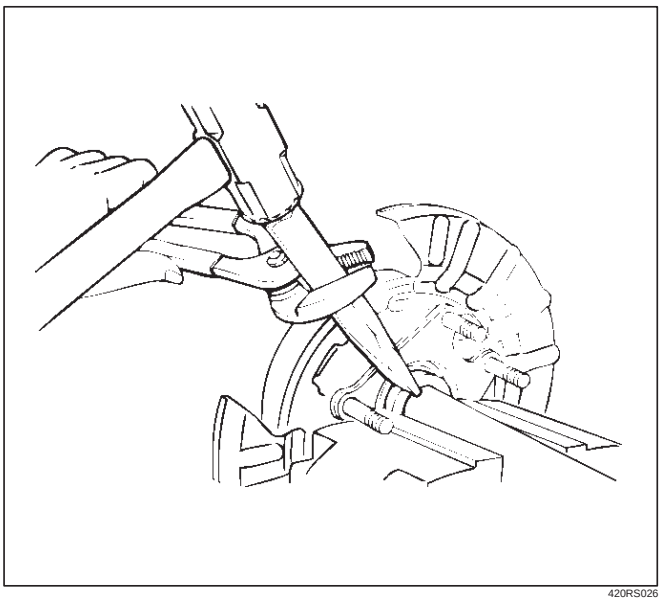
420RX001

Legend

(1) Axle Shaft
(2) Backing Plate
(3) Oil Seal
(4) Bearing
(5) Axle Housing
(6) Lock Washer
(7) Nut

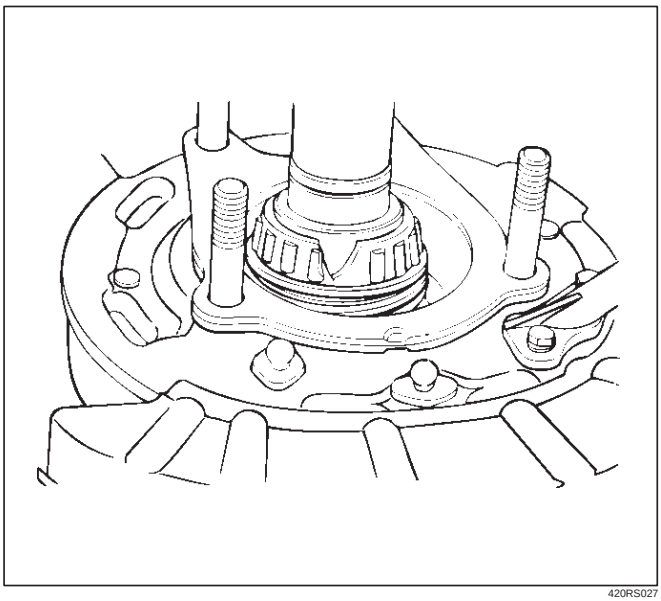
Removal

1. Raise the vehicle.
2. Remove rear wheels and brake calipers or drums.
   Do not let calipers hang from the vehicle by the brake line or hose. Use a wire to hang the caliper to the frame to prevent damage to the caliper.
3. Remove four nuts and lockwashers.
4. Remove shaft assembly from the axle housing.
5. Remove snap ring and bearing cup.
6. Break retainer ring with hammer and chisel.



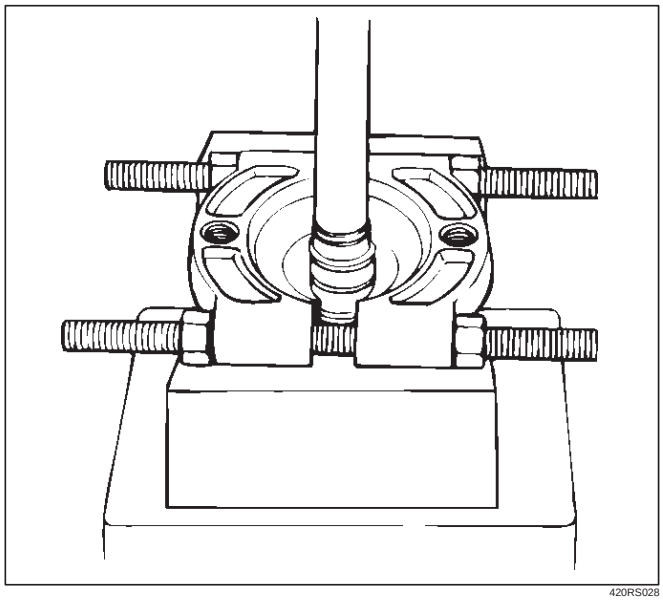
420RS026

7. Break bearing cage with hammer and chisel.



420RS027

8. Remove oil seal, retainer, and emergency brake assembly.
9. Remove inner race from shaft with OTC–1126 bearing splitter and press.



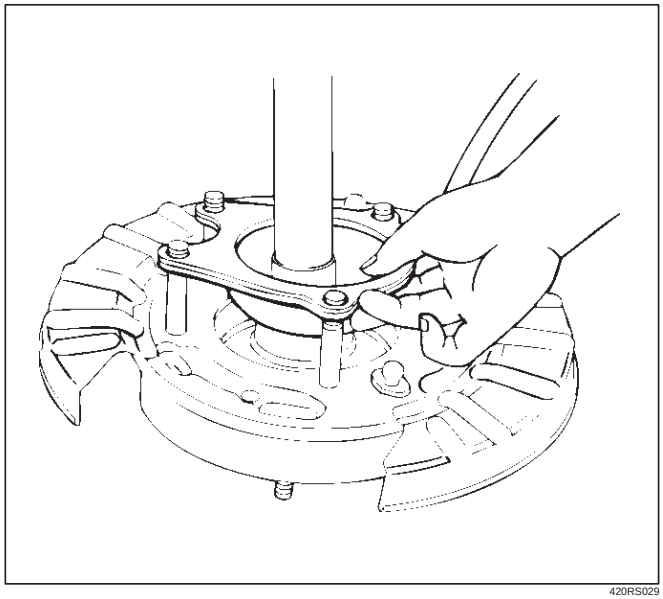
420RS028

Inspection

- ▼ Shaft for spalling or grooves from seal wear.
- ▼ Retainer – bent or damaged.
- ▼ Replace items if required.

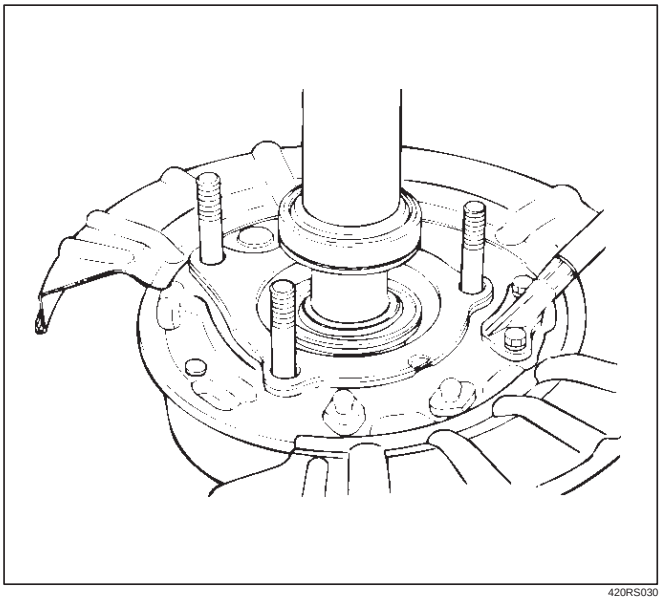
Installation

1. Emergency brake assembly.
2. Install retainer.
   Note direction – do not install backwards.



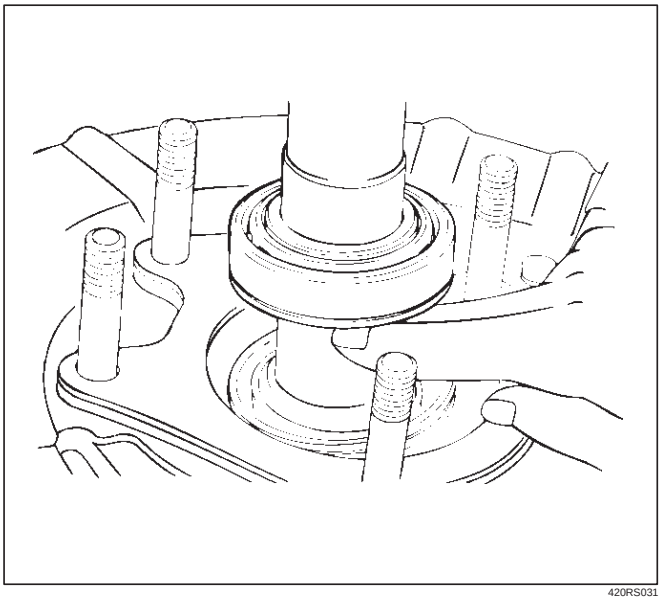
420RS029

3. Install oil seal. Note direction.
4. Install bearing assembly, using installer and press.



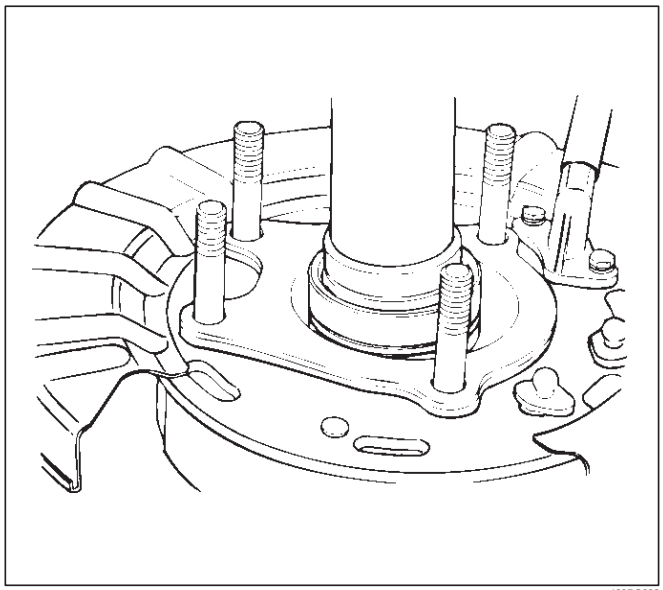
420RS030

NOTE: Install bearing with cup towards inboard side.



420RS031

5. Install retainer ring, using installer and press.



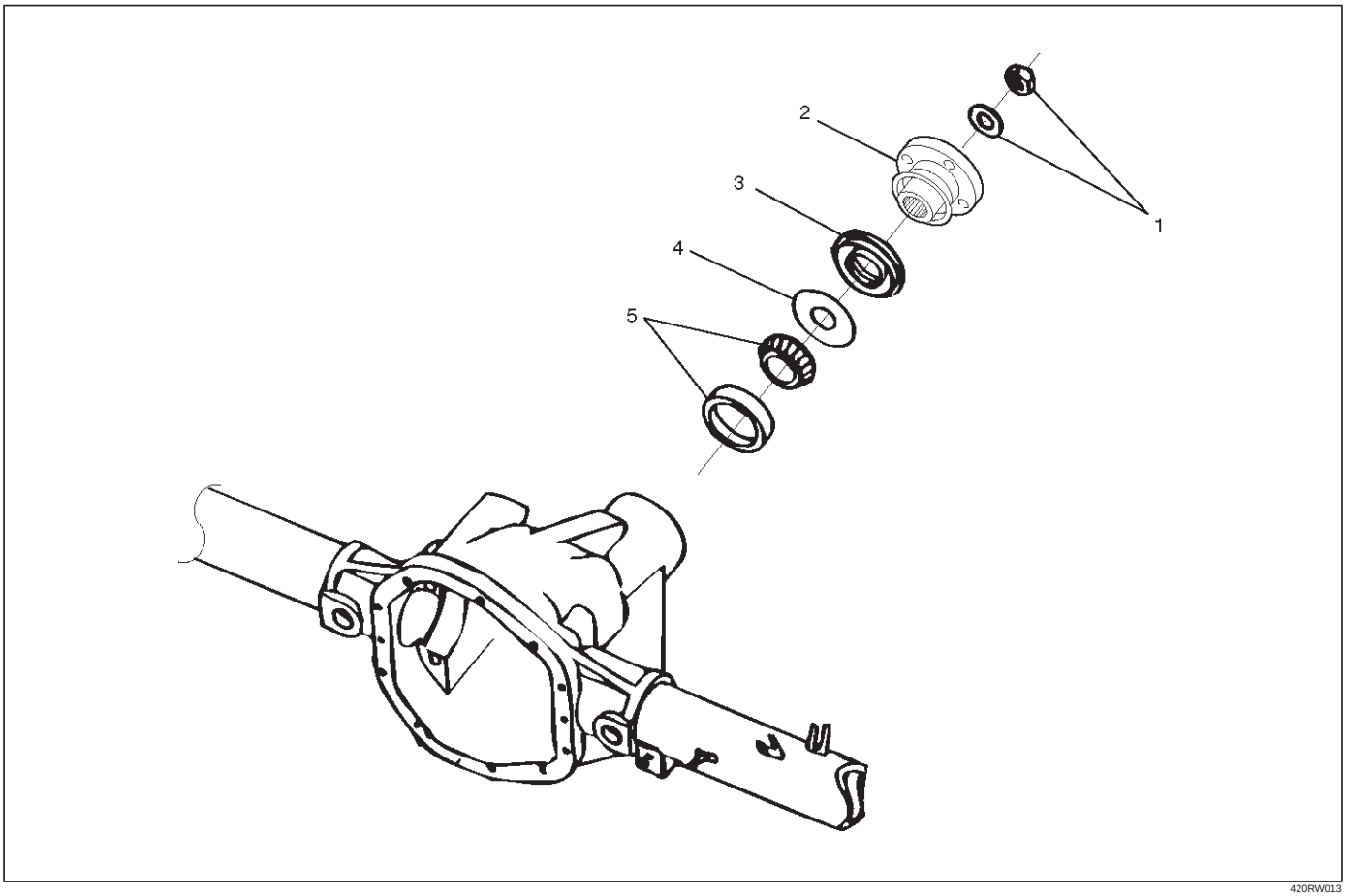
420RS033

6. Install snap ring.
7. Install axle shaft assembly into housing.
8. Install bolts, lockwashers, and nuts.
   Tighten the retainer nuts to the specified torque.

Torque : 75 N·m (55 lb ft)

Pinion Oil Seal

Pinion Oil Seal and Associated Parts



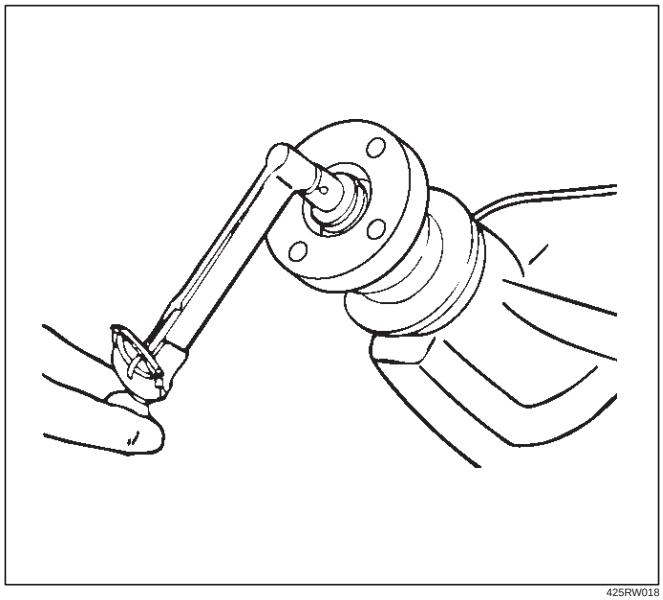
420RW013

Legend

(1) Flange Nut and Washer
(2) Flange
(3) Oil Seal
(4) Outer Oil Seal Slinger
(5) Outer Pinion Bearing (Cup and Cone)

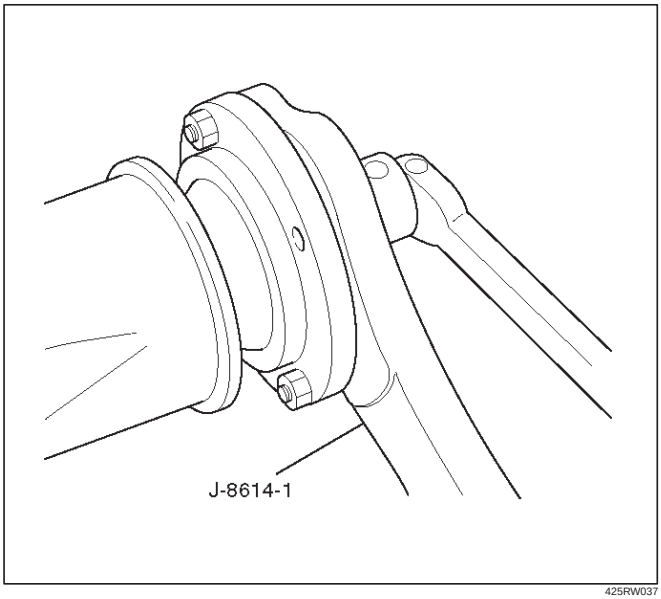
Removal

1. Remove the rear propeller shaft. Refer to *Rear Propeller Shaft* in this section.
2. Drain the rear axle oil.
3. Check and record preload with an inch pound torque wrench. This will give combined pinion bearing, seal, carrier bearing, axle bearing and seal preload.



425RW018

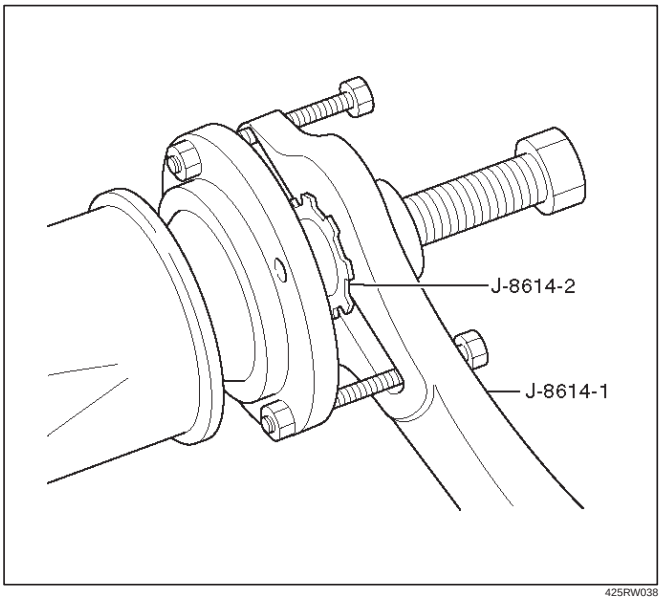
4. Remove flange nut and washer by using pinion flange holder J–8614–01 after raising up its staked parts completely.



425RW037

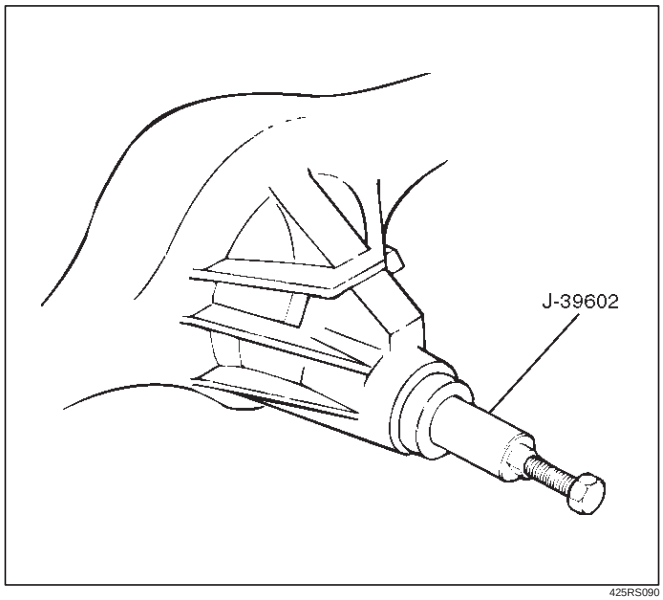
5. Remove flange by using SST J–8614–1 ~ 3.

▼Have a suitable container in place to catch lubricant.



425RW038

6. Remove oil seal.
7. Remove pinion oil seal slinger.
8. Remove outer bearing by using remover J–39602.



425RS090

9. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

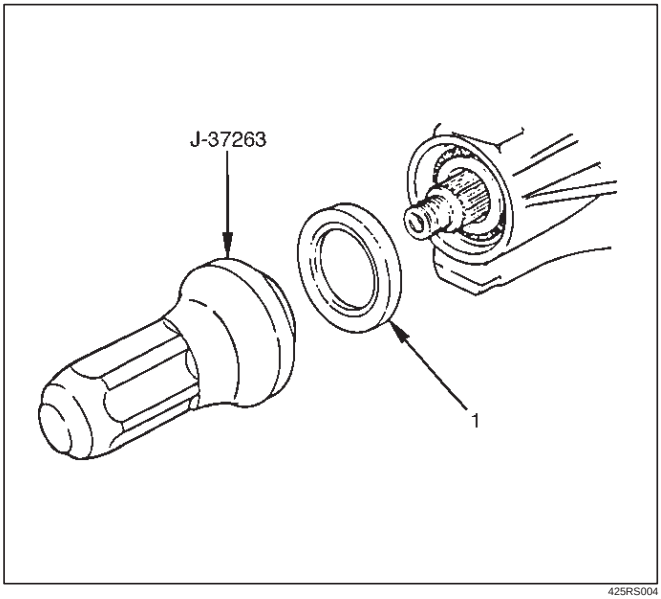
1. Seal surface of the flange.
2. Cage bore for burns.

Installation

1. Install collapsible spacer, discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. By using the seal installer J–37263, install a new oil seal (1) that has grease on seal lip.

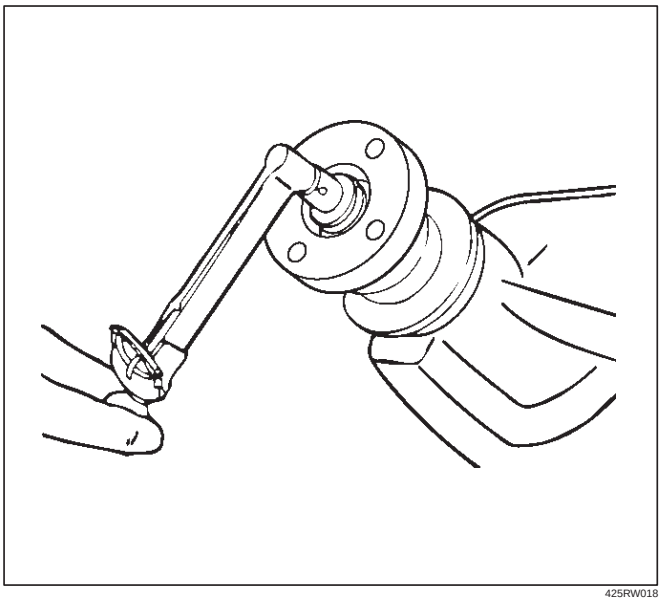


425RS004

4. Install flange.
5. The pinion washer and a new nut while holding the pinion flange with J–8614–01.

▼Tighten the nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is not end play in the pinion, the preload torque should be checked.

▼Remove J–8614–01. Using an inch-pound torque wrench, check to make sure the pinion preload is equal to or slightly over the reading recorded during removal.

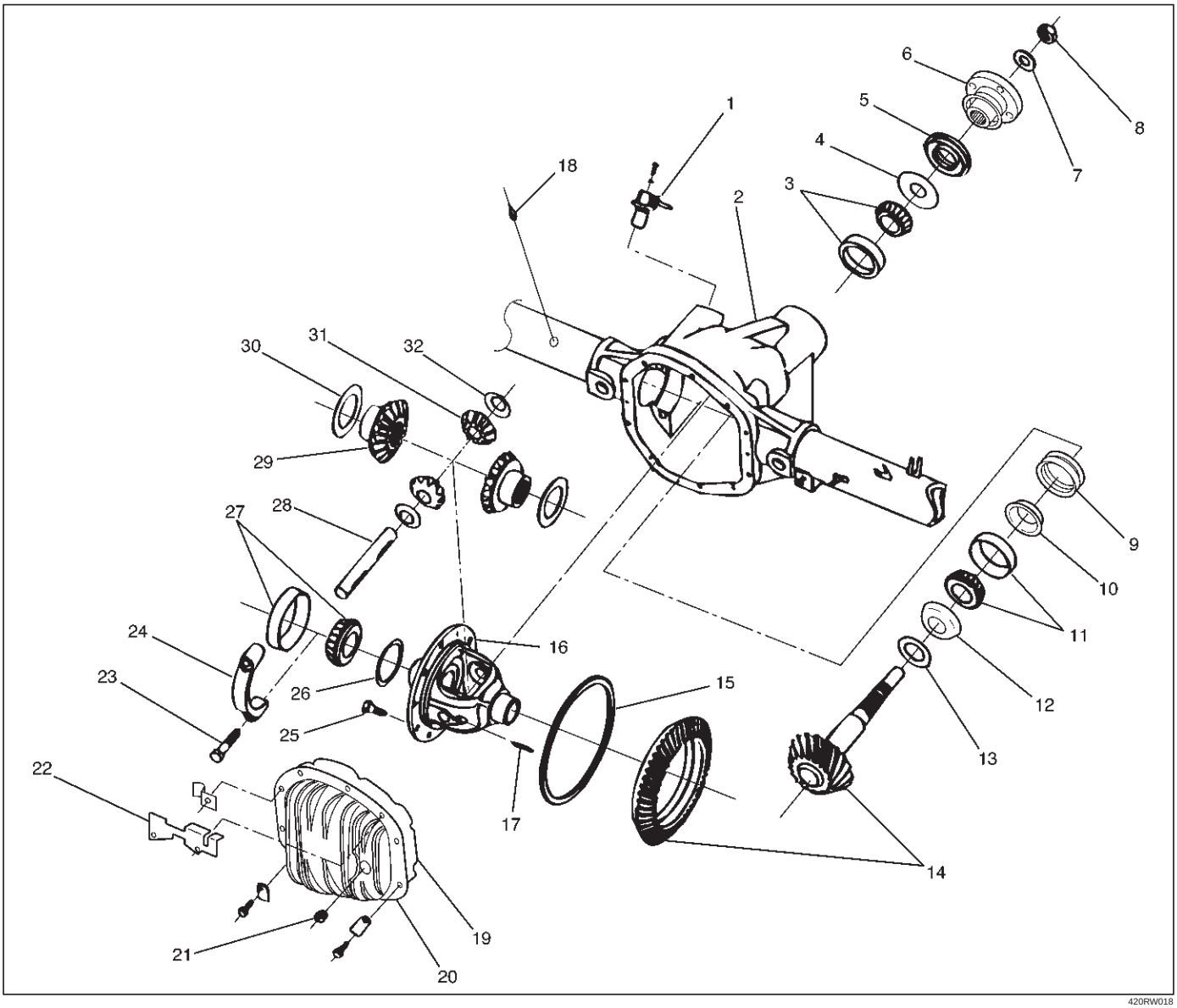

425RW018

6. Install propeller shaft to the frange.
7. Install bolt and nut. Tighten the bolt and nut to the specified torque.

Torque: 63 N·m (46 lb ft)

Differential Assembly

Disassembled View



420RW018

Legend

(1) ABS Speed Sensor
(2) Housing
(3) Outer Pinion Bearing (Cup and Cone)
(4) Outer Oil Slinger
(5) Oil Seal
(6) Companion Flange Assembly
(7) Pinion Nut Washer
(8) Pinion Nut
(9) Collapsible Spacer
(10) Baffle Plate
(11) Inner Pinion Bearing (Cup and Cone)
(12) Inner Oil Slinger
(13) Pinion gear adj. Shim-Selective (Position)
(14) Ring gear and Pinion Gear Assembly
(15) Exciter Ring
(16) Differential Case
(17) Lock Pin
(18) Axle Vent
(19) Gasket
(20) Cover and Clip Assembly
(21) Fill Plug (with Magnet)
(22) Mounting Bracket
(23) Side Bearing Cap Bolt
(24) Side Bearing Cap
(25) Ring Gear Bolts
(26) Differential Adjustment Shims (Side Bearing Preload and Ring Gear/Pinion Backlash)
(27) Side Bearing (Cup and Cone)
(28) Differential Shaft
(29) Differential Side Gears
(30) Side Gear Thrust Washer
(31) Pinion Mate Gears
(32) Thrustwasher-Differential Pinion Mate Gear

Inspecting the Axle Before Disassembly

1. Remove the axle cover from the rear axle and drain the axle lubricant into a suitable container.
2. Check ring gear backlash. Refer to *Backlash Adjustment* in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential cage.
3. Check case for metal chips and shavings. Determine where these chips and shavings come from, such as a broken gear or bearing cage.

   ▼If possible, determine the cause of the axle problem before disassembly.

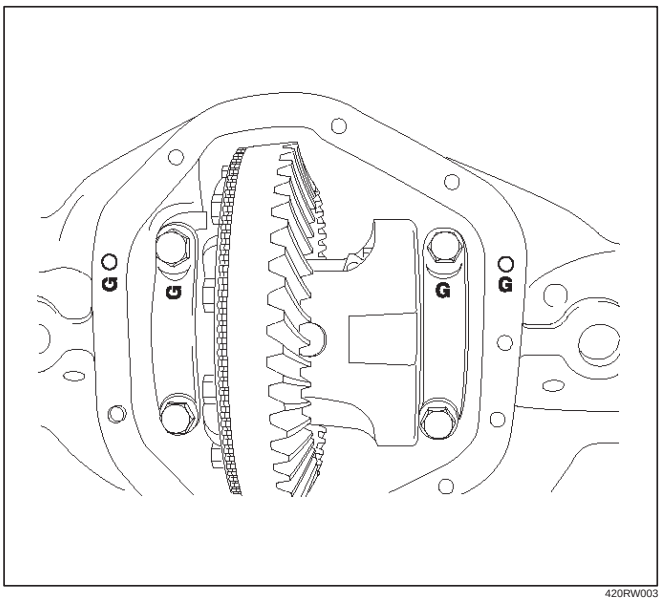
Disassembly

1. Remove axle shafts.

   ▼Refer to *axle shaft replacement* in this section.
2. Remove ABS sensor.
3. Remove bearing caps and bolts.

   ▼Mark the caps and the housing as left and right.

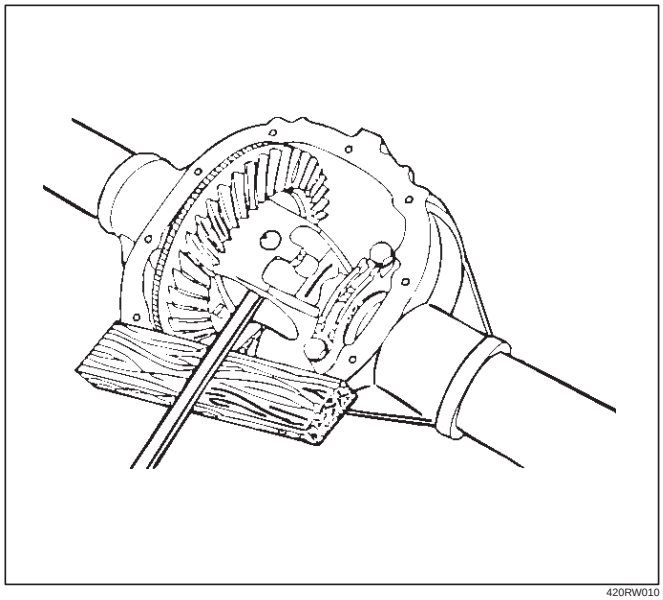
CAUTION: Bearing caps are machined with the housing and must be assembled in the same position as removed. Note the matched letter stamped on the caps and carrier. When assembled, the letters on the caps must agree in both the hosizontal and vertical position with the letters on the carrier.



420RW003

4. Remove Differential case.

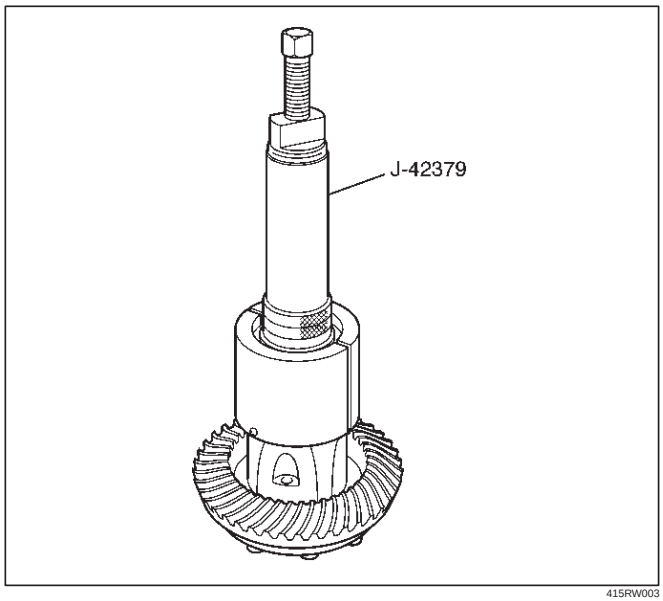
   ▼Pry the case from the axle housing at the differential “window”.


420RW010

5. Remove side bearing outer races and shims.

   ▼Mark the races and shims as left and right, and place them with the bearing cups.
6. Remove differential side bearings using remover J–42379 and plug J–39830.

   ▼Select insert ; 303174 and collet halves ; 44801 in remover kit J–42379.



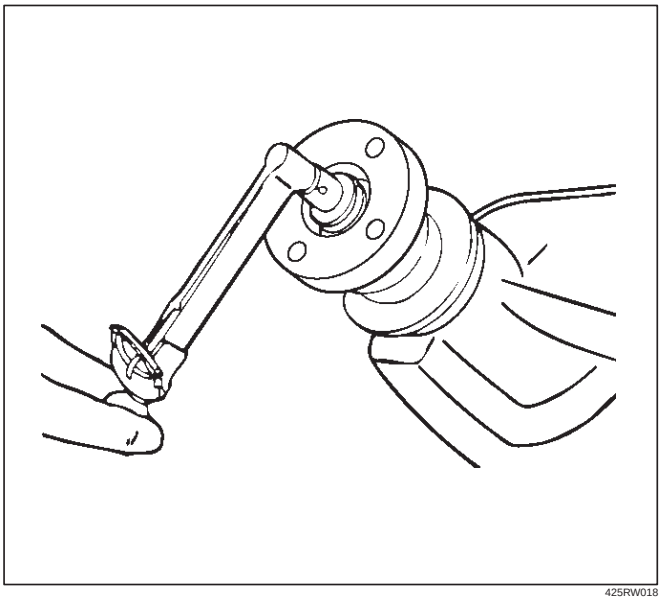
415RW003

7. Remove ring gear bolts.

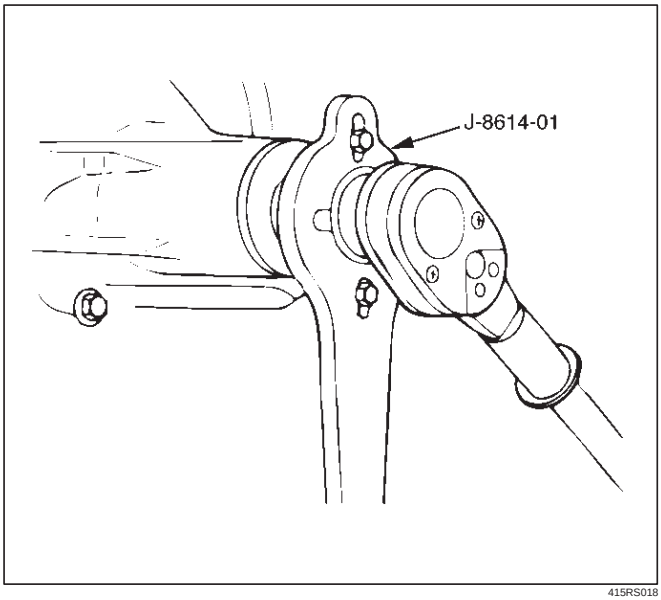
   ▼Ring gear bolts use right handed threads.

CAUTION: DO not pry the ring gear from the case. This will damage the ring and the differential case.

8. Remove ring gear from the differential.
   ▼Drive the ring gear off with a brass drift if necessary.
   ▼Check drive pinion bearing preload.

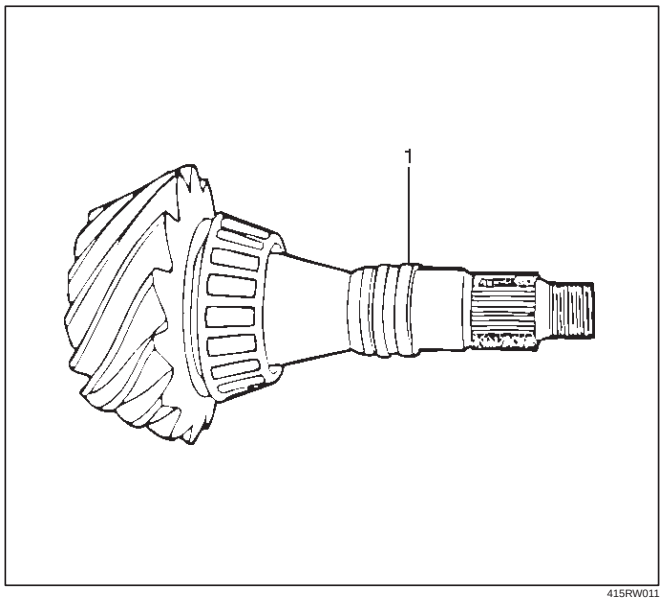

425RW018

   ▼Check the pinion assembly for looseness by moving it back and forth. (Looseness indicates excessive bearing wear.)
9. Remove pinion flange nut and washer.
   ▼Use flange holder J–8614–01 to hold the pinion flange.
10. Remove pinion flange.
   ▼Use flange holder J–8614–01 to remove the pinion flange.



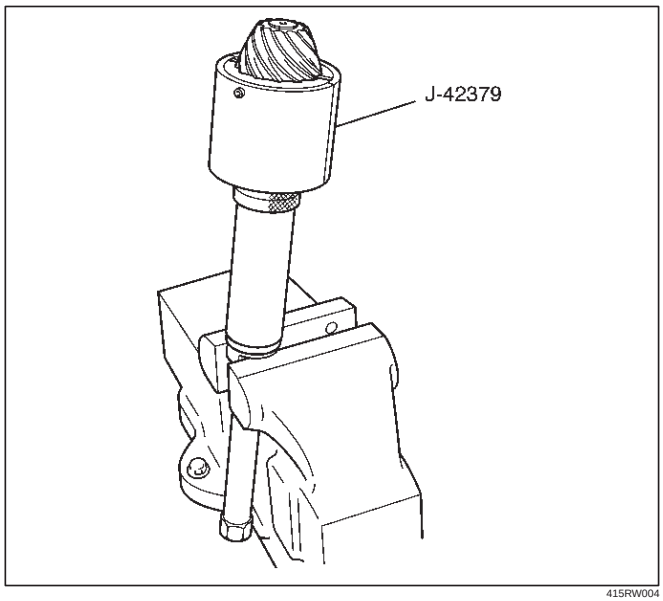
415RS018

11. Remove pinion from the axle housing.
   ▼Thread the pinion nut halfway onto the pinion.
   ▼Drive the pinion out of the housing with a hammer and a soft drift.
   ▼Remove the nut and then remove the pinion.
12. Remove collapsible spacer(1).



415RW011

13. Remove outer seal, outer oil slinger and outer pinion bearing.
14. Remove inner bearing, inner oil slinger and shim from the pinion.
   ▼Press the bearing off the pinion using remover J–42379.

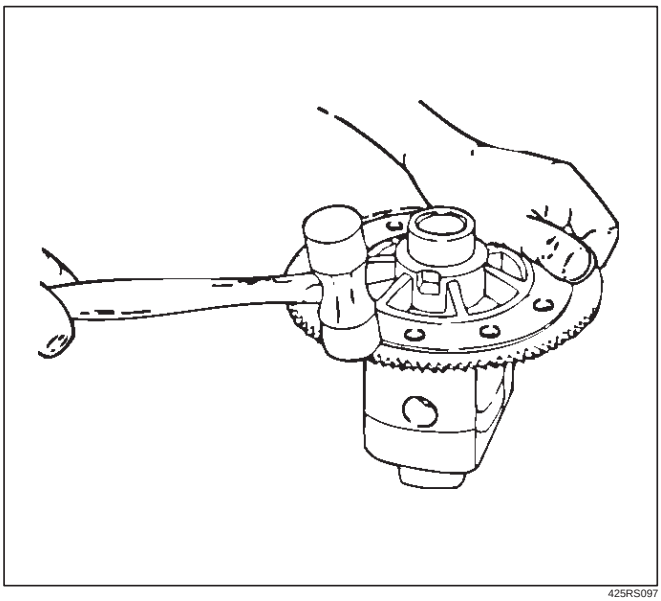


415RW004

   ▼Select insert ; 303174 and collet halves ; 44801 in remover kit J–42379.
   ▼Remove the shim.
15. Remove bearing cups and baffle plate from the axle housing using a hammer and a punch.
   ▼Work the cups out of the housing evenly, moving the punch back and forth between one side of the cup and the other.
   ▼The baffle plate will be destroyed and should be replaced with a new one.

16. Remove exciter ring.
    ▼Remove the exciter ring from the differential using a mallet or a brass hammer if it is required.

NOTE: Discard the exciter ring after removal.


425RS097

Cleaning

Do not steam clean drive parts which have ground and polished surfaces such as gears, bearings, and shafts. These parts should be cleaned in a suitable solvent. All parts should be disassembled before cleaning.
Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with cimpressed air. Do not allow the bearings to spin while drying them with compressed air.

Inspection and Repair

It is very important to carefully and thoroughly inspect all drive unit parts before reassembly.
Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

Axle Housing

- ▼The carrier bore for nicks or burrs that would prevent the outer diameter of the pinion seal from sealing, Remove any burrs that are found.
- ▼The bearing cap bores for nicks or burrs.
  Remove any burrs that are found.
- ▼The housing for cracks. Replace the housing if any cracks are found.
- ▼The housing for foreign material such as metal chips, dirt, or rust.

Pinion and Ring Gear

- ▼Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- ▼Pinion splines for wear.
- ▼Pinion flange splines for wear.
- ▼The sealing surface of the pinion flange for nicks, burrs, or rough tool marks which would cause damage to the seal's inside diameter and result in an oil leak.
- ▼Replace all worn or broken parts.
- ▼Ring and pinion gears are matched sets and are both replaced anytime a replacement of either is necessary.

Bearings

- ▼Bearings visually and by feel.
- ▼The bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.
  The large end of the bearing rollers for wear.
  This is where tapered roller bearing wear is most evident.
- ▼Bearing cups for wear, cracks, brinelling and scoring.
- ▼Bearing and cups are only replaced as sets.
- ▼If the rear axle was operated for an extended period of time with very loose bearings, the ring gear and drive pinion will also require replacement.
- ▼Low mileage bearings may have minute scratches and pits on the rollers and the bearing cups from the initial pre-load. Do not replace a bearing for this reason.
- ▼Bearing cups for cracks or chips.

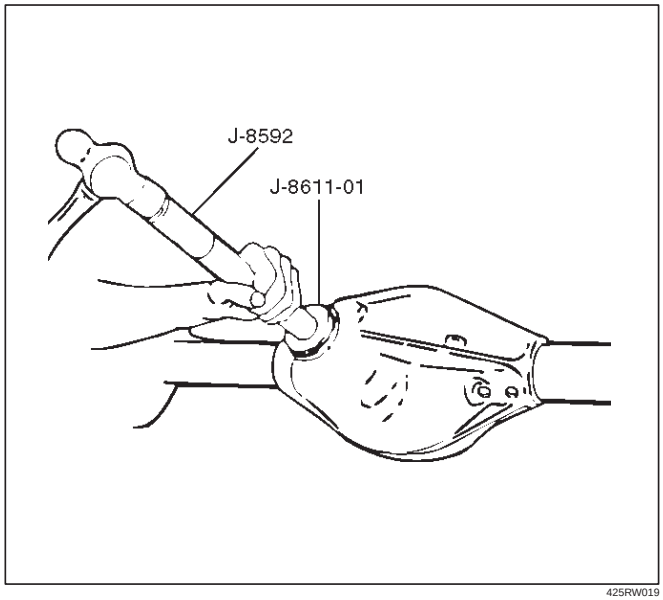
Shims

- ▼Shims for cracks and chips. Damaged shims should be replaced with an equally sized service shim.

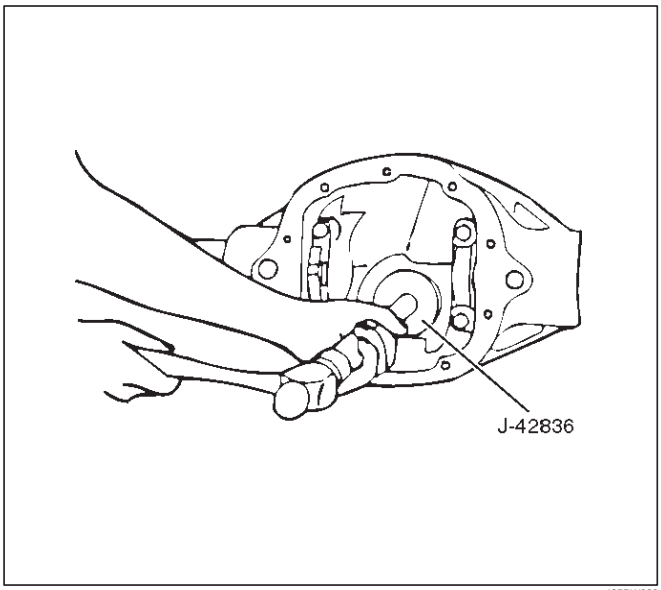
Reassembly

1. Install pinion bearing races and baffle plate using outer bearing race installer J–8611–01 / inner bearing race installer J–42836 and drive handle J–8592.

NOTE: Baffle plate must be installed, when install the inner pinion bearing race.



425RW019

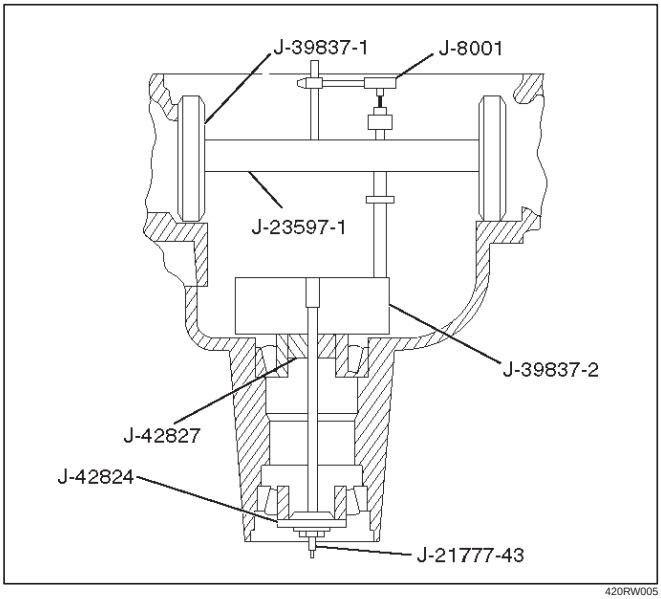


425RW020

2. Clean all the gauge parts.
3. Lubricate the outer and inner bearings with axle lubricant.
4. Place the bearings into the pinion bearing races.
5. Place the inner oil slinger onto the inner pinion bearing.

NOTE: The inner oil slinger must be placed between gauge plate and inner pinion bearing when measuring the pinion depth.

6. Install gauge plate J–39837–2, inner J–42827 stud and nut J–21777–43 and outer pilot J–42824 to the pinion bore.



420RW005

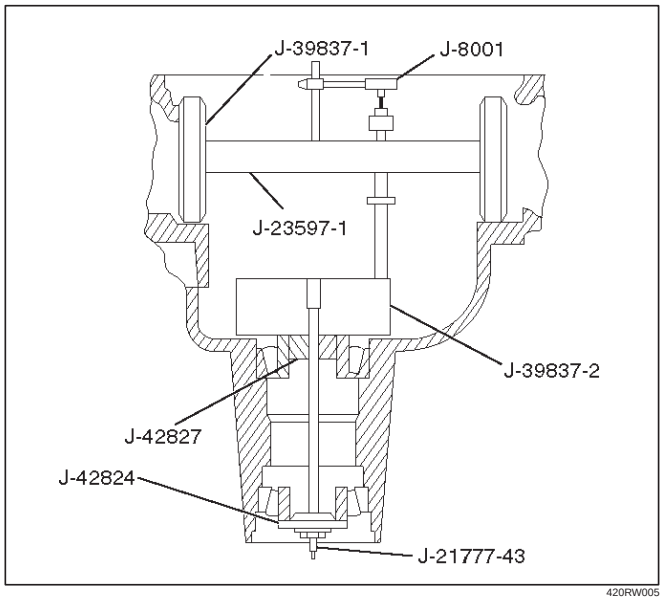
7. Hold the stud stationary at the flats of the stud (and).

Tighten the stud nut

Torque: 2.2 N·m (1.6 lb ft)

8. Rotate the gauge plate and bearings several complete revolutions to seat the bearings.
9. Tighten the stud nut until a torque of 1.6 to 2.2 N·m (1.2 to 1.6 lb ft.) is required to keep the gauge plate in rotation.
10. Assemble discs J–39837–1, arbor J–23597–1 and dial indicator J–8001 to the side bearing bores.

NOTE: The bearing bores must be clean and burr-free.



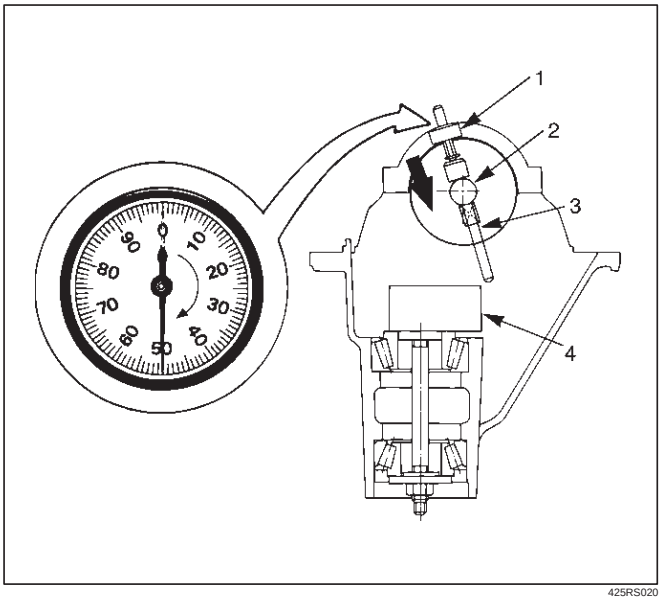
420RW005

11. Install the side bearing caps and tighten the bolts to the specified torque.

Torque: 108 N·m (80 lb ft)

12. Rotate the gauge plate until the gauging area is parallel with the discs.
13. Position the arbor assembly in the carrier so that the plunger is centered on the gauge area of the gauge plate.

14. Set the dial indicator to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad.
    Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.

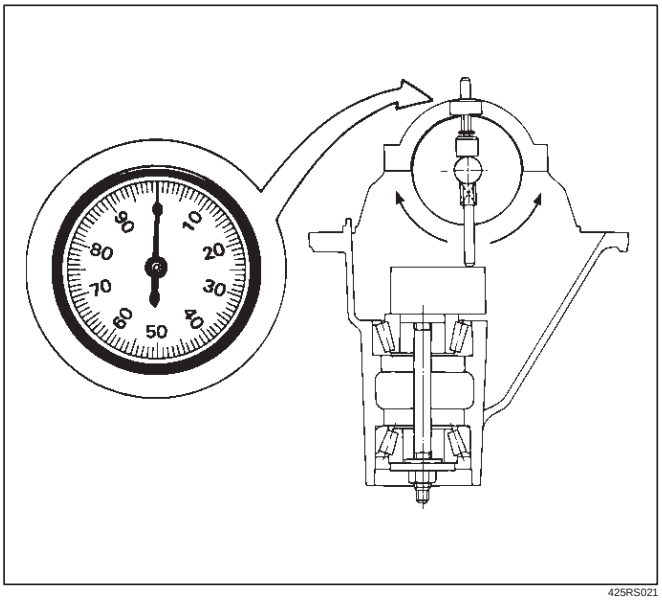


425RS020

Legend

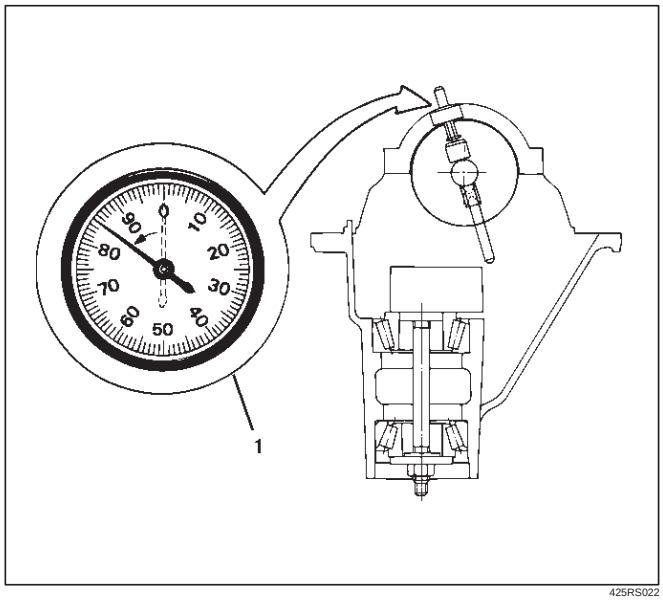
(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gaug Plate

15. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”.
    Repeat the procedure to verify the “0” setting.



425RS021

16. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.
    Record the number the dial indicator needle points to.

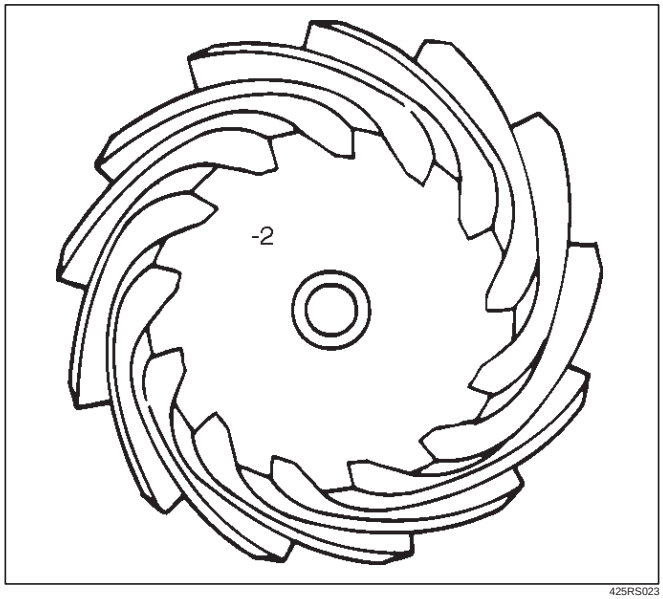


425RS022

Legend

(1) Example=Dial indicator reading of 0.085

17. Record the pinion depth code on the head of the drive pinion.
    The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



425RS023

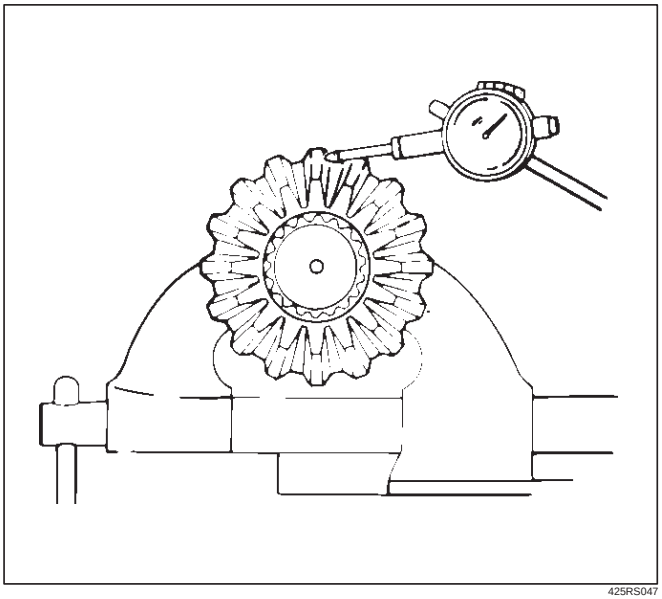
18. Select the shim using the chart;

Dial Indicator Reading (inches)	Marking (inches)						
	+3	+2	+1	0	–1	–2	–3
0.027							0.030
0.028						0.030	0.031
0.029					0.030	0.031	0.032
0.030				0.030	0.031	0.032	0.033
0.031			0.030	0.031	0.032	0.033	0.034
0.032		0.030	0.031	0.032	0.033	0.034	0.035
0.033	0.030	0.031	0.032	0.033	0.034	0.035	0.036
0.034	0.031	0.032	0.033	0.034	0.035	0.036	0.037
0.035	0.032	0.033	0.034	0.035	0.036	0.037	0.038
0.036	0.033	0.034	0.035	0.036	0.037	0.038	0.039
0.037	0.034	0.035	0.036	0.037	0.038	0.039	0.040
0.038	0.035	0.036	0.037	0.038	0.039	0.040	0.041
0.039	0.036	0.037	0.038	0.039	0.040	0.041	0.042
0.040	0.037	0.038	0.039	0.040	0.041	0.042	0.043
0.041	0.038	0.039	0.040	0.041	0.042	0.043	0.044
0.042	0.039	0.040	0.041	0.042	0.043	0.044	0.045
0.043	0.040	0.041	0.042	0.043	0.044	0.045	0.046
0.044	0.041	0.042	0.043	0.044	0.045	0.046	0.047
0.045	0.042	0.043	0.044	0.045	0.046	0.047	0.048
0.046	0.043	0.044	0.045	0.046	0.047	0.048	0.049
0.047	0.044	0.045	0.046	0.047	0.048	0.049	0.050
0.048	0.045	0.046	0.047	0.048	0.049	0.050	0.051
0.049	0.046	0.047	0.048	0.049	0.050	0.051	0.052
0.050	0.047	0.048	0.049	0.050	0.051	0.052	0.053
0.051	0.048	0.049	0.050	0.051	0.052	0.053	
0.052	0.049	0.050	0.051	0.052	0.053		
0.053	0.050	0.051	0.052	0.053			
0.054	0.051	0.052	0.053				
0.055	0.052	0.053					
0.056	0.053						

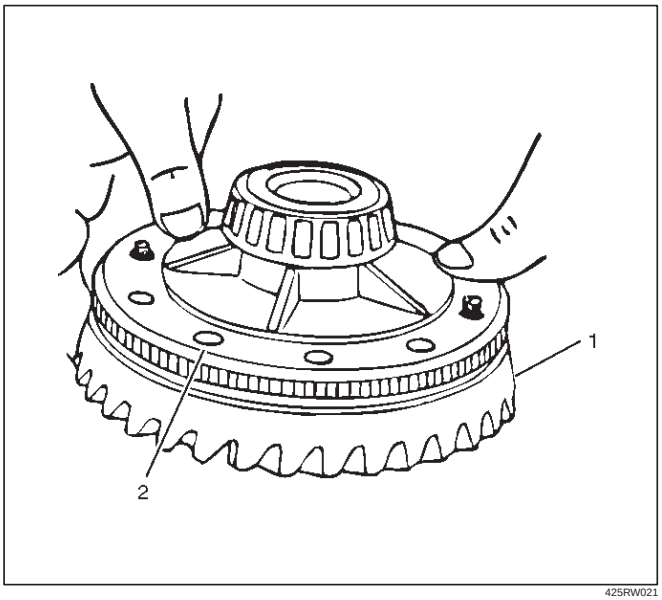
19. Remove bearing caps and depth gauging tools.
20. Install the correct pinion shim and inner oil slinger onto pinion.

NOTE: Do not install pinion gear into housing at this time.

21. If the exciter ring was removed, install the new exciter ring onto the differential case by pressing using the ring gear as a pilot.


425RS047

22. Install ring gear(1) to the differential case(2)



425RW021

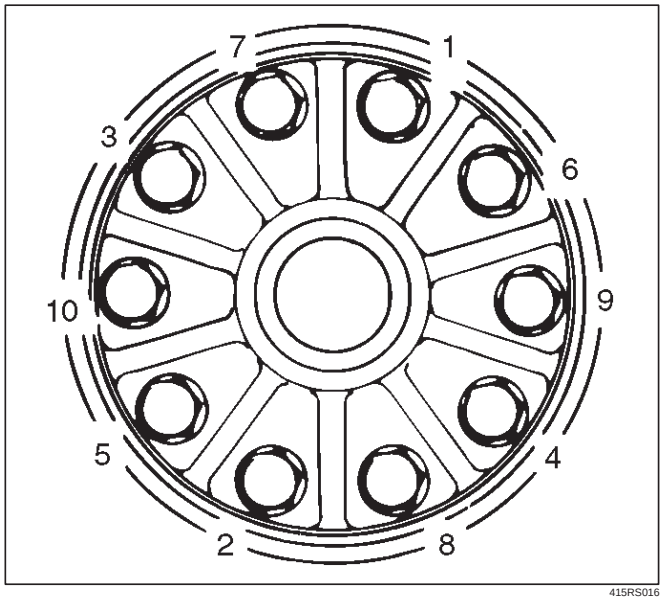
23. Install new ring gear bolts.

▼Tighten the ring gear bolts alternately in stages, gradually pulling the ring gear onto the differential case.

Tighten the ring gear bolts in sequence

Torque: 108 N·m (80 lb ft)

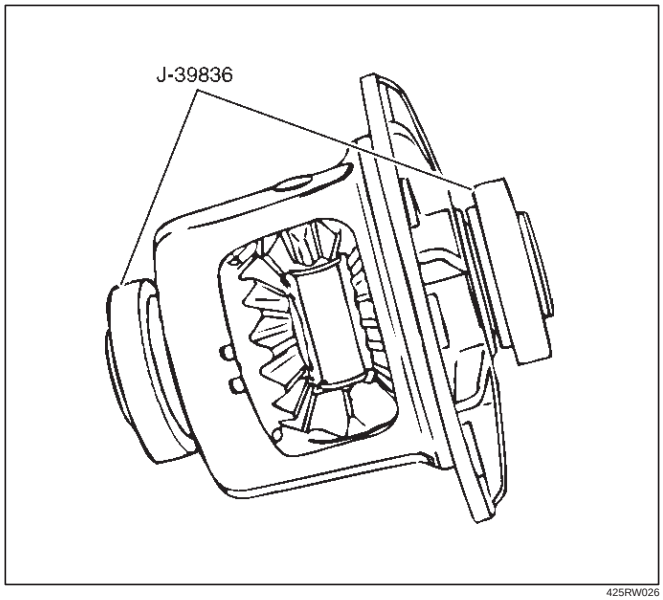
NOTE: Discard used bolts and install new ones.



415RS016

Side Bearing Preload Adjustment

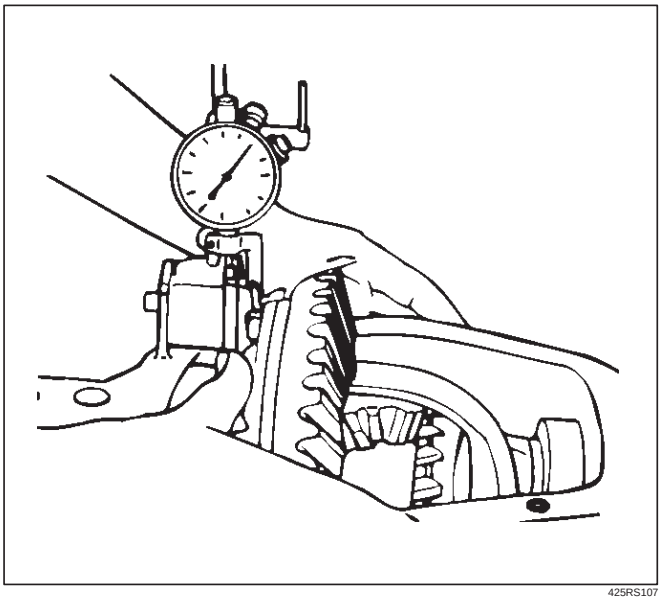
1. The side bearing preload adjustment must be made before installing the pinion.
2. The side bearing preload is adjusted by changing the thickness of both the left and right shims equally. This maintain the original backlash.
3. Install master side bearings J–39836 onto the case. Remove all nicks, burrs, dirt etc., from the hubs to allow the master bearings to rotate freely.



425RW026

4. Assemble the differential case into the housing (less pinion). Install bearing caps and finger tight bolts. Mount a dial indicator with a magnetic base to the housing and indicate on the flange or head of screw.
   Force the differential assembly as far as possible in the dirction towards the indicator.
   With force still applied, set indicator at zero(0).

NOTE: Dial indicator set should be capable of a minimum travel of 5.08 mm (0.2 in).

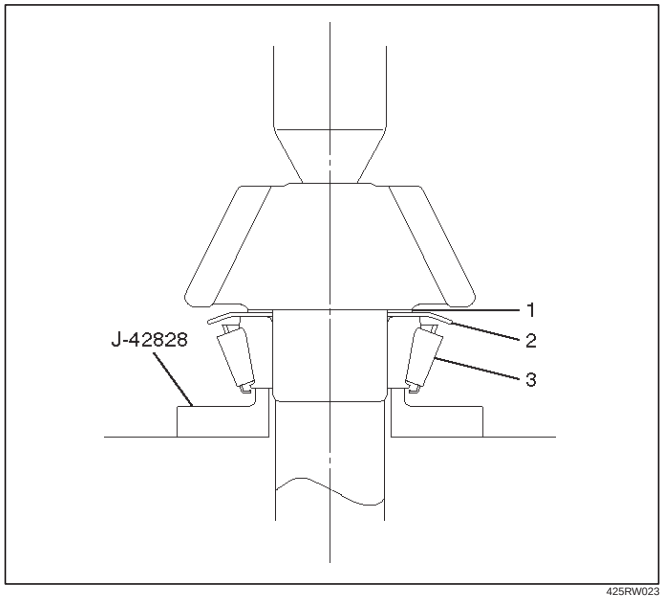

425RS107

5. Force the differetial assembly as far as it will go in the opposite direction. Repeat these steps until the same reading is obtained.
6. RECORD THE READING OF THE INDICATOR.
   This amount, in shims, will be included in the final assembly shim stack to establish side bearing preload and ring gear and pinion backlash.
7. After marking sure the readings are correct, remove the indicator and differetial assembly from the housing.

Pinion Installation

▼ The bearing cups should have been installed in Pinion Depth Adjustment in this section.

1. Place the shim(1) and inner oil slinger(2) on the pinion gear, then install the pinion inner bearing(3) using installer J–42828.



425RW023

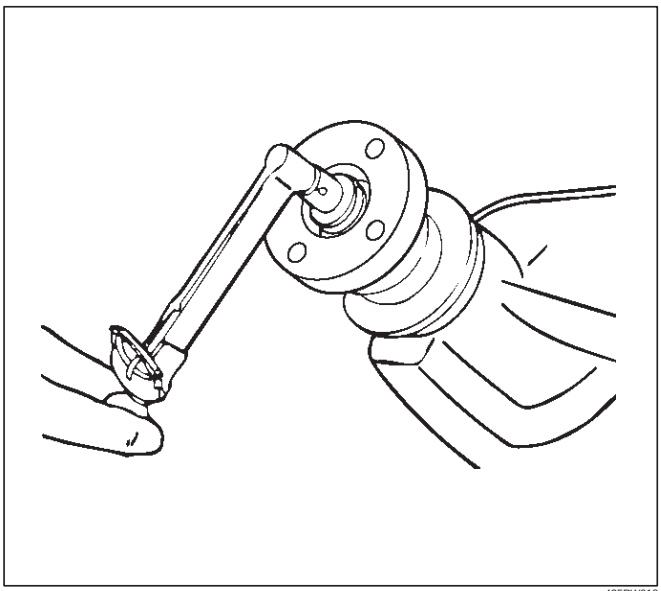
▼Drive the bearing until the bearing cone seats on the pinion shims.

2. Install a new collapsible spacer.
   ▼Lubracate the pinion bearings with axle lublicant.
3. Install pinion to the axle housing.
4. Install outer pinion bearing onto the pinion.
   ▼Hold the pinion forward from inside the case while driving the bearing onto the pinion.
5. Install oil seal slinger.
6. Install pinion oil seal using installer J–37263.
7. Install the pinion flange to the pinion by tapping it with a rawhide hammer until a few threads show through the pinion flange.
8. Install pinion washer and a new nut while holding the pinion flange with flange holder J–8614–01.
   ▼Tighten the nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings.

Torque:217-678 N·m (160-500 lb ft)

Once there is no end play in the pinion, the preload torque should be checked.

▼Remove flange holder J–8614–01. Using an inch-pound torque wrench, check the pinion preload by rotating the pinion with the wrench.


425RW018

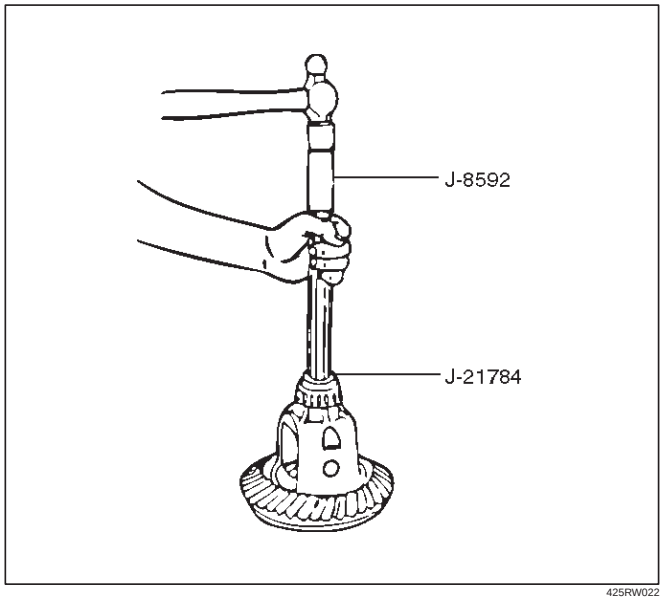
Preload should be at 1.0 to 1.6 N·m (8 to 14 in lbs.) on new bearings, or 0.46 to 0.69 N·m (4 to 6 in lbs.) for used bearings.

▼If the preload torque is below the preloads given above, continue torquing the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload by several pounds. If the bearing preload is exceeded, the pinion will have to be removed, and a new collapsible spacer installed.

▼Once a preload of 1.0 to 1.4 N·m (8 to 12 in lbs.) has been obtained, rotate the pinion several times to assure that the bearings have seated. Recheck the preload, and adjust if necessary.

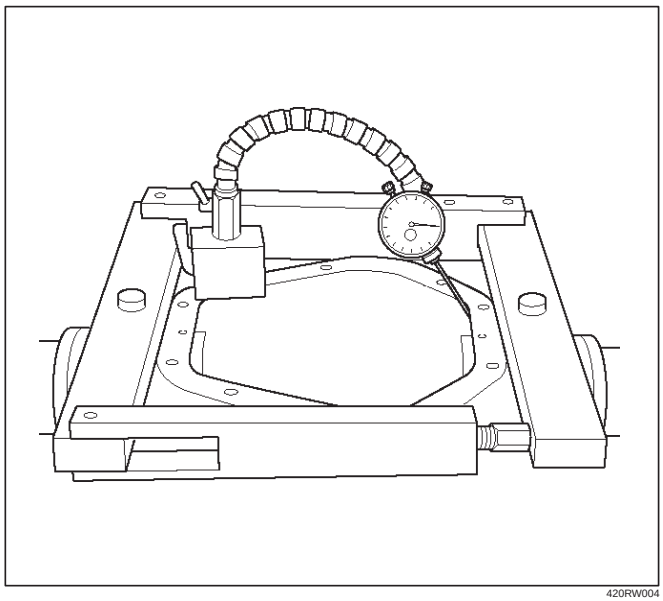
Determination of Backlash & Preload Shims

1. Install master side bearings onto the case.
2. Install differential assembly into the carrier.
3. Install the bearing cap and finger tight bolts.
4. Set up the dial indicator.
5. Force the differential assembly away from the pinion gear until it is completely seated against the cross bore face of the carrier.
6. With force still applied to the differential case, place the tip of dial indicator on a machined surface of the differential case, if available, or on the head of a ring gear screw, and set the indicator at zero(0).
7. Force the ring gear to mesh with the pinion gear. Rock the ring gear slightly to make sure the gear teeth are meshed. Repeat this procedure several times until the same reading is obtained each time. Be sure the indicator reads zero(0) each time the ring gear is forced back into contact with the cross bore face. This reading will be the necessary amount of shims to be placed between the differential case and side bearing cone on the ring gear side.
8. The remaining amount of shims, which is the difference between the overall found in step 6 of Side Bearing Pre-load Adjustment and step(7) above, should be placed on the other side of the differential case, plus additional 0.38 mm (0.015 in) for obtaining preload and backlash.
9. Place the required amount of shims on each hub as determined in the previous steps and assemble side bearing cone by using installer J–21784 and handle J–8592.



425RW022

10. Total torque to rotate — Increase of pinion torque to rotate due to differential case assembly shall not exceed 3.4 N·m (30 in lbs.) divided by the gear ratio.
11. Assembly the spreader J–24385–B and indicator to the carrier as shown in figure. Spread the carrier 0.5 mm (0.02 in) for differential installation.


420RW004

CAUTION: Do not spread the carrier over 0.5 mm (0.02 in).

12. Remove the indicator.

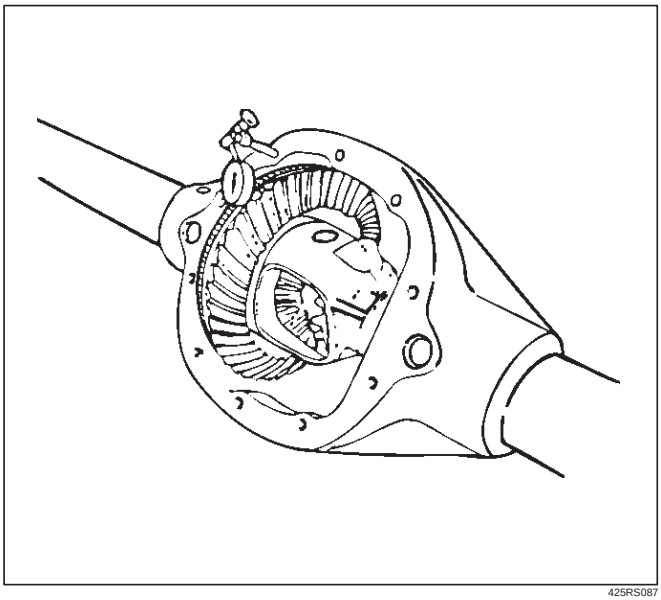
Backlash Adjustment

1. Install the differential case assembly and bearing caps.
2. Rotate the case several times to seat the bearings.
3. Remove the spreader.
4. Install the side bearing cap bolts.

   Tighten side bearing cap bolts

   Torque: 108 N·m (80 lb ft)
5. Install a dial indicator to the case using a magnetic base.
6. Place the indicator stem at the heel end of a tooth.

   ▼Set the dial indicator so that the stem is in line with the gear rotation and perpendicular to the tooth angle.



425RS087

7. Check and record the backlash at three points around the ring gear.

   ▼The pinion must be held stationary when checking backlash.

   ▼The backlash should be the same at each point within 0.07 mm (0.003 in). If the backlash varies more than 0.07 mm (0.003 in), check for burrs, a distorted case flange, or uneven bolting conditions.
8. Backlash at the minimum lash point measured should be between 0.13 and 0.20 mm (0.005 and 0.008 in) for all new gear sets.
9. If the backlash is not within specifications, move the ring gear in or out from the pinion by increasing the thickness of one shims, and decreasing the thickness of the other shim by the same amount.

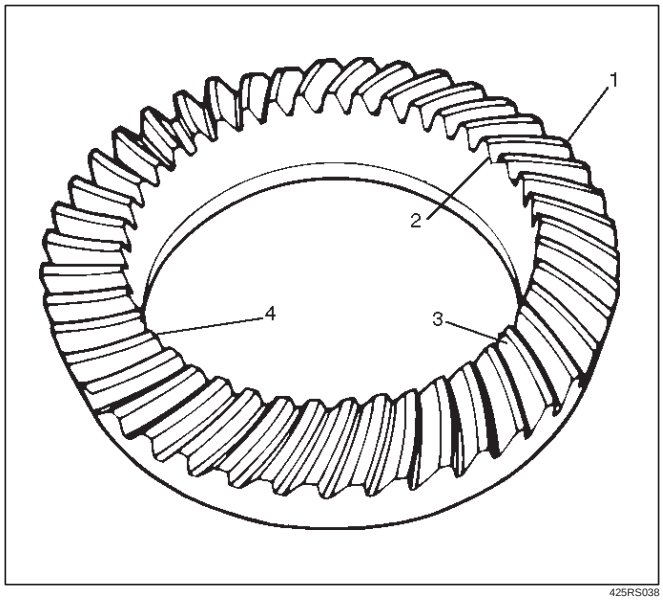
   This will maintain the correct rear axls side bearing preload.

   ▼Moving 0.05 mm (0.002 in) worth of shim from one side of the differential to the other will change the backlash adjustment by 0.03 mm (0.001 in).
10. After obtaining correct tooth contact described in later, install ABS speed sensor.
11. Install the cover with sealant.

    Torque: 40 N·m (30 lb ft)
12. Fill the axle lubricant.

Gear Tooth Pattern Check

Checking the ring gear to pinion tooth pattern is to be done only after setting up the axle according to the methods in this section. The pattern check is NEVER to be used as an initial check, or instead of checking pinion depth and backlash adjustments.
This check is only to be verify the correct adjustment of the gear set after set up.

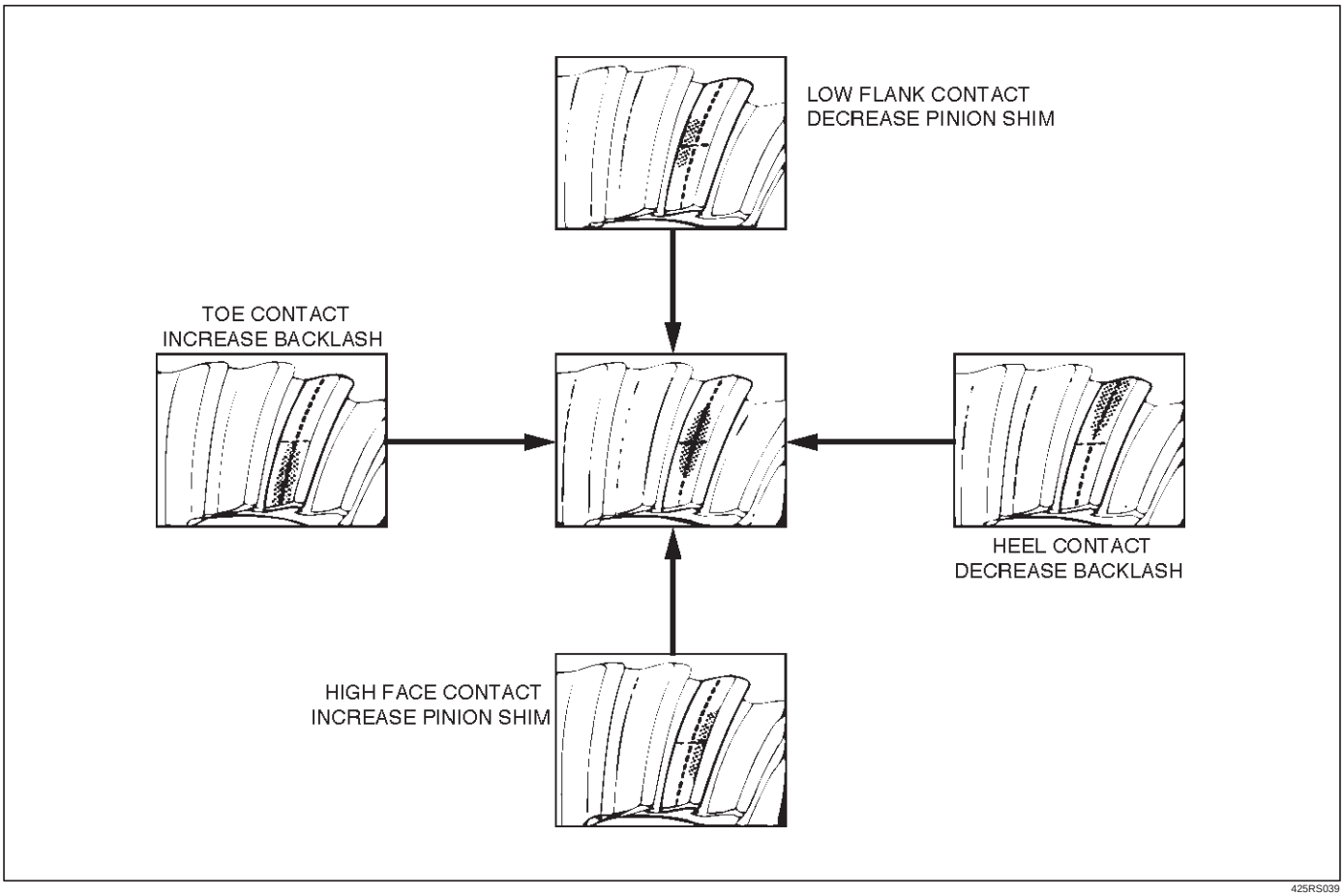


425RS038

Legend

(1) Heel
(2) Toe
(3) Concave Side (Coast)
(4) Convex Side (Drive)

1. Wipe all oil out of the carrier, and carefully clean each tooth of the ring gear.
2. Use gear marking compound 1052351 or equivalent and apply this mixture sparingly to all ring gear teeth, using a medium-stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten the bearing cap bolts to the specified torque.
4. Expand the brake shoes until a torque of 54 to 68 N·m (40 to 50 lb ft.) is required to turn the pinion. A test made without loading the gears will not give a satisfactory pattern. Turn the pinion flange with a wrench so that the ring gear rotates one full revolution, then reverse the rotation so that the ring gear rotates one revolution in the opposite direction.
5. Observe the pattern on the ring gear teeth and compare this with figure.



Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern: backlash, and the position of the drive pinion in the case. The effects of bearing preloads are not readily apparent on head loaded tooth contact pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear.

Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

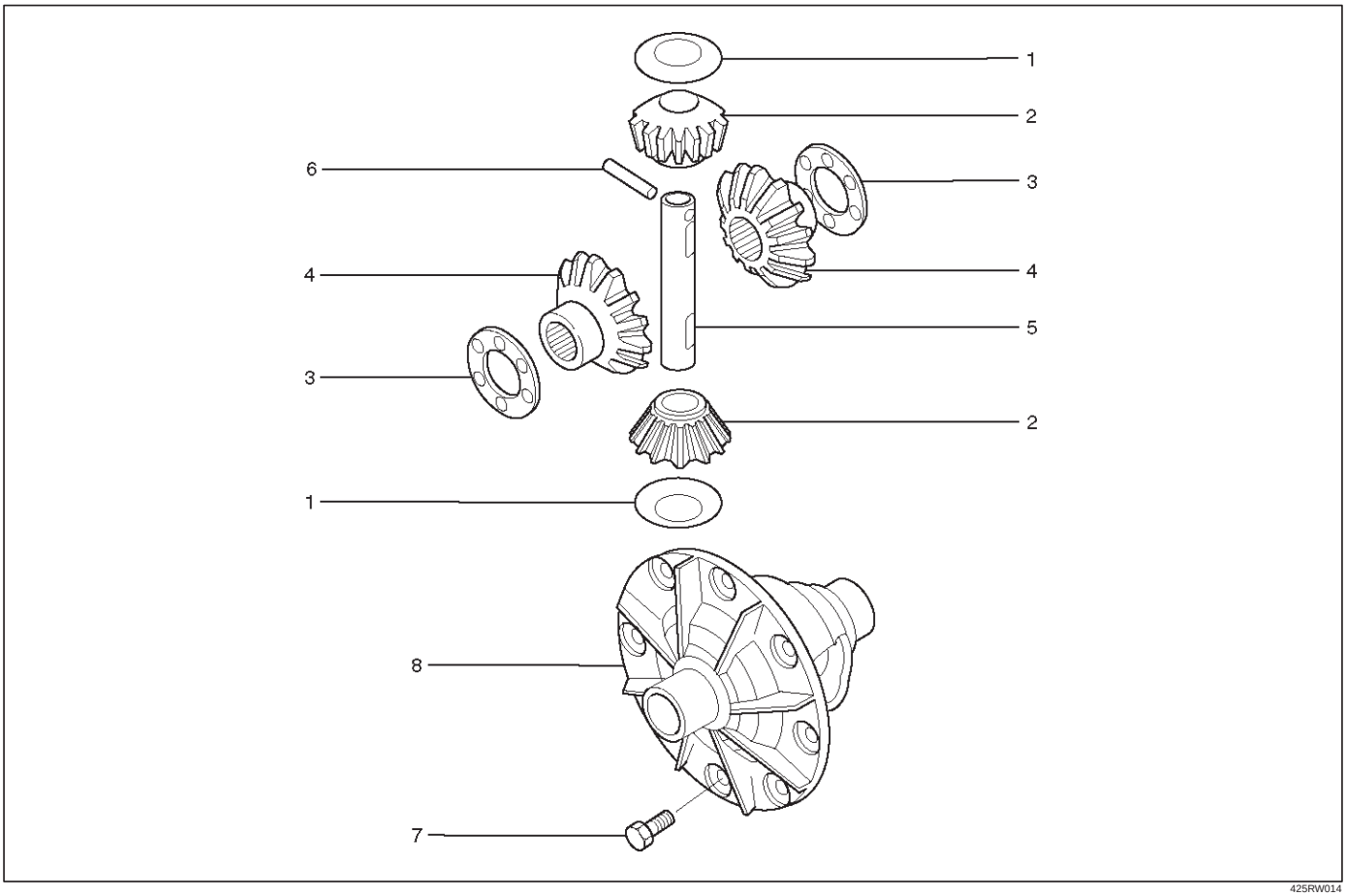
Backlash is adjusted by means of the side bearing adjusting shims which move the entire case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload.)

If the thickness of the right shim is increased (along with decreasing the left shim thickness), backlash will increase.

The backlash will decrease if the left shim thickness is increased (along with a decrease in right shim thickness).

Differential Case Assembly

Disassembled View



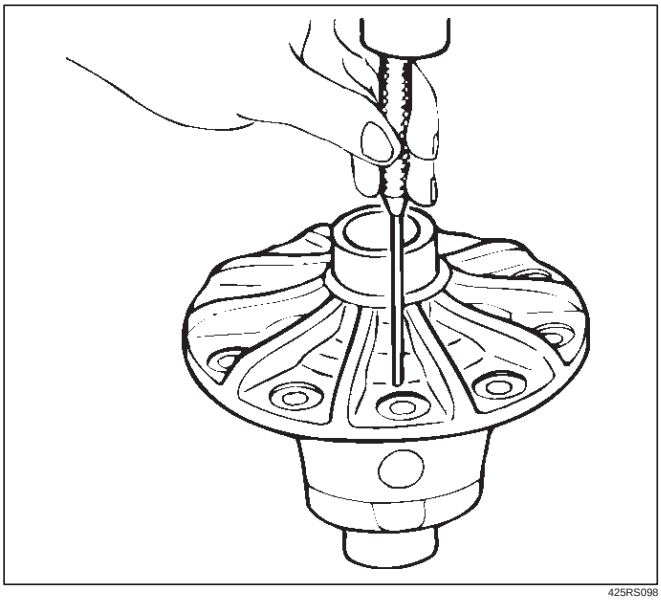
425RW014

Legend

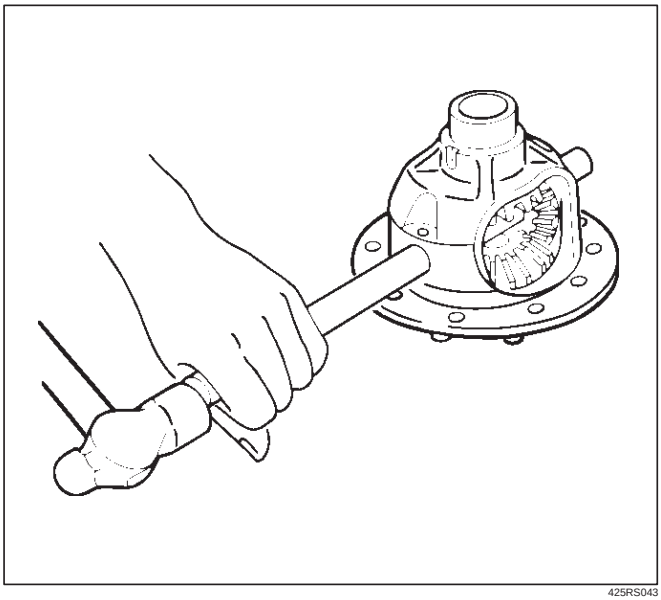
(1) Thrust Washer (for Pinion Gear)
(2) Pinion Mate Gear
(3) Thrust Washer(for Side Gear)
(4) Side Gear
(5) Differential Shaft
(6) Lock Pin
(7) Bolt
(8) Differential Case

Disassembly

1. Remove lock pin using a small drift.


425RS098

2. Remove the differential shaft by using a soft metal rod and a hammer.


425RS043

3. Remove pinion mate gear and thrust washer.
4. Remove side gear and thrust washer.

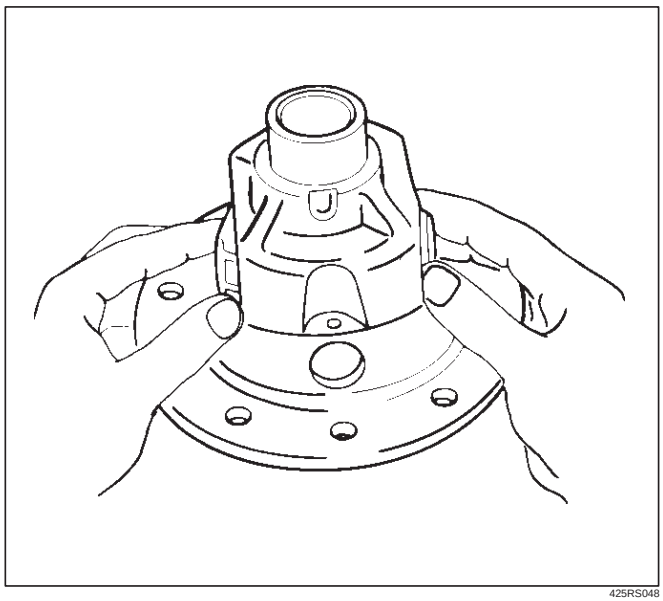
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

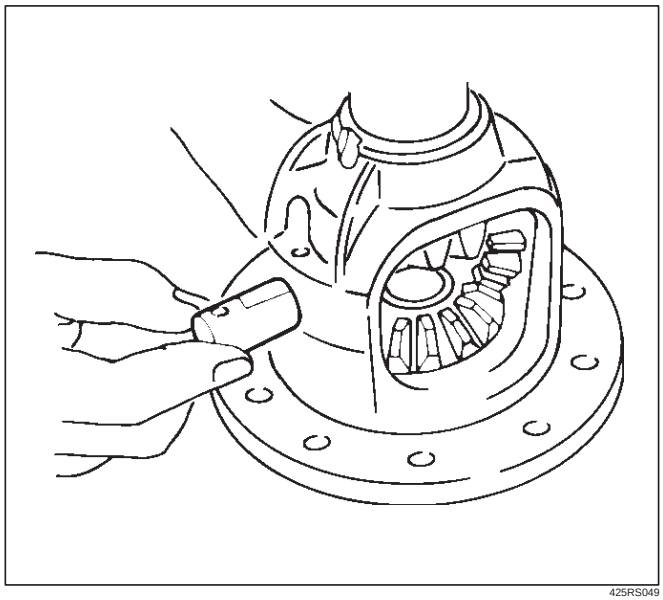
- ▼ Ring gear, pinion gear
- ▼ Bearing
- ▼ Side gear, pinion mate gear, differential shaft
- ▼ Differential case, carrier
- ▼ Thrust washer
- ▼ Oil seal

Reassembly

1. Install side gear with thrust washer.
2. Install the pinion mate gear with thrust washer by engaging it with the side gears while turning both pinion mate gears simultaneously in the same direction.


425RS048

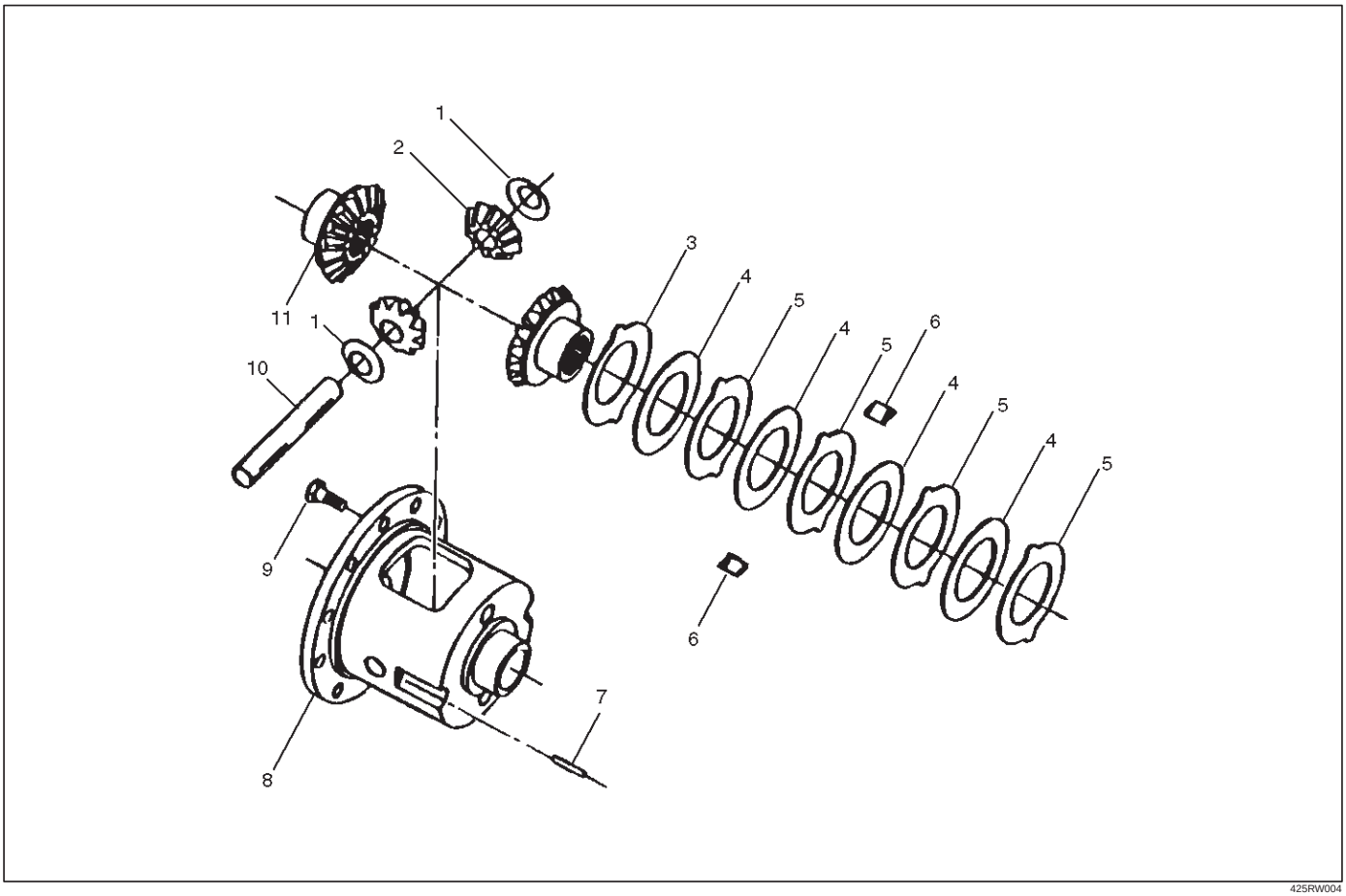
3. Install differential shaft.
   1. Be sure to install the differential shaft so that it is in alignment with the lock pin hole in the differential case.


425RS049

4. Install lock pin.
   After lock pin installation, stake the case to secure the lock pin.

Limited Slip Differential Assembly

Disassembled View



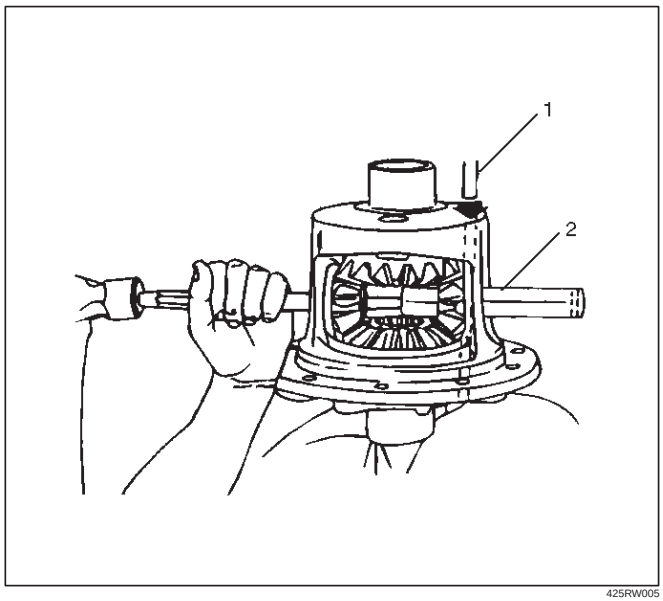
425RW004

Legend

(1) Thrust Washer–Differential Pinion Mate Gear
(2) Pinion Mate Gear
(3) Dished Spacer
(4) Disc
(5) Plate
(6) Differential Plate Retainer
(7) Lock Pin
(8) Differential Case
(9) Ring Gear Bolts
(10) Differential Shaft
(11) Differential Side Gear

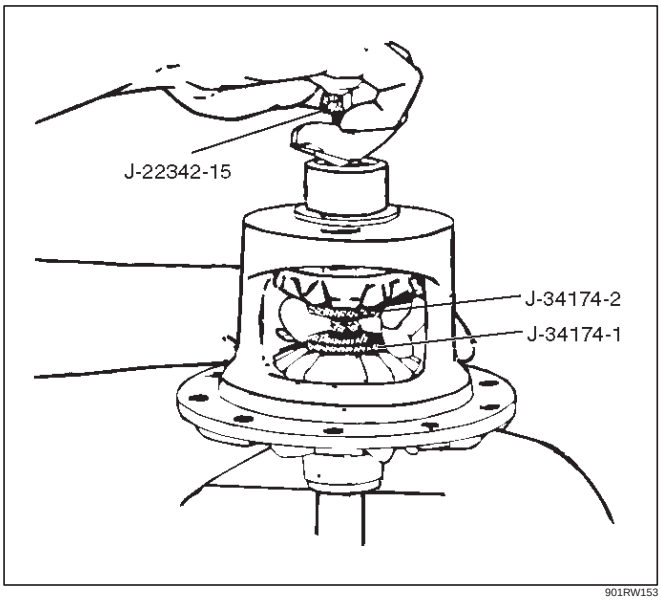
Disassembly

1. Place the holder J–39824 into a vise.
   Position the differential on the holder with the ring gear side down.
2. Remove Lock pin (1) from differential shaft using a punch.
3. Remove Differential shaft (2) using hammer and punch.
   Place shop towel behind case to prevent differential shaft from dropping out of case.



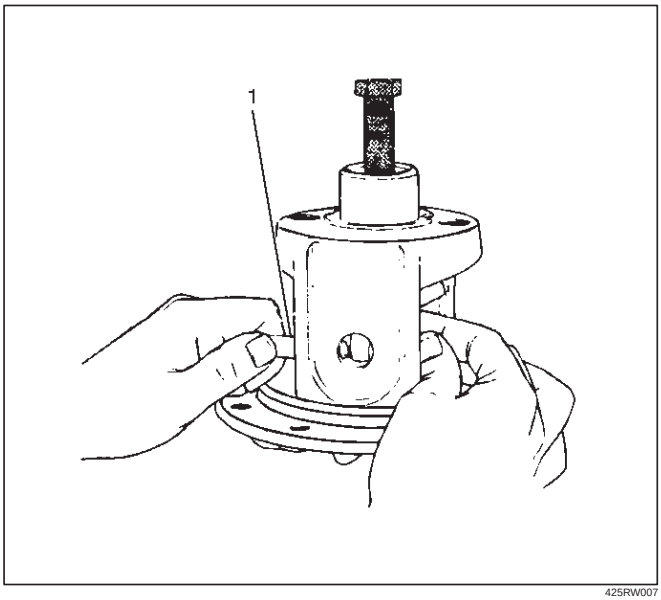
425RW005

4. Assemble clutch pack unloading tool .
   a. Install cap J–34174–1 to the bottom differential side gear.
   b. Install threaded screw cap J–34174–2 to top differential side gear. Thread forcing screws J–22342–15 into threaded screw cap until it becomes centered into the bottom cap.



901RW153

   c. Tighten forcing screw until tight enough to collapse dished spacers and allow looseness between side and pinion mate gears.
5. Both pinion mate gear thrust washers using a shim stock (1) of 0.51 mm (0.020 in.) or equivalent tool to push out washers.



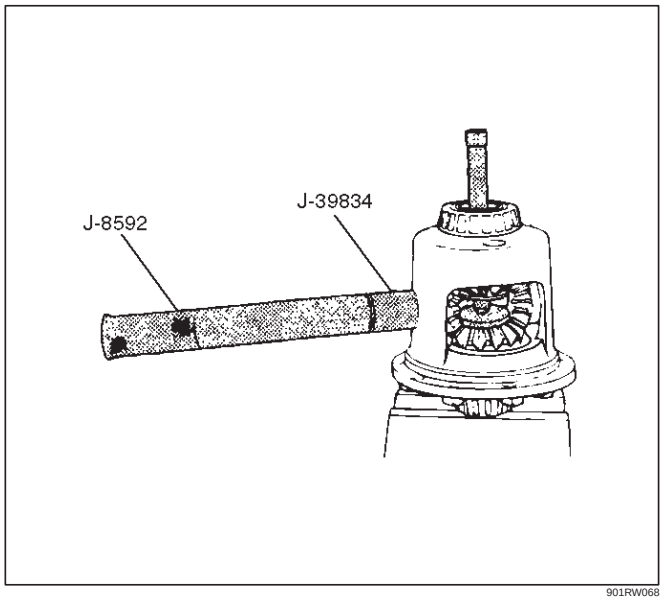
425RW007

6. Relieve tension of dished spacers by loosening forcing screw.

NOTE:

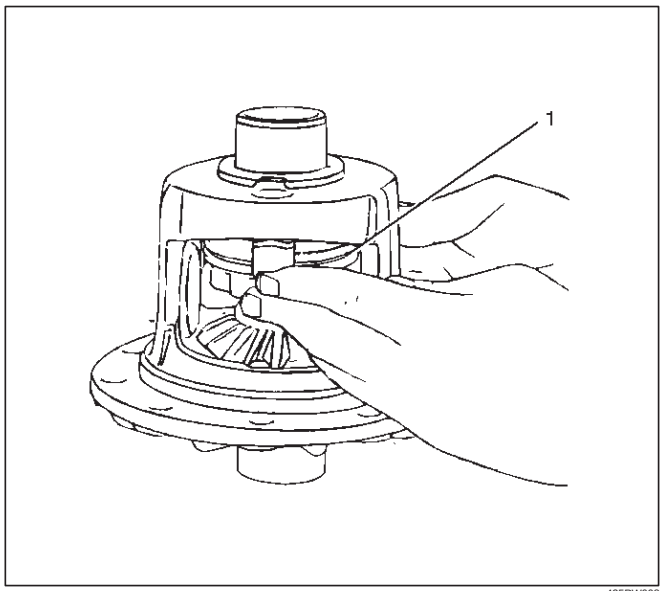
▼ You may have to adjust the forcing screw slightly to allow the case to rotate.

7. Assemble LSD service adapter J–39834 onto long drive handle J–8592.Insert it into differential shaft hole of case. Pull on handle and rotate case until pinion mate gears can be removed.



901RW068

8. Remove pinion mate gears.
9. Hold side gear top clutch pack (1) with one hand and remove positraction unloading tools.



425RW008

10. Remove top side gear and clutch pack.

NOTE:

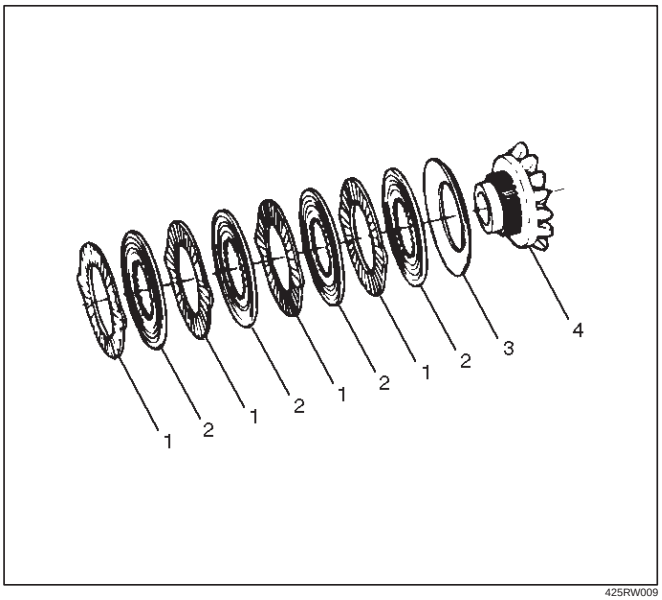
▼ Keep the stack of plates and discs intact and in exactly the same position while they are being removed.

11. Remove case from holder. Turn case with flange or ring gear side up to allow side gear and clutch pack to be removed from case.

12. Remove differential plate retainer from both clutch packs to allow separation of the plates and discs.

NOTE:

▼Keep the discs and plates in the same order as they were removed.



425RW009

Legend

(1) Differential Plate
(2) Differential Disc
(3) Dished Spacer
(4) Side Gear

Inspection and Repair

Cleaning

▼All parts with solvent.

Visual Inspection

▼Clean all parts with solvent.

▼Plates and Discs. If any one disc or plate in either stack shows evidence of excessive wear or scoring, the complete stack is to be replaced on both sides.

▼Side Gears and Pinion Mate Gears. The gear teeth of these parts should be checked for extreme wear and possible cracks. The external teeth of the side gear, which retain the concentric groove discs, should also be checked for wear or cracks.

▼If replacement of one gear is required due to wear, etc., then both side gears, pinion mate gears, and thrust washers are to be replaced.

▼Differential Shaft. If excessive wear is evident, the differential shaft should be replaced.

▼Differential Plate Retainers. If wear is evident on any one of the differential plate retainers, all four retainers must be replaced.

▼Differential Case. If scoring, wear or metal pickup is evident on the machined surfaces, replacement of the case is necessary.

Reassembly

1. Lubricate thrust face of side gears, plates and discs with the proper limited slip rear axle lubricant.
2. Assemble plates and discs in exactly in the same position as they were removed, regardless of whether they are new or original.
3. Install differential plate retainer to ears of plates.

NOTE:

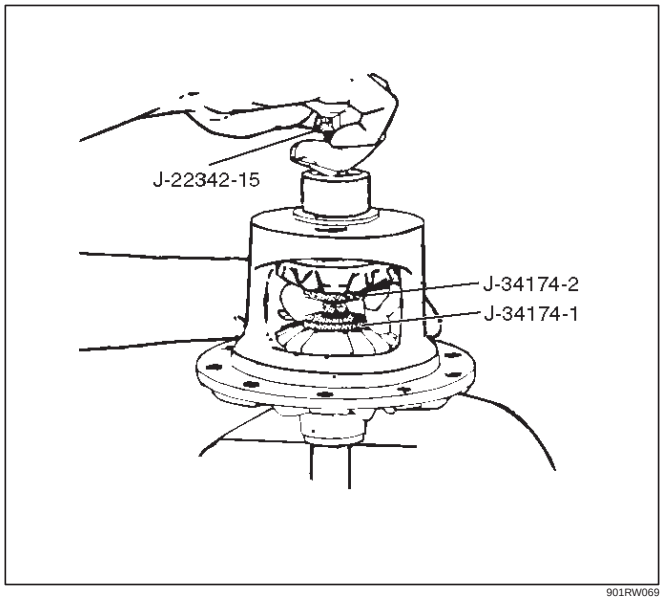
▼Make sure both retainers are Completely seated on ears of plates.

4. Install clutch pack and side gear into bottom side gear bore. Make sure clutch pack stays assembled to side gear splines, and that retainers are completely seated into pockets of case.

NOTE:

▼To prevent clutch pack from falling out of case, hold clutch pack in place by hand while repositioning case on bench.

5. Install other side gear and clutch pack. Make sure clutch pack stays assembled to side gear splines, and retainers are completely seated into pockets of case.
6. Hold clutch pack in position and assemble screw cap J–34174–2, cap J–34174–1 and forcing screw J–22342–15. Tighten forcing screw into bottom cap to hold both clutch packs in position.
7. With tools assembled to case, position case on holder J–39824 by aligning splines of side gear with those of shaft. Tighten forcing screw to compress clutch packs in order to provide clearance for pinion mate gears.

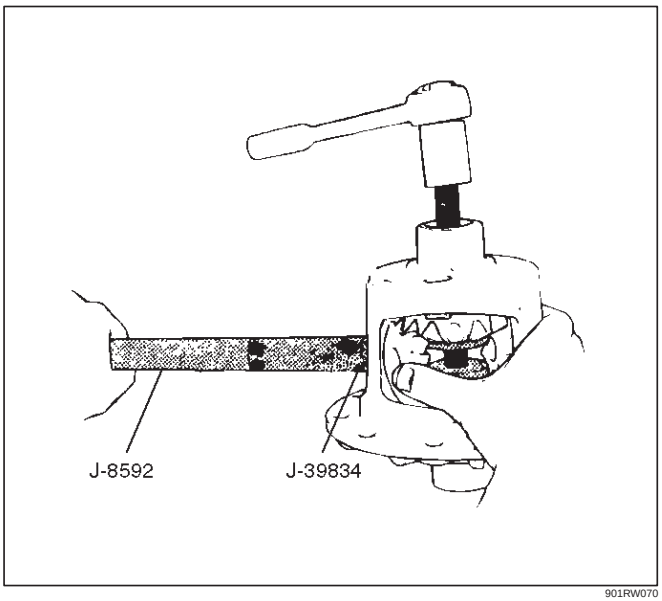


901RW069

8. Install pinion mate gears.

▼Place the pinion mate gears into the differential 180 degrees apart.

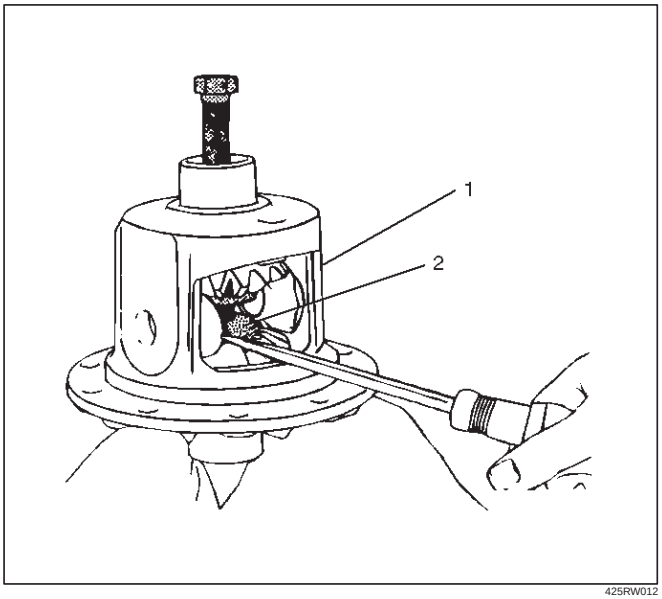
9. While holding gears in place, insert LSD service adapter J–39834 with long drive handle J–8592 in differential shaft hole of case. Pull on long drive handle J–8592 and rotate case, allowing gears to turn. Make sure that holes in pinion mate gears align with holes in case.



901RW070

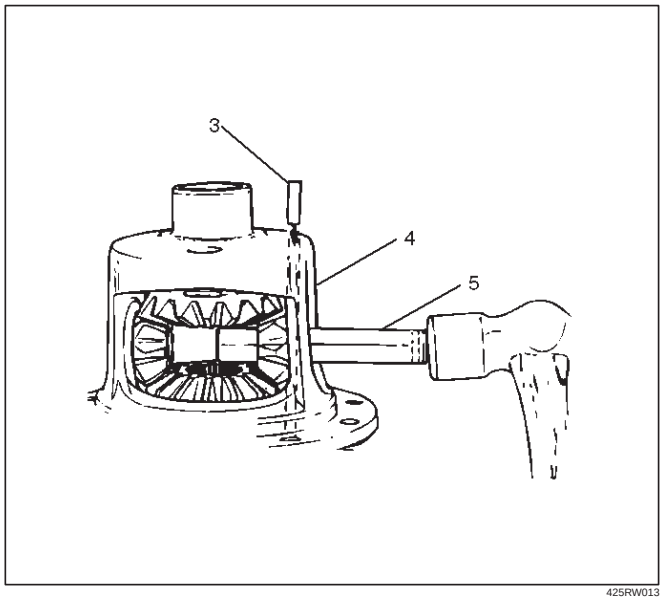
▼It may be necessary to adjust tension on forcing screw to rotate case.

10. Tighten forcing screw to compress the clutch packs, to allow installation of spherical thrust washers.
11. Lubricate spherical thrust washers (2), and assemble into case (1). Use a small screw driver to push washers into place. Remove tools.



425RW012

12. Position differential shaft in case and drive in with hammer. Be sure lock pin hole of differential shaft (5) is properly aligned to allow installation of lock pin (3). Be sure that thrust washers and differential pinion mate gears are aligned with the differential case (4). Install new lock pin to proper depth using a punch. Stake metal of case over pin in two places, 180 degrees apart.



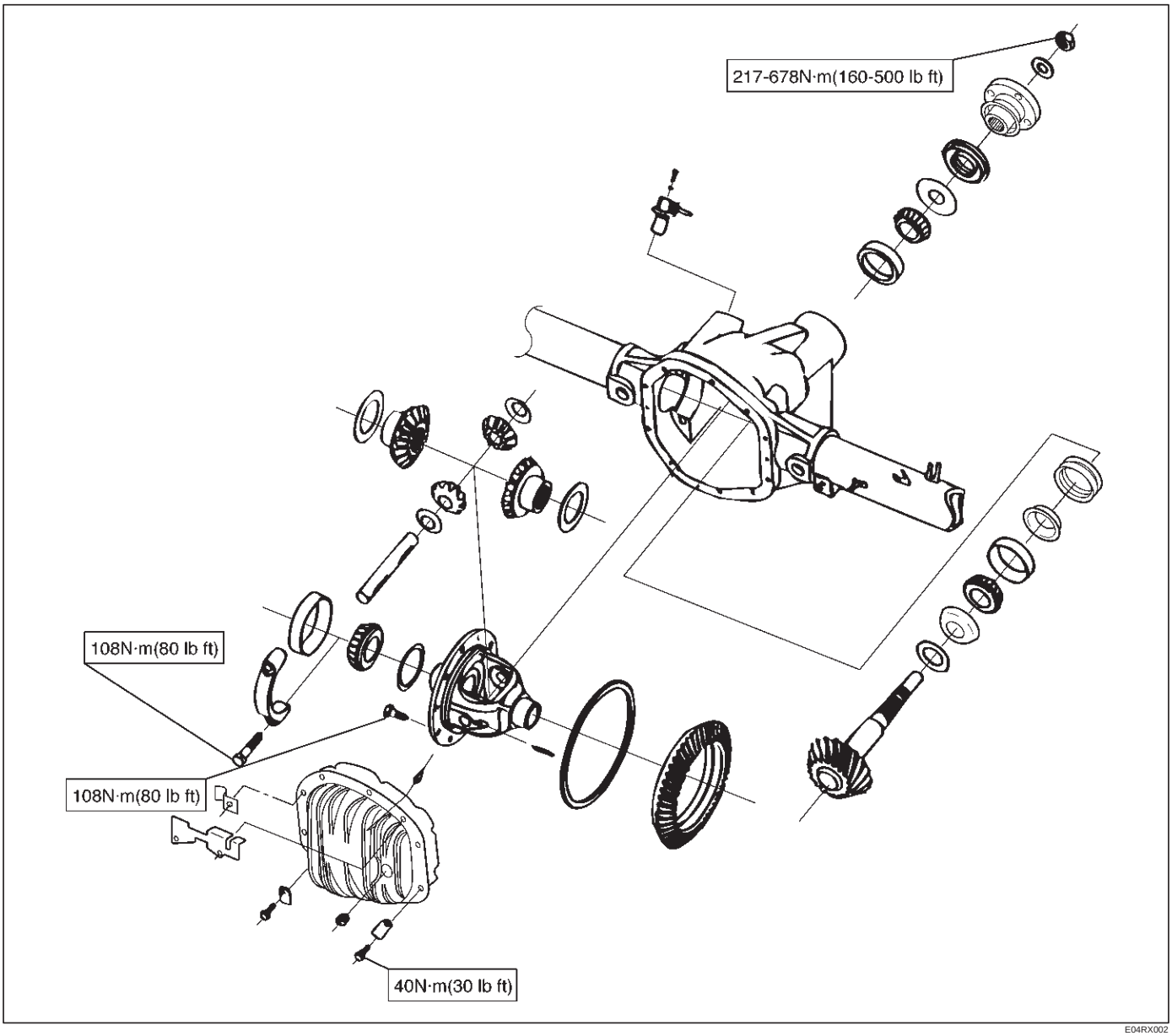
425RW013

Main Data And Specifications

General Specifications

Rear axle	
Type	Salisbury, Semi–floating
Rear axle Size	226 mm (8.9 in)
Gear type	Hypoid
Gear ratio	4.300
Differential type	Two pinion
Lubricant Grade	GL–5: (Standard differential)
	GL–5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL–5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	1.77 liter (1.87 US qt)

Torque Specifications



E04RX002

Special Tools

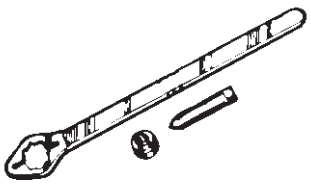
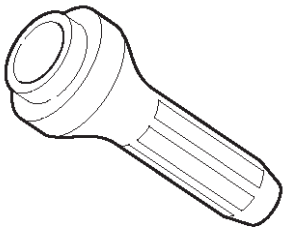
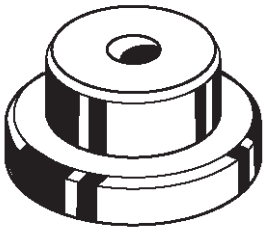
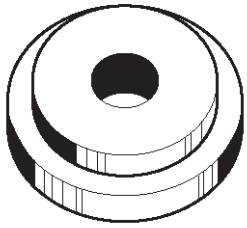
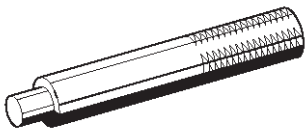
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW037	**J–8614–01** Pinion flange holder
 901RS211	**J–37263** Installer; Pinion oil seal
901RW039	**J–42379** Remover; Bearing
 901RS215	**J–39830** Adapter; Side bearing plug
 901RS217	**J–8611–01** Installer; Outer bearing outer race
 901RS218	**J–8592** Grip

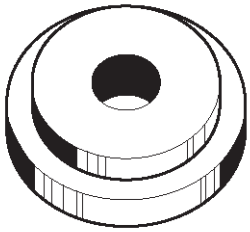
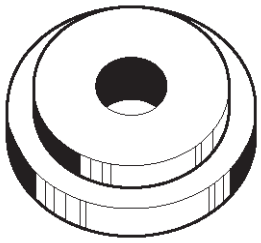
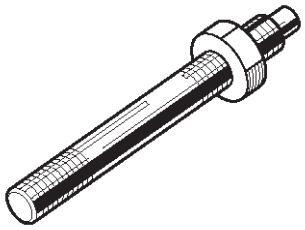
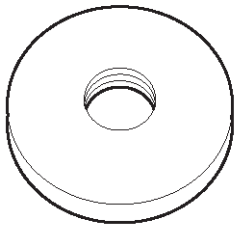
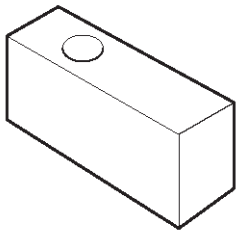
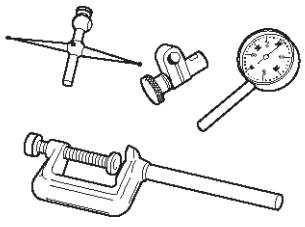
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS219	**J–42836** Installer; Inner bearing outer race
 901RS220	**J–42824** Pilot;Outer
 901RS221	**J–21777–43** Nut & Stud
 901RS222	**J–42827** Pilot;Inner
 901RS223	**J–39837–2** Gauge plate
 901RS224	**J–8001** Dial indicator

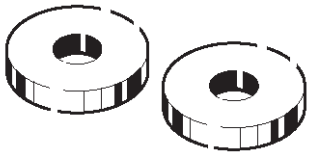
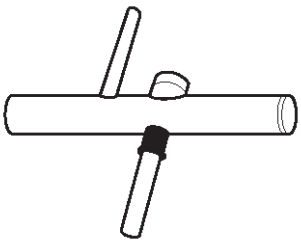
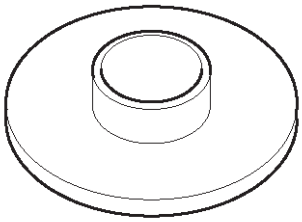
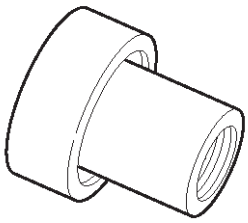
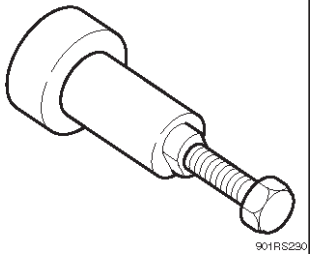
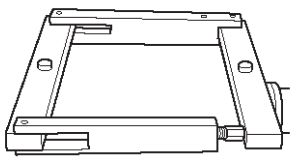
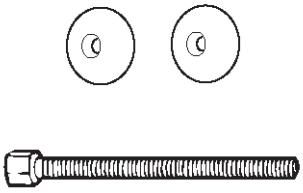
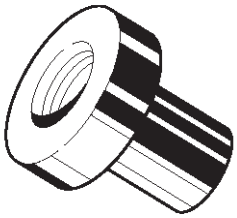
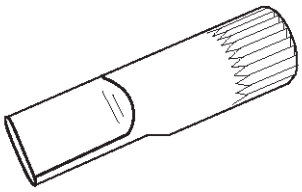
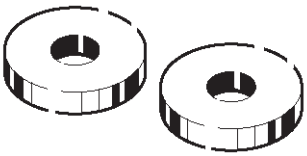
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS225	**J–39837–1** Disc (2 required)
 901RS226	**J–23597–1** Arbor
 901RS208	**J–42828** Installer; Pinion bearing
 901RS229	**J–21784** Installer; Side bearing
 901RS230	**J–39602** Remover; Outer bearing
 901RW170	**J–24385–B** Spreader

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW064	**J–39858** Clutch pack unloading tool kit Includes **J–34174–1/J–34174–2** Screw cap and Cap **J–22342–15** Forcing screw
 901RW065	**J–39834** Limited–slip differential (LSD) service adapter
 901RW066	**J–39824** Holder
 901RS225	**J–39836** Side bearing preload master bearings

AXIOM

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM

CONTENTS

Service Precaution 4B1–1
Shift On The Fly System 4B1–2
Outline of Shift on The Fly System 4B1–2
Functions of Indicator Lamp 4B1–4
Shift On The Fly Electrical Equipment 4B1–5
Axle Shaft Connection and Disconnection . . 4B1–5
Shift On The Fly Controller 4B1–7
Shift On The Fly Controller and Associated Parts 4B1–7
Removal 4B1–7
Installation 4B1–7

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

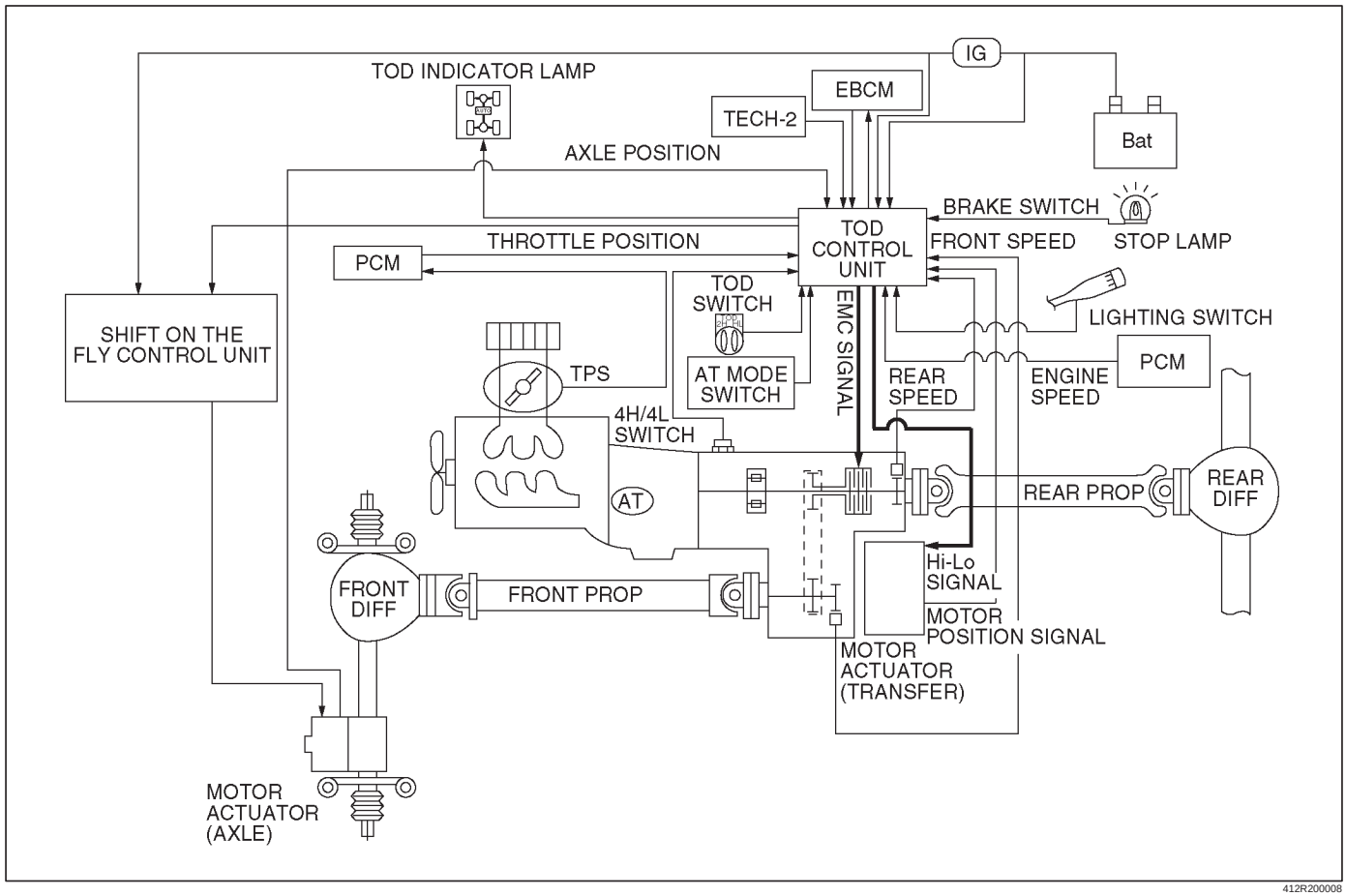
Shift On The Fly System

Outline of Shift on The Fly System

The shift on the fly system switches between 2 wheel drive (2WD) and 4 wheel drive (4WD) electronically by the driver turning the TOD switch on the instrument panel. This system will control the following operations. (Shifting between “4H” and “4L” must be performed by TOD switch.)

1. Transmitting the torque to the front propeller shaft.
2. Connecting front wheels to, and disconnecting them from, the front axles by axle motor actuator.
3. Indicating on instrument panel.
4. 4WD out signal to other Electronic Brake Control Module (EBCM).

System Diagrams

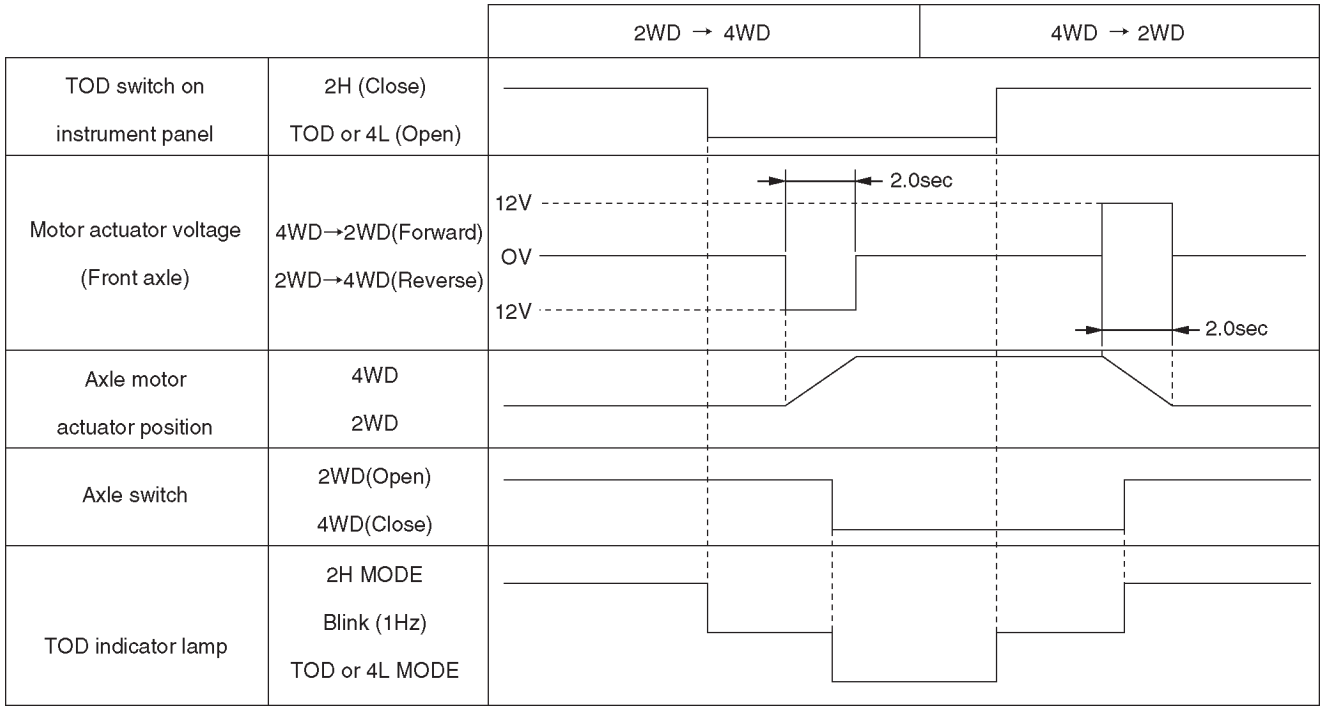


412R200008

Normal Operation

The axle disconnect controller is driven by the signal from TOD control unit and the axle motor actuator connects (or disconnects when the 4WD switch is deactivated) the front wheels to the front axles.

Time Chart of Shifting Under Normal Condition



F04R200002

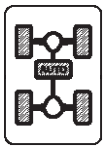
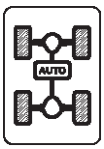
4WD out signal to other Electronic Brake Control Module : TOD Control Unit of shift on the fly sends 4WD out signal to other Electronic Brake Control Module as below.

4WD out signal (Period)	Vehicle Condition	Transfer position switch	Front axle switch
120 ms	2WD	2WD (Open)	2WD (Open)
240 ms	4WD	4WD (Close)	4WD (Close)

Functions of Indicator Lamp

TOD Switch and Indication of Drive Mode

The TOD switch sends signals to the TOD control unit which selects drive modes and controls the shift on the fly system (axle disconnect : ADC).

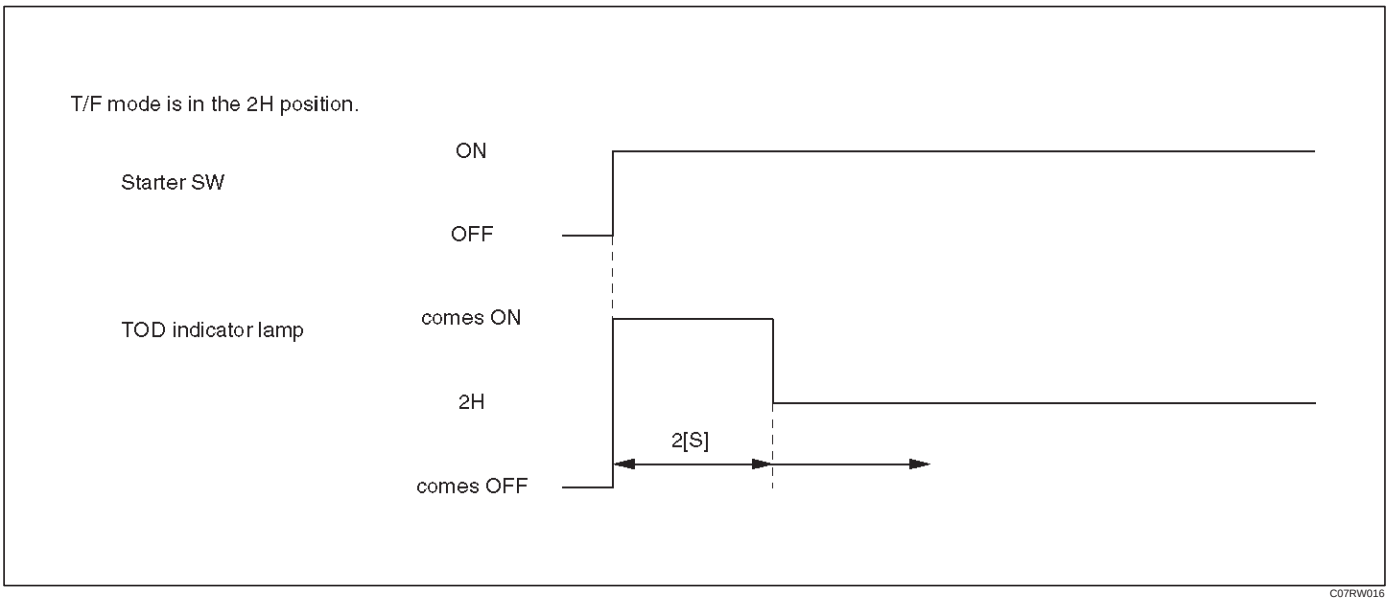
TOD switch state	Drive mode	Transfer shift condition	Transfer position detection		Shift on the fly		TOD indicator state
			4HSW	4LSW	Axle SW	ADC circuit	
2H	Rear-wheel drive (RWD)	Permissible during driving (less than 100 km/h or 62 mph)	OFF	OFF	OFF	Turning on electricity	
TOD	Electronic torque split 4WD (HIGH) (TOD)		OFF	OFF	ON	Turning off electricity	
		AT: Neutral Brake: Applied The car stops (less than 2 km/h or 1.2 mph and less than 1500 rpm)					
4L	Low range mechanical direct 4WD (LOW) (4L)		OFF	ON	ON	Turning off electricity	
ADC: Shift on the fly SW: Switch							

Bulb check : The bulb of indicator lamp is checked for 2 seconds when ignition key is turned on.

Bulb Check

When the starter switch is turned on, the TOD indicator lamps comes on as shown below.

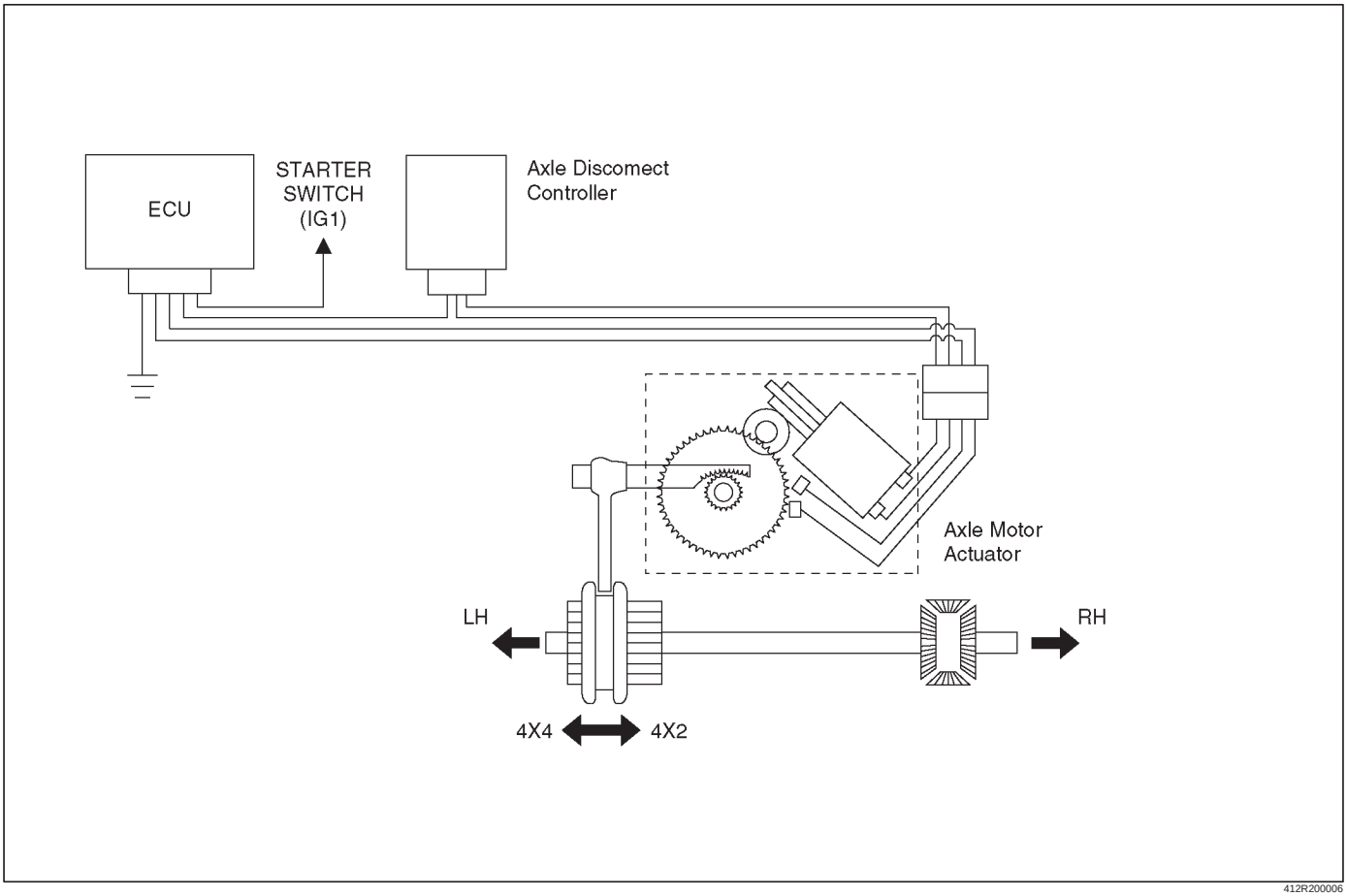
NOTE: Once the starter switch is turned on, all the TOD indicator lamps are lit for two seconds even if the transfer lever is in any position.



C07RW016

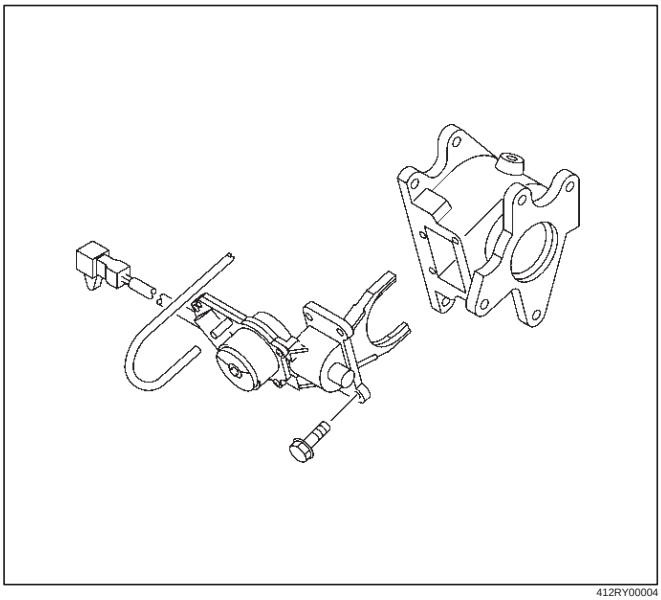
Shift On The Fly Electrical Equipment

Axle Shaft Connection and Disconnection



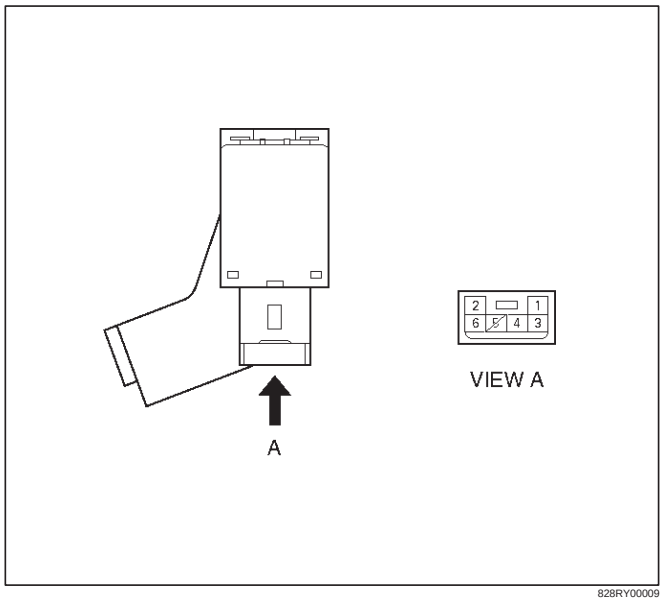
412R200006

Actuator Assembly

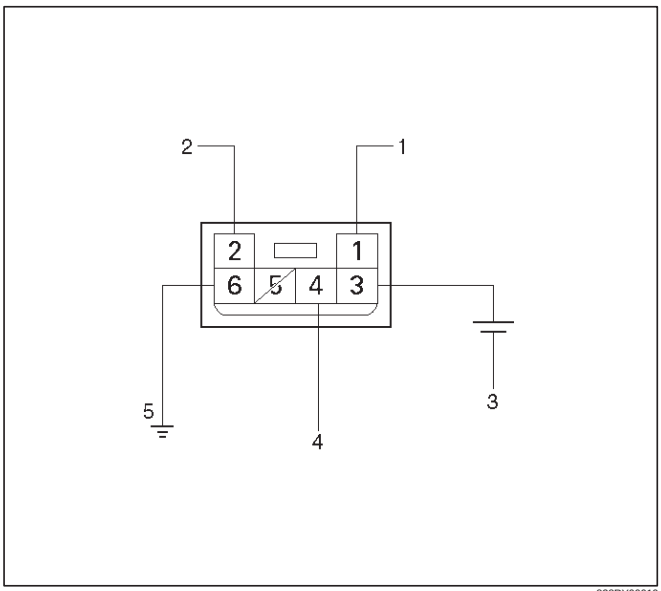


412RY00004

Axle Disconnect Controller



828RY00009



828RY00010

Legend

(1) Output Signal
(2) Output Signal
(3) 12V
(4) Input Signal
(5) GND

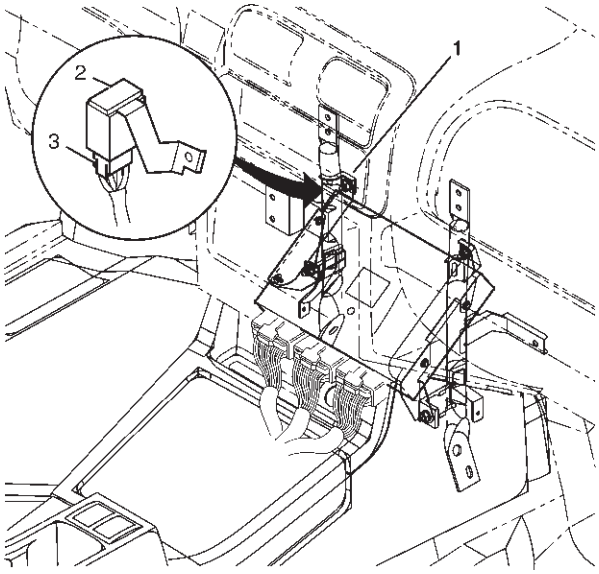
1. Connect 12V with terminal (3) and the ground with the terminal (6).
2. Send the signal to the terminal (4)
   2WD → 4WD less than 2.4V
   4WD → 2WD more than 9.0V
3. Confirm the output signal from the terminals (1) & (2) (2 seconds output)

	INPUT SIGNAL	OUTPUT SIGNAL (2 seconds)	
	4	1	2
2WD → 4WD	Less than 2.4V	0V	12V
4WD → 2WD	More than 9.0V	12V	0V

4. If the trouble occurs afther above test, charge the Axle Disconnect Controller to the new one.

Shift On The Fly Controller

Shift On The Fly Controller and Associated Parts



828RY00003

Legend
(1) Nut
(2) SOF Controller
(3) Connector

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   Refer to *Consoles in Body and Accessories* section.
3. Disconnect the connector from the controller.
4. Remove the nut.
5. Remove the controller.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

Torque: Nut (1) 8 N·m (69 lb in)

AXIOM

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM (TOD)

CONTENTS

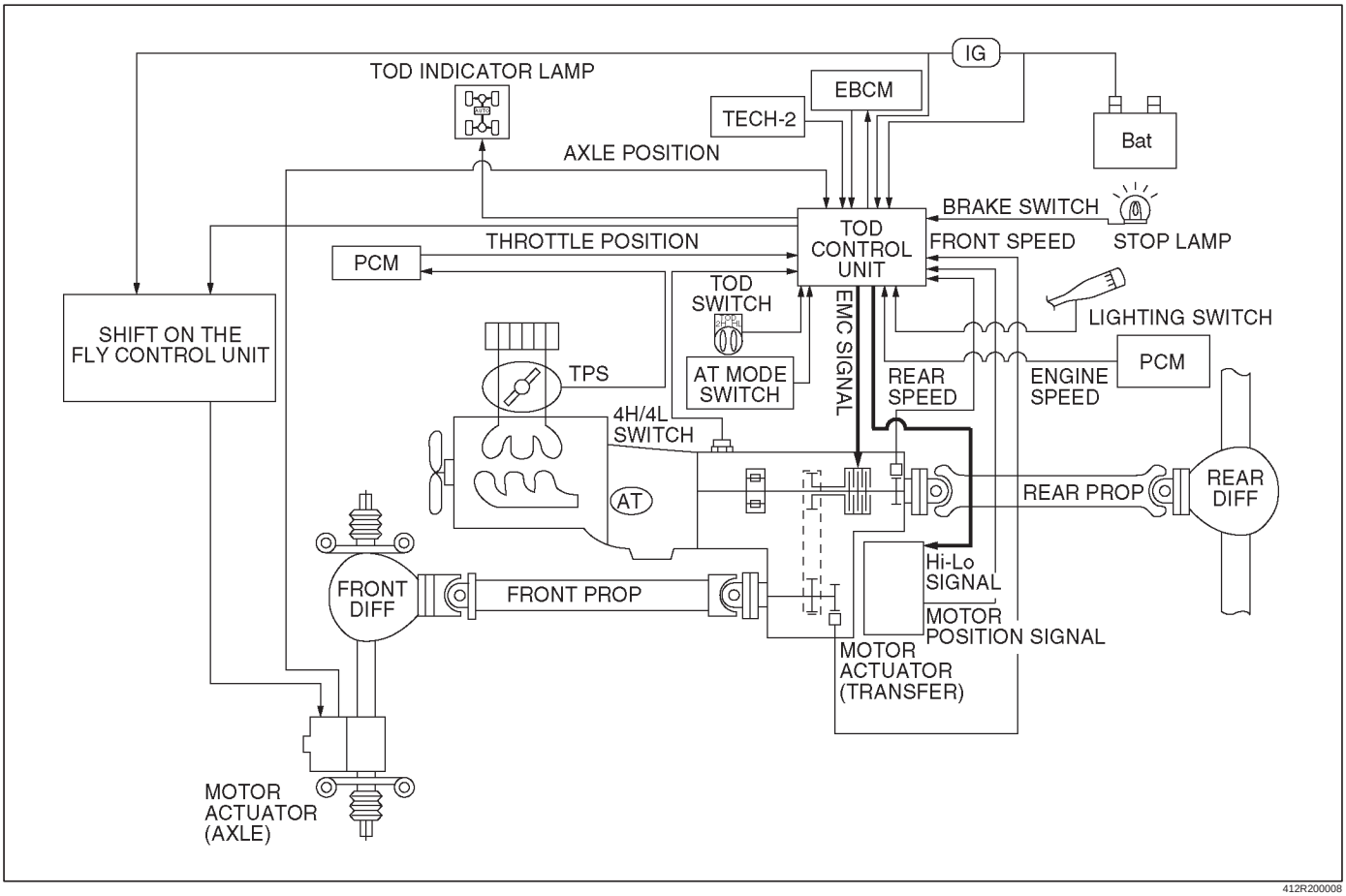
Service Precaution 4B2–1
General Description 4B2–2
Transfer Position and Drive Mode 4B2–2
TOD Control 4B2–3
TOD Indicator Control 4B2–3
Abbreviations 4B2–3
System Components 4B2–4
Parts Location 4B2–4
Front and Rear Speed Sensors 4B2–5
Electromagnetic Coil 4B2–5
Multi Plate Disk Clutch Pack 4B2–5
Mechanical Lock Sleeve 4B2–5
High-Low Planetary Gear Set 4B2–6
4H and 4L Switch 4B2–6
Transfer Connector (12-pin type) 4B2–6
Transfer Connector (8-pin type) 4B2–6
TOD Indicator Lamps (on the instrument panel) 4B2–7
Check Lamp 4B2–7
TOD ECU 4B2–8
High-Low Shift Motor 4B2–9
Motor Position and Encoder Position Code 4B2–10
Encode Position Plate 4B2–10
Shift High Range and Low Range 4B2–10
Functions of TOD Switch and Indicator Lamp 4B2–11
TOD Switch and Indication of Drive Mode . 4B2–11
Check Lamp 4B2–13
Diagnosis 4B2–14
General Information Diagnosis 4B2–14
Self-diagnosis 4B2–14
Precautions on Diagnosis 4B2–16
Basic Diagnostic Flow Chart 4B2–18
Parts Location 4B2–19
Circuit Diagram 4B2–20
Connector List 4B2–24
Checking Failed Pin 4B2–26
Connector Pin Assignment 4B2–26
Reference 4B2–28
Checking Failed TOD Control Unit Pin 4B2–30
Tech 2 Scan Tool 4B2–32
Getting Started 4B2–33
Operating Procedure 4B2–33
Diagnostic Trouble Codes 4B2–35
Diagnosis from Trouble Codes 4B2–36
Trouble Diagnosis Depending on The Status of TOD Indicator 4B2–67
Diagnosis from Symptom 4B2–102

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



TOD (Torque on Demand) system is traction state control system to vehicle.

Transfer Position and Drive Mode

Three drive modes can be selected through operation of TOD switch and transfer lever.

Transfer Position	TOD SWITCH	Mode	Drive mode
HIGH	2H	RWD	Rear wheel drive
	TOD	4WD (HIGH)	Electronically controlled torque split four wheel drive
LOW	4L	4WD (LOW)	Low-speed mechanical lock-up four wheel drive

The electronic control unit (ECU) judges the signals from the TOD switch and controls the transfer drive mode and shift-on-the-fly system status.

TOD Control

The TOD position usually drives the rear wheels, and transmits the torque to the front wheels with the help of electronically controlled torque split mechanism according to running conditions encountered. The driving force is directly transmitted to the rear wheels. This force is split by the transfer and delivered to the front wheels. The magnitude of the torque transmitted to the front wheels is controlled by changing the pressing force of the multi plate disk clutch built in the transfer unit. The pressing force of the clutch is controlled by changing the duty ratio to the electromagnetic coil mounted to the rear of the clutch. When the clutch is completely disengaged, the rear wheels are driven. When the clutch is completely engaged, a rigid four wheel drive mode is obtained. The torque split status is controlled continuously between the rear wheel and four wheel drive modes. This system includes front and rear speed sensors, and receives throttle position sensor and engine speed information from the PCM, ABS control unit signal, brake switch signal, and shift motor position information.

The control unit receives signals sent from these sensors and changes the pressing force of the multi-plate disk clutch to determine the torque distribution on the front and rear wheels. Therefore, when the slip of the rear wheels is increased against the current torque level in the normal rear wheel drive mode, the control unit detects the slip condition, determines the optimum torque based on the feedback control logic, and increases the torque to the front wheels.

The control unit uses the signal from the throttle position sensor to predict the future vehicle condition and the intention of the driver with respect to acceleration and deceleration, and determines the initial torque distribution using these data and the information from the speed sensors.

In case of small circle turning in the parking lot, for example, the control unit minimizes the clutch pressing force to restrict a braking phenomenon. When the ABS becomes active, the control unit optimizes the clutch pressing force to ensure stable braking.

TOD Indicator Control

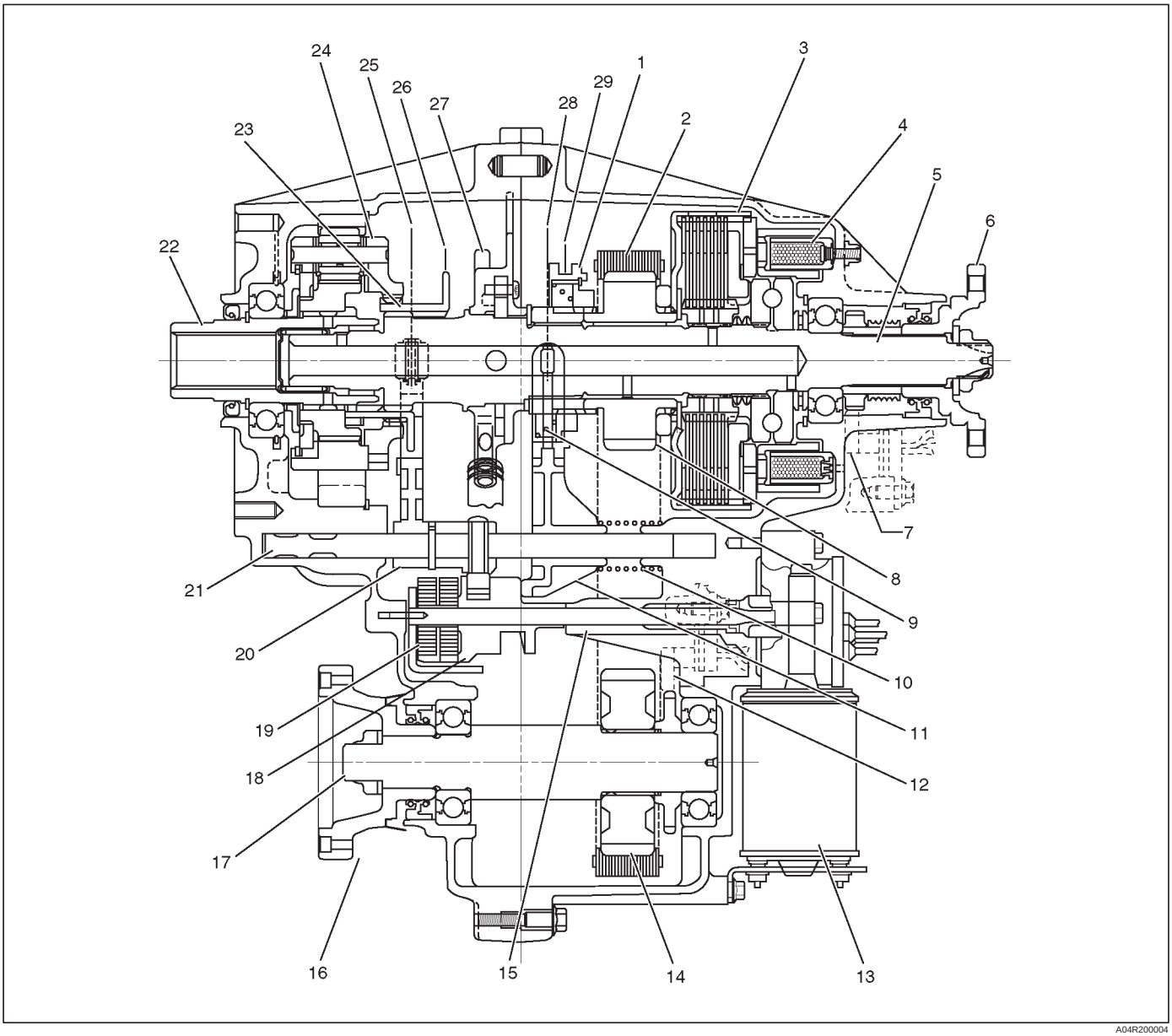
The TOD indicator on the instrument panel informs the driver of the current working status of the transfer unit. The information is the drive mode (2H, TOD, 4L, transition). The indicator can display occasional errors and corresponding error codes.

Abbreviations

ABS	Anti-lock Brake System
ADC	Axle Disconnect (Shift on the fly system)
VB	Battery Voltage
VIGN	Ignition Voltage

System Components

Parts Location



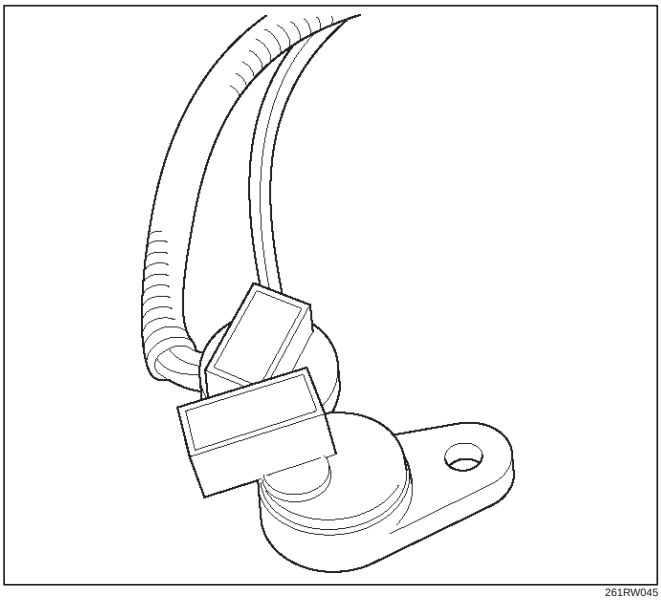
A04R200004

Legend

(1) Mechanical Lock Sleeve
(2) Drive Chain
(3) Clutch Pack
(4) Electromagnetic Clutch Solenoid
(5) Output Shaft
(6) Rear Output Coupling
(7) Rear Speed Sensor
(8) Drive Sprocket
(9) Spring
(10) Return Spring
(11) Lockup Shift Fork
(12) Front Speed Sensor
(13) High-Low Shift Motor
(14) Driven Sprocket
(15) Shift Shaft
(16) Front Output Coupling
(17) Front Output Shaft
(18) Shift Cam
(19) Torsional Spring
(20) High-Low Shift Fork
(21) Shift Rod
(22) Input Shaft
(23) Reduction Hub
(24) High-Low Planetary Gear
(25) High Position
(26) Low Position
(27) Oil Pump
(28) Free Position
(29) Lock Position

Front and Rear Speed Sensors

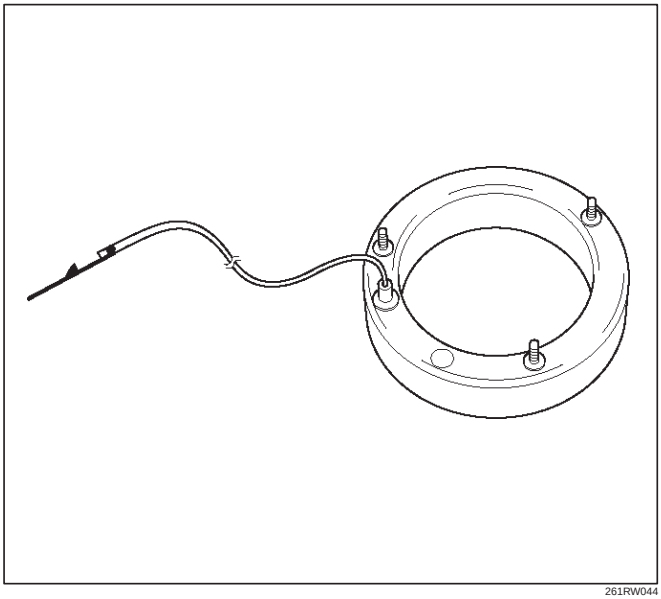
The sensors are built in the transfer case, and detect the rotation of rotors directly coupled to the propeller shafts. Thirty rectangular pulses are output per one rotation of the propeller shaft.



261RW045

Electromagnetic Coil

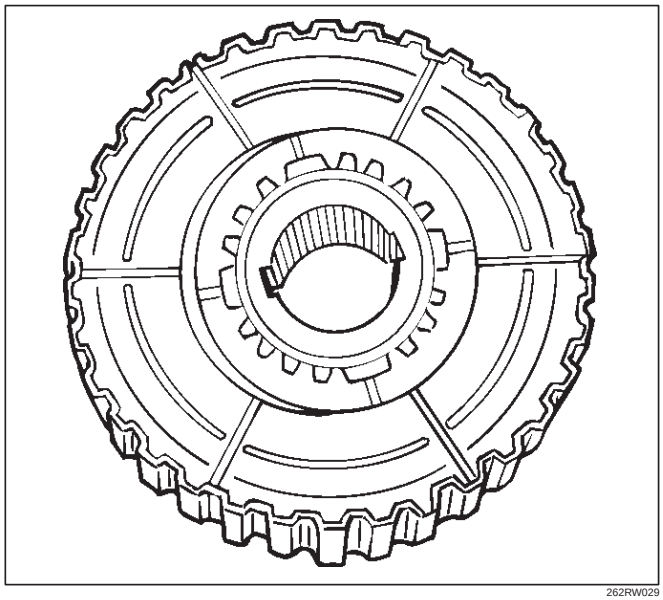
Receives the duty signals from the TOD control unit and controls the pressing force of the clutch pressure cam.



261RW044

Multi Plate Disk Clutch Pack

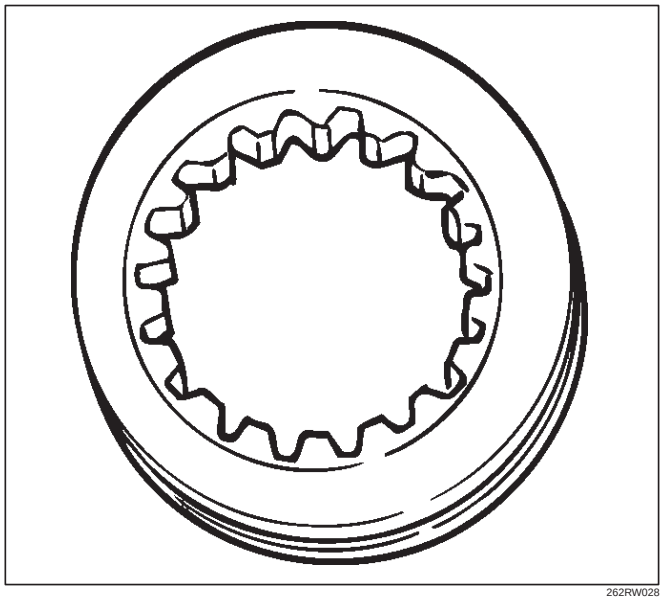
Transmits the torque determined by the clutch pressing force to the front propeller shaft via the front drive chain.



262RW029

Mechanical Lock Sleeve

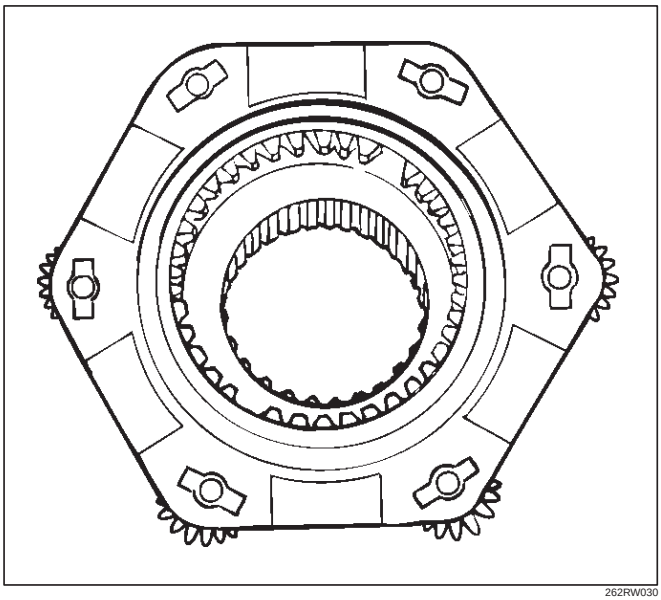
Couples the front and rear propeller shaft mechanically when the transfer shaft is in the 4L position.



262RW028

High-Low Planetary Gear Set

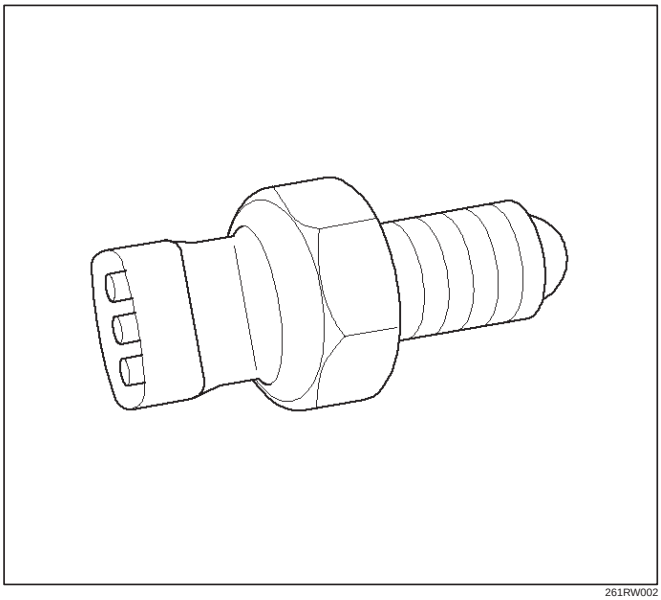
Establishes an auxiliary transmission mechanism. When the TOD switch is set to the 2H or TOD position, the reduction gear ratio is 1.000 and the corresponding driving force is generated. When the TOD switch is set to the 4L position, the reduction gear ratio is 2.480 and the corresponding driving force is generated.



262RW030

4H and 4L Switch

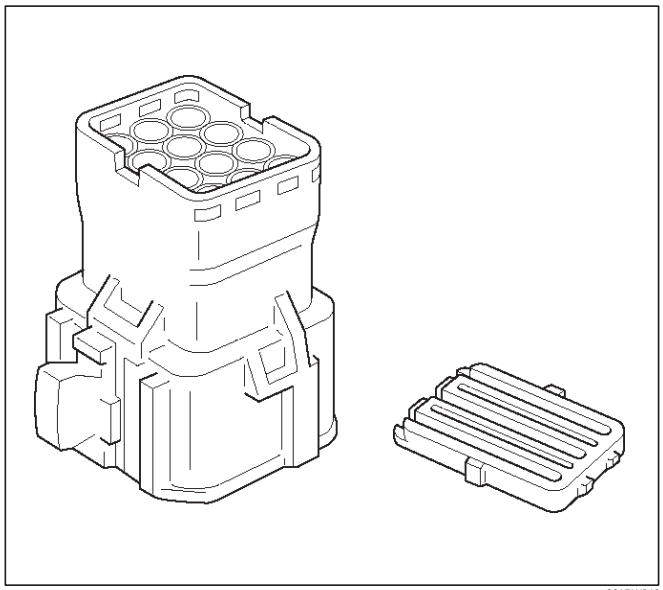
Detects the shift position of the transfer from the movement of the shift rod and outputs signals to the TOD control unit.



261RW002

Transfer Connector (12-pin type)

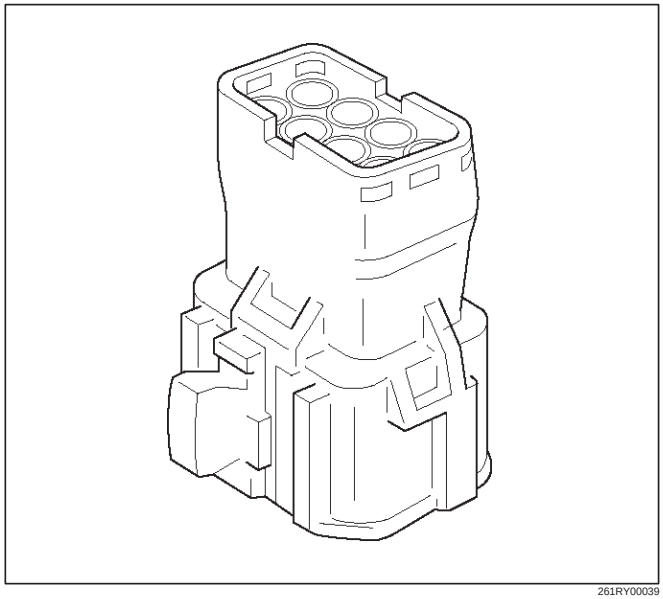
Transmits the input and output signals of the speed sensors, electromagnetic coil, and 4H and 4L switche to the vehicle harness. A waterproof 12-pin type is used.



261RW046

Transfer Connector (8-pin type)

Transmits the output signals of the shift motor position to the vehicle harness and power for the shift motor to the transfer. A waterproof 8-pin type is used.

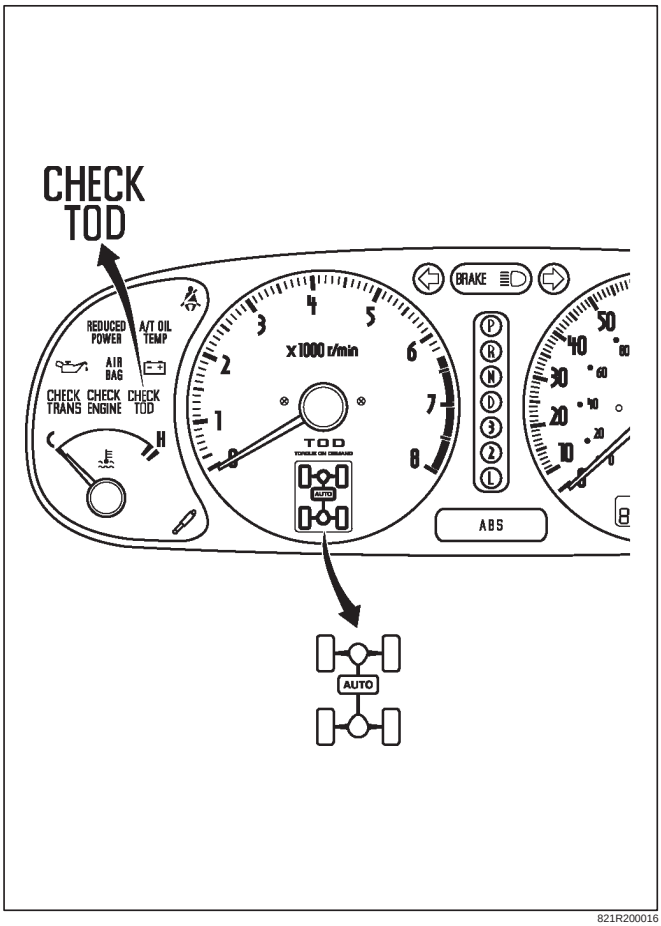


261RY00039

TOD Indicator Lamps (on the instrument panel)

Inform the following items.

- ▼Bulb check
- ▼Drive mode
- ▼ABS IN status
- ▼BRAKE ON status

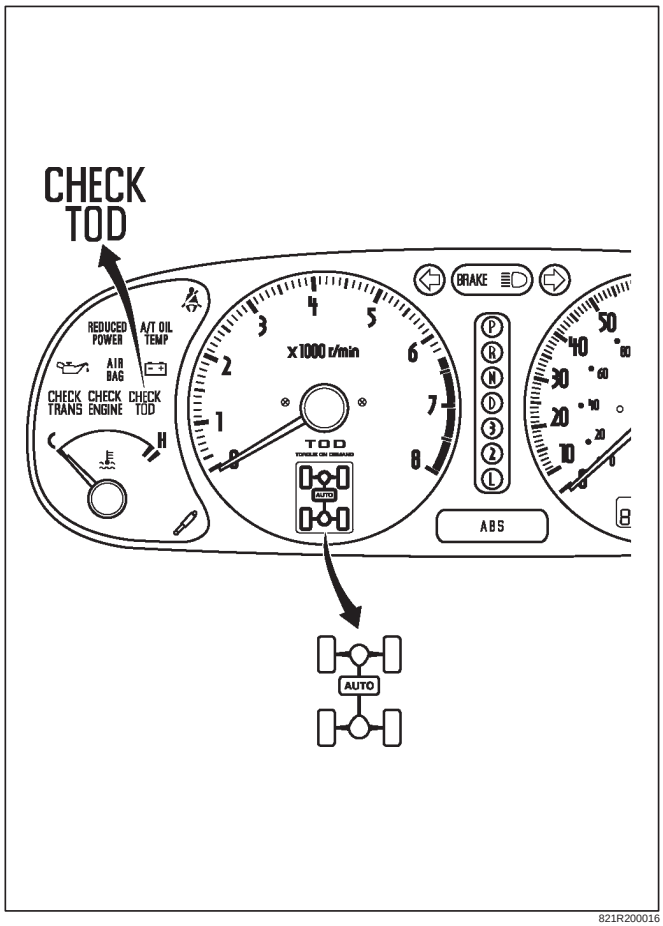


821R200016

Check Lamp

Inform the following items.

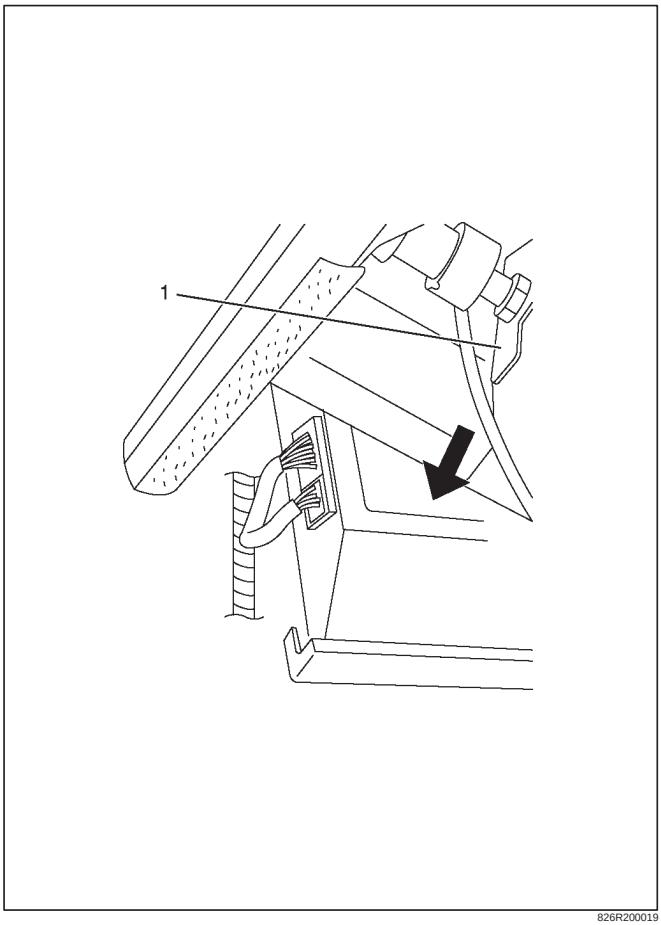
- ▼Bulb check
- ▼Fail (fail alarm)
- ▼Trouble code



821R200016

TOD ECU

This control unit is mounted to the clutch pedal position via a special bracket.

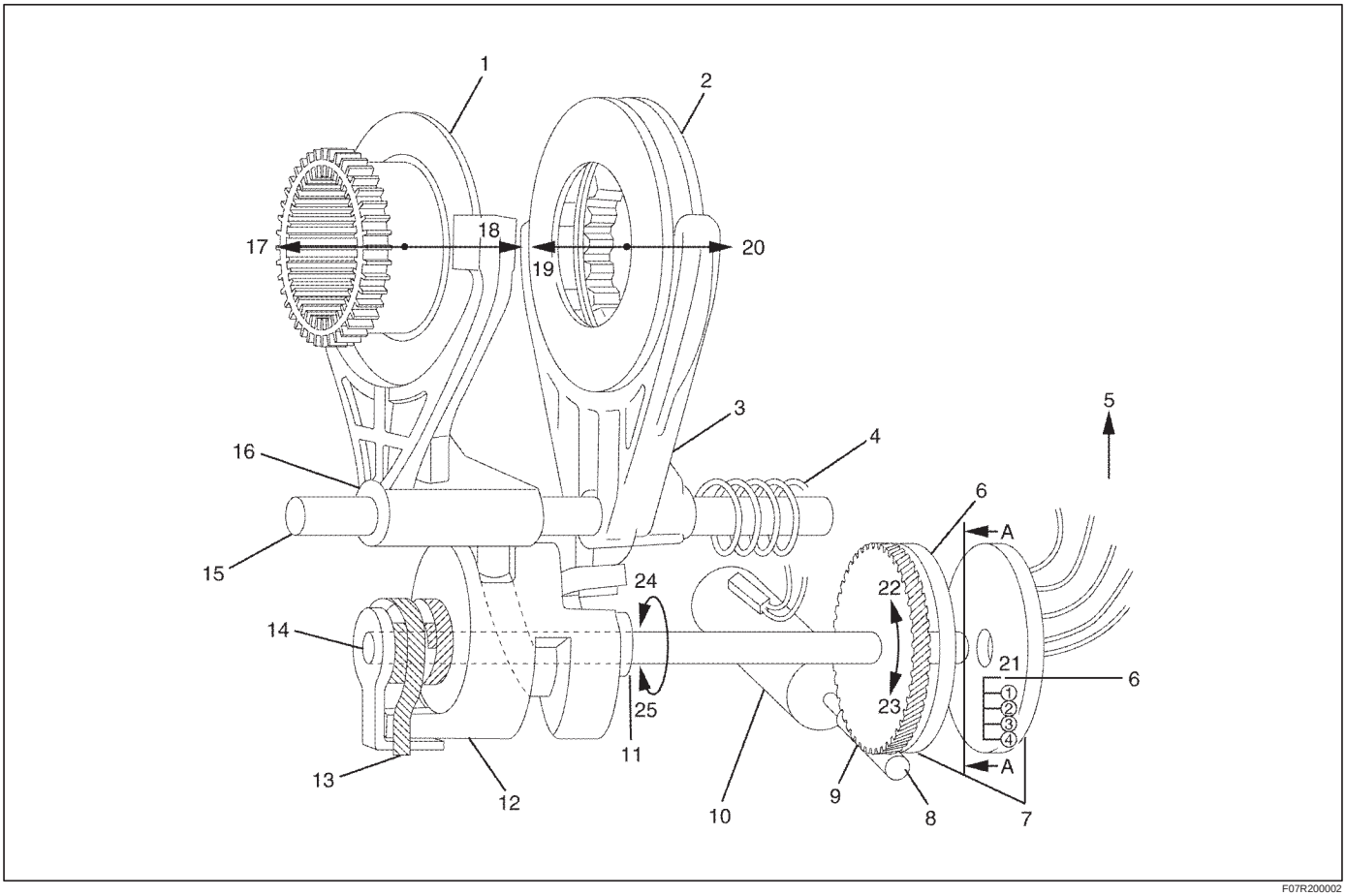


826R200019

Legend

(1) Brake Pedal Bracket

High-Low Shift Motor



F07R200002

Legend

(1) Reduction Hub
(2) Mechanical Lock Sleeve (Including the built-in Spring)
(3) Lockup Shift Fork
(4) Return Spring
(5) To TOD Control Unit
(6) Fixed Contact Point
(7) Encoder
(8) Worm gear
(9) Rotate
(10) Shift Motor
(11) The shift cam (12) can be turned freely around the shift shaft (14).
(12) Shift Cam
(13) Torsional Spring
(14) Shift Shaft
(15) Shift Rod
(16) High-Low Shift Fork
(17) High
(18) Low
(19) 2H and TOD Position
(20) Direct Four Wheel Drive (4L Position)
(21) Earth
(22) High
(23) Low
(24) High
(25) Low

When the TOD switch is changed to the 4L (or TOD) position from the TOD (or 4L) position, the TOD control unit drives the high–low shift motor according to the signal. The transfer is shifted to low range from high range (or to high range from low range) by the shift motor.
The high-low shift motor can run, only when the operation meets the following conditions to prevent an unexpected shift between high and low range by a operation error.

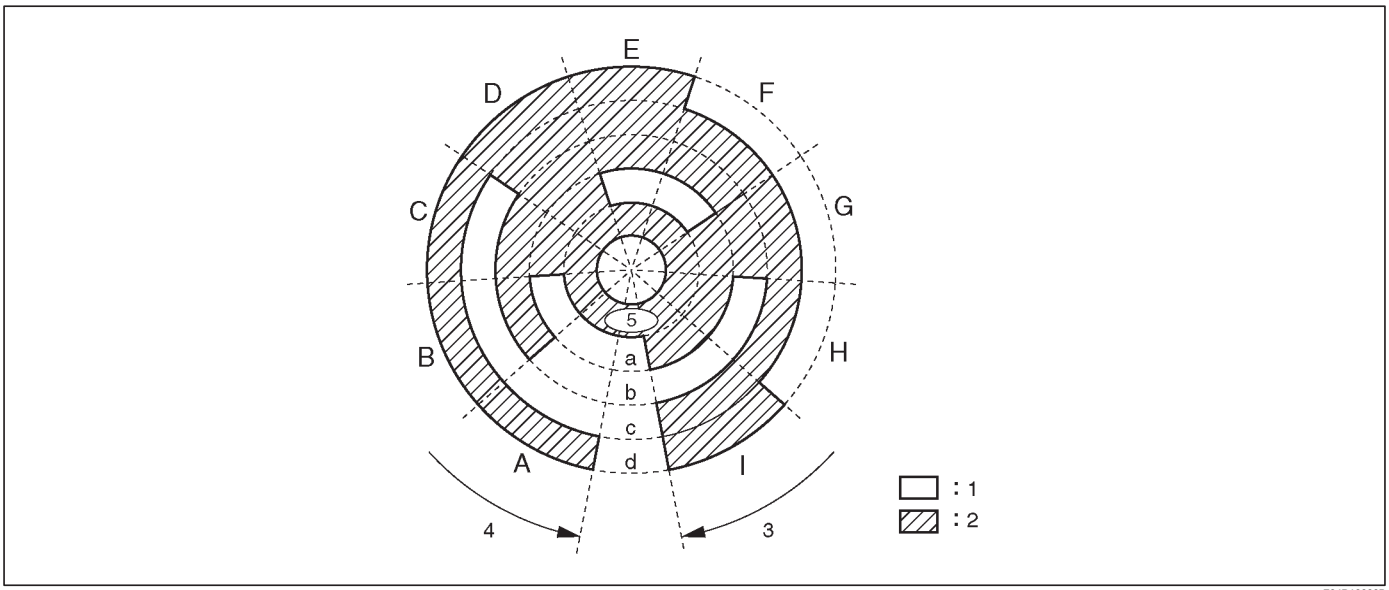
1. The car stops. (less than 2 km/h or 1.2 mph and less than 1500 rpm.)
2. The AT selector position is neutral.
3. The brake is applied. (brake switch is on.)

The shift motor has a built-in encoder which watches motor rotation position. The control unit controls the rotation of the shift motor based on the position code detected by the encoder.
The encoder position plate turns together with the shift shaft and switches on or off the current from the 4 (four) fixed contact points on the case, then the control unit recognizes the rotation position of the shift motor.

Motor Position and Encoder Position Code

High-Low Shift Motor Position		High-Low shift Motor Encoder Signal				State of Motor
		Position a	Position b	Position c	Position d	
High End	A	OFF	OFF	OFF	ON	High Position
Near High End	B	OFF	ON	OFF	ON	
High Position	C	ON	ON	OFF	ON	
Middle Zone (1)	D	ON	ON	ON	ON	
Middle Zone (2)	E	OFF	ON	ON	ON	
Neutral Position	F	OFF	ON	ON	OFF	
Middle Zone (3)	G	ON	ON	ON	OFF	
Low Position	H	ON	OFF	ON	OFF	Low Position
Low End	I	ON	OFF	ON	ON	

Encode Position Plate



F04R100005

Legend

(1) OFF Aria
(2) ON Aria
(3) Low
(4) High
(5) Earth

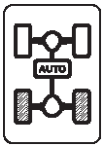
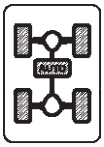
Shift High Range and Low Range

When the car is stops (less than 2km/h or 1.2 mph and less than 1500 rpm), the AT selector position is neutral, the brake is applied, and the TOD switch is changed to 4L from TOD (or to TOD from 4L), the high-low shift motor starts by power applied from the TOD control unit and turns the shift shaft through the worm gear.
The shift shaft turns the shift cam through the torsional spring.
The end of the shift cam moves the lockup shift fork and the spiral groove on the outside of the shift cam slides the high–low shift fork.

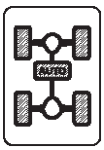
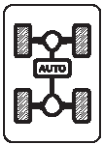
Functions of TOD Switch and Indicator Lamp

TOD Switch and Indication of Drive Mode

The TOD switch sends signals to the TOD control unit which selects drive modes and controls the shift on the fly system (axle disconnect : ADC).

TOD switch state	Drive mode	Transfer shift condition	Transfer position detection		Shift on the fly		TOD indicator state
			4HSW	4LSW	Axle SW	ADC circuit	
2H	Rear-wheel drive (RWD)	Permissible during driving (less than 100 km/h or 62 mph)	OFF	OFF	OFF	Turning on electricity	
TOD	Electronic torque split 4WD (TOD)		OFF	OFF	ON	Turning off electricity	
		AT: Neutral Brake: Applied The car stops (less than 2 km/h or 1.2 mph and less than 1500 rpm)					
4L	Low range mechanical direct 4WD (4L)		OFF	ON	ON	Turning off electricity	

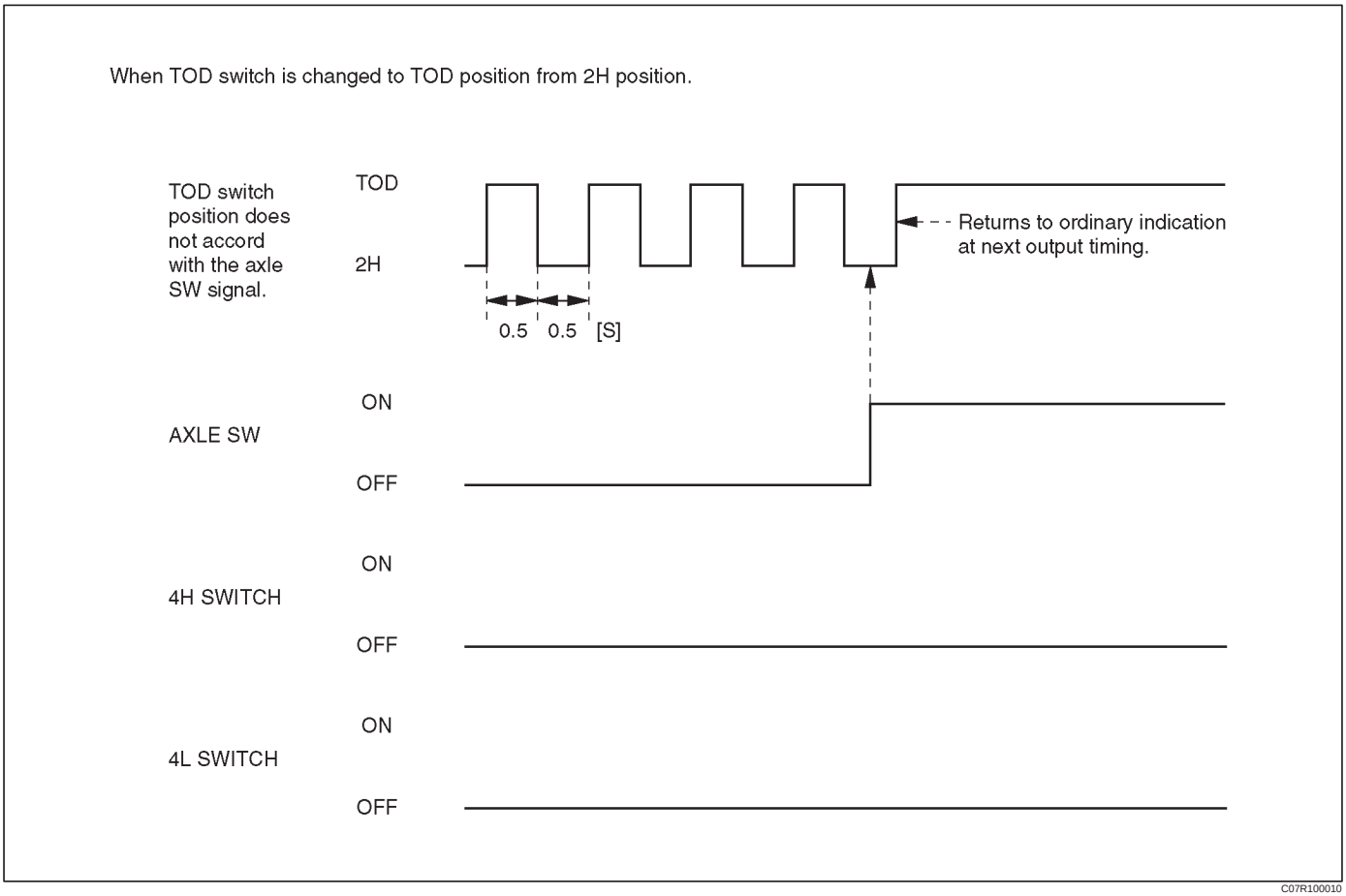
ADC: Shift on the fly
SW: Switch

TOD Switch state	TOD control unit terminal No.					TOD indicator state
	TOD indicator			TOD switch		
	7(Front)	8(Rear)	19(Auto)	30(2H)	43(4L)	
2H	OFF	ON	OFF	ON	OFF	
TOD	ON	ON	ON	OFF	OFF	
4L	ON	ON	OFF	OFF	ON	

Indication During Transition of Shift Rod

When the TOD switch is turned, and the signals from the AXLE switch do not comply with the signal conditions of the 4H and 4L switch, the indicator lamp state selected on the TOD switch and light-off mode are repeatedly output at an interval of 1.0 second.

NOTE: After the TOD switch is turned to the specified position and the AXLE switch generates compliant signals, the normal output status is returned.

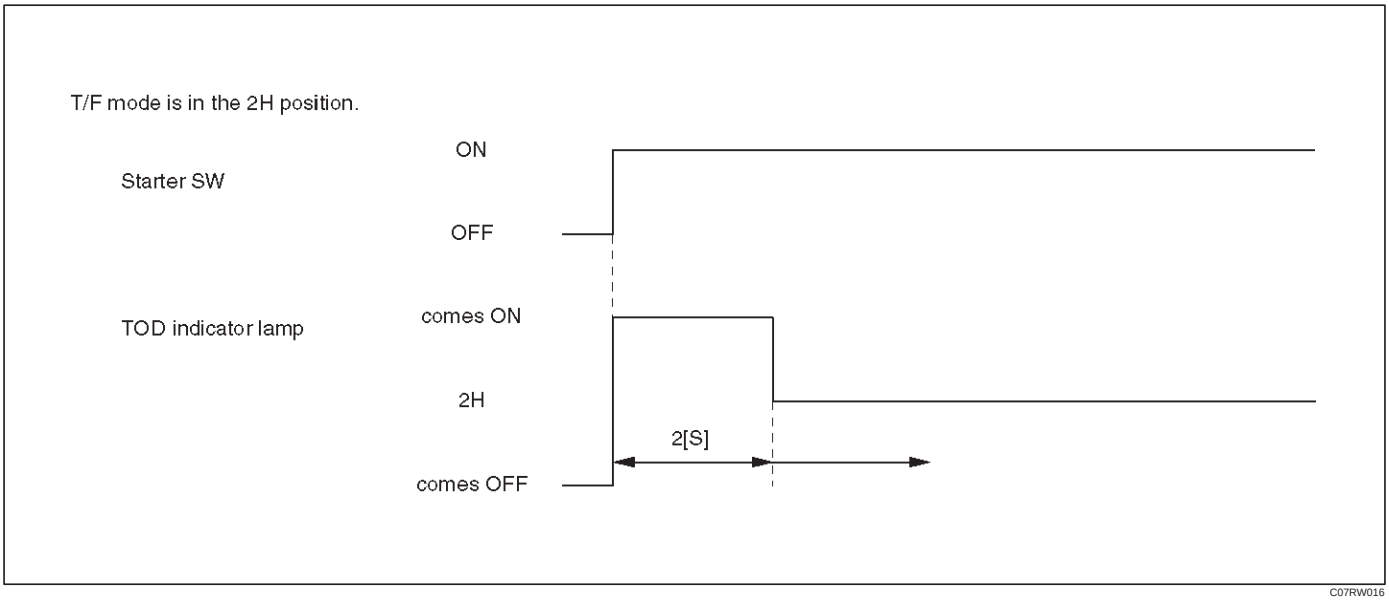


C07R100010

Bulb Check

When the starter switch is turned on, the TOD indicator lamps go on as shown below.

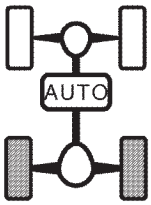
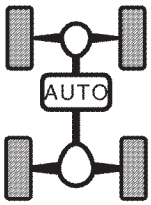
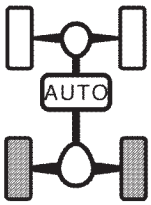
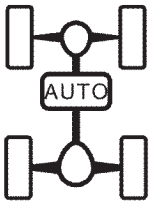
NOTE: Once the starter switch is turned on, all the TOD indicator lamps are lit for two seconds even if the TOD switch is in any position.



C07RW016

Simplified checking method of ABS IN and BRAKE ON signals:

In the event that any of the signal inputs listed below are observed while the self-diagnostic code is being displayed (the self-diagnostic connector is short-circuited to GND), you can simply check the ABS IN and BRAKE ON signals as shown in the figures below.

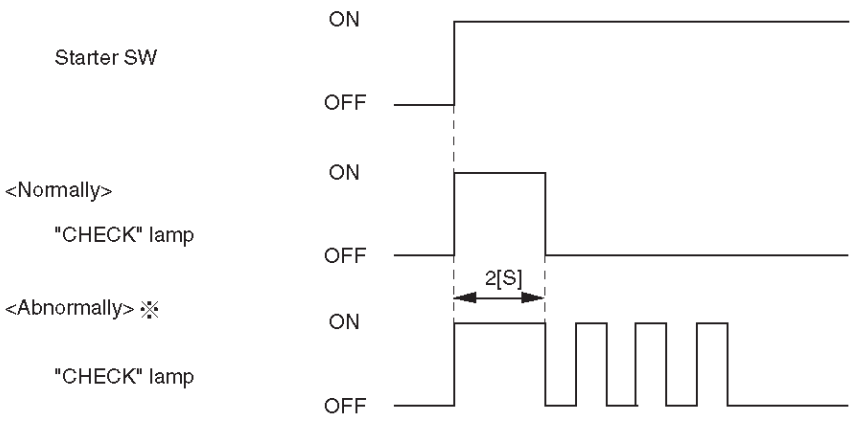
1		• In case of ABS signal being inputted, TOD indicator will light as illustrated.
2		• In case of BRAKE ON signal being inputted, TOD indicator will light as illustrated.
3		• When both the ABS and BRAKE ON signals are inputted simultaneously, ABS signal is indicated.
4		• In cases other than “1, 2, 3”, the indication is always as illustrated. (This is light-off mode) • TOD indicator light returns to usual control (mode) at 12 km/h or more.

C07R200002

Check Lamp

Check Lamp Bulb Check

When the starter switch is turned on in the normal state, the control unit turns on the CHECK lamp to check the bulb.



C07RW019

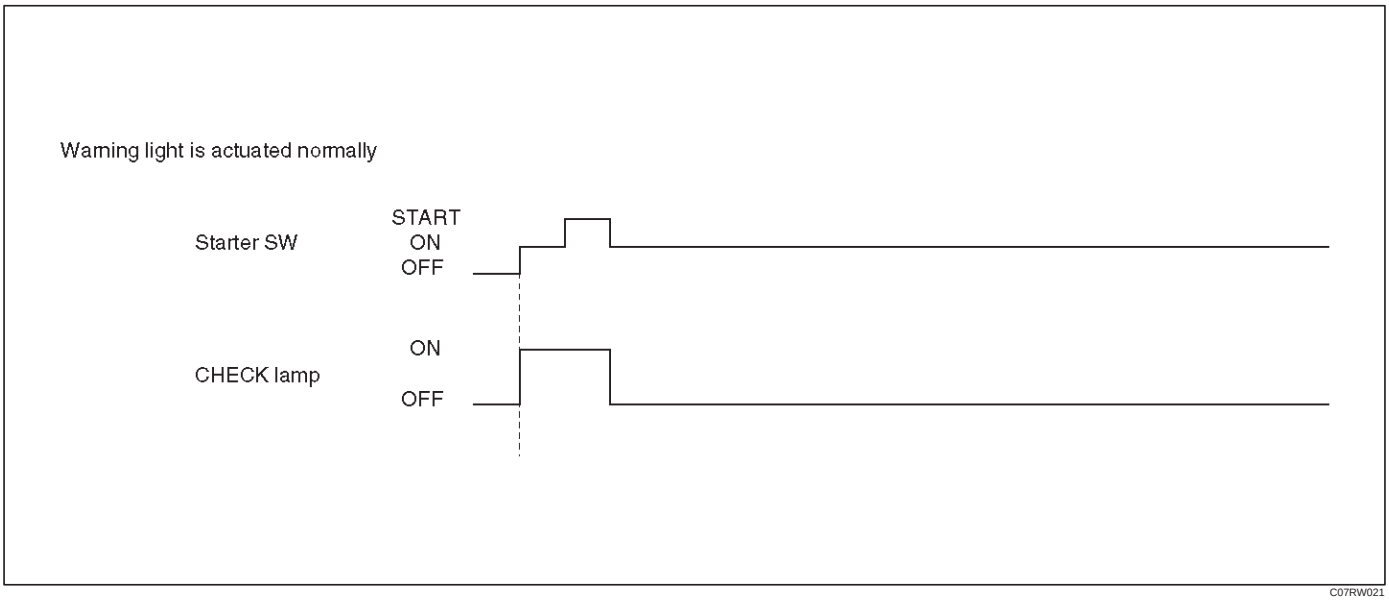
Diagnosis

General Information Diagnosis

The troubles on TOD are classified into the group that can be identified by the lighting status of the TOD indicator lamps and those that can be recognized as abnormal phenomena of the vehicle by the driver.
The troubles that can be identified by the lighting status of the TOD indicator lamps are examined by the procedures “Diagnosis from Trouble Codes” and “Trouble Diagnosis Depending on The Status of TOD Indicator”. The troubles that can be recognized as abnormal phenomena of the vehicle by the driver are examined by the procedure “Diagnosis from symptom”.

Self-diagnosis

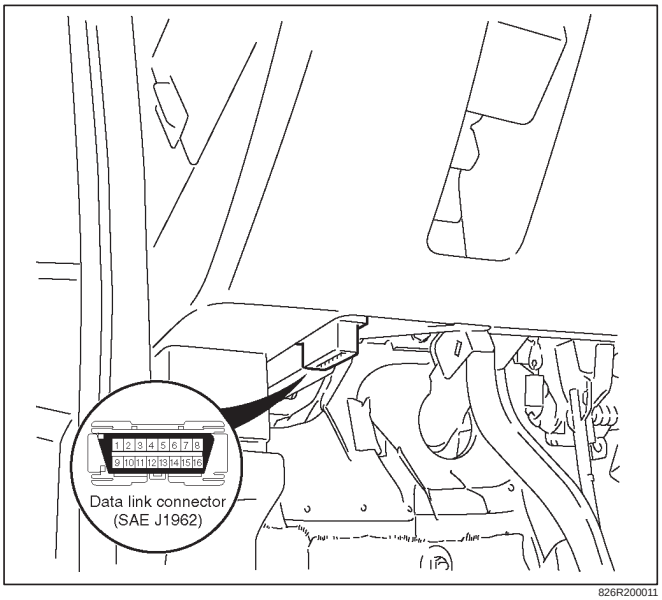
The control unit has a function of self-diagnosis. If a trouble occurs in the course of system startup, the control unit blinks the CHECK lamp and saves the trouble code.



NOTE: If an intermittent fault occurs, the control unit stops blinking upon removal of the fault. The trouble code is saved to the control unit.

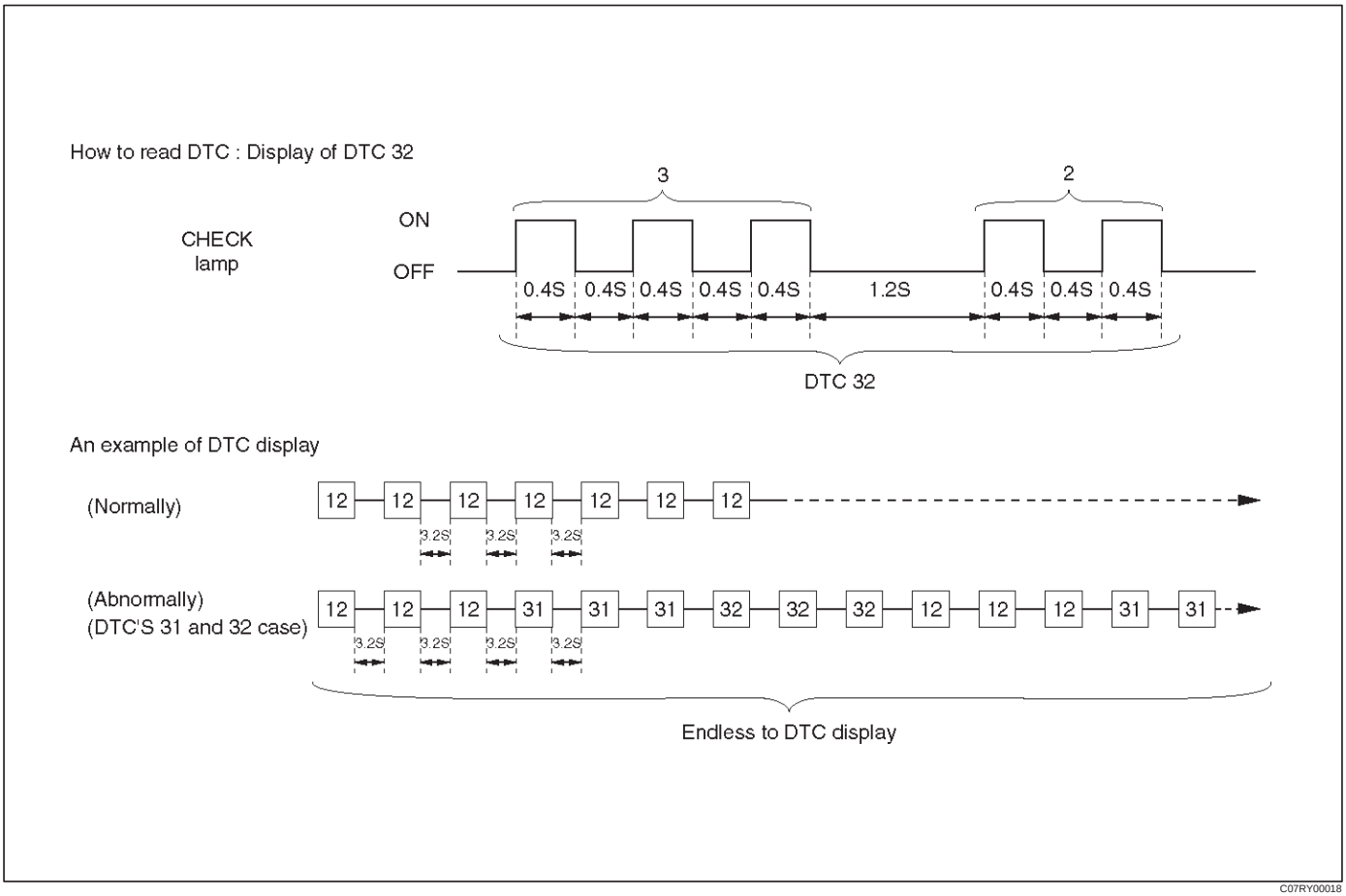
Indication Method of Trouble Code

- ▼ Turn on the starter switch, while the engine does not start.
- ▼ Short-circuit terminal 8 of the self-diagnostic connector to GND (terminal 4 or 5) to display the trouble code on the CHECK lamp.



826R200011

- ▼ If no trouble codes exist, code “12” is displayed continuously.
- ▼ If trouble codes exist, code “12” is displayed three times, and the trouble codes, starting from the smaller code number, are displayed three times respectively.

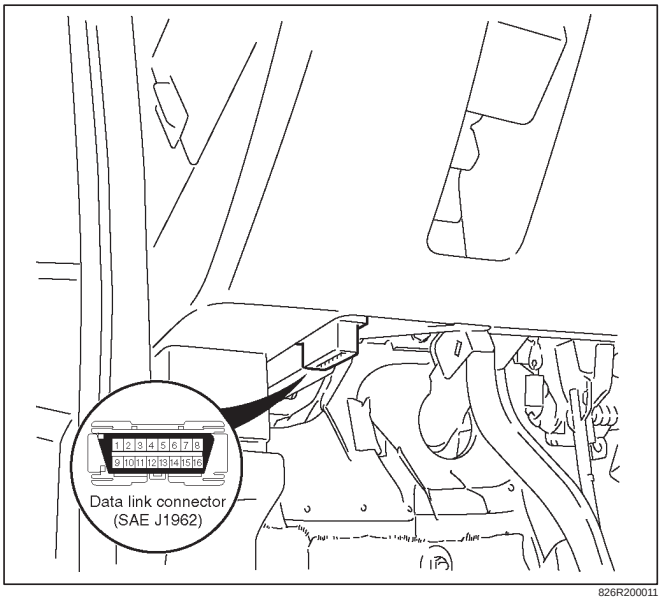


C07RY00018

How to Clear The Trouble Code

The trouble codes saved to the control unit can be deleted by the following procedure if the starter switch is being in the OFF position.

1. Short-circuit terminal 8 of the self-diagnostic connector to GND (terminal 4 or 5).
2. Turn on the starter switch while maintaining the state of step1, and stop short-circuiting terminal 8 to GND within five seconds.



826R200011

3. If the conditions shown in steps 1 and 2 are met, the trouble codes saved to the control unit are cleared. (After the codes are completely deleted, the code 12 that indicates the normal condition is continuously displayed.)

Precautions on Diagnosis

Replacement of Control Unit

The control unit itself rarely fails. In most cases, the harnesses have failed (i.e. short-circuit) to cause secondary troubles. Other cases include that the cause has been unknown due to intermittent occurrence of troubles and the troubles are removed accidentally along with replacement of control unit, resulting in misjudgment of cause. Therefore, before replacing the control unit, check the connector joints and whether the unspecified current flows in the control unit due to short-circuit between harnesses.

Trouble Intermittently Observed

Troubles intermittently observed are mostly attributable to temporary imperfect connection of harnesses and connectors.

When such troubles are found, check the associated circuit according to the following procedure.

1. Check whether improper connectors are plugged in or connector terminals are completely engaged.
2. Check whether the terminals are deformed or damaged. If yes, remove the deformation or damage and connect the terminals securely.
3. It is likely that wires in the harness are falsely broken. Therefore, in examination of failed harness circuit, shake the harness for check to such extent that the harness will not be damaged.

Test Run of Failed TOD Vehicle

If the TOD indicator lamps experienced faulty operation even once in the past, the failed portion can be identified by use of the procedure “Diagnosis from Trouble Codes” or “Trouble Diagnosis Depending on the Status of TOD Indicator”. If the troubles that are only recognized as abnormal phenomena of the vehicle by the driver are observed, conduct the test run in the following procedure to reproduce the faulty phenomena and diagnose the fault for each phenomenon.

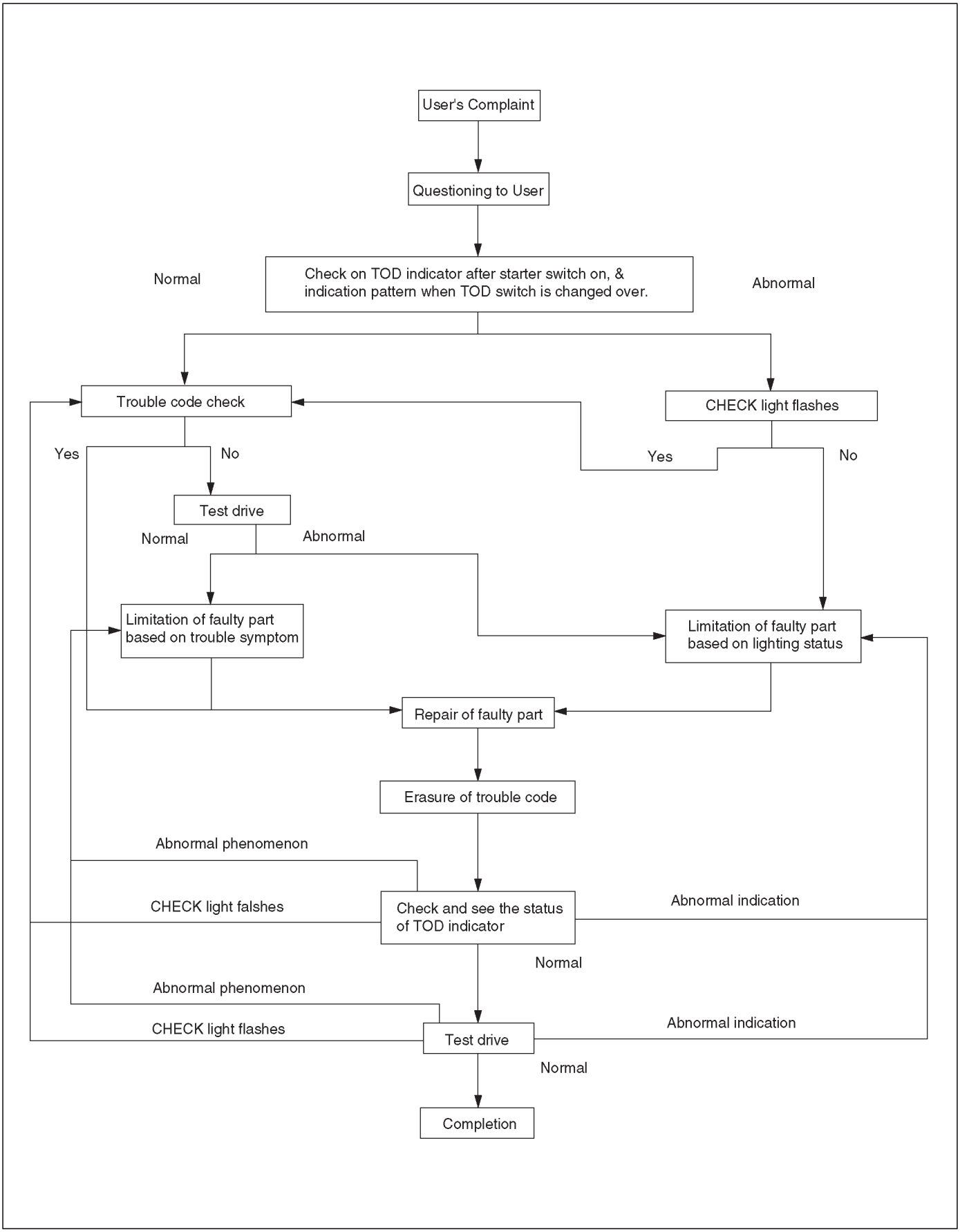
1. Start the engine, and check that the TOD indicator lamps are turned on for about two seconds for initial check; the CHECK lamp goes off; and the TOD indicator lamps display the specified drive mode. (If the CHECK lamp starts blinking, read the trouble codes and identify the failed portion.)
2. While keeping the vehicle standstill, operate the TOD switch to change the modes: 2H mode→TOD mode→4L mode→TOD mode→2H mode. Check that the TOD indicator lamps correctly display the status whenever the mode is changed. If the transition status is displayed during the shift operation, run the vehicle a little to complete shifting.
3. Slowly start the vehicle in the TOD mode, and add the power to accelerate to at least 40 km/h (25 mph)and maintain the speed for about two minutes. Apply the brake to completely stop the vehicle. Repeat this test pattern at least three times.
4. Turn the steering to the right end (or left end) in the TOD mode, and slowly start the vehicle and make a circle five times. Next, conduct the same test in the 2H mode.
5. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h (25 mph). Keep the established speed, carefully change the mode in the sequence “TOD mode→2H mode →TOD mode” while checking that the shift is complete in each mode change. After the test, apply the brake to completely stop the vehicle.
6. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h (25 mph). Apply the brake strongly so that the ABS works, and completely stop the vehicle.
7. Slowly start the vehicle in the 4L mode, and accelerate to at least 20 km/h (13 mph). Apply the brake to completely stop the vehicle.

If the CHECK lamp starts blinking during the test run, read the trouble codes and give appropriate maintenance according to the diagnostic procedure. If the TOD indicator lamps are lit abnormally during the run, check the lighting condition and give appropriate maintenance according to the diagnostic procedure. Even if the phenomena are not observed, try to reproduce the abnormal state reported by the customer to the possible extent.

Post-Repair Check

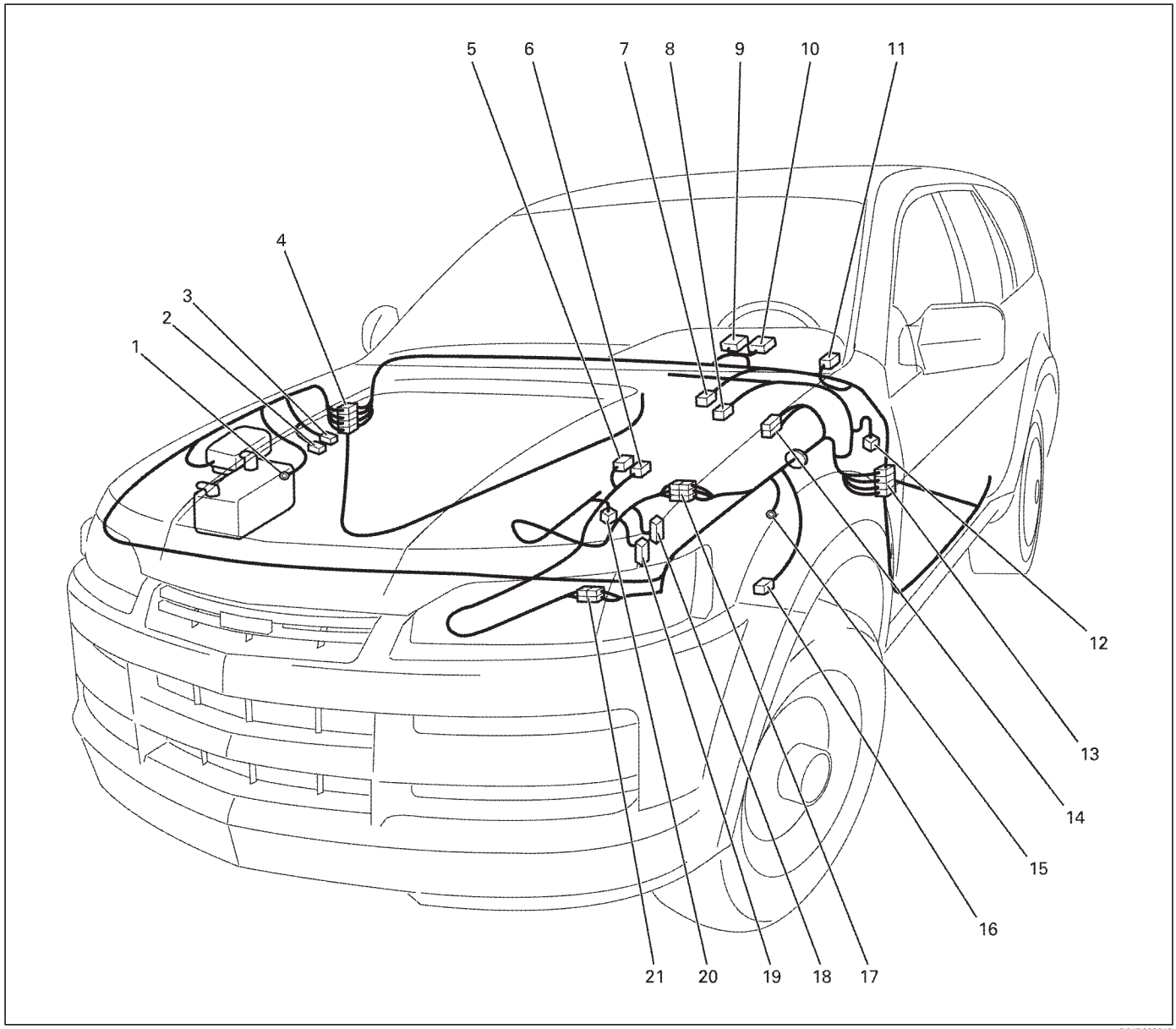
As long as the starter is not turned off, the TOD indicator lamps continue blinking even after the failed portion is repaired. Therefore, upon completion of repair, be sure to turn off the starter switch once and then turn on it to conduct the test run sequence specified in steps 1 through 7 above and check that the TOD indicator lamps no longer show any faulty status.

Basic Diagnostic Flow Chart



C07R100011

Parts Location

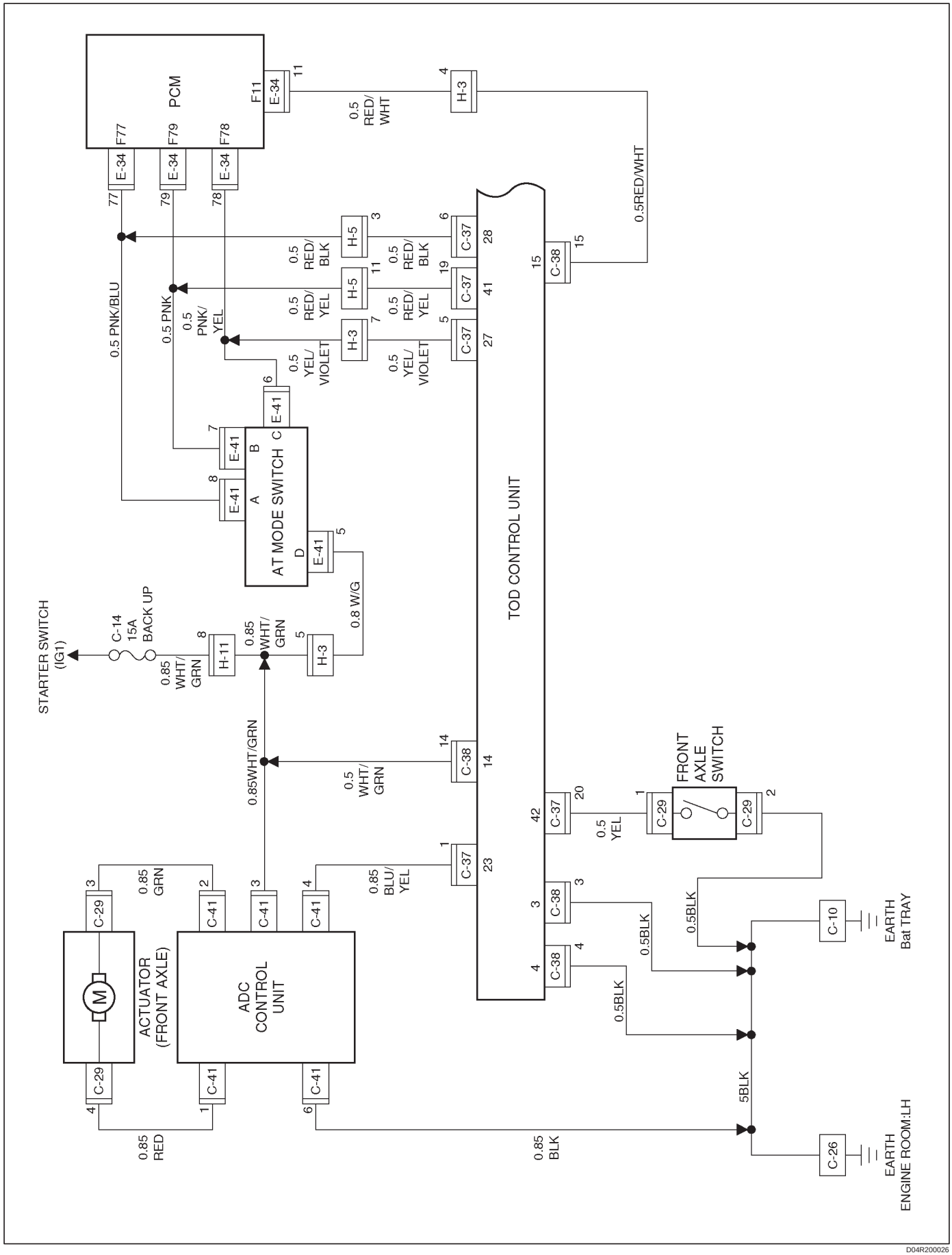


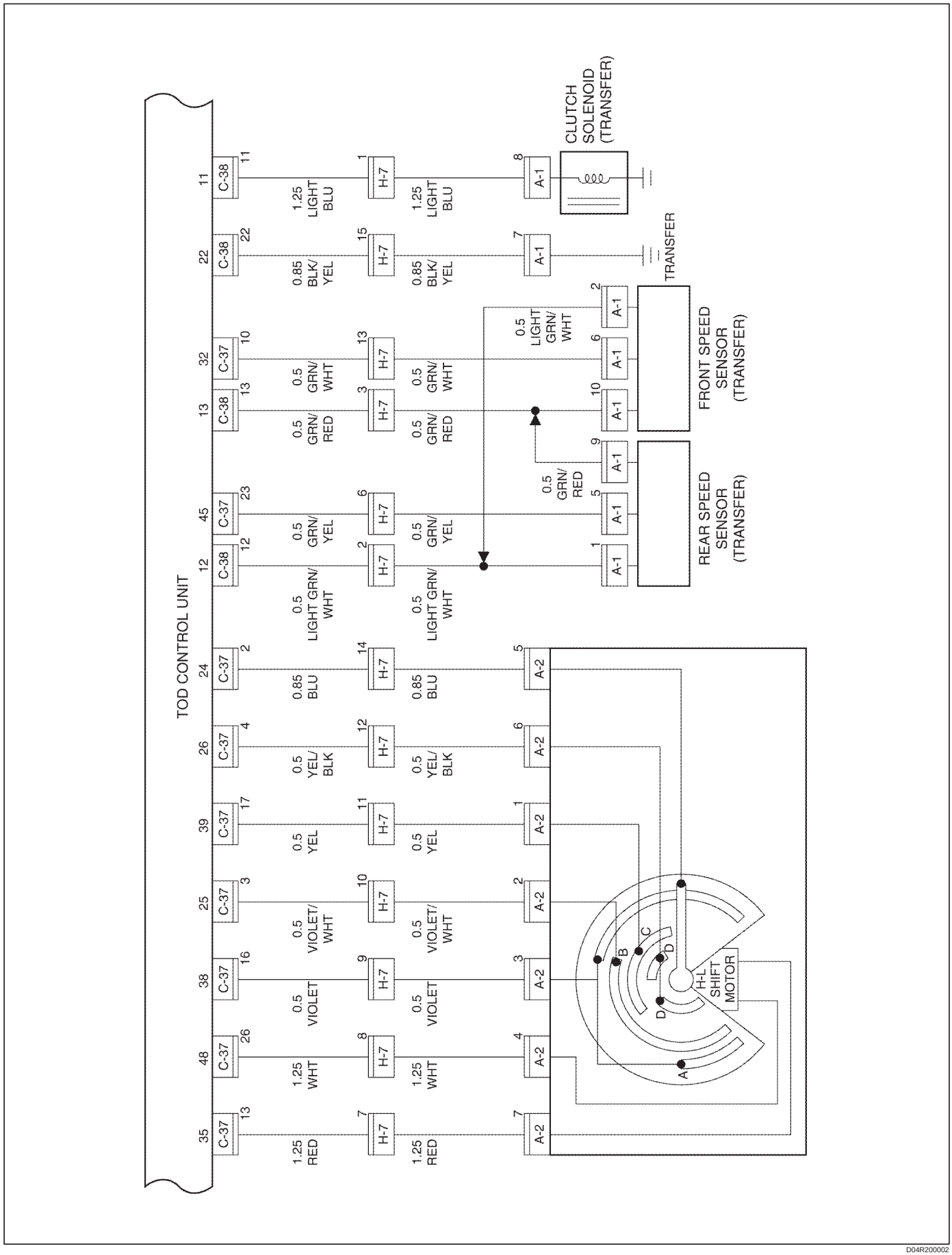
D04R200019

Legend

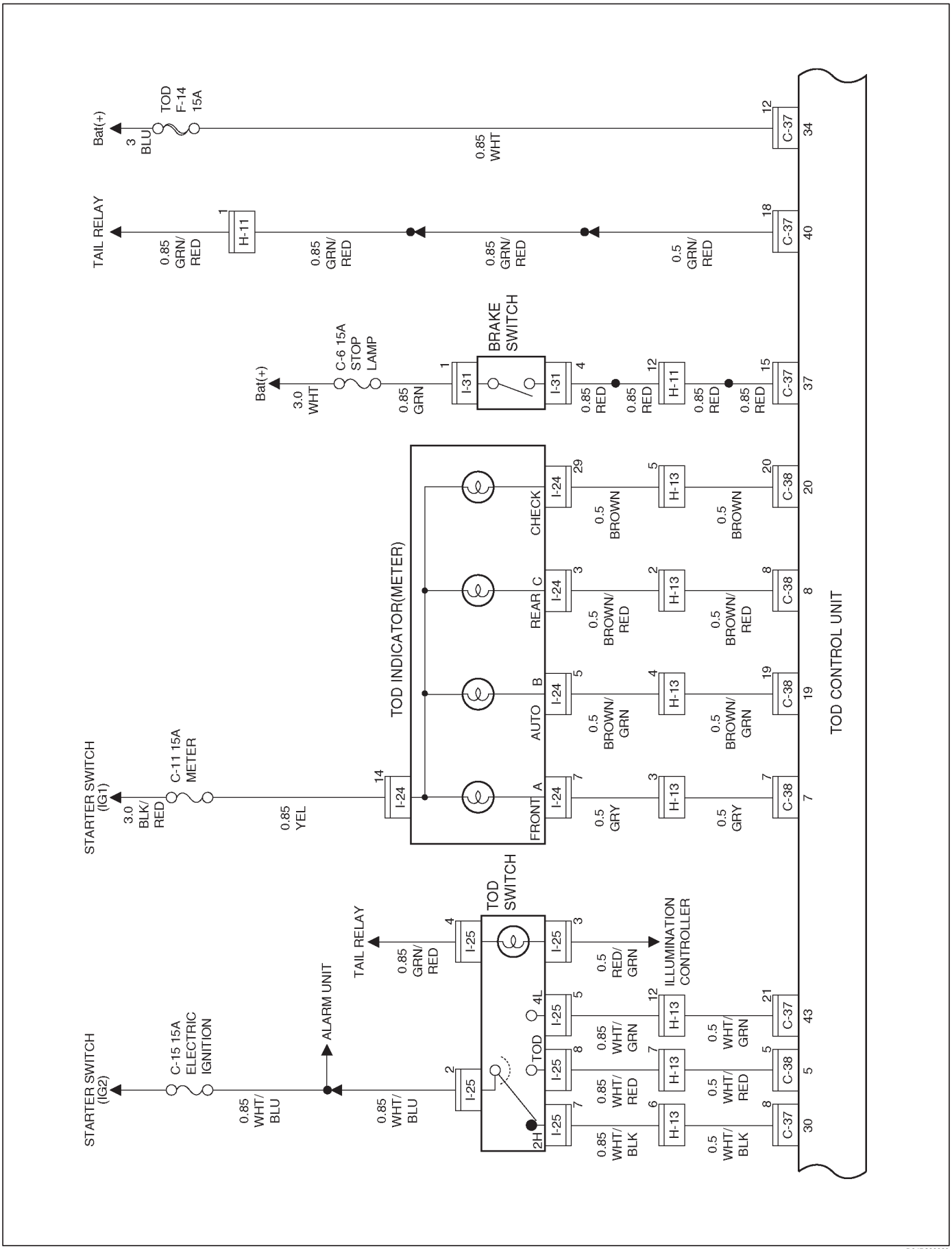
(1) C–10
(2) C–6
(3) C–5
(4) H–13 H–14
(5) A–1
(6) A–2
(7) I–31
(8) C–41
(9) I–23
(10) I–24
(11) I–25
(12) C–39
(13) H–10
(14) C–37 C–38
(15) C–26
(16) C–29
(17) H–3 H–5
(18) E–35
(19) E–34
(20) E–41
(21) H–7

Circuit Diagram

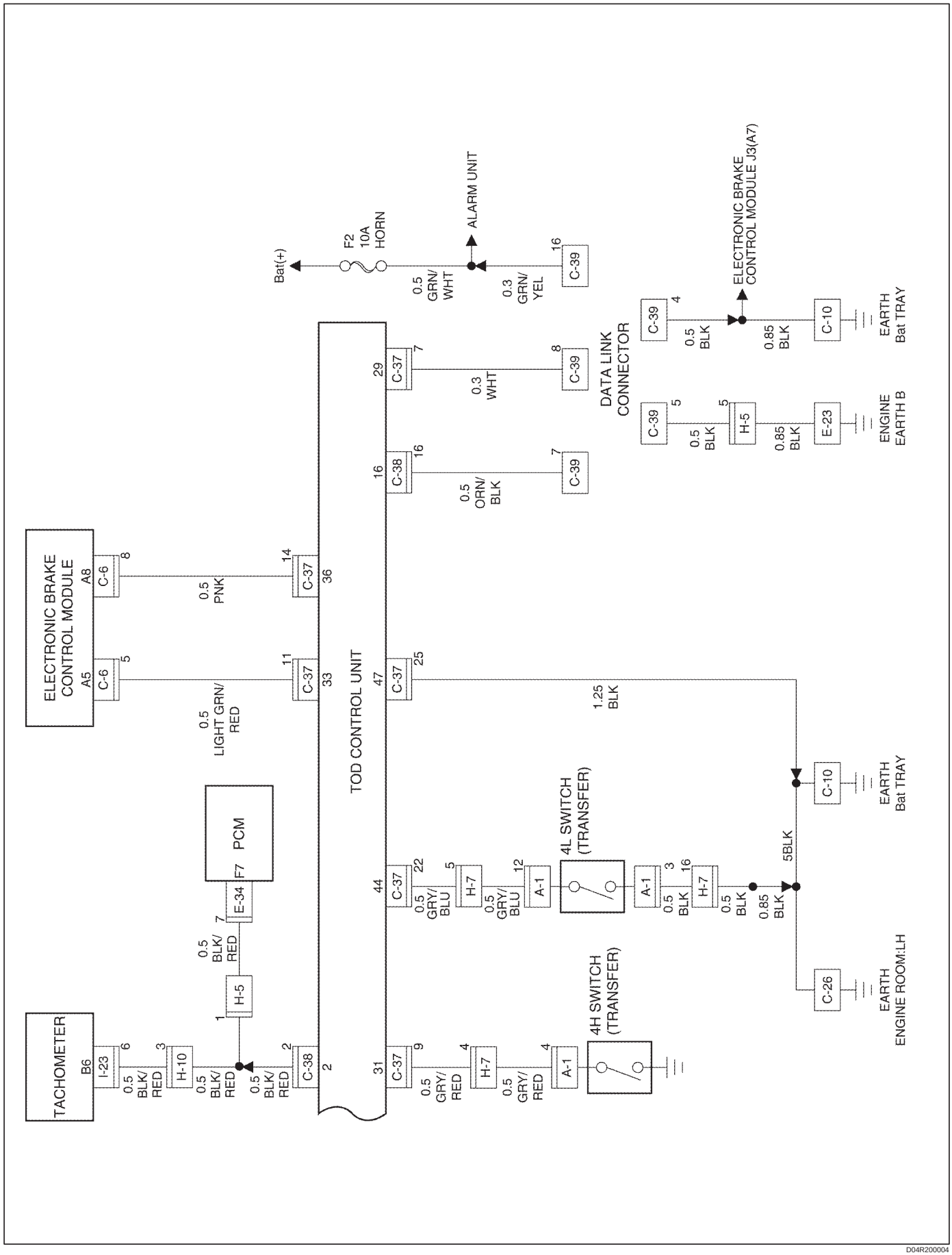



TOD CONTROL UNIT
CLUTCH SOLENOID (TRANSFER)
TRANSFER
FRONT SPEED SENSOR (TRANSFER)
REAR SPEED SENSOR (TRANSFER)
H-L SHIFT MOTOR
A
B
C
D
D
C-37
C-38
H-7
A-1
A-2
1.25 LIGHT BLU
0.85 BLK/YEL
0.5 GRN/WHT
0.5 GRN/RED
0.5 GRN/YEL
0.5 LIGHT GRN/WHT
0.85 BLU
0.5 YEL/BLK
0.5 YEL
0.5 VIOLET/WHT
0.5 VIOLET
1.25 WHT
1.25 RED
0.5 LIGHT GRN/WHT
0.5 GRN/RED

D04R200002

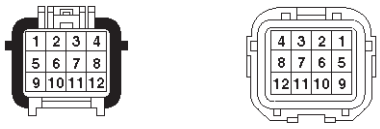
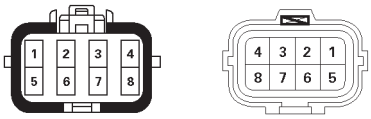
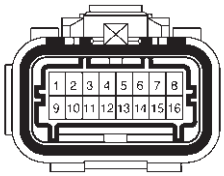
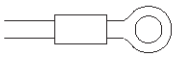
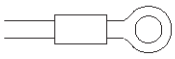
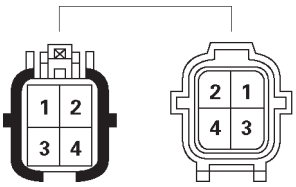
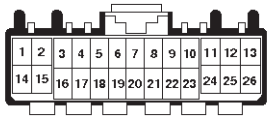
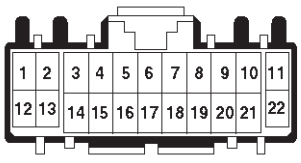
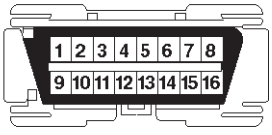

Bat(+)
3
BLU
TOD
F-14
15A
0.85
WHT
12
C-37
34
TAIL RELAY
0.85
GRN/
RED
1
H-11
0.85
GRN/
RED
0.85
GRN/
RED
0.5
GRN/
RED
18
C-37
40
Bat(+)
3.0
WHT
C-6 15A
STOP
LAMP
0.85
GRN
1
I-31
BRAKE
SWITCH
I-31
4
0.85
RED
0.85
RED
12
H-11
0.85
RED
0.85
RED
15
C-37
37
TOD INDICATOR(METER)
CHECK
REAR C
AUTO
B
FRONT A
I-24
29
0.5
BROWN
5
H-13
0.5
BROWN
20
C-38
20
I-24
3
0.5
BROWN/
RED
2
H-13
0.5
BROWN/
RED
8
C-38
8
I-24
5
0.5
BROWN/
GRN
4
H-13
0.5
BROWN/
GRN
19
C-38
19
TOD CONTROL UNIT
STARTER SWITCH
(IG1)
3.0
BLK/
RED
C-11 15A
METER
0.85
YEL
14
I-24
I-24
7
0.5
GRY
3
H-13
0.5
GRY
7
C-38
7
TAIL RELAY
0.85
GRN/
RED
4
I-25
TOD
SWITCH
I-25
3
0.5
RED/
GRN
ILLUMINATION
CONTROLLER
4L
I-25
5
H-13
12
C-37
21
43
TOD
I-25
8
0.85
WHT/
GRN
H-13
7
0.5
WHT/
GRN
5
C-38
5
STARTER SWITCH
(IG2)
C-15 15A
ELECTRIC
IGNITION
0.85
WHT/
BLU
ALARM UNIT
0.85
WHT/
BLU
2
I-25
2H
I-25
7
0.85
WHT/
BLK
H-13
6
0.5
WHT/
BLK
8
C-37
30

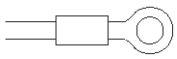
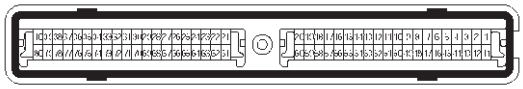
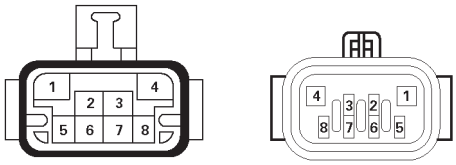
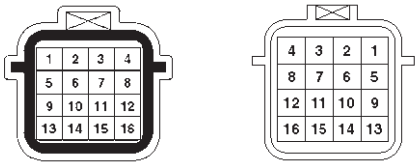
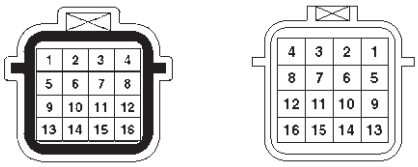
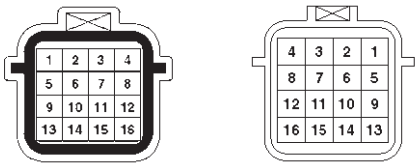
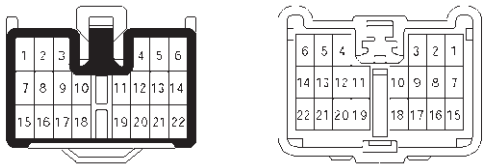
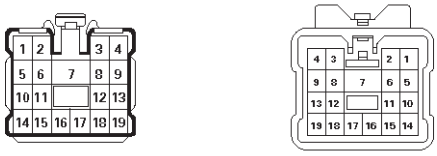
D04R200020

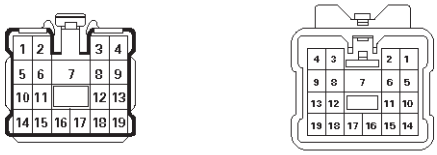
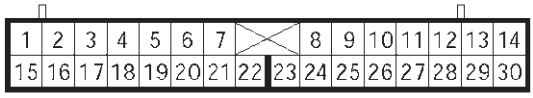

Bat(+)
F2
10A
HORN
ALARM UNIT
0.5
GRN/
WHT
0.3
GRN/
YEL
C-39
16
ELECTRONIC BRAKE
CONTROL MODULE J3(A7)
DATA LINK
CONNECTOR
C-39
4
0.5
BLK
C-10
0.85
BLK
EARTH
Bat TRAY
C-39
5
0.5
BLK
H-5
5
0.85
BLK
E-23
ENGINE
EARTH B
C-37
7
0.3
WHT
C-39
8
C-38
16
0.5
ORN/
BLK
C-39
7
C-37
29
C-37
47
C-37
25
1.25
BLK
C-10
EARTH
Bat TRAY
5BLK
C-26
EARTH
ENGINE ROOM:LH
ELECTRONIC BRAKE
CONTROL MODULE
A8
C-6
8
A5
C-6
5
0.5
PNK
C-37
14
0.5
LIGHT GRN/
RED
C-37
11
C-37
36
C-37
33
TOD CONTROL UNIT
2
C-38
2
0.5
BLK/
RED
H-5
1
0.5
BLK/
RED
E-34
7
PCM
F7
TACHOMETER
B6
I-23
6
0.5
BLK/
RED
H-10
3
0.5
BLK/
RED
C-37
44
0.5
GRY/
BLU
H-7
5
0.5
GRY/
BLU
A-1
12
4L SWITCH
(TRANSFER)
A-1
3
0.5
BLK
H-7
16
0.5
BLK
0.85
BLK
C-37
31
0.5
GRY/
RED
H-7
4
0.5
GRY/
RED
A-1
4
4H SWITCH
(TRANSFER)
C-37
22

D04R200004

Connector List

No.	Connector face
A-1	
A-2	
C-6	
C-10	
C-26	
C-29	
C-37	
C-38	
C-39	

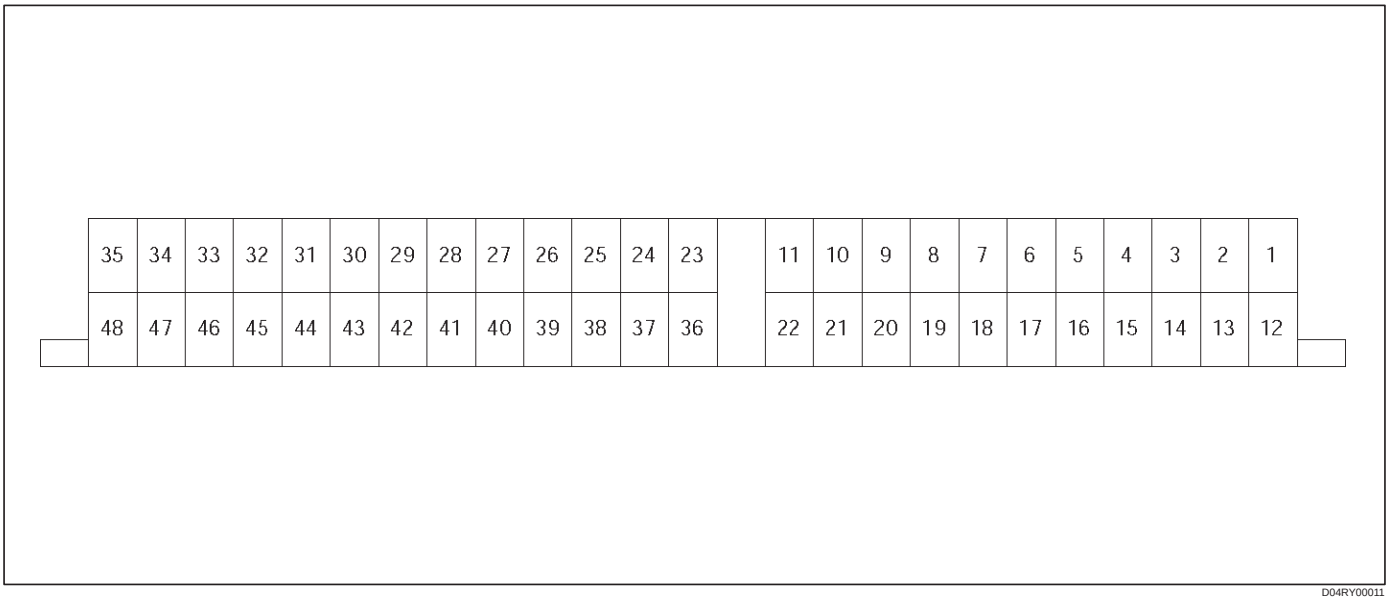
No.	Connector face
C-41	
E-23	
E-34	
E-41	
H-5 6VD1	
H-3	
H-7	
H-10	
H-11	

No.	Connector face
H-13	
I-23	
I-24	
I-25	
I-31	

Checking Failed Pin

Connector Pin Assignment

▼TOD control unit pin assignment



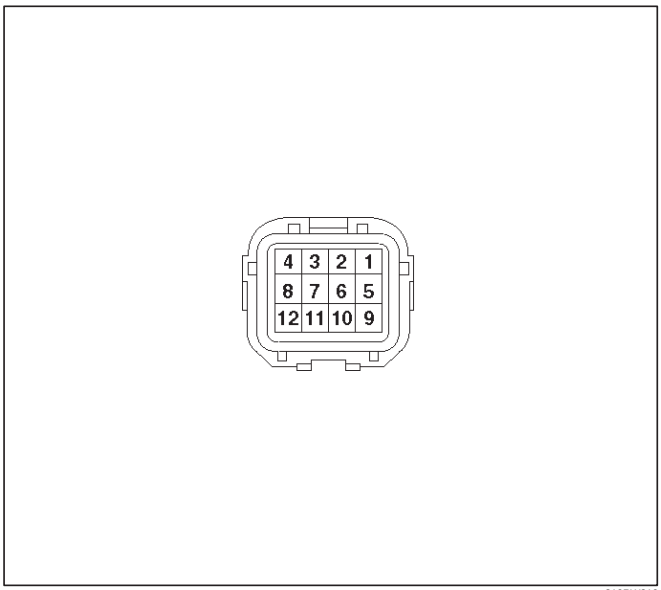
D04RY00011

No.	NAME	CONTENTS
1	N.C	Not used
2	ENG REV	Engine Speed
3	N.C	Not used
4	N.C	Not used
5	N.C	Not used
6	N.C	Not used
7	IND.A	Display Front
8	IND. C	Display Rear
9	N.C	Not used
10	N.C	Not used
11	EMC	Clutch Solenoid
12	REF	Speed Reference
13	COM (–)	Speed GND
14	VIG	Ignition
15	TPS	TPS (PWM)
16	TECH 2	TECH–2
17	N. C	Not used
18	N. C	Not used
19	IND. B	Display Auto
20	CHK TOD	Check TOD
21	N.C	Not used
22	PWR GND	Power Ground
23	ADC (+)	Axle Disconnect Output
24	COM GND	Shift Motor Position GND
25	MTR POS3	Shift Motot Position 3

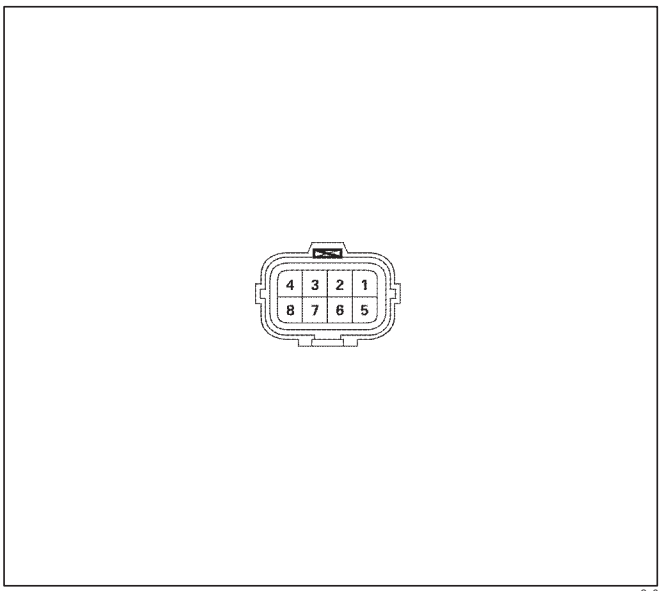
No.	NAME	CONTENTS
26	MTR POS1	Shift Motor Position 1
27	POSC	AT Position C
28	POSA	AT Position A
29	DIAG	Diagnostic Input
30	TOD SW A	TOD Switch A (2H)
31	4H SW	4H Switch Input
32	FT. SIG	Front Speed Signal
33	ABS IN	ABS In
34	VB	Power Bat
35	MTR H-L	Power Shift Motor H-L
36	4WD OUT	4WD Signal Output
37	BRAKE SW	Brake Switch Input
38	MTR POS4	Shift Motor Position 4
39	MTR POS2	Shift Motor Position 2
40	LIGHTING SW	Lighting Switch Input
41	POSB	AT Position B
42	AXLE SW	Axle Switch Input
43	TOD SWB	TOD Switch B (4L)
44	4L SW	4L Switch Input
45	RR. SIG	Rear Speed Signal
46	GND. 1	ECU Ground 1
47	GND. 2	ECU Ground 2
48	MTR L-H	Power Shift Motor L-H

Reference

▼ Transfer connector pin assignment (connector on the transfer case)
for inspection of transfer pins.



No.	NAME	CONTENTS
1	Ref. (Rer.)	Rear speed sensor reference output
2	Ref. (Frt.)	Front speed sensor reference output
3	SW GND	SW GND
4	4H SW (+)	4H SW plus terminal
5	RR. SIG	Rear Speed Sensor Signal
6	FT. SIG	Front Speed Sensor Signal
7	POWER GND	Power GND
8	SOL (+)	Electromagnetic solenoid
9	COM (–) (Rer.)	Rear speed sensor GND
10	COM (–) (Frt.)	Front speed sensor GND
11	NC	Not used
12	4L SW (+)	4L SW Plus Terminal



No.	NAME	CONTENTS
1	MTR POS2	Shift Motor Position 2
2	MTR POS3	Shift Motor Position 3
3	MTR POS4	Shift Motor Position 4
4	MTR L-H	Power Shift Motor L-H
5	POS RETURN	Shift Motor Position GND
6	MTR POS1	Shift Motor Position 1
7	MTR H-L	Power Shift Motor H-L
8	NC	Not Used

Checking Failed TOD Control Unit Pin

NOTE:

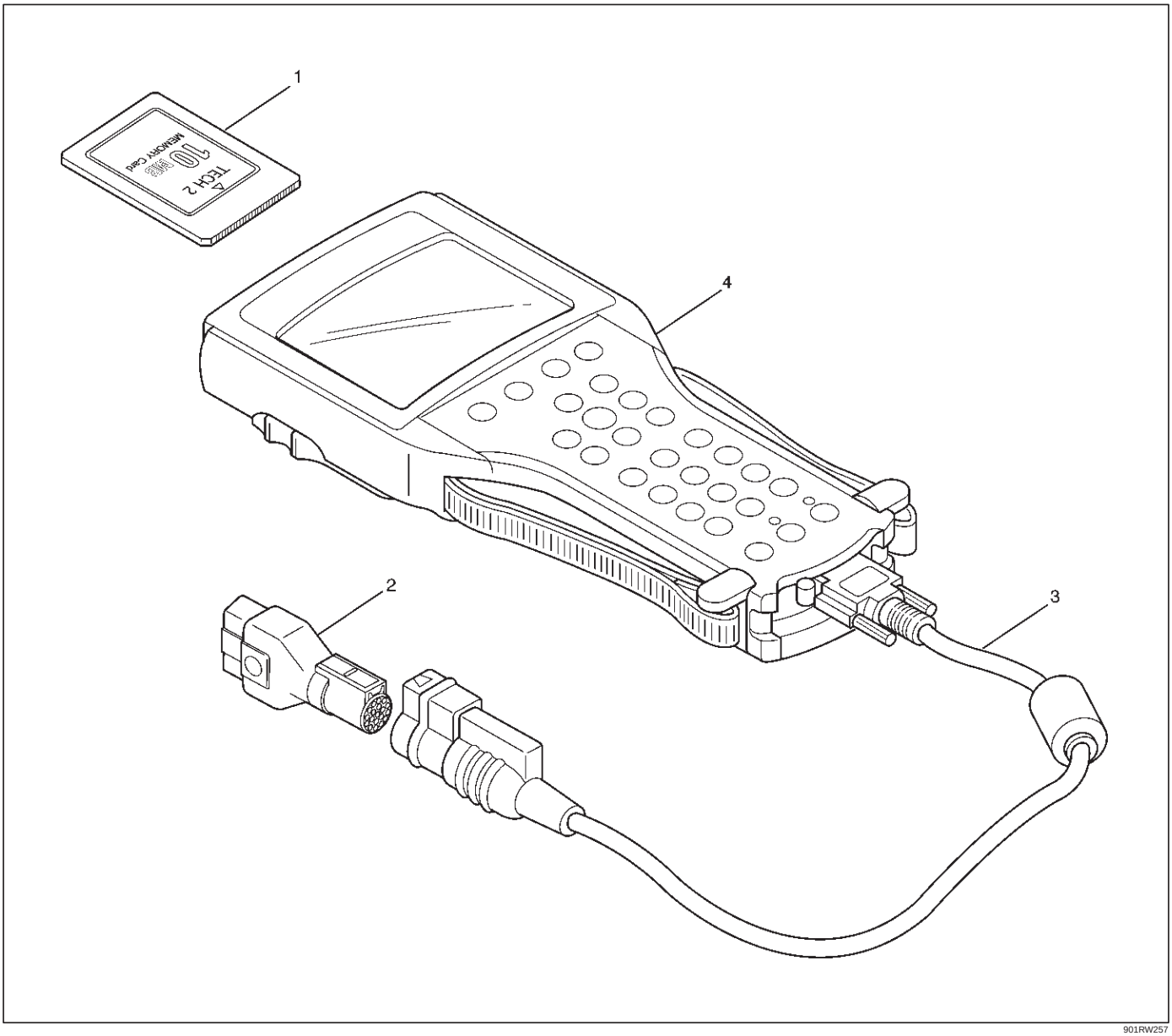
1. Unplug the ECU connector and the pins, unless otherwise specified.
2. Before removing the ECU, turn off the ignition switch.
3. If the standard values are not observed, check the pins with other testers.

Check Pin No.	Circuit to be tested	Ignition Switch Position	Engine State	Unit Scale/ Range	Measure between Pin No.	Standard Value	Note
22	P-GND	OFF	STOP	Ω	22, 47	Continuity : OK	
46	GNDI	OFF	STOP	Ω	46, 47	Continuity : OK	
47	GND 2	OFF	STOP	Ω	47, GND	Continuity : OK	
31	4H SW	OFF	STOP	Ω	31, 47	No continuity (high, 4L) : OK	
44	4L SW	OFF	STOP	Ω	44, 47	No continuity (high) and continuity (4L) : OK	
42	AXLE SW	ON	RUN	Ω	42, 47	Continuity(TOD, 4L) : OK	Remove ECU connector and start the engine. Move the vehicle forth and back to connect axle surely.
29	DIAG	OFF	STOP	Ω	29 (TOD), 8 (DLC Connec-tor)	Continuity : OK	DLC connector terminal 8
7	IND.A	ON	STOP	DCV	7 (+), 47 (–)	8.0 ~14.5 V	when the indicator lamp is turned off.
20	CHECK TOD	ON	STOP	DCV	20 (+), 47 (–)	8.0 ~14.5 V	When the indicator lamp is turned off.
33	ABS IN	ON	STOP	DCV	33 (+), 47 (–)	6.0 ~11.0 V	
12	REF	ON	STOP	DCV	12 (+), 47 (–)	5 ~9 V	Connect ECU
32	FRT.(+)	ON	STOP	DCV	32 (+), 47 (–)	0.7 ~6 V	Connect ECU and move the vehicle (off one tooth of speed sensor ring) making sure of voltage change.
45	RR.(+)	ON	STOP	DCV	45 (+), 47 (–)	0.7 ~6 V	Connect ECU and move the vehicle (off one tooth of speed sensor ring) making sure of voltage change.
13	COM(-)	ON	STOP	DCV	13 (+), 47 (–)	0V	Connect ECU
14	VIG	ON	STOP	DCV	14 (+), 47 (–)	8 ~14.5 V	
34	VB	OFF	STOP	DCV	34 (+), 47 (–)	8.0 ~14.5 V	
37	BRAKE SW	OFF	STOP	DCV	37 (+), 47 (–)	8 ~14.5 V	Press brake pedal
15	TPS	ON	STOP	DCV	15 (+), 47 (–)	PWM duty cycle 10%(MAX) – 90 %(MIN)	Step on the accelerator pedal and make sure that duty cycle changes.

Check Pin No.	Circuit to be tested	Ignition Switch Position	Engine State	Unit Scale/ Range	Measure between Pin No.	Standard Value	Note
36	4WD OUT	OFF	STOP	Ω	36, 47	7 ~12 kΩ	Disconnect battery GND terminal
11	EMC(+)	OFF	STOP	Ω	11, 22	1.0 ~5.0 Ω	Disconnect battery GND terminal
30	TOD SW A	ON	STOP	DCV	30 (+), 47 (–)	SW: TOD, 4L: 0 V SW:2H:8.0 ~ 14.5 V	
43	TOD SWB	ON	STOP	DCV	43 (+), 47 (–)	SW: 2H, TOD:0V SW: 4L: 8.0 ~ 14.5V	
40	LIGHT	ON	STOP	DCV	40 (+), 47 (–)	SW OFF : 0 V SW ON : 8.0 ~ 14.5 V	
19	IND B	ON	STOP	DCV	19 (+), 47 (–)	8.0 ~14.5 V	When the indicator lamp is turned off
8	IND C	ON	STOP	DCV	8 (+), 47 (–)	8.0 ~ 14.5 V	When the indicator lamp is turned off
27	AT POSC	ON	STOP	DCV	27 (+), 47 (–)	ON:D, 3, 2, 1 OFF:PRN	ON:8.0 ~ 14.5 V OFF:0V
41	AT POSB	ON	STOP	DCV	41 (+), 47 (–)	ON:R, N, D, 3 OFF:P, 2, 1	ON:8.0 ~ 14.5 V OFF:0V
28	AT POSA	ON	STOP	DCV	28 (+), 47 (–)	ON:P, R, 3, 2 OFF:N, D, 1	ON:8.0 ~ 14.5 V OFF:0V
2	ENG REV	ON	RUN	ms	2, 47	Waveform (PWM)	50 ms (1000 rpm)

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW257

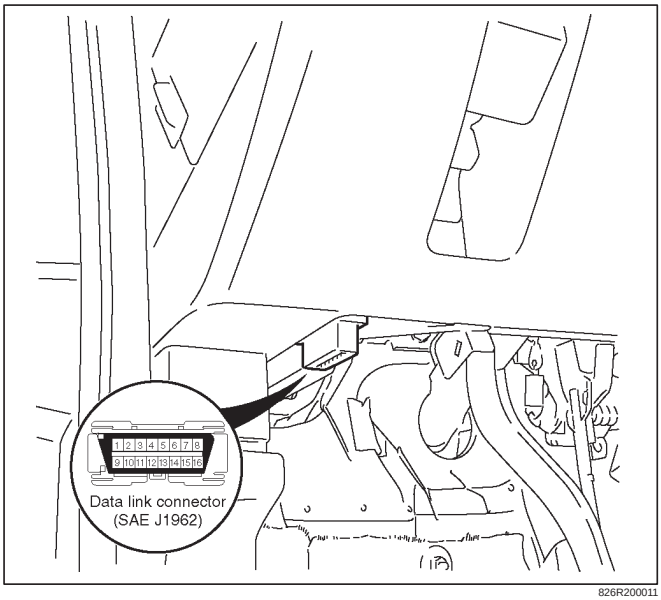
Legend

(1) PCMCIA Card
(2) SAE 16/19 Adaptor
(3) DLC Cable
(4) Tech 2

Getting Started

▼ Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 02 System PCMCIA card (1) inserts into the Tech 2 (4).
2. Connect the SAE 16/19 adapter (2) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (4)
4. Mark sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC connector.



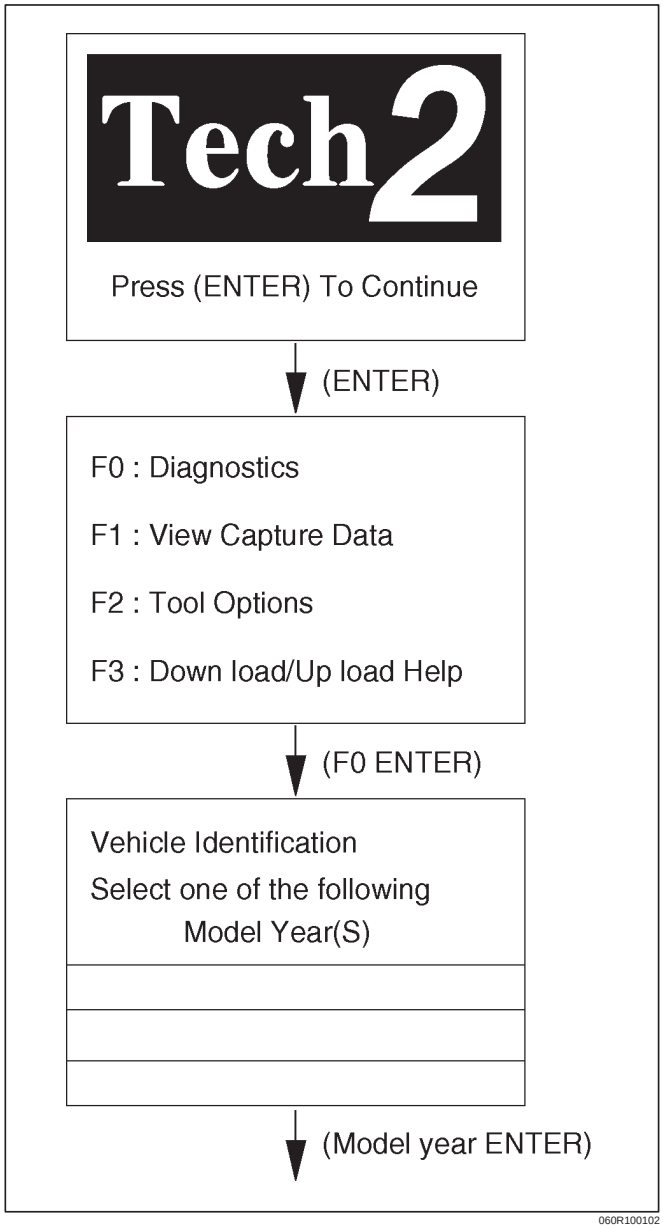
826R200011

6. The vehicle ignition turns on.
7. Power up the Tech 2.
8. Verify the Tech 2 power up display.

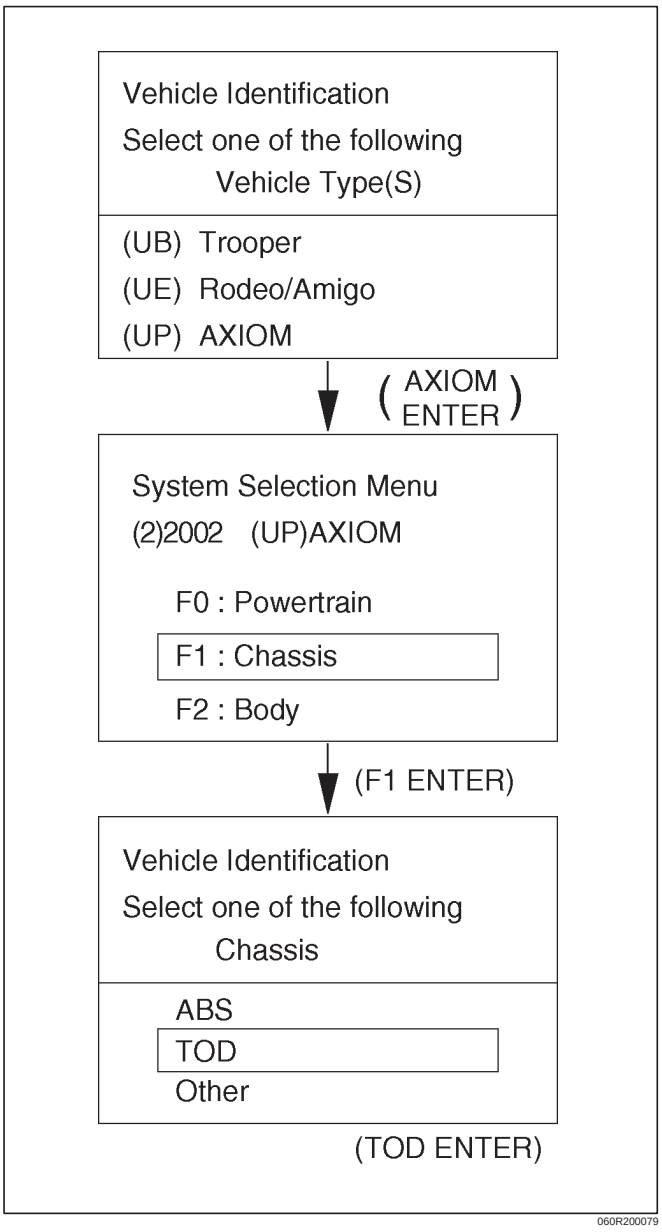
060RW009

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060R100102


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper
(UE) Rodeo/Amigo
(UP) AXIOM
(AXIOM ENTER)
System Selection Menu
(2)2002 (UP)AXIOM
F0 : Powertrain
F1 : Chassis
F2 : Body
(F1 ENTER)
Vehicle Identification
Select one of the following
Chassis
ABS
TOD
Other
(TOD ENTER)
060R200079

Diagnostic Trouble Codes

Code	Tech 2 code (P code)	Item	Diagnosis	Check flow No.
12	—	Start code	Normal	—
13	P1735	Ref	Shorted GND	6
14	P1731	Front speed sensor	Input abnormality (open, sig or com)	2
15	P1736	Ref	Shorted V_B	6
16	P1737	Front speed sensor	Input abnormality	4
17	P1774	Inhibitor switch	Input abnormality	8
21	P1716	TPS	Shorted or disconnected wiring, abnormality in input	7
23	—	ECU	CPU abnormality	1
24	P1733	Rear speed sensor	Input abnormality (open, sig or com)	3
27	P1738	Rear speed sensor	Input abnormality	5
28	P1760	ADC (+) & AXLE SW	Output abnormality	10
31	P1721	EMC (+)	Shorted VB, disconnected coil/wiring or shorted GND	9
32	P1761	ADC (+)	Shorted VB or disconnected wiring	11
33	P1762	ADC (+)	Shorted GND	12
36	—	ECU	CPU abnormality	1
37	P1712	ECU	CPU abnormality	1
38	P1714	ECU	CPU abnormality	1
41	P1741	Hight-Low shift motor	Shorted GND or disconnected wiring	13
42	P1773	Hight-Low shift motor	User operation error (not failure)	14
43	P1743	Hight-Low shift motor	Motor moving more than 5s	15
55	P1755	Hight-Low shift motor	Input abnormality of motor position signal	16

TPS : Throttle Position Sensor
EMC : Electromagnetic coil
ADC : Shift on the fly (Axle Dis Connect)

Diagnosis from Trouble Codes

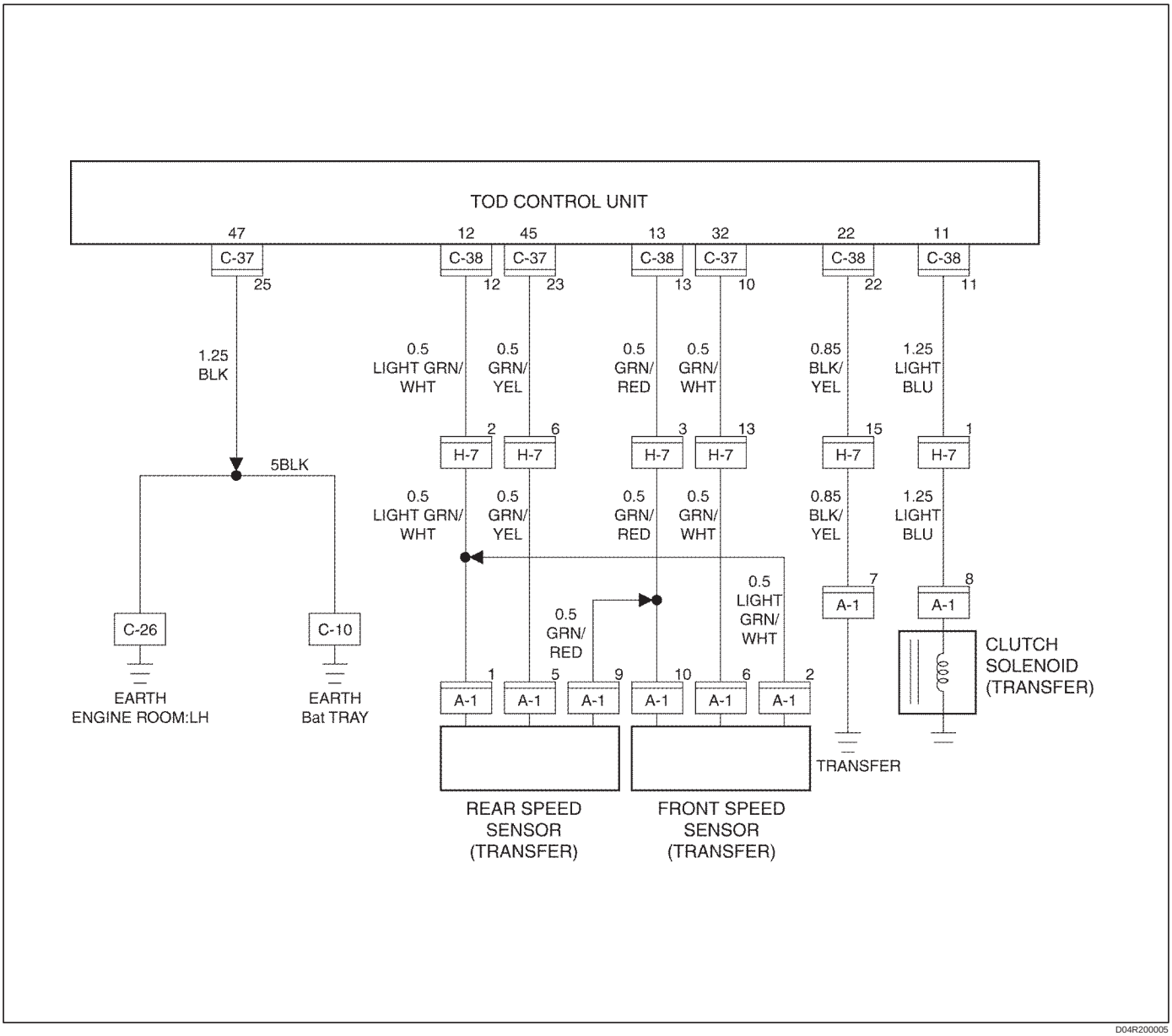
▼ Diagnose the fault that have been saved to the control unit according to the system self-diagnostic function.

Check flow	Trouble code	Phenomenon	Standard
1	23, 36, 37, 38	The ECU has failed.	—
	P1712, P1714		

Step	Action	Yes	No
1	Turn on the starter switch. Is the trouble reproduced?	Replace the ECU and conduct the test run. Go to *Step 3*	Go to *Step 2*
2	1. Clear the trouble codes. 2. Conduct the test run. Is the trouble reproduced during the test run?	Replace the ECU and conduct the test run. Go to *Step 3*	The trouble is not reproduced. Refer to *"Trouble intermittently observed".* Go to *Step 3*
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Verify the repair.	Return to *Step 3*

Check flow	Trouble code	Phenomenon	Standard
2	14 P1731	Front speed sensor signal open or GND short, speed sensor com open.	0.2V > sensor voltage

NOTE: The following procedure shows the case that the front or rear sensor common grounding line is broken.

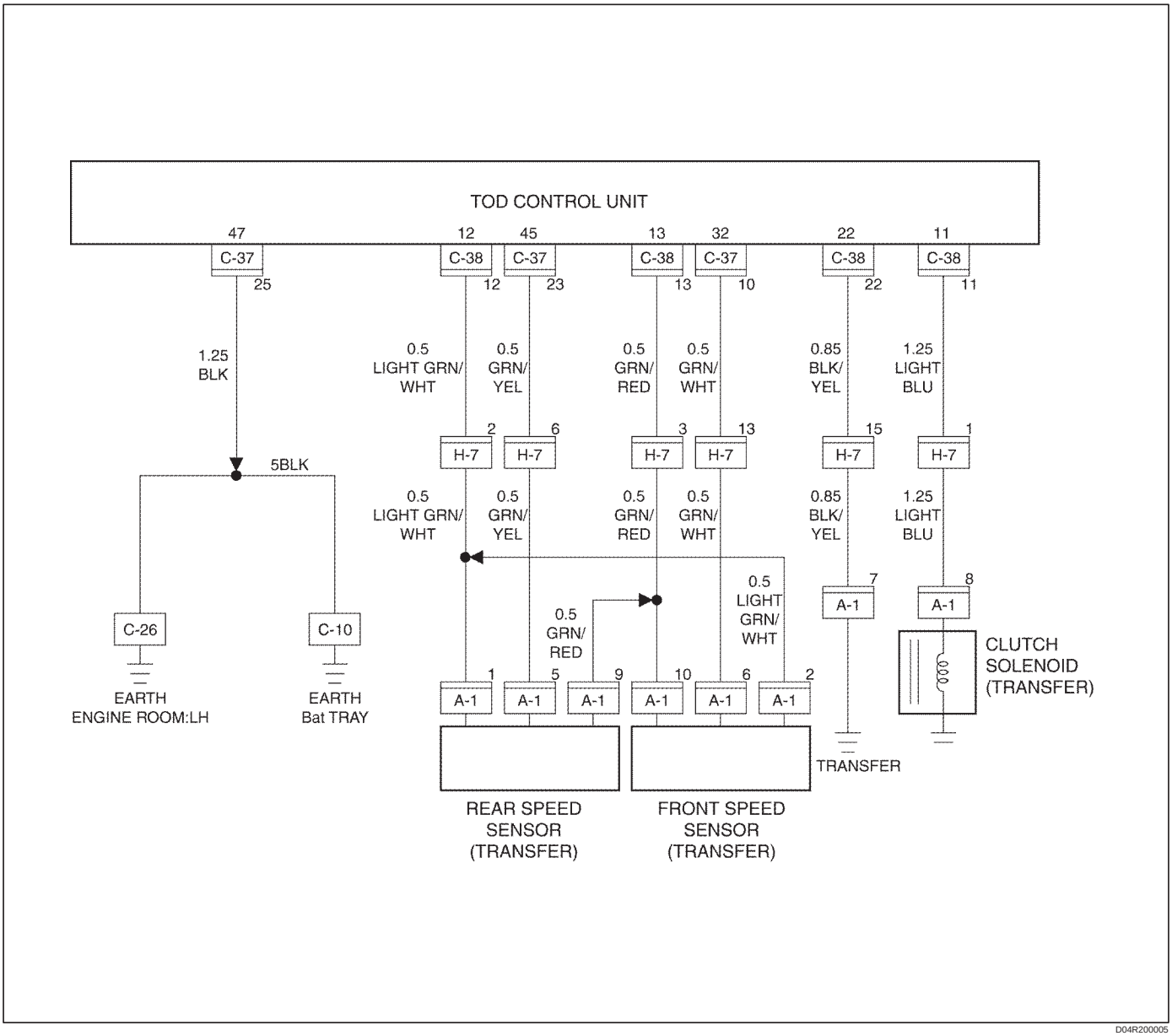


D04R200005

Step	Action	Yes	No
1	1. Start the engine. 2. Select TOD mode. Is there the memory except DTC 14(P1731)?	Go to *Step 4*	Go to *Step 2*
2	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38) and (C–37). Is there the continuity between (C–37) terminal 10 and 25?	Repair the circuit. Go to *Step 7*	Go to *Step 3*
3	1. Disconnect the transfer connector (A–1). Is there the continuity between the connector (C–37) terminal 10 and the connector (A–1) terminal 6, the connector (C–38) terminal 12 and connector (A–1) terminal 2, and the connector (C–38) terminal 13 and connector (A–1) terminal 10?	Replace the front speed sensor. Go to *Step 7*	Repair the circuit. Go to *Step 7*
4	Is the memory DTC 24(P1733)?	Go to *Step 5*	Refer to *other trouble check flow.*
5	Is there the continuity between harnesses of terminal 32 and 45 (vehicle side terminal of the front and rear speed sensor)?	Go to *Step 6*	Repair the circuit. Go to *Step 7*
6	Is there the continuity between harnesses of terminal 12 and 13 (vehicle side terminal of the speed sensor COM(–) and ref)?	Replace front and rear speed sensor. Go to *Step 7*	Repair the circuit. Go to *Step 7*
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Verify the repair.	Return to *Step 7*

Check flow	Trouble code	Phenomenon	Standard
3	24 P1733	Rear speed sensor signal open or GND short, speed sensor COM open.	0.2 V > sensor voltage

NOTE: The following procedure shows the case that the front or rear sensor common grounding line is broken.

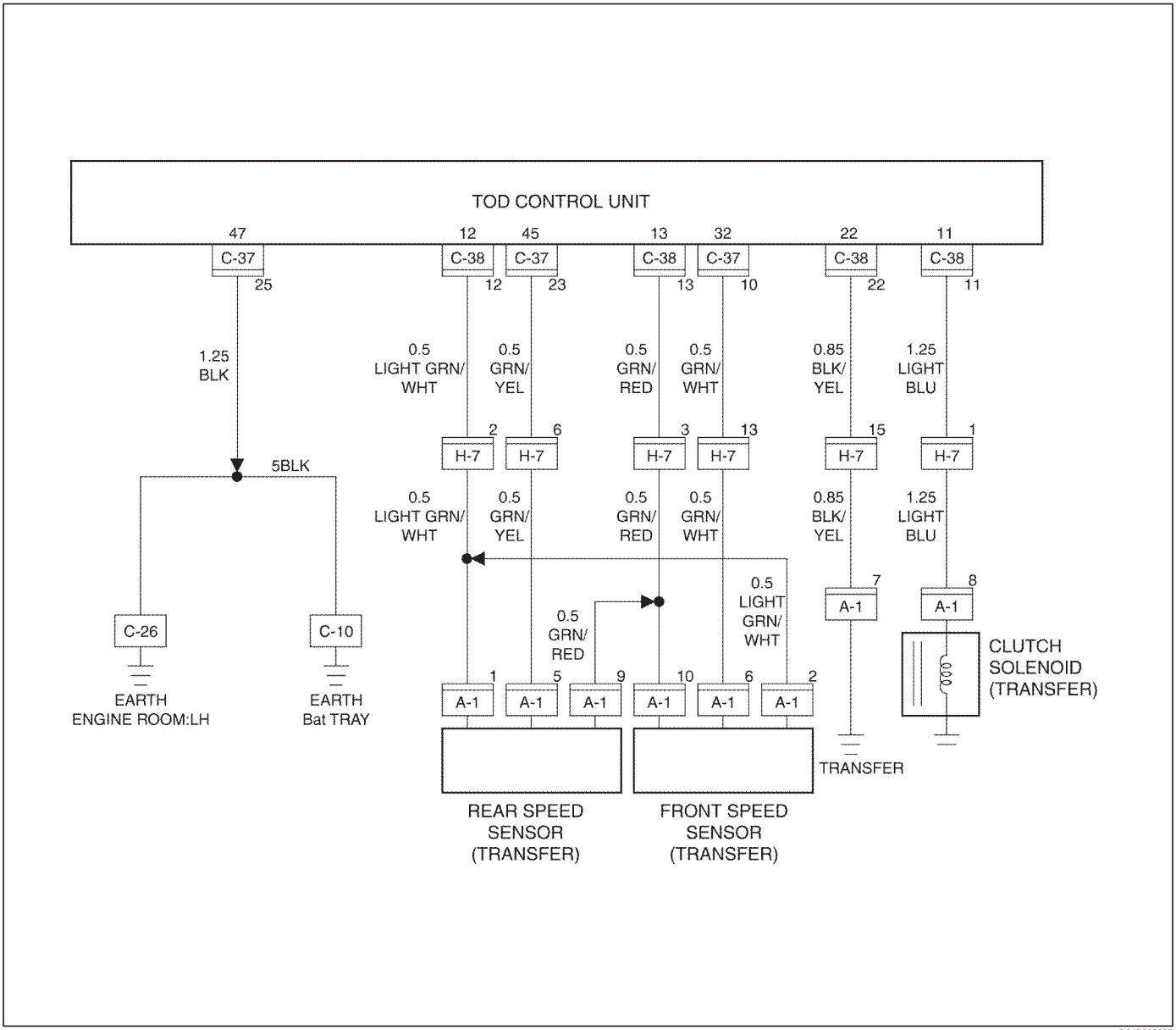


D04R200005

Step	Action	Yes	No
1	1. Start the engine. 2. Select TOD mode. Is there the memory except DTC 24(P1733)?	Go to *Step 4*	Go to *Step 2*
2	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38) and (C–37). Is there the continuity between the connector (C–37) terminal 23 and 25?	Repair the circuit. Go to *Step 7*	Go to *Step 3*
3	1. Disconnect the transfer connector (A–1). Is there the continuity between the connector (C–37) terminal 23 and the connector (A–1) terminal 5, the connector (C–38) terminal 12 and connector (A–1) terminal 1, and the connector (C–38) terminal 13 and connector (A–1) terminal 9?	Replace the rear speed sensor. Go to *Step 7*	Repair the circuit. Go to *Step 7*
4	Is the memory DTC 14(P1731)?	Go to *Step 5*	Refer to *other trouble cheek flow.*
5	Is there the continuity between harnesses of terminal 32 and 45 (vehicle side terminal of the front and rear speed sensor)?	Go to *Step 6*	Repair the circuit Go to *Step 7*
6	Is there the continuity between harnesses of terminal 12 and 13 (vehicle side terminal of the speed sensor COM(–) and ref)?	Replace front and rear speed sensor. Go to *Step 7*	Repair the circuit. Go to *Step 7*
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Verify the repair	Return to *Step 7*

Check flow	Trouble code	Phenomenon	Standard
4	16 P1737	The front speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = 700-850 Hz (at 50 km/h or 31 mph)

NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.

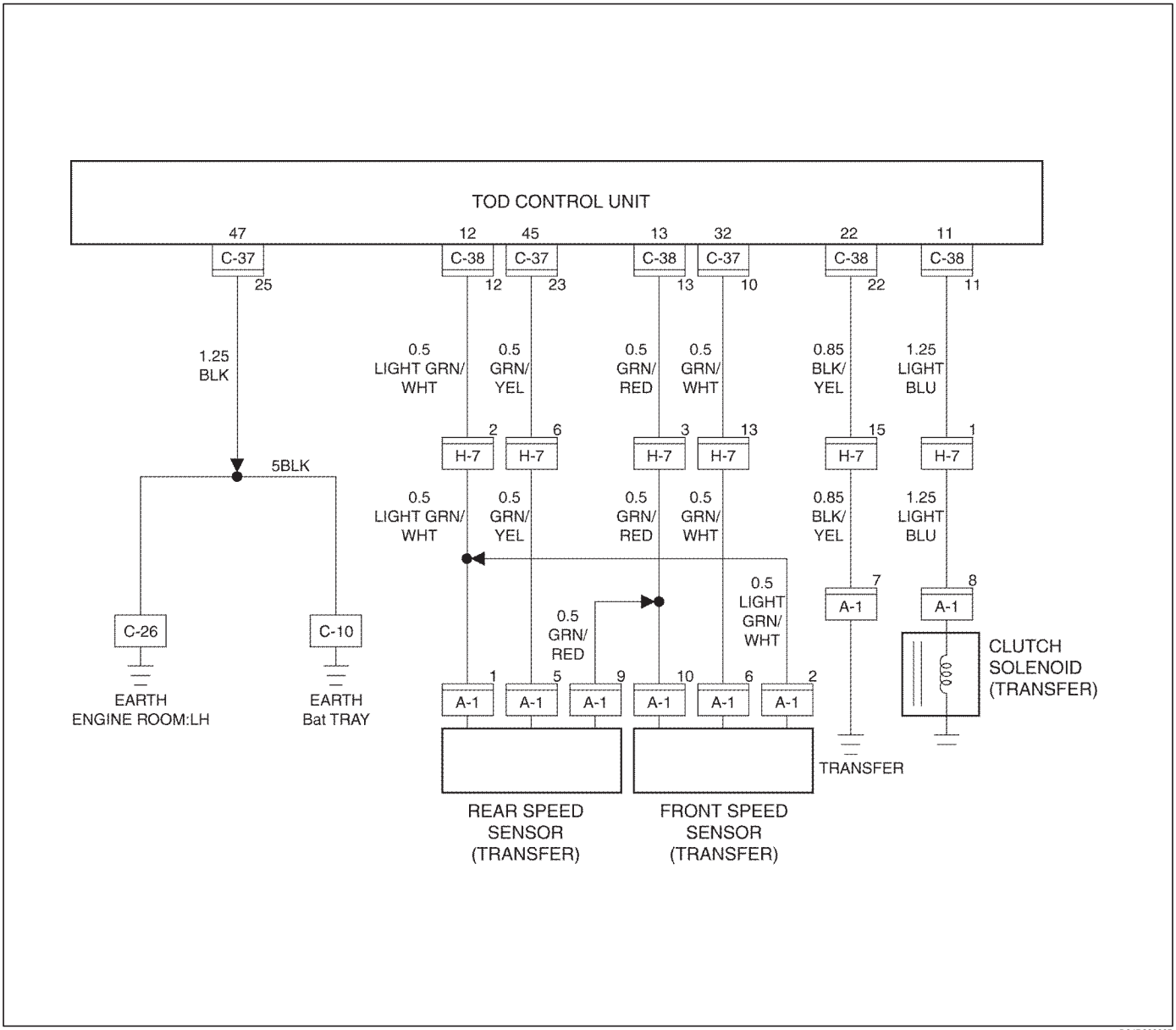


D04R200005

Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH–2's front speed sensor indication change with vehicle speed?	Go to *Step 2*	Repair and inspection front speed sensor tone wheel. Go to *Step 6*
2	1. Clear the trouble code. While running at 40 km/h or 25 mph in TOD mode for 30 consecutive sec, is the trouble code reissued?	Go to *Step 3*	The trouble is not reproduced. Refer to *"Troubles intermittently observed".*
3	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38) and (C–37). Is there the continuity between the connector (C–37) terminal 10 and 25?	Repair the circuit. Go to *Step 6*	Go to *Step 4*
4	1. Disconnect the transfer connector (A–1). Is there the continuity between the connector (C–37) terminal 10 and the connector (A–1) terminal 6, the connector (C–38) terminal 12 and connector (A–1) terminal 2, and the connector (C–38) terminal 13 and connector (A–1) terminal 10?	Replace the front speed sensor. Go to *Step 5*	Repair the circuit. Go to *Step 5*
5	1. Clear the trouble code. While running at 40 km/h or 25 mph in TOD mode for 30 consecutive sec, is the trouble code reissued?	Replace ECU. Go to *Step 6*	Go to *Step 6*
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 6

Check flow	Trouble code	Phenomenon	Standard
5	27 P1738	The rear speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = 700-850 Hz (at 50 km/h or 31 mph)

NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.

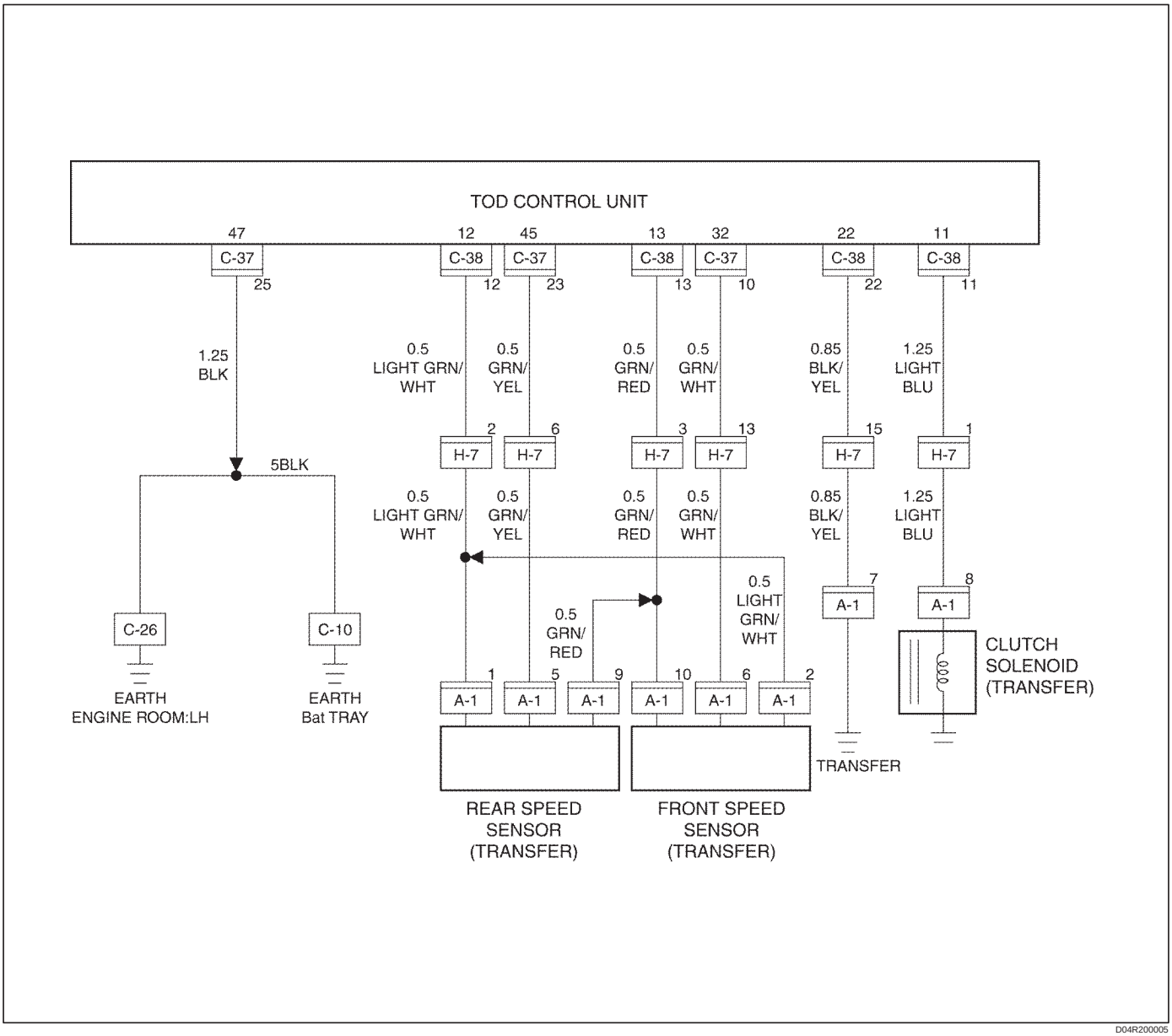


D04R200005

Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH–2's rear speed sensor indication change with vehicle speed?	Go to *Step 2*	Repair and inspection front speed sensor tone wheel. Go to *Step 6*
2	1. Clear the trouble code. While running at 40 km/h or 25 mph in TOD mode for 30 consecutive sec, is the trouble code reissued?	Go to *Step 3*	The trouble is not reproduced. Refer to *"Troubles intermittently observed"*.
3	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38) and (C–37). Is there the continuity between the connector (C–37) terminal 23 and 25?	Repair the circuit. Go to *Step 5*	Go to *Step 4*
4	1. Disconnect the transfer connector (A–1). Is there the continuity between the connector (C–37) terminal 23 and the connector (A–1) terminal 5, the connector (C–38) terminal 12 and connector (A–1) terminal 1, and the connector (C–38) terminal 13 and connector (A–1) terminal 9?	Replace the rear speed sensor. Go to *Step 5*	Repair the circuit. Go to *Step 5*
5	1. Clear the trouble code. While running at 40 km/h or 25 mph in TOD mode for 30 consecutive sec, is the trouble code reissued?	Replace ECU. Go to *Step 6*	Go to *Step 6*
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to *Step 6*

Check flow	Trouble code	Phenomenon	Standard
6	13 (P1735)	The reference is short-circuited to GND.	Reference ≃ 5 V
	15 (P1736)	The reference is short-circuited to VB.	

If the reference wire (12) is short-circuited to GND, the speed signal is not generated. If the wire is short-circuited to the battery voltage, the signal level becomes faulty.

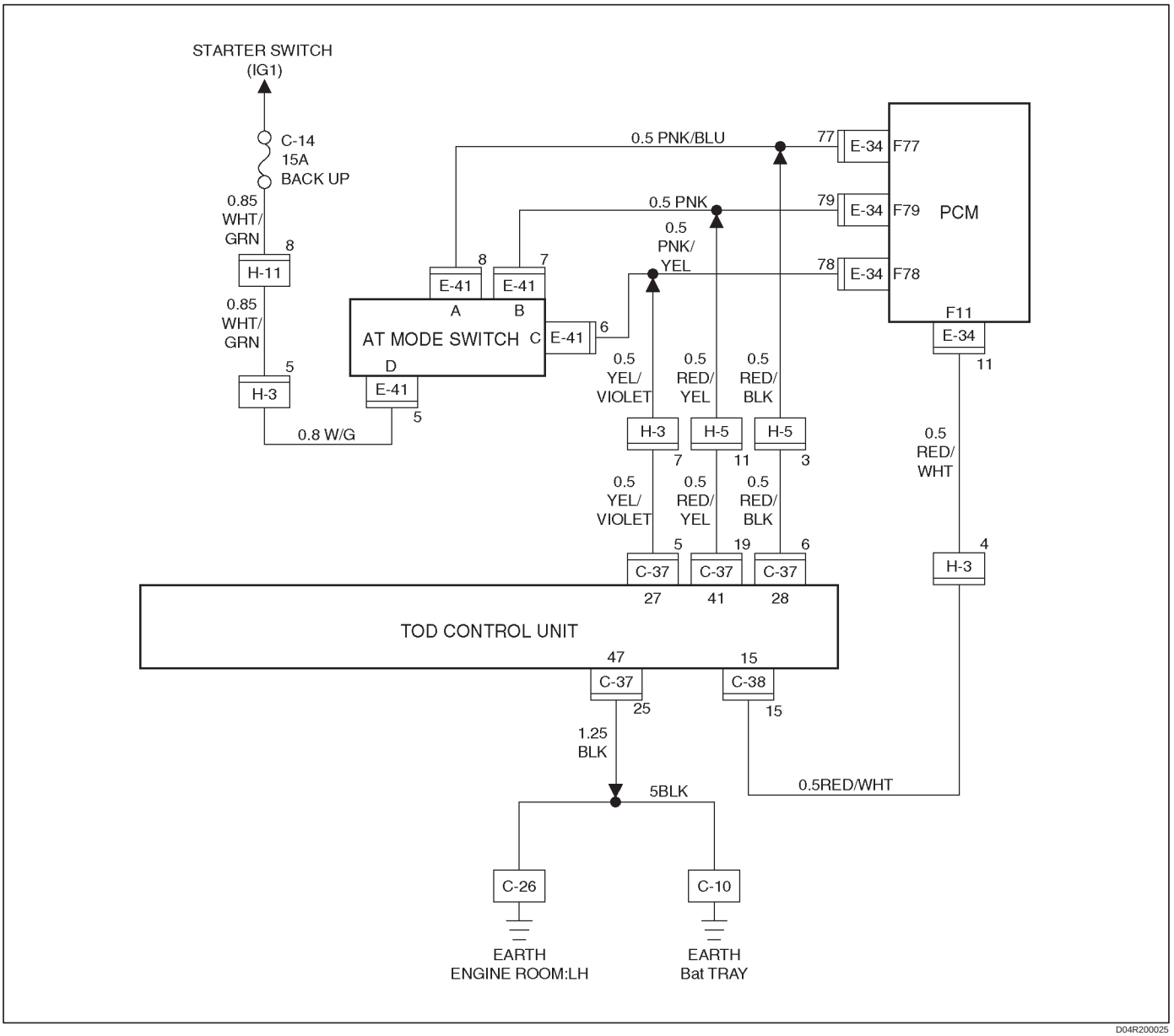


D04R200005

Step	Action	Yes	No
1	1. Start the engine. Does the voltage between terminals 12 and 47 meet the standard 5V?	Refer to *"Trouble intermittently observed".*	Go to *Step 2*
2	Is the voltage below the standard?	Go to *Step 3*	Go to *Step 7*
3	1. Turn off the starter switch. 2. Disconnect the ECU connector. Is the continuity established between vehicle harness terminals (C–38)12 and (C–37)25?	Go to *Step 4*	The ECU is failed. Replace the ECU. Go to *Step 8*
4	1. Disconnect the H-7 connector. Is the continuity established between floor harness connector terminals (H-7)2 and (H-7)15?	Go to *Step 5*	Short to GND between (C–38)12 and (H–7)2. Repair the circuit. Go to *Step 8*
5	1. Disconnect the A-1 connector. Is the continuity established between transfer harness connector male terminals (A–1)1 and (A–1)7?	Replace the rear speed sensor. Go to *Step 8*	The reference harness for the rear speed sensor is short–circuited to GND. Repair the circuit. Go to *Step 6*
6	1. Disconnect the A-1 connector. Is the continuity established between transfer harness connector terminals (A–1)2 and (A–1)7?	Replace the front speed sensor. Go to *Step 8*	The reference harness for the rear speed sensor is short–circuited to GND. Repair the circuit. Go to *Step 8*
7	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Is the battery voltage observed between harness connector terminals (C–38)12 and (C–37)25?	Repair the circuit. Go to *Step 8*	The ECU has failed. Replace the ECU. Go to *Step 8*
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow"	Go to *Step 8*

Check flow	Trouble code	Phenomenon	Standard
7	21 (P1716)	The voltage of the throttle position sensor (TPS) is faulty.	See below table.

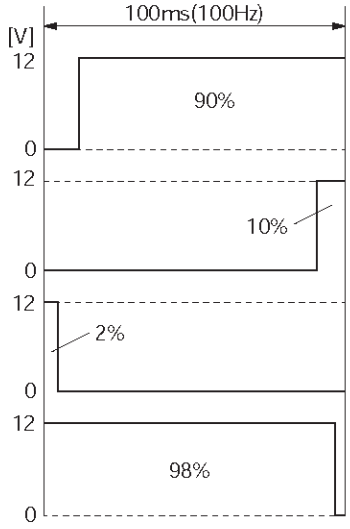
NOTE: The signal voltage from the TPS deviates from the standard range.



D04R200025

Oscilloscope Waveform

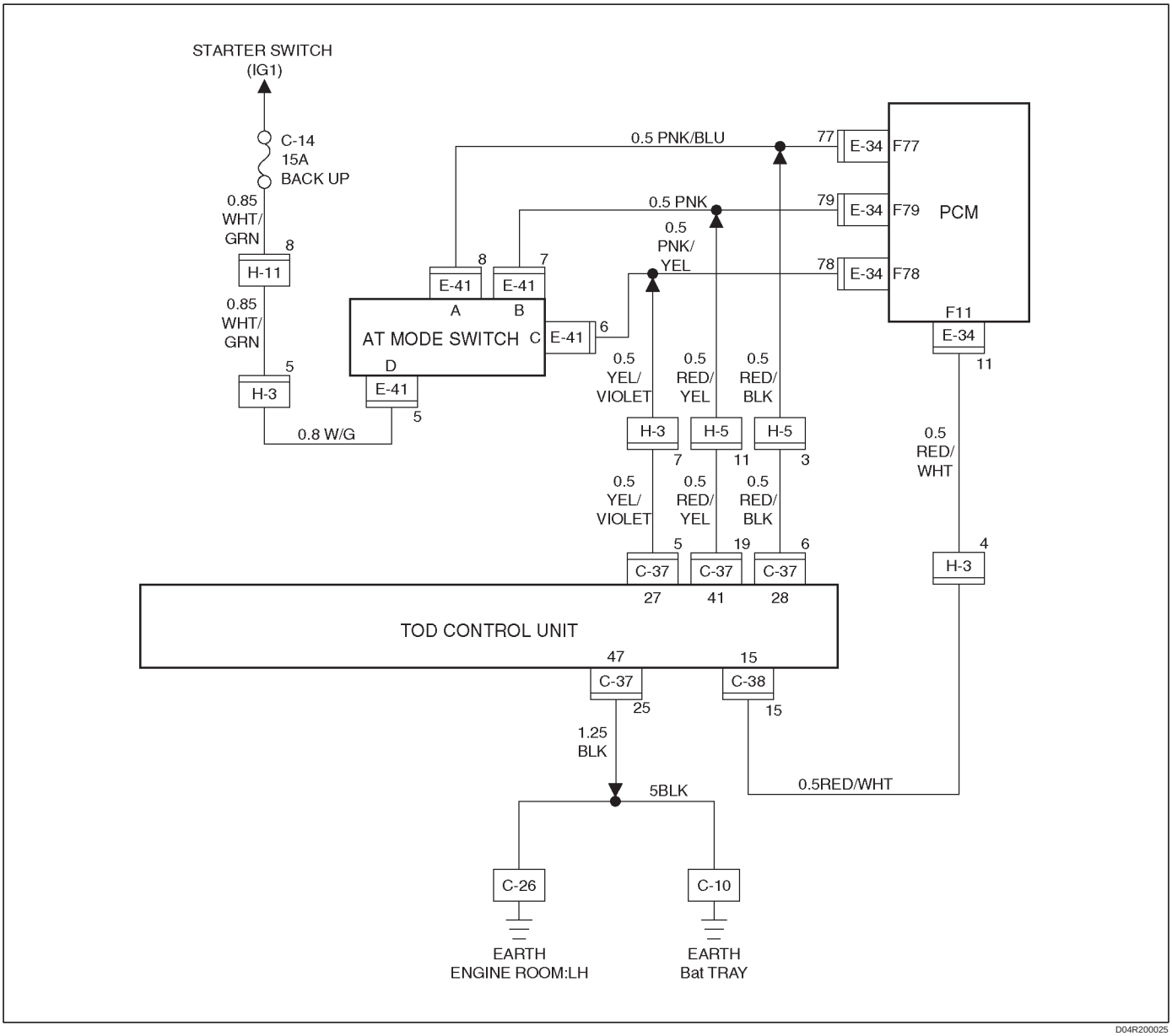
PWM 0-12V	Duty Cycle
1. Minimum Throttle	90%
2. Maximum Throttle	10%
3. TPS PWM FAULT	Less than 2% More than 98%



D04RY00012

Step	Action	Yes	No
1	1. Turn off the starter switch. Is the battery voltage normal?	Go to *Step 2*	Charge or replace the battery. Go to *Step 7*
2	1. Turn on the starter switch. Does the voltage between terminals 15 and 47 fall within the standard range?	Go to *Step 3*	Go to *Step 4*
3	1. Clear the trouble code. 2. Turn on the starter switch. Is there DTC21 (P1716)?	Go to *Step 4*	Refer to *"Trouble intermittently observed".*
4	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Does the voltage between terminals (C–38)15 and (C–37)25 fall within the standard range above?	The ECU has failed. Replace the ECU. Go to *Step 7*	Go to *Step 5*
5	Is the harness healthy?	Go to *Step 6*	Repair the harness. Go to *Step 7*
6	Is the TPS healthy?	Go to *Step 7*	Replace the TPS. Go to *Step 7*
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Go to *Step 7*

Check flow	Trouble code	Phenomenon	Standard
8	17 (P1774)	The input from the mode switch is abnormal.	—



D04R200025

Step	Action	Yes	No
1	Is the TOD control unit the regular part? (Verity the part number.)	Go to *Step 2*	Replace with the regular part. Go to *Step 2*
2	1. Turn on the starter switch. Does the voltage between the terminal 28 and 47 accord with the table 1 corresponding to the AT selector positions?	Go to *Step 3*	Go to *Step 5*
3	Does the voltage between the terminal 41 and 47 accord with the table 1 corresponding to the AT selector positions?	Go to *Step 4*	Go to *Step 6*
4	Does the voltage between the terminal 27 and 47 accord with the table 1 corresponding to the AT selector positions?	Refer to *"Trouble intermittently observed".*	Go to *Step 7*
5	1. Disconnect the AT mode connector (E–41). Does the continuity between the inhibitor switch terminal 5 (D) and 8 (A) accord with the table 2 corresponding to the AT selector positions?	Repair the circuit between the connector terminal (C–37) 6 and (E–41) 8. Go to *step 8*	Replace the inhibitor switch. Go to *Step 8*
6	1. Disconnect the AT mode connector (E–41). Does the continuity between the inhibitor switch terminal 5 (D) and 7 (B) accord with the table 2 corresponding to the AT selector positions?	Repair the circuit between the connector terminal (C–37) 19 and (E–41) 7. Go to *Step 8*	Replace the inhibitor switch. Go to *Step 8*
7	1. Disconnect the AT mode connector (E–41). Does the continuity between the inhibitor switch terminal 5 (D) and 6 (C) accord with the table 2 corresponding to the AT selector positions?	Repair the circuit between the connector terminal (C–37) 5 and (E–41) 6. Go to *Step 8*	Replace the inhibitor switch. Go to *Step 8*
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Go to *Step 8*

Table 1

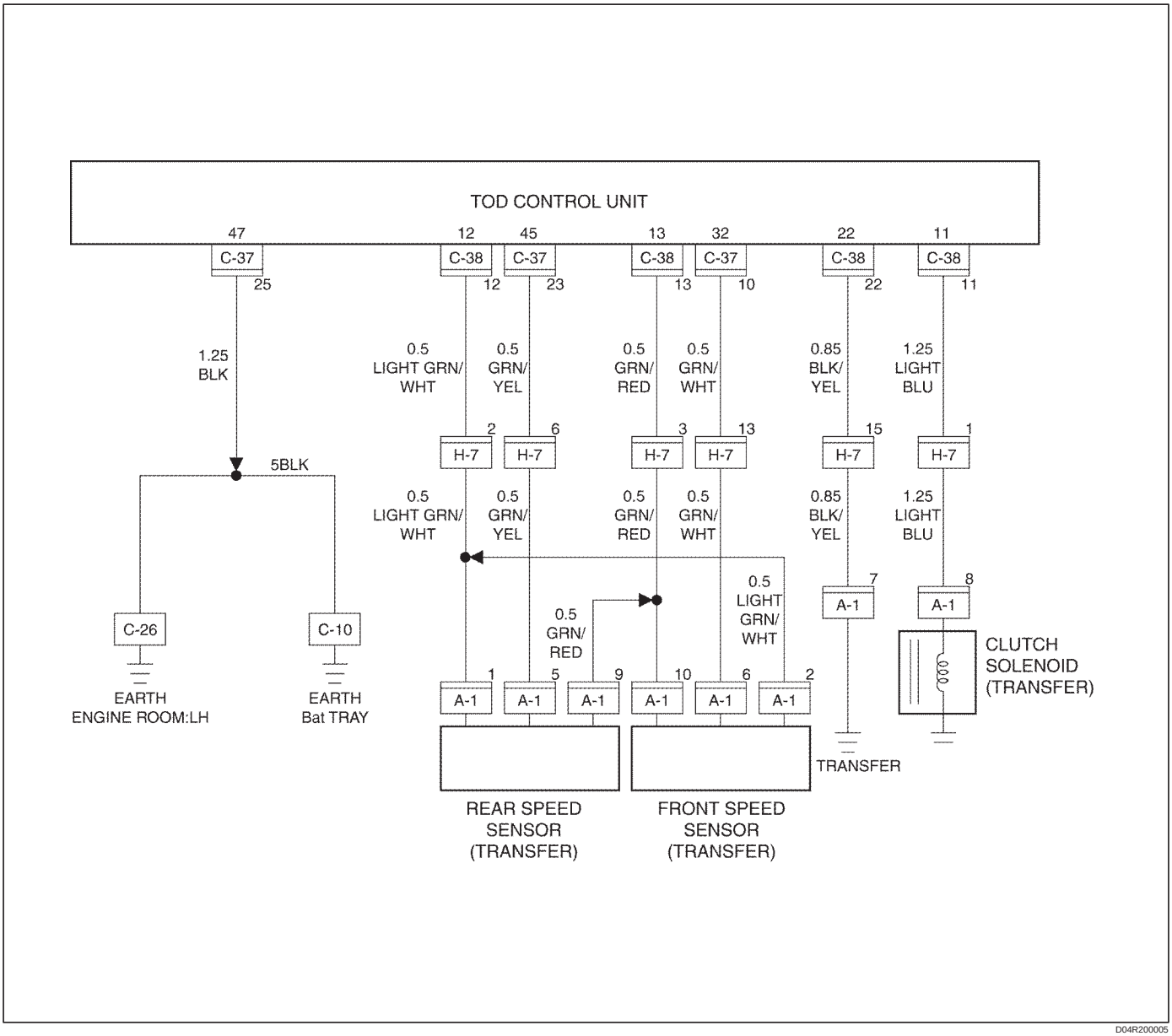
Unit: V

AT selector position	Voltage between terminal 28 and 47	Voltage between terminal 41 and 47	Voltage between terminal 27 and 47
P	12	0	0
R	12	12	0
N	0	12	0
D	0	12	12
3	12	12	12
2	12	0	12
1	0	0	12

Table 2

Continuity between terminals of inhibitor switch connector (E–41)			
AT selector position	Continuity between terminal 8(A) and 5(D)	Continuity between terminal 7(B) and 5(D)	Continuity between terminal 6(C) and 5(D)
P	YES	NO	NO
R	YES	YES	NO
N	NO	YES	NO
D	NO	YES	YES
3	YES	YES	YES
2	YES	NO	YES
1	NO	NO	YES

Check flow	Trouble code	Phenomenon	Standard
9	31 (P1721)	The electromagnetic coil is broken or shorted to the battery or GND.	—



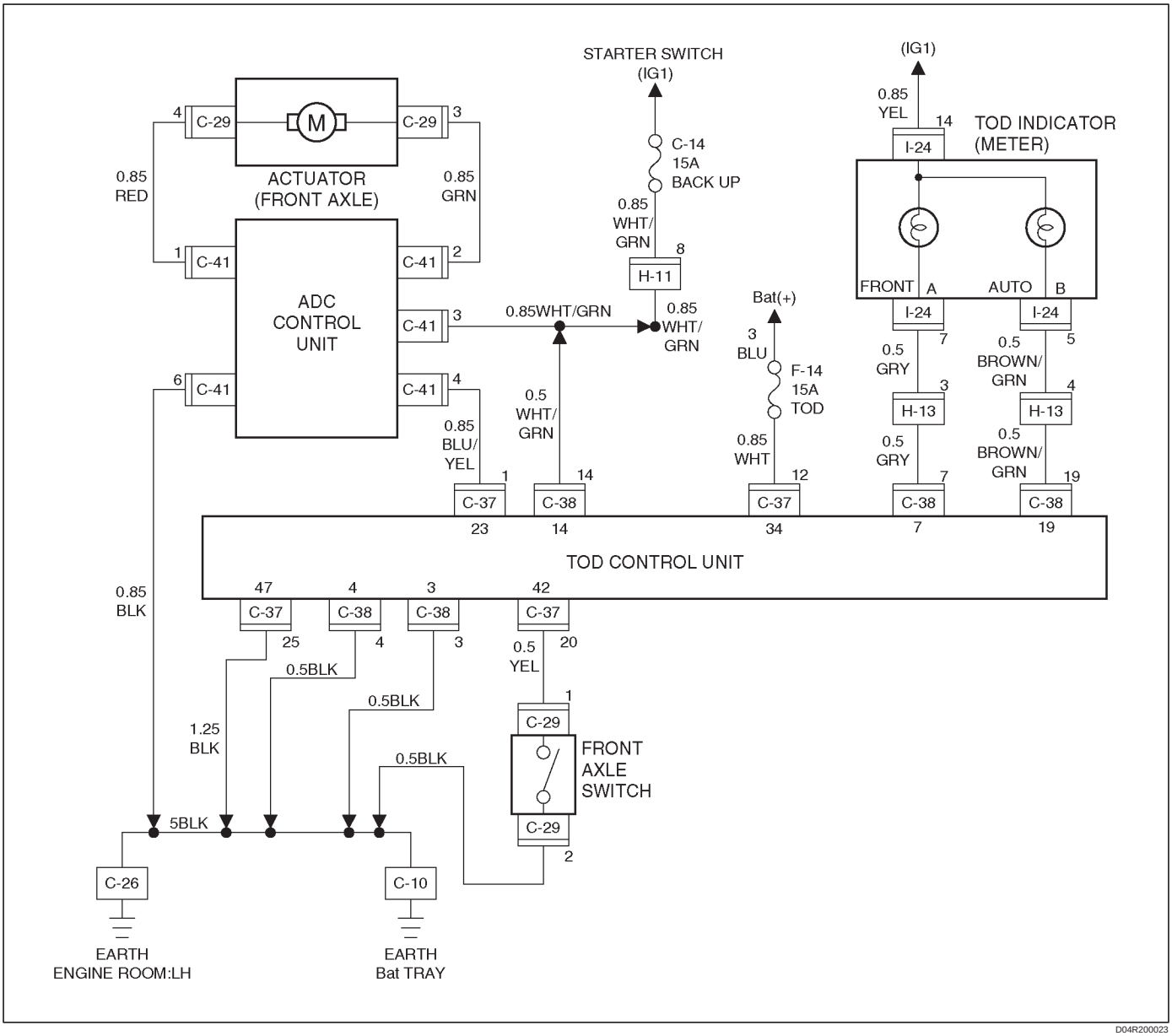
D04R200005

Step	Action	Yes	No
1	1. Clear the trouble code. 2. Start the engine 3. Set the TOD mode. Is there DTC31 (P1721)?	Go to *Step 2*	Refer to *"Trouble intermittently observed".*
2	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the continuity established between terminals (C–38)11 and (C–38)22?	Go to *Step 3*	Go to *Step 5*
3	1. Connect the ECU connector. 2. Start the engine. 3. Set the TOD mode. Does the voltage between terminals 11 and 22 indicate at least 0.4V?	Go to *Step 4*	Go to *Step 6*
4	Is the battery voltage always observed between terminals 11 and 22?	The harness is short–circuited on the battery. Repair the circuit. Go to *Step 8*	Go to *Step 6*
5	1. Disconnect the A–1 connector. Is the continuity established between transfer connector terminals (A–1)8 and (A–1)7?	The harness is broken. Repair the circuit. Go to *Step 8*	Replace the transfer electromagnetic coil (solenoid clutch). Go to *Step 8*
6	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the resistance between the connector (C–38) terminal 11 and 22 1.0 ~ 5.0Ω?	The ECU has failed. Replace the ECU Go to *Step 8*	Go to *Step 7*
7	Is the resistance between the transfer connector (A–1) terminal 8 and 7 1.0 ~ 5.0Ω?	The harness is disconnection or short to GND. Repair the circuit. Go to *Step 8*	Replace the transfer electromagnetic coil (solenoid clutch). Go to *Step 8*
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 8

Check flow	Trouble code	Phenomenon	Standard
10	28 (P1760)	The shift on the fly system (front axle disconnect) works incorrectly.	—

NOTE: The shift on the fly system is not changed between 2WD and 4WD modes normally.

CAUTION: If code 32 or 33 is also observed, remove the trouble associated with code 32 or 33 first.

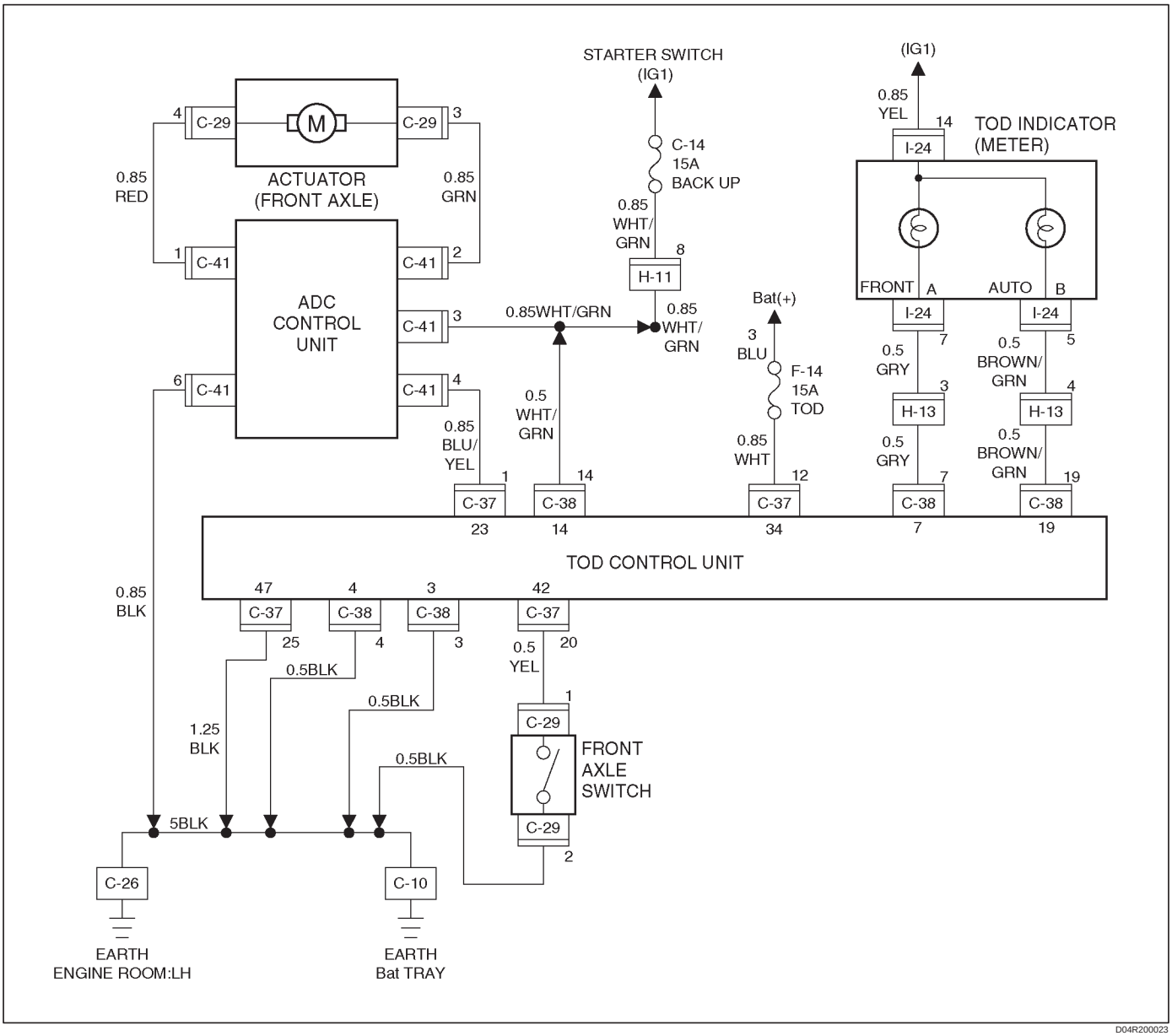


D04R200023

Step	Action	Yes	No
1	1. Turn on the starter switch. 2. Set the transfer to the 2H mode. Is the battery voltage observed between terminals 23 and 47?	Go to *Step 2*	Go to *Step 5*
2	Is 5V observed between terminals 42 and 47?	Go to *Step 3*	Go to *Step 6*
3	1. Set the transfer to the TOD mode. Does the voltage between terminals 23 and 47 indicate 0~1V?	Go to *Step 4*	The ECU has failed. Replace the ECU. Go to *Step 7*
4	Does the voltage between terminals 42 and 47 indicate 0V?	The phenomenon is not reproduced. Refer to *"Troubles intermittently observed".*	The shift on the fly system is failed (refer to *Section 4B1 and 4C*). Go to *Step 7*
5	Does the TOD indicator show the 2H mode?	The ECU has failed. Replace the ECU. Go to *Step 7*	See "Trouble Diagnosis Depending on The Status of TOD Indicator".
6	Set the transfer to the TOD mode. Does the voltage between terminals 23 and 47 indicate 0~1V?	The shift on the fly system has failed (refer to *Section 4B1 and 4C*). Go to *Step 7*	The ECU has failed. Replace the ECU. Go to *Step 7*
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Return to *Step 7*

Check flow	Trouble code	Phenomenon	Standard
11	32 (P1761)	The on/off signal (ADC) line of the shift on the fly system (front axle disconnect) is broken, or the line is short-circuited to the battery.	—

NOTE: The on/off signal line of the shift on the fly system is broken, or the line is short–circuited to the battery.



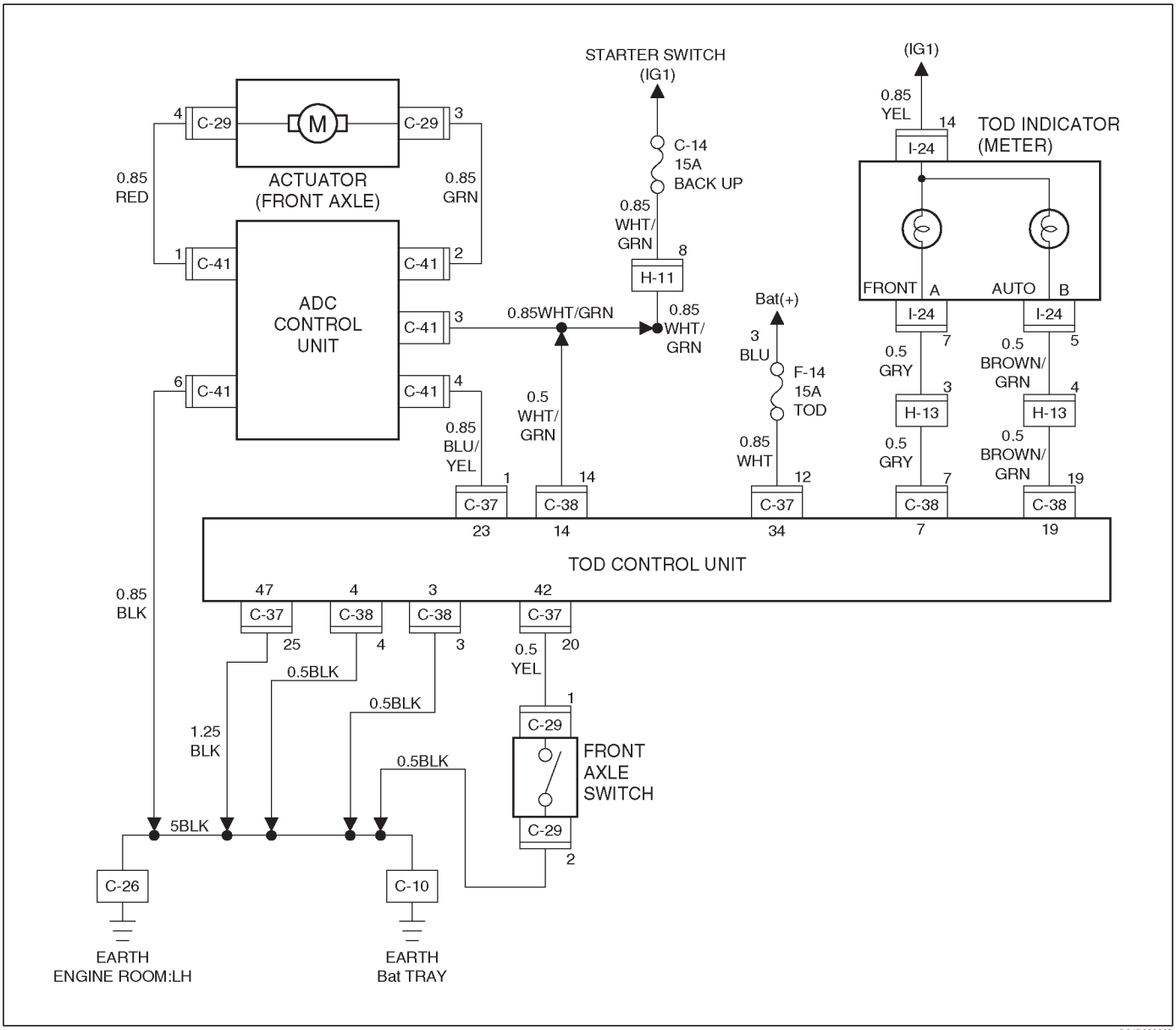
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. 3. Disconnect ADC control unit connector (C–41). Is the continuity established between terminals (C–37) 1 and (C–41) 4? After checking, connect the ADC control unit connector.	Go to *Step 2*	The harness is broken. Repair the circuit. Go to *Step 6*
2	1. Disconnect the battery ground cable. Is there the continuity between the connector terminal (C–37) 1 and (C–38) 14?	The harness is short-circuited to VIGN. Repair the circuit. Go to *Step 6*	Go to *Step 3*
3	1. Disconnect the battery ground cable. Is there the continuity between the connector terminal (C–37) 1 and (C–37) 12?	The harness is short-circuited to VB. Repair the circuit. Go to *Step 6*	Go to *Step 4*
4	Is the resistance between the connector terminal (C–37) 1 and (C–37) 25 less than 1Ω?	The harness is short-circuited to GND. Repair the circuit. Go to *Step 6*	Go to *Step 5*
5	1. Turn off the starter switch. 2. Connect ECU connector. 3. Turn on the starter switch. 4. Set the transfer to the 2H mode. Is the battery voltage observed between the connector (C–37) terminals 1 and 25?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed",* or refer to *"Sec 4B1 Shift on the Fly".*	The ECU has failed. Replace the ECU. Go to *Step 6*
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Return to Step 6

Check flow	Trouble code	Phenomenon	Standard
12	33 (P1762)	The ADC line is short-circuited to GND.	—

NOTE:

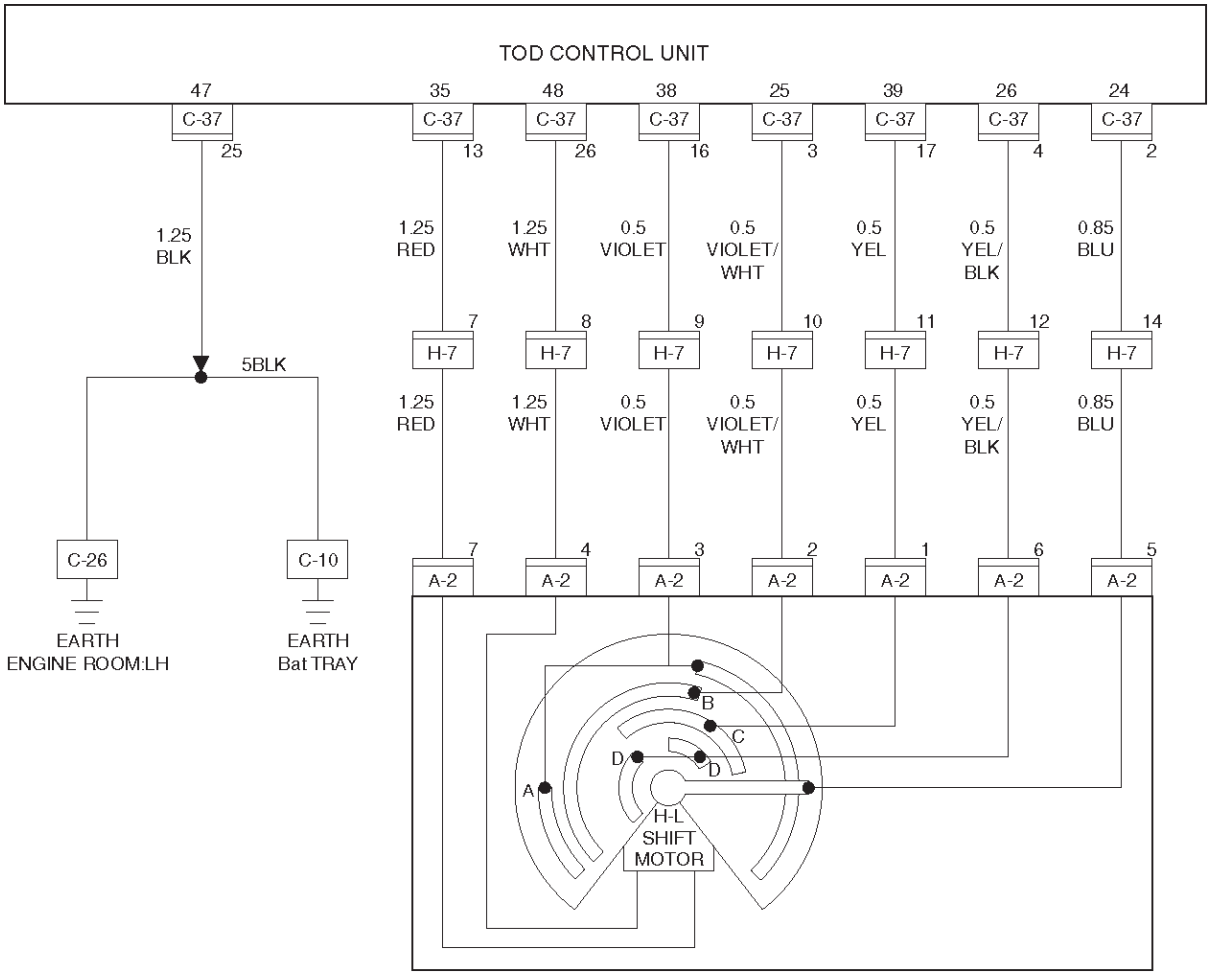
- ▼ The on/off signal line of the shift on the fly system is short–circuited to GND.
- ▼ The system enters into the fail-safe mode because of fusing or system protection.

  (If a short–circuit is observed on GND, the output to the on/off signal line becomes 0V.)



Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. 3. Disconnect the ADC control unit connector (C–41). Is there the continuity between the connector terminal (C–37) 1 and (C–41) 4? After checking, connect the ADC control unit connector.	Go to *Step 2*	The harness is broken. Repair the circuit. Go to *Step 4*
2	Is the resistance between terminals (C–37) 1 and (C–37) 25 less than 1Ω?	The signal line circuit of the shift on the fly system is short-circuited to GND. Repair the circuit. Go to *Step 4*	Go to *Step 3*
3	1. Connect the ECU connector. 2. Turn on the starter switch. 3. Set the transfer to the 2H mode. Is the battery voltage observed between the connector (C–37) terminal 1 and 25?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observe",* or refer to *"Sec 4B1 Shift on the Fly".*	The ECU has failed.Replace the ECU. Go to *Step 4.*
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Return to *Step 4*

Check flow	Trouble code	Phenomenon	Standard
13	41 (P1741)	The High-Low motor circuit is broken. The circuit is short–circuited to GND.	—
	43 (P1743)	The High-Low motor has moved consecutive more than 5 sec.	—



D04R200007

Step	Action	Yes	No
1	1. Turn on the starter switch. When the motor is not moving, is the voltage between the terminals 35 and 47 8.0 ~ 14.5V?	Go to *Step 2*	Go to *Step 3*
2	When the motor is not moving, is the voltage between the terminal 48 and 47 8.0 ~ 14.5V?	Go to *Step 5*	Go to *Step 3*
3	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37) and transfer connector (A–2). Is there the continuity between the connector terminal (C–37) 13 and (A–2) 7?	Go to *Step 4*	Repair the circuit. Go to *Step 11*
4	Is there the continuity between the connector terminal (C–37) 26 and (A–2) 4?	Go to *Step 5*	Repair the circuit Go to *Step 11*
5	1. Connect the ECU connector (C–37) and transfer connector (A–2). 2. Turn on the starter switch Is the transfer shifted to the low range from the high range?	Go to *Step 6*	Go to *Step 7*
6	1. Is the transfer shifted to the high range from the low range.	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 8*
7	1. After the starter switch is turned off, turn on the starter switch. 2. Right after the TOD switch is changed to the 4L position from the TOD position, measure the voltage for 5 seconds. Is the voltage between terminal 48 and 47 0V while the motor is moving and 8.0 ~ 14.5V after the motor moving stops?	Go to *Step 9*	Replace the ECU. Go to *Step 11*
8	1. After the starter switch is turned off, turn on the starter switch. 2. Right after the TOD switch is changed to the TOD position from 4L position, measure the voltage for 5 seconds. Is the voltage between terminals 35 and 47 0V while motor is moving and 8.0 ~14.5V after the motor moving stops?	Go to *Step 9*	Replace the ECU. Go to *Step 11*
9	1. Remove the motor asm with the connector (A–2) from the transfer. 2. Connect the ECU connector (C–37). 3. Turn on the starter switch. When the TOD switch is changed to the 4L position from the TOD position, does the shaft in the motor asm rotate to the Low direction?	Go to *Step 10*	Replace the high-low motor asm. Go to *Step 11*
10	When the TOD switch is changed to the TOD position from the 4L position, does the shaft in the motor asm rotate to the High direction?	Repair the transfer asm. Go to *Step 11*	Replace the high–low motor asm. Go to *Step 11*
11	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair	Return to *Step 11*

NOTE:

▼ Confirm the operation conditions when changing high and low range.

– The car stops. (less than 2 km/h or 1.2 mph and engine speed less than 1500 rpm)

– The AT selector position is neutral.

– The brake is applied (brake switch: ON)

▼ Verify the completion of changing the high/low range by the TOD indicator on the instrument panel.

Check flow	Trouble code	Phenomenon	Standard
14	42 (P1773)	Error operation was carried out under high–low motor running.	—

Step	Action	Yes	No
1	1. Clear the trouble code. Is the transfer changed to the low range from the high range?	Go to *Step 2*	Go to *Step 3*
2	Is the transfer changed to the high range from the low range?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 3*
3	Is the trouble code memoried?	Go to *Step 4*	See "Diagnosis from Symptom".
4	Is the memory DTC42 (P1773)?	Go to *Step 5*	Remove the trouble associated with codes except DTC 42 first. Confirm the DTC again. Go to *Step 5*
5	1. Clear the trouble code. 2. Confirm the condition and operation of the transfer range changing and check the state of the TOD indicator. Change the transfer to the low from the high and vice versa. Is the transfer changed to the low from the high and to the high from the low?	The transfer is changed in both ranges by the correct operation. Operate the transfer according to *"Owner's Manual".*	Go to *Step 6*
6	Is the trouble code memoried?	Go to *Step 7*	See *"Diagnosis from Symptom".*
7	Is the memory DTC 42 (P1773)?	Replace the ECU. Go to *Step 8*	Remove the trouble associated with codes except DTC 42 first. Confirm the DTC again. Go to *Step 5*
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Go to *Step 8*

NOTE:

▼Confirm the operation conditions when changing high/low range.

– The car stops. (less than 2 km/h or 1.2 mph and engine speed: less than 1500 rpm)

– The AT selector position is neutral.

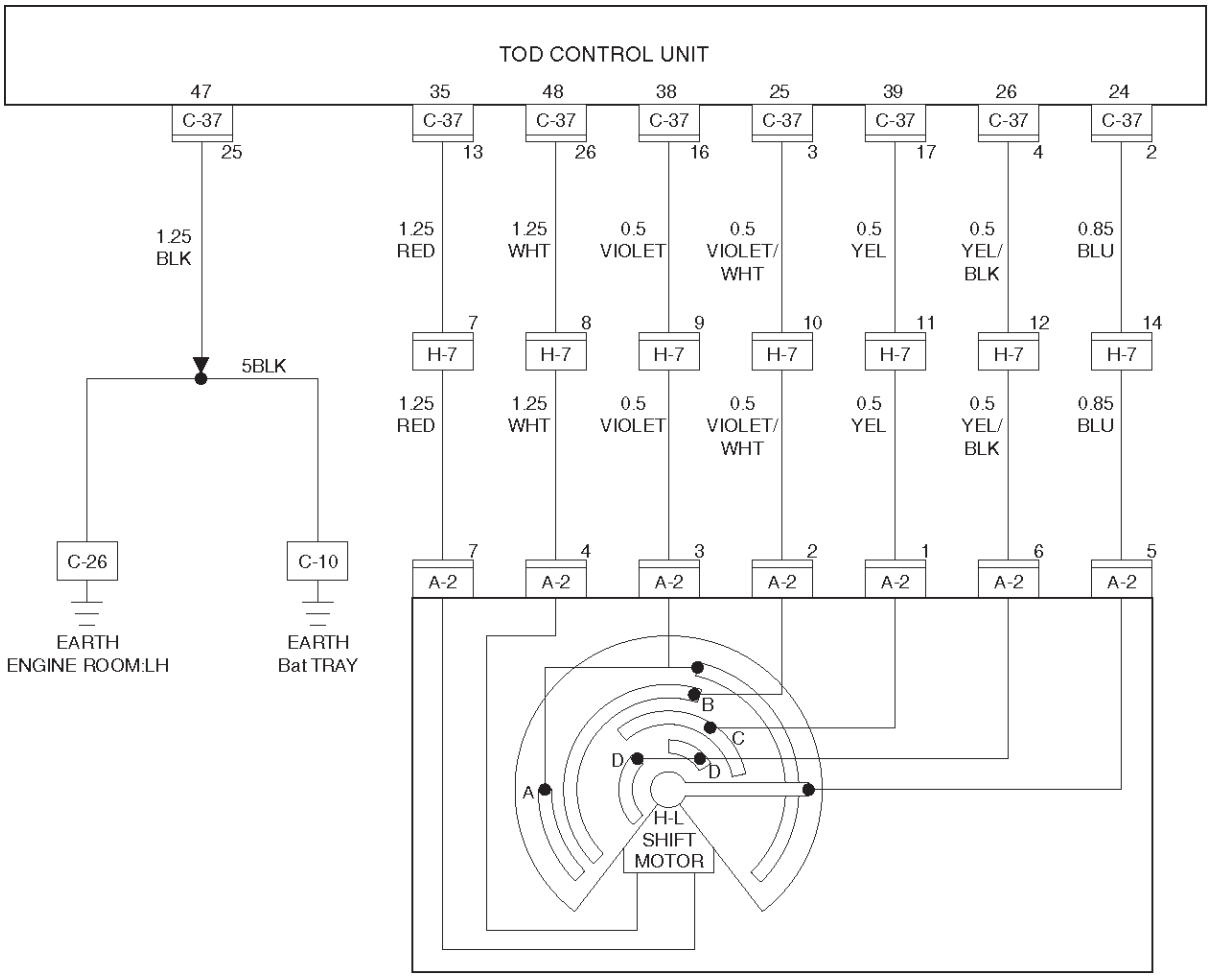
– The brake is applied (brake switch: ON)

▼Verify the completion of changing the high/low range by the TOD indicator on the instrument panel.

▼This code does not indicate the trouble of the transfer or ECU, and is memoried when an error operation is carried out under high-low motor running.

Therefore this code is not memoried if the transfer is operated according to *"Owner's Manual"*.

Check flow	Trouble code	Phenomenon	Standard
15	55 (P1755)	High-Low motor position signal is abnormal. Circuit is shorted to GND.	—



D04R200007

Step	Action	Yes	No
1	1. Turn on the starter switch. Is the transfer changed to the low range from the high range?	Go to *Step 2*	Go to *Step 4*
2	Is the transfer changed to the high range from the low range?	Go to *Step 3*	Go to *Step 5*
3	1. Clear the trouble code. 2. Turn on the starter switch. Is the memory DTC 55 (P1755)?	Go to *Step 1*	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*
4	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37). Is the continuity between the terminals ranged within the any case (case1, 2 or 3) in the following table (1)?	Go to *Step 8*	Go to *Step 6*
5	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37). Does the continuity between the terminals comply with the following table (2)?	Go to *Step 8*	Go to *Step 7*
6	1. Turn off the starter switch. 2. Disconnect the transfer connector (A–2). Is the continuity between the male terminals ranged within the any case (case1, 2 or 3) in the following table (3)?	Go to *Step 8*	The encoder has failed. Replace the high-low motor asm. Go to *Step 9*
7	1. Turn off the starter switch. 2. Disconnect the transfer connector (A-2). Does the continuity between male terminals comply with the following table (4)?	Go to *Step 8*	The encoder has failed. Replace the high-low motor asm. Go to *Step 9*
8	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37) and transfer connector (A–2). Is there the continuity between connector terminal (C–37) 4 and (A–2) 6, (C–37) 17 and (A–2) 1, (C–37) 3 and (A–2) 2, (C–37) 16 and (A–2) 3, and (C–37) 2 and (A–2) 5?	The encoder has failed. Replace the high-low motor asm. Go to *Step 9*	The circuit in which there is no continuity is broken. Repair the circuit. Go to *Step 9*
9	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Verify the repair.	Go to *Step 9*

NOTE:

▼ Confirm the operation conditions when changing high and low range.
- – The car stops. (less than 2 km/h or 1.2 mph and engine speed: less than 1500 rpm)
- – The AT selector position is neutral.
- – The brake is applied (brake switch: ON)

▼ Verify the completion of changing the high/low range by the TOD indicator on the instrument panel.

▼ When changing high/low range, start the engine to prevent the battery dead.

Table (1) (high position standard)

Case	Continuity between terminals:			
	26 and 24	39 and 24	25 and 24	38 and 24
1	NO	NO	NO	YES
2	NO	YES	NO	YES
3	YES	YES	NO	YES

Table (2) (low position standard)

Continuity between terminals:			
26 and 24	39 and 24	25 and 24	38 and 24
YES	NO	YES	YES or NO

Table (3) (high position standard)

Case	Continuity between the connector (A–2) terminals:			
	6 and 5	1 and 5	2 and 5	3 and 5
1	NO	NO	NO	YES
2	NO	YES	NO	YES
3	YES	YES	NO	YES

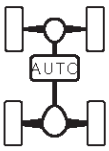
Table (4) (low position standard)

Continuity between the connector (A–2) terminals:			
6 and 5	1 and 5	2 and 5	3 and 5
YES	NO	YES	YES or NO

Trouble Diagnosis Depending on The Status of TOD Indicator

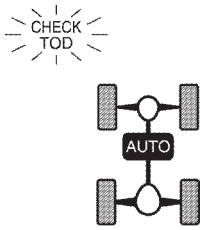
Functional check with TOD indicator light is conducted prior to check on Charts A–H.

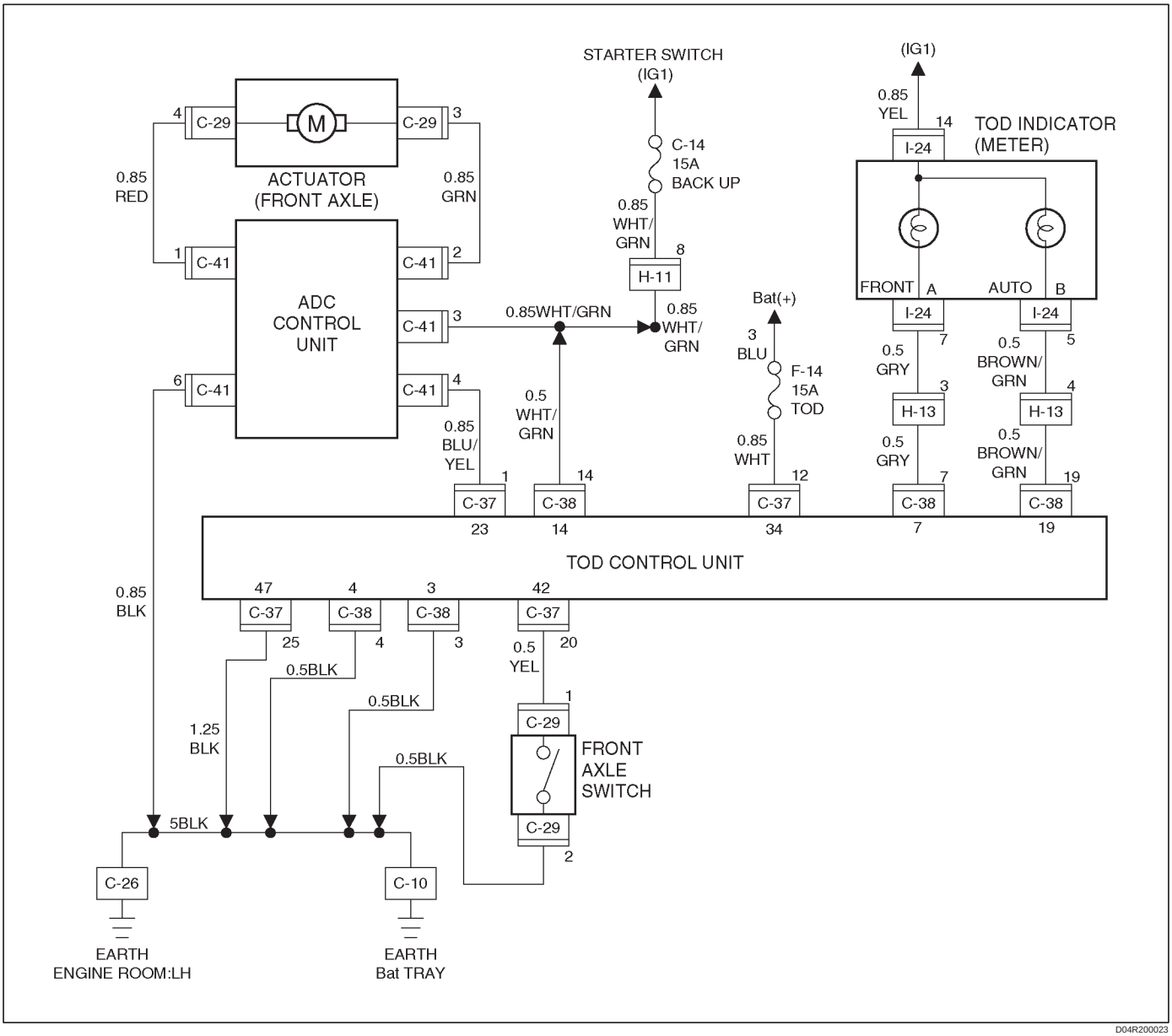
▼After the starter is switched on, check and see if the status has become as tabulated below.

ECU Terminal 8	ECU Terminal 7	ECU Terminal 19	TOD Indicator state
Short to terminal 47	Short to terminal 47	Short to terminal 47	
Open	Open	Open	

C04R200003

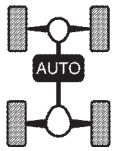
▼If the status is as tabulated above, there is no problem. If not as tabulated above, inspect the harness.

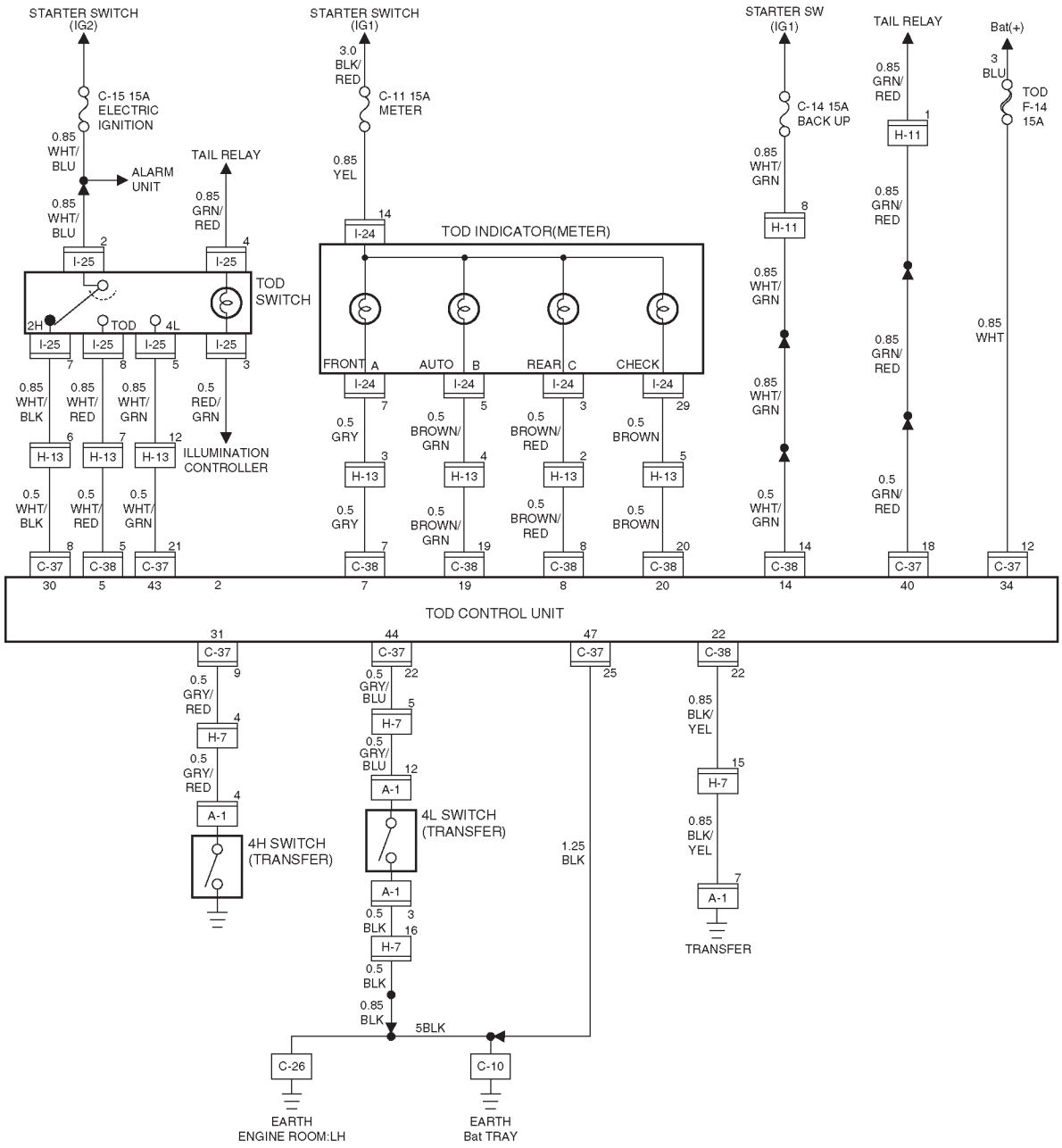
Chart A	Indicator drive circuit	
Function of circuit	The circuit informs the indicator of the working condition of the ECU.	
Fail condition	All the TOD indicator lamps and CHECK lamp are lit.	
Indicator lamp state		—
TOD switch position	2H/TOD/4L	—



D04R200023

Step	Action	Yes	No
1	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 47?	The ECU has failed. Replace the ECU. Go to *Step 2*	Check the battery circuit. Go to *Step 2*
2	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 2

Chart B–1	The TOD switch A circuit wires are broken or short-circuited to the GND	
Function of circuit	—	
Fail condition	Even after the TOD switch position is selected from TOD to 2H, the indicator lamp status is not changed.	
Indicator lamp state	CHECK TOD 	—
TOD switch position	2H	—


STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
H-11
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
EARTH ENGINE ROOM:LH
C-10
EARTH Bat TRAY

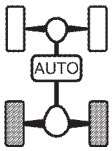
D04R200022

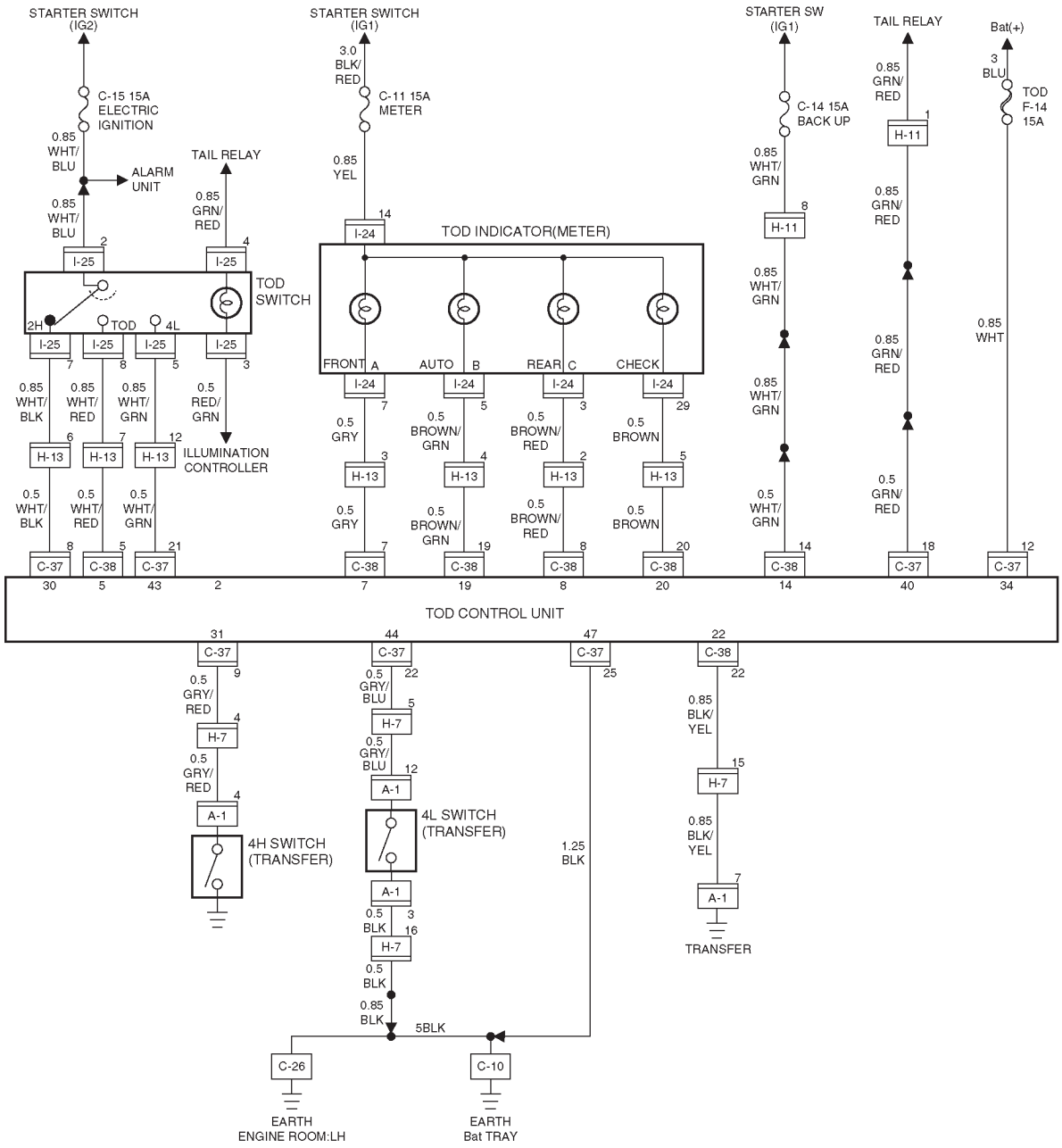
Step	Action	Yes	No
1	1. Turn on the starter switch. When the TOD switch is selected to the TOD position, is 0V observed between terminal 30 and 47, and 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the TOD mode in the following table?	Go to *Step 2*	Repair the TOD switch circuit. Go to *Step 4*
2	When the TOD switch is selected to the 2H position, is 12 V observed between terminals 30 and 47 and is 0V observed between terminal 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 2H mode is the following table?	Go to *Step 3*	Repair the TOD switch circuit. Go to *Step 4*
3	When the TOD switch is selected to the 4L position, is 0V observed between terminals 30 and 47 and is 12V observed between terminal 43 and 47? Does the voltage between terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 4L mode in the following table?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Repair the TOD switch circuit. Go to *Step 4*
4	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Return to Step 4

Table: Indicator Voltage

Unit: V

TOD switch mode	Terminals measured		
	Front 7 and 47	AUTO 19 and 47	Rear 8 and 47
2H	8.0 ~ 14.5	8.0 ~ 14.5	0
TOD	0	0	0
4L	0	8.5 ~ 14.5	0

Chart B–2	The TOD switch A circuit is shorted to battery.
Function of circuit	—
Fail condition	Even after the transfer mode is selected from 2H to TOD, the indicator lamp state does not change.
Indicator lamp state	CHECK TOD 
TOD switch position	TOD


STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
H-11
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

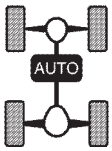
D04R200022

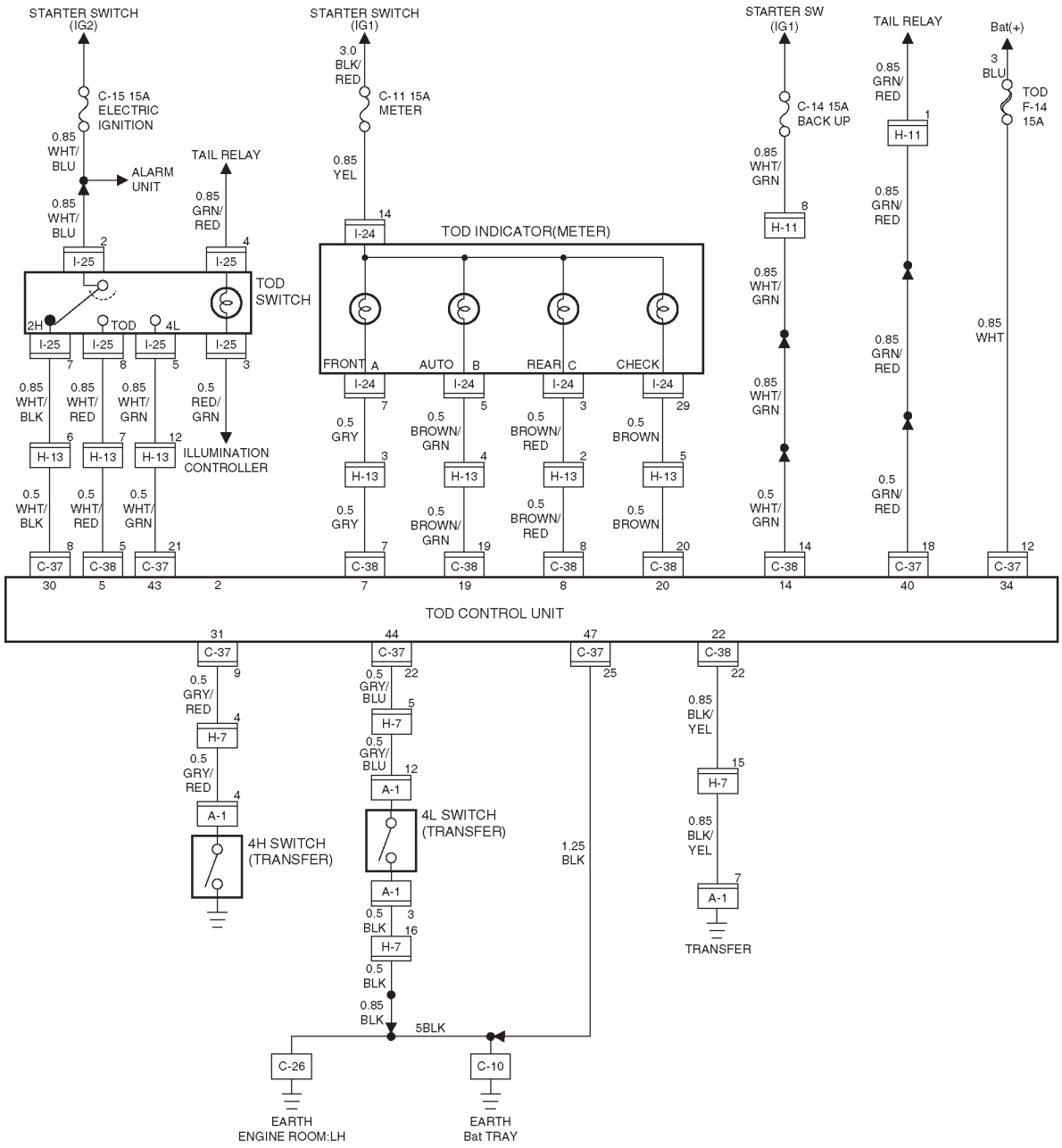
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38). Is the continuity established between the connector terminals (C–38) 14 and (C–38) 7?	Go to *Step 2*	Replace TOD indicator lamp bulb. Go to *Step 6*
2	Is the continuity established between the connector terminals (C–38) 14 and (C–38) 19?	Go to *Step 3*	Replace TOD indicator lamp bulb. Go to *Step 6*
3	1. Turn off the starter switch and connect the ECU connector. 2. Turn on the starter switch. When the TOD switch is selected to the TOD position, is 0V observed between terminals 30 and 47, and 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the TOD mode in the following table?	Go to *Step 4*	Repair the TOD switch circuit. Go to *Step 6*
4	When the TOD switch is selected to the 2H position, is 12V observed between terminals 30 and 47, and 0V observed between terminals 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 2H mode in the following table?	Go to *Step 5*	Repair the TOD switch circuit. Go to *Step 6*
5	When the TOD switch is selected to the 4L position, is 0V observed between the terminal 30 and 47 and 12V observed between the terminal 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 4L mode in the following table?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Repair the TOD switch circuit. Go to *Step 6*
6	1. Check that all the parts are mounted. Is this step complete?	Verify repair.	Go to *Step 6*

Table: Indicator terminal voltage

Unit: V

TOD switch mode	Terminals measured		
	Front 7 and 47	AUTO 19 and 47	Rear 8 and 47
2H	8.0 ~ 14.5	8.0 ~ 14.5	0
TOD	0	0	0
4L	0	8.0 ~ 14.5	0

Chart B–3	The TOD switch B circuit is shorted to GND or broken.
Function of circuit	—
Fail condition	Even after the transfer mode is selected from TOD to 4L, the indicator lamp state does not change.
Indicator lamp state	CHECK TOD 
TOD switch position	4L


STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
H-11
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
C-37
C-38
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

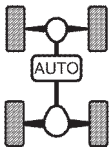
D04R200022

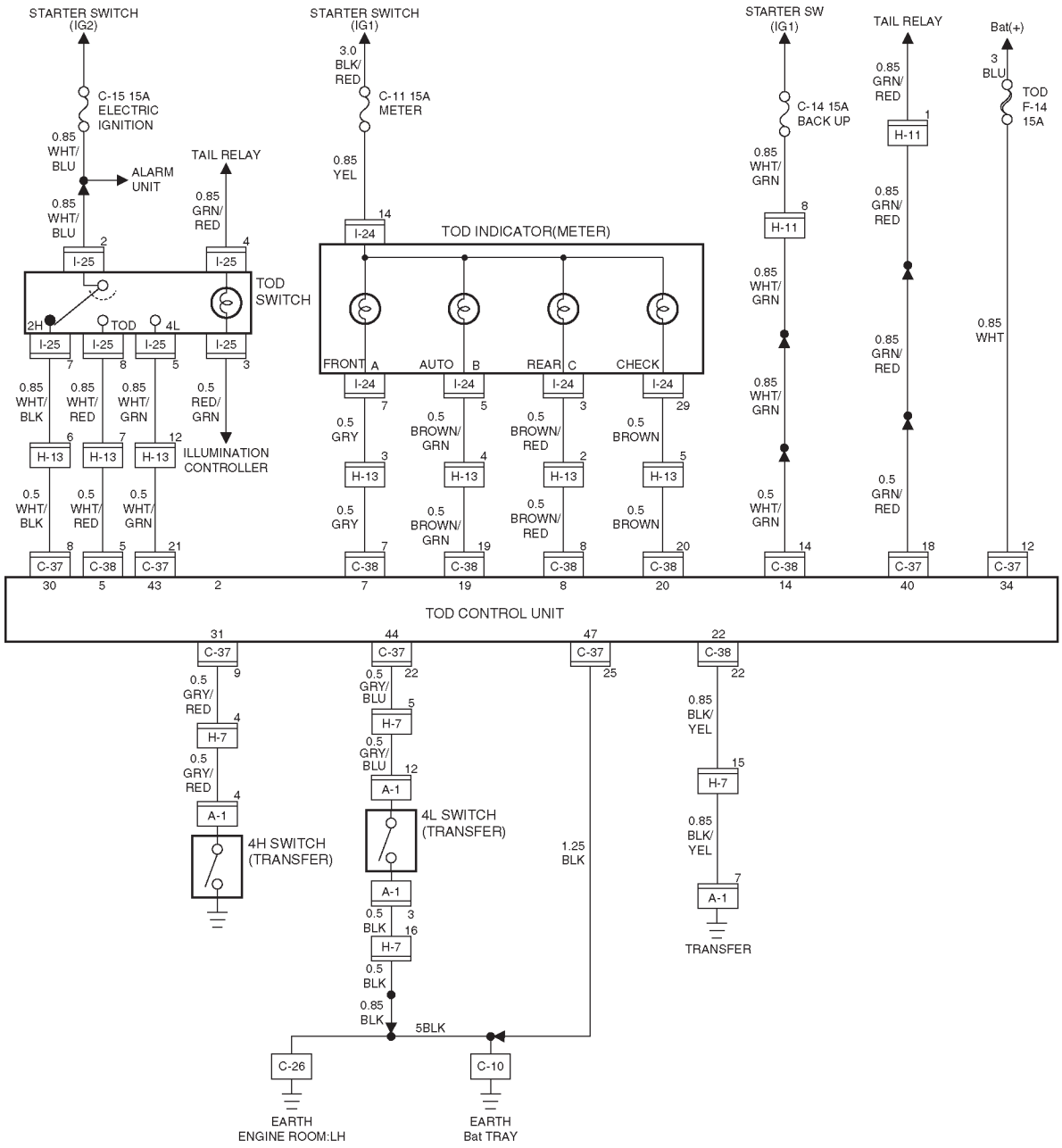
Step	Action	Yes	No
1	1. Turn on the starter switch. When the TOD switch is selected to the TOD position, is 0V observed between terminals 30 and 47, and 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the TOD mode in the following table?	Go to *Step 2*	Repair the TOD switch circuit. Go to *Step 4*
2	When the TOD switch is selected to the 2H position, is 12V observed between terminals 30 and 47, and 0V observed between terminals 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 2H mode in the following table?	Go to *Step 3*	Repair the TOD switch circuit. Go to *Step 4*
3	When the TOD switch is selected to the 4L position, is 0V observed between the terminal 30 and 47 and 12V observed between the terminal 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 4L mode in the following table?	The phenomenon is not reproduced. Refer to *"Trouble intermittentry observed".*	Repair the TOD switch circuit. Go to *Step 4*
4	1. Check that all the parts are mounted. Is this step complete?	Verify repair.	Go to *Step 4*

Table: Indicator terminal voltage

Unit: V

TOD switch mode	Terminals measured		
	Front 7 and 47	AUTO 19 and 47	Rear 8 and 47
2H	8.0 ~ 14.5	8.0 ~ 14.5	0
TOD	0	0	0
4L	0	8.0 ~ 14.5	0

Chart B–4	The TOD switch B circuit is shorted to battery.
Function of circuit	—
Fail condition	Even after the transfer mode is selected from 4L to TOD, the indicator lamp state does not change.
Indicator lamp state	CHECK TOD 
TOD switch position	TOD


STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
0.5 GRY/ BLU
0.85 BLK/ YEL
4H SWITCH (TRANSFER)
4L SWITCH (TRANSFER)
1.25 BLK
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

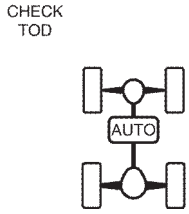
D04R200022

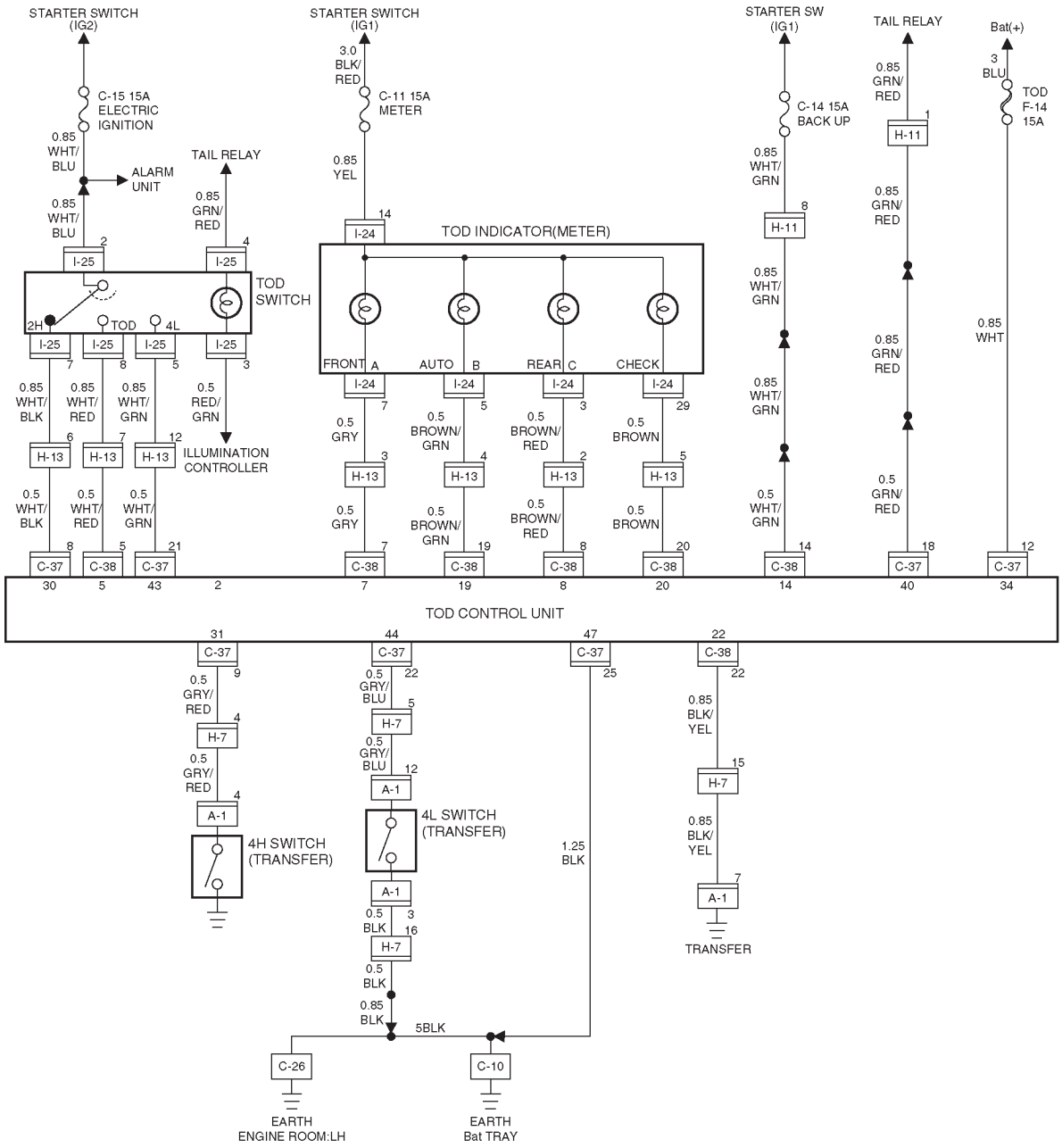
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–38). Is the continuity established between the connector terminals (C–38) 14 and (C–38) 19?	Go to *Step 2*	Replace TOD indicator lamp bulb. Go to *Step 5*
2	1. Turn off the starter switch and connect the ECU connector. 2. Turn on the starter switch. When the TOD switch is selected to the TOD position, is 0V observed between terminals 30 and 47, and 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the TOD mode in the following table?	Go to *Step 3*	Repair the TOD switch circuit. Go to *Step 5*
3	When the TOD switch is selected to the 2H position, is 12V observed between terminals 30 and 47, and 0V observed between terminals 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 2H mode in the following table?	Go to *Step 4*	Repair the TOD switch circuit. Go to *Step 5*
4	When the TOD switch is selected to the 4L position, is 0V observed between the terminal 30 and 47 and 12V observed between the terminal 43 and 47? Does the voltage between the terminals 7 and 47, 19 and 47, and 8 and 47 comply with the 4L mode in the following table?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Repair the TOD switch circuit. Go to *Step 5*
5	1. Check that all the parts are mounted. Is this step complete?	Verify repair.	Go to *Step 5*

Table: Indicator terminal voltage

Unit: V

TOD switch mode	Terminals measured		
	Front 7 and 47	AUTO 19 and 47	Rear 8 and 47
2H	8.0 ~ 14.5	8.0 ~ 14.5	0
TOD	0	0	0
4L	0	8.0 ~ 14.5	0

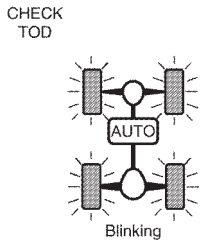
Chart C–1	4H switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	When the TOD switch is selected to 4L from TOD, all the indicator lamps are turned off.
Indicator lamp state	
TOD switch position	4L

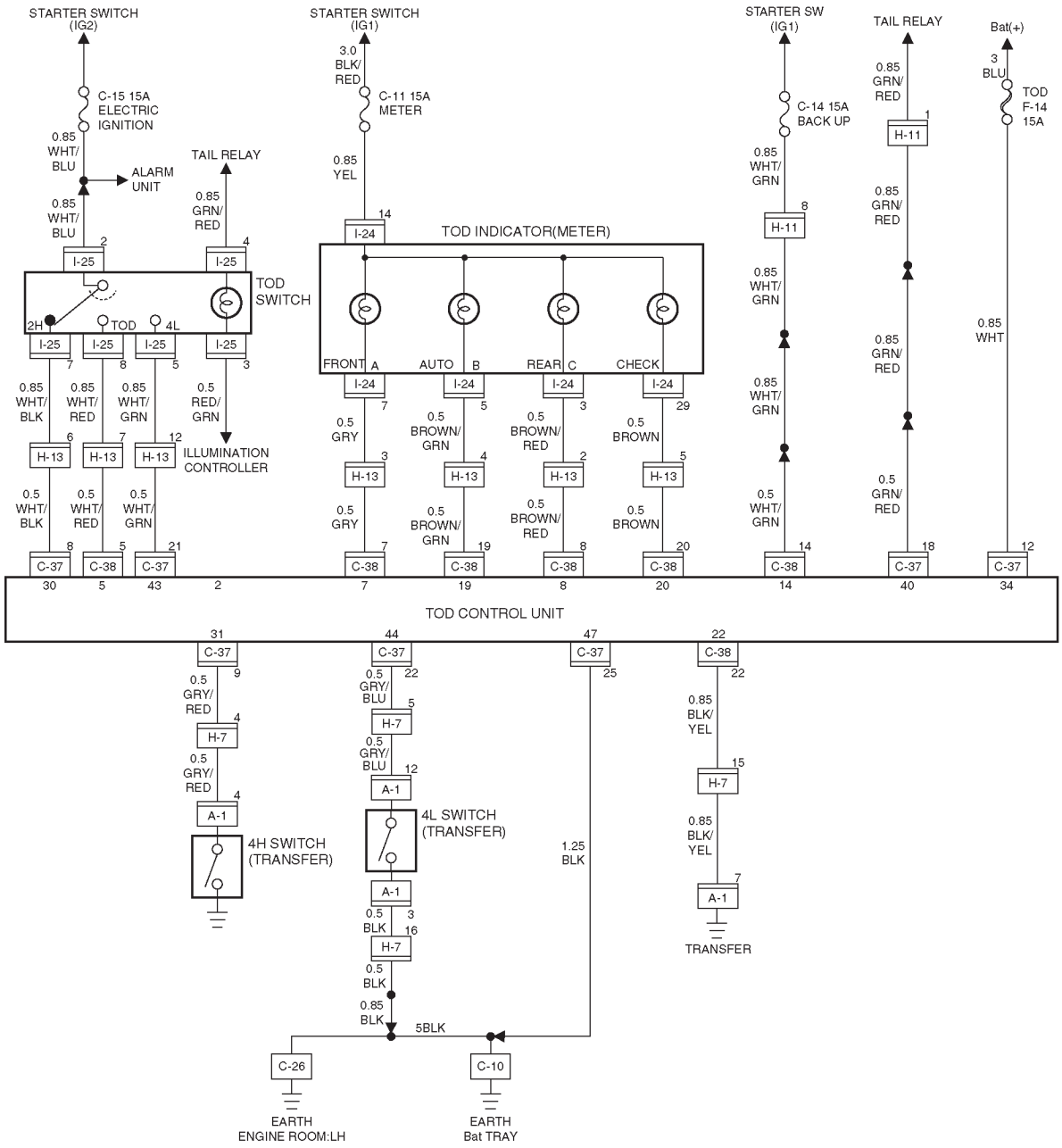

STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

D04R200022

Step	Action	Yes	No
1	1. Turn on the starter switch. 2. The car stops, the AT selector is N position and the brake is applied. When the TOD switch is changed to the TOD position, is 12V observed between terminals 31 and 47 (4H switch)?	Go to *Step 2*	Go to *Step 9*
2	1. The car stops the AT selector is N position and the brake is applied. When the TOD switch is changed to the 4L position, is 12V observed between terminals 31 and 47 (4H switch)?	Go to *Step 3*	Go to *Step 9*
3	1. Turn off the starter switch. Is there the continuity terminal 14 and 7?	Go to *Step 4*	Replace the TOD indicator lamp bulb, or repair the circuit. Go to *Step 13*
4	Is there the continuity between the terminals 14 and 19?	Go to *Step 5*	Replace the TOD indicator lamp bulb, or repair the circuit. Go to *Step 13*
5	Is there the continuity between the terminal 14 and 8?	Go to *Step 6*	Replace the TOD indicator lamp bulb, or repair the circuit. Go to *Step 13*
6	1. Turn on the starter switch. 2. The car stops the AT selector is N position and the brake is applied. When the TOD switch is changed to the 4L position, is 0V observed between terminal 7 and 47? (for 2 seconds after the starter switch ON) ?	Go to *Step 7*	The ECU has frailed. Replace the ECU. Go to *Step13*
7	Is 0V observed between terminal 19 and 47? (for 2 seconds after the starter switch ON)	Go to *Step 8*	The ECU has failed. Replace the ECU. Go to *Step 13*
8	Is 0V observed between terminal 8 and 47? (for 2 seconds after the starter switch ON)	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	The ECU has failed. Replace the ECU. Go to *Step 13*
9	1. The car stops, the AT selector is N position, and the brake is applied. 2. The TOD switch is changed to the TOD (or 2H) position. 3. Turn off the starter switch. 4. Disconnect the ECU connector (C–37). Is there the continuity between the connector (C–37) terminal 9 and 25?	Go to *Step 11*	Go to *Step 10*

Step	Action	Yes	No
10	1. Connect the ECU connector (C–37) and turn on the starter switch. 2. The car stops, the AT selector is N position, and the brake is applied. 3. Change the TOD switch to the 4L position. 4. Turn off the starter switch and disconnect the ECU connector (C–37). Is there the continuity between the connector (C–37) terminal 9 and 25?	Go to *Step 11*	The ECU has failed. Replace the ECU. Go to *Step 13*
11	1. Disconnect the connector (H–7). Is the continuity established between the transfer connector terminals (H–7)4 and (C–37) 9?	Go to *Step 12*	The harness is broken between terminal (H–7) 4 and (C–37) 9. Repair the circuit. Go to *Step 13*
12	1. Connect the connector (H–7). 2. Disconnect the connector (A–1). Is there the continuity between the connector terminal (A–1) 4 and (C–37) 9?	Repair the transfer. Go to *Step 13*	The harness between the connector terminal (C–37) 9 and (A–1) 4 is short-circuited to GND. Repair the circuit. Go to *Step 13*
13	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Return to Step 13

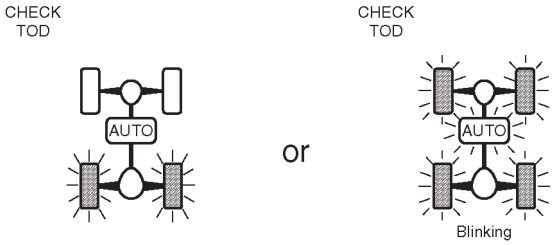
Chart D–1	4L switch circuit wires are broken or the battery circuit is short-circuited.
Function of circuit	—
Fail condition	When the TOD switch is changed to the 4L position, the indicator 4L mode goes on and off.
Indicator lamp state	
TOD switch position	4L

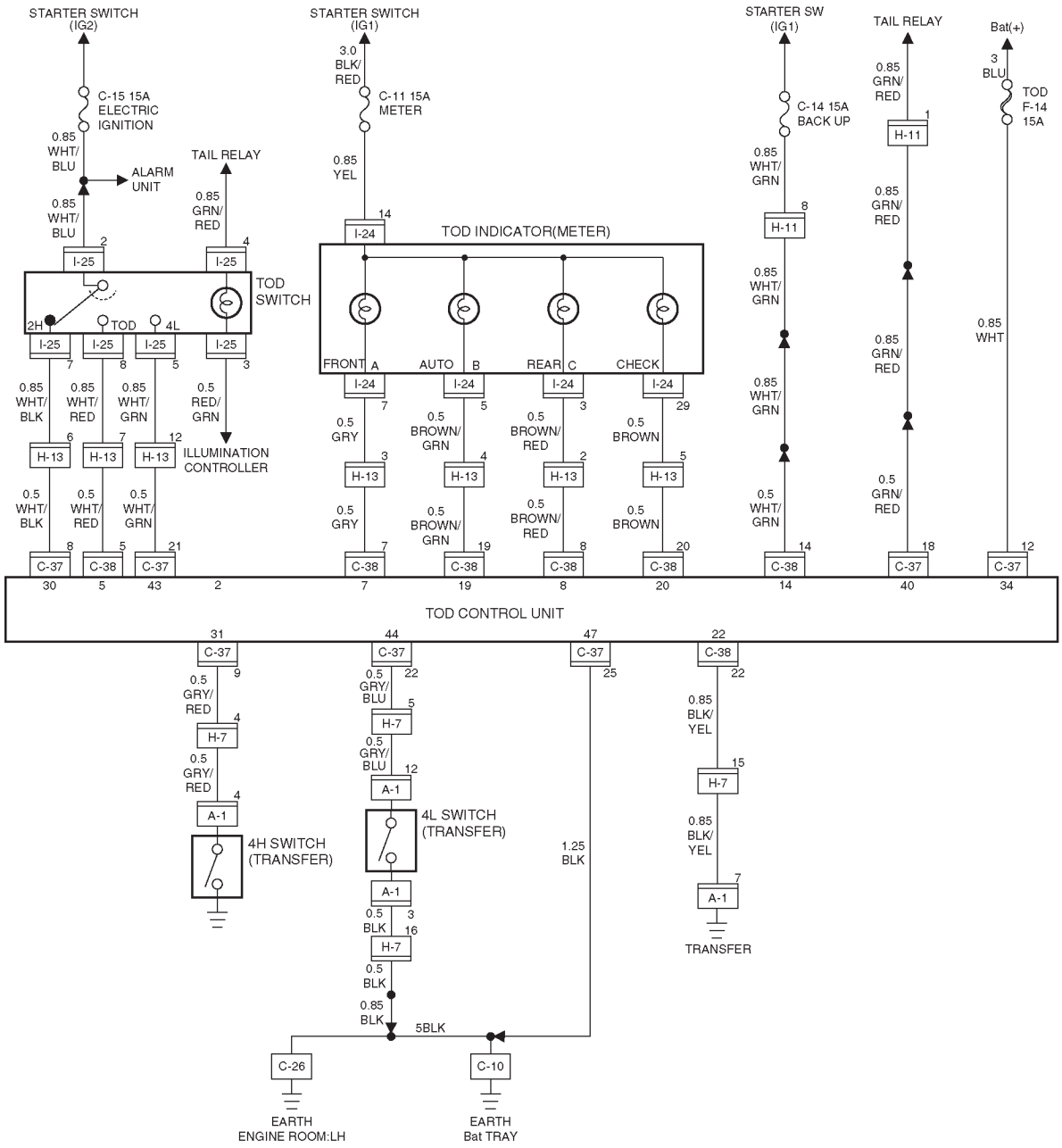

STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

D04R200022

Step	Action	Yes	No
1	1. Turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the TOD (or 2H) position, is 12V observed between terminals 44 and 47 (4L switch)?	Go to *Step 2*	Go to *Step 4*
2	1. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the 4L position, does the transfer become the 4L state?	Go to *Step 3*	Refer to *"Diagnosis from symptom".*
3	Is 0V observed between the terminal 44 and 47?	The ECU has failed.Replace the ECU. Go to *Step 10*	Go to *Step 10*
4	1. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the TOD (or 2H) position, is 12V observed between the connector (C–37) terminal 22 and 25?	Go to *Step 5*	Go to *Step 6*
5	1. Turn off the starter switch and connect the EUC connector. 2. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the 4L position, is 0V observed between terminals (C–37) 22 and (C–37) 25 (4L switch)?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 6*
6	1. Turn off the starter switch and connect ECU connector. 2. Turn on the starter switch. 3. The car stops, the AT selector is the N position, and the brake is applied. 4. Change the TOD switch to the TOD (or 2H) position. 5. After the transfer has changed to the TOD (or 2H) mode, turn off the starter switch and disconnect the ECU connector (C–37). Is there the continuity between the connector (C–37) terminal 22 and 25?	Go to *Step 9*	Go to *Step 7*
7	1. Turn off the starter switch and connect the ECU connector. 2. Turn on the starter switch. 3. The car stops, the AT selector is the N position, and the brake is applied. 4. Change the TOD switch to the 4L position. 5. After the transfer has changed to the 4L mode, turn off the starter switch. 6. Disconnect the ECU connector. Is there the continuity between the connector (C–37) terminal 22 and 25?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 8*
8	1. Turn off the starter switch and connect the ECU connector. 2. Turn on the starter switch. 3. The car stops, the AT selector is the N position, and the brake is applied. 4. Change the TOD switch to the TOD (or 2H) position. 5. After the transfer has changed to the TOD (or 2H) mode, turn off the starter switch. 6. Disconnect the transfer connector (A–1). Is there the continuity between the connector terminal (A–1) 12 and GND?	Repair the transfer. Go to *Step 10*	Repair the circuit between (C–37) 22 and (A–1) 12. Go to *Step 10*

Step	Action	Yes	No
9	1. Turn off the starter switch and connect the connector (A–1). 2. Turn on the starter switch. 3. The car stops, the AT selector is N position, and the brake is applied. 4. Change the TOD switch to the 4L position. 5. After the transfer has changed to the 4L mode, turn off the starter switch. 6. Disconnect the transfer connector (A–1). Is there the continuity between the connector terminal (A–1) 12 and GND?	Repair the circuit between (C–37)22 and (A–1)12. Go to *Step 10*	Repair the transfer. Go to *Step 10*
10	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 10*

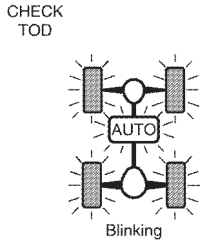
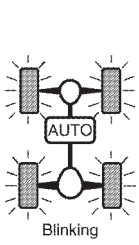
Chart D–2	The 4L switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	When the TOD switch is changed to the 2H or TOD position, the indicator 2H or TOD mode goes on and off.
Indicator lamp state	
TOD switch position	2H or TOD

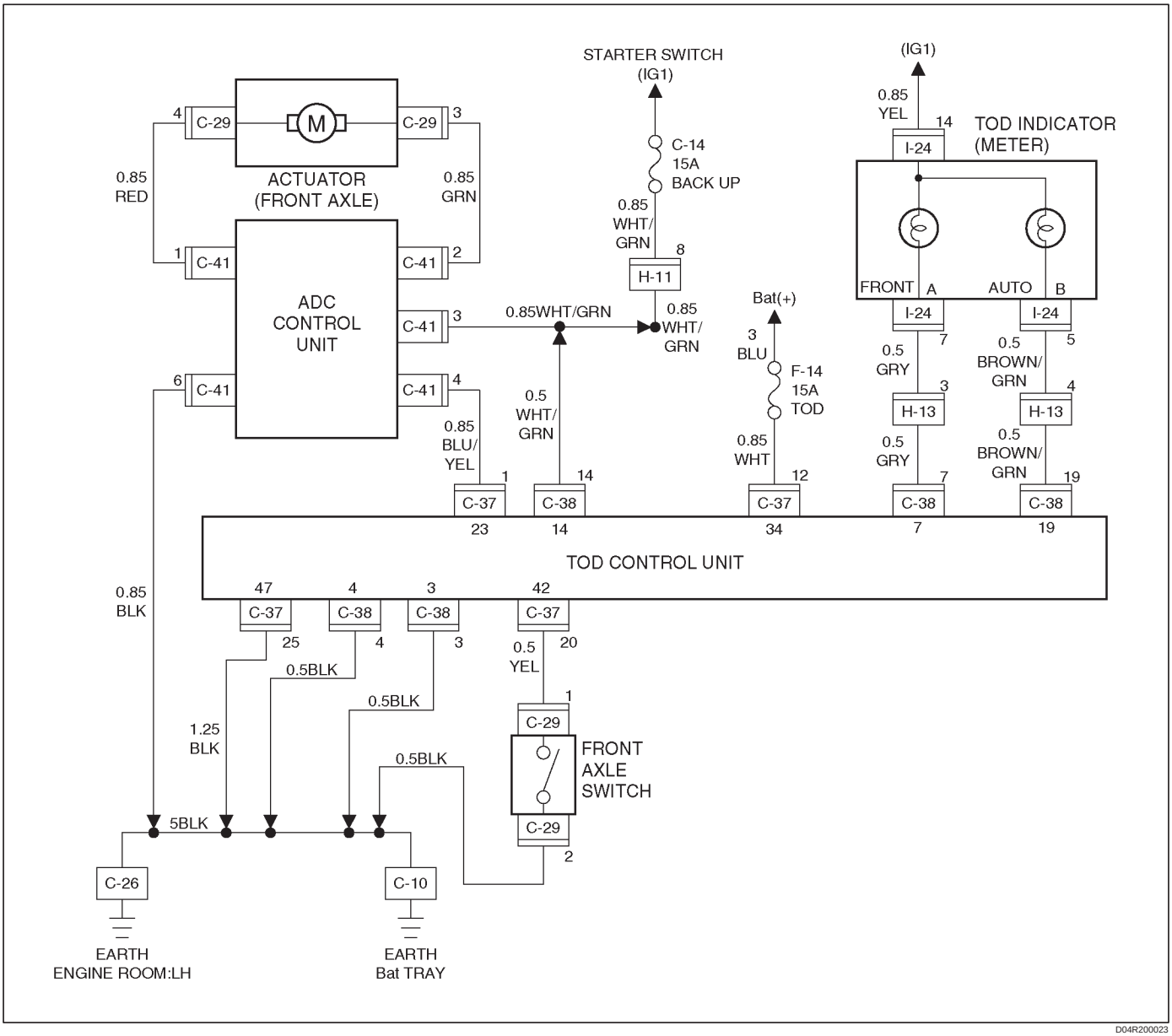

STARTER SWITCH (IG2)
C-15 15A ELECTRIC IGNITION
0.85 WHT/ BLU
ALARM UNIT
TAIL RELAY
0.85 GRN/ RED
I-25
TOD SWITCH
2H
TOD
4L
0.85 WHT/ BLK
0.85 WHT/ RED
0.85 WHT/ GRN
0.5 RED/ GRN
H-13
ILLUMINATION CONTROLLER
0.5 WHT/ BLK
0.5 WHT/ RED
0.5 WHT/ GRN
C-37
C-38
STARTER SWITCH (IG1)
3.0 BLK/ RED
C-11 15A METER
0.85 YEL
I-24
TOD INDICATOR(METER)
FRONT A
AUTO B
REAR C
CHECK
0.5 GRY
0.5 BROWN/ GRN
0.5 BROWN/ RED
0.5 BROWN
STARTER SW (IG1)
C-14 15A BACK UP
0.85 WHT/ GRN
0.5 WHT/ GRN
TAIL RELAY
0.85 GRN/ RED
H-11
0.5 GRN/ RED
Bat(+)
3 BLU
TOD F-14 15A
0.85 WHT
TOD CONTROL UNIT
0.5 GRY/ RED
H-7
A-1
4H SWITCH (TRANSFER)
0.5 GRY/ BLU
4L SWITCH (TRANSFER)
1.25 BLK
0.85 BLK/ YEL
TRANSFER
0.5 BLK
0.85 BLK
5BLK
C-26
C-10
EARTH ENGINE ROOM:LH
EARTH Bat TRAY

D04R200022

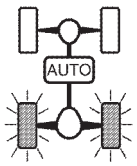
Step	Action	Yes	No
1	1. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the TOD (or 2H) position, is 12V observed between terminals 44 and 47 (4L switch)?	Go to *Step 2*	Go to *Step 3*
2	1. The car stops, the AT selector is the N position, and the brake is applied. When the TOD switch is changed to the 4L position, is 0V observed between terminals 44 and 47 (4L switch)?	Refer to *"Trouble intermittently observed".*	Go to *Step 3*
3	1. The car stops, the AT selector is the N position, and the brake is applied. 2. Select the TOD switch to the TOD (or 2H) position. Is there the continuity between the connector (C–37) terminal 22 and 25?	Go to *Step 5*	Go to *Step 4*
4	1. Connect the ECU connector (C–37) and turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. 3. Select the TOD switch to the 4L position. 4. Turn off the starter switch and disconnect the ECU connector (C–37). Is there the continuity between the connector (C–37) terminal 22 and 25?	The ECU has failed.Replace the ECU. Go to *Step 9*	Go to *Step 5*
5	1. Connect the ECU connector (C–37) and turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. 3. Select the TOD switch to the TOD (or 2H) position. 4. Turn off the starter switch and disconnect the connector (H–7). Is there the continuity between the connector terminal (H–7) 5 and (C–37) 25?	Go to *Step 7*	Go to *Step 6*
6	1. Connect the connector (H–7) and turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. 3. Select the TOD switch to the 4L position. 4. After the transfer has changed to the 4L mode, turn off the starter switch and disconnect the connector (H–7). Is there the continuity between the connector terminal (H–7) 5 and (C–37) 25?	Go to *Step 7*	GND is short-circuited between terminals (C–37) 2 and (H–7) 5. Repair the circuit. Go to *Step 9*
7	1. Connect the connector (H–7) and turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. 3. Select the TOD switch to the TOD (or 2H) position. 4. After the transfer has changed to the TOD (or 2H) mode, turn off the starter switch and disconnect the connector (A–1). Is there the continuity between the connector terminal (A–1) 12 and GND?	Repair the transfer. Go to *Step 9*	Go to *Step 8*

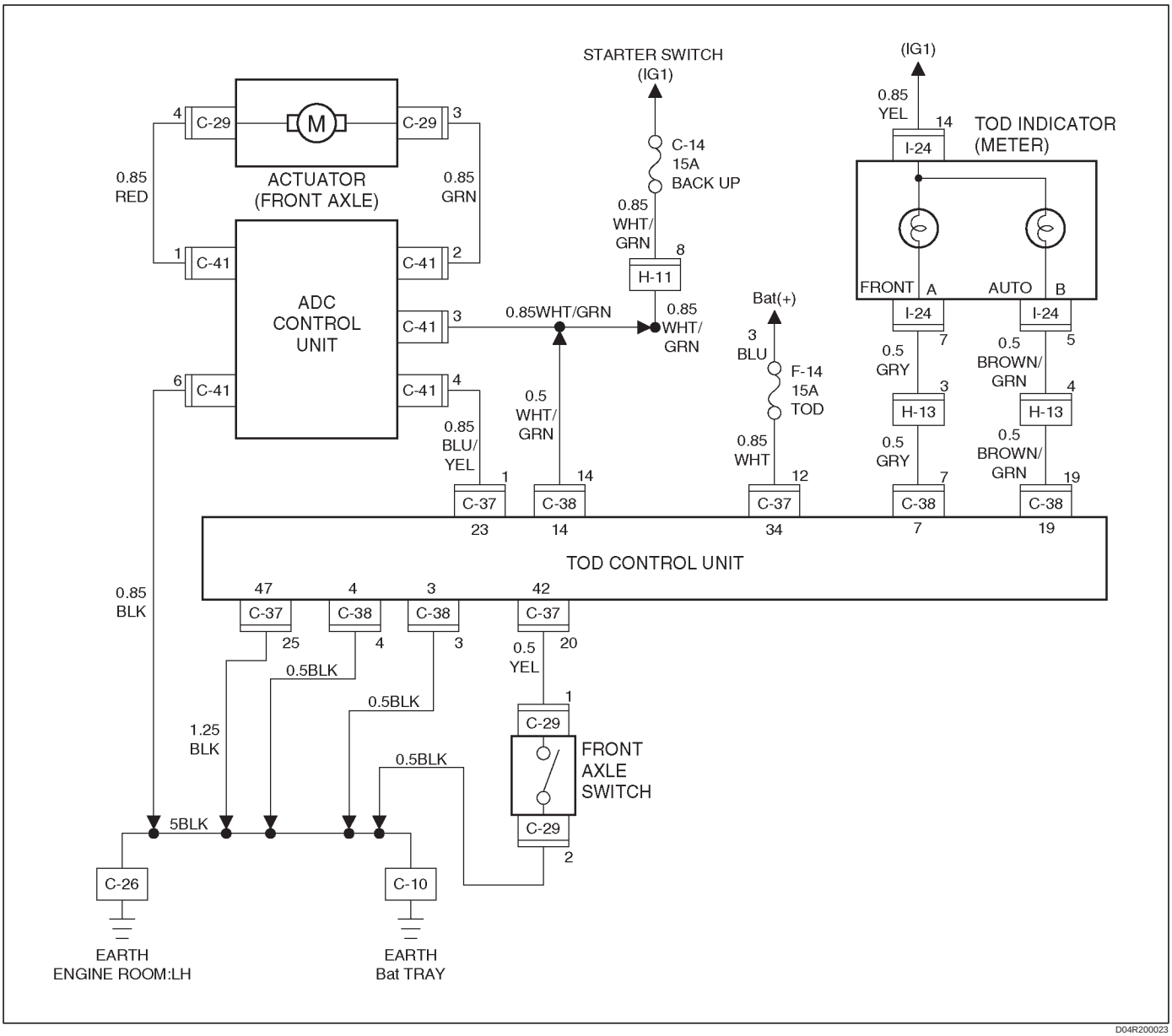
Step	Action	Yes	No
8	1. Connect the connector (A–1) and turn on the starter switch. 2. The car stops, the AT selector is the N position, and the brake is applied. 3. Select the TOD switch to the 4L position. 4. After the transfer has changed to the 4L mode, disconnect the connector (A–1). Is there the continuity between the connector terminal (A–1) 12 and GND?	GND is short-circuited between terminals (A–1) 12 and (H–7) 5. Repair the circuit. Go to *Step 9*	Repair the transfer. Go to *Step 9*
9	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 9*

Chart E–1	AXLE switch circuit wires are broken.	
Function of circuit	—	
Fail condition	Both the TOD and 4L modes are disabled. (The transition status is not removed.)	
Indicator lamp state		
TOD switch position	TOD	4L



Step	Action	Yes	No
1	Start the engine. When the TOD switch is selected to the TOD position, is 0V observed between terminals 42 and 47?	Go to *Step 2*	Go to *Step 4*
2	1. The car stops, the AT selector is N position, and the brake is applied. 2. Select the TOD switch to the 4L position. Is 0V observed between terminals 42 and 47?	Go to *Step 3*	Go to *Step 4*
3	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 4L position, is 12V observed between the terminal 19 and 47?	The phenomenon is not reproduced. Refer to *"Troubles intermittently observed".*	The ECU has failed.Replace the ECU. Go to *Step 8*
4	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 2H position, is the battery voltage observed between the terminal 23 and 47.	Go to *Step 5*	Go to *Step 7*
5	When the TOD switch is selected to the TOD position (TOD mode), is 0 ~ 1V observed between terminals 23 and 47?	Go to *Step 6*	Go to *Step 7*
6	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 4L position, is 0V observed between terminals 23 and 47?	Repair the circuit or check the "Front Axle Disconnect". (Refer to *section 4B*) Go to *Step 8*	Go to *Step 7*
7	Is any of the trouble codes 28 (P1760), 32 (P1761) and 33 (P1762) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	The ECU has failed. Replace the ECU. Go to *Step 8*
8	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 8*

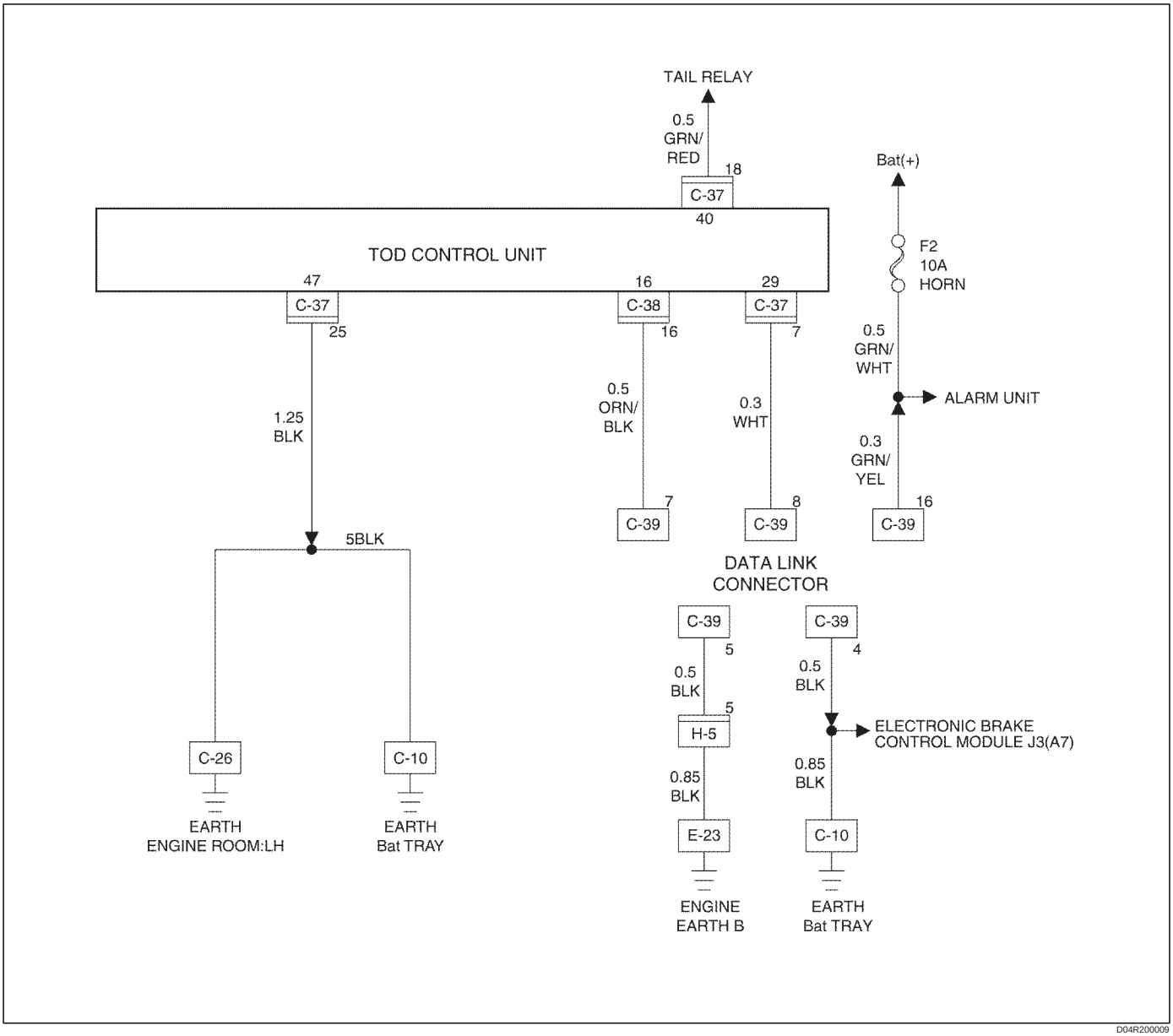
Chart E–2	The AXLE switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	Even after the TOD switch is selected to the 2H position, the 2H mode is not enabled. (The transition status is not removed.)
Indicator lamp state	CHECK TOD 
TOD switch position	2H



D04R200023

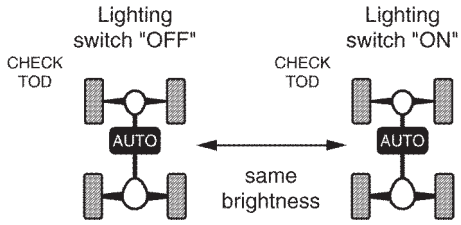
Step	Action	Yes	No
1	Start the engine. When the TOD switch is selected to the TOD position, is 0V observed between terminals 42 and 47?	Go to *Step 2*	Go to *Step 6*
2	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 4L position, is 0V observed between terminals 42 and 47?	Go to *Step 3*	Go to *Step 6*
3	1. The car stops, the AT selector is N position, and the brake is applied. 2. Select the TOD switch to the 2H position. Is 5V observed between terminals 42 and 47?	Go to *Step 4*	Go to *Sep 6*
4	Is 12V observed between terminals 7 and 47?	Go to *Step 5*	Replace the ECU. Go to *Step 10*
5	Is 12V observed between terminals 19 and 47?	The phenomenon is not reproduced. Refer to *"Troubles intermittently observed".*	The ECU has failed.Replace the ECU. Go to *Step 10*
6	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 2H position, is the battery voltage observed between terminals 23 and 47?	Go to *Step 7*	Go to *Step 9*
7	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the TOD position, is 0V observed between terminals 23 and 47?	Go to *Step 8*	Go to *Step 9*
8	1. The car stops, the AT selector is N position, and the brake is applied. When the TOD switch is selected to the 4L position, is 0V observed between terminals 23 and 47?	Repair the circuit or check the "Front Axle Disconnect". (Refer to *section 4B*) Go to *Step 10*	Go to *Step 9*
9	Is any of the trouble codes 28 (P1760), 32 (P1761) and 33 (P1762) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	The ECU has failed. Replace the ECU. Go to *Step 10*
10	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 10*

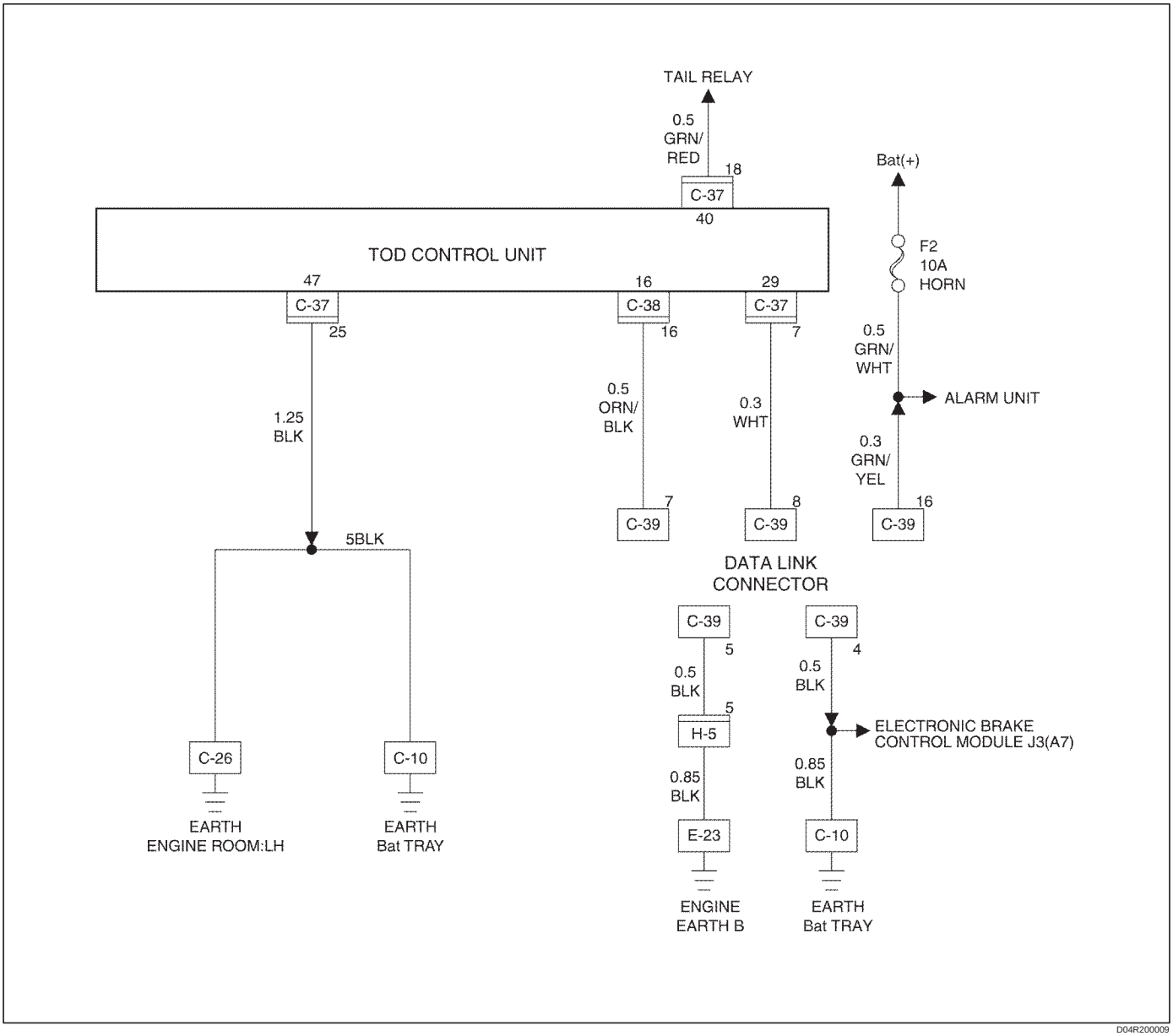
Chart G	The trouble codes are displayed.
Function of circuit	—
Fail condition	The CHECK lamp continues blinking irregularly. ON OFF error
Indicator lamp state	CHECK TOD AUTO
TOD switch position	—



D04R200009

Step	Action	Yes	No
1	Disconnect the ECU connector from ECU. Is there the continuity established between terminals (C–37)7 and (C–37)25?	Go to *Step 2*	The ECU has failed. Replace the ECU. Go to *Step 3*
2	Is the self-diagnostic connector short-circuited?	Go to *Step 3*	Open the self-diagnostic connector. Go to *Step 3*
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Verify the repair.	Go to *Step 3*

Chart H	Lighting switch circuit
Function of circuit	Reads in the status of lighting switch, and reduces the indicator at night.
Fail condition	Even if the lighting switch is pressed on and off, brightness does not change.
Indicator lamp state	
TOD switch position	All position (exsample TOD mode)



D04R200009

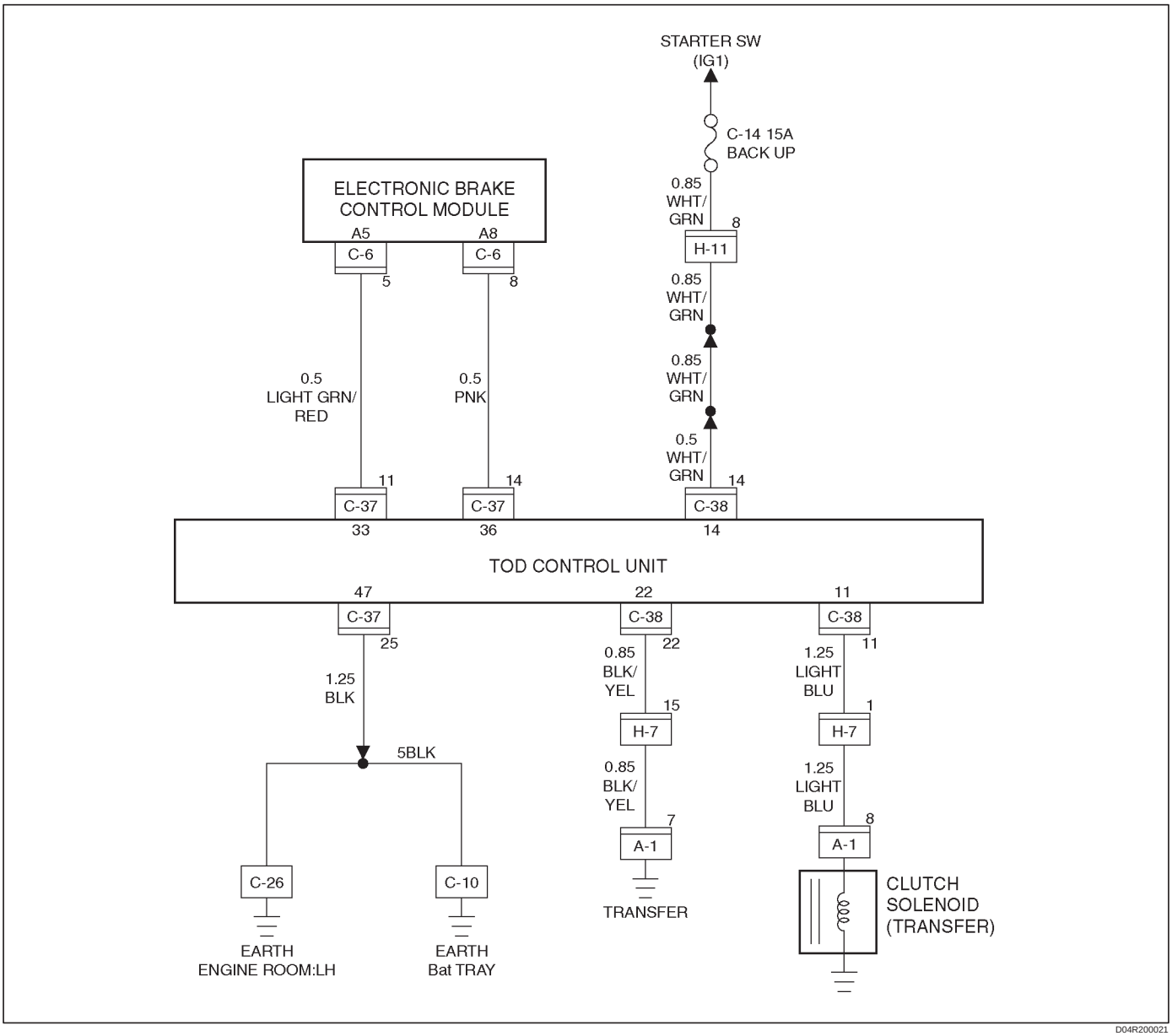
Step	Action	Yes	No
1	1. Turn on the starter switch. 2. Turn off the lighting switch. Is 0V observed between the EUC terminal 40 and 47?	Go to *Step 2*	Lighting switch battery circuit short. Repair the circuit. Go to *Step 4*
2	Turn lighting switch “ON”. Is the battery voltage observed between ECU terminal 40 and 47?	Go to *Step 3*	Wires are broken in lighting switch circuit. Repair the circuit. Go to *Step 4*
3	While the lighting switch is pressed on and off, does the brightness of the indicator change?	The phenomenon is not reproduced. Refer to *“Troubles intermittently observed”*	The ECU has failed. Replace the ECU. Go to *Step 4*
4	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 4*

Diagnosis from Symptom

Troubles that are not indicated by the warning lamp are listed in the table below. These troubles are caused by the faults that cannot be detected by the self-diagnostic function of the control unit.
If this type of trouble is observed, interview the customer and conduct test runs to reproduce the trouble, cross-check the reported trouble with the listed phenomena, and diagnose and analyze the trouble on the item by item basis.

	Phenomena	Major cause	Corrective action
1	The tight corner braking is observed when the vehicle is subject to full steering.	▼The standard tires are not used. ▼The tire pressure is incorrect. ▼The tires are worn inuniformity. ▼The transfer or wiring is imperfect. ▼The limited slip differential is failed.	Check and recondition the vehicle according to Chart 1.
2	Even if the TOD switch is selected to the TOD position, the F4WD mode is not active, resulting in remarkable rear wheel spin.	▼The transfer or wiring is imperfect. ▼The shift on the fly system is failed.	Check and recondition the vehicle according to Chart 2.
3	▼When the TOD switch is selected to the TOD position, the drive resistance of the F4WD system is too large to get sufficient running speed. ▼Noised drive line.	▼The standard tires are not used. ▼The tires are worn inuniformity. ▼The transfer or wiring is imperfect. ▼The limited slip differential is failed.	Check and recondition the vehicle according to Chart 1.
4	The shift on the fly system (front axle disconnect) generates gear noises.	▼The wiring is imperfect. ▼The shift on the fly system is failed.	Check and recondition the vehicle according to Chart 3.
5	The braking distance gets long even when the ABS is active.	▼The wiring is imperfect. ▼The ABS is failed.	Check and recondition the vehicle according to Chart 4.
6	The transfer does not change to the low range from the high range.	▼The transfer or wiring is imperfect. ▼The TOD switch is imperfect. ▼The AT inhibitor switch is imperfect. ▼The brake switch is imperfect. ▼The engine speed signal is imperfect. ▼The speed sensor is imperfect.	Check and recondition the vehicle according to chart 5.
7	The transfer does not change to the high range from the low range.		Check and recondition the vehicle according to chart 6.
8	The transfer stays neutral and the vehicle does not run.	▼The transfer is imperfect.	Check and recondition the vehicle according to chart 7.

Chart 1	The tight corner braking is observed.
Function of circuit	—
Fail condition	When the vehicle is subject to full steering in the TOD mode, the drive resistance gets large or the judder occurs. Otherwise, the above phenomenon is observed only when the brake is applied.



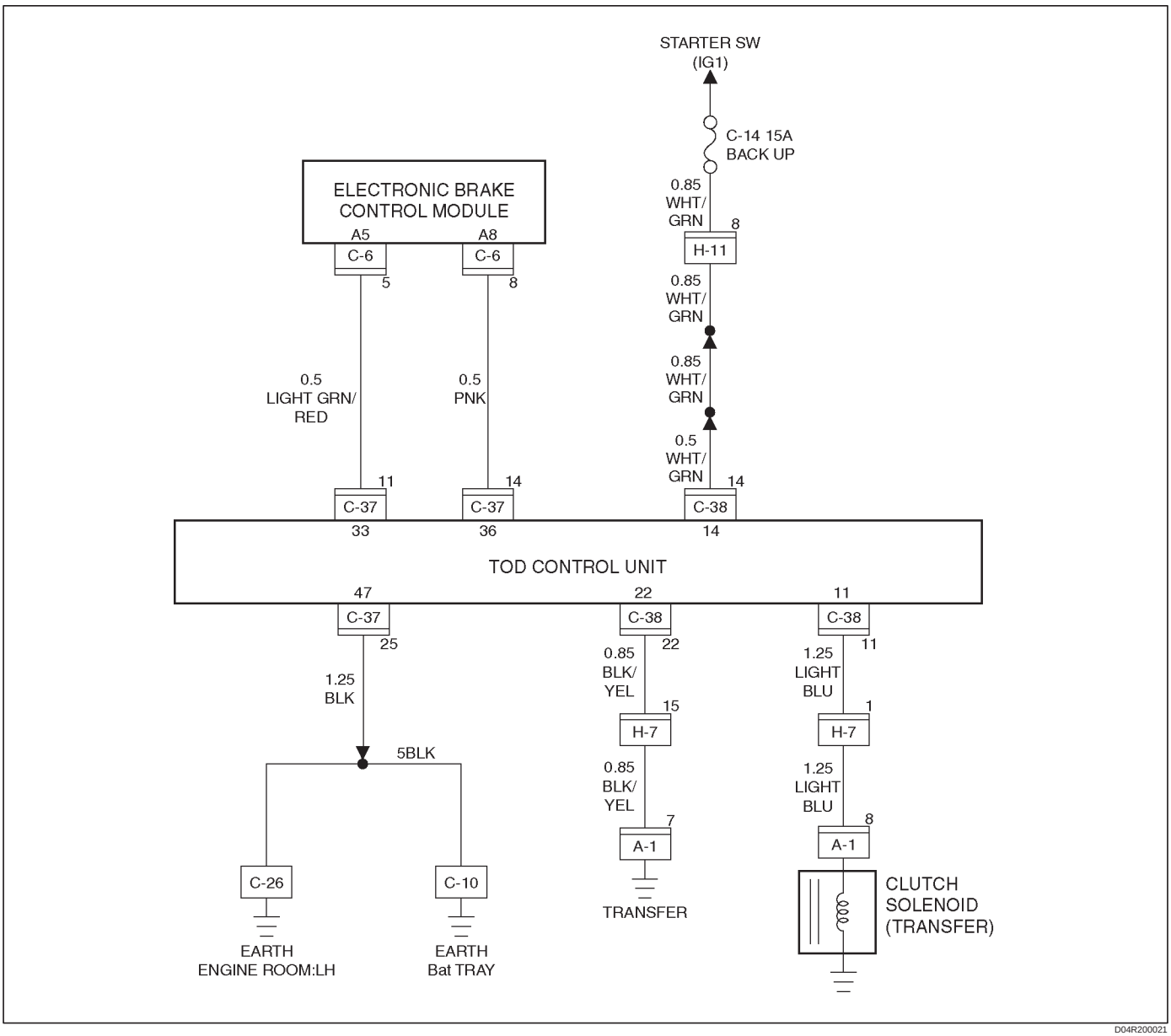
D04R200021

Step	Action	Yes	No
1	Are the front and rear tires in specified size?	Go to *Step 2*	Replace the tires with specified ones, and service the new tires. Go to *Step 16*
2	Is the tire pressure correct?	Go to *Step 3*	Inflate the tires with specified pressure. Go to *Step 16*
3	Are the tires free from abnormal wear?	Go to *Step 4*	Replace the tires with specified ones, and service the new tires. Go to *Step 16*
4	Are different types of tires used?	Go to *Step 5*	Replace the tires with specified ones, and service the new tires. Go to *Step 16*
5	1. Start the engine. 2. Select the TOD switch to the TOD position. 3. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.	Go to *Step 6*	Go to *Step 11*
6	1. Select the TOD switch to the 2H position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.	Go to *Step 7*	Go to *Step 14*
7	Is an LSD mounted to the rear differential?	Go to *Step 8*	Go to *Step 9*
8	Is the genuine LSD oil used in the rear differential?	Go to *Step 9*	Replace the differential oil. Go to *Step 16*
9	Does the engine output the power correctly?	Go to *Step 10*	Check the engine. Go to *Step 16*
10	Do the speed sensors work correctly? (Check trouble codes.)	The ECU has failed. Replace the ECU. Go to *Step 16*	Replace the speed sensors. Go to *Step 16*
11	Is the tight corner braking observed only when the brake is applied?	Go to *Step 12*	Conduct full steering under WOT. Go to *Step 5*
12	1. Turn on the starter switch. Is 8 ~ 10 V observed between terminals 33 and 47?	Go to *Step 13*	Repair the circuit of the ECU connector terminal 33 (ABS IN). Go to *Step 16*

Step	Action	Yes	No
13	1. Apply the brake and fully turn the steering to the left (or right) end, and start the creep run. Does the voltage between terminals 11 and 22 range between 0.1 and 1.0V?	Repair the transfer assembly. Go to *Step 16*	The ECU has failed. Replace the ECU. Go to *Step 16*
14	1. Select the TOD switch to the TOD position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the voltage between terminals 11 and 22 range between 0.1 and 1.0V?	Go to *Step 15*	Go to *Step 10*
15	1. Select the TOD switch to the 2H position. 2. Jack up the right front wheel. Does the front tire rotate smoothly?	The phenomenon is not reproduced. Refer to *"Troubles intermittently observed"*.	Repair the transfer assembly. Go to *Step 16*
16	Check that all the parts are mounted. Is this step complete?	Verify the repair	Go to *Step 16*

*NOTE: Before checking this item, run the vehicle more than 10 meters with the steering wheel in straight position so that the 4L mechanical lock sleeve can be released certainly.

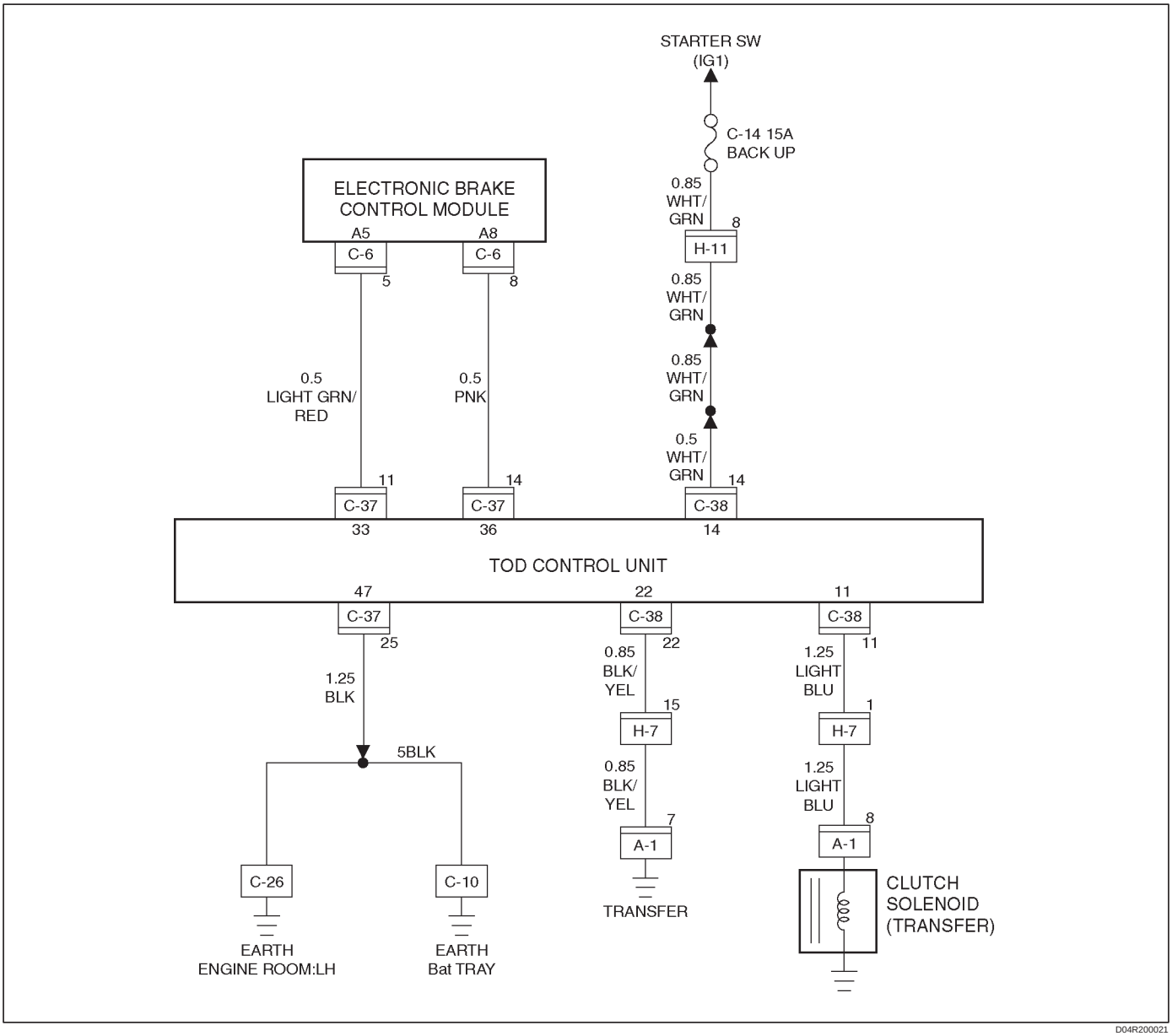
Chart 2	The TOD mode is not active.
Function of circuit	—
Fail condition	The rear wheels spin in the TOD mode, so the driving torque is not transmitted to the front wheels. The indicator lamps will not show the 4L and TOD status.



D04R200021

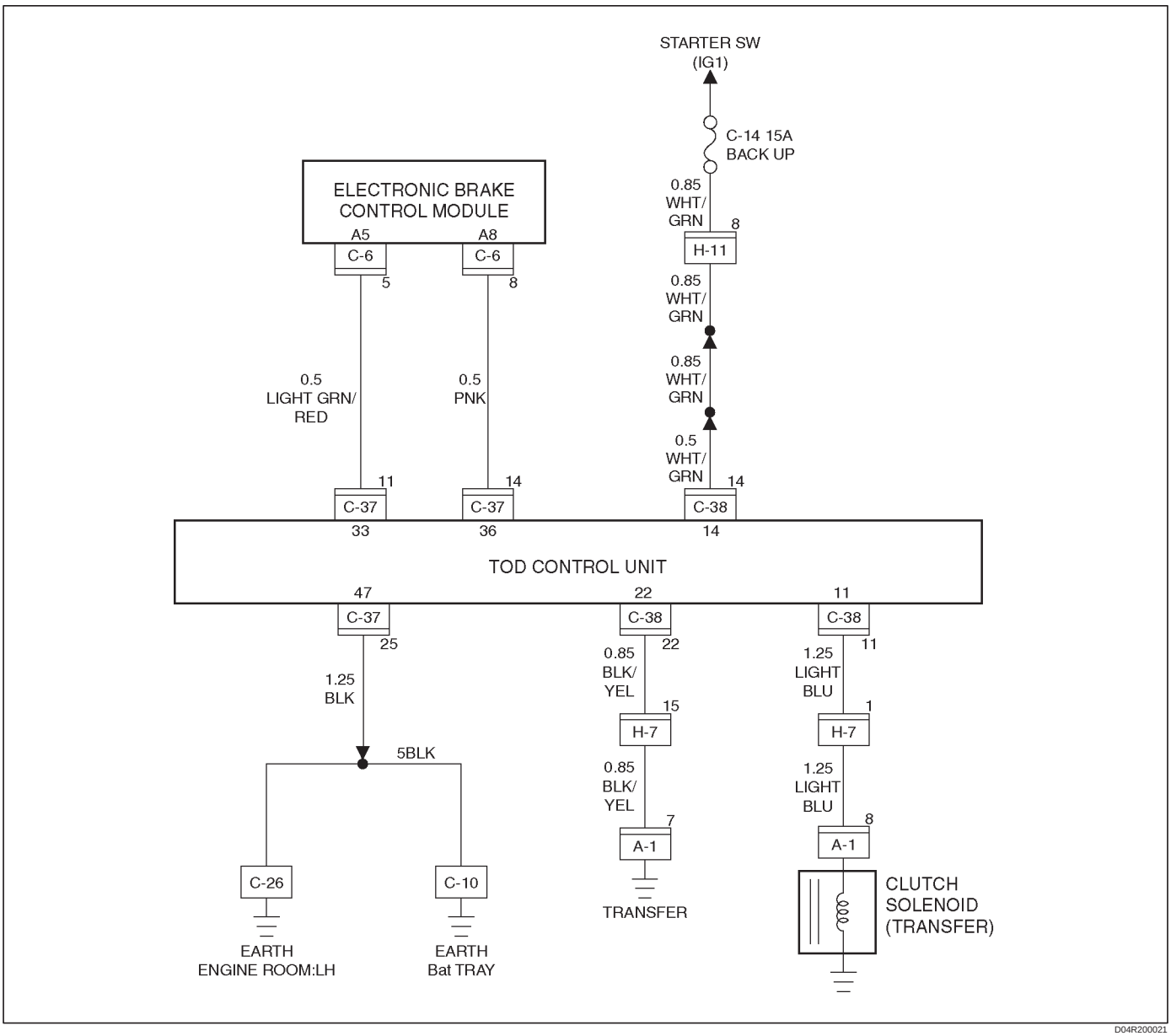
Step	Action	Yes	No
1	Is the trouble code 31(P1721) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 2*
2	Is any of the trouble codes 28(P1760), 32(P1761) and 33(P1762) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 3*
3	When the TOD switch is selected to the specified position, do the TOD indicator lamps show the correct status?	Go to *Step 4*	Examine the trouble based on "Trouble Diagnosis Depending on The Status of TOD Indicator".
4	Select the TOD switch to the 4L position, fully turn the steering to the left (or right) end, and start the creep run. Does the tight corner braking occur?	Go to *Step 5*	Repair the transfer assembly. Go to *Step 7*
5	1. Select the TOD switch to the TOD position. 2. Turn on the starter switch. Does the voltage between terminals 11 and 22 indicate at least 3V while the throttle is completely open?	Go to *Step 6*	The ECU has failed. Replace the ECU. Go to *Step 7*
6	Does the voltage between terminals 11 and 22 indicate at least 0.1V while the throttle is completely closed?	The TOD clutch is worn. Repair the transfer assembly. Go to *Step 7*	The ECU has failed. Replace the ECU. Go to *Step 7*
7	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 7*

Chart 3	The shift on the fly system generates gear noises. (The fuel economy is bad in the 2H mode.)
Function of circuit	—
Fail condition	When the vehicle is run in the 2H mode, the shift on the fly system generates gear noises or the front wheel gears are engaged to generate a shock.



Step	Action	Yes	No
1	Do the indicator lamps show the correct status?	Go to *Step 2*	Examine the trouble based on "Trouble Diagnosis Depending on the Status of TOD Indicator".
2	Is any of the trouble codes 28(P1760), 32(P1761) and 33(P1762) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 3*
3	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 47?	Go to *Step 4*	Go to *Step 5*
4	When the TOD Switch is selected to the 2H position, are the front axle gears correctly disengaged (and when the left front tire is jacked up and turned, is the front propeller shaft standstill)?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed"*.	The shift on the fly system is failed (refer to *Section 4B1 and 4C*).
5	Does the battery voltage maintain the correct level?	Repair the battery circuit. Go to *Step 6*	Repair the battery and charging system. Go to *Step 6*
6	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 6*

Chart 4	The braking distance gets long even when the ABS is active.
Function of circuit	—
Fail condition	Enough deceleration is not obtained and the braking distance gets long even when the ABS is active in the 2H mode.



D04R200021

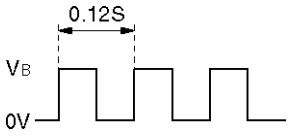
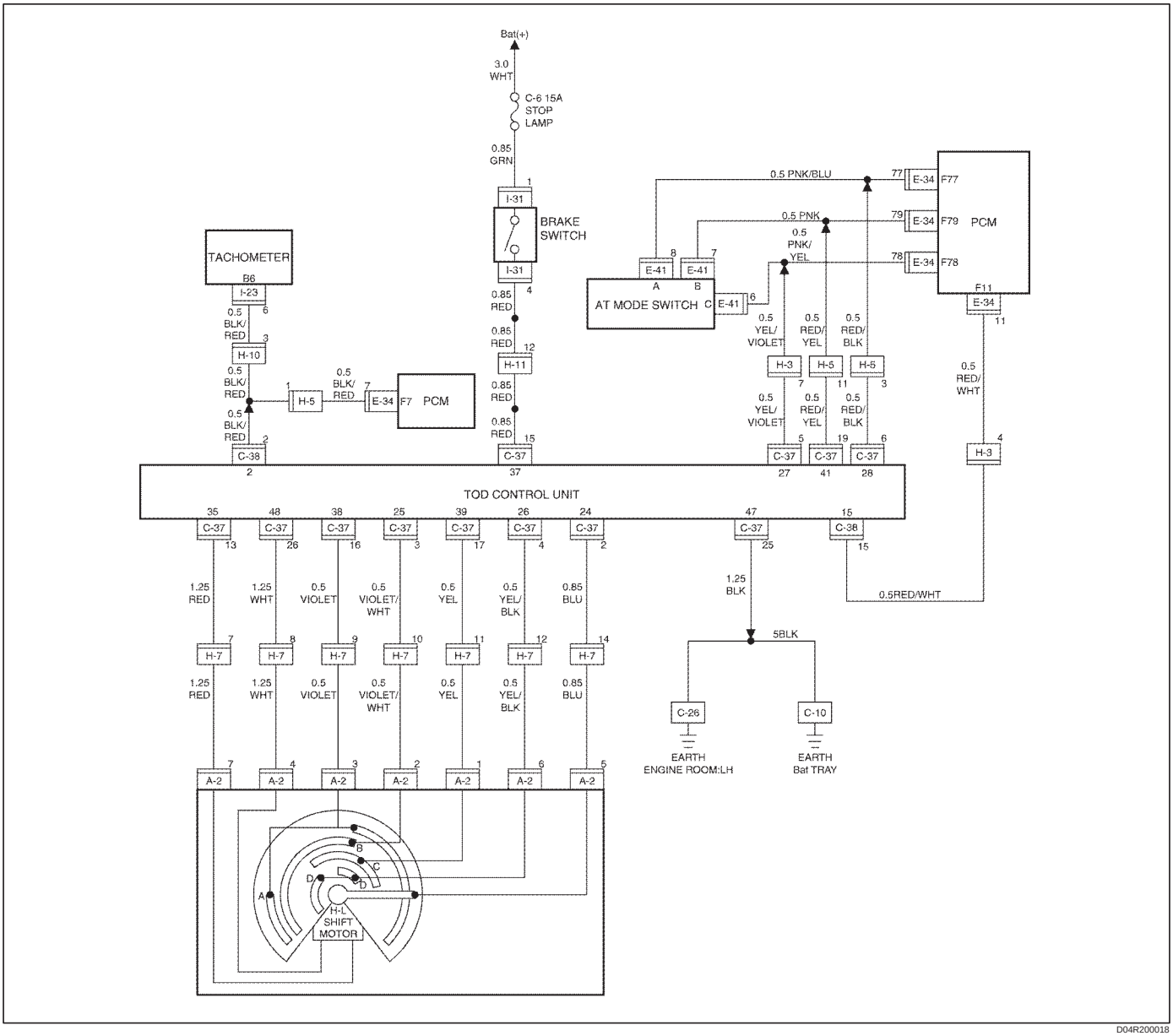
Step	Action	Yes	No
1	Are the brake and ABS systems healthy?	Go to *Step 2*	Repair the brake and ABS. (Refer to *section 5A and 5B)*
2	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 47?	Go to *Step 3*	Repair the battery system. Go to *Step 5*
3	1. Select the TOD switch to the 2H position.  Does the voltage between terminals 36 and 47 range between 7.5 and 16V (0.12 seconds make a cycle)?	Go to *Step 4*	The ECU has failed. Replace the ECU. Go to *Step 5*
4	1. Turn off the starter switch. 2. Disconnect the connector (C–37). Is there the continuity between the connector terminal (C–37) 14 and (C–6) 8?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Repair the harness. Go to *Step 5*
5	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 5*

Chart 5	The transfer does not change to low from high.
Function of circuit	—
Fail condition	When the TOD switch is selected to the 4L position, the transfer does not change to the low range.



D04R200018

Step	Action	Yes	No
1	1. Turn on the starter switch. Is any of the trouble codes 41 (P1741), 42 (P1773), 43 (P1743) and 55 (P1755) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 2*
2	Is any of the trouble codes 13 (P1735), 14 (P1731), 15 (P1736), 16 (P1737), 24 (P1733), and 27 (P1738) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 3*
3	Is the trouble code 17 (P1774) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 4*
4	1. Turn on the starter switch. 2. The car stops, engine speed is less than 1500 rpm, the AT selector is N position, and select the TOD switch to the 4L position. Do the front lamp and rear lamp in the indicator blink?	Go to *Step 5*	Examine the trouble based on "Trouble Diagnosis Depending on the Status of TOD Indicator".
5	1. Step on the brake pedal. Is the transfer changed to the 4L mode?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 6*
6	When the vehicle is moved forth and back, is the transfer changed to the 4L mode?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 7*
7	Does the continuity corresponding to the encoder position between the terminals comply with the 4L position in the following table (continuity)?	Examine the trouble based on "Trouble diagnosis Depending on The Status of TOD Indicator".	Go to *Step 8*
8	1. Step on the brake pedal. Is the battery voltage observed between the terminal 37 and 47?	Go to *Step 10*	Go to *Step 9*
9	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37) and the brake switch connector (I–31). Is there the continuity between the connector terminal (C–37) 15 and (I–31) 4?	The brake switch is abnormal. Repair or replace the brake switch. Go to *Step 13*	Repair the harness. Go to *Step 13*
10	1. Select the AT selector to the N position. Is the voltage between the terminals ranged within the following table (voltage)?	Go to *Step 12*	Go to *Step 11*
11	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37). 3. Disconnect the AT mode switch connector (E–41). Is there the continuity between the following connector terminals? (C–37)6 and (E–41)8 (C–37)19 and (E–41)7 (C–37)5 and (E–41)6	Repair or replace the AT mode switch. Go to *Step 13*	Repair the circuit which has no continuity. Go to *Step 13*

Step	Action	Yes	No
12	1. Start the engine. Is the engine pulse signal between terminal 2 and 47 at engine speed under 1500 rpm within the standard? Standard: less than 4500 Hz	Replace the ECU. Go to *Step 13*	The engine pulse signal is abnormal. Repair or replace the PCM. Go to *Step 13*
13	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 13*

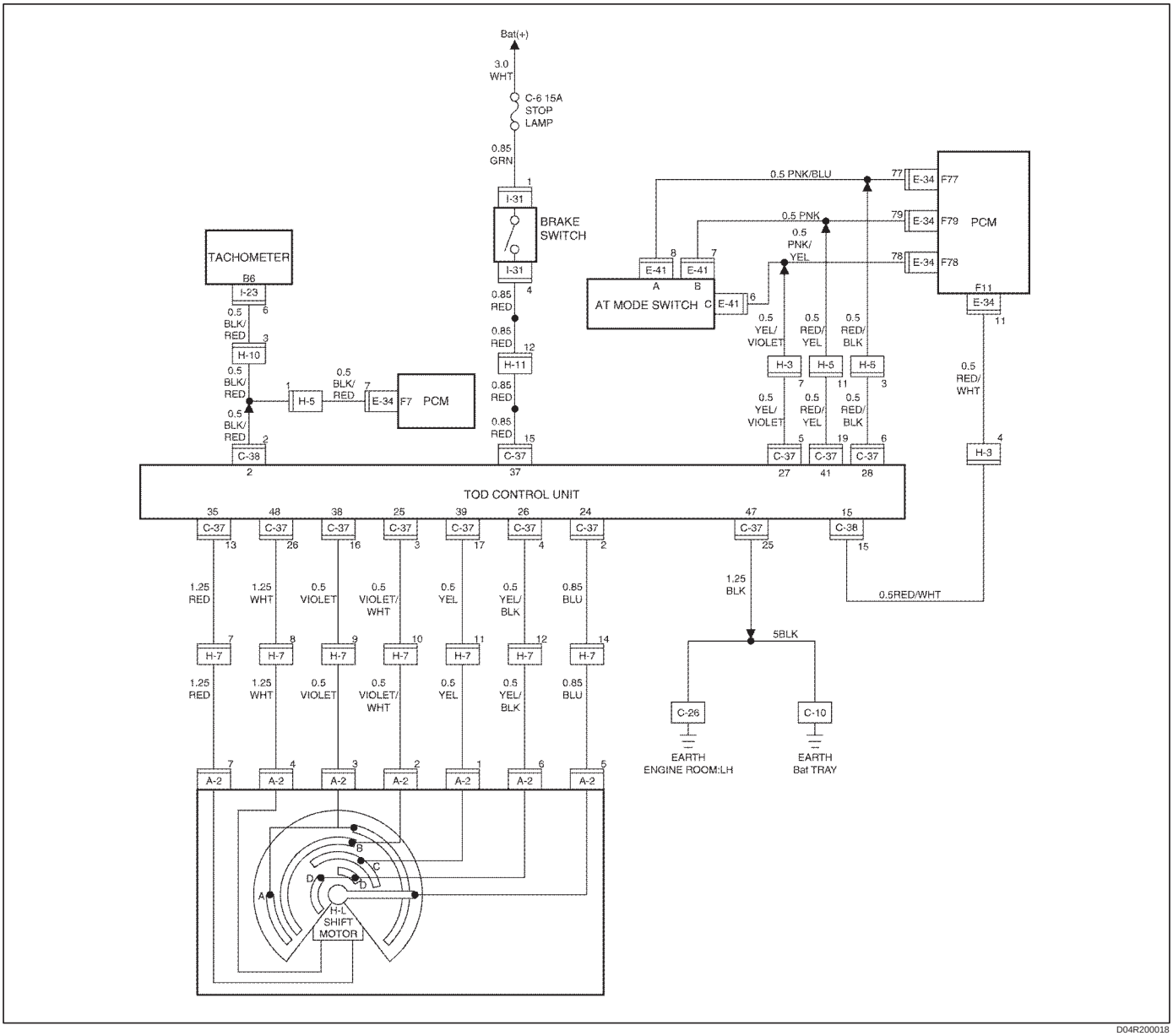
Continuity between terminal in 4L position
(Table: continuity)

Terminals No.	26 and 24	39 and 24	25 and 24	38 and 24
Continuity of 4L position	YES	NO	YES	YES or NO

Standard (Table: voltage)

			Unit: V
Terminals	28 and 47	41 and 47	27 and 47
Voltage	0	12	0

Chart 6	The transfer does not change to high from low.
Function of circuit	—
Fail condition	When the TOD switch is selected to the TOD, the transfer does not change to the high range.



D04R200018

Step	Action	Yes	No
1	1. Turn on the starter switch. Is any of the trouble codes 41 (P1741), 42 (P1773), 43 (P1743) and 55 (P1755) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 2*
2	Is any of the trouble codes 13 (P1735), 14 (P1731), 15 (P1736), 16 (P1737), 24 (P1733), and 27 (P1738) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 3*
3	Is the trouble code 17 (P1774) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	Go to *Step 4*
4	1. Turn on the starter switch. 2. The car stops, engine speed is less than 1500 rpm, the AT selector is N position, and select the TOD switch to the TOD position. Do the front, rear, and AUTO lamps in the indicator blink?	Go to *Step 5*	Examine the trouble based on "Trouble Diagnosis Depending on the Status of TOD Indicator".
5	1. Step on the brake pedal. Is the transfer changed to the TOD mode?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 6*
6	When the vehicle is moved forth and back, is the transfer changed to the TOD mode?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 7*
7	Is the continuity corresponding to the encoder position between the terminals ranged within the any case (case 1, 2 and 3) of TOD position in the following table (continuity)?	Examine the trouble based on "Trouble diagnosis Depending on The Status of TOD Indicator".	Go to *Step 8*
8	1. Step on the brake pedal. Is the battery voltage observed between the terminal 37 and 47?	Go to *Step 10*	Go to *Step 9*
9	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37) and the brake switch connector (I–31). Is there the continuity between the connector terminal (C–37) 15 and (I–31) 4?	The brake switch is abnormal. Repair or replace the brake switch. Go to *Step 13*	Repair the harness. Go to *Step 13*
10	1. Select the AT selector to the N position. Is the voltage between the terminals ranged within the following table (voltage)?	Go to *Step 12*	Go to *Step 11*
11	1. Turn off the starter switch. 2. Disconnect the ECU connector (C–37) and brake switch connector (I–31). 3. Disconnect the AT mode switch connector (E–41). Is there the continuity between the following connector terminals? (C–37)6 and (E–41)8 (C–37)19 and (E–41)7 (C–37)5 and (E–41)6	Repair or replace the AT mode switch. Go to *Step 13*	Repair the circuit which has no continuity. Go to *Step 13*

Step	Action	Yes	No
12	1. Start the engine. Is the engine pulse signal between terminal 2 and 47 at engine speed under 1500 rpm within the standard? Standard: less than 4500 Hz	Replace the ECU. Go to *Step 13*	The engine pulse signal is abnormal. Repair or replace the PCM. Go to *Step 13*
13	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 13*

Continuity in TOD position (Table: continuity)

Case	Continuity between terminals			
	26 and 24	39 and 24	25 and 24	38 and 24
1	NO	NO	NO	YES
2	NO	YES	NO	YES
3	YES	YES	NO	YES

Standard (Table: voltage)

			Unit: V
Terminals	28 and 47	41 and 47	27 and 47
Voltage	0	12	0

Chart 7	The transfer does not change to low from high.
Function of circuit	—
Fail condition	When the TOD switch is selected to the 4L position, the transfer does not change to the low position. (The transfer stays neutral and the vehicle does not run.)

Step	Action	Yes	No
1	1. Turn on the starter switch. 2. Set the TOD switch to the any position. Is the transfer changed to high or low?	Go to *Step 2*	Go to *Step 3*
2	Is the transfer changed to high from low and the low from high?	The phenomenon is not reproduced. Refer to *"Trouble intermittently observed".*	Go to *Step 3*
3	Is any of the trouble codes 41 (P1741), 42 (P1773), 43 (P1743), and 55 (P1755) recorded?	Examine the trouble based on "Diagnosis from Trouble Codes".	The transfer is abnormal. Repair the transfer. Go to *Step 4*
4	Check that all the parts are mounted. Is this step complete?	Verify the repair.	Go to *Step 4*

AXIOM (Vehicles Produced Before July/31/2001)

DRIVELINE/AXLE

DRIVE SHAFT SYSTEM

CONTENTS

Service Precaution 4C–1
General Description 4C–2
Diagnosis 4C–2
Front Hub and Disc (2WD Model) 4C–3
Disassembled View 4C–3
Disassembly 4C–3
Inspection and Repair 4C–4
Reassembly 4C–5
Front Hub and Disc (4WD Model) 4C–8
Disassembled View 4C–8
Disassembly 4C–8
Inspection and Repair 4C–10
Reassembly 4C–10
Front Drive Shaft Joint 4C–13
Front Drive Shaft Joints Replacement 4C–13
Front Axle Drive Shaft 4C–14
Front Axle Drive Shaft and Associated Parts 4C–14
Disassembly 4C–15
Inspection And Repair 4C–16
Bushing Replacement 4C–16
Reassembly 4C–17
Shift On The Fly System 4C–19
Shift On The Fly System and Associated Parts 4C–19
Disassembly 4C–20
Inspection And Repair 4C–21
Reassembly 4C–23
Main Data and Specifications 4C–26
Special Tools 4C–28
Propeller Shaft 4C–29
General Description 4C–29
Front Propeller Shaft 4C–30
General Description 4C–30
Front Propeller Shaft and Associated Parts 4C–31
Removal 4C–31
Installation 4C–32
Main Data and Specifications 4C–35
Rear Propeller Shaft 4C–36
Rear Propeller Shaft and Associated Parts 4C–36
Removal 4C–36
Installation 4C–36
Slip Joint Disassembly 4C–37
Universal Joint Disassembly 4C–38
Inspection 4C–40
Universal Joint Reassembly 4C–41
Slip Joint Reassembly 4C–42
Main Data and Specifications 4C–43

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

This publication contains essential removal, installation, adjustment and maintenance procedures.
The front axle utilizes a central disconnect type front axle/transfer case system.

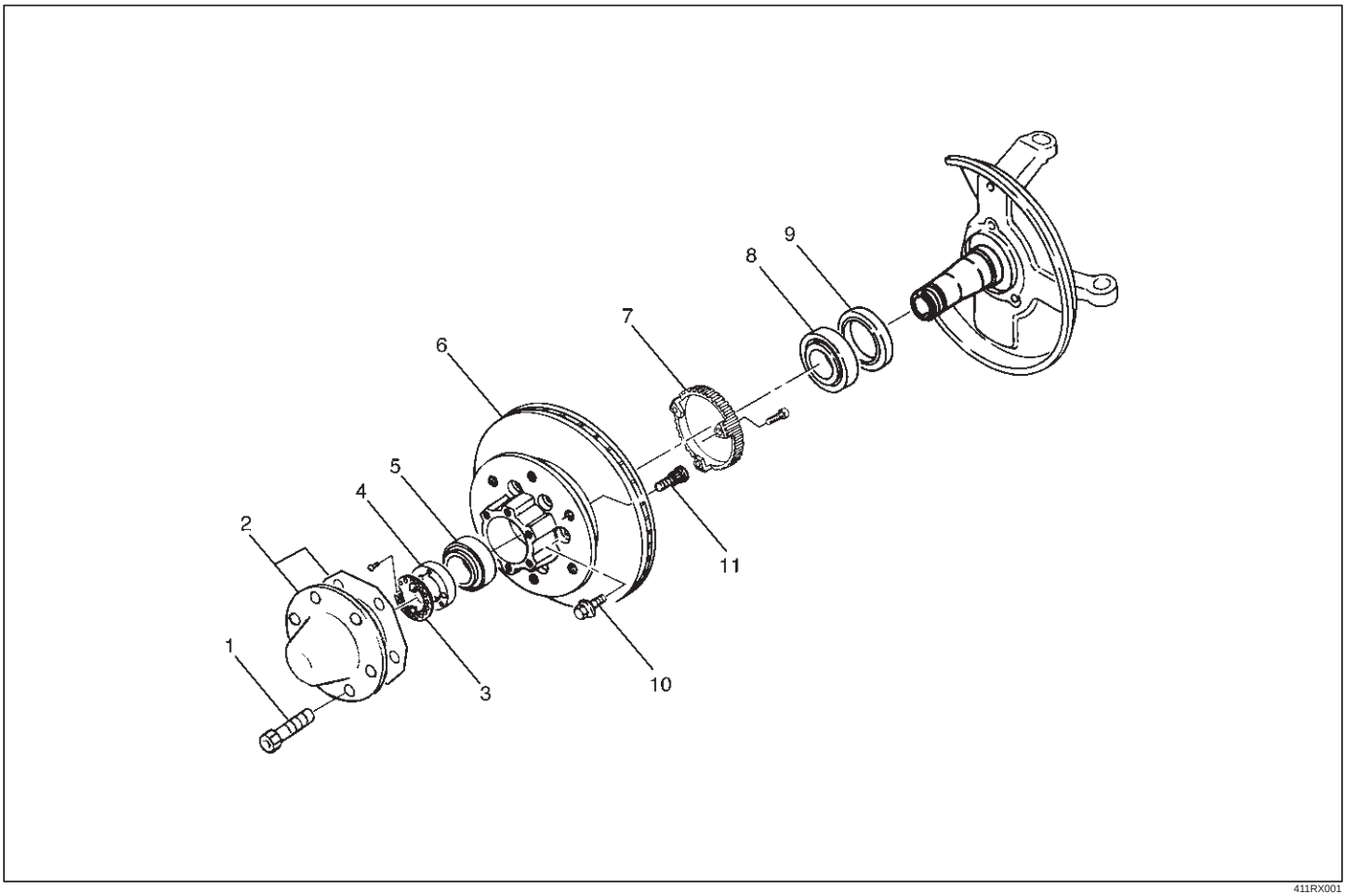
The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) drive shaft joints connected by an axle shaft.
For description of front propeller shaft and universal joint, refer to *Front Propeller Shaft* in this section.

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Front Hub and Disc (2WD Model)

Disassembled View



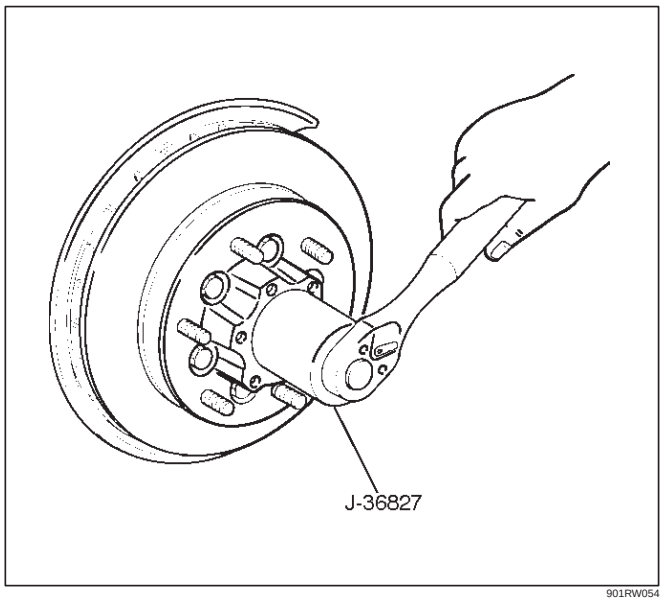
411RX001

Legend

(1) Bolt
(2) Cover and Gasket
(3) Lock Washer and Lock Screw
(4) Hub Nut
(5) Outer Bearing
(6) Hub and Disc Assembly
(7) ABS Sensor Ring
(8) Inner Bearing
(9) Oil Seal
(10) Bolt
(11) Wheel Pin

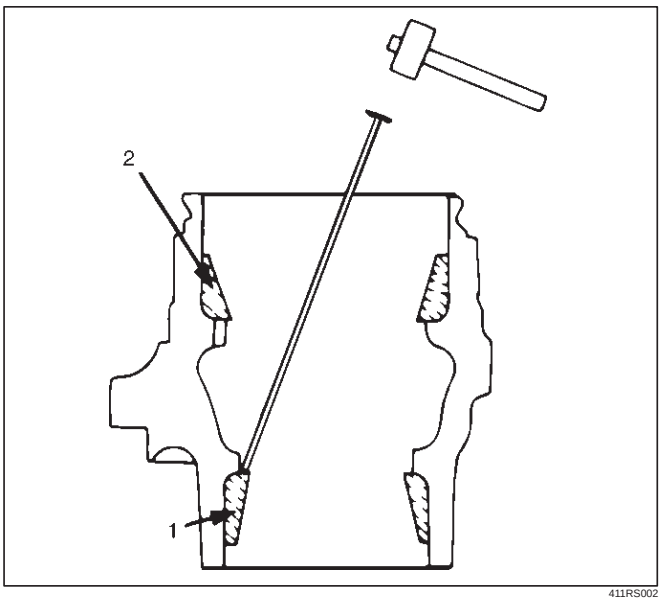
Disassembly

1. Before disassembly, jack up the front of vehicle and support frame with jack stands.
2. Remove the two bolts from the rear side of the knuckle arm, then remove the brake caliper, with the brake hose attached.
   Use a wire to attach the brake caliper to the upper link. Refer to *Disk Brakes in Brake* section.
3. Remove cover bolt.
4. Remove cover and gasket.
5. Remove lock washer and Lock screw.
6. Remove hub nut, using front hub nut wrench J–36827.



901RW054

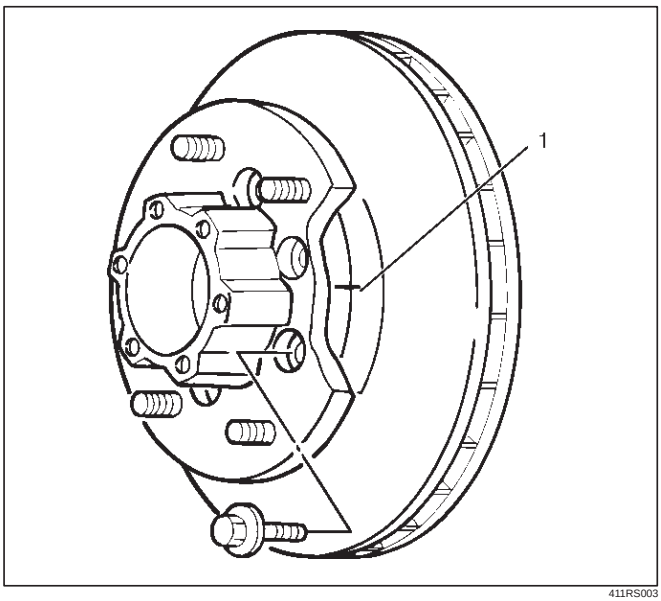
7. Remove hub and disc assembly.
8. Remove ABS sensor ring.
9. Remove outer bearing.
10. Remove oil seal.
11. Remove inner bearing.
12. Use a brass bar to remove the outer bearing outer race(1), oil seal, inner bearing and inner bearing outer race(2) from the hub.



411RS002

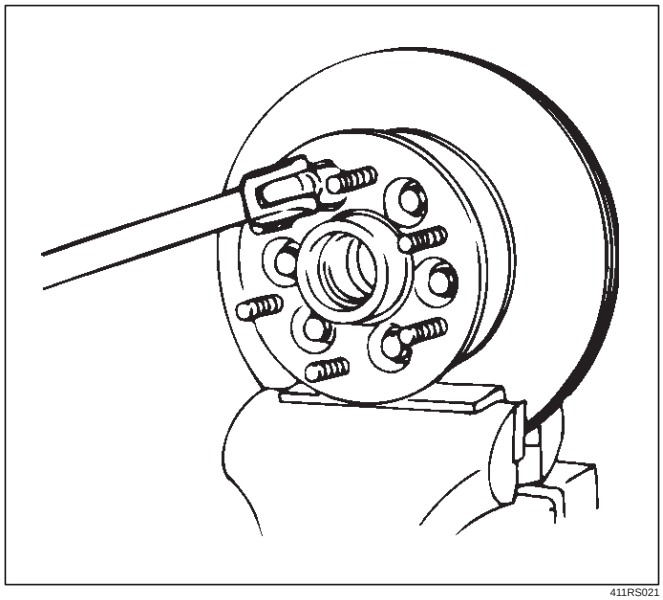
13. Remove bolt.
14. If necessary, replace the wheel pin in the following manner.

▼Scribe mark(1) on hub to disc before disassembly to insure proper assembly.

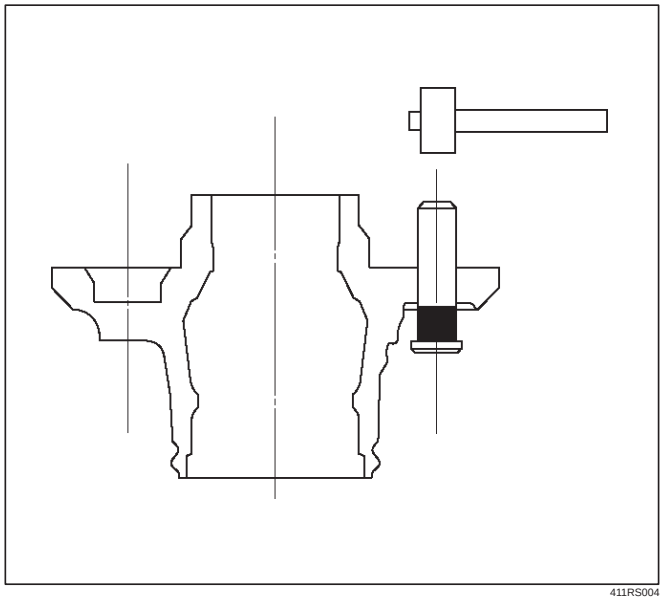


411RS003

▼Clamp hub and disc assembly in vise, using protective pads. Remove six(6) disc-to-hub retaining bolts.


411RS021

▼Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.


411RS004

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

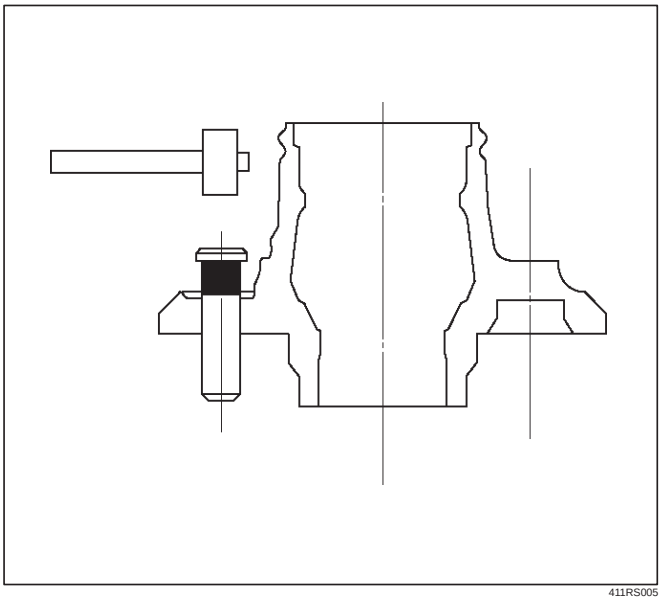
- ▼Hub
- ▼Hub bearing oil seal
- ▼Knuckle spindle
- ▼Disc
- ▼Caliper
- ▼ABS sensor ring

For inspection and servicing of disc caliper and related parts, refer to *Disc Brake in Brake* section.

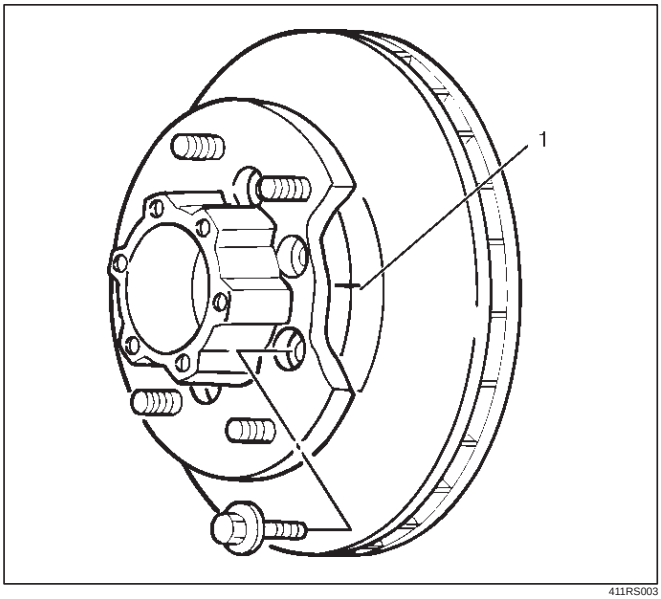
Reassembly

1. Install wheel pin.
   ▼Place hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.
   ▼Install wheel stud, using a hammer.

NOTE: Be sure wheel stud is started squarely and seats completely.

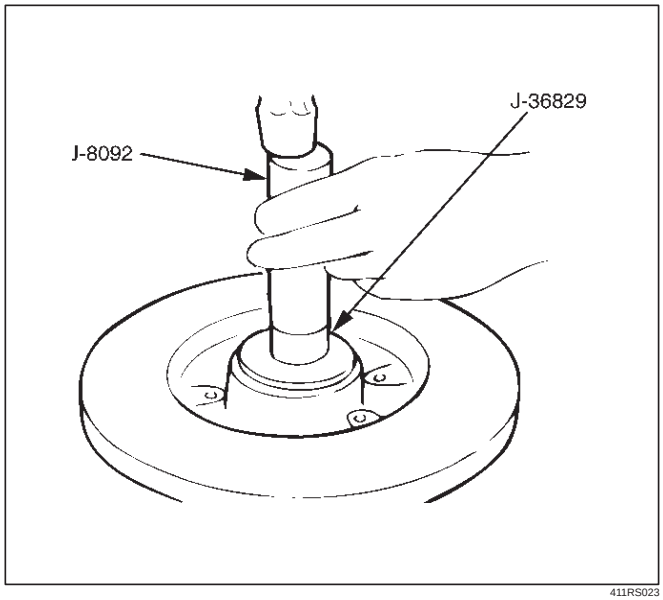

411RS005

2. Align scribe marks(1) and attach the hub to disc then tighten the bolts to the specified torque.
   Torque: 103 N·m (76 lb ft)



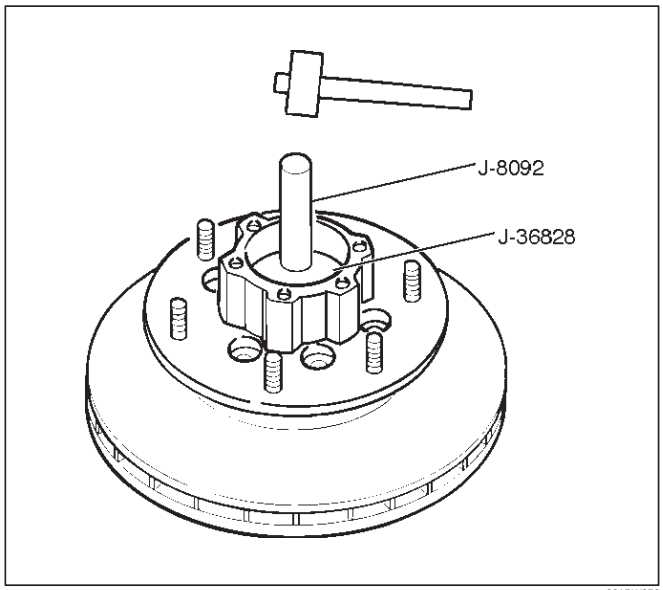
411RS003

3. Install inner bearing.
   Install the outer race by driving it into the hub by using installer J–36829 and grip J–8092.



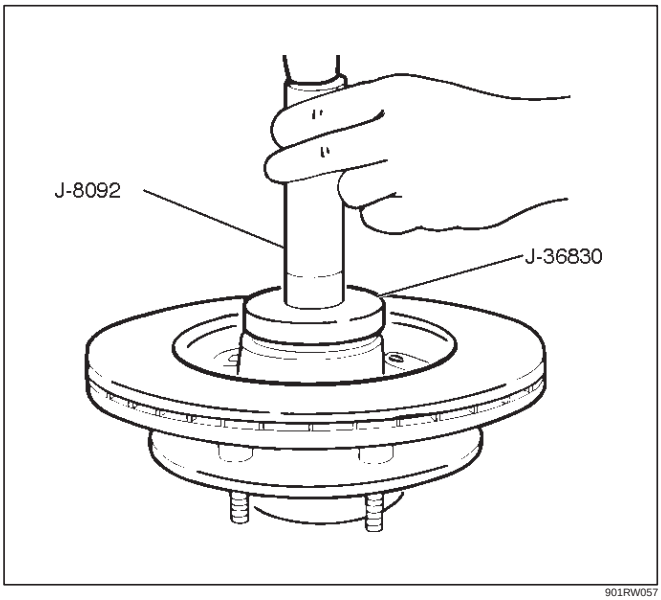
411RS023

4. Install outer bearing.
   Install the outer race by driving it into the hub by using installer J–36828 and grip J-8092.



901RW056

5. Install oil seal by using installer J–36830 and grip J–8092.
   Apply Multipurpose grease (NLGI No. 2 or equivalent) to the lip portion.

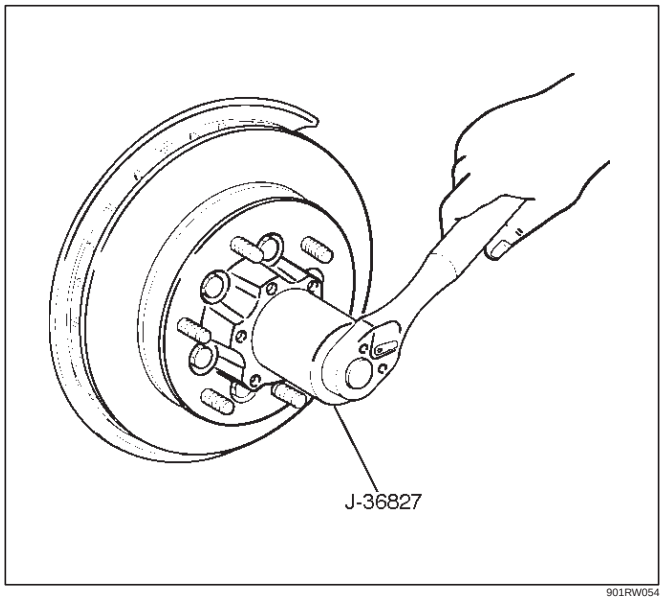


901RW057

6. Inatall ABS sensor ring, then tigthen the bolts to the specified torque.
   Torque: 18 N·m (13 lb ft)
7. Install hub and disc assembly.
   ▼Apply grease in the hub.
   ▼Apply wheel bearing type grease (NLGI No.2 or equivalent) to the outer and inner bearing.

Hub	35 g (1.23 oz)
Outer bearing	10 g (0.35 oz)
Inner bearing	15 g (0.53 oz)

8. Install hub nut.
   Turn the place where there is a chamfer in the tapped hole to the outer side, then attach the nut by using front hub nut wrench J–36827.



901RW054

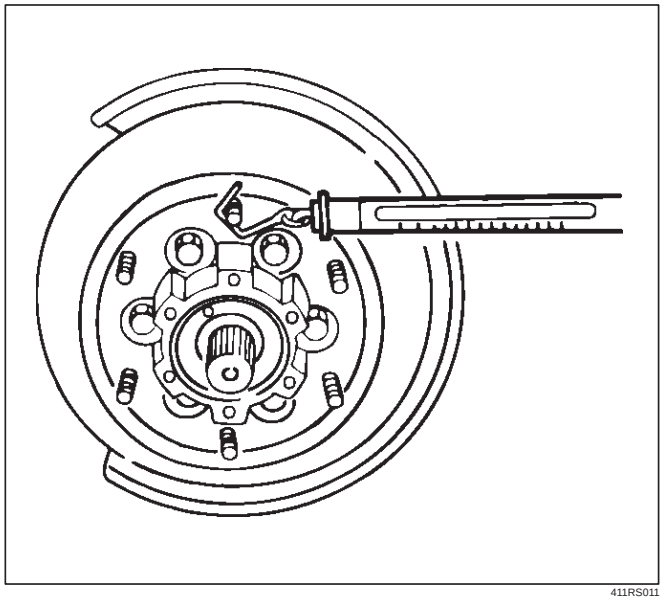
Preload Adjustment

1. Tighten the hub nut to 29.4 N·m (21.7 lb ft), then fully loosen the nut.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

Bearing Preload

New bearing and New oil seal	19.6 – 24.5 N (4.4 – 5.5 lb)
Used bearing and New oil seal	11.8 – 17.7 N (2.6 – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the hub nut.


411RS011

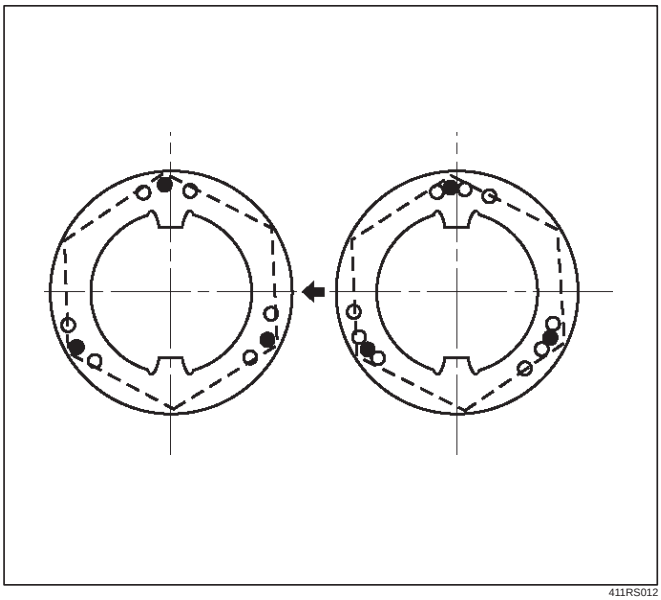
9. Install lock washer and lock screw.

▼Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.

▼If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.

▼If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.

▼Screw is to be fastened tightly so its head may come lower than the surface of the washer.



411RS012

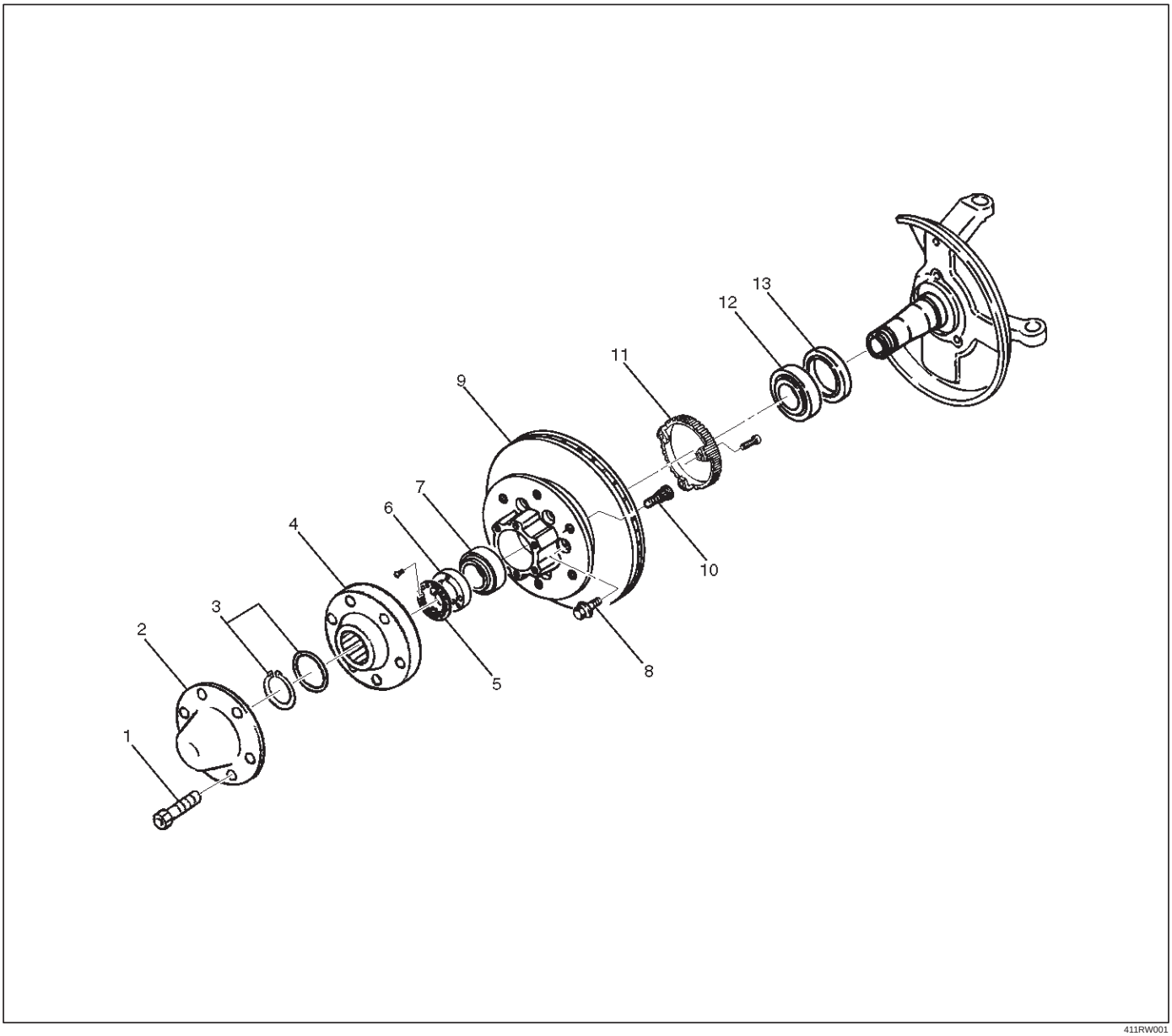
10. Install cover and gasket then tighten the cover bolt.

Torque: 59 N·m (43 lb ft)

11. Install brake caliper and tighten fixing bolt.

Front Hub and Disc (4WD Model)

Disassembled View



411RW001

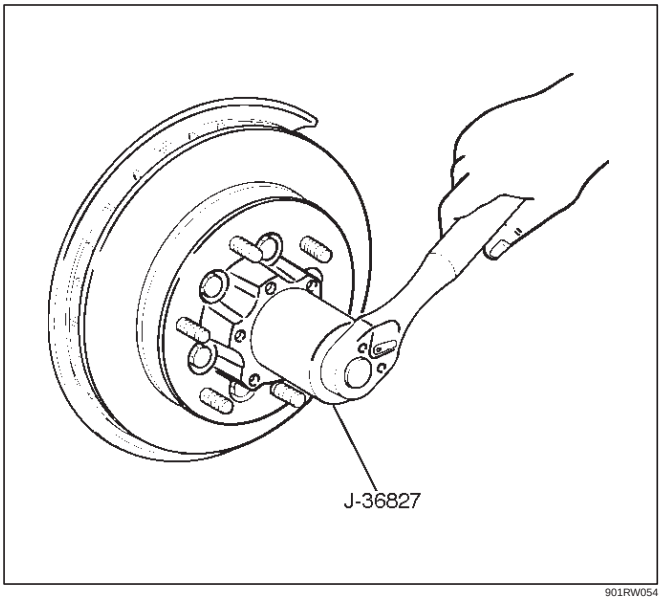
Legend

(1) Bolt
(2) Cap
(3) Snap Ring and Shim
(4) Hub Flange
(5) Lock Washer and Lock Screw
(6) Hub Nut
(7) Outer Bearing
(8) Bolt
(9) Hub and Disc Assembly
(10) Wheel Pin
(11) ABS Sensor Ring
(12) Inner Bearing
(13) Oil Seal

Disassembly

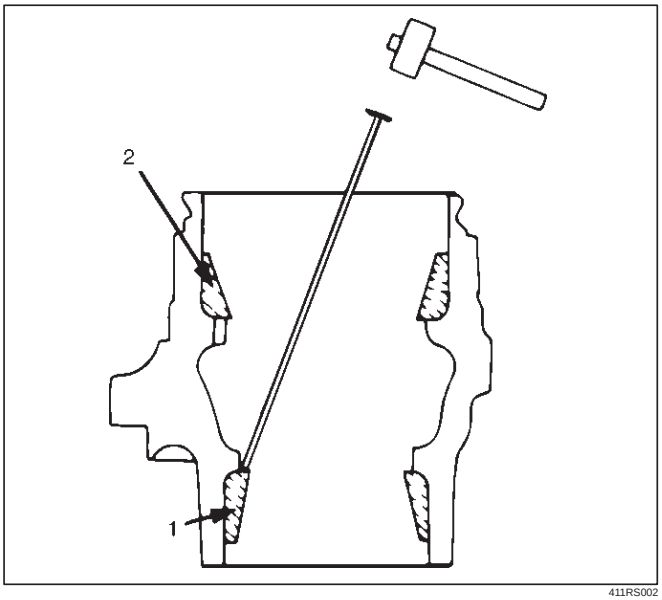
1. Before disassembly, select the 2WD position with the 4WD switch.
2. Jack up the front of vehicle and support frame with jack attached.
3. Remove the two bolts from the rear side of the knuckle arm, then remove the brake caliper, with the brake hose attached.
   Use a wire to attach the brake caliper to the upper link.
   Refer to *Disk Brakes in Brake* section.
4. Remove Bolt.
5. Remove cap.

6. Remove snap ring and shim.
7. Remove hub flange.
8. Remove lock washer and lock screw.
9. Remove hub nut, using front hub nut wrench J–36827.



901RW054

10. Remove hub and disc assembly.
11. Remove ABS sensor ring.
12. Remove outer bearing.
13. Remove oil seal.
14. Remove inner bearing.
15. Use a brass bar to remove the outer bearing outer race(1), oil seal, inner bearing and inner bearing outer race(2) from the hub.



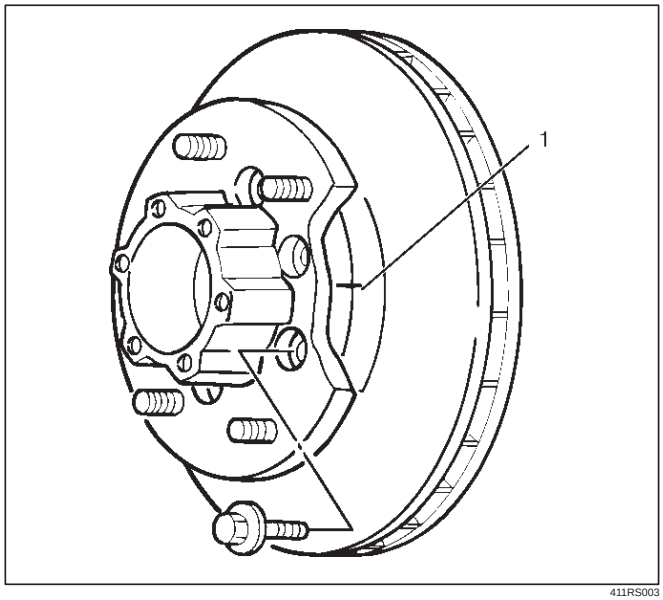
411RS002

16. Remove bolt.

If necessary, replace the wheel pin in the following manner.

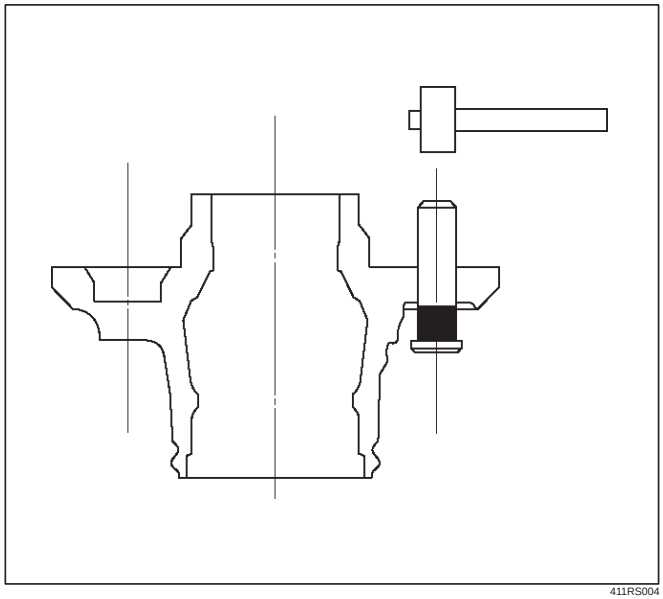
▼Scribe mark(1) on the hub to disc before disassembly to insure proper assembly.

▼Clamp the hub and disc assembly in a vise, using protective pads. Remove the 6 disc–to–hub retaining bolts.



411RS003

▼Place hub on a suitable work surface and remove wheel studs, as required, by using a hammer.


411RS004

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

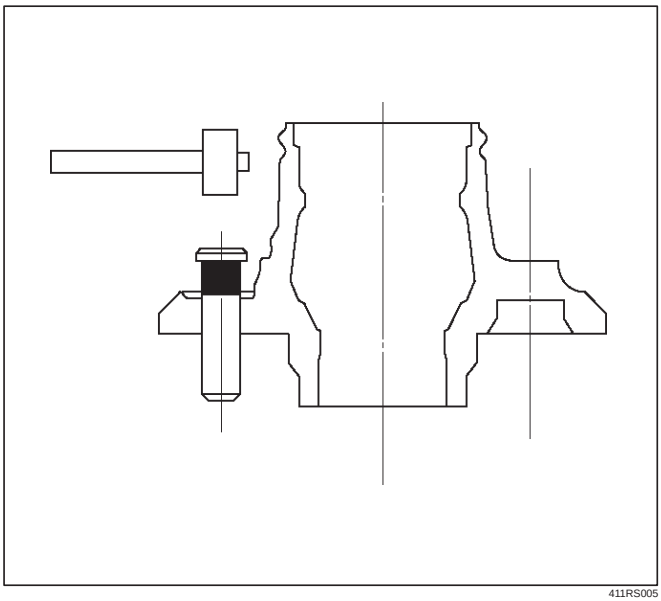
- ▼Hub
- ▼Hub bearing, oil seal
- ▼Knuckle spindle
- ▼Disc
- ▼Caliper
- ▼Shift on the fly system parts (Cap, Hub flange, Shim, Snap ring)
- ▼ABS sensor ring

For inspection and servicing of disc caliper and related parts, refer to *Disc Brakes in Brake* section.

Reassembly

1. Install wheel pin.
   - ▼Place the hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.
   - ▼Insert a wheel stud using a hammer.

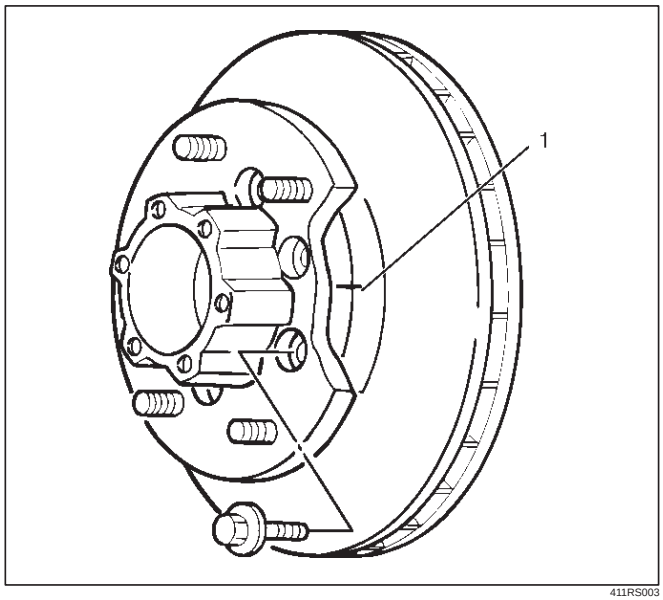
NOTE: Be sure the wheel stud is started squarely and seats completely.



411RS005

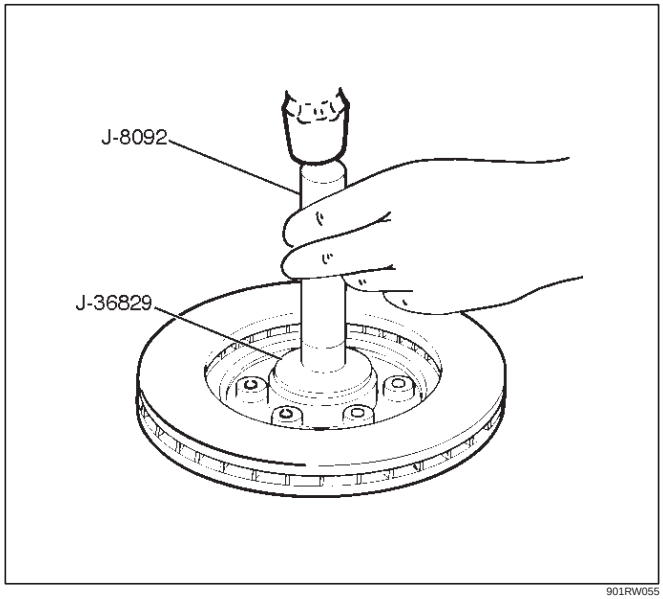
2. Align scribe marks(1) and attach the hub to the disc, then tighten the bolts to the specified torque.

   Torque: 103 N·m (76 lb ft)



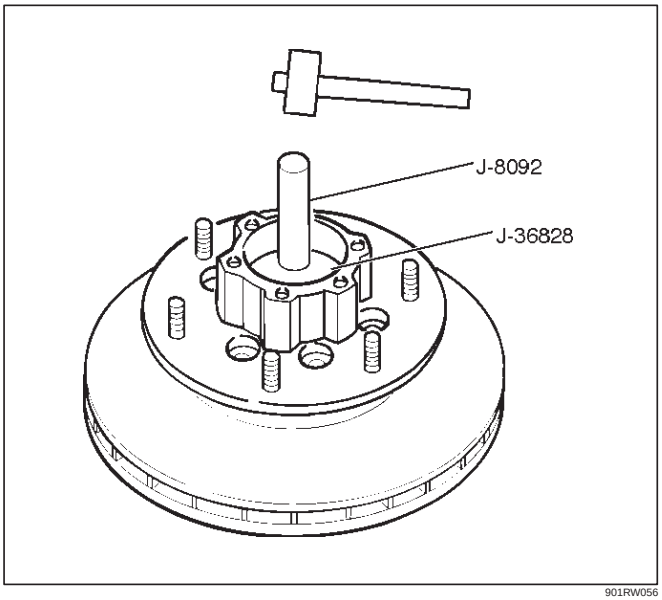
411RS003

3. Install inner bearing.
   Install the outer race by driving it into the hub by using insatller J–36829 and grip J–8092.



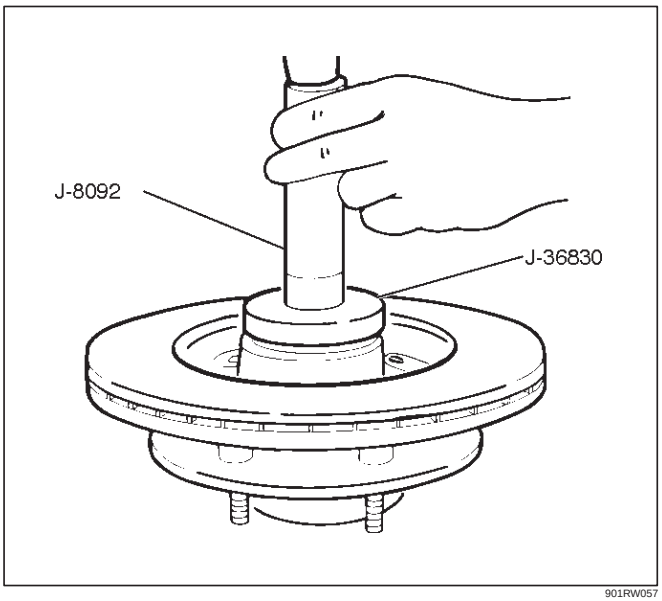
901RW055

4. Install outer bearing.
   Install the outer race by driving it into the hub by using install J–36828 and grip J–8092.



901RW056

5. Install oil seal by using installer J–36830 and grip J–8092.
   Apply Multipurpose grease (NLGI No.2 or equivalent) to the lip portion.



901RW057

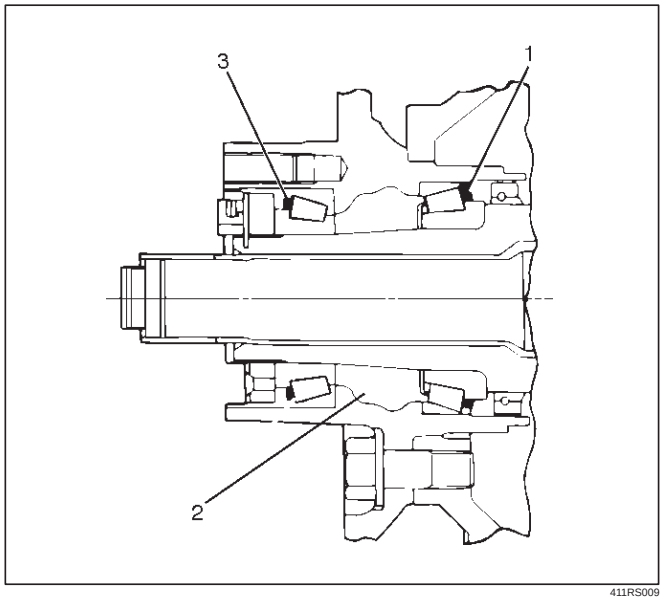
6. Install ABS sensor ring, then tighten the bolts to the specified torque.

   Torque: 18 N·m (13 lb ft)

7. Install hub and disc assembly.
   ▼Apply grease in the hub.
   ▼Apply wheel bearing type grease NLGI No. 2 or equivalent to the outer and inner bearing.

Grease Amount

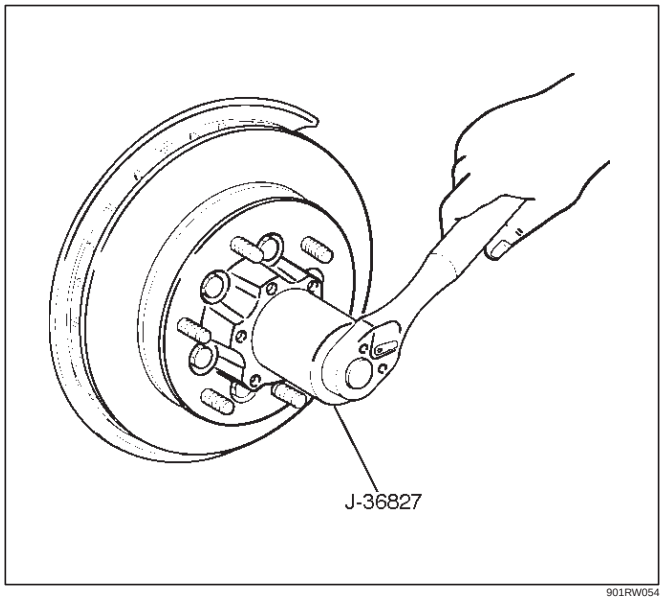
Hub	35 g (1.23 oz)
Outer bearing	10 g (0.35 oz)
Inner bearing	15 g (0.53 oz)



411RS009

Legend
(1) Inner Bearing
(2) Hub
(3) Outer Bearing

8. Install hub nut.
   Turn to the place where there is a chamfer in the tapped hole to the outer side, then attach the nut by using front hub nut wrench J–36827.



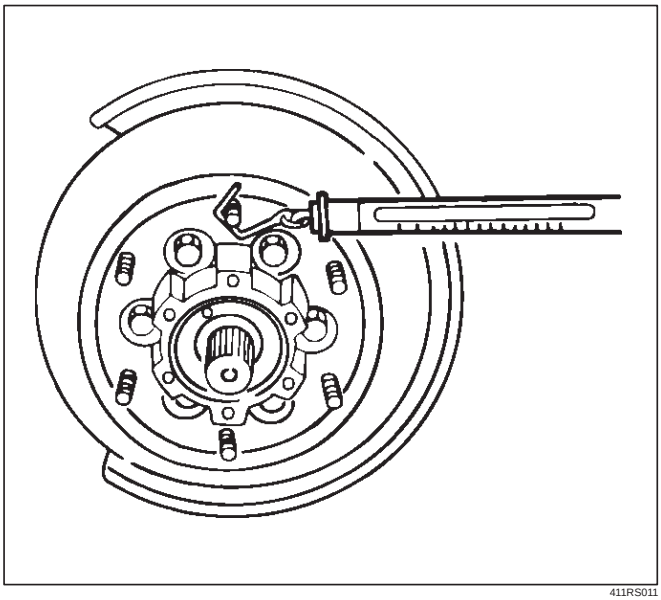
901RW054

Preload Adjustment

1. Tighten the hub nut to 29 N·m (22 lb ft), then fully loosen the nut.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

New bearing and New oil seal	19.6 – 24.5 N (4.4 – 5.5 lb)
Used bearing and New oil seal	11.8 – 17.7 N (2.6 – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the hub nut.



411RS011

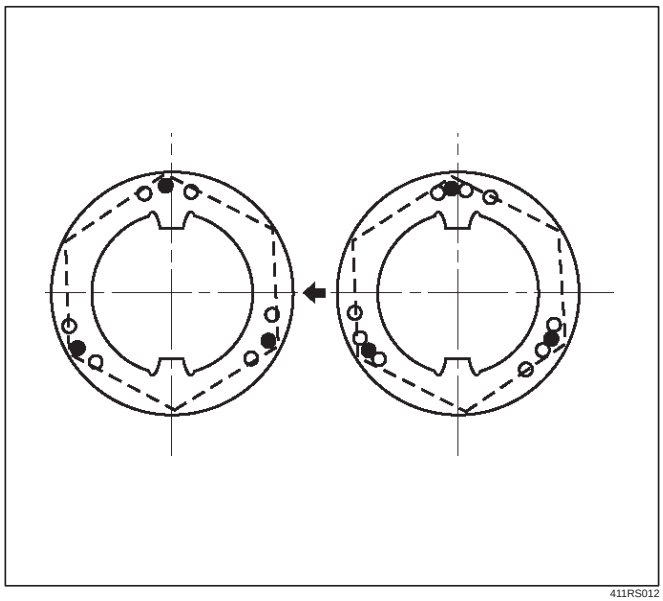
9. Install lock washer and lock screw.

▼Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.

▼If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.

▼If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.

▼Screw is to be fastened tightly so its head may come lower than the surface of the washer.



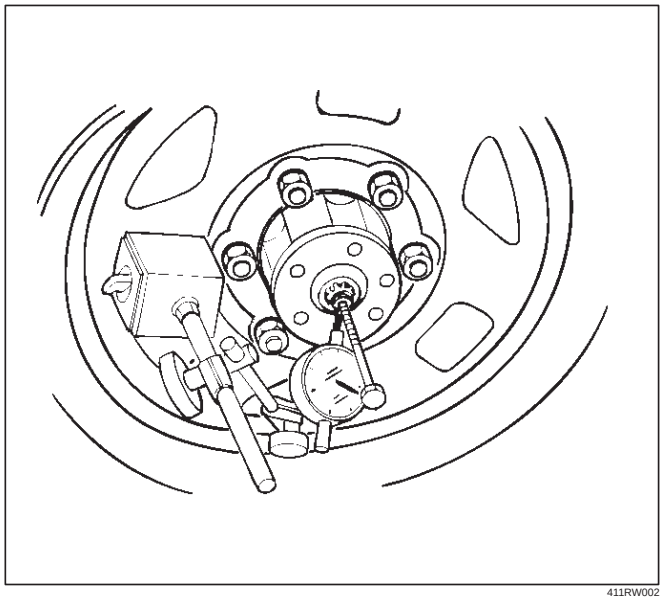
411RS012

10. Apply adhesive (LOCTITE 515 or equivalent) to both joining flange faces then install hub flange.
11. Install snap ring and shim.

▼Adjust the clearance between the free wheeling hub body and the snap ring.

Clearance: 0 mm–0.3 mm (0 in–0.012 in)

Shims Available: 0.2 mm, 0.3 mm, 0.5 mm, 1.0 mm (0.008 in, 0.012 in, 0.020 in, 0.039 in)



411RW002

12. Install hub cap.
13. Tighten the bolts to the specified torque.

Torque: 59 N·m (43 lb ft)

14. Install brake caliper and tighten fixing bolt.

Front Drive Shaft Joint

Front Drive Shaft Joints Replacement

▼ Refer to *Front Drive Axle Assembly Replacement* in this section, and refer to *Front Hub and Disc Overhaul in Suspension* section.

Front Hub Bearing Preload Check

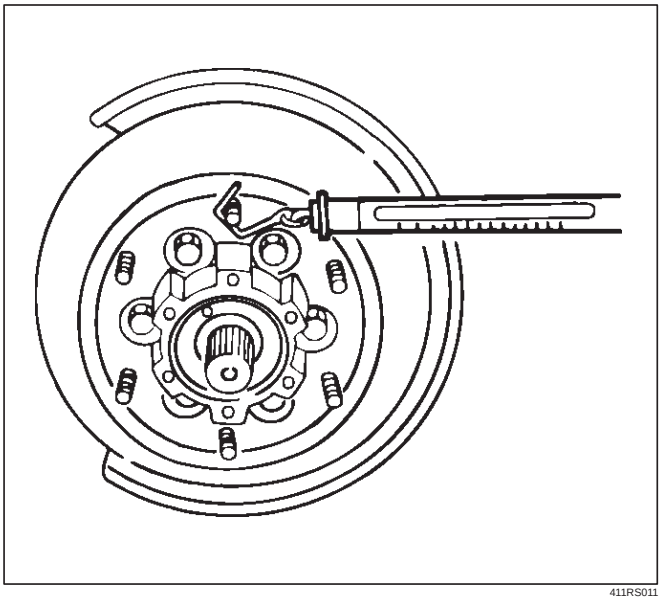
Check the hub bearing preload at the wheel pin.

New bearing and New oil seal:

19.6 – 24.5 N (4.4 – 5.5 lb)

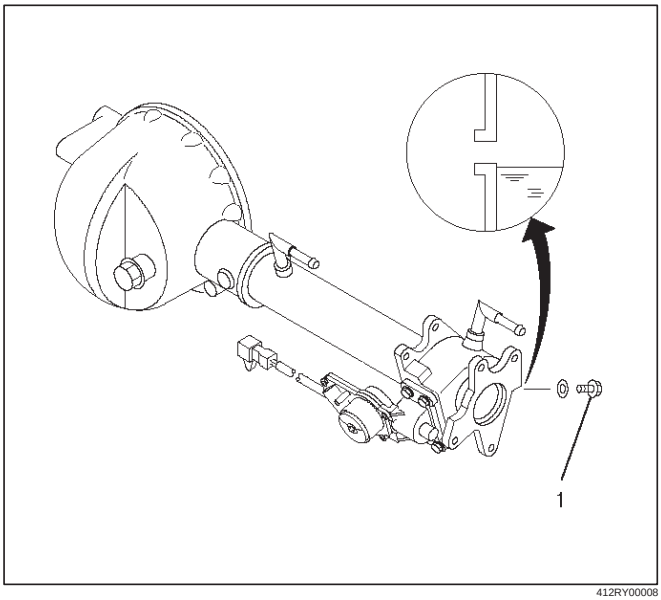
Used bearing and New oil seal:

11.8 – 17.7 N(2.6 – 4.0 lb)



411RS011

Inspection Of Shift On The Fly System Gear Oil



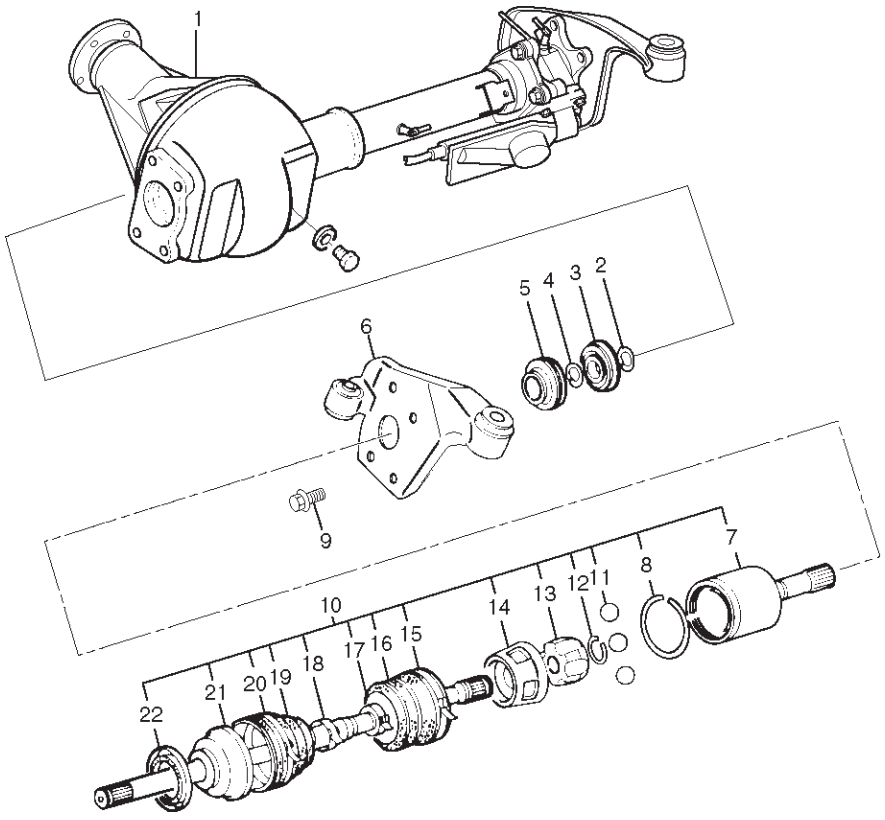
412RY00008

1. Open filler plug and make sure that the oil up to the plug port.
   If the oil is short, replenish with gear oil GL–5 grade.
2. Tighten the filler plug to specified torque.

Torque: 78 N·m (58 lb in)

Front Axle Drive Shaft

Front Axle Drive Shaft and Associated Parts



412RY00036

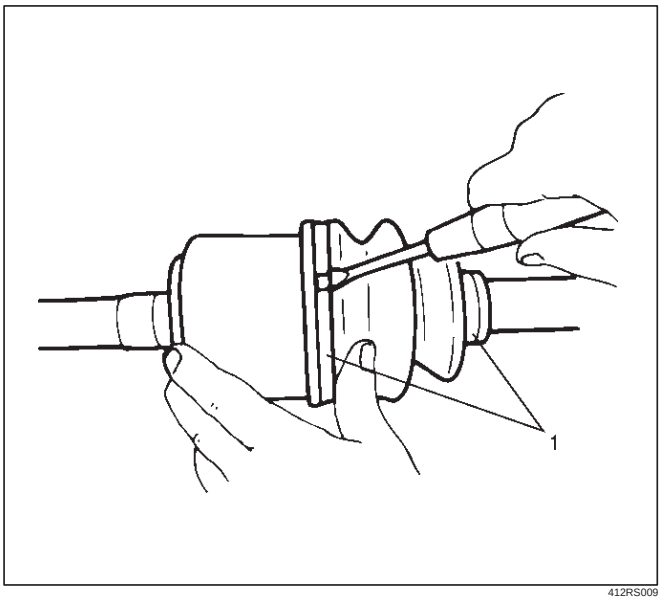
Legend

(1) Axle Case and Differential
(2) Snap Ring
(3) Bearing
(4) Snap Ring
(5) Oil Seal
(6) Bracket
(7) DOJ Case
(8) Circlip
(9) Bolt
(10) Drive Shaft Joint Assembly
(11) Ball
(12) Snap Ring
(13) Ball Retainer
(14) Ball Guide
(15) Band
(16) Bellows
(17) Band
(18) Band
(19) Bellows
(20) Band
(21) BJ Shaft
(22) Dust Seal

Disassembly

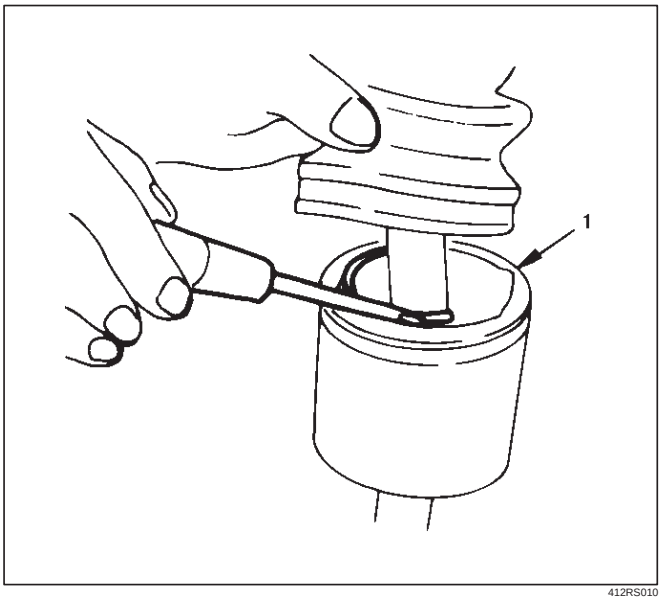
NOTE: For the left side, follow the same steps as right side.

1. Raise the hooked end of the band with a screwdriver or equivalent.



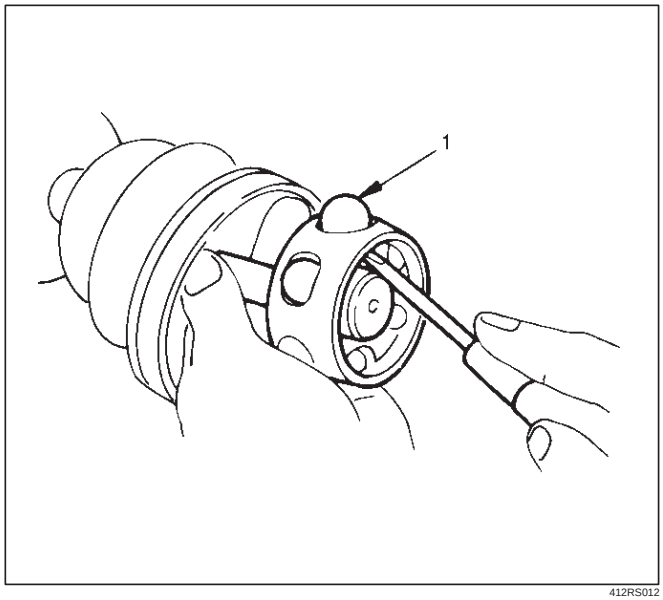
412RS009

2. Remove band(1).
3. Pry off circlip (1) with a screwdriver or equivalent.



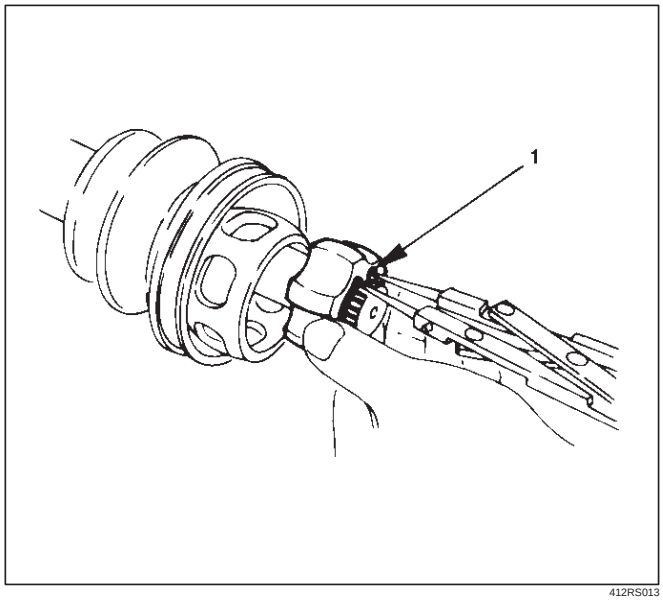
412RS010

4. Remove drive shaft joint assembly.
5. Remove the six balls (1) with a screwdriver or equivalent.



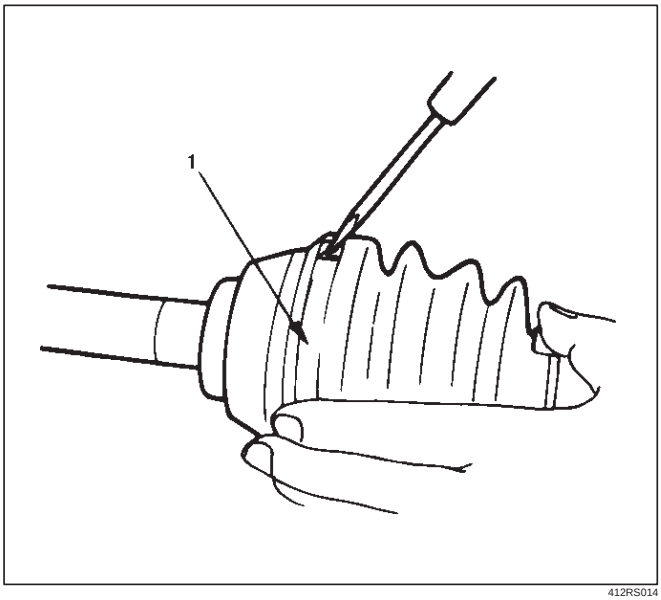
412RS012

6. Using snap ring pliers, remove the snap ring (1) fastening the ball retainer to the center shaft.



412RS013

7. Remove ball retainer, ball guide and bellows.
8. Raise the hooked end of the band with a screwdriver or equivalent.



412RS014

9. Remove band(1).
10. Remove bellows.
11. Remove dust seal.
12. Remove BJ shaft assembly.
13. Remove the mounting bracket fixing bolts, and then remove DOJ case assembly from the axle case.
14. Remove snap ring and bearing.
15. Remove snap ring and oil seal.
16. Remove bracket.

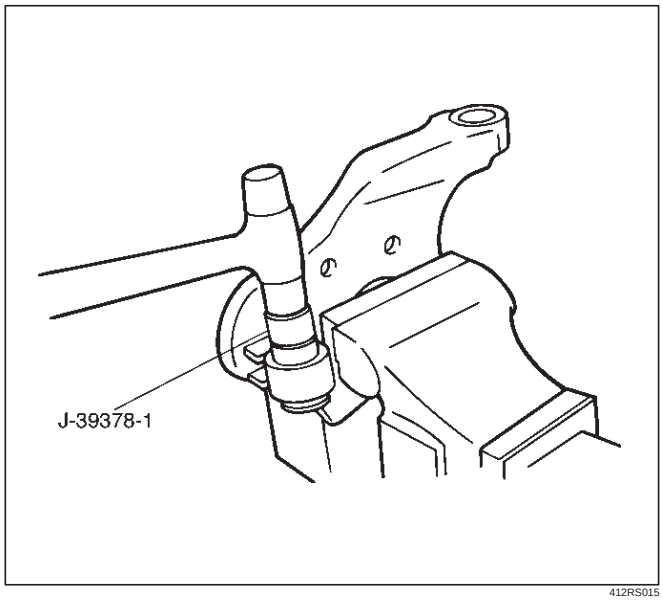
Inspection And Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

1. Drive shaft joint assembly
2. DOJ case, ball, ball guide, ball retainer
3. Bellows
4. Bearing
5. Dust seal, oil seal

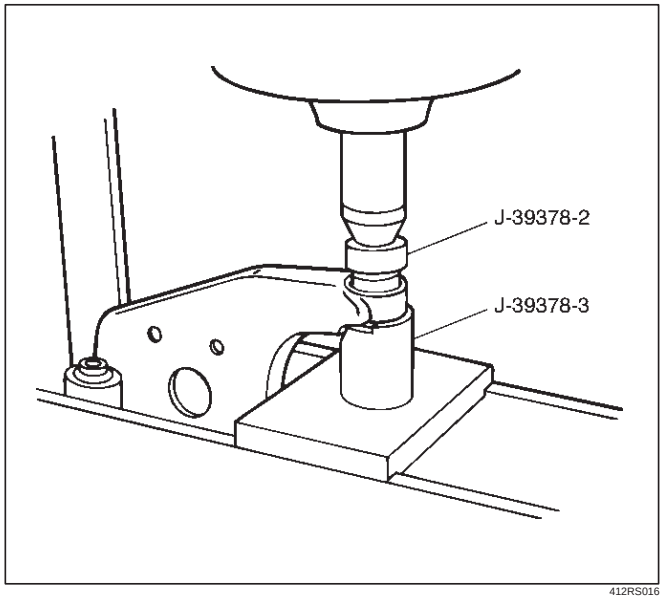
Bushing Replacement

▼ Remove the bushings using a remover J–39378–1 and hammer.



412RS015

▼ By using installer J–39378–2 and base J–39378–3, press fit the bushings into the bracket.

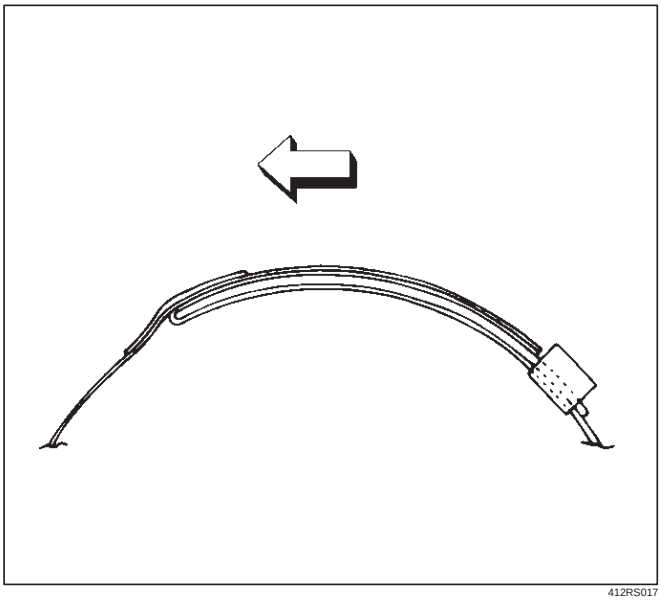


412RS016

Reassembly

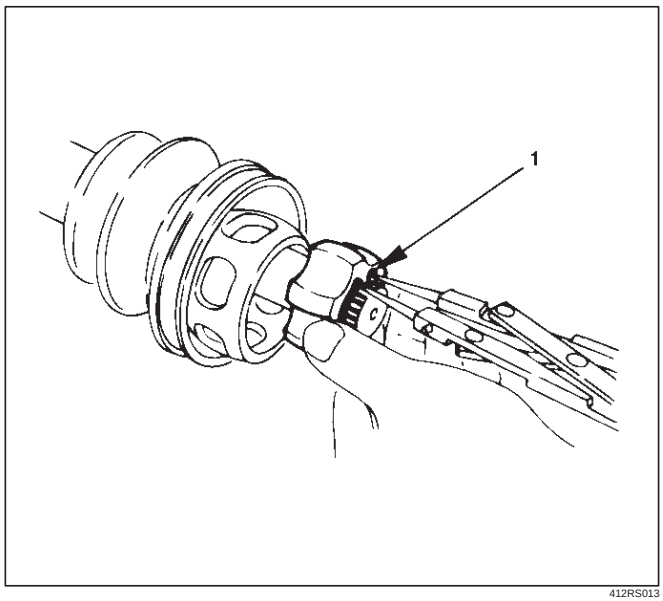
1. Install DOJ case to bracket.
2. Install oil seal and fix snap ring.
3. Install bearing and fix snap ring.
4. Install bracket to axle case. Tighten the bracket bolt to the specified torque.

   Torque: 116 N·m (85 lb ft)
5. Apply 150g of the specified grease in BJ.
6. Install dust seal.
7. Apply a thin coat of grease to the shaft for smooth installation then install bellows.
8. Install band. Note the setting direction. After installation, check that the bellows is free from distortion.



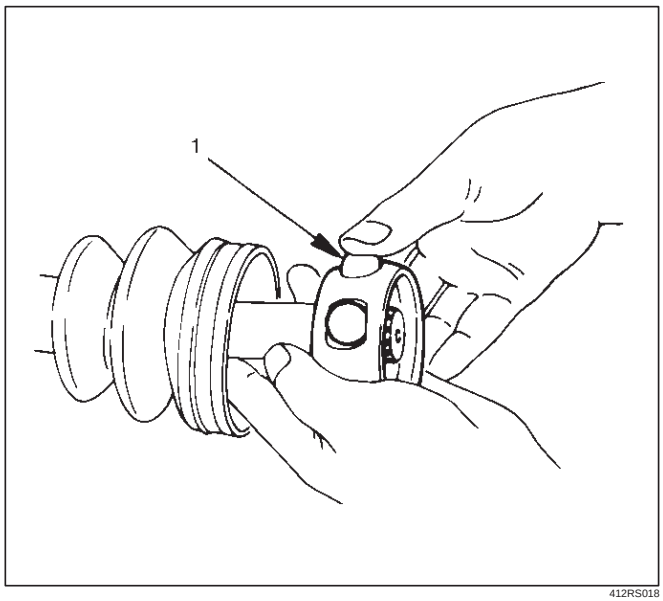
412RS017

9. Install another bellows and fix band.
10. Install the ball guide with the smaller diameter side ahead onto the shaft.
11. Install ball retainer.
12. Using snap ring pliers, install the snap ring (1) securing the ball retainer to the shaft.



412RS013

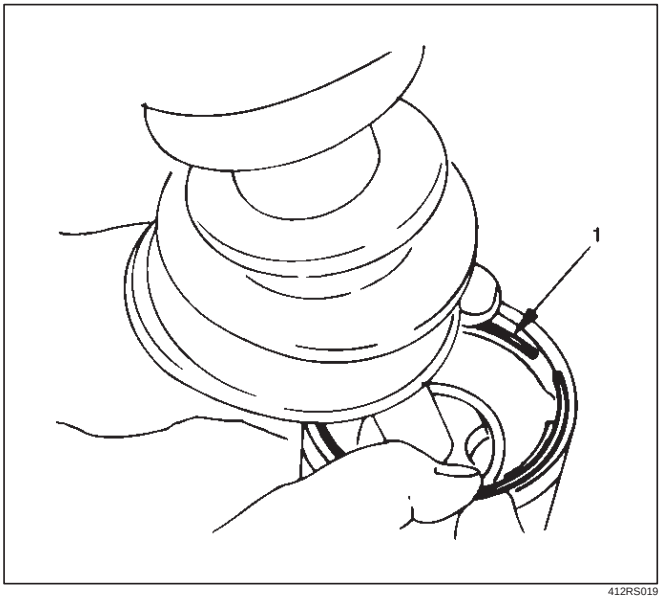
13. Align the track on the ball (1) retainer with the window in the cage, and install the six balls into position.



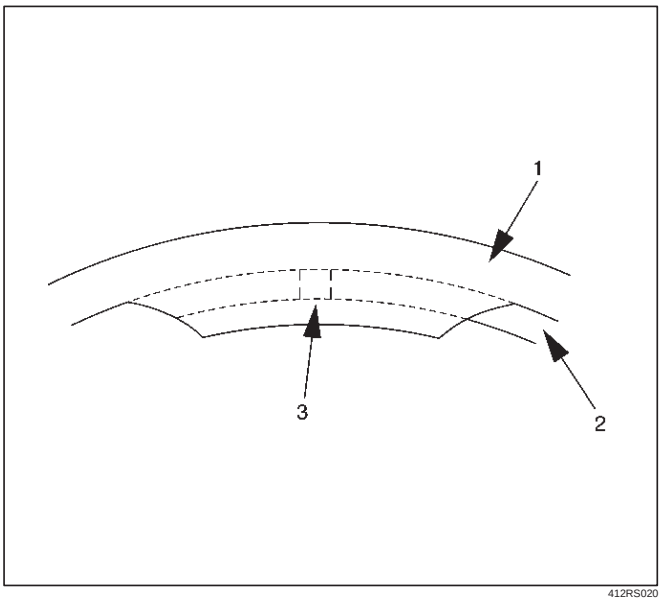
412RS018

14. Pack 150g of the specified grease in DOJ case, then install drive shaft joint assembly. After reassembly, move the DOJ longitudinally several times to get to fit.

15. Install the circlip (1) so that open ends are positioned away from the ball groove.



412RS019

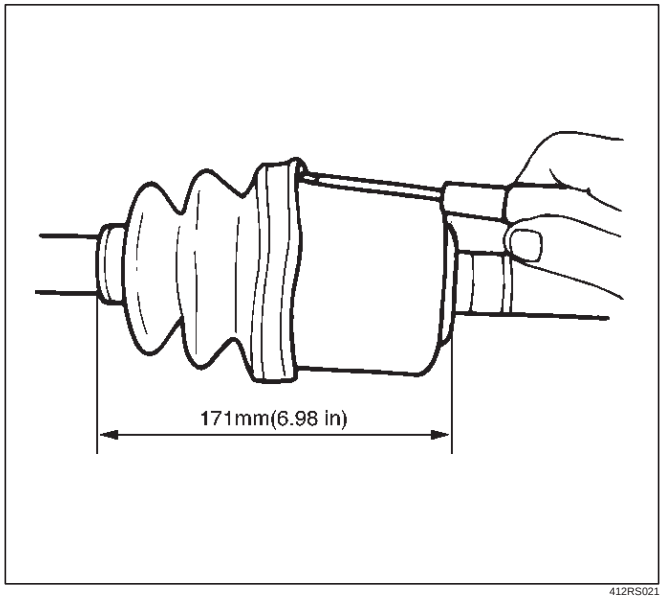


412RS020

Legend

(1) Outer Case
(2) Circlip
(3) Open Ends

16. Install bellows. Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.

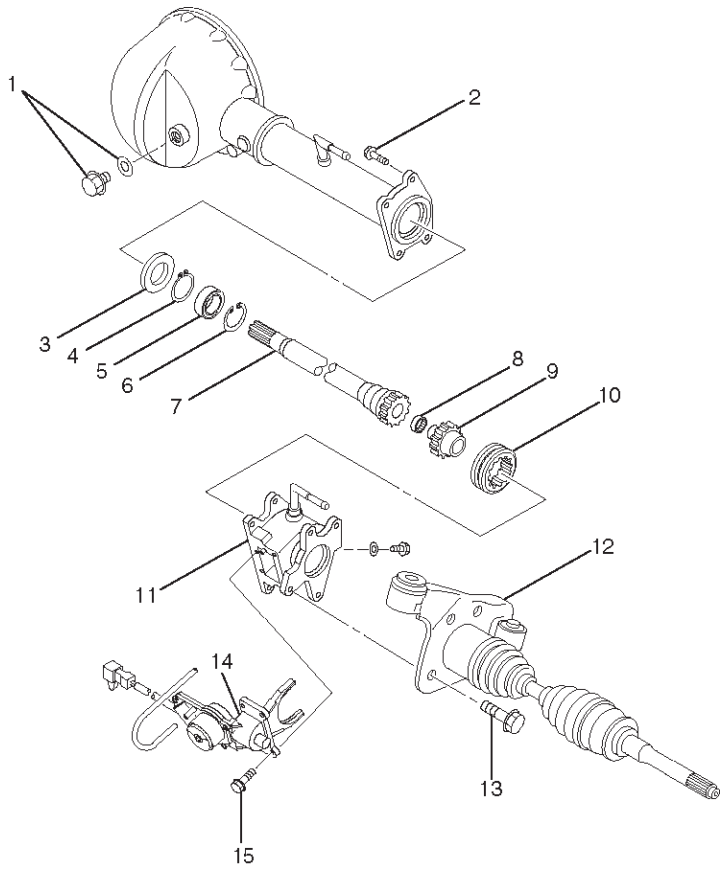


412RS021

17. Install band. After installation, check that the bellows is free from distortion.

Shift On The Fly System

Shift On The Fly System and Associated Parts



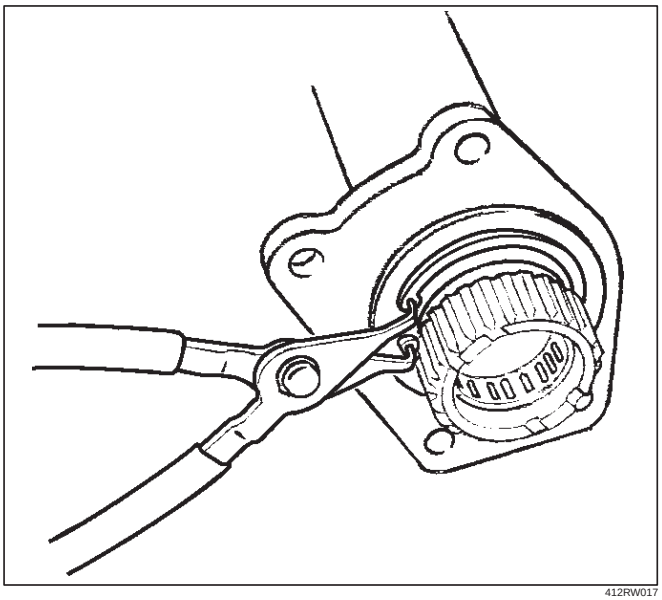
412RY00007

Legend

(1) Filler Plug
(2) Bolt
(3) Oil Seal
(4) Snap Ring(External)
(5) Inner Shaft Bearing
(6) Snap Ring(Internal)
(7) Inner Shaft
(8) Needle Bearing
(9) Clutch Gear
(10) Sleeve
(11) Housing
(12) Front Axle Drive Shaft(LH side) with Bracket
(13) Bolt
(14) Actuator Assembly
(15) Bolt

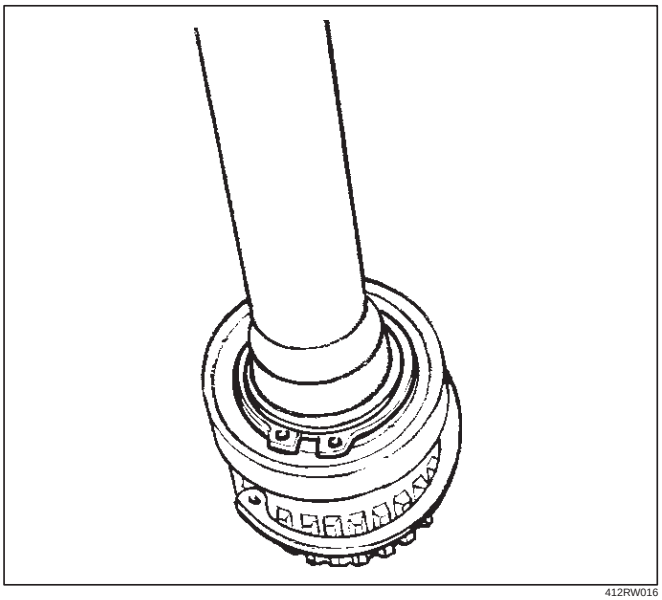
Disassembly

1. Remove filler plug and gasket, drain oil.
2. Loosen mounting bracket fitting bolts and remove front axle drive shaft from front axle case.
3. Remove actuator assembly and draw out actuator ASM.
4. Remove housing.
5. Remove sleeve.
6. Remove clutch gear.
7. Remove snap ring from front axle case by using snap ring pliers.



412RW017

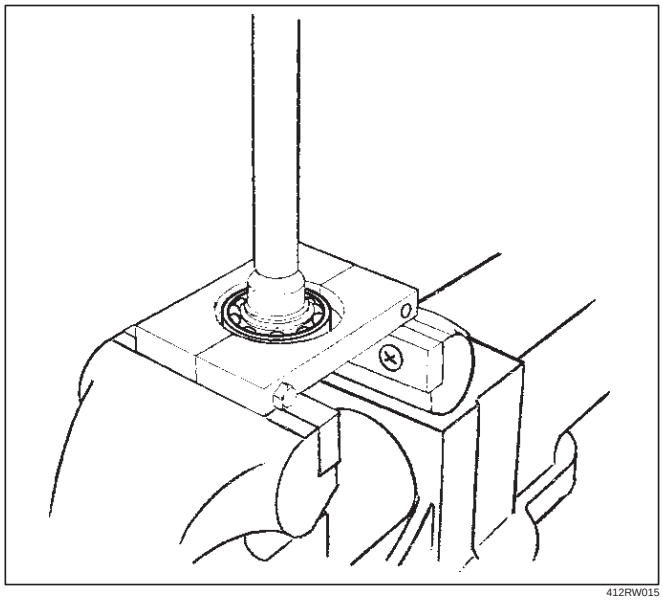
8. Take out inner shaft from front axle case.
9. Remove snap ring from inner shaft by using snap ring pliers.



412RW016

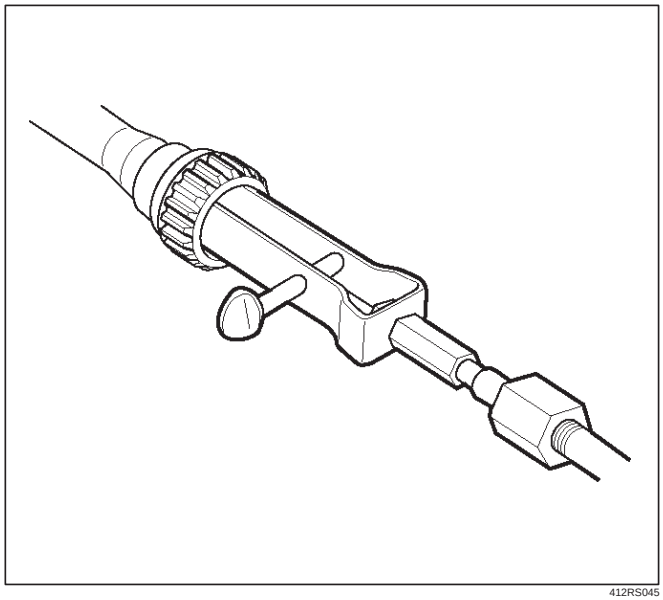
10. Remove inner shaft bearing.

NOTE: Be careful not to damage the shaft.



412RW015

11. Remove needle bearing from inner shaft by using a remover J–26941 and sliding hammer J–2619–01.



412RS045

12. Remove oil seal from front axle case.

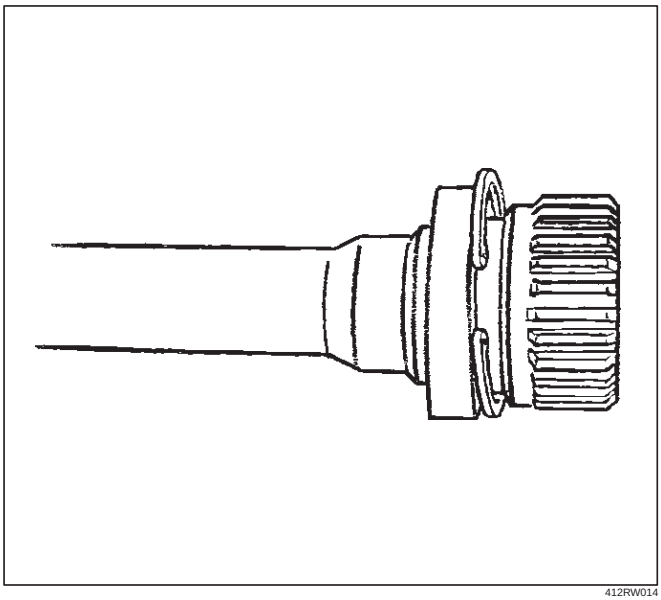
NOTE: Be careful not to damage the front axle case.

Inspection And Repair

Inspect the removed parts. If there are abnormalities such as wear and damage, take corrective action or replace.

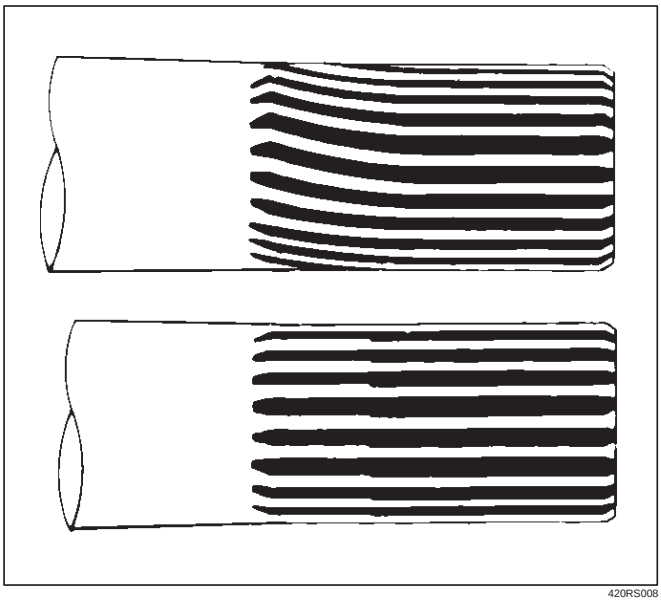
Visual Check

1. Check and see if the inner shaft has such abnormalities as wear and damage.



412RW014

2. Replace the shaft if any signs of deterioration in the gear is present.



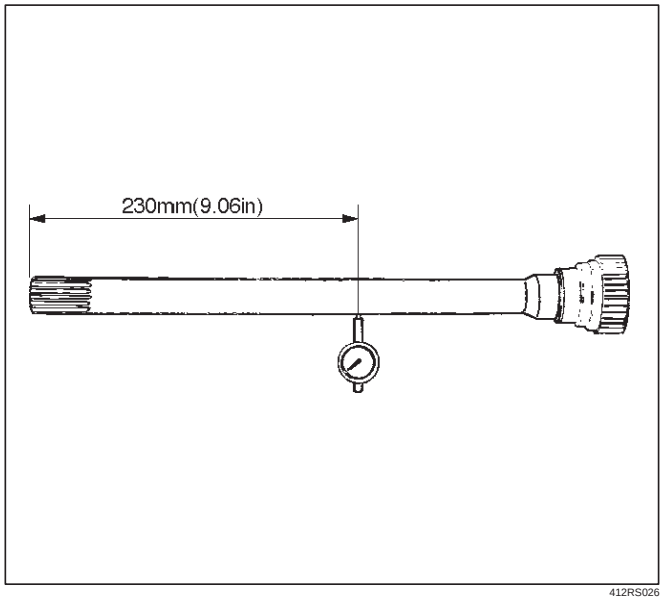
420RS008

Inner Shaft Run–Out

With both end centers supported, rotate the shaft slowly and measure deflection with a dial gauge.

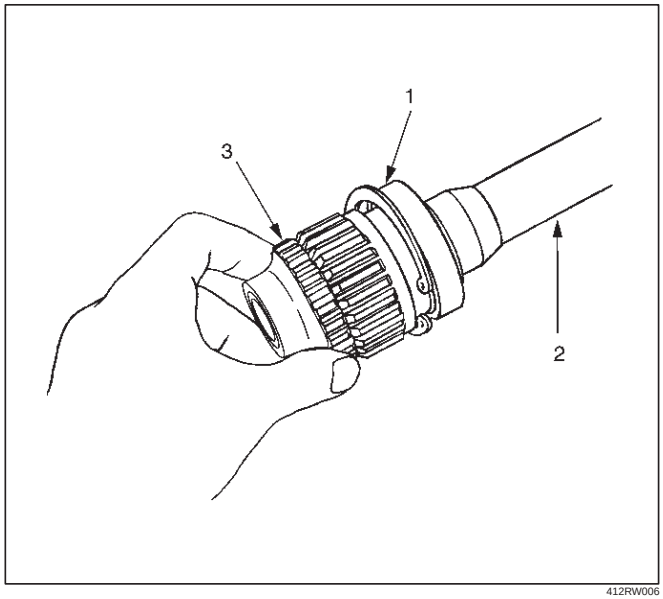
Limit: 0.5 mm (0.02 in)

NOTE: Do not heat the shaft to correct its bend.



412RS026

Inner Shaft Bearing



412RW006

Legend

(1) Inner Shaft Bearing
(2) Inner Shaft
(3) Clutch Gear

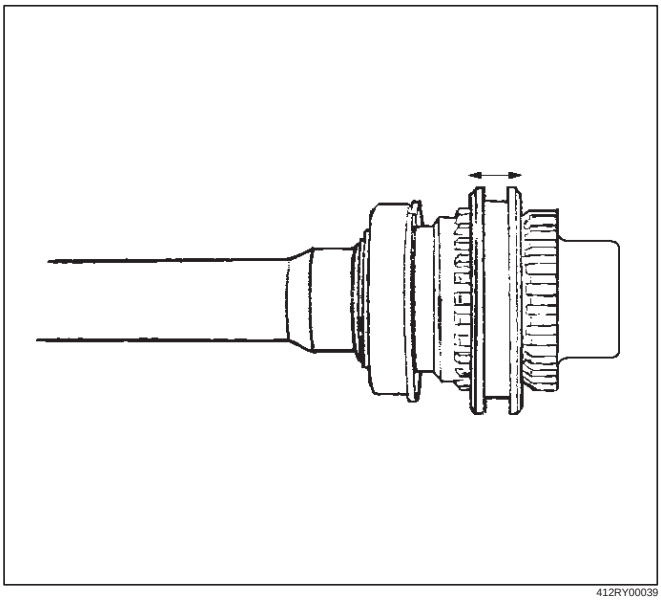
1. Inspect the inner shaft bearing for any signs of deterioration, replace if uneven.
2. Insert the clutch gear and inspect the needle bearing.
3. Replace the needle bearing if found to be uneven.

Sleeve Condition

Check and see that there is not wear damage, or cracking in the sleeve.

NOTE: Close inspection of the groove and inner gear are required because those are important parts.

Sleeve Function



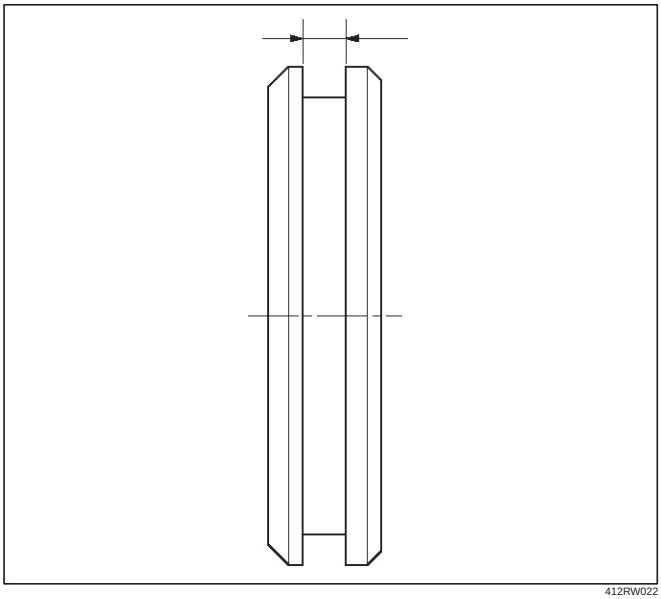
412RY00039

Test the sleeve for smoothness by sliding it between the inner shaft and the clutch gear, replace the sleeve if its difficult to slide.

NOTE: Gear oil should be applied to the contact surface of gear.

Check the width of sleeve center groove.

Limit: 7.1 mm (0.28 in)

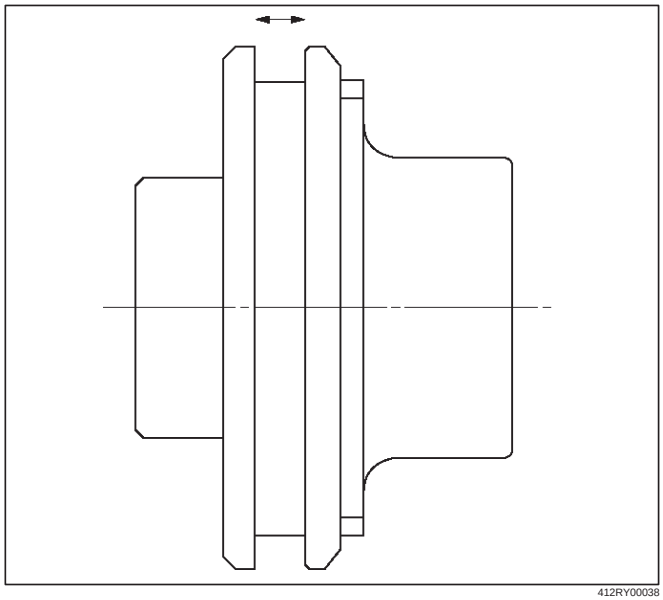


412RW022

Clutch Gear Condition

Check for wear, damage, crack or any other deterioration in the clutch gear.

Clutch Gear Function



412RY00038

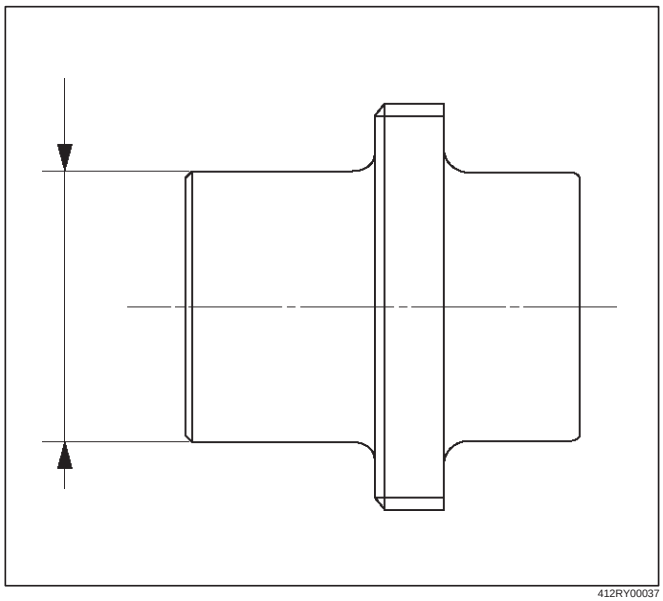
Test the sleeve for smoothness by sliding it across the clutch gear, replace the clutch gear if its difficult to slide.

NOTE: When inspecting, gear oil should be applied to the contact surface of gear.

Clutch Gear Journal Diameter

Make sure of the size illustrated.

Limit: 36.98 mm (1.456 in)

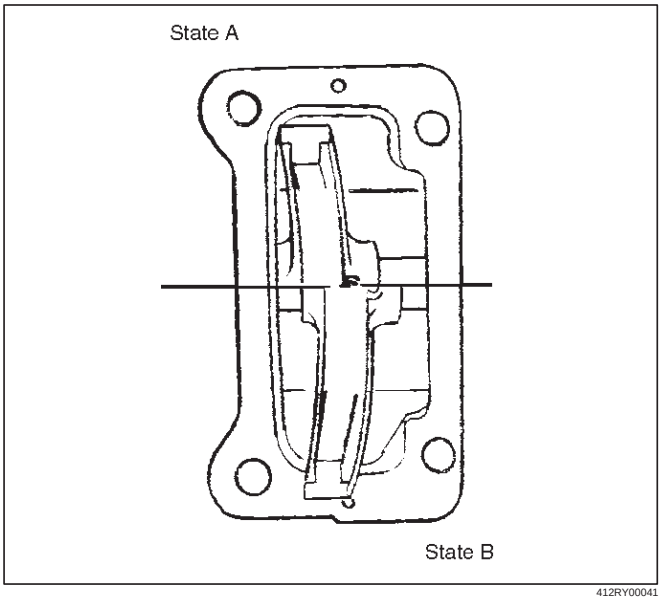


412RY00037

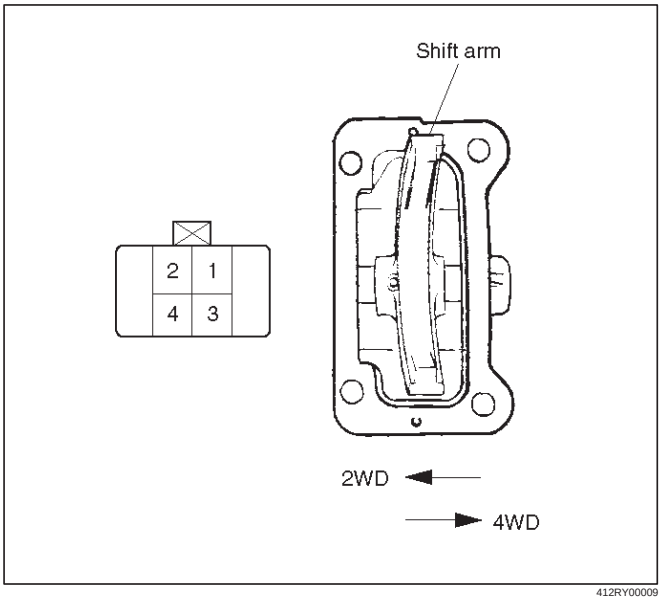
Actuator

Check for damage, cracking or other abnormality.

Functional Check



412RY00041



412RY00009

Verify functionality by applying voltage (12V) to terminals 3 and 4 and set the tester to terminal 1 and 2 according to the table bellow.

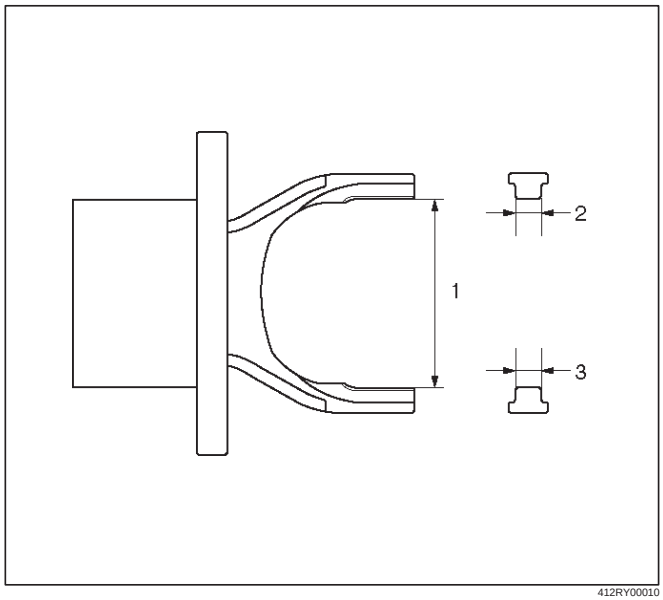
State	Trminal 3	Trminal 4	Electric circuit between terminal 1 & 2	Functio n
A	+12V	Ground	OK	2WD
B	Ground	+12V	NONE	4WD

If there is an abnormality, replace the actuator as an assembly.

NOTE: Be careful not to permit the entry of water or dust into of the actuator.

Dimentional Check

Measure illustrated sizes 1, 2, and 3.



412RY00010

Limit

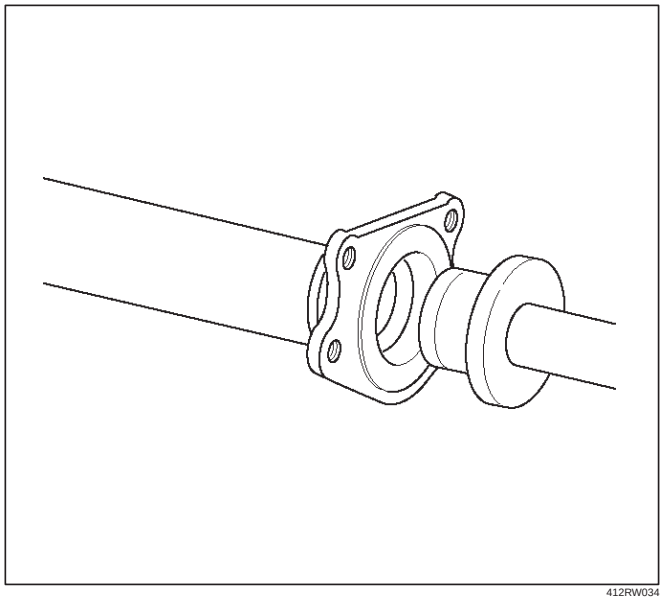
1=64.3 mm (2.53 in)

2=6.7 mm (0.26 in)

3=6.7 mm (0.26 in)

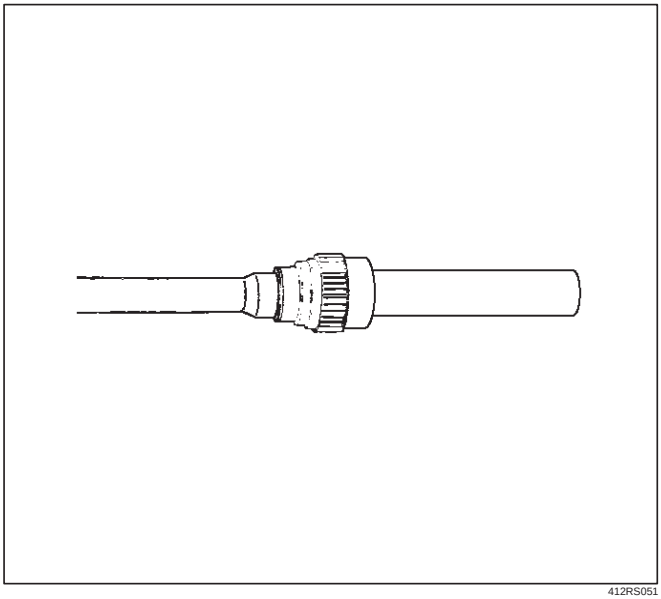
Reassembly

1. Install the new oil seal which has been immersed in differential gear oil, by using an oil seal installer J–41693 and grip J–8092.



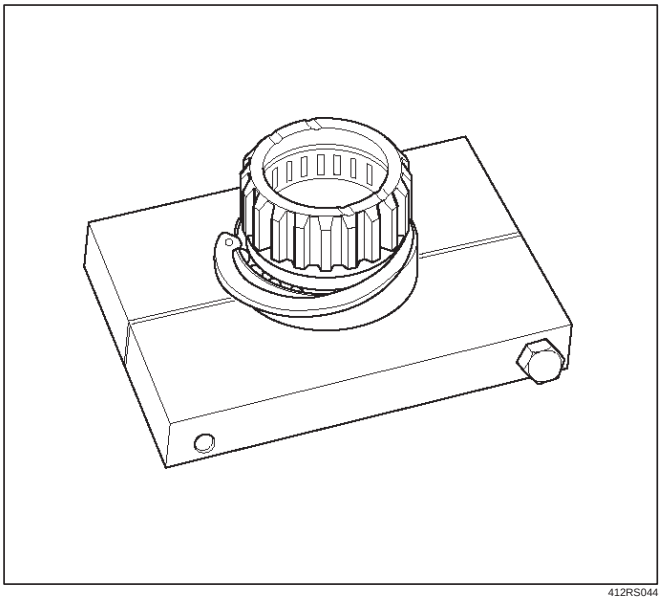
412RW034

2. Install a new needle bearing into inner shaft by using a Installer J–41694 and grip J–8092.



412RS051

3. Place a new snap ring(internal) in inner shaft.
   Install a new inner shaft bearing into the inner shaft.



412RS044

4. Install snap ring(external).

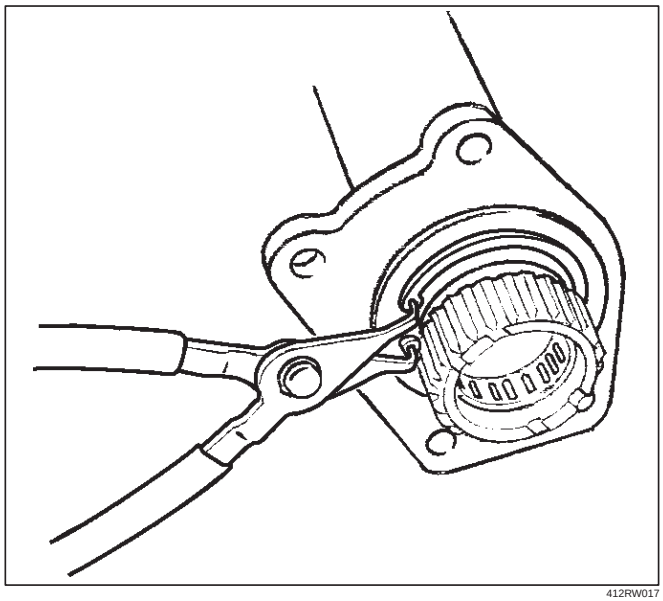
NOTE: Be careful not to damage the inner shaft.

5. Clean the housing contact surface of the front axle case and insert inner shaft assembly into the front axle case.

NOTE: Be careful not to damage seal.

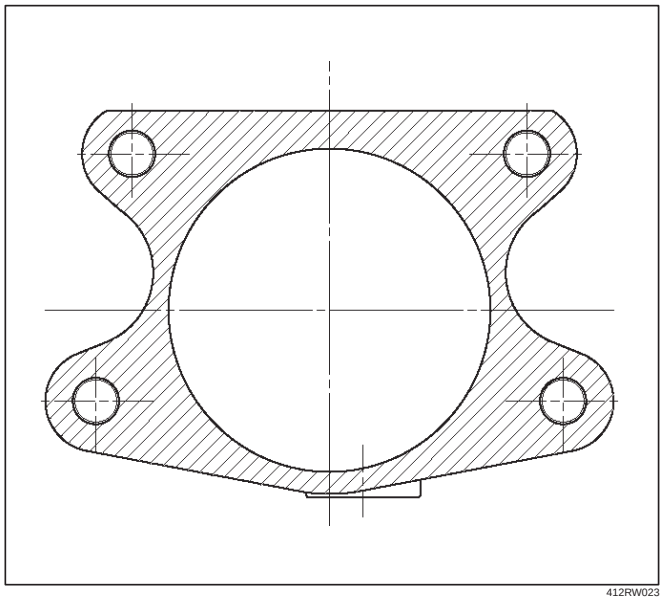
6. Install snap ring internal in the groove of front axle case.

NOTE: Be sure to install the snap ring properly.



412RW017

7. Apply differential gear oil to clutch gear, then install clutch gear.
8. Apply differential gear oil to sleeve, then install sleeve.
9. Clean contact surface with the front axle and actuator mounting surface. Apply liquid gasket to the contact surface on the front axle case, then install in the housing.



412RW023

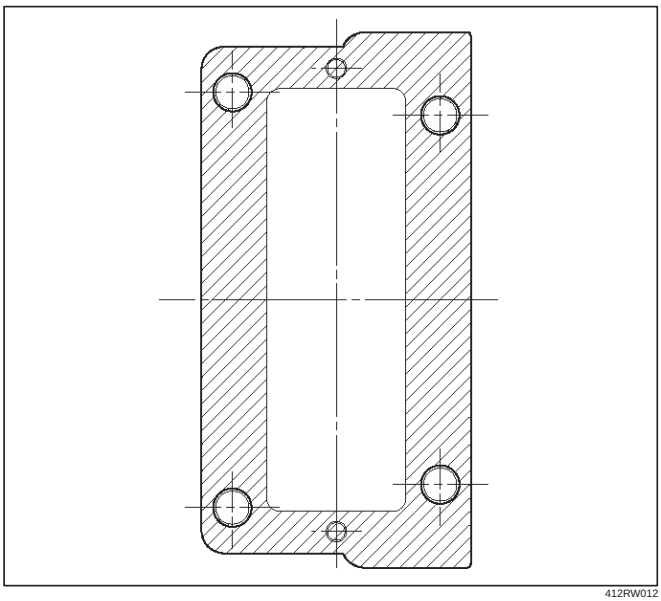
10. Tighten bolts to specified torque.

    Torque: 75N·m(55 lb ft)

11. Clean the actuator contact surface with the housing then Install and tighten shift position switch to specified torque.

    Torque: 39N·m (29 lb ft)

12. Apply liquid gasket to the contact surface on the actuator side.


412RW012

13. Align shift arm with the groove of sleeve and install the actuator.
14. Tighten bolts to specified torque.

    Torque: 9N·m(78 lb in)

15. Install front axle drive shaft and mounting bracket. Tighten fitting bolts to specified torque.

    Torque: 116N·m (85 lb ft)

16. Pour specified amount of differential gear oil to filler plug.

    Front Differential

    Oil Capacity: 1.4lit (1.48US qt)

    Actuator Housing

    Oil Capacity: 0.12lit(0.13US qt)

17. Install filler plug through gasket and tighten to specified torque.

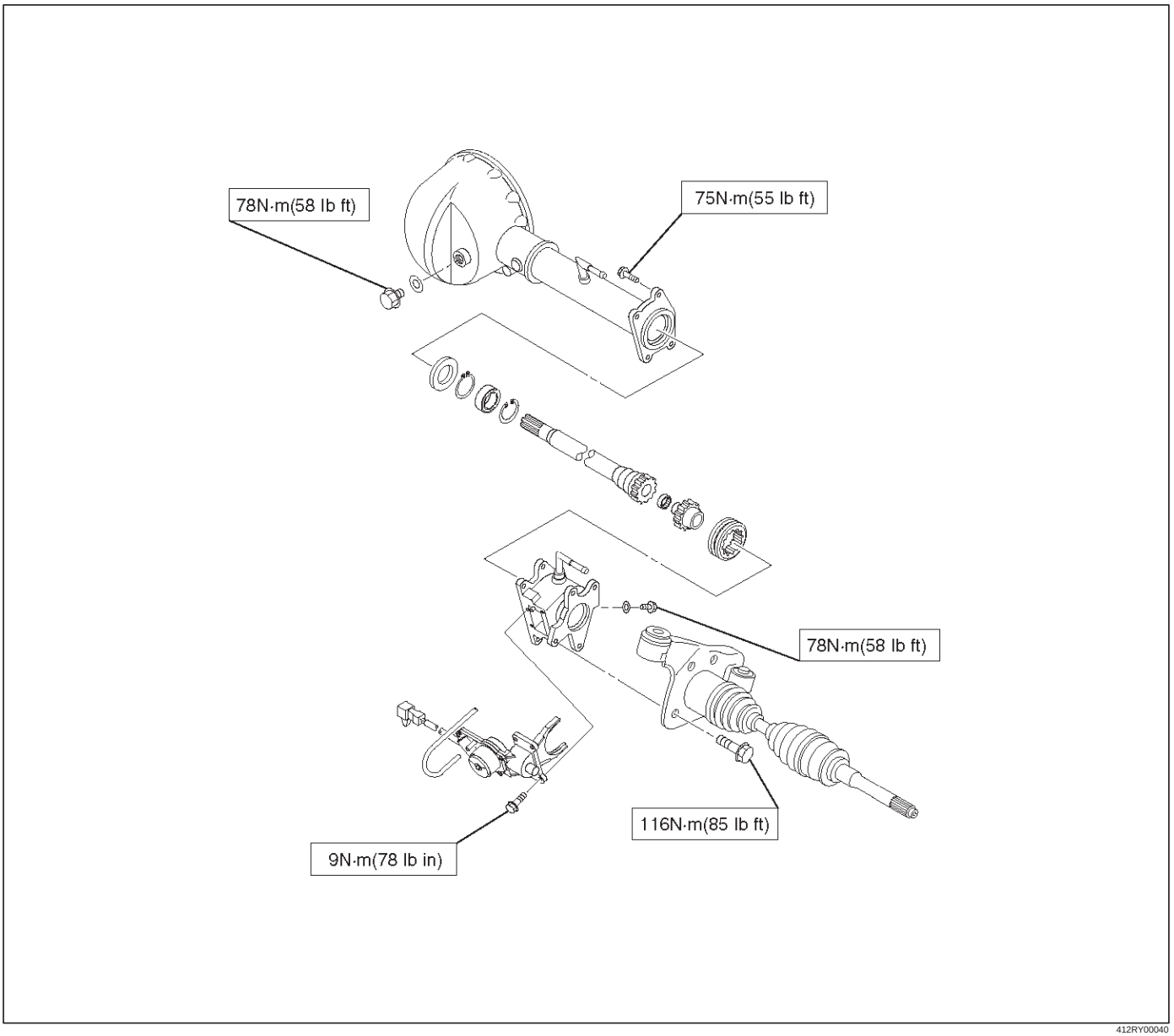
    Torque: 78N·m (58lb ft)

Main Data and Specifications

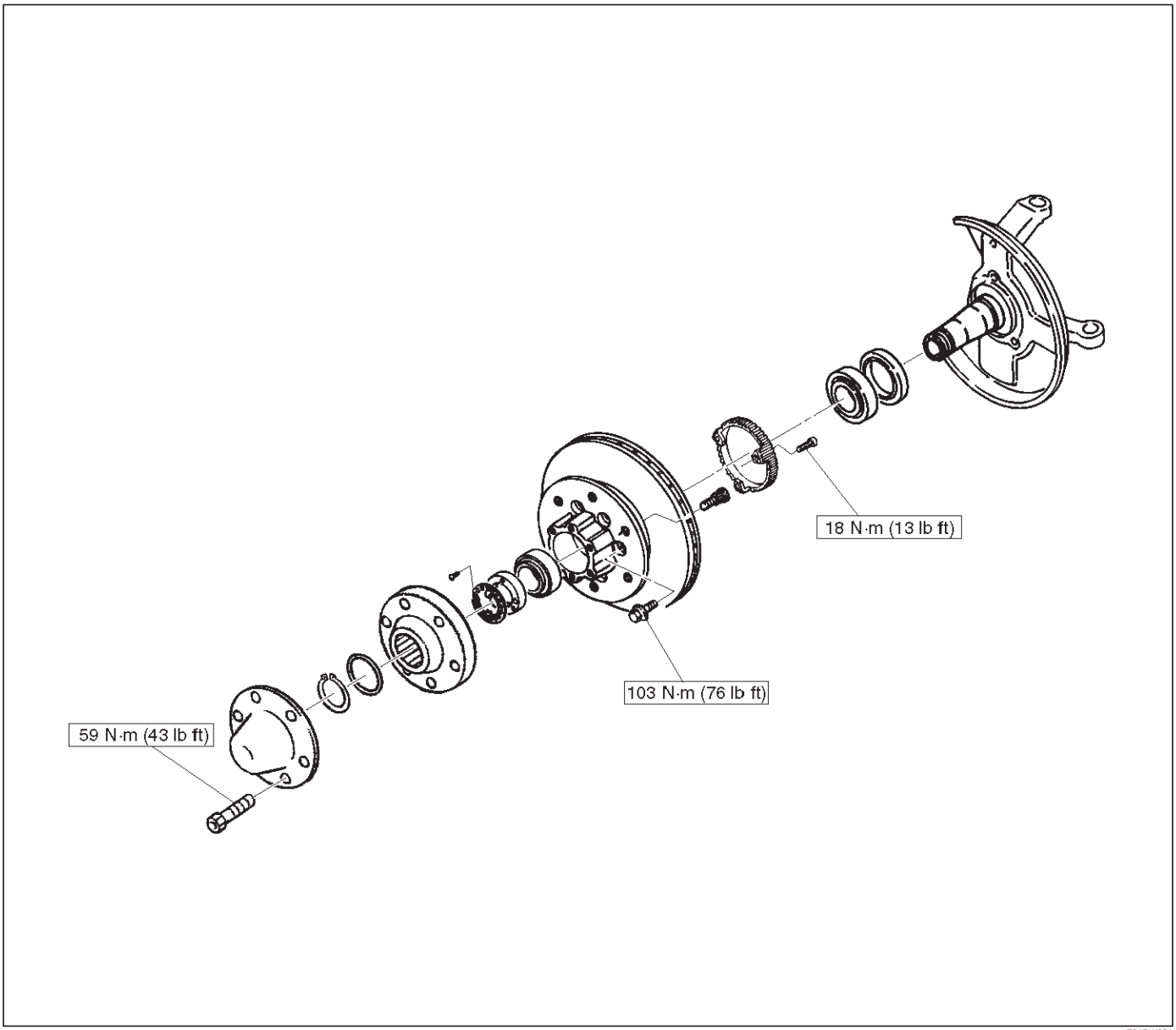
General Specifications

Front drive axle oil capacity	1.25 liter (1.32 US qt)(Differential)
	0.12 liter (0.13 US qt)(Actuator Housing:Shift on the fly)
Type of lubricant	GL–5 (75W–90) Refer to *chart in General Information*
Axle shaft type	Constant velocity joint(Birfield joint type and double offset joint)

Torque Specifications



412RY00040



E04RW001

Special Tools

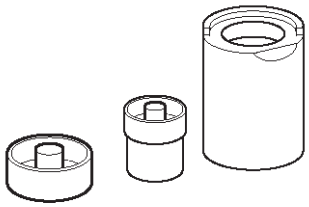
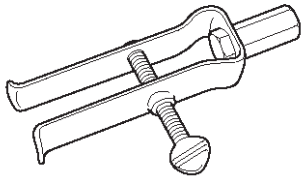
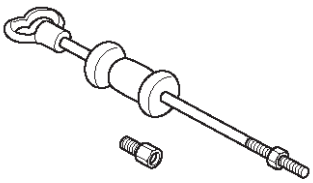
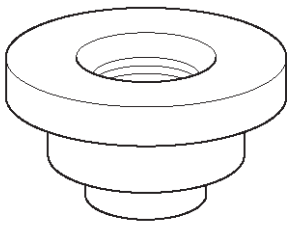
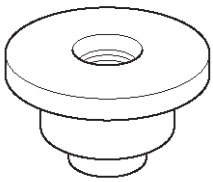
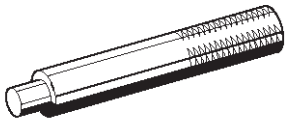
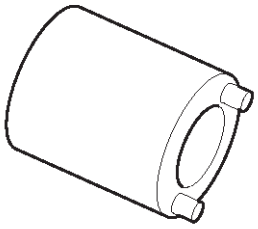
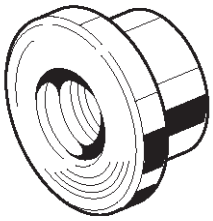
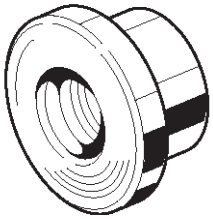
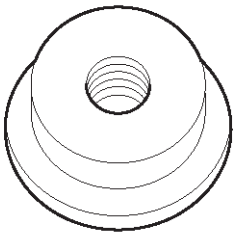
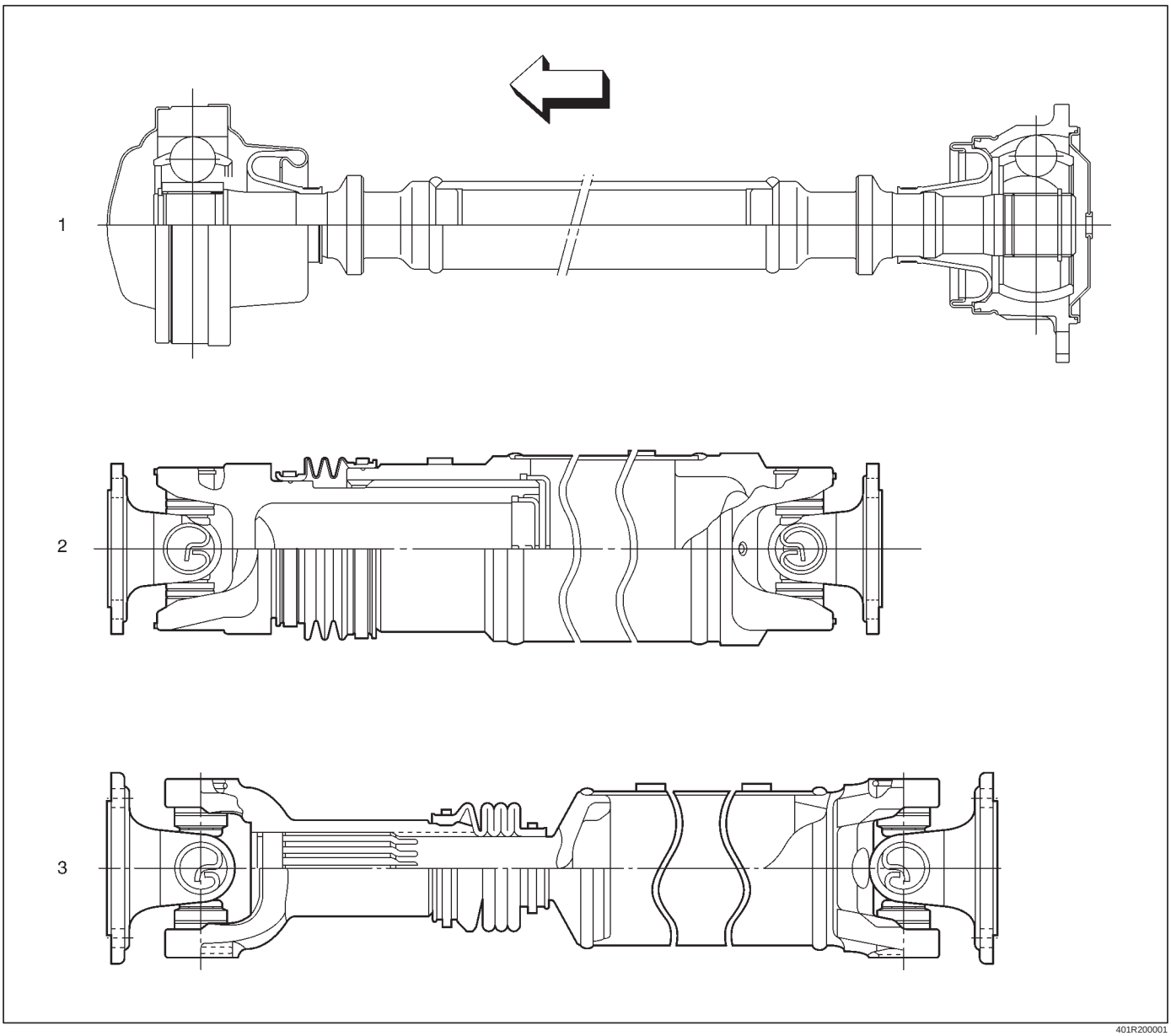
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS233	**J–39378** Remover and Installer; Front Axle mount bushing
 901RS234	**J– 26941** Remover; Bearing needle
 901RS235	**J–2619–01** Hammer; Sliding
 901RS236	**J–41693** Installer; Oil seal
 901RS177	**J–41694** Installer; Bearing needle
 901RS285	**J–8092** Grip

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS246	**J–36827** Wrench; Hub nut
 901RS247	**J–36829** Installer; Inner bearing
 901RS248	**J–36828** Installer; Outer bearing
 901RS249	**J–36830** Installer; Oil seal

Propeller Shaft

General Description



401R200001

Legend

(1) Front Propeller Shaft
(2) Rear Propeller Shaft;
Aluminum Tube with Flange Yoke Type (for 4×2 model)
(3) Rear Propeller Shaft;
Steel Tube Type (for 4×4 model)

Torque is transmitted from the transmission to the axle through the propeller shaft and universal joint assembles. All propeller shafts are the balanced tubular type. A splined slip joint is provided in some drivelines.

▼ Since the propeller shaft is balanced carefully, welding or any other modification is not permitted.

▼ Alignment marks should be applied to each propeller shaft before removal.

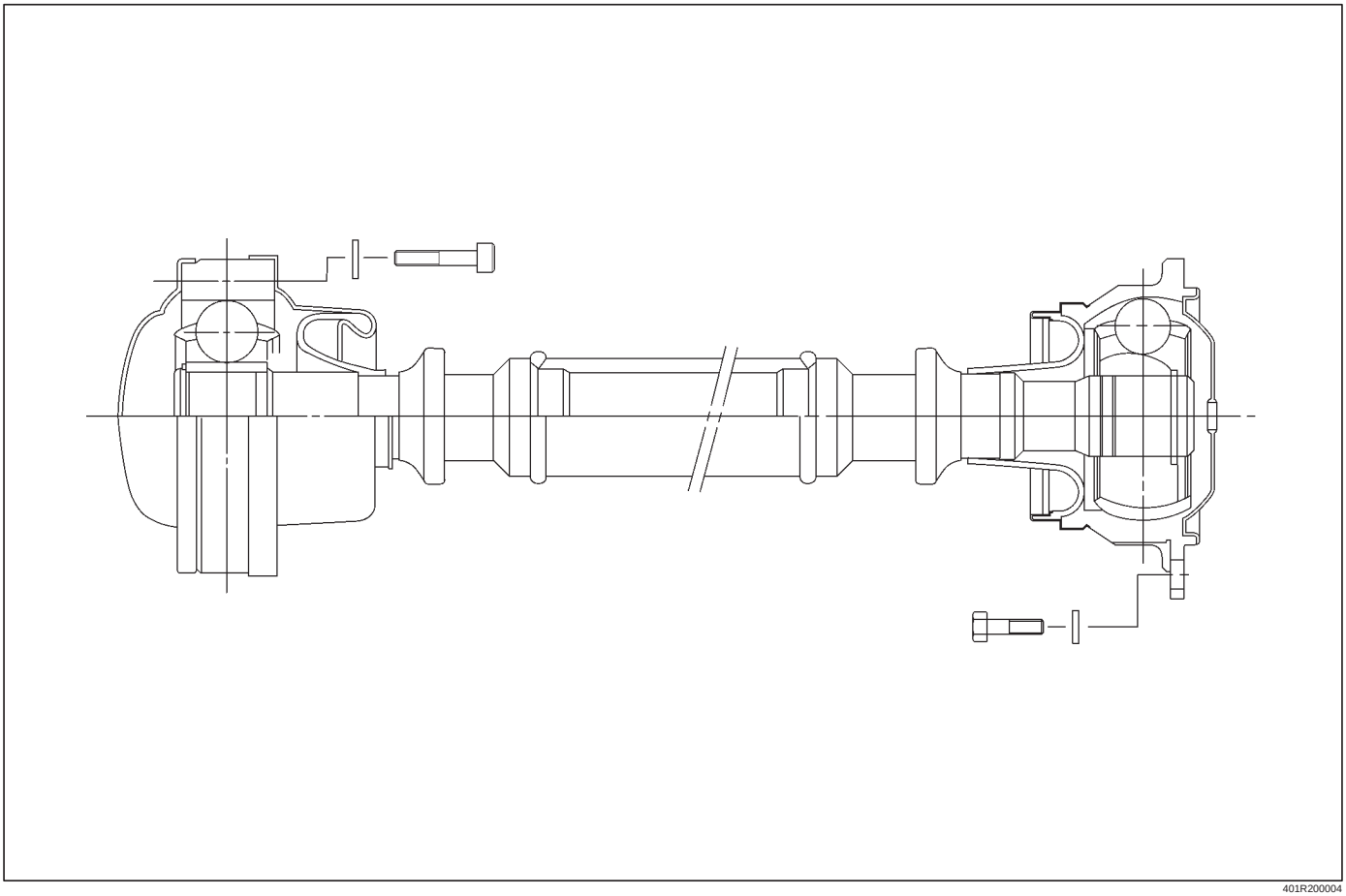
▼ Park, turn the engine off and apply the parking brake to secure the vehicle.

▼ Carefully attach the propeller shaft to the vise, do not overtighten the vise when securing the propeller shaft, this may cause deformation.

Front Propeller Shaft

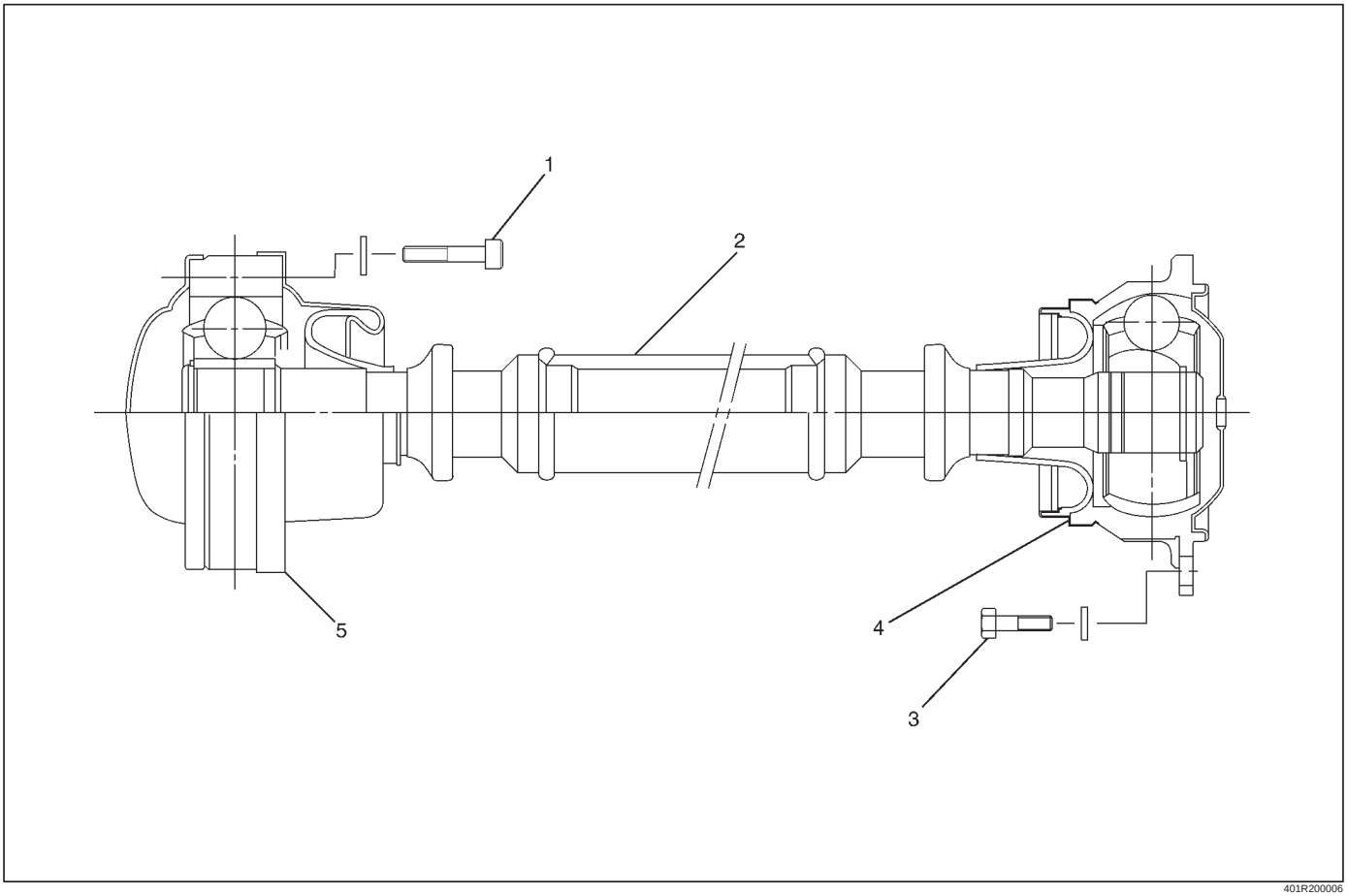
General Description

Since the propeller shaft is balanced carefully, welding or any other modifications are not permitted.
Alignment marks should be applied to each propeller shaft before removal.



401R200004

Front Propeller Shaft and Associated Parts



401R200006

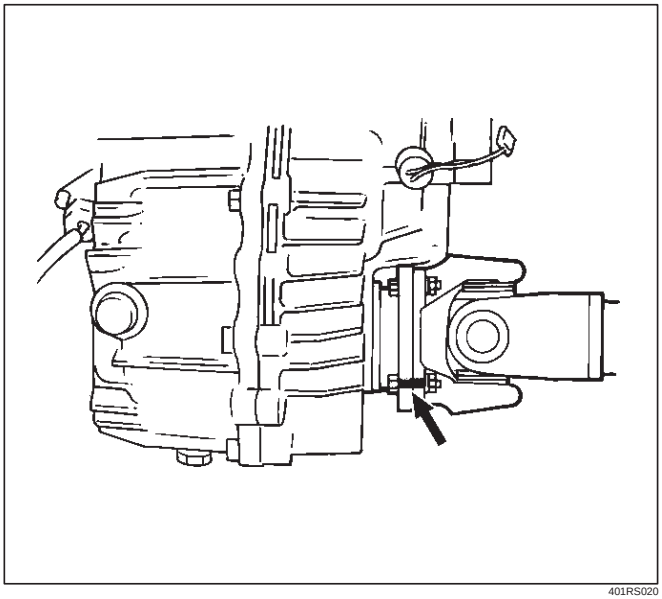
Legend

(1) Bolt, and Washer (Front Axle Side)
(2) Front Propeller Shaft (with TOD)
(3) Bolt and Washer (Transfer Side)
(4) BJ Constant Velocity Joint
(5) LJ Constant Velocity Joint

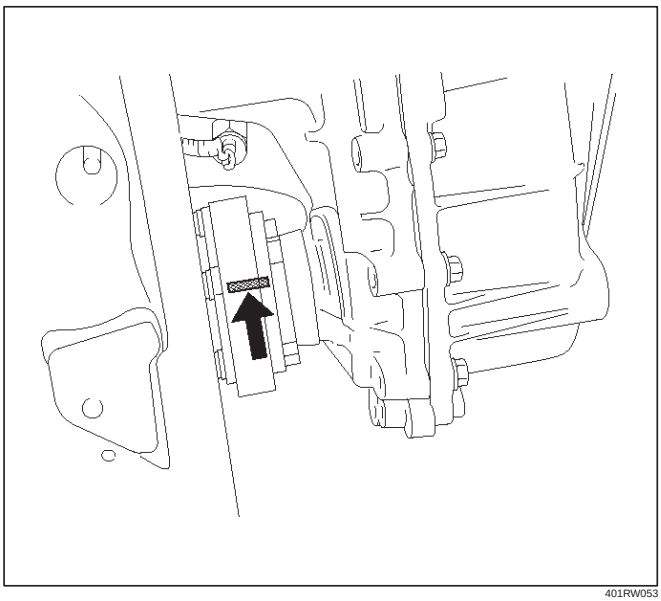
Removal

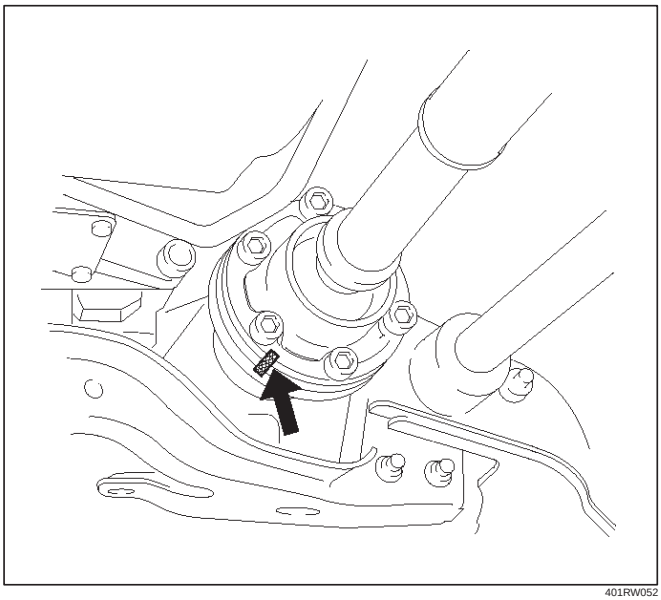
1. Jack up the vehicle and support it on the chassis stands.
2. Gear shift lever should be placed in neutral position and parking brake released.
3. Remove the exhaust and transfer protectors.

NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



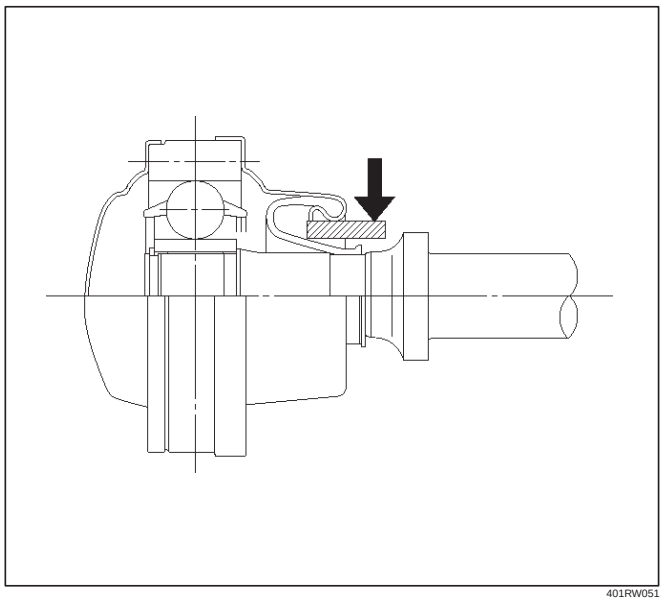
401RS020


401RW053


401RW052

4. Remove bolt, nut and washer (Front axle side).
5. Remove bolt, nut and washer (Transfer side).
6. Remove front propeller shaft.

NOTE: When removing, installing or carring the front propeller shaft, be sure to wrap a piece of cloth around the part of the boot with which fittings may interfere so that the boot can be protected. The boot may be damaged if bending force is applied to the constant velocity joint of the shaft.


401RW051

Installation

NOTE: Never install the shaft assembly backwards. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which was applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

   Torque: 63 N·m (46 lb ft)

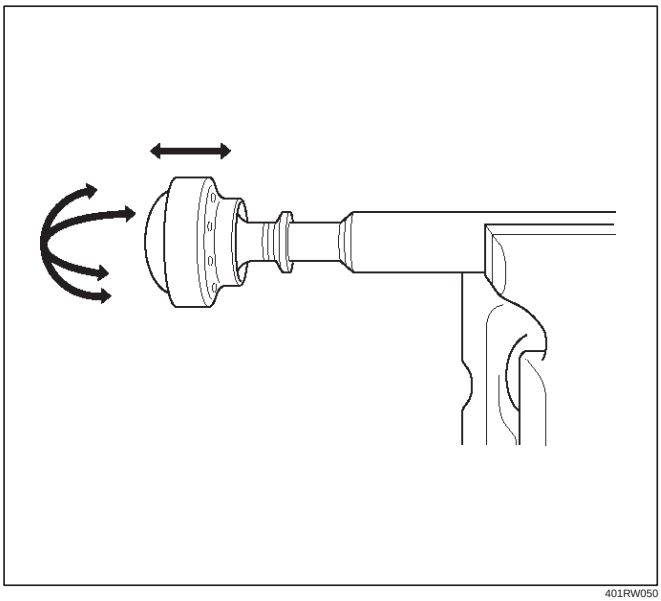
2. Install the exhaust and transfer protectors.

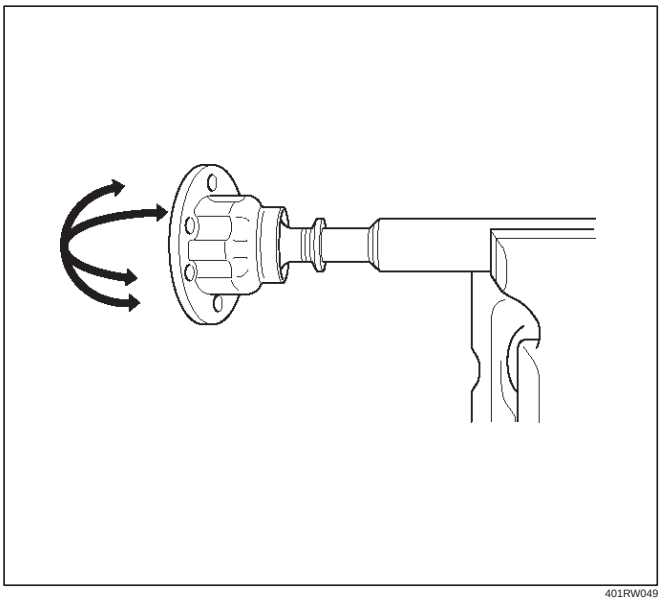
Constant Velocity Joint

NOTE: LJ and BJ constant velocity joints are unremovable types. Check the joint for play and the boot for damage, wear, and leak of grease. If abnormality is found, replace propeller shaft as an assembly.

Play in Constant Velocity Joint

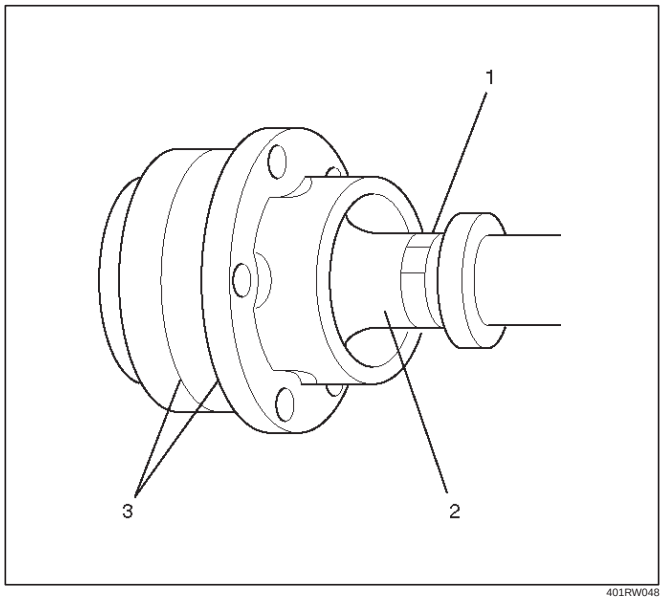
Position the shaft in a vise between two pieces of wood, then secure.
Test for shaft movement by attempting to move back and forth, and side to side.
Secure as needed.


401RW050

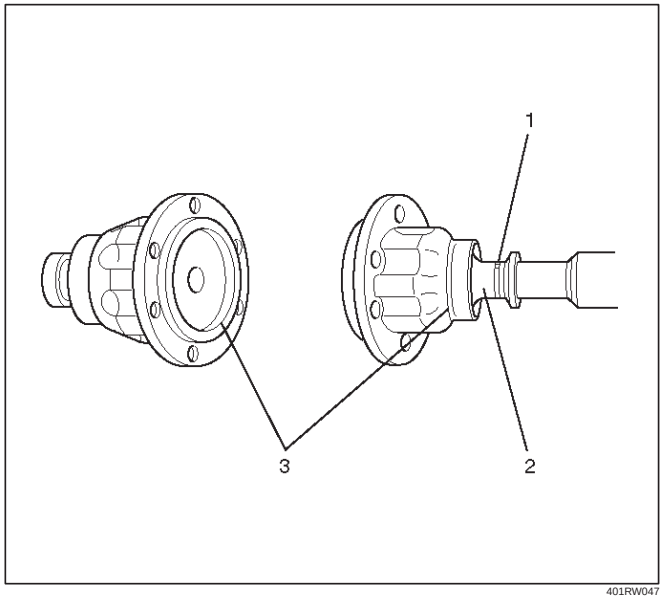

401RW049

Boot of Constant Velocity Joint

Check the following: boot (2) for crack, damage and grease leakage, the boot band (1) for looseness and damage, and both sides of the joint for gease leakage coming from the cover press-in parts (3).



401RW048

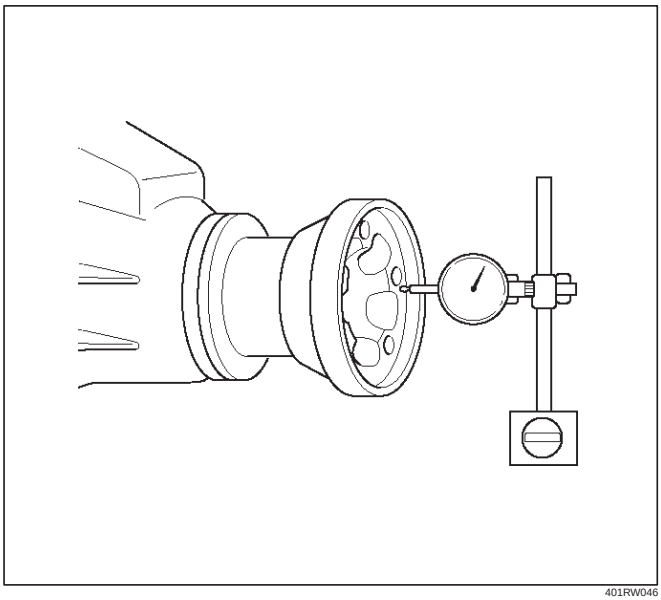


401RW047

Front Axle Flange Run-out

1. Set a dial gage at right angle near the outer circumference of the flange face and check the run-out of the flange face.

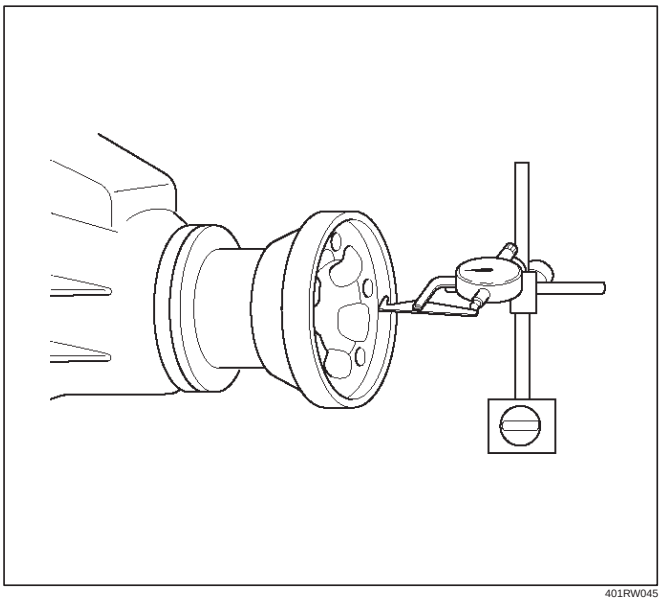
   Limit: 0.15 mm (0.006 in)



401RW046

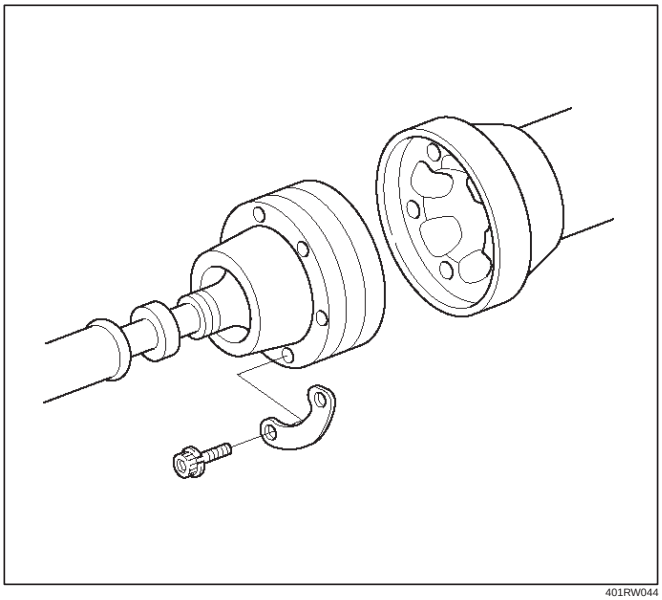
2. Set a dial gage at right angle near the inner circumference and check the run-out of the flange.

   Limit: 0.15 mm (0.006 in)



401RW045

3. If vibration is felt during the 4H AUTO drive, disconnct the propeller shaft at the front axle. Reinstall the propeller shaft at 60˚, 120˚, 180˚, 240˚, and 300˚ and conduct test drive in each position and check if there is vibration.



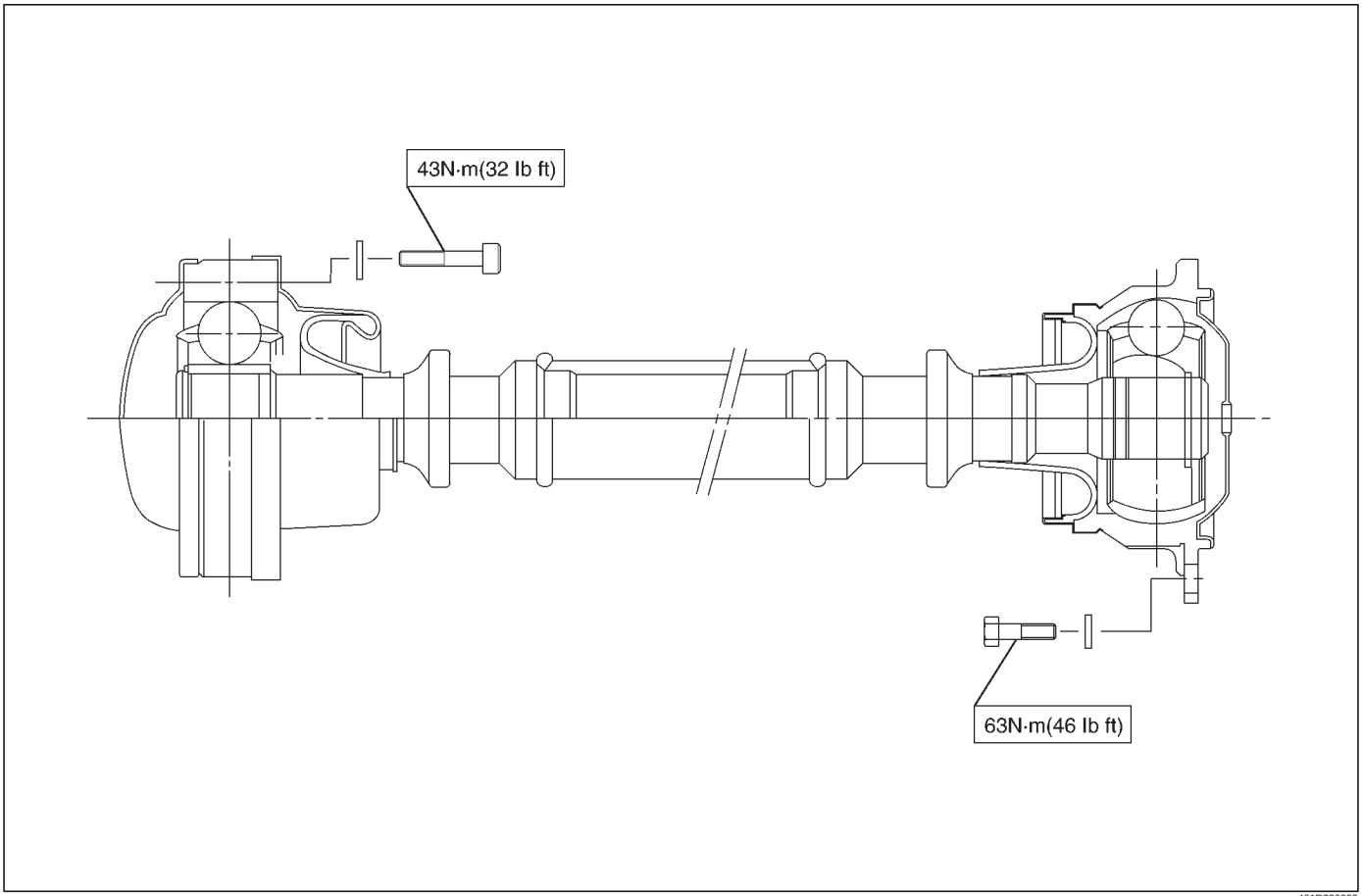
401RW044

Main Data and Specifications

General Specifications

Engine	6VE1(3.5 L)
Transmission	A/T with TOD
Construction	Hollow steel tube with constant velocty joints.
Outside diameter	40.0 mm (1.57 in)
Length	597 mm (23.50 in)

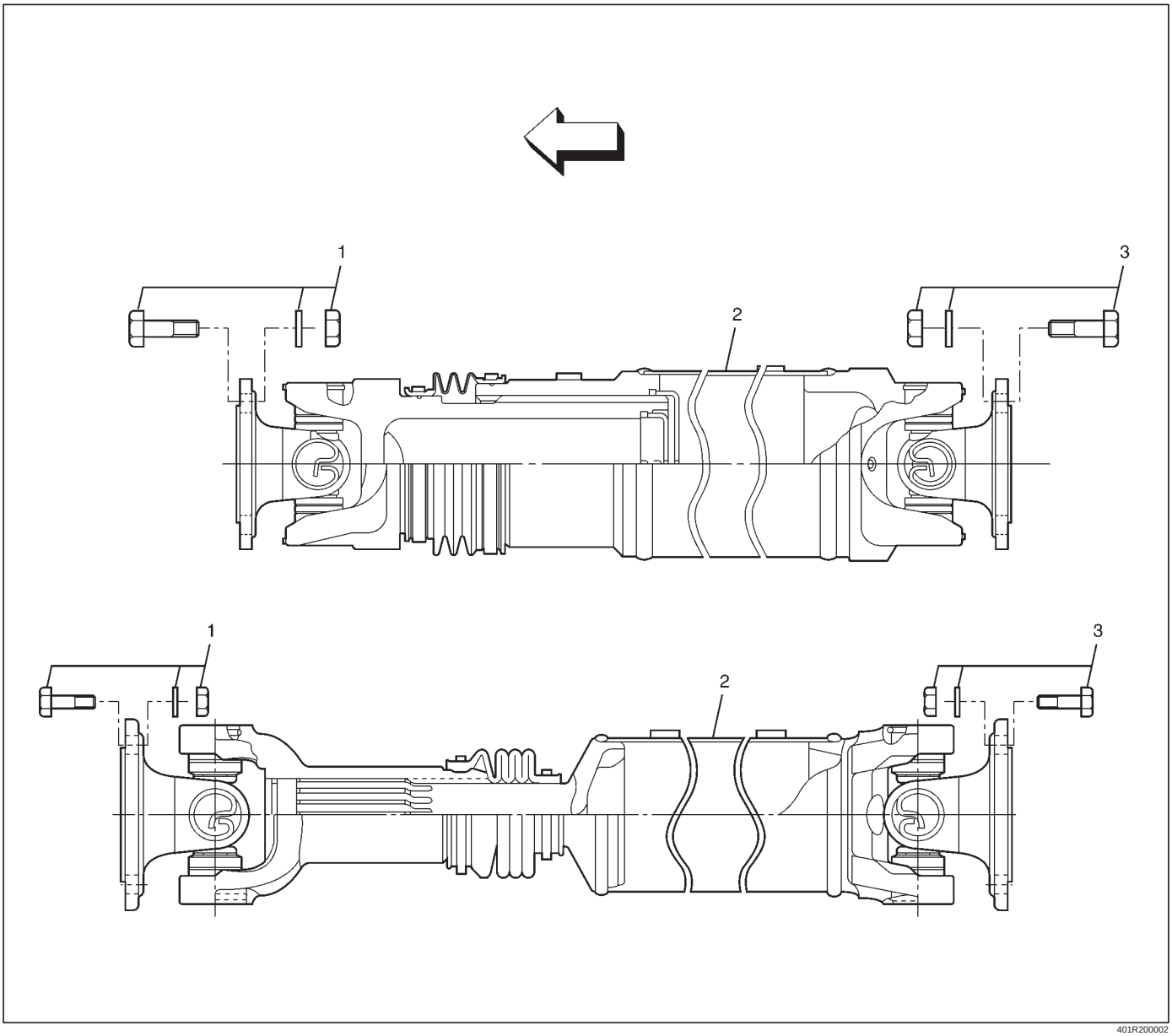
Torque Specifications



401R200005

Rear Propeller Shaft

Rear Propeller Shaft and Associated Parts



401R200002

Legend

(1) Bolt, Nut and Washer (Transfer Side)
(2) Rear Propeller Shaft
(3) Bolt, Nut and Washer (Rear Axle Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.

2. Remove transfer side bolt, nut and washer (except spline yoke type).
3. Remove rear axle side bolt, nut and washer.
4. Remove rear propeller shaft.

NOTE: Plug the hole of the transmission rear end to prevent oil leakage (spline yoke type only).

Installation

NOTE: Never install the shaft assembly backwards.

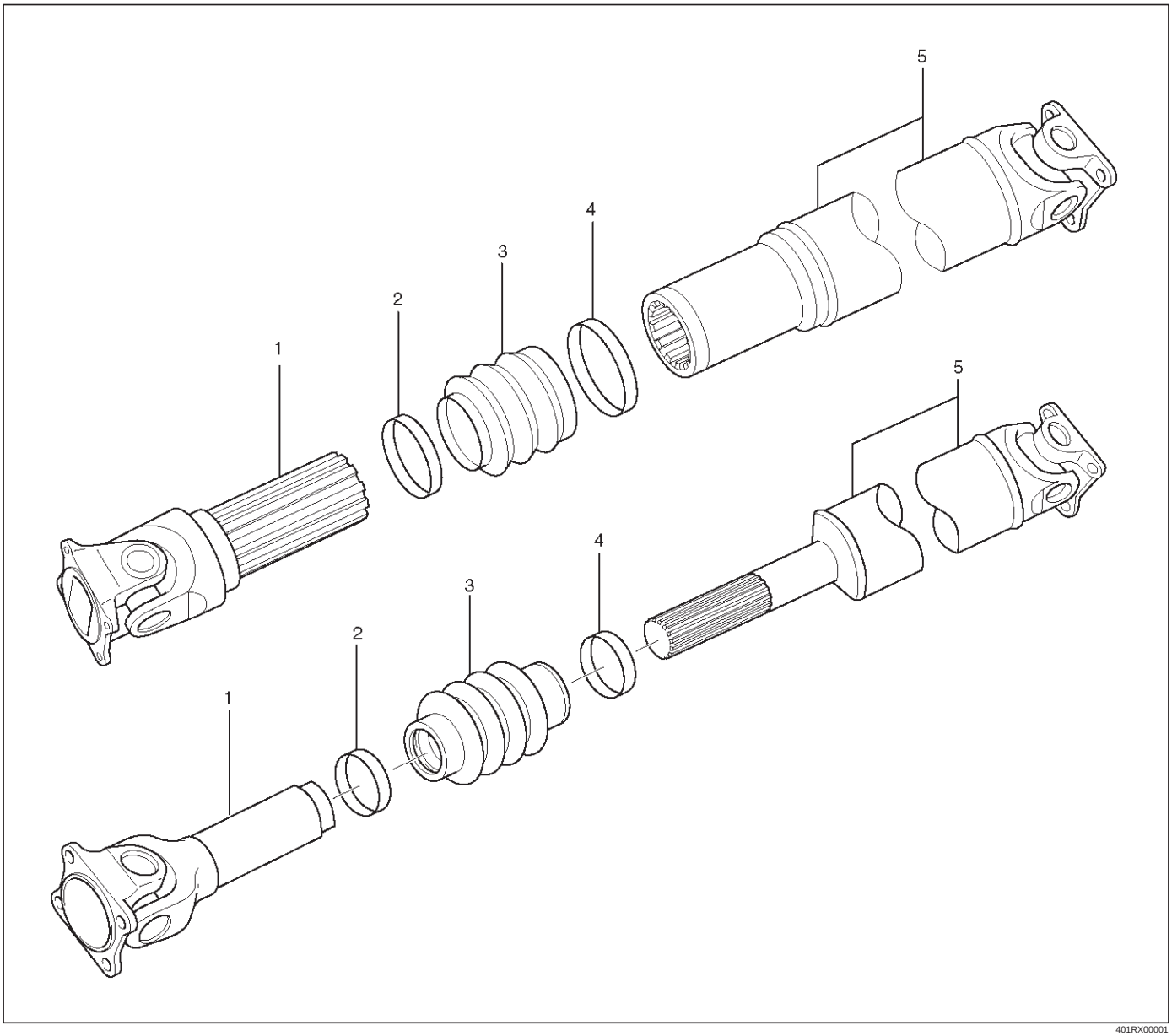
Never insert bar between yoke lugs when tightening or removing bolts.

Completely remove the dust or foreign matter from the connecting surface of flange coupling on each end of the propeller shaft.

1. Align the mark which is applied at removal.
2. Install rear propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m(46 lb ft)

Slip Joint Disassembly



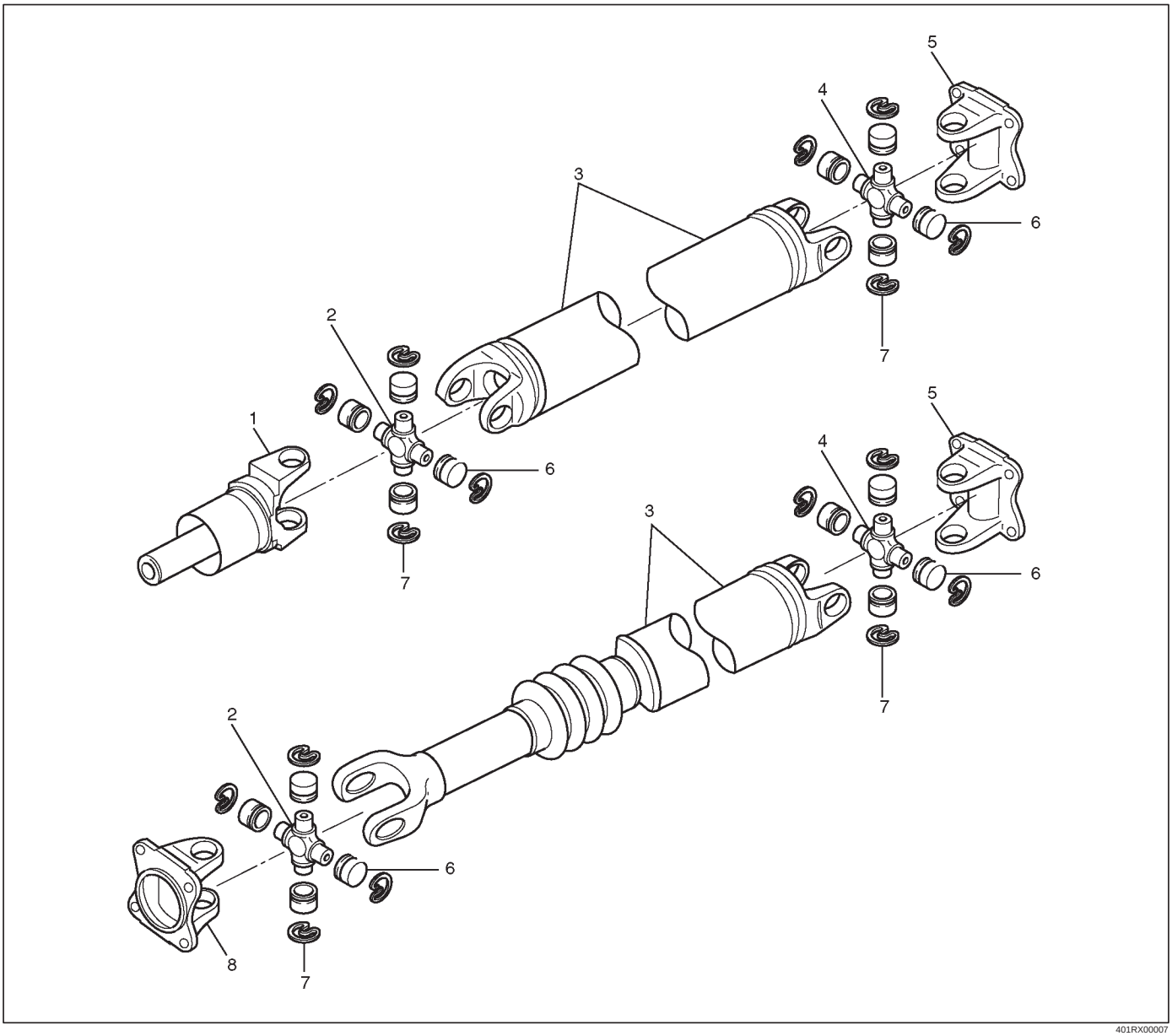
401RX00001

Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position by marking the phasing of the shaft prior to disassembly.
3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the slip yoke assembly from the driveshaft, by securing the boot with one hand and pulling on the slip yoke.
7. Remove the boot from the shaft assembly.

Universal Joint Disassembly



401RX00007

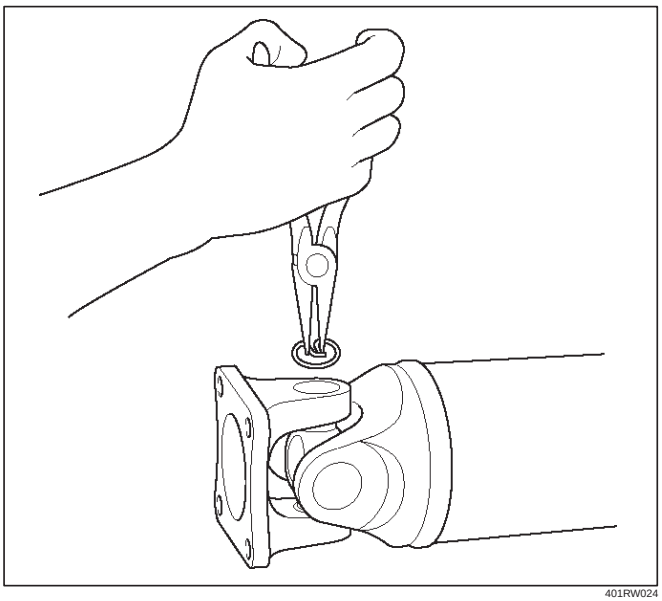
Legend

(1) Spline Yoke
(2) Spider
(3) Propeller Shaft Assembly
(4) Spider
(5) Flange Yoke
(6) Bearing
(7) Snap Ring
(8) Flange Yoke

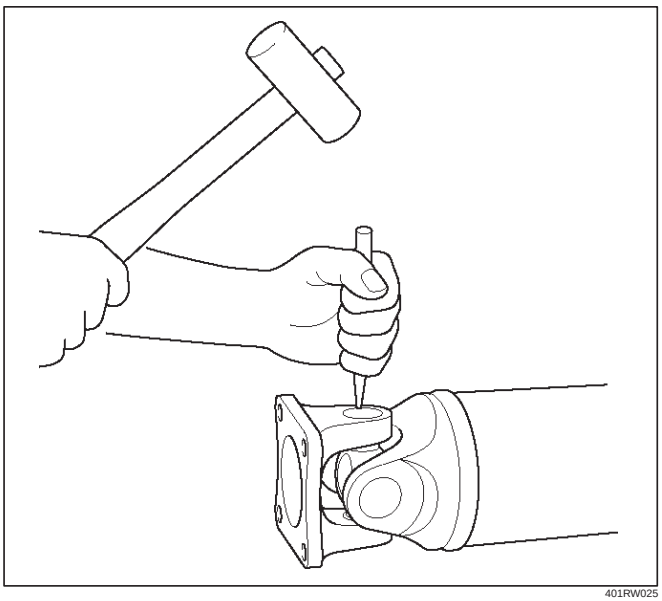
NOTE: Aluminum is softer than steel. Care must be taken not to remove excessive material or damage bearing holes.

If the vehicle has aluminum tube type propeller shaft, flange yoke, boot kit, journal kit can be replaced. If other parts are damaged, replace propeller shaft assembly.

1. Apply alignment marks on the yokes of the universal joint, then remove the snap ring.

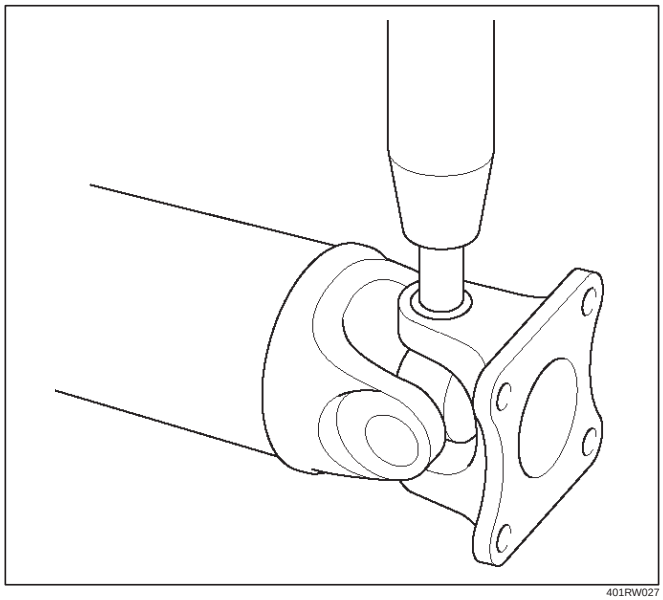

401RW024

If the snap ring is stuck in position, remove paint from the hole in the yoke or tap around the edge of the bearing lightly with a soft drift.

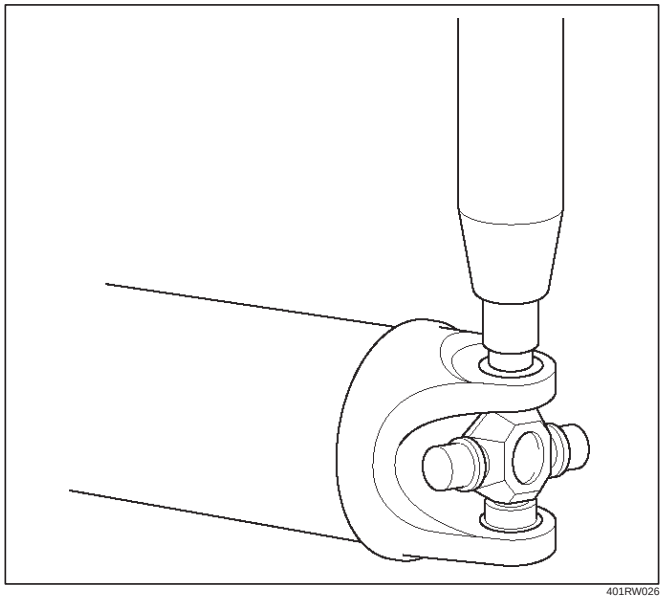

401RW025

2. Set the yoke in the arbor press with a piece of tube stock beneath it.

   Place a solid plug on the upper bearing and press it through to release the lower bearing.


401RW027

3. If the bearing will not pull out by hand after pressing, tap the base of the lug near the bearing to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open spider hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin it.


401RW026

5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.

Inspection

▼ Propeller shaft for run-out Aluminum tube type.

Static run-out limit : 1.0 mm(0.04 in)

TIR full length of tubing maximum.

(TIR : Total Indicator Reading)

▼ Propeller shaft for runout (Steel tube type).

Static runout limit : 0.13 mm(0.005 in)

TIR on the neck of the slip tube shaft (with a boot).

0.25 mm(0.010 in)

TIR on the ends of the tubing 3 inch from the welds.

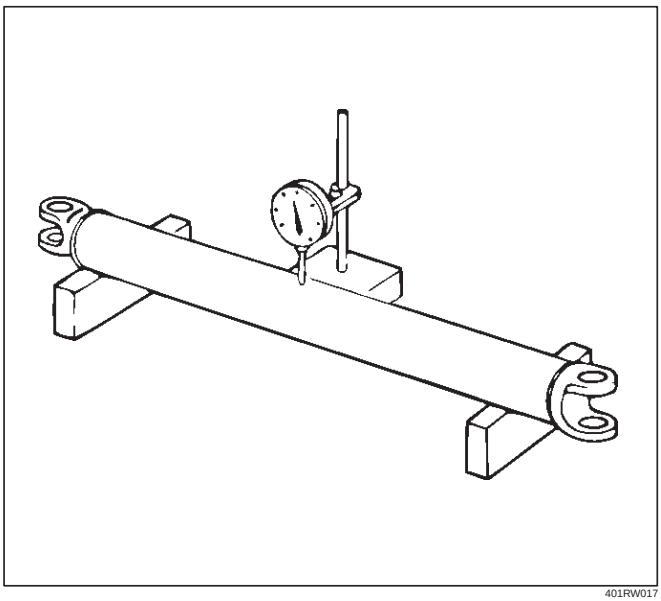
0.38 mm(0.015 in)

TIR at the linear center of the tube.

0.38 mm(0.015 in)

TIR for the full length of tube with 30” or less of tubing.

(TIR: Total Indicator Reading)

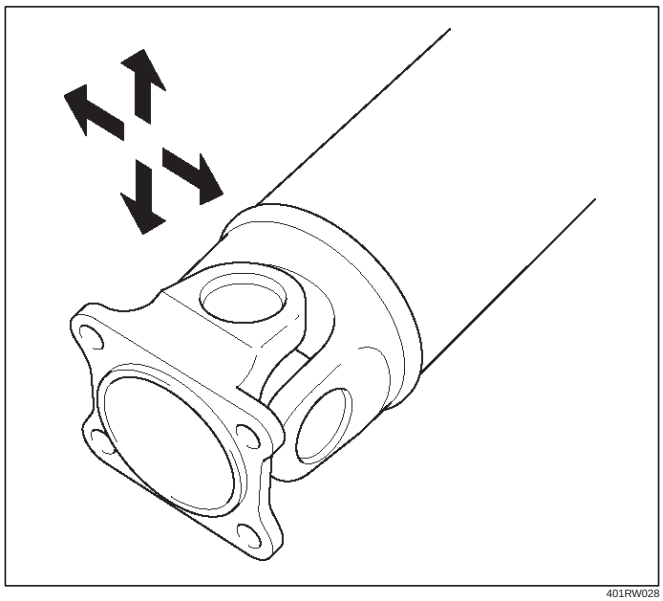

401RW017

▼ Play in universal joint.

Limit: Less than 0.15 mm(0.006 in)

▼ Spider pin should be smooth and free from fretting or galling.

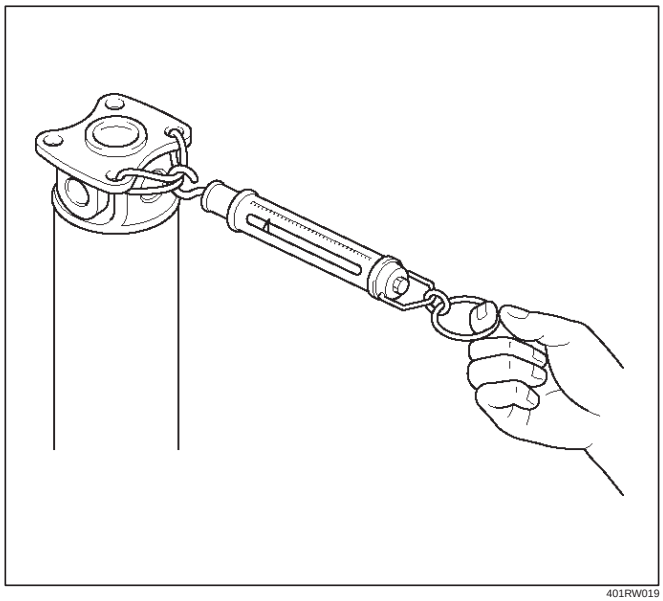
Visible signs of needle presence is normal, but wear should not be felt.


401RW028

▼ Preload of the universal joint.

Preload should be 0 to 49 N (0 to 11.0 lb).

Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.


401RW019

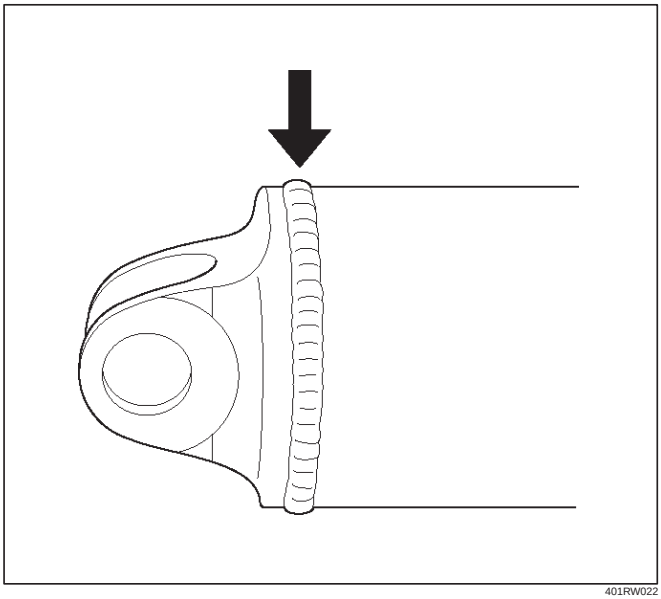
▼ Inspect splines of slip joint for wear.

The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible.

After cleaning the nylon coating spline, the coating should exhibit only slight indication of wear.

Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

▼Aluminum tube type only: Inspect the aluminum tubing for surface scratches and dents. These scratches may not exceed 0.2 mm (0.008 in) in depth.

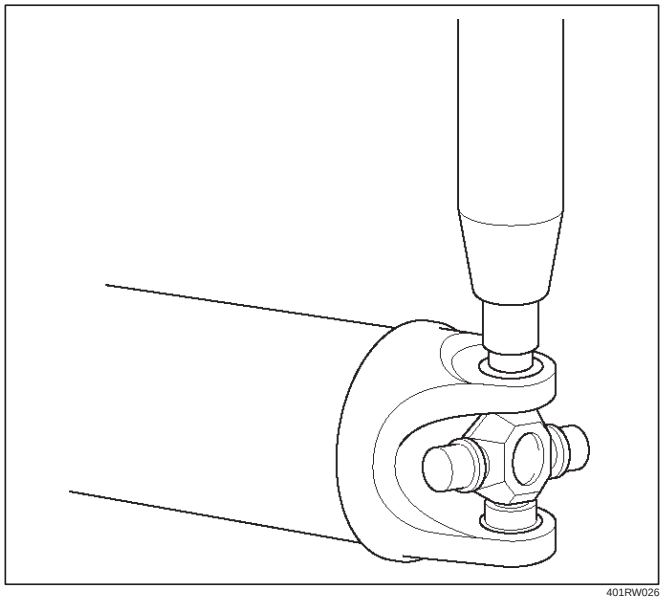

401RW022

▼Aluminum tube type only: Visually inspect the circle welds and fittings for any signs of cracks or signs of deterioration. If there are any cracks that exceed 0.2 mm (0.008 in) in depth, the assembly must be replaced.

▼Aluminum tube type only: Check to be sure there are no missing balance weights. If balance weights are missing and void has occurred in the aluminum tubing greater than 0.2 mm (0.008 in), the assembly must be replaced.

Universal Joint Reassembly

1. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to bearing cup assembly.
2. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole.
   Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install a snap ring.

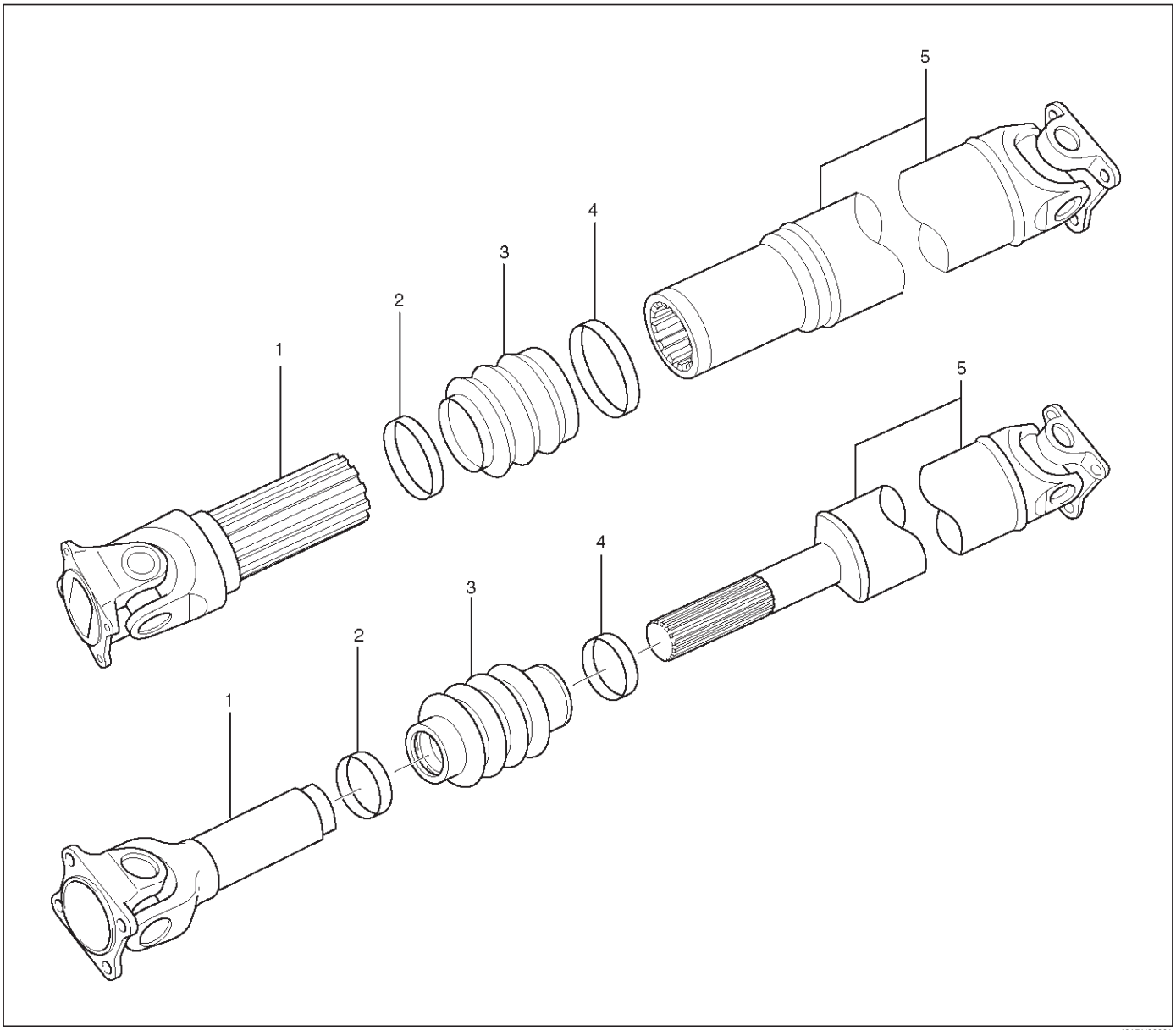

401RW026

3. Install a snap ring.

NOTE: Be sure the snap rings are properly seated in the grooves.

4. Repeat steps 2 and 3 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat the bearing.
5. Align the setting marks and join the yokes.

Slip Joint Reassembly



401RX00001

Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot (smaller diameter side) onto the spline yoke shaft being careful not to damage the spline coating or boot.
4. Insert the spline yoke shaft spline into the tube assembly being careful to maintain proper phasing. The spider holes should be in line as originally marked prior to disassembly.
5. Position boot onto tube and yoke shaft in its assembled position.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

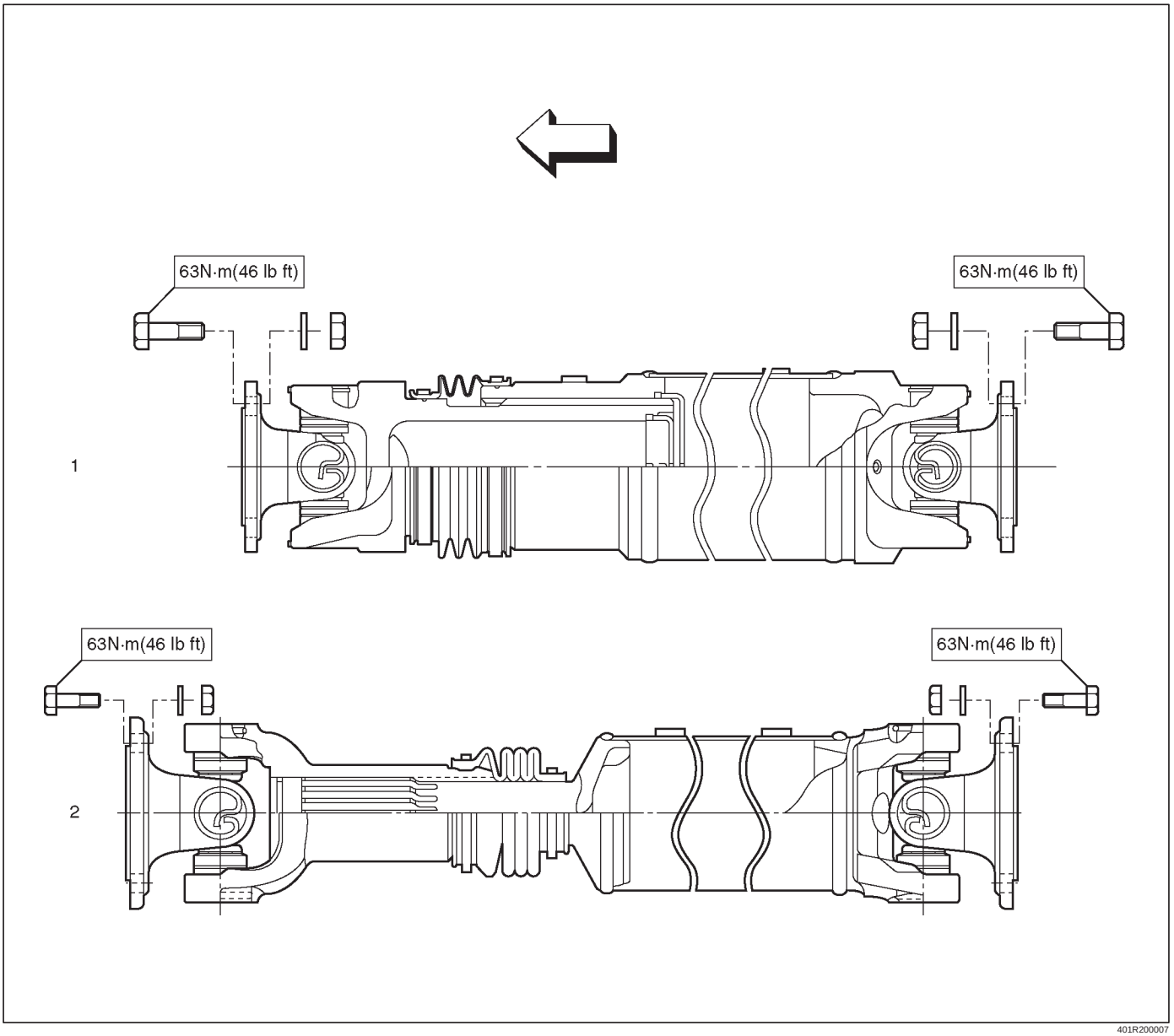
CAUTION: Only use a similar type or same as the original type clamp. Using any other clamp may create an imbalanced shaft or lead to grease leakage.

Main Data and Specifications

General Specifications

	2WD Model	4WD Model
Engine	6VD1	6VD1
Transmission	A/T	A/T
Type (See illustration)	1	2
Length between two spiders center)	1323.0mm (52.09in)	1030.0mm (40.55in)
Universal joint type	Cardan type	

Torque Specifications



401R200007

AXIOM (Vehicles Produced After Aug./1/2001)

DRIVE SHAFT SYSTEM

CONTENTS

Service Precaution 4C–44
General Description 4C–45
Diagnosis 4C–45
Front Hub and Disc (2WD Model) 4C–46
Disassembled View 4C–46
Disassembly 4C–46
Inspection 4C–47
Reassembly 4C–48
Front Hub and Disc (4WD Model) 4C–49
Disassembled View 4C–49
Disassembly 4C–49
Inspection 4C–50
Reassembly 4C–51
Front Drive Shaft Joint 4C–52
Front Drive Shaft Joints Replacement 4C–52
Front Axle Drive Shaft 4C–53
Front Axle Drive Shaft and Associated Parts 4C–53
Disassembly 4C–54
Inspection And Repair 4C–55
Bushing Replacement 4C–55
Reassembly 4C–55
Shift On The Fly System 4C–59
Shift On The Fly System and Associated Parts 4C–59
Disassembly 4C–59
Inspection And Repair 4C–61
Reassembly 4C–63
Main Data and Specifications 4C–66
Special Tools 4C–68
Propeller Shaft 4C–69
General Description 4C–69
Universal Joint 4C–70
Diagnosis of Propeller Shaft and Universal Joint 4C–71
Front Propeller Shaft 4C–72
Front Propeller Shaft and Associated Parts 4C–72
Removal 4C–72
Installation 4C–72
Disassembly 4C–73
Universal Joint Disassembly 4C–74
Inspection and Repair 4C–75
Universal Joint Reassembly 4C–76
Reassembly 4C–77
Main Data and Specifications 4C–78
Rear Propeller Shaft 4C–79
Rear Propeller Shaft and Associated Parts 4C–79
Removal 4C–79
Installation 4C–79
Slip Joint Disassembly 4C–80
Universal Joint Disassembly 4C–81
Inspection 4C–83
Universal Joint Reassembly 4C–84
Slip Joint Reassembly 4C–85
Main Data and Specifications 4C–86

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE *SRS COMPONENT AND WIRING LOCATION VIEW* IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE *SRS SERVICE INFORMATION.* FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

This publication contains essential removal, installation, adjustment and maintenance procedures.
The front axle utilizes a central disconnect type front axle/transfer case system.

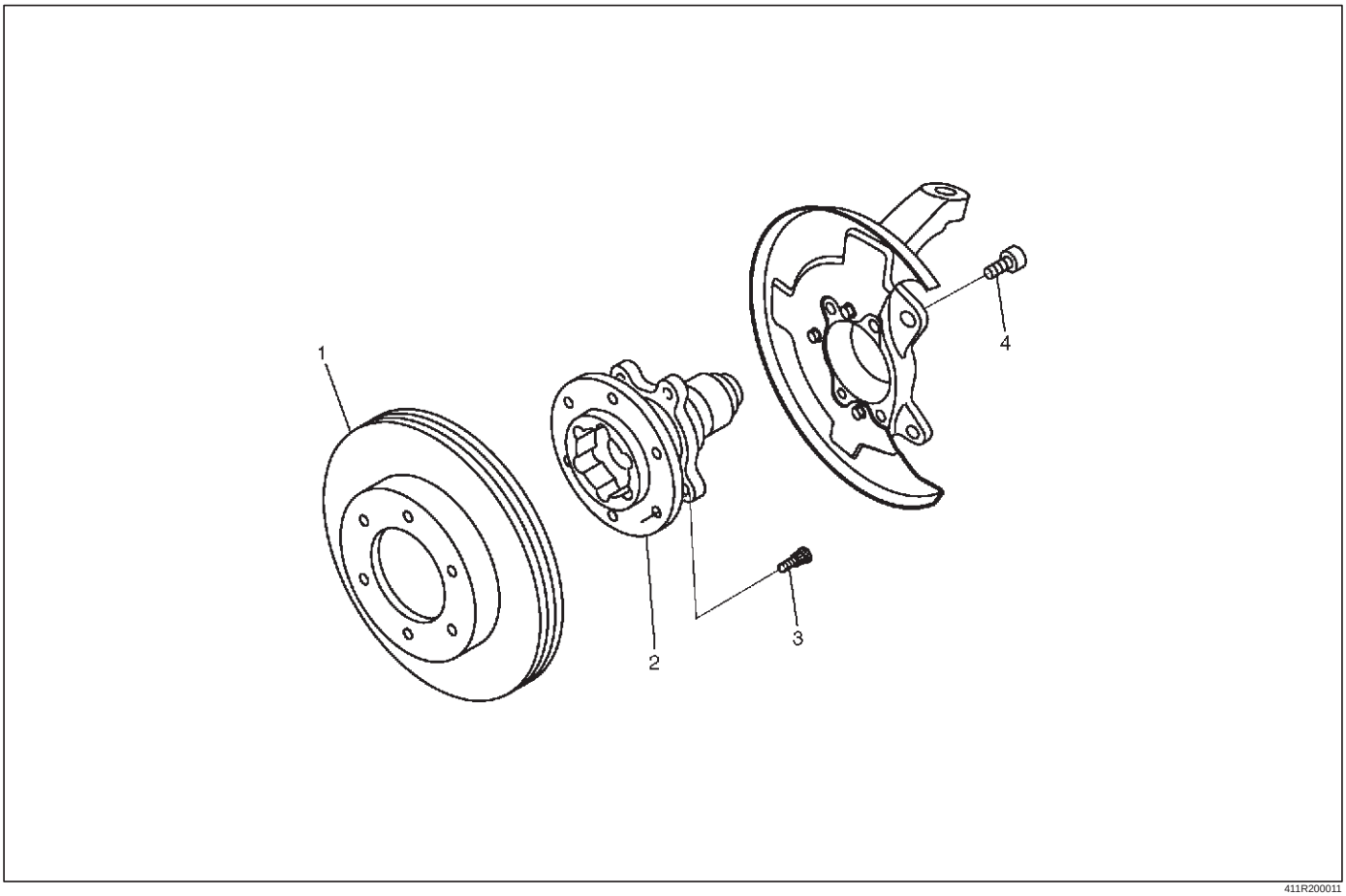
The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) drive shaft joints connected by an axle shaft.
For description of front propeller shaft and universal joint, refer to *Front Propeller Shaft* in this section.

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Hub unit bearing worn.	Replace the hub unit bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Incorrect front alignment.	Adjust the front alignment.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Hub unit bearing worn.	Replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Front Hub and Disc (2WD Model)

Disassembled View



411R200011

Legend

(1) Disc Rotor
(2) Hub unit, Bearing
(3) Wheel Pin
(4) Bolt

Disassembly

1. Raise the vehicle with a jack. Support the frame with chassis stands.
2. Remove the brake caliper from the bracket. Secure the caliper with a wire so that it does not interfere with the work process.

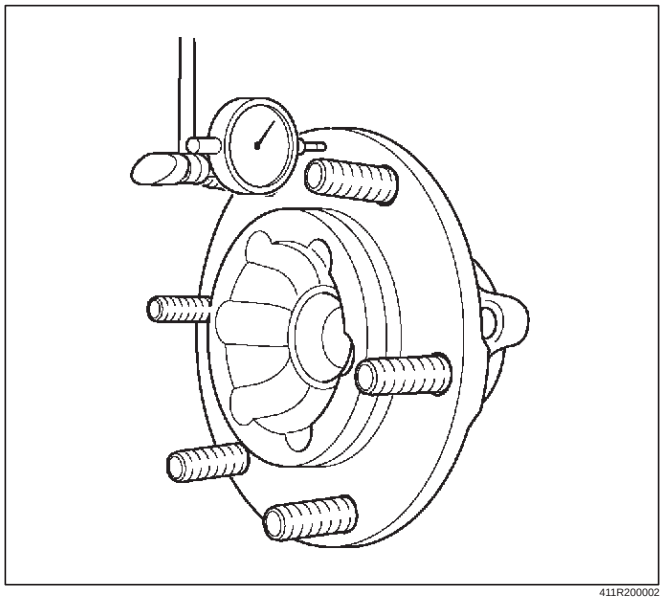
Refer to *Front disc caliper assembly* in Section 5C of this Manual.

3. Remove the disk rotor

Apply penetrating oil to the bearing and disc rotor contact surfaces if the surfaces are stuck together because of rust.

4. Inspect the hub unit bearing. Refer to *Inspection* below.
5. Use a dial gauge to measure the bearing axial rattle.

Bearing axial rattle: 0.05 mm max

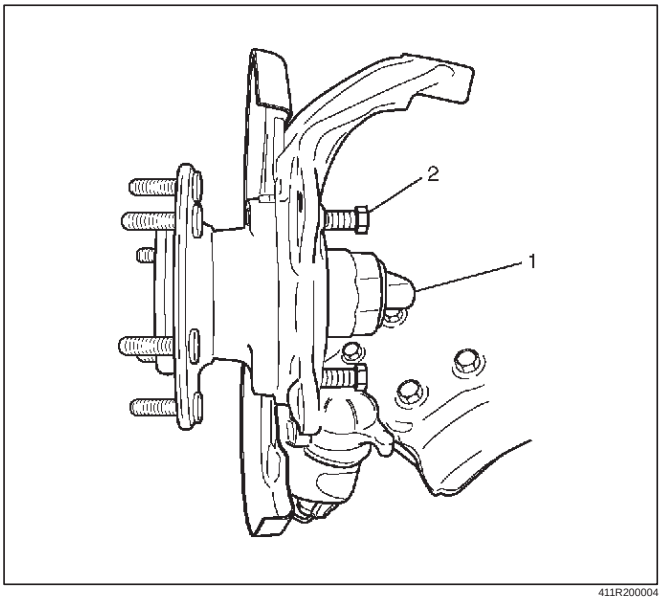


411R200002

If abnormal conditions are discovered during inspection, go to Step 6. If there are no abnormal conditions, reassemble the front disc rotor and caliper.

NOTE: Hub, wheel bearing and spindle is integrated to the hub unit bearing so it must not be disassembled. If it has abnormal rattle or noise, replace the hub unit bearing.

6. Remove the ABS sensor connector.



411R200004

Legend

(1) ABS Sensor Connector
(2) Bolt

7. Remove the 4 bolts fixing the hub unit bearing to the knuckle.

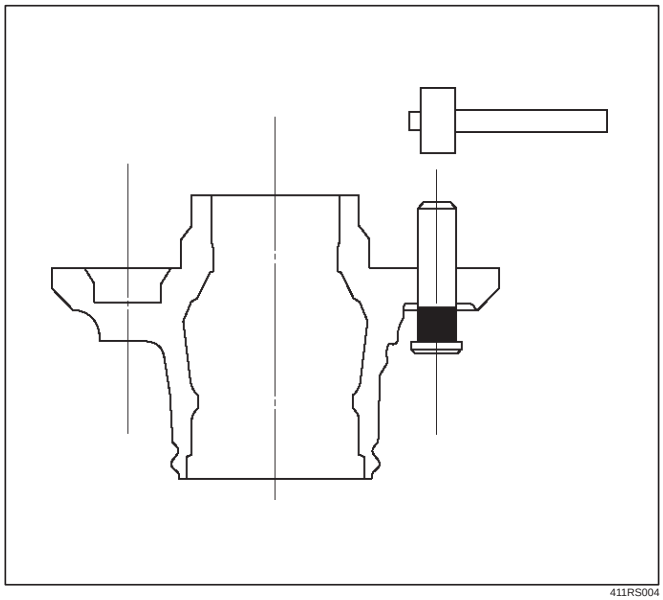
Apply penetrating oil to the bearing and knuckle contact surfaces if the surfaces are stuck together because of rust.

8. Temporarily install long bolts to 2 of the fixing bolt holes (the bolts must have the same diameter and thread width).
9. Strike the long bolts with a hammer to loosen and remove the hub unit bearing from the knuckle.

Take care not to drop the bearing.

10. If necessary, replace the wheel pin in the following manner.

▼Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.



411RS004

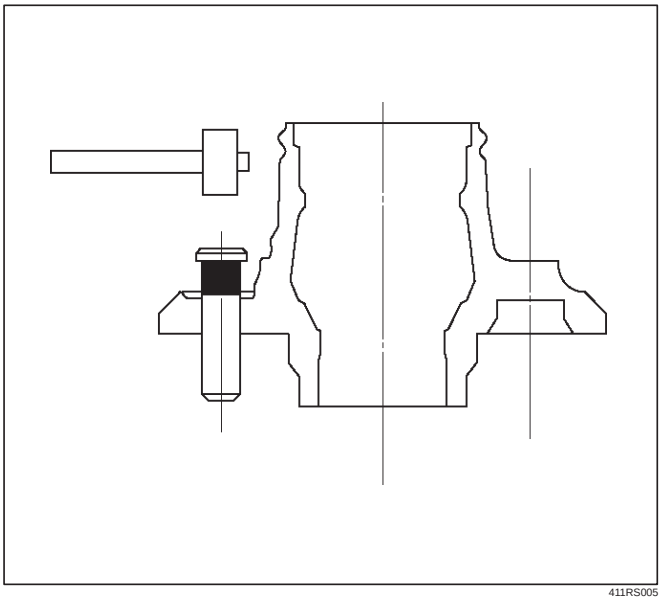
Inspection

Inspect the parts listed below for abrasion, breakage, and other abnormal conditions.
Repair, or replace the parts as required.

▼Disc
▼Caliper
▼Wheel pin
▼Hub unit bearing

Reassembly

1. Install wheel pin.



▼Place hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.

▼Install wheel stud, using a hammer.

NOTE: Be sure wheel stud is started squarely and seats completely.

2. Install the hub unit bearing to the knuckle.
   Tighten the bolts to the specified torque.

Hub unit bearing bolt

Torque: 103±10 N·m (10.5 ± 1 kg·m)

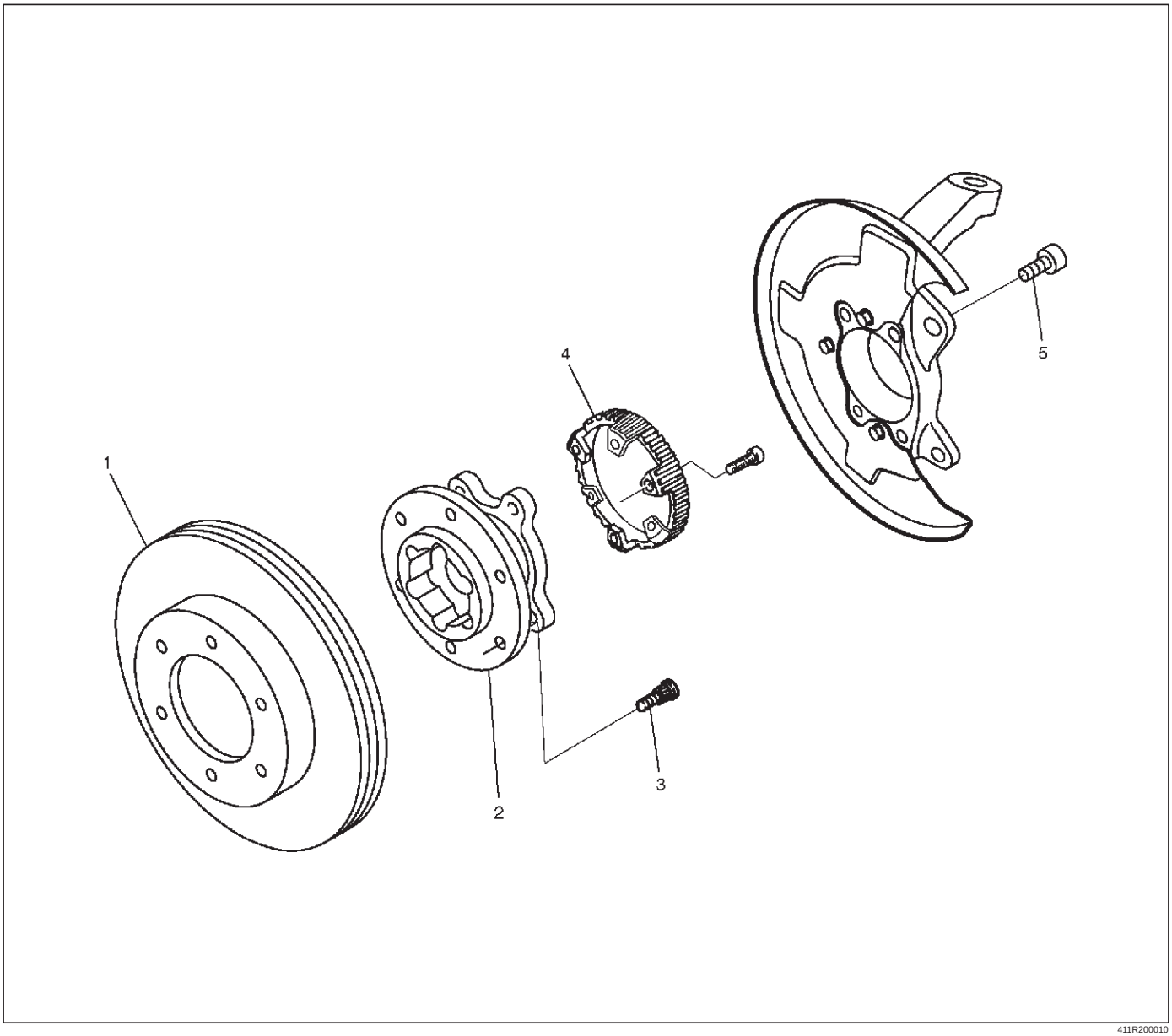
If there is rust on the bearing and knuckle contact surfaces, use sandpaper to remove it before installation.

3. Install the ABS sensor connector.
4. Install the disc rotor.
5. Install the brake caliper to the bracket.

Refer to *Front disc caliper assembly* in Section 5C of this Manual.

Front Hub and Disc (4WD Model)

Disassembled View



411R200010

Legend

(1) Disc Rotor
(2) Hub Unit, Bearing
(3) Wheel Pin
(4) ABS Sensor Ring
(5) Bolt

Disassembly

1. Move the transfer case lever to the 2WD position.
2. Raise the vehicle with a jack. Support the frame with chassis stands.
3. Remove the brake caliper from the bracket. Secure the caliper with a wire that it does not interfare with the work process.

Refer to *Front disc caliper assembly* in Section 5C of this Manual.

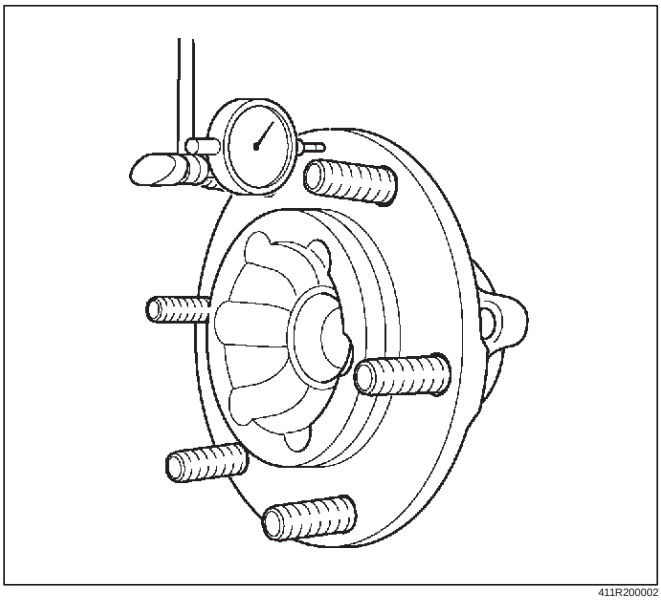
4. Remove the disk rotor.

Apply penetrating oil to the bearing and disc rotor contact surfaces if the surfaces are stuck together because of rust.

5. Inspect the hub unit bearing. Refer to *inspection* below.

6. Use a dial gauge to measure the bearing axial rattle.

Bearing axial rattle: 0.05 mm max



411R200002

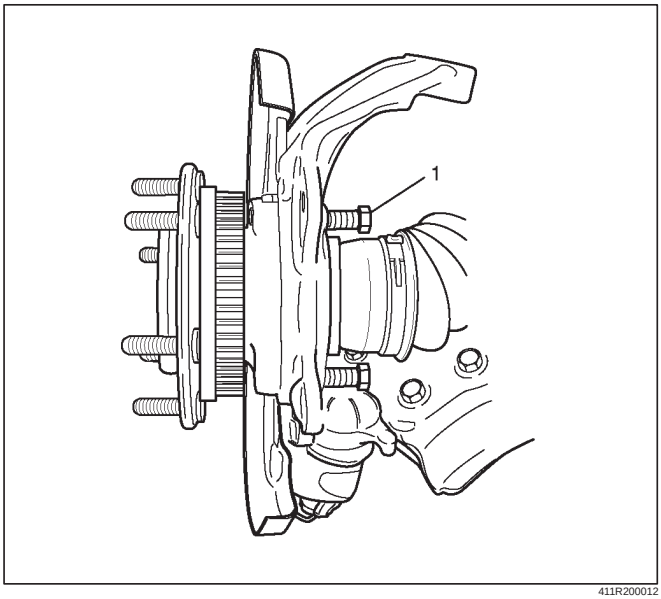
If abnormal conditins are discovered during inspection, go to Step 7. If there are no abnormal conditions, reassemble the front discrotor and caliper.

NOTE: Hub, wheel bearing and spindle is integrated to the hub unit bearing so it must not be disassembled. If it has abnormal rattle or noize, replace the hub unit bearing.

7. Loosen the caulking around the front drive shaft nuts.
8. Remove the nuts and discard them (they cannot be reused).
9. Remove the 4 bolts fixing the hub unit bearing to the knuckle.

Apply penetrating oil to the bearing and knuckle contact surfaces if the surfaces are stuck together because of rust.

10. Temporarily install long bolts to 2 of the fixing bolt holes (the bolts must have the same diameter and thread width).

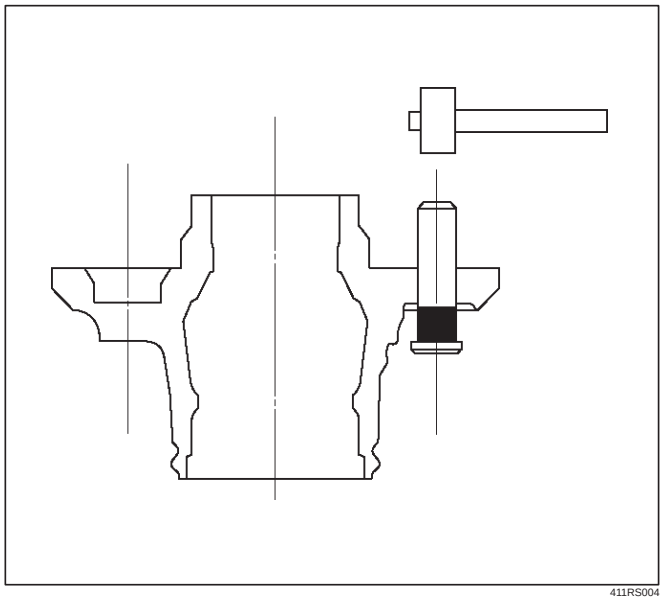


411R200012

Legend

(1) Bolt

11. Strike the long bolts with a hammer to loosen and remove the hub unit bearing from the knuckle.
    - ▼Take care not to strike the front drive shaft.
    - ▼Take care not to drop the bearing.
12. Remove the ABS rotor sensor from the bearing.
13. If necessary, replace the wheel pin in the following manner.
    - ▼Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.



411RS004

Inspection

Inspect the parts listed below for abrasion, breakage, and other abnormal conditions.
Repair or replace the parts as required.

- ▼Disc
- ▼Caliper
- ▼Drive shaft oil seal
- ▼ABS sensor rotor
- ▼Wheel pin
- ▼Hub unit bearing

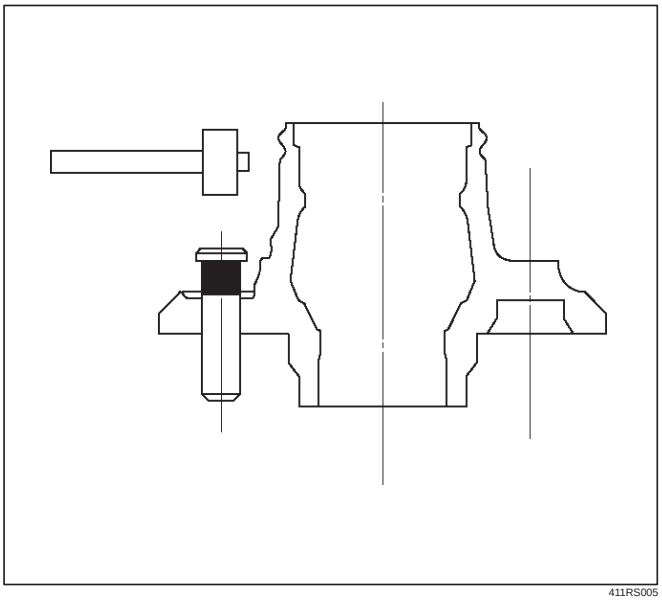
Reassembly

1. Install the wheel pin.

▼Place hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.

▼Install the wheel stud, using a hammer.

NOTE: Be sure wheel stud is started squarely and seats completely.


411RS005

2. Install the ABS rotor sensor to the hub unit bearing. Tighten the bolts to the specified torque.

ABS rotor sensor bolt

Torque: 18.7±5 N·m (1.9±0.5 kg·m)

3. Install the hub unit bearing to the knuckle. Tighten the bolts to the specified torque.

Hub unit bearing bolt

Torque: 103±10 N·m (10.5±1 kg·m)

If there is rust on the bearing and knuckle contact surfaces, use sandpaper to remove it before installation. Take care not to push the front drive shaft and oil seal out of position.

4. Hand tighten the front drive shaft nuts.

Use new nuts.

5. Install the disc rotor.

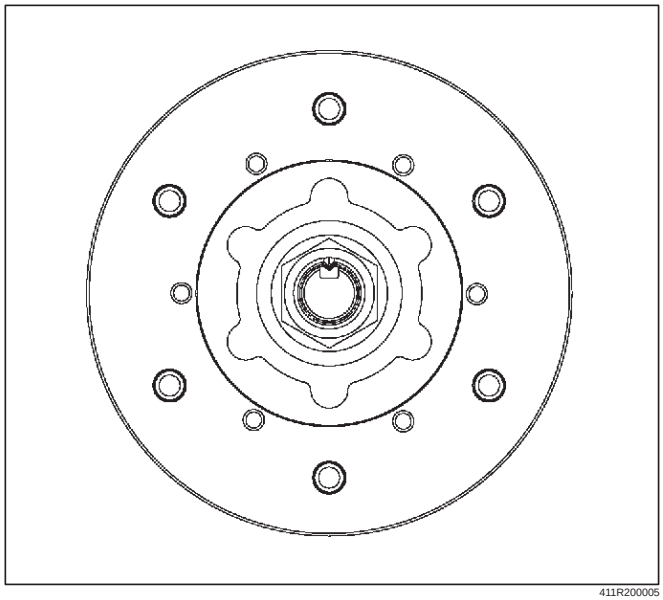
6. Install the brake caliper to the bracket.

Refer to *Front disc caliper assembly* in Section 5C of this Manual.

7. Tighten the front drive shaft nuts to the specified torque.

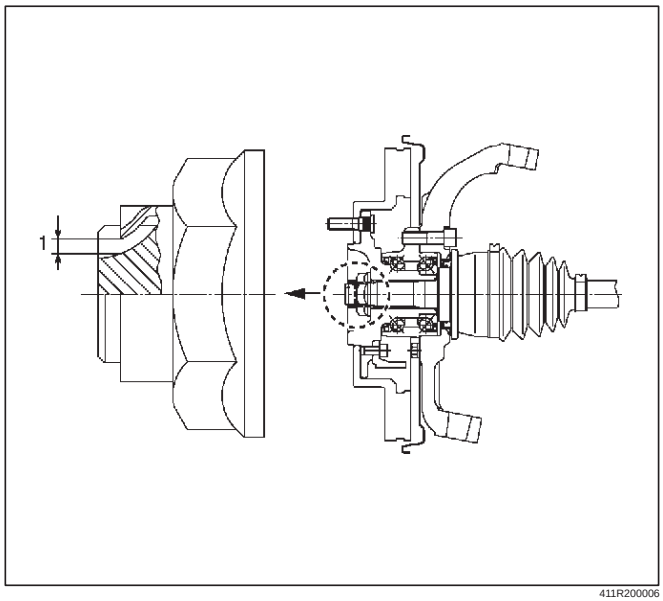
Front drive shaft nut

Torque: 245±19.6 N·m (25±2 kg·m)


411R200005

8. Caulk the front drive shaft nuts.

The caulking must be free of cracks.



411R200006

Front Drive Shaft Joint

Front Drive Shaft Joints Replacement

▼ Refer to *Front Drive Axle Assembly Replacement* in this section, and refer to *Front Hub and Disc Overhaul* in Suspension section.

Front Hub Bearing Preload Check

Check the hub bearing preload at the wheel pin.

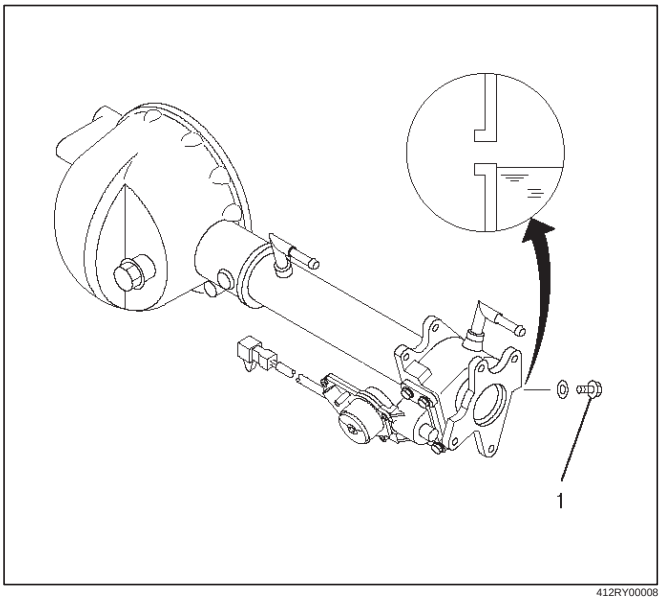
New bearing and New oil seal:

24.5 N (4.4 – 5.5 lb)

Used bearing and New oil seal:

11.8– 17.7 N(2.6 – 4.0 lb)

Inspection Of Shift On The Fly System Gear Oil



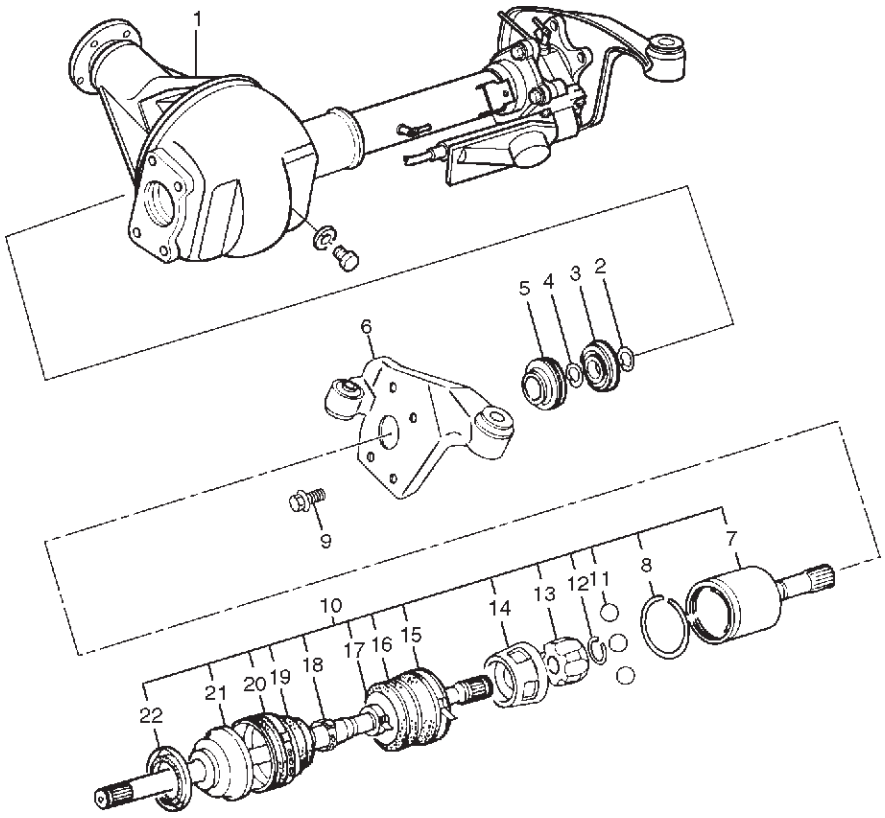
412RY00008

1. Open filler plug and make sure that the oil is up to the plug port.
   If the oil is short, replenish with gear oil GL–5 grade.
2. Tighten the filler plug to the specified torque.

   Torque: 78 N·m (58 lb in)

Front Axle Drive Shaft

Front Axle Drive Shaft and Associated Parts



412R200009

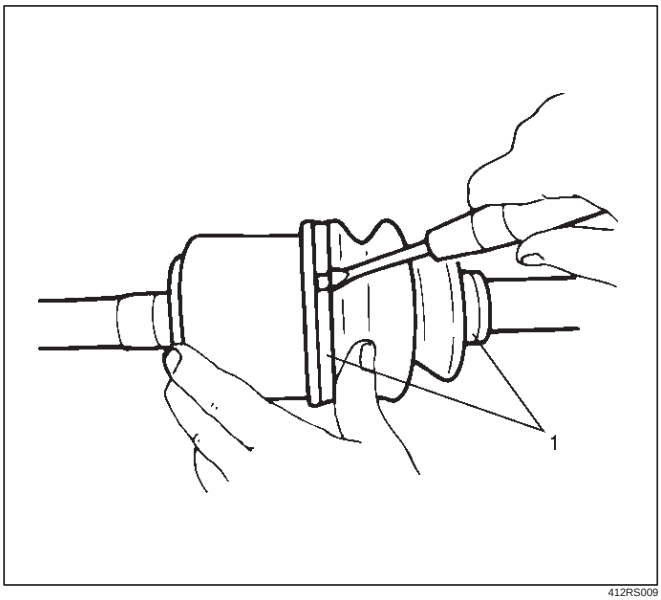
Legend

(1) Axle Case and Differential
(2) Snap Ring
(3) Bearing
(4) Snap Ring
(5) Oil Seal
(6) Bracket
(7) DOJ Case
(8) Circlip
(9) Bolt
(10) Drive Shaft Joint Assembly
(11) Ball
(12) Snap Ring
(13) Ball Retainer
(14) Ball Guide
(15) Band
(16) Bellows
(17) Band
(18) Band
(19) Bellows
(20) Band
(21) BJ Shaft
(22) Dust Seal

Disassembly

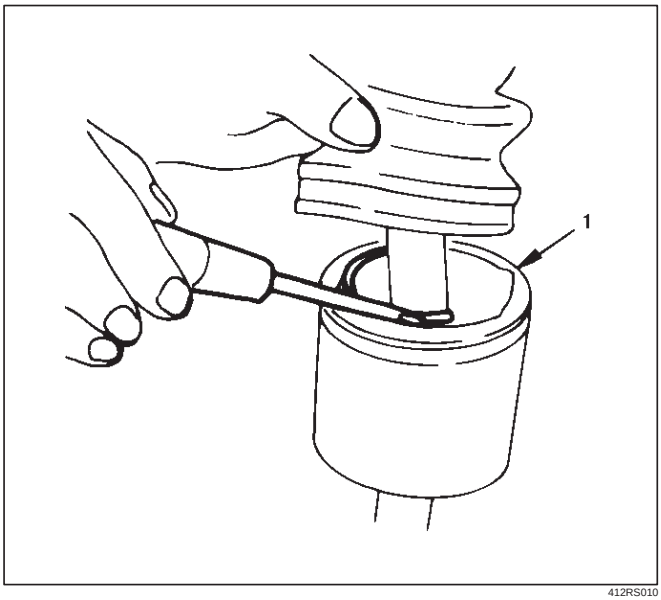
NOTE: For the left side, follow the same steps as right side.

1. Raise the hooked end of the band with a screwdriver or equivalent.



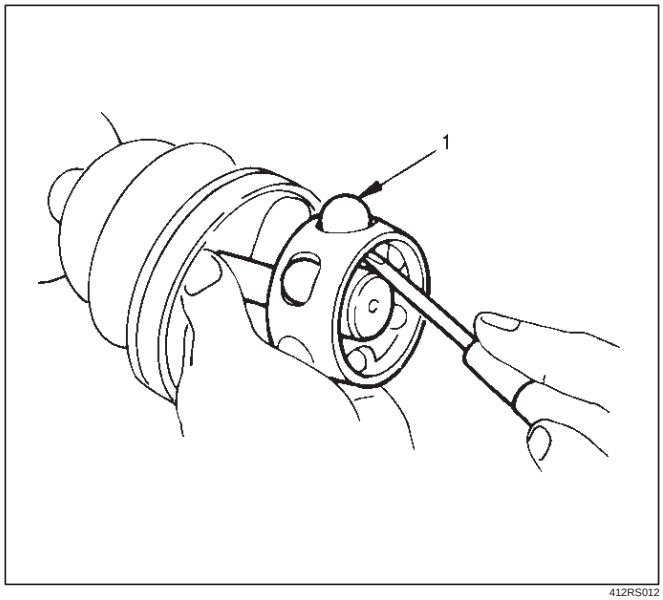
412RS009

2. Remove band(1).
3. Pry off circlip (1) with a screwdriver or equivalent.



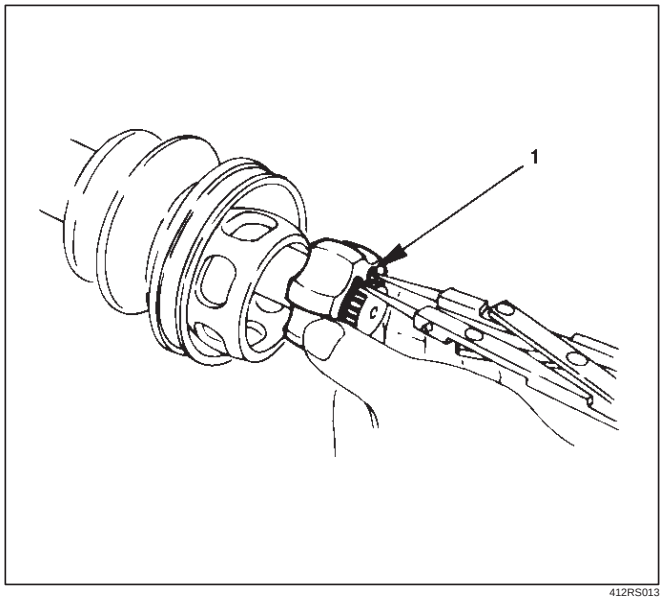
412RS010

4. Remove drive shaft joint assembly.
5. Remove the six balls (1) with a screwdriver or equivalent.



412RS012

6. Using snap ring pliers, remove the snap ring (1) fastening the ball retainer to the center shaft.

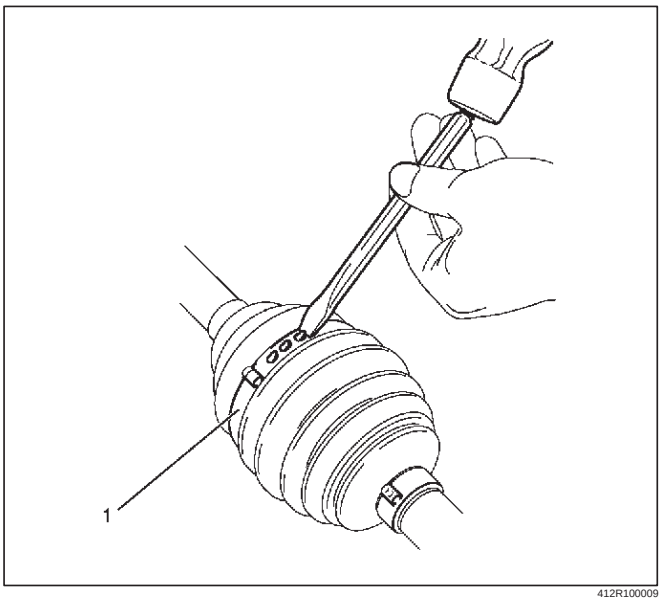


412RS013

7. Remove ball retainer, ball guide and bellows.

8. Use a hammer and chisel to remove the 3 pawls (above the large and small boot bands on the BJ side).

CAUTION: Take care not to damage the bellows during band removal.



412R100009

9. Remove band(1).
10. Remove bellows.
11. Remove dust seal from BJ.
12. Remove BJ shaft assembly.
13. Remove the mounting bracket fixing bolts, and then remove DOJ case assembly from the axle case.
14. Remove snap ring and bearing.
15. Remove snap ring and oil seal.
16. Remove bracket.

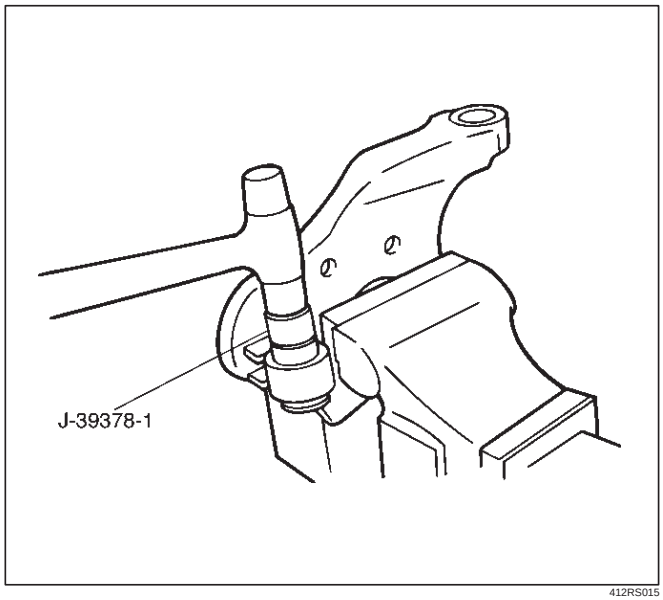
Inspection And Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

1. Drive shaft joint assembly
2. DOJ case, ball, ball guide, ball retainer
3. Bellows
4. Bearing
5. Dust seal, oil seal

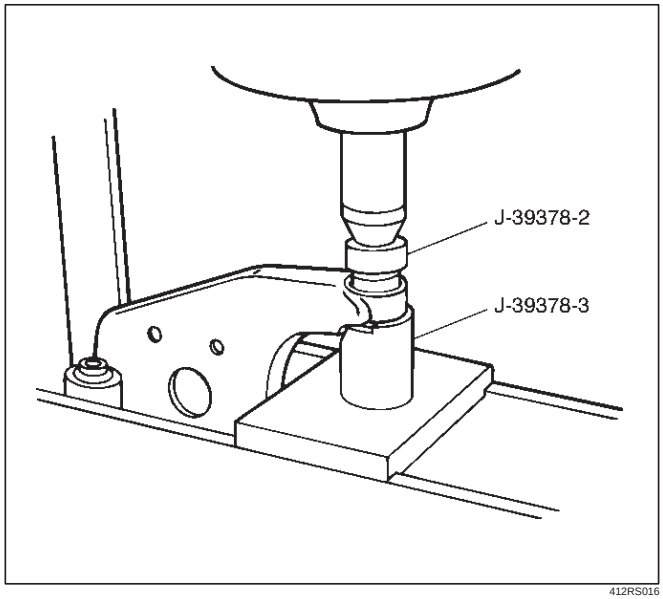
Bushing Replacement

▼ Remove the bushings using a remover J–39378–1 and hammer.



412RS015

▼ By using installer J–39378–2 and base J–39378–3, press fit the bushings into the bracket.



412RS016

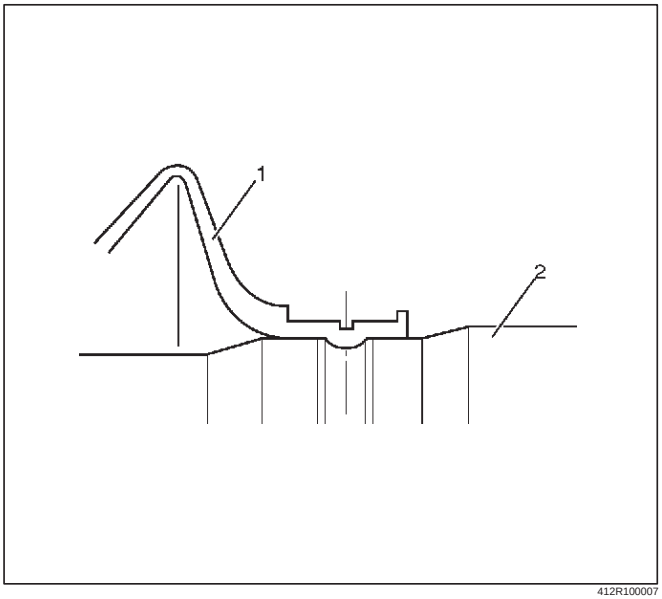
Reassembly

1. Install DOJ case to bracket.
2. Install oil seal and fix snap ring.
3. Install bearing and fix snap ring.
4. Install bracket to axle case. Tighten the bracket bolt to the specified torque.

   Torque: 116 N·m (85 lb ft)

5. Apply 150g of the specified grease in BJ.
6. Install dust seal for BJ.
7. Apply a thin coat of grease to the shaft for smooth installation then install bellows.

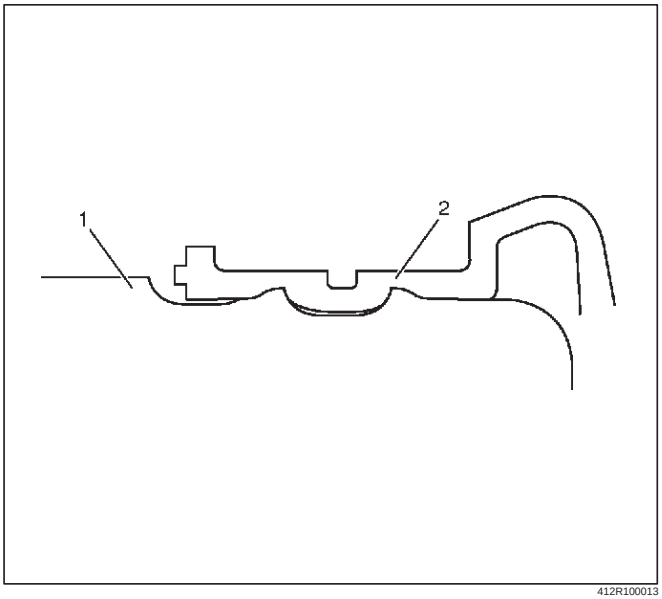
CAUTION: During bellows assembly, be sure to insert both ends of the bellows into the BJ ASM and shaft grooves.



412R100007

Legend

(1) Bellows
(2) Shaft

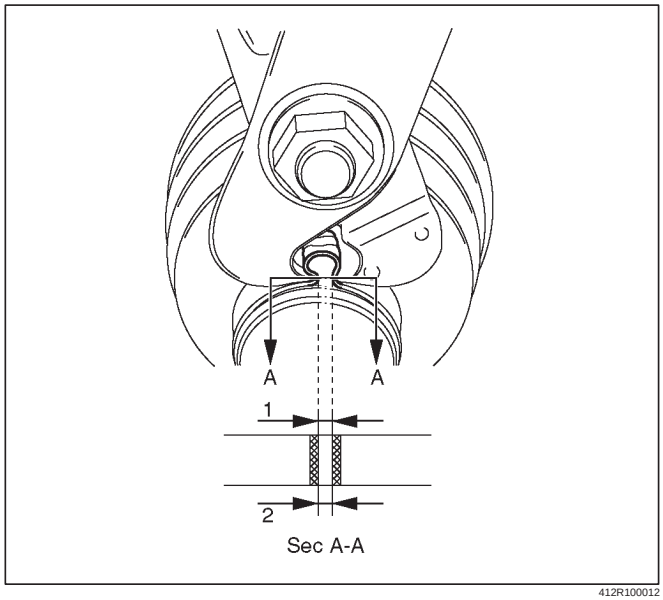


412R100013

Legend

(1) BJ ASM
(2) Bellows

8. Install band. Note the setting direction. After installation, check Standard Caulk Measure.Use the special tool pliers J–35910 to caulk the bands to the specified value.

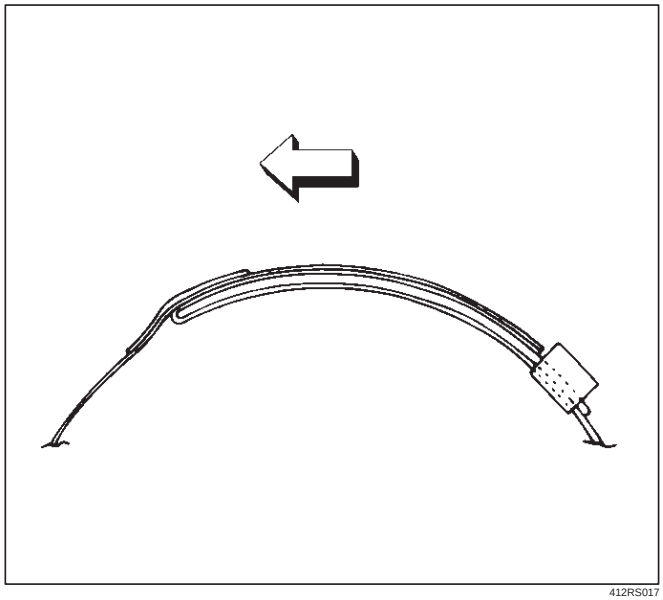


412R100012

Standard Caulk Measure

▼1.2mm (0.05in) <= (1) and (2) <= 4.0mm (0.16in)
▼(1) – (2) or (2) – (1) <= 0.4mm (0.016in)

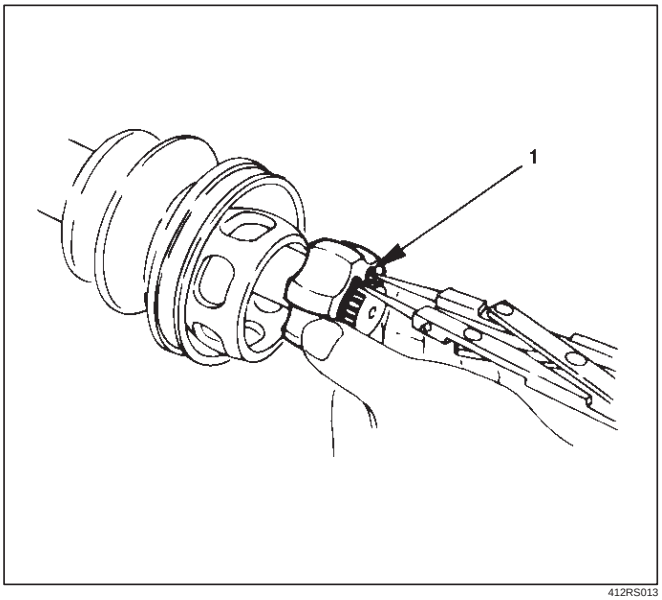
9. Install another bellows and fix band.
10. Install band. Note the setting direction. After installation, check that the bellows is free from distortion. (DOJ SIDE ONLY)



412RS017

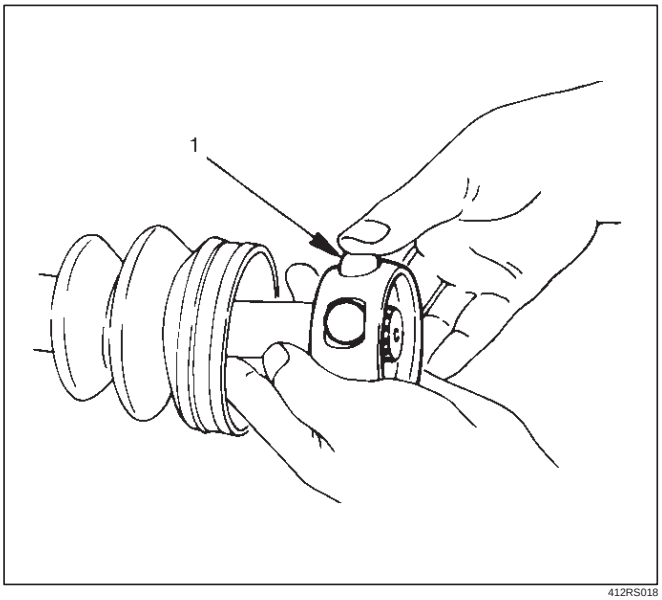
11. Install another bellows and fix band.
12. Install the ball guide with the smaller diameter side ahead onto the shaft.

13. Install ball retainer.
14. Using snap ring pliers, install the snap ring (1) securing the ball retainer to the shaft.



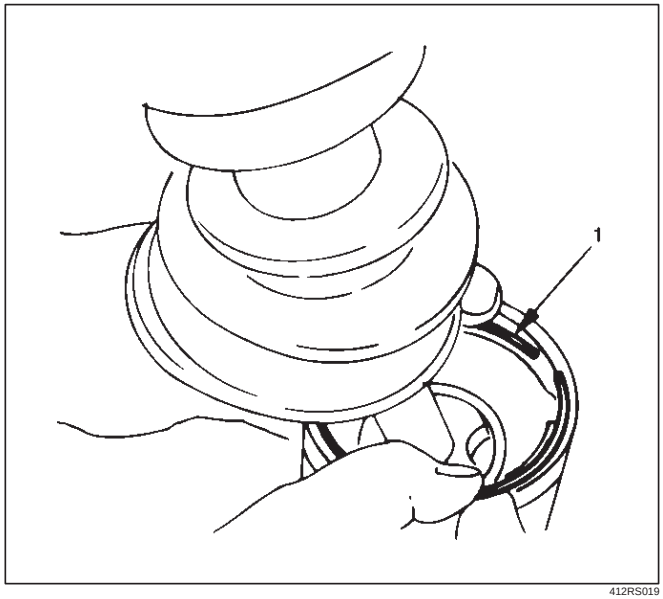
412RS013

15. Align the track on the ball (1) retainer with the window in the cage, and install the six balls into position.

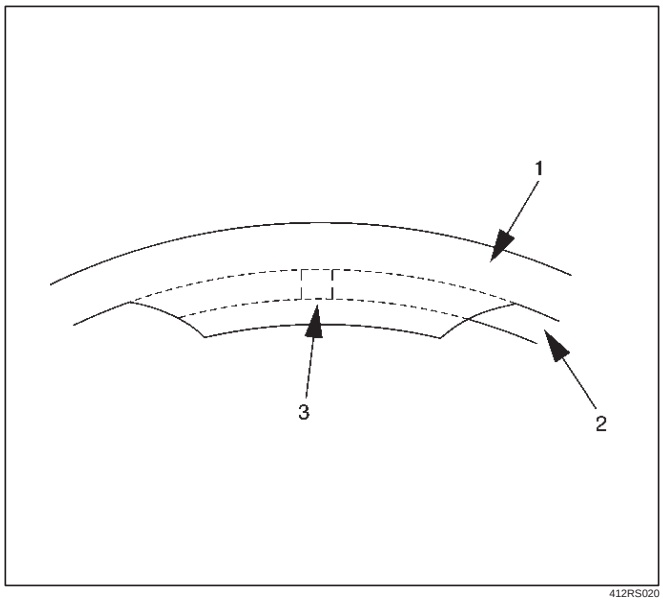


412RS018

16. Pack 150g of the specified grease in DOJ case, then install drive shaft joint assembly. After reassembly, move the DOJ longitudinally several times to get to fit.
17. Install the circlip (1) so that open ends are positioned away from the ball groove.



412RS019

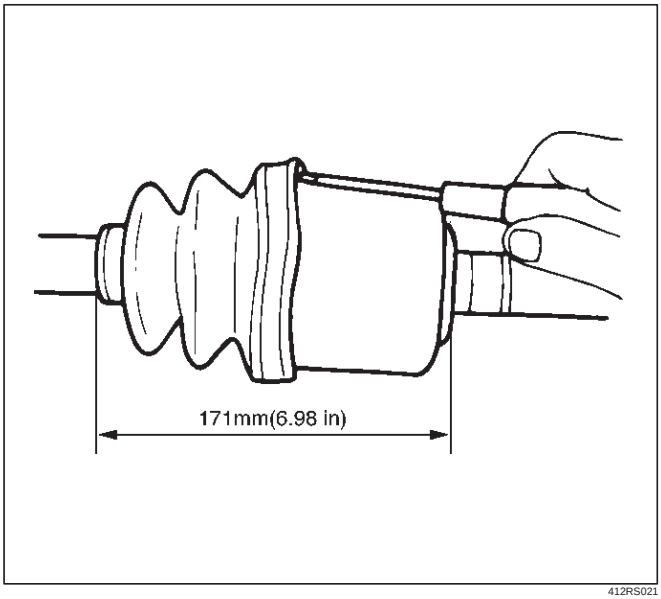


412RS020

Legend

(1) Outer Case
(2) Circlip
(3) Open Ends

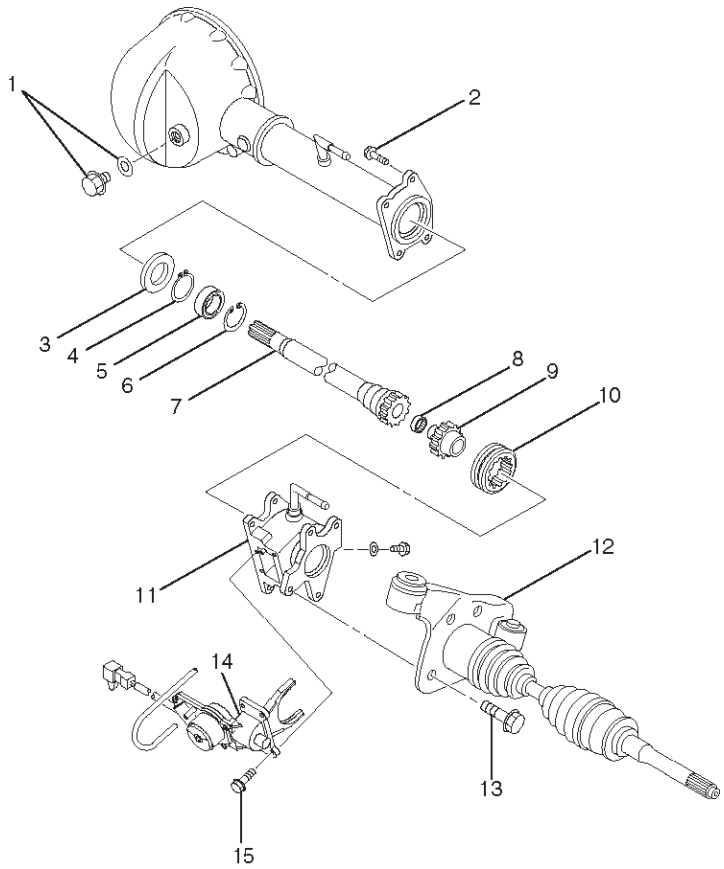
18. Install bellows. Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.



19. Install band. After installation, check that the bellows is free from distortion.

Shift On The Fly System

Shift On The Fly System and Associated Parts



412RY00007

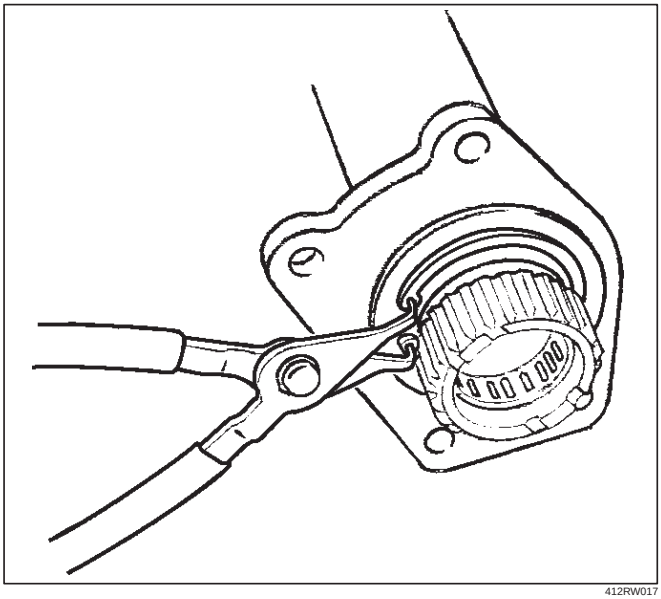
Legend

(1) Filler Plug
(2) Bolt
(3) Oil Seal
(4) Snap Ring(External)
(5) Inner Shaft Bearing
(6) Snap Ring(Internal)
(7) Inner Shaft
(8) Needle Bearing
(9) Clutch Gear
(10) Sleeve
(11) Housing
(12) Front Axle Drive Shaft(LH side) with Bracket
(13) Bolt
(14) Actuator Assembly
(15) Bolt

Disassembly

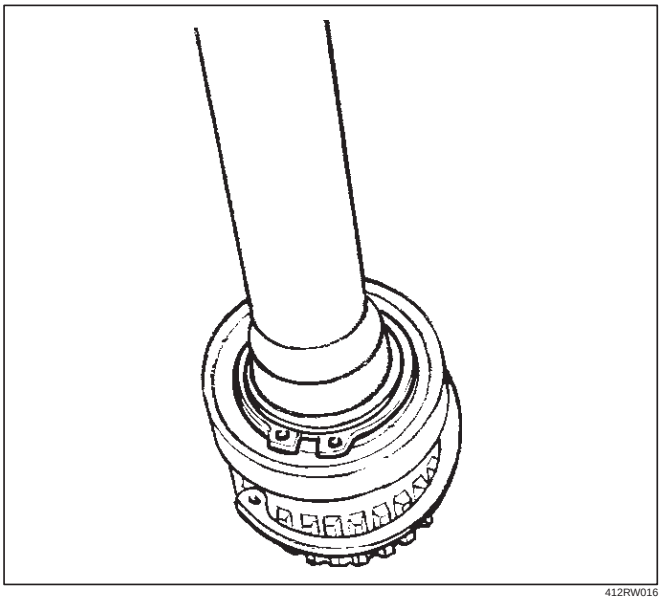
1. Remove filler plug and gasket, drain oil.
2. Loosen mounting bracket fitting bolts and remove front axle drive shaft from front axle case.
3. Remove actuator assembly and draw out actuator ASM.
4. Remove housing.
5. Remove sleeve.
6. Remove clutch gear.

7. Remove snap ring from front axle case by using snap ring pliers.



412RW017

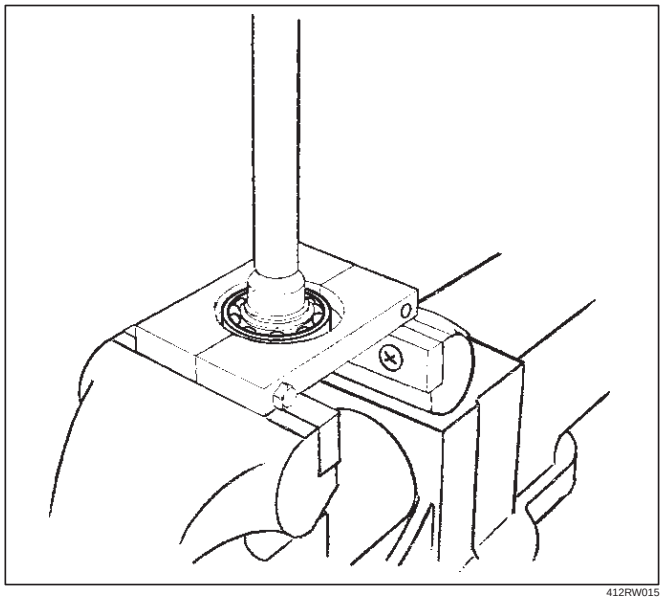
8. Take out inner shaft from front axle case.
9. Remove snap ring from inner shaft by using snap ring pliers.



412RW016

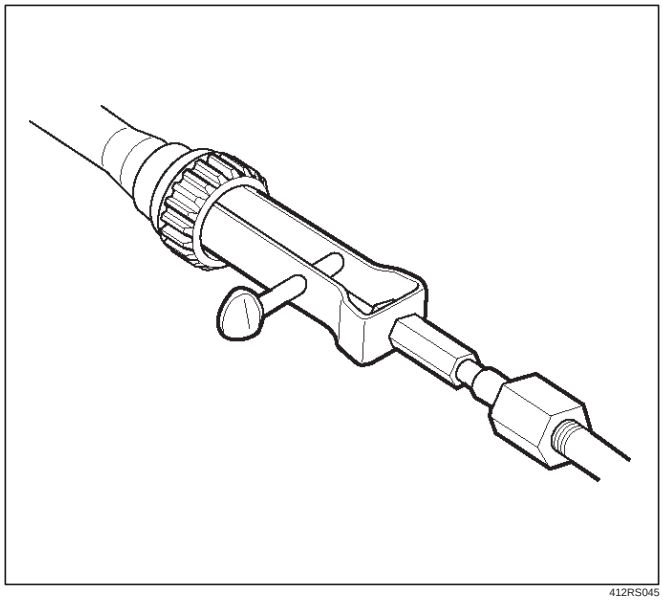
10. Remove inner shaft bearing.

NOTE: Be careful not to damage the shaft.



412RW015

11. Remove needle bearing from inner shaft by using a remover J–26941 and sliding hammer J–2619–01.



412RS045

12. Remove oil seal from front axle case.

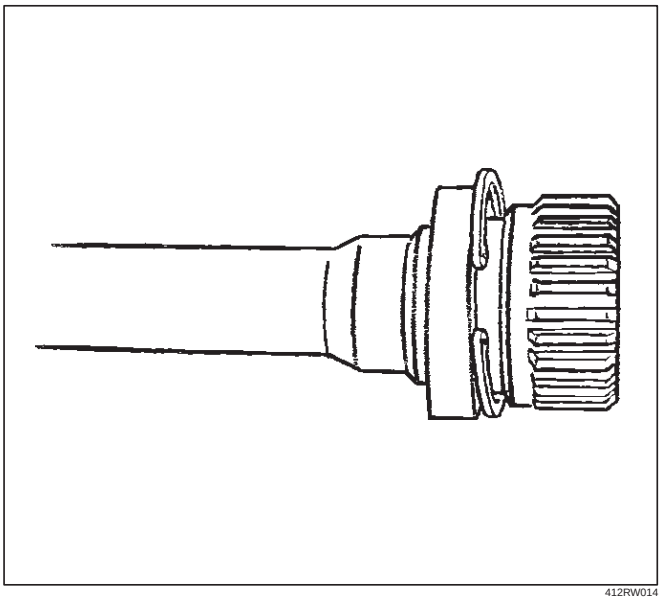
NOTE: Be careful not to damage the front axle case.

Inspection And Repair

Inspect the removed parts. If there are abnormalities such as wear and damage, take corrective action or replace.

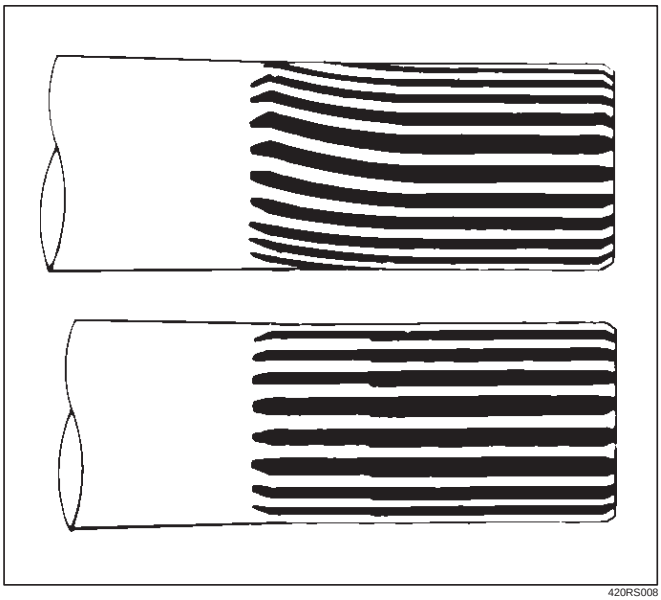
Visual Check

1. Inspect the inner shaft for wear and damage.



412RW014

2. Replace the shaft if any signs of deterioration in the gear is present.



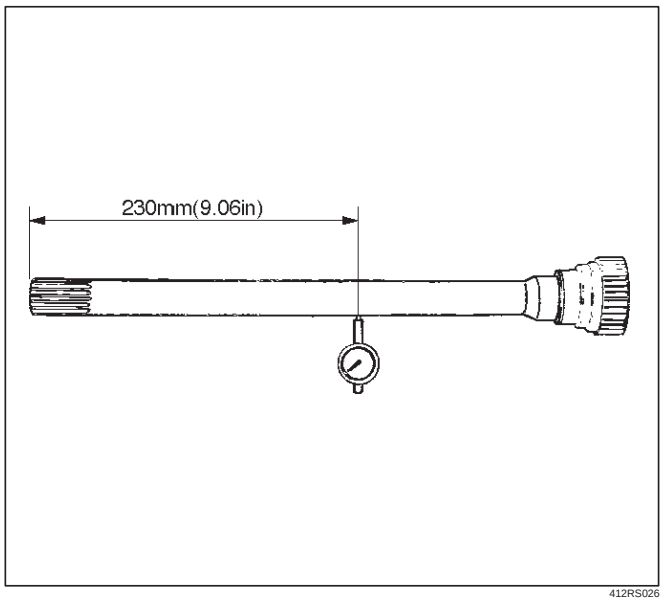
420RS008

Inner Shaft Run–Out

With both end centers supported, rotate the shaft slowly and measure deflection with a dial gauge.

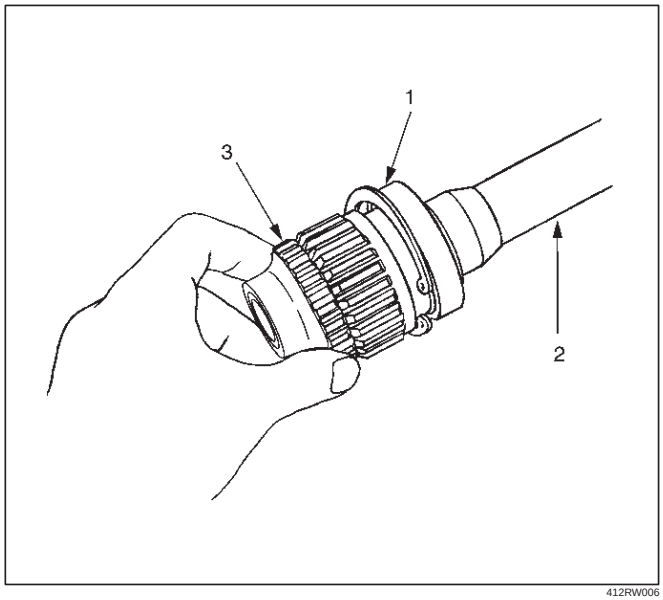
Limit: 0.5 mm (0.02 in)

NOTE: Do not heat the shaft to correct its bend.



412RS026

Inner Shaft Bearing



412RW006

Legend

(1) Inner Shaft Bearing
(2) Inner Shaft
(3) Clutch Gear

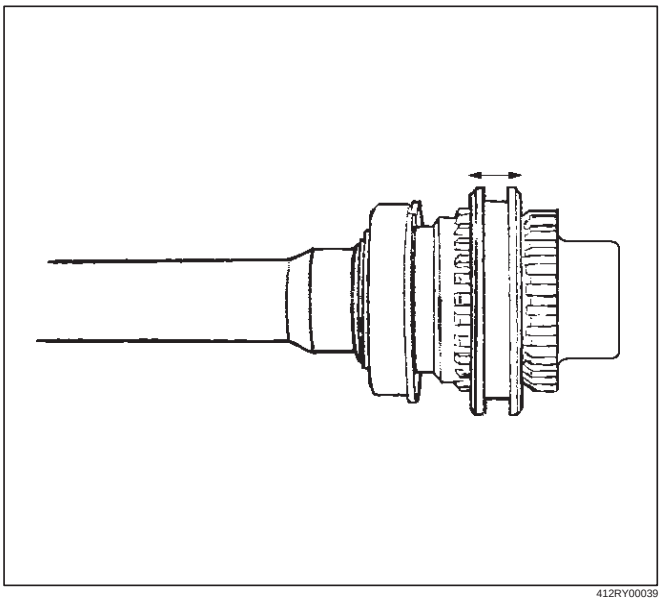
1. Inspect the inner shaft bearing for any signs of deterioration, replace if uneven.
2. Insert the clutch gear and inspect the needle bearing.
3. Replace the needle bearing if found to be uneven.

Sleeve Condition

Check for wear damage, or cracking in the sleeve.

NOTE: Close inspection of the groove and inner gear are required because those are important parts.

Sleeve Function

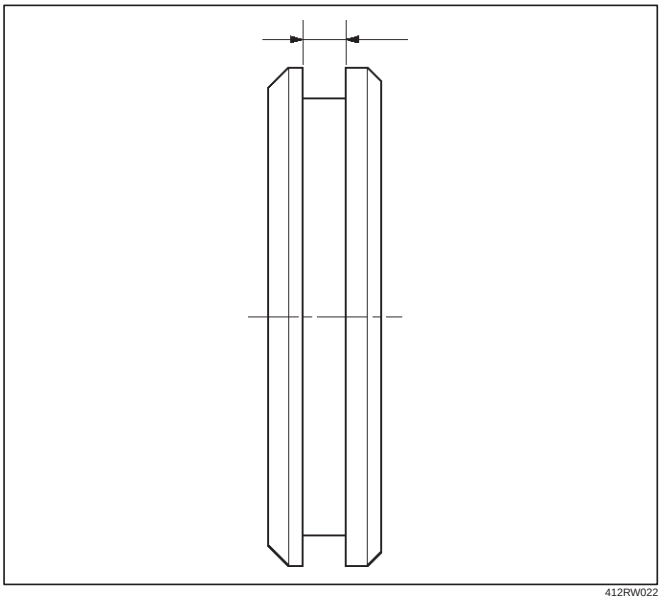

412RY00039

Test the sleeve for smoothness by sliding it between the inner shaft and the clutch gear, replace the sleeve if its difficult to slide.

NOTE: Gear oil should be applied to the contact surface of gear.

Check the width of sleeve center groove.

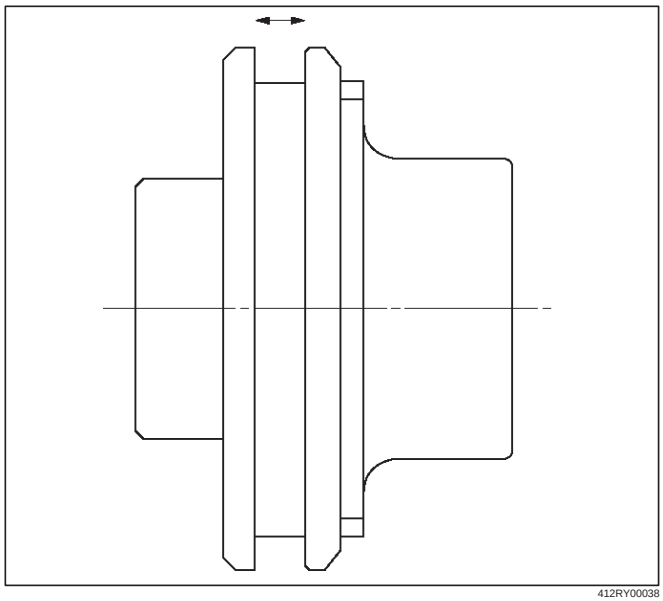
Limit: 7.1 mm (0.28 in)


412RW022

Clutch Gear Condition

Check for wear, damage, crack or any other deterioration in the clutch gear.

Clutch Gear Function


412RY00038

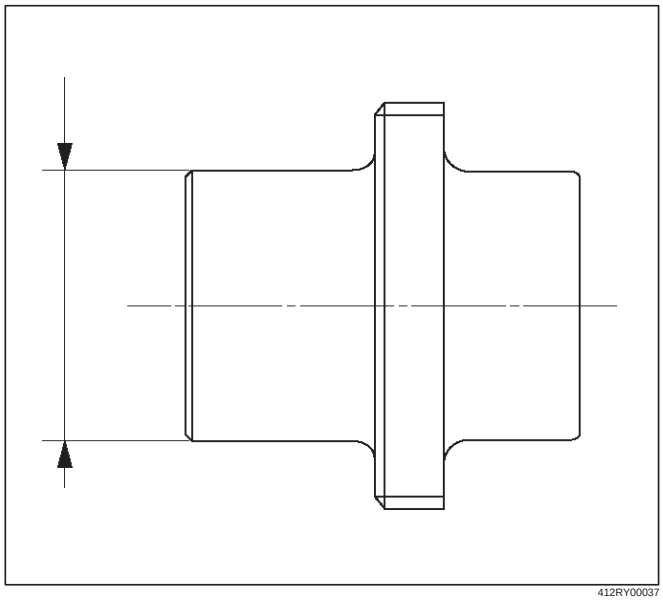
Test the sleeve for smoothness by sliding it across the clutch gear, replace the clutch gear if its difficult to slide.

NOTE: When inspecting, gear oil should be applied to the contact surface of gear.

Clutch Gear Journal Diameter

Make sure of the size illustrated.

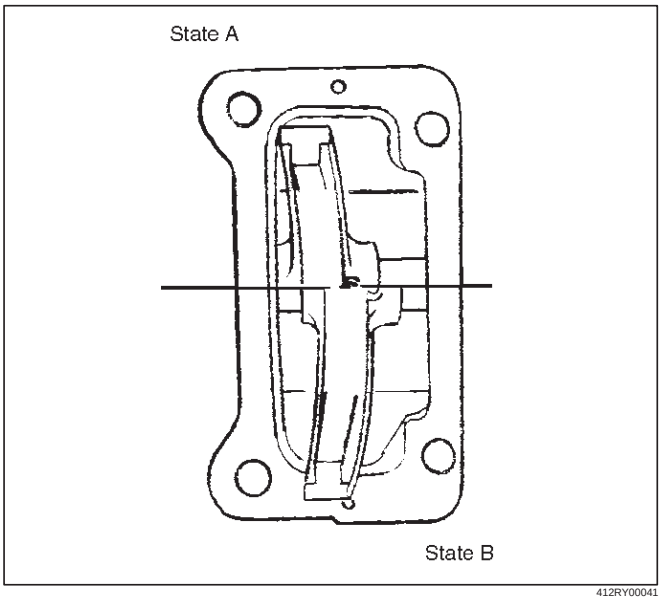
Limit: 36.98 mm (1.456 in)


412RY00037

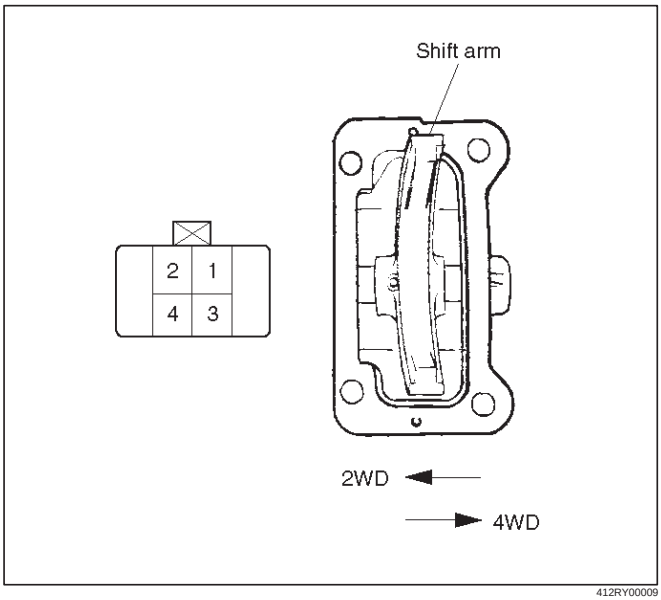
Actuator

Check for damage, cracking, or other abnormality.

Functional Check



412RY00041



412RY00009

Verify functionality by applying voltage (12V) to terminals 3 and 4 and set the tester to terminal 1 and 2 according to the table bellow.

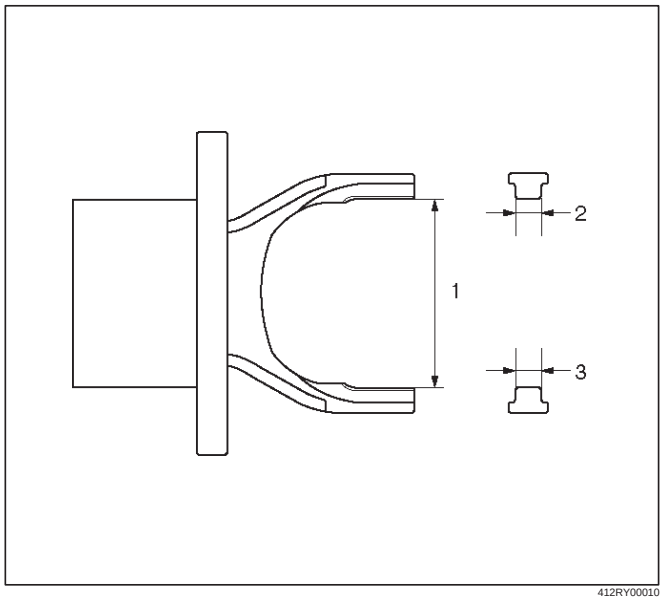
State	Trminal 3	Trminal 4	Electric circuit between terminal 1 & 2	Function
A	+12V	Ground	OK	2WD
B	Ground	+12V	NONE	4WD

If there is an abnormality, replace the actuator as an assembly.

NOTE: Be careful not to permit the entry of water or dust into of the actuator.

Dimentional Check

Measure illustrated sizes 1, 2, and 3.



412RY00010

Limit

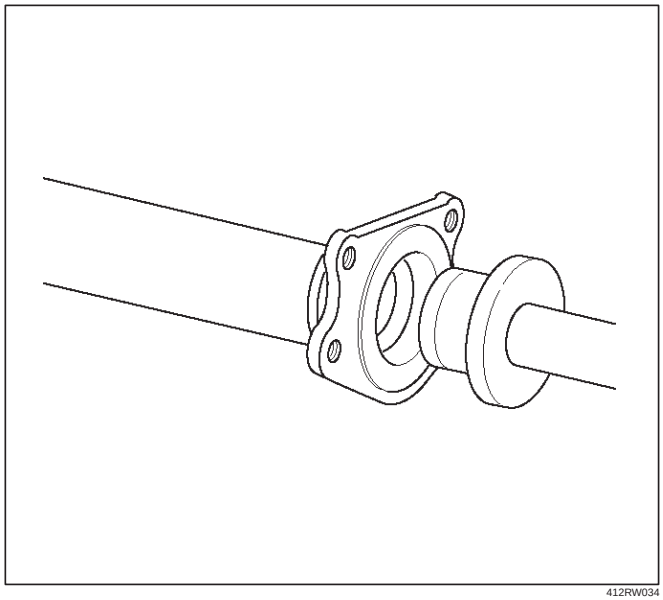
1=64.3 mm (2.53 in)

2=6.7 mm (0.26 in)

3=6.7 mm (0.26 in)

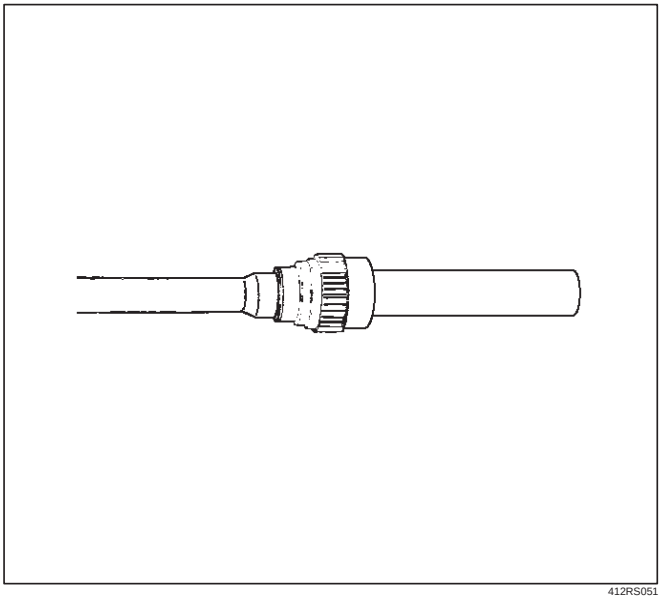
Reassembly

1. Install the new oil seal which has been immersed in differential gear oil, by using an oil seal installer J–41693 and grip J–8092.



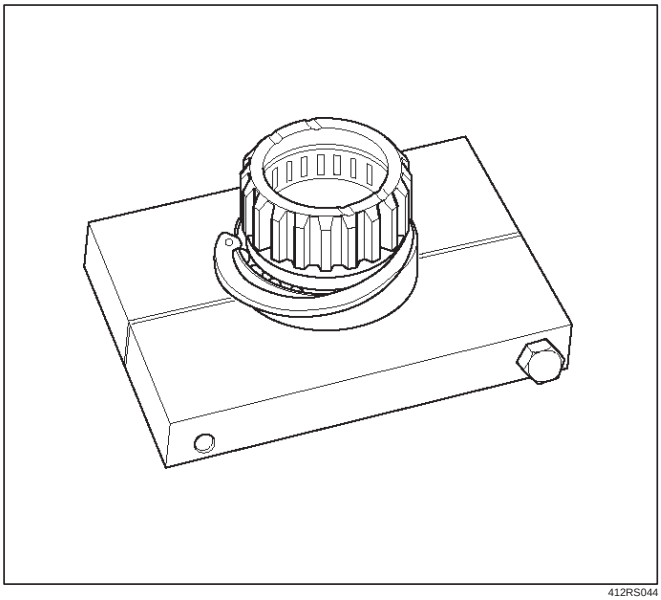
412RW034

2. Install a new needle bearing into inner shaft by using a Installer J–41694 and grip J–8092.



412RS051

3. Place a new snap ring(internal) in inner shaft.
   Install a new inner shaft bearing into the inner shaft.



412RS044

4. Install snap ring(external).

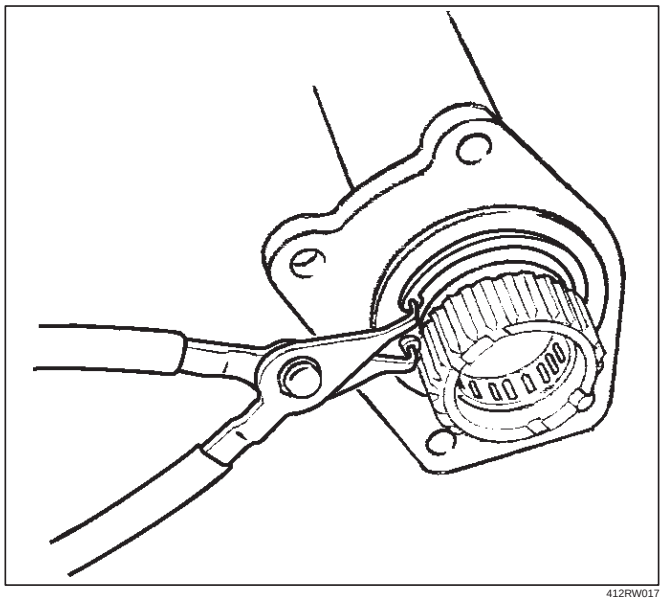
NOTE: Be careful not to damage the inner shaft.

5. Clean the housing contact surface of the front axle case and insert inner shaft assembly into the front axle case.

NOTE: Be careful not to damage seal.

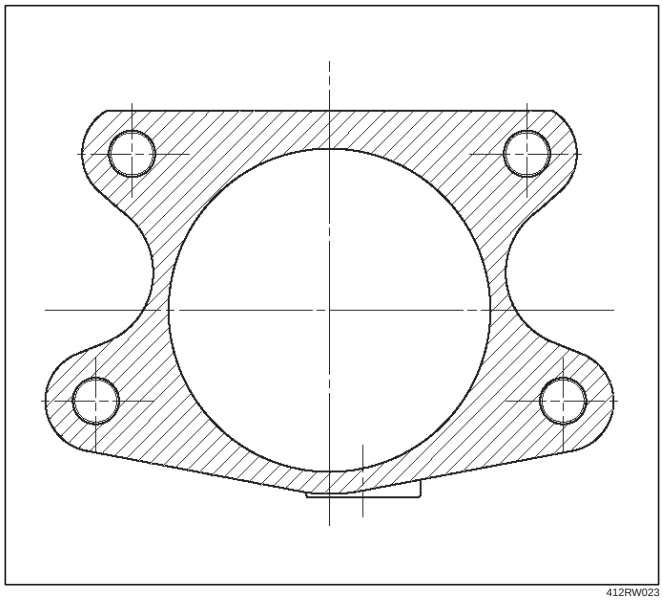
6. Install snap ring internal in the groove of front axle case.

NOTE: Be sure to install the snap ring properly.



412RW017

7. Apply differential gear oil to clutch gear, then install clutch gear.
8. Apply differential gear oil to sleeve, then install sleeve.
9. Clean contact surface with the front axle and actuator mounting surface. Apply liquid gasket to the contact surface on the front axle case, then install in the housing.



412RW023

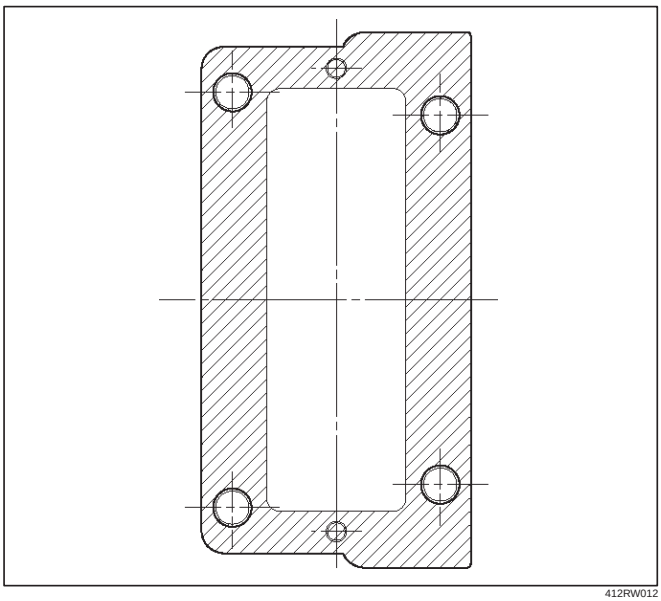
10. Tighten bolts to specified torque.

    Torque: 75N·m(55 lb ft)

11. Clean the actuator contact surface with the housing then Install and tighten shift position switch to the specified torque.

    Torque: 39N·m (29 lb ft)

12. Apply liquid gasket to the contact surface on the actuator side.


412RW012

13. Align shift arm with the groove of sleeve and install the actuator.
14. Tighten bolts to specified torque.

    Torque: 9N·m(78 lb in)

15. Install front axle drive shaft and mounting bracket. Tighten fitting bolts to specified torque.

    Torque: 116N·m (85 lb ft)

16. Pour specified amount of differential gear oil to filler plug.

    Front Differential

    Oil Capacity: 1.25lit (1.32US qt)

    Actuator Housing

    Oil Capacity: 0.12lit(0.13US qt)

17. Install filler plug through gasket and tighten to specified torque.

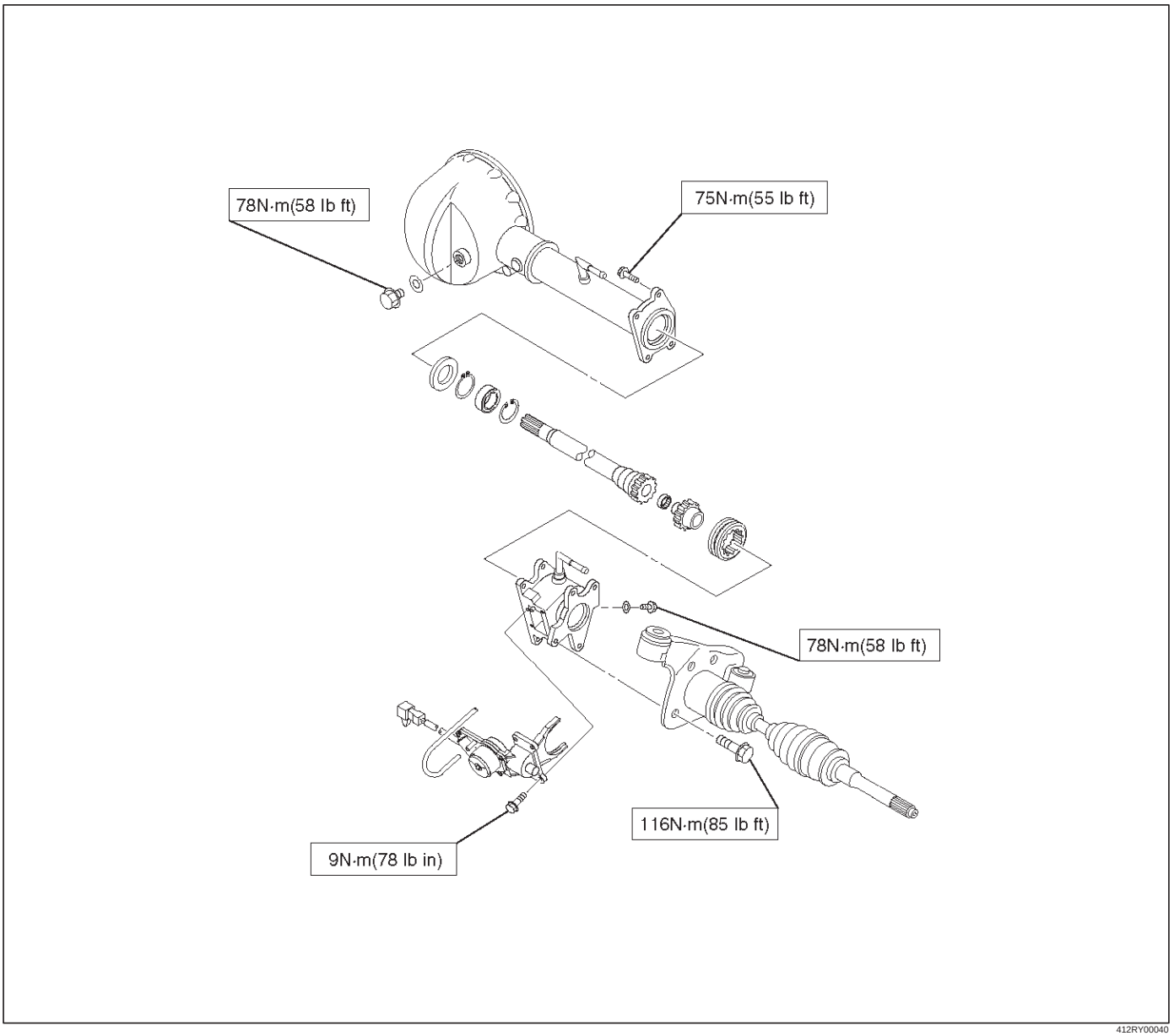
    Torque: 78N·m (58lb ft)

Main Data and Specifications

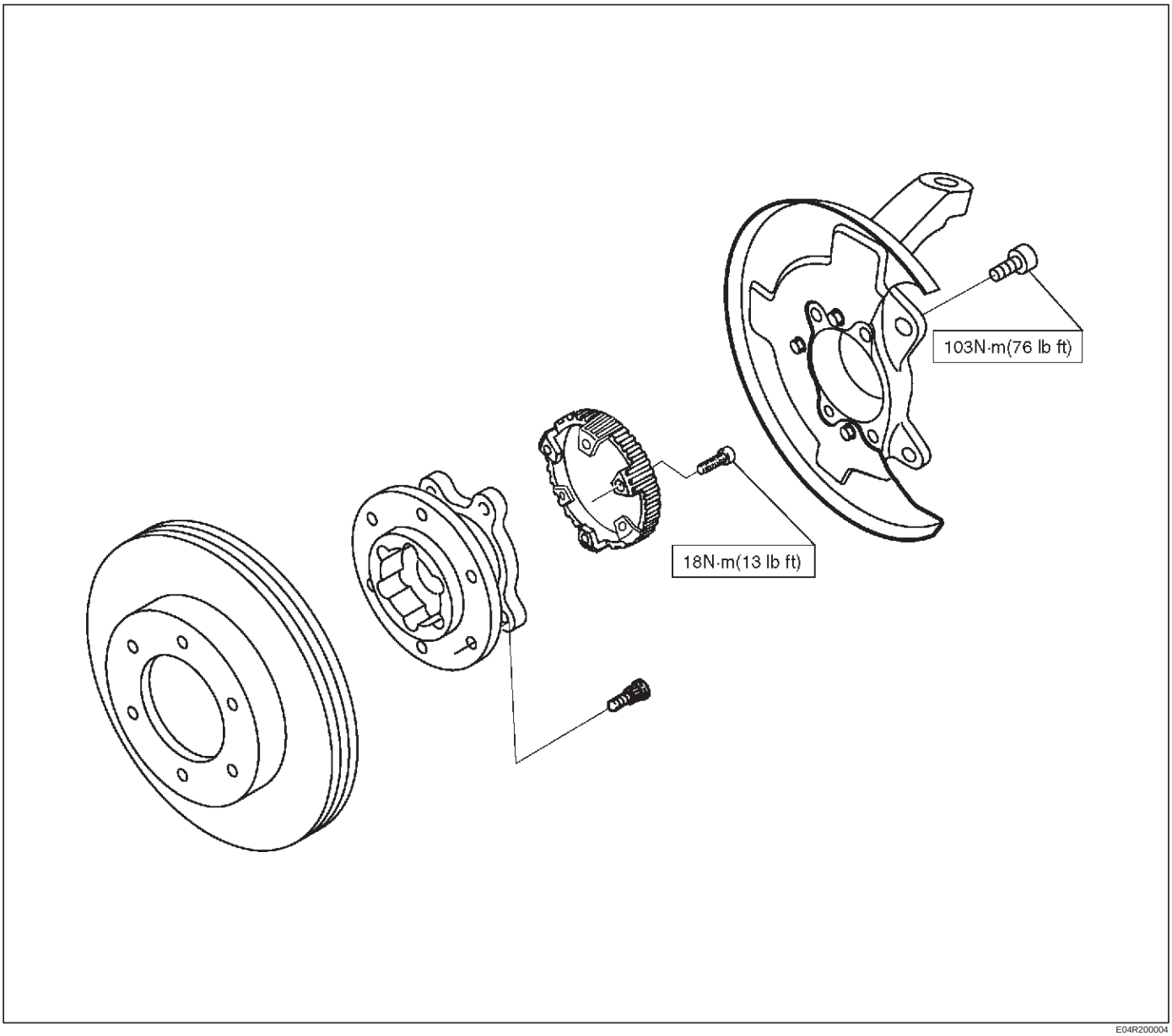
General Specifications

Front drive axle oil capacity	1.25 liter (1.32 US qt)(Differential)
	0.12 liter (0.13 US qt)(Actuator Housing:Shift on the fly)
Type of lubricant	GL–5 (75W–90) Refer to *chart in General Information*
Axle shaft type	Constant velocity joint(Birfield joint type and double offset joint)

Torque Specifications



412RY00040



E04R200004

Special Tools

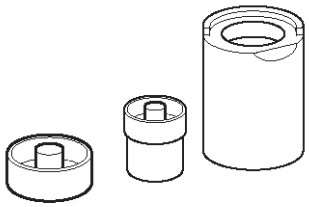
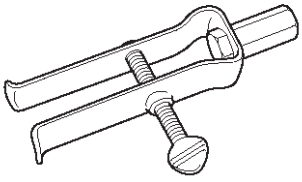
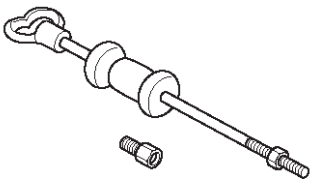
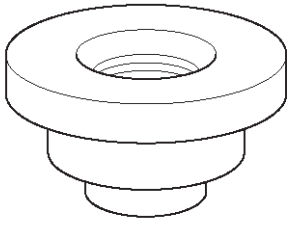
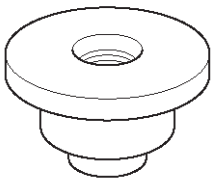
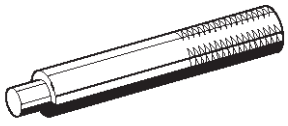
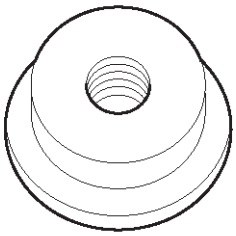
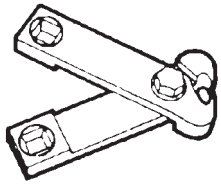
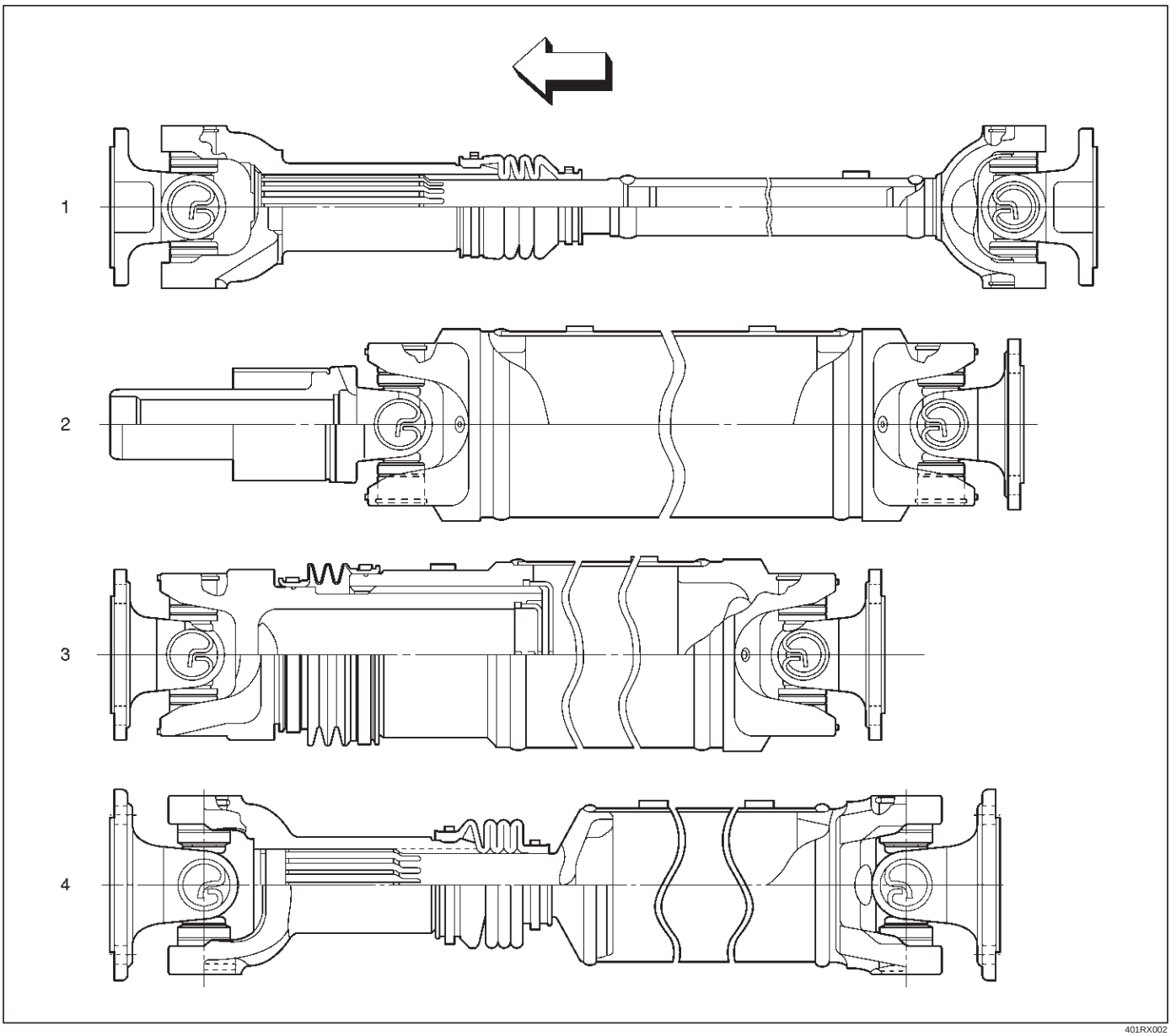
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS233	**J–39378** Remover and Installer; Front Axle mount bushing
 901RS234	**J– 26941** Remover; Bearing needle
 901RS235	**J–2619–01** Hammer; Sliding
 901RS236	**J–41693** Installer; Oil seal
 901RS177	**J–41694** Installer; Bearing needle
 901RS285	**J–8092** Grip

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS249	**J–36830** Installer; Oil seal
 5884027460	**J–35910** Pliers; Band bellows, drive shaft

Propeller Shaft

General Description



401RX002

Legend

(1) Front Propeller Shaft
(2) Rear Propeller Shaft;
Aluminum Tube with Spline Yoke Type
(3) Rear Propeller Shaft;
Aluminum Tube with Flange Yoke Type
(4) Rear Propeller Shaft;
Steel Tube Type (for 4×4, 6VD1, A/T model)

Torque is transmitted from the transmission to the axle through the propeller shaft and universal joint assembles. All propeller shafts are the balanced tubular type. A splined slip joint is provided in some drivelines.

▼ Since the propeller shaft is balanced carefully, welding or any other modification is not permitted.

▼ Alignment marks should be applied to each propeller shaft before removal.

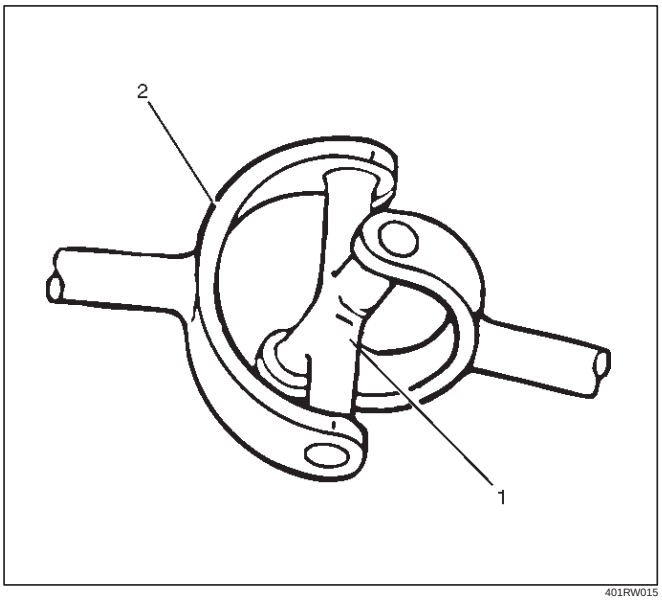
▼ Park, turn the engine off and apply the parking brake to secure the vehicle.

▼ Carefully attach the propeller shaft to the vise, do not overtighten the vise when securing the propeller shaft, this may cause deformation.

Phasing

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other. This design produces the smoothest running shaft possible, called phasing.Vibration can be caused by an out–of–phase propeller shaft.The propeller shaft will absorb vibrations from speeding up and slowing down each time the universal joint spins.This vibration would be the same as a person snapping a rope and watching the ”wave” reaction flow to the end.A propeller shaft working in phase would be similar to two persons snapping a rope at the same time, and watching the ”waves” meet and cancel each other out.In comparison, this would be the same as the universal joints on a propeller shaft.A total cancellation of vibration produces a smooth flow of power in the driveline.It is very important to apply a reference mark to the propeller shaft before removal, to assure installation alignment.

Universal Joint



401RW015

Legend

(1) Spider
(2) Yoke

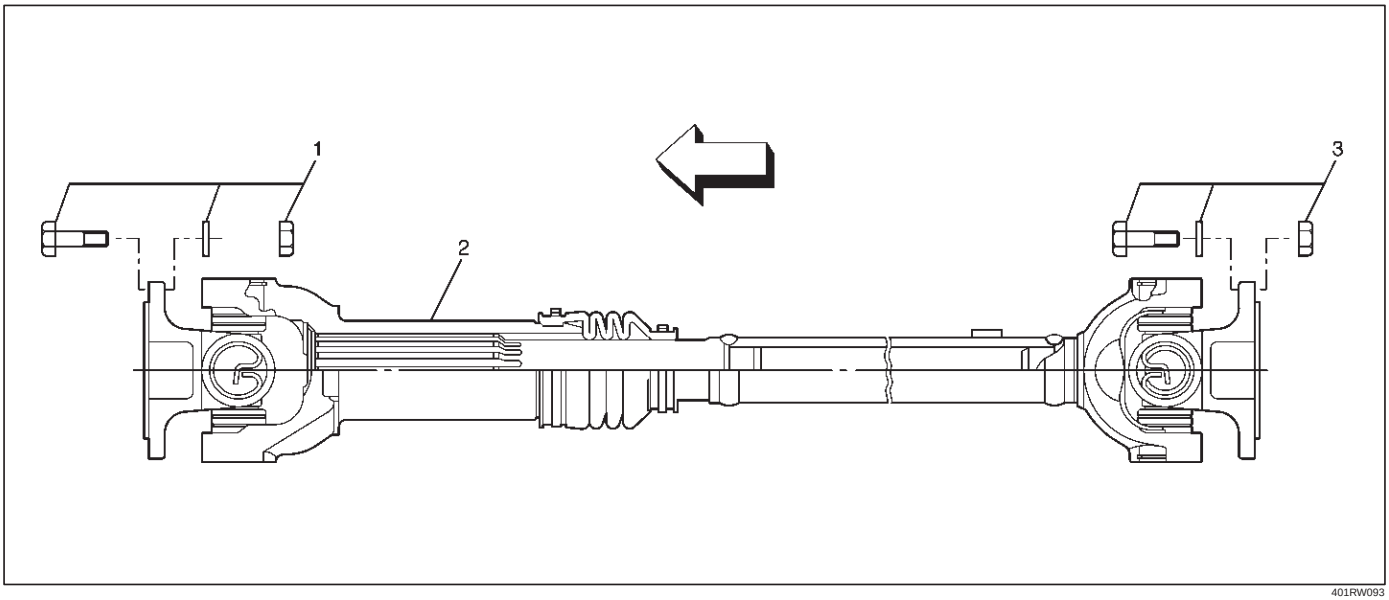
A universal joint consists of two Y-shaped yokes connected by a crossmember called a spider.
The spider is shaped like a cross. Universal joints are designed to handle the effects of various loadings and front or rear axle windup during acceleration. Within the designed angle variations, the universal joint will operate efficiently and safely. When the design angle is changed or exceeded the operational life of the joint may decrease. The bearings used in universal joints are of the needle roller type. The needle rollers are held in place on the trunnions by round bearing cups. The bearing cups are held in the yokes by snap rings.

Diagnosis of Propeller Shaft and Universal Joint

Condition	Possible cause	Correction
Universal Joint Noise.	Worn universal joint bearings.	Replace.
	Improper lubrication.	Lubricate as directed.
	Loose flange bolts.	Tighten to specifications.
Ping, Snap, or Click in Drive Line (Usually Heard on Initial Load after the Transmission is in Forward or Reverse Gear)	Loose bushing bolts on the rear springs or upper and lower control arms.	Tighten the bolts to specified torque.
	Loose or out-of-phase end yoke.	Remove end yoke, turn 180 degrees from its original position, lubricate the splines and reinstall. Tighten the bolts and pinion nut to specified torque.
Knocking or Clanking Noise in the Driveline when in High or Neutral Gear at 16km/h(10mph)	Worn or damaged universal joint	Replace the universal joint.
Squeak	Lack of lubricant.	Lubricate joints and splines. Also check for worn or brinelled parts.
Shudder on Acceleration (Low Speed)	Loose or missing bolts at the flanges.	Replace or tighten bolts to specified torque.
	Incorrectly set front joint angle.	Install shim under the transmission support mount to change the front joint angle.
	Worn universal joint.	Replace.
Vibration	Incorrect shaft runout.	Replace.
	Shaft out of balance.	Adjust.
	Transmission rear housing bushing, transfer case housing bushing worn.	Replace.
	Yoke spline jammed.	Replace.
Excessive Leak at the Front Spline Yoke of Rear Propeller Shaft	Rough surface on splined yoke; burred nicked or worn.	Replace the seal. Minor burrs can be Smoothed by careful use of crocus cloth or fine stone honing. Replace the yoke if badly burred.
	Defective transmission rear oil seal.	Replace the transmission rear oil seal and replenish the transmission oil.

Front Propeller Shaft

Front Propeller Shaft and Associated Parts



401RW093

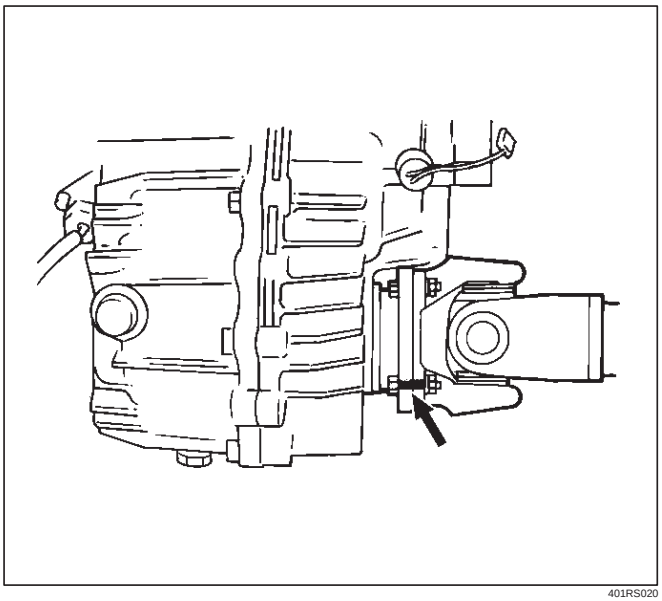
Legend

(1) Bolt, Nut and Washer (Front Axle Side)
(2) Front Propeller Shaft
(3) Bolt, Nut and Washer (Transfer Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



401RS020

2. Remove bolt, nut and washer (Front axle side).
3. Remove bolt, nut and washer (Transfer side).
4. Remove front propeller shaft.

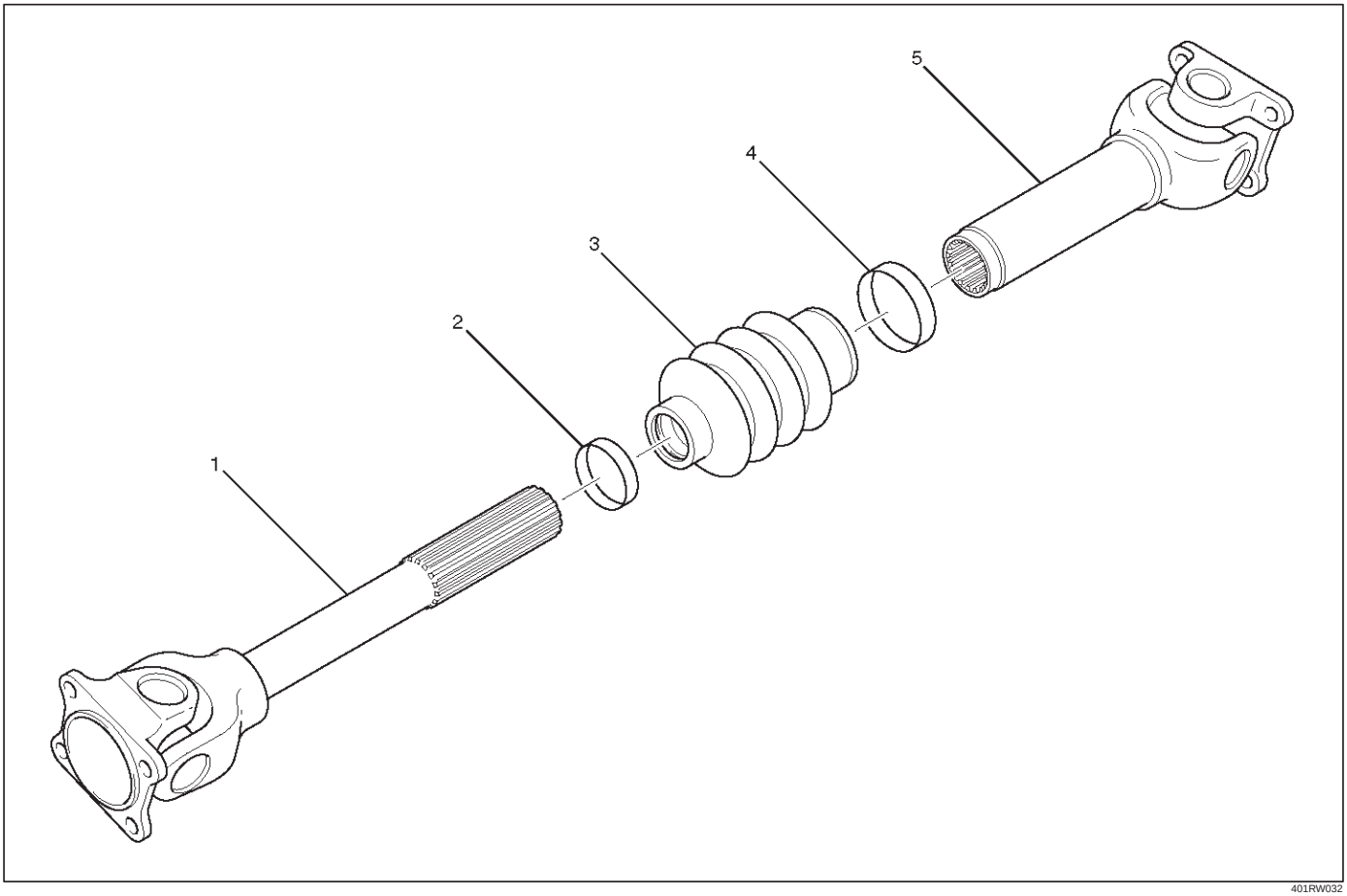
Installation

NOTE: Never install the shaft assembly backwards. Never insert bar between yoke lugs when tightening or removing bolts. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which is applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m (46 lb ft)

Disassembly

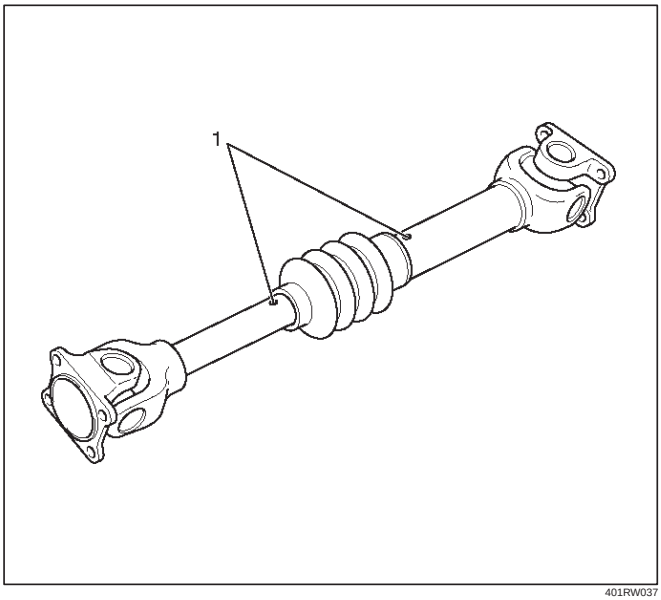


401RW032

Legend

(1) Sleeve Yoke
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube Assembly

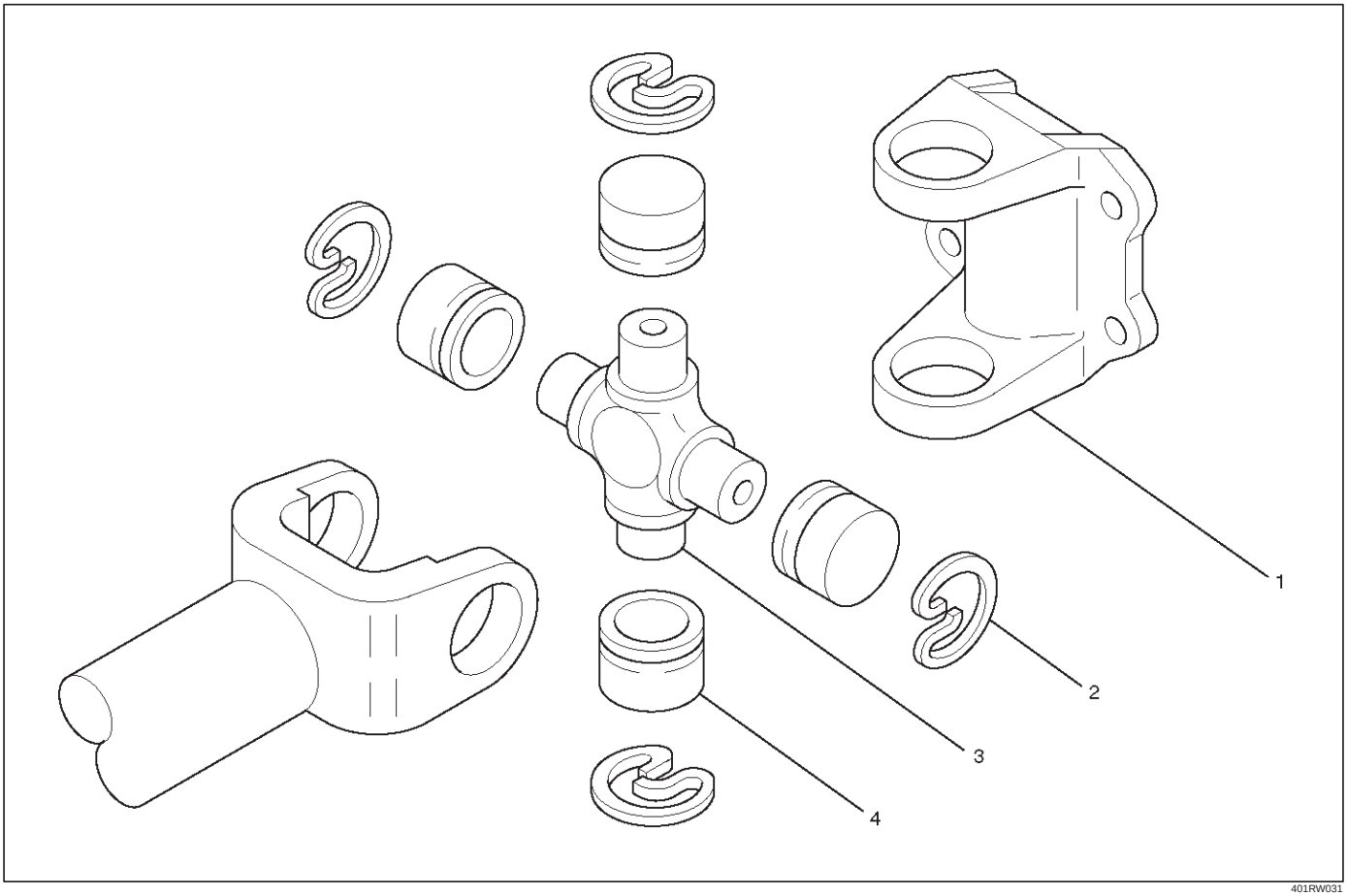
1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position (1) by marking the phasing of the shaft prior to disassembly.



401RW037

3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the slip yoke assembly from the driveshaft, by securing the boot with one hand and pulling on the slip yoke.
7. Remove the boot from the shaft assembly.

Universal Joint Disassembly



401RW031

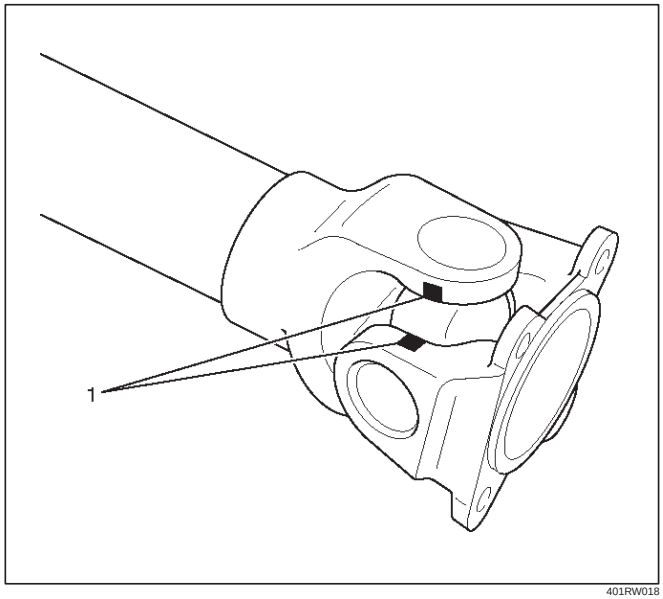
Legend

(1) Flange Yoke
(2) Snap Ring
(3) Spider
(4) Needle Roller Bearing

1. Using a soft drift, tap the outside of the bearing cup assembly to loosen snap ring. Tap bearing only hard enough to break assembly away from snap ring.

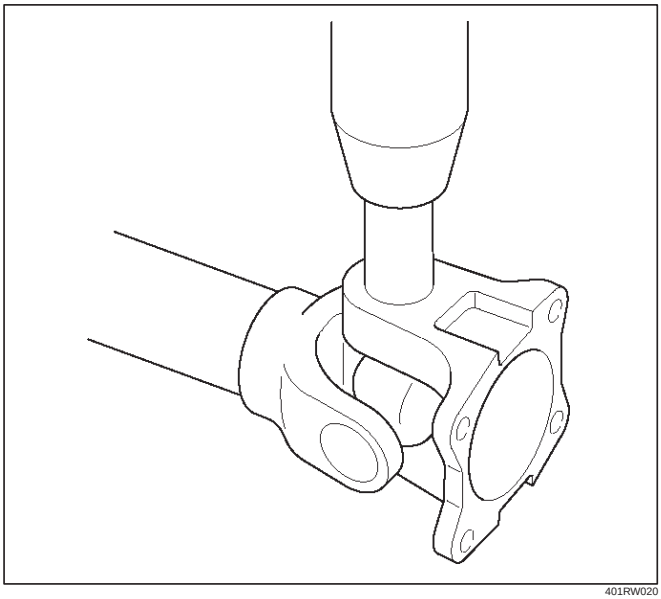
   Remove snap ring from yoke. Turn joint over, tap bearing away from snap ring, then remove opposite snap ring.

   Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RW018

2. Set the yoke in the arbor press with a piece of tube stock beneath it.
   Place a solid plug on the upper bearing assembly and press it through to release the lower bearing assembly.


401RW020

3. If the bearing assembly will not pull out by hand after pressing, tap the base of the lug near the bearing assembly to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin the yoke.
5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.
6. Make sure of proper position for reinstallation by applying setting marks, then remove spider .

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

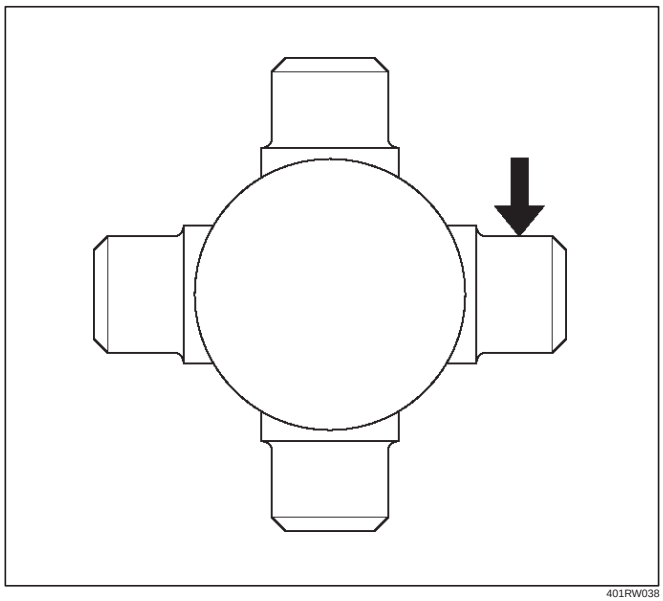
NOTE: When any part of the journal assembly (spider, needle roller bearing) requires replacement, be sure to replace the entire assembly.

Check the following parts for wear, damage, noise or any other abnormal conditions.

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange
5. Boot

Spider pin for wear

Spider pin should be smooth and free from fretting or galling. Visible signs of needle presence is normal, but wear should not be felt.


401RW038

Propeller shaft run–out

Support the propeller shaft on V-blocks (2) and check for run-out by holding the probe of a dial indicator (1) in contact with the shaft.

Static run-out limit:

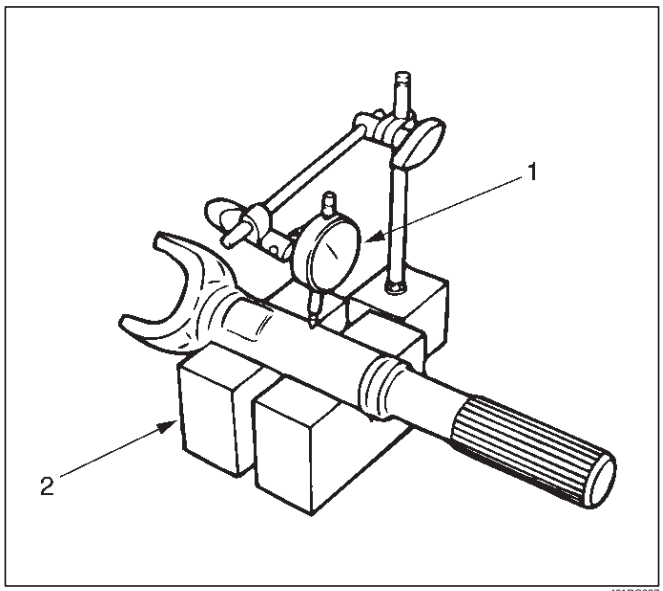
0.13 mm (0.005 in)
TIR on the neck of the slip tube shaft (with a boot).

0.25 mm (0.010 in)
TIR on the ends of the tubing 3 inch from the welds.

0.38 mm (0.015 in)
TIR at the linear center of the tube.

0.38 mm (0.015 in)
TIR for the full length of tube with 30” or less of tubing.

(TIR : Total Indicator Reading)



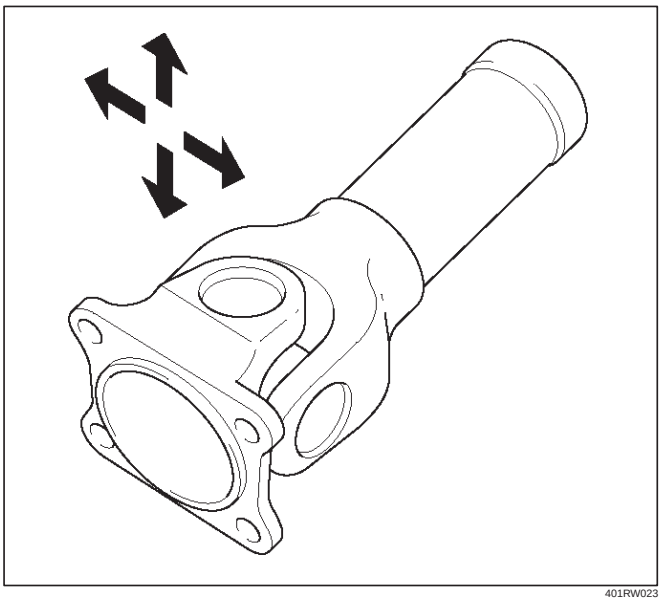
401RS027

Spline

The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible. After cleaning the nylon coating spline, the coating should exhibit only slight indicator of wear.
Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

Play in the universal joint

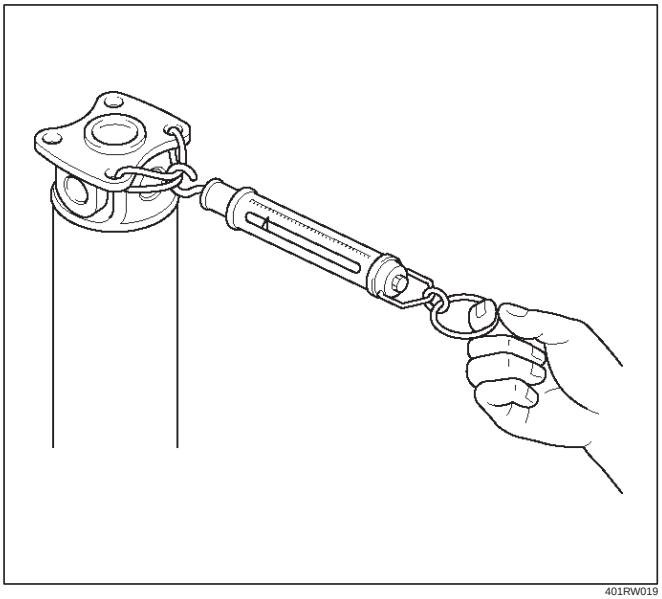
Limit: Less than 0.15 mm (0.006 in)



401RW023

Preload of the universal joint

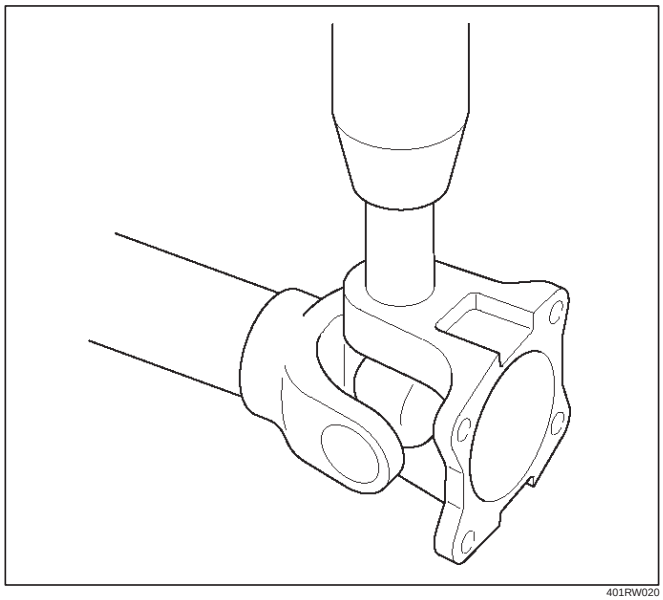
Preload should be 0 to 49 N(0 to11.0 lb). Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



401RW019

Universal Joint Reassembly

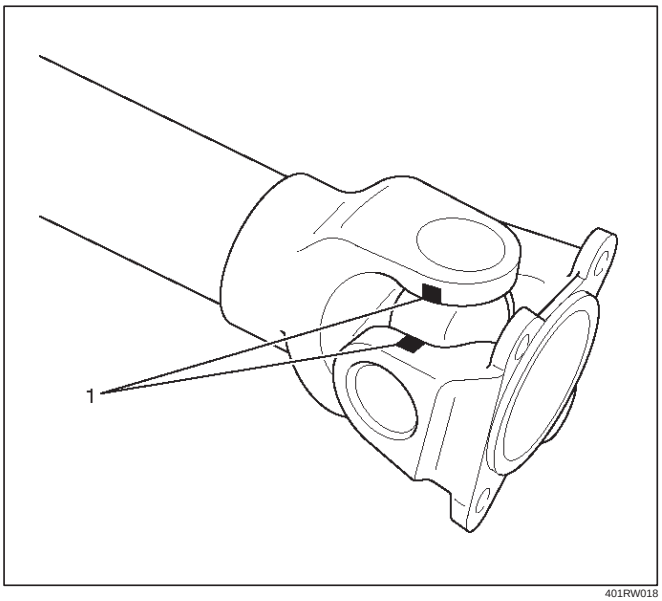
1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to the bearing cup assembly.
3. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole. Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install a snap ring.



401RW020

4. Install a snap ring.
   Be sure the snap rings are properly seated in the grooves.
5. Repeat steps 3 and 4 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat needle bearings.

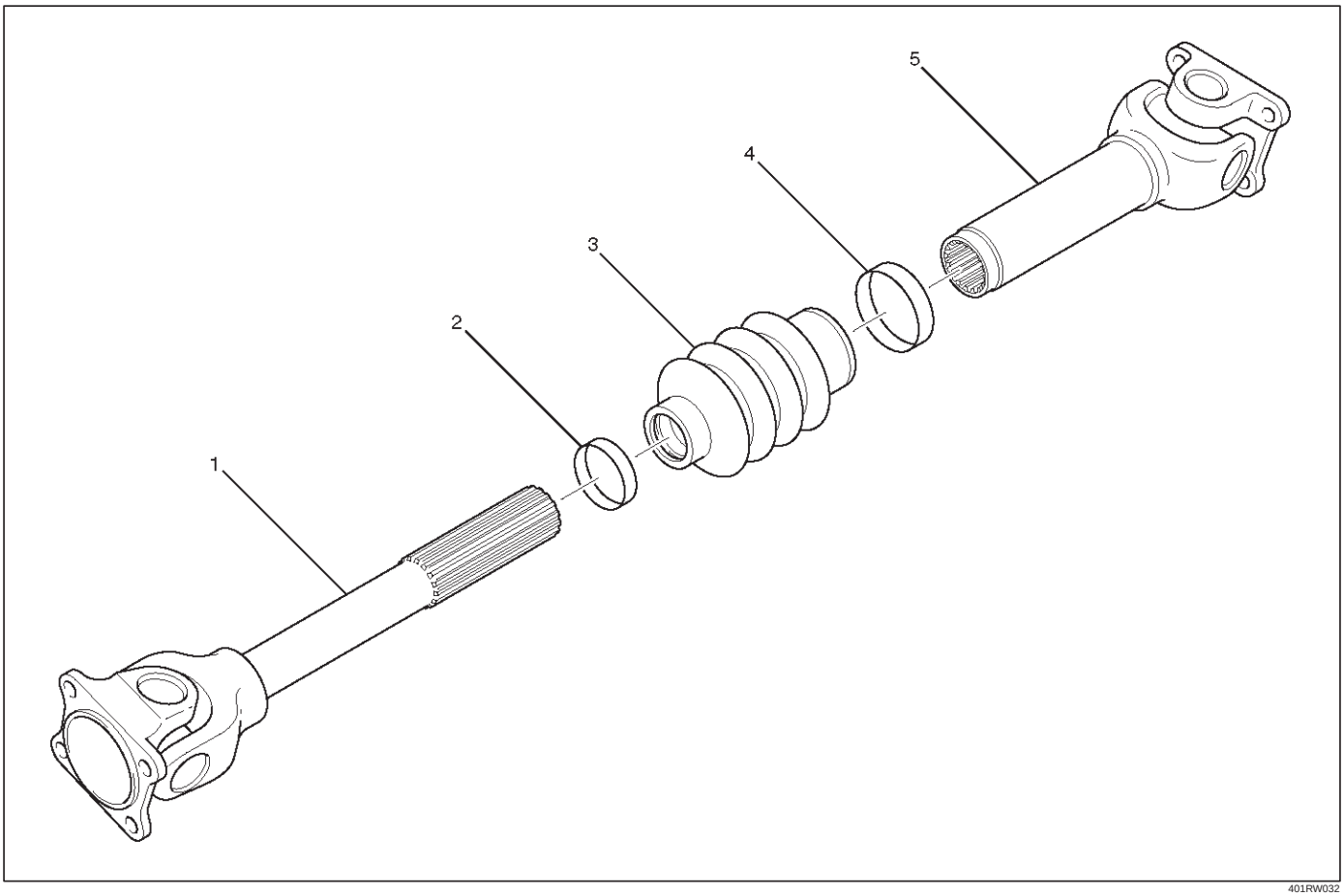
6. Align setting marks (1) and join the yokes.



401RW018

7. Install snap ring.

Reassembly



401RW032

Legend

(1) Sleeve Yoke
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube Assembly

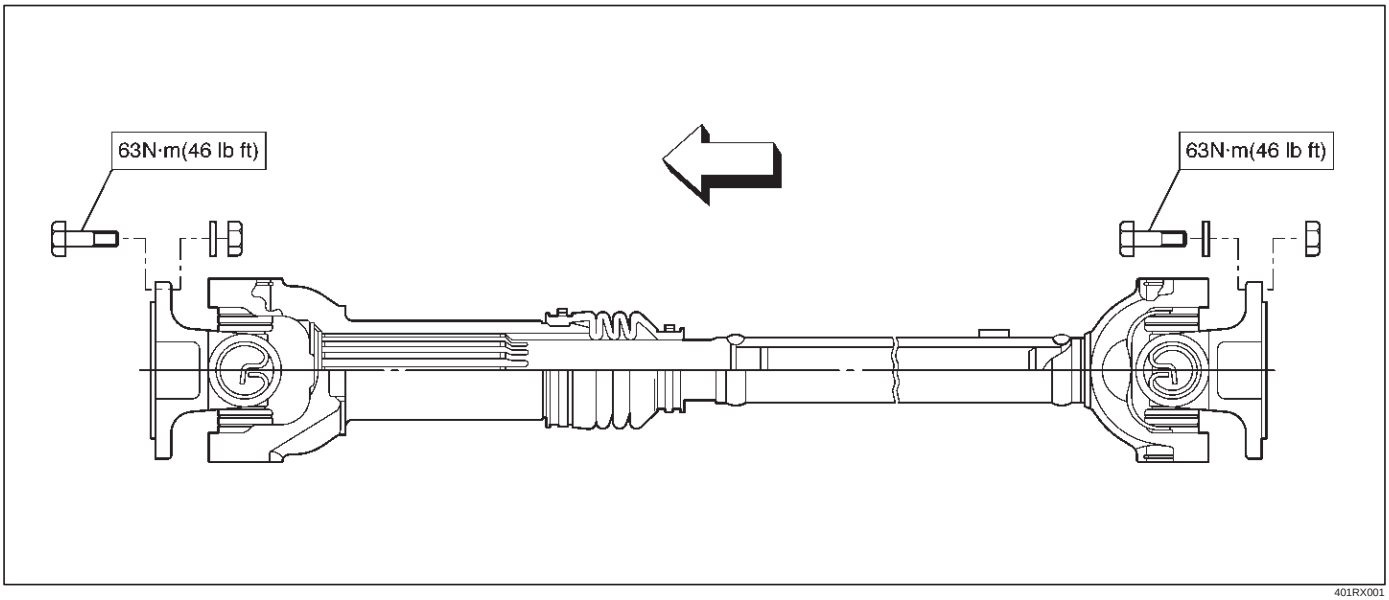
1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot onto the yoke shaft being careful not to damage the spline coating or boot.
4. Insert the yoke shaft spline into the sleeve being careful to maintain proper phasing. The spider holes should be in line and as per originally marked prior to disassembly.
5. Position boot onto sleeve and yoke shaft in final position over boot grooves.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

Main Data and Specifications

General Specifications

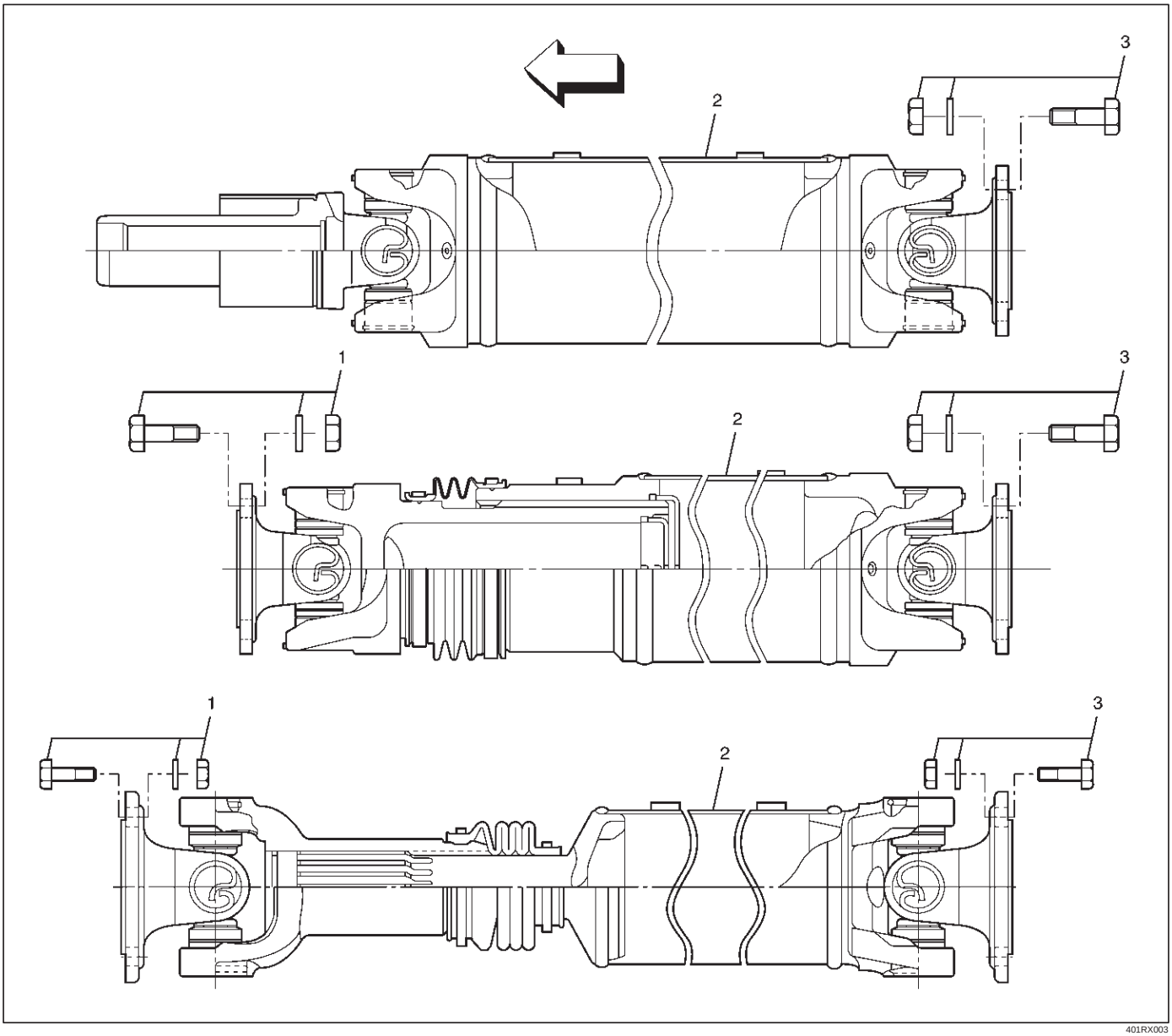
Transmission	M/T	A/T
Length (between two spiders center)	367.2 mm (14.81 in)	542.2 mm (21.35 in)

Torque Specifications



Rear Propeller Shaft

Rear Propeller Shaft and Associated Parts



401RX003

Legend

(1) Bolt, Nut and Washer (Transfer Side)
(2) Rear Propeller Shaft
(3) Bolt, Nut and Washer (Rear Axle Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.

2. Remove transfer side bolt, nut and washer (except spline yoke type).
3. Remove rear axle side bolt, nut and washer.
4. Remove rear propeller shaft.

NOTE: Plug the hole of the transmission rear end to prevent oil leakage (spline yoke type only).

Installation

NOTE: Never install the shaft assembly backwards.

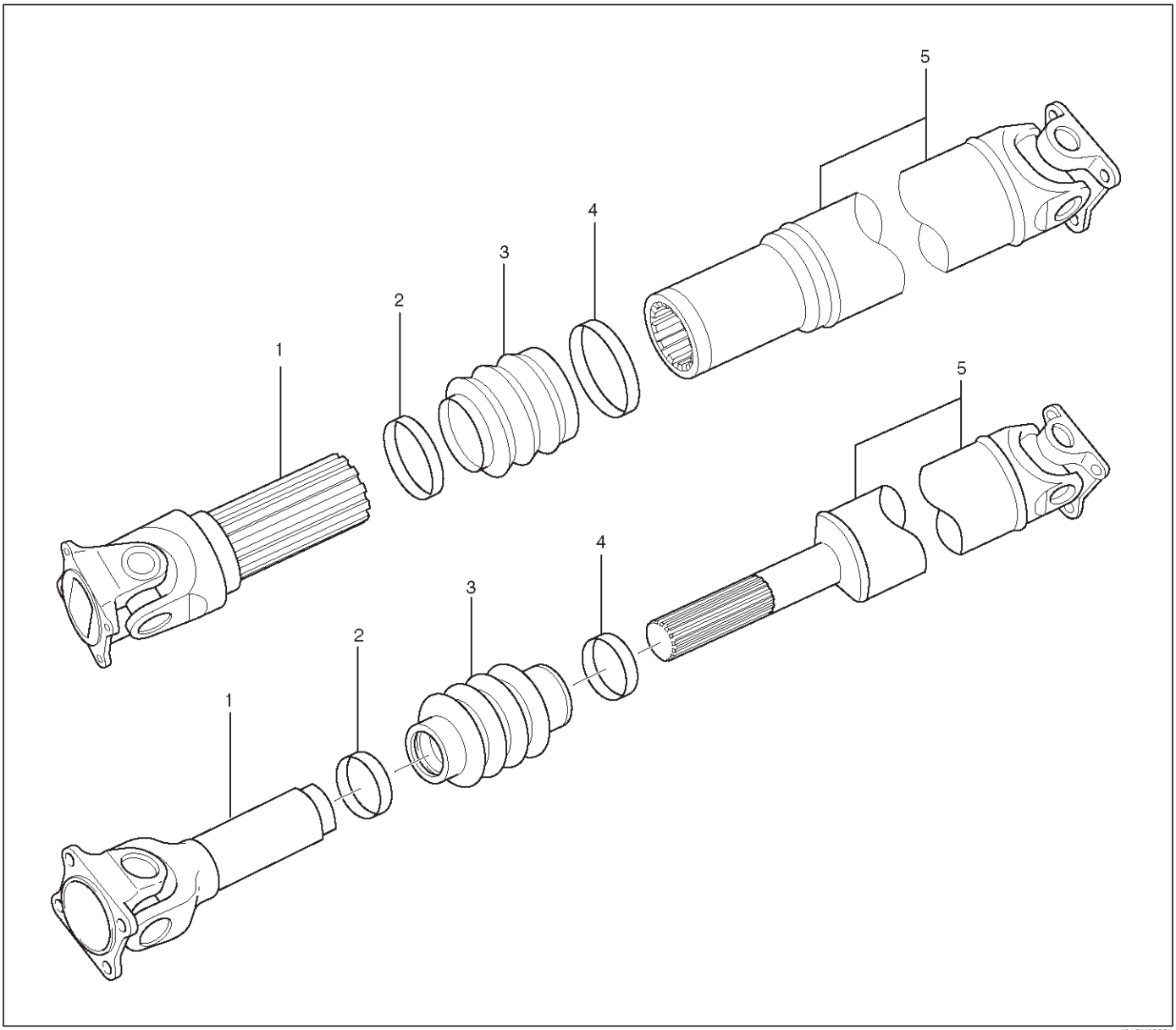
Never insert bar between yoke lugs when tightening or removing bolts.

Completely remove the dust or foreign matter from the connecting surface of flange coupling on each end of the propeller shaft.

1. Align the mark which is applied at removal.
2. Install rear propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m(46 lb ft)

Slip Joint Disassembly



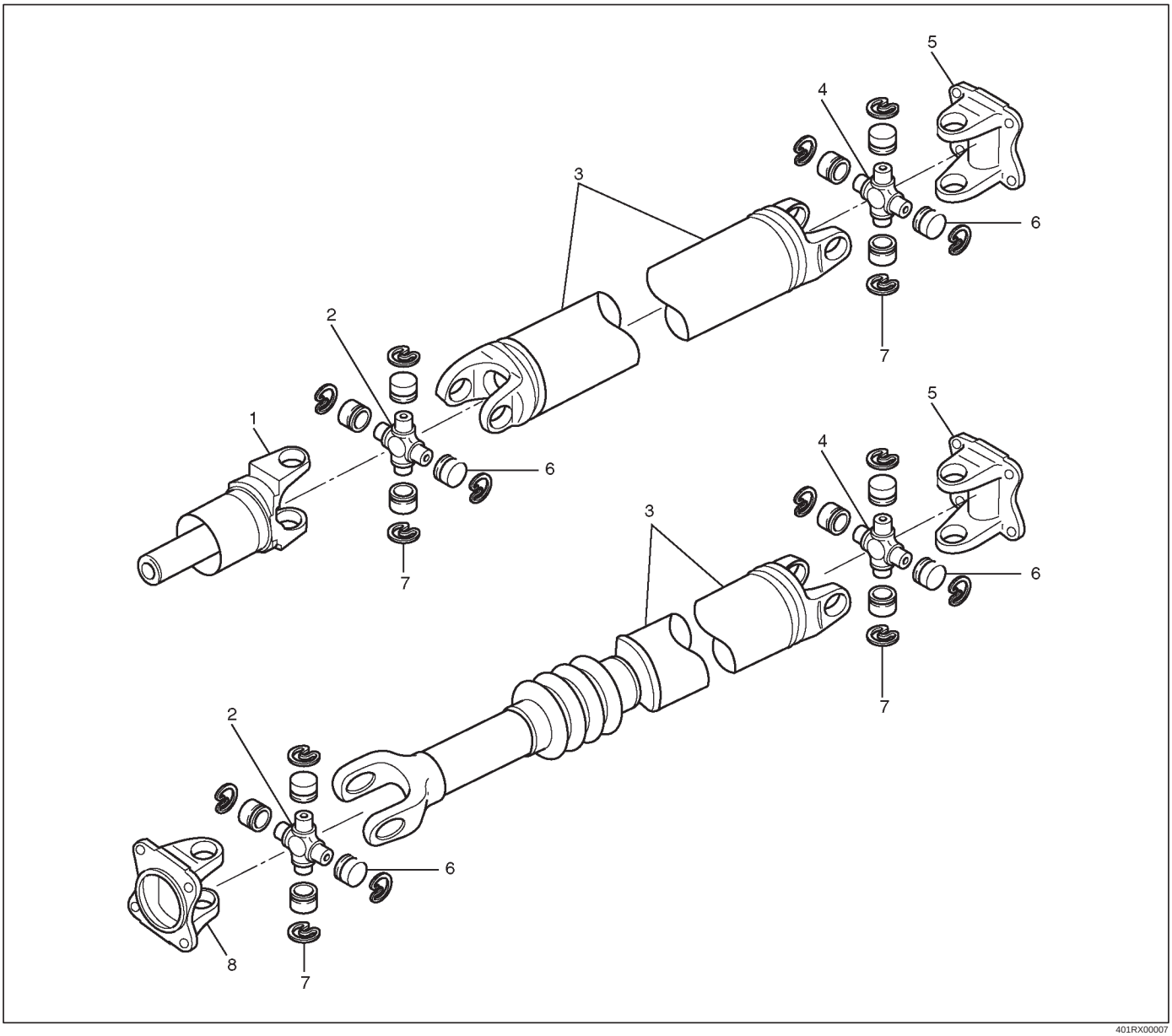
401RX00001

Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position by marking the phasing of the shaft prior to disassembly.
3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the slip yoke assembly from the driveshaft, by securing the boot with one hand and pulling on the slip yoke.
7. Remove the boot from the shaft assembly.

Universal Joint Disassembly



401RX00007

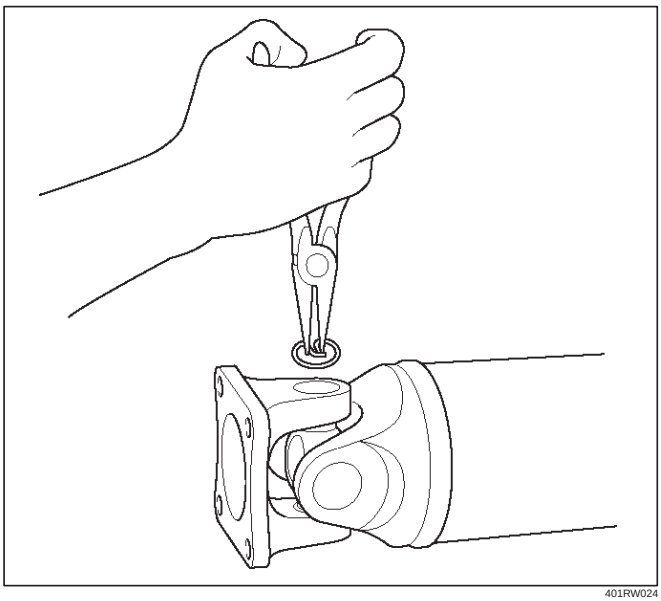
Legend

(1) Spline Yoke
(2) Spider
(3) Propeller Shaft Assembly
(4) Spider
(5) Flange Yoke
(6) Bearing
(7) Snap Ring
(8) Flange Yoke

NOTE: Aluminum is softer than steel. Care must be taken not to remove excessive material or damage bearing holes.

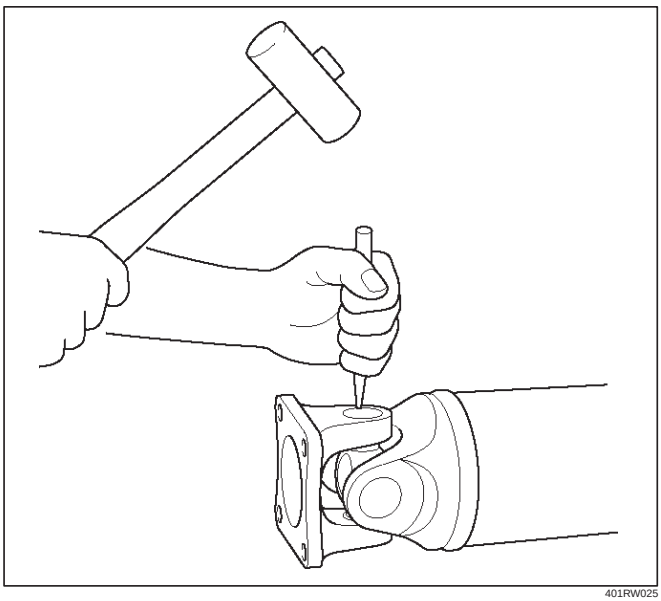
If the vehicle has aluminum tube type propeller shaft, flange yoke, boot kit, journal kit can be replaced. If other parts are damaged, replace propeller shaft as assembly.

1. Apply alignment marks on the yokes of the universal joint, then remove the snap ring.



401RW024

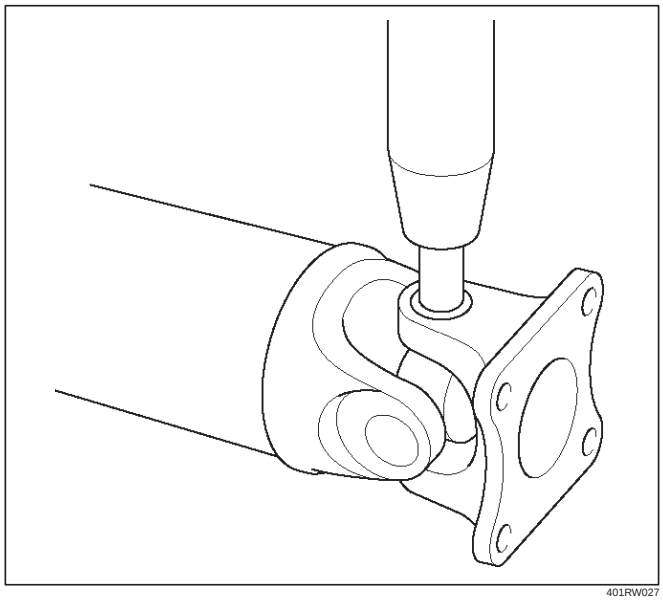
If the snap ring is stuck in position, remove paint from the hole in the yoke or tap around the edge of the bearing lightly with a soft drift.



401RW025

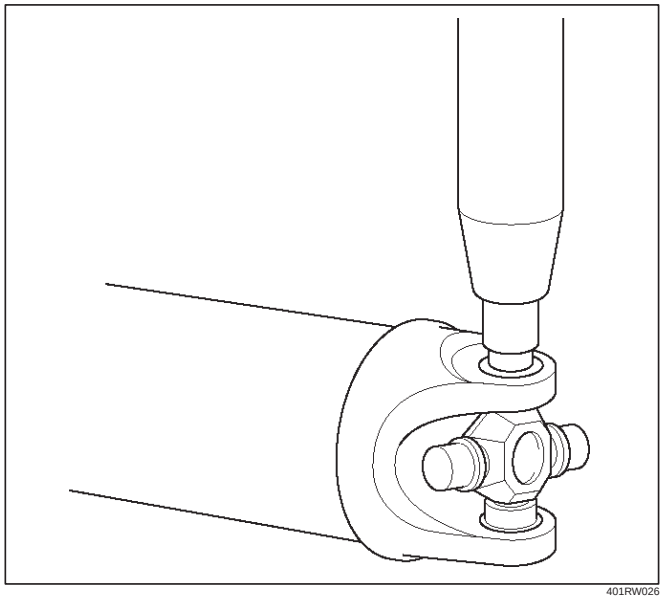
2. Set the yoke in the arbor press with a piece of tube stock beneath it.

   Place a solid plug on the upper bearing and press it through to release the lower bearing.



401RW027

3. If the bearing will not pull out by hand after pressing, tap the base of the lug near the bearing to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open spider hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin it.



401RW026

5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.

Inspection

▼ Propeller shaft for run-out Aluminum tube type.

Static run-out limit : 1.0 mm(0.04 in)

TIR full length of tubing maximum.

(TIR : Total Indicator Reading)

▼ Propeller shaft for runout (Steel tube type).

Static runout limit : 0.13 mm(0.005 in)

TIR on the neck of the slip tube shaft (with a boot).

0.25 mm(0.010 in)

TIR on the ends of the tubing 3 inch from the welds.

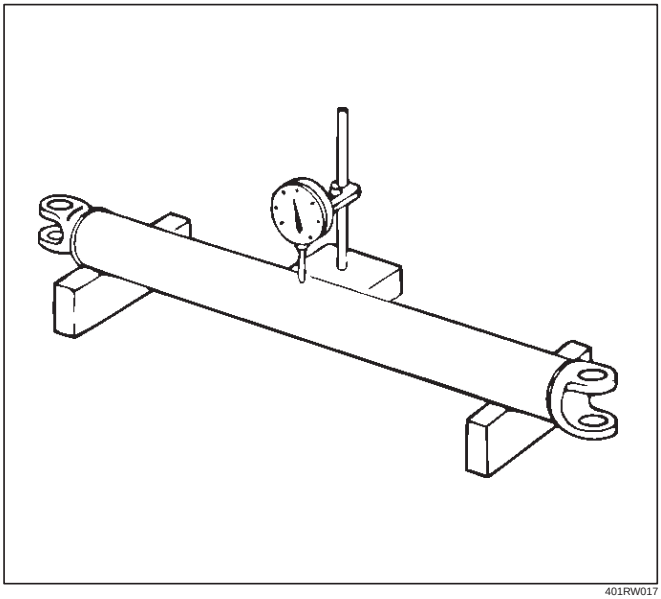
0.38 mm(0.015 in)

TIR at the linear center of the tube.

0.38 mm(0.015 in)

TIR for the full length of tube with 30” or less of tubing.

(TIR: Total Indicator Reading)



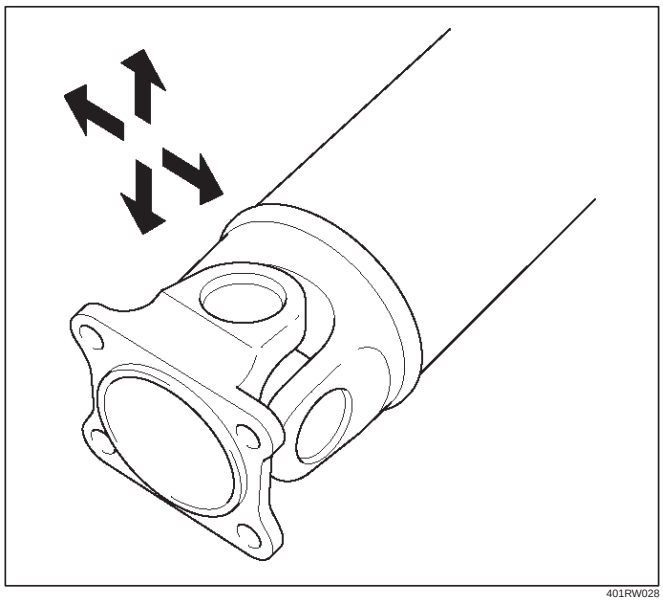
401RW017

▼ Play in universal joint.

Limit: Less than 0.15 mm(0.006 in)

▼ Spider pin should be smooth and free from fretting or galling.

Visible signs of needle presence is normal, but wear should not be felt.

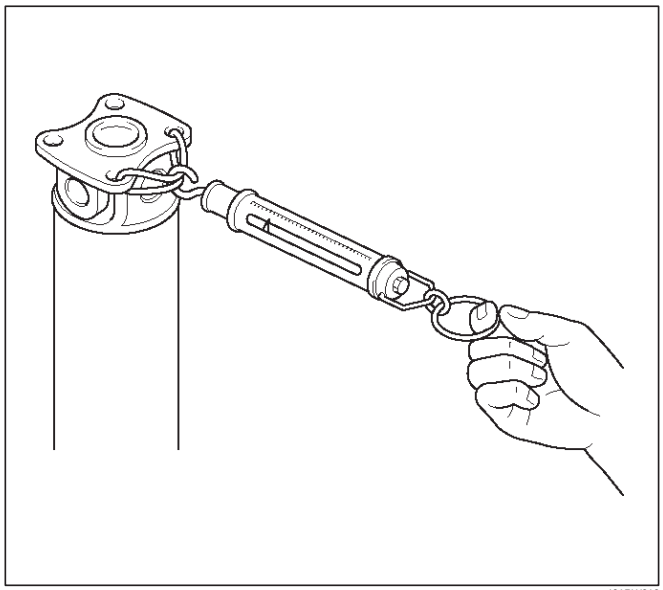


401RW028

▼ Preload of the universal joint.

Preload should be 0 to 49 N (0 to 11.0 lb).

Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



401RW019

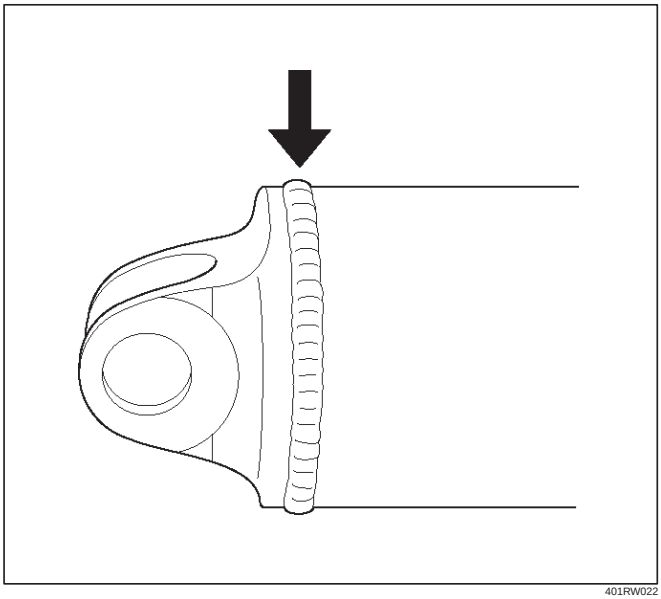
▼ Inspect splines of slip joint for wear.

The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible.

After cleaning the nylon coating spline, the coating should exhibit only slight indication of wear.

Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

▼Aluminum tube type only: Inspect the aluminum tubing for surface scratches and dents. These scratches may not exceed 0.2 mm (0.008 in) in depth.



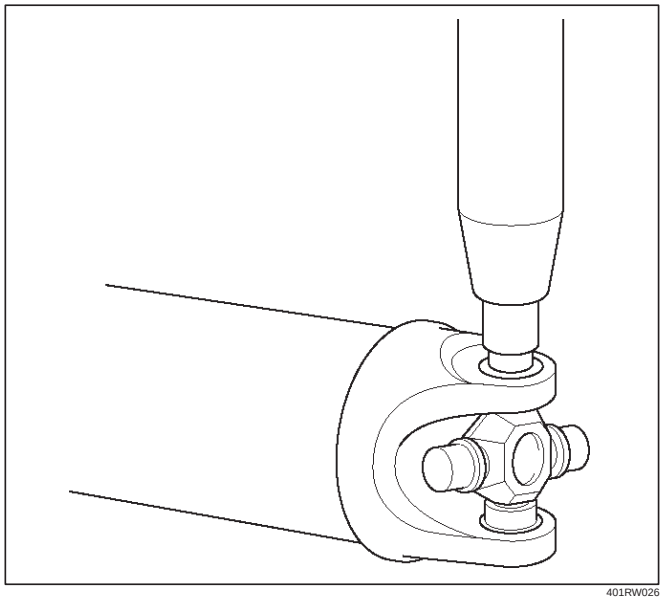
401RW022

▼Aluminum tube type only: Visually inspect the circle welds and fittings for any signs of cracks or signs of deterioration. If there are any cracks that exceed 0.2 mm (0.008 in) in depth, the assembly must be replaced.

▼Aluminum tube type only: Check to be sure there are no missing balance weights. If balance weights are missing and void has occurred in the aluminum tubing greater than 0.2 mm (0.008 in), the assembly must be replaced.

Universal Joint Reassembly

1. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to bearing cup assembly.
2. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole.
   Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install snap ring.



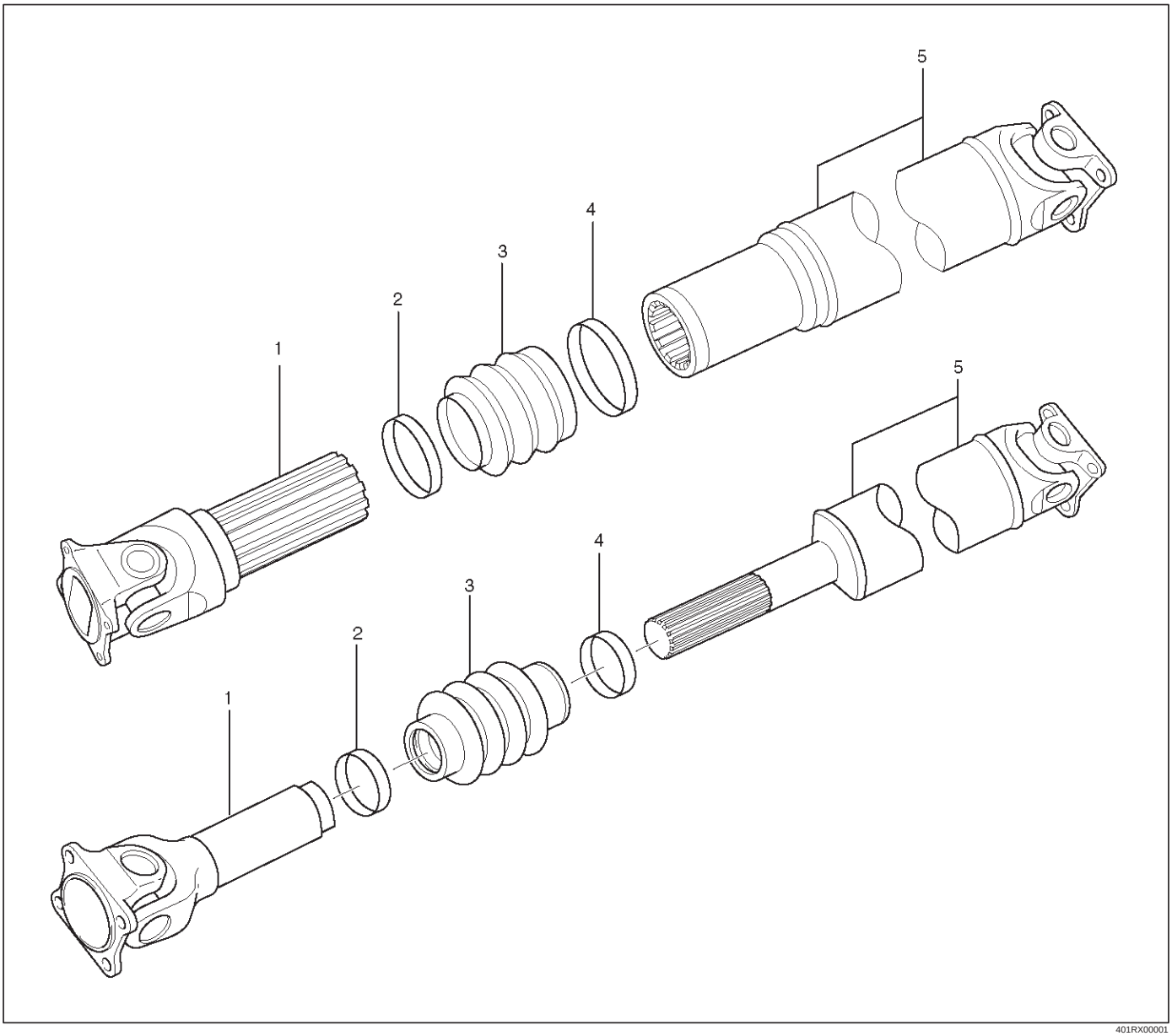
401RW026

3. Install a snap ring.

NOTE: Be sure the snap rings are properly seated in the grooves.

4. Repeat steps 2 and 3 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat the bearing.
5. Align the setting marks and join the yokes.

Slip Joint Reassembly



401RX00001

Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot (smaller diameter side) onto the spline yoke shaft being careful not to damage the spline coating or boot.
4. Insert the spline yoke shaft spline into the tube assembly being careful to maintain proper phasing. The spider holes should be in line as originally marked prior to disassembly.
5. Position boot onto tube and yoke shaft in its assembled position.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

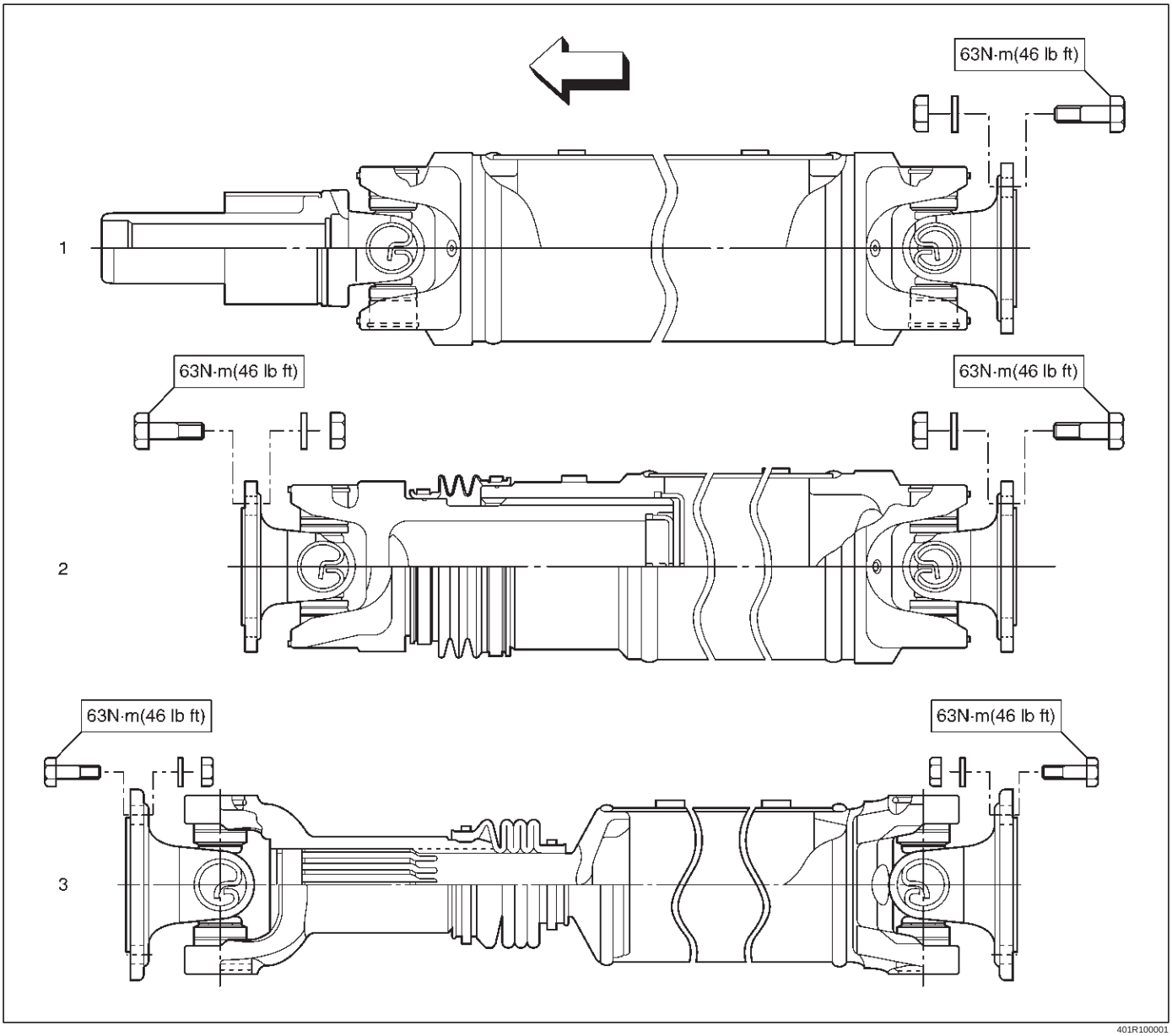
CAUTION: Only use a similar type or same as the original type clamp. Using any other clamp may create an imbalanced shaft or lead to grease leakage.

Main Data and Specifications

General Specifications

	2WD Model				4WD Model	
Engine	Y22SE		6VD1		6VD1	
Transmission	M/T	A/T	M/T	A/T	M/T	A/T
Type (See illustration)	1	2	1	2	2	3
Length between two spiders center)	1314.4mm (51.75in)	1334.7mm (52.55in)	1298.4mm (51.12in)	1323.0mm (52.09in)	1191.2mm (46.9in)	1021.2mm (40.21in)
Universal joint type	Cardan type					

Torque Specifications



AXIOM

DRIVELINE/AXLE

TRANSFER CASE (TOD)

CONTENTS

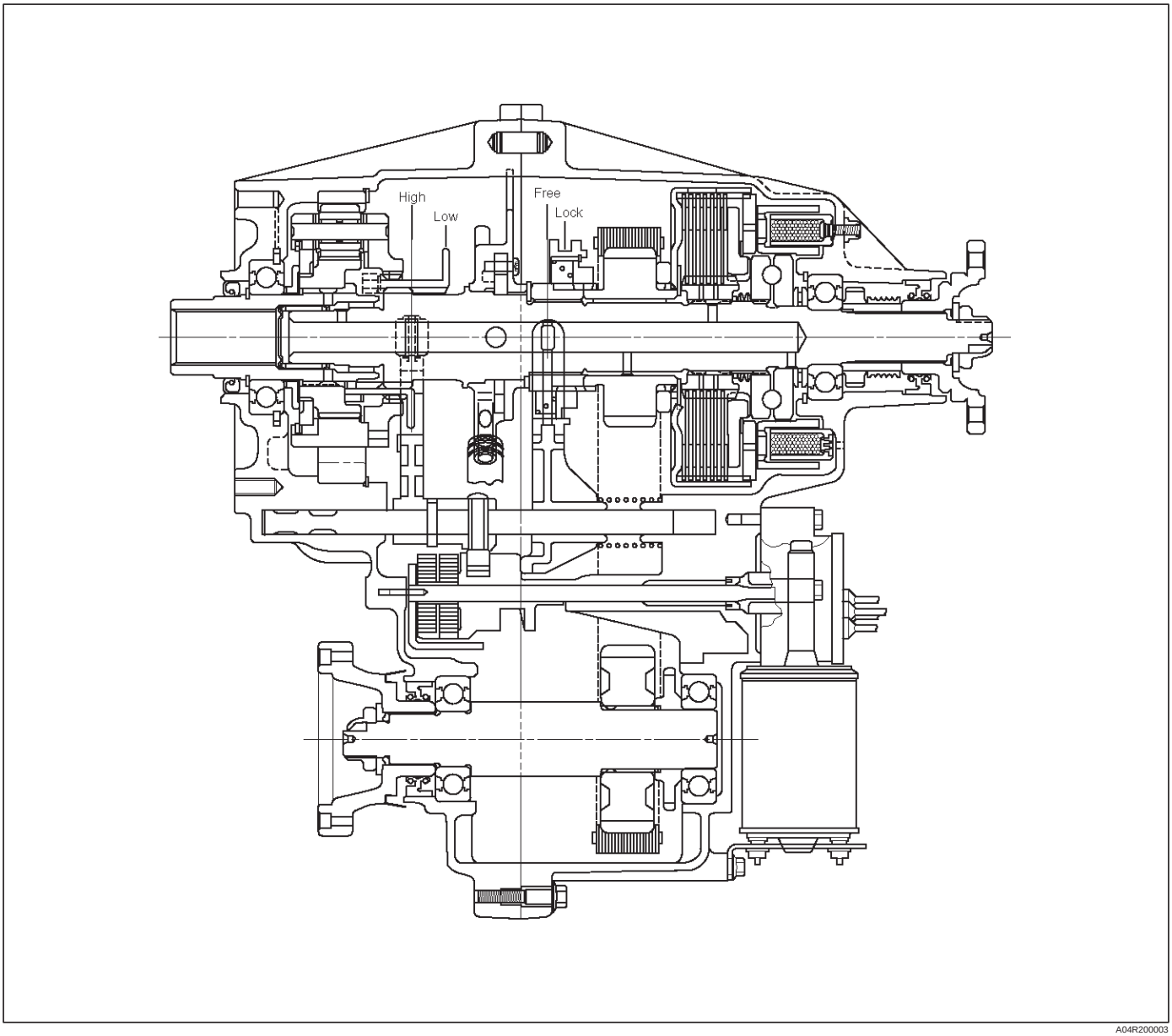
Service Precaution 4D2–1
General Description 4D2–2
Removal and Installation of Tfansfer Case Assembly 4D2–3
Removal 4D2–4
Installation 4D2–4
Transfer Rear Oil Seal 4D2–6
Removal 4D2–6
Installation 4D2–6
TOD Control Unit 4D2–8
Removal 4D2–8
Installation 4D2–8
Unit Repair 4D2–9
Disassembly and Reassembly of Major Components 4D2–9
Disassembly 4D2–10
Reassembly 4D2–10
Transfer Cover Assembly 4D2–13
Disassembly 4D2–13
Inspection and Repair 4D2–14
Reassembly 4D2–15
Clutch Pack and Clutch Cam (Transfer Case Assembly) 4D2–16
Disassembly 4D2–16
Reassembly 4D2–18
Chain, Sprocket and Mechanical Lock (Transfer Case Assembly) 4D2–20
Disassembly 4D2–21
Reassembly 4D2–22
Transfer Case Assembly 4D2–24
Disassembly 4D2–24
Reassembly 4D2–26
Inspection and Repair (Transfer Case Assembly) 4D2–28
Main Data and Specification 4D2–32
General Specification 4D2–32
Torque Specifications 4D2–33
Torque Specifications (Cont'd) 4D2–34
Torque Specifications (Cont'd) 4D2–35
Special Tools 4D2–36

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



A04R200003

The Torque-On-Demand (TOD) is an electronically-controlled torque-split 4-wheel drive system with the following features.

Shifting Between High and Low Ranges

The shifting mechanism consists of the cam and shaft rail assembly, the high/low shift motor and the encoder. The encoder is built-in to the motor.

The encoder senses high/low range shift motor rotation position and sends this data to the TOD control unit. Based on this data, the TOD control unit adjusts motor rotation speed or stops the motor.

The shifting between the high and low ranges using the TOD switch only is possible. The vehicle must be stopped or nearly stopped (vehicle speed less than 2 km/h (1.2 mph) and engine speed less than 1,500 rpm), the automatic transmission selector level must be in the neutral (N) position, and the brakes must be applied.

Electronically-controlled Wet-type Multiple Disc Clutch

The clutch automatically provides the optimum drive power to the front wheels of the vehicle in response to varying road surface conditions when the vehicle is operated in the TOD mode. The delivered power ranges from 0% to 100% of power train output. Superior operational stability is maintained over a wide range of operating conditions.

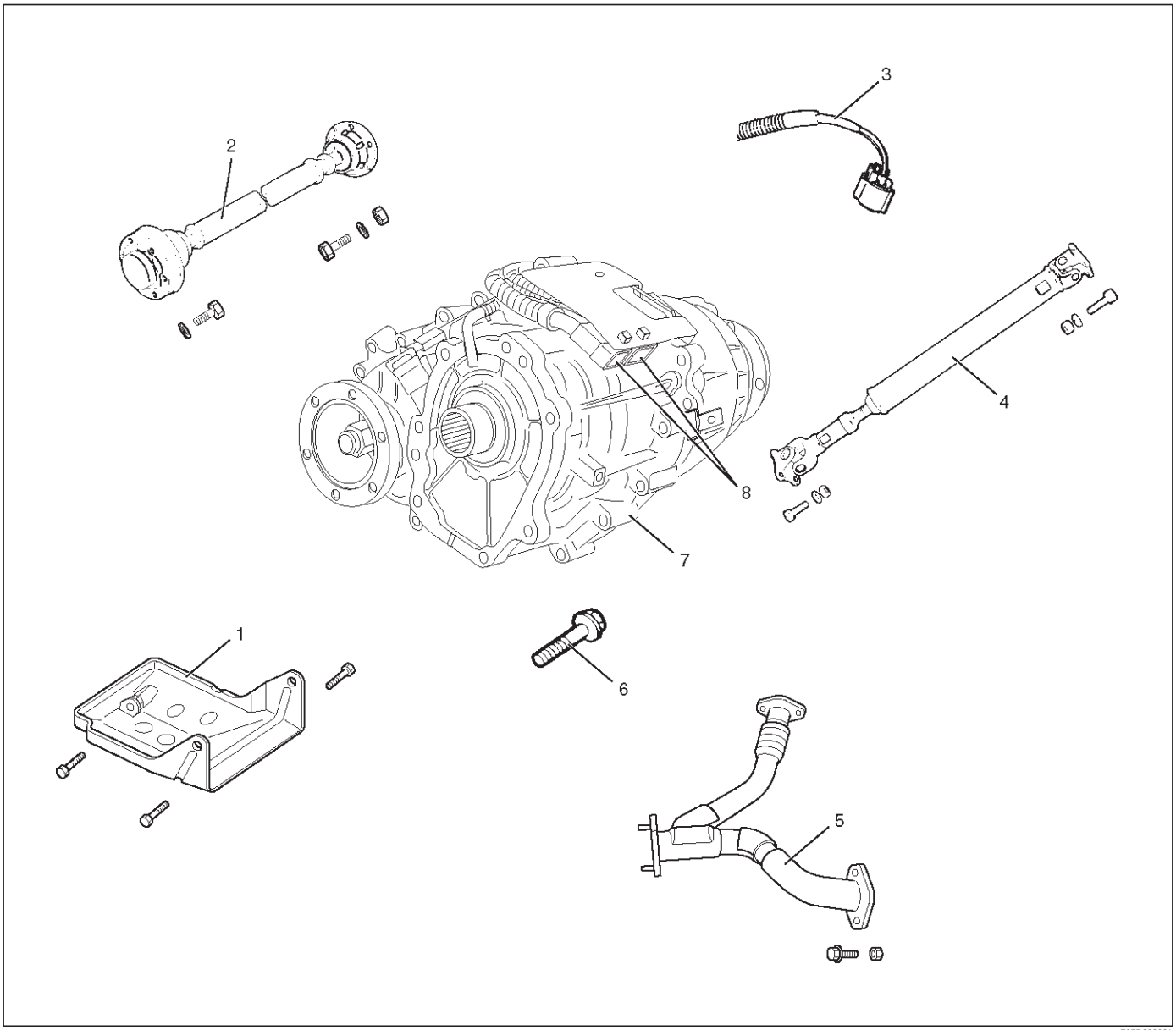
Front Output Drive

Front output drive is provided by a chain. This reduces the loud noise associated with 4-wheel drive operation.

Oil Pump Lubrication

An oil pump is used to lubricate the transfer. This ensures stable multiple-disc clutch operation and maintains the lubricating oil at a constant temperature.

Removal and Installation of Tfansfer Case Assembly



F07R200001

Legend

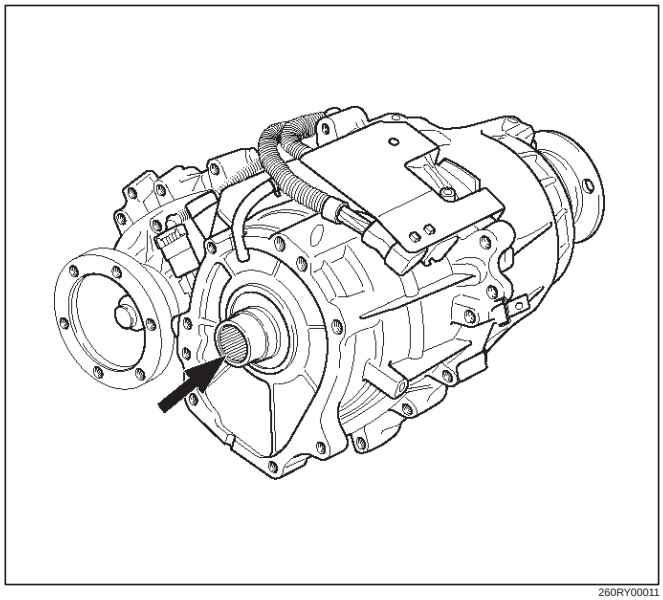
(1) Transfer Protector
(2) Front Propeller Shaft Assembly
(3) Speedometer Sensor Harness Connector
(4) Rear Propeller Shaft Assembly
(5) Center Exhaust Pipe
(6) Transfer Case Bolt
(7) Transfer Case Assembly
(8) Transfer Case Harness Connector

Removal

1. Disconnect the battery ground cable.
2. Remove the transfer protector.
3. Disconnect the rear propeller shaft assembly from the transfer case.
4. Disconnect the front propeller shaft assembly from the transfer case.
5. Remove the center exhaust pipe.
6. Disconnect the speedometer sensor harness connector from the speedometer sensor, and remove the harness clamp from the connector bracket of the transfer case.
7. Disconnect the engine harness connector from the transfer harness connector.
8. Support the transfer case with a transmission jack.
9. Remove the transfer bolts.
10. Remove the transfer case assembly.

Installation

1. Apply grease (Besco L2 or its equivalent) to the input shaft spline.

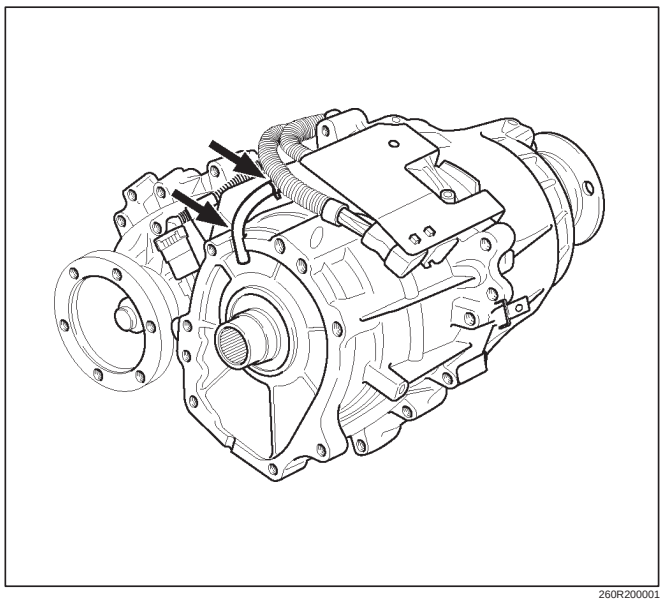


260RY00011

2. Install the transfer case assembly to the transmission assembly.
3. Install the transfer bolts to the specified torque (Refer to *next page*).

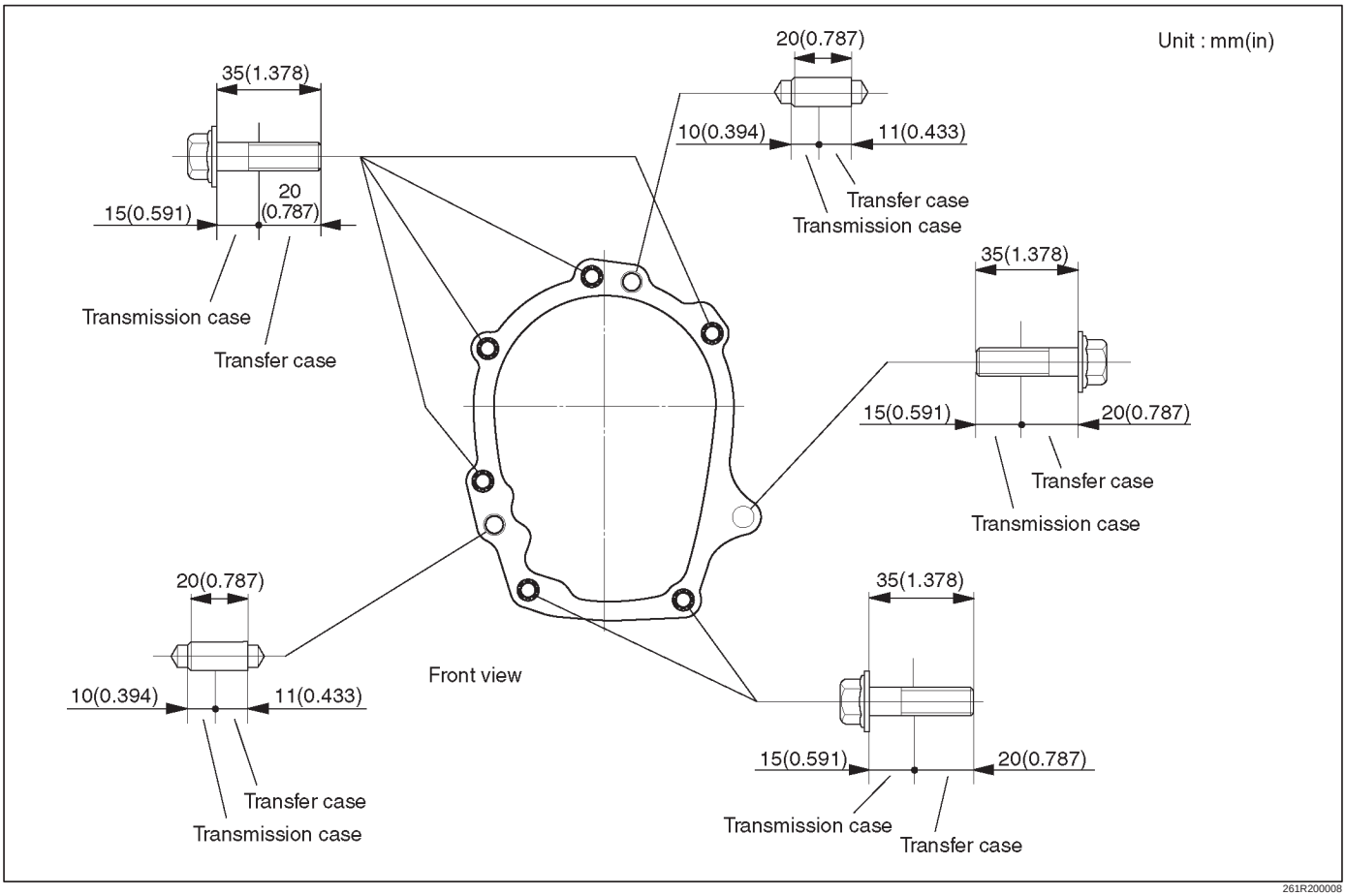
   Torque: 46 N·m (34 lb ft)

4. Connect the engine harness connector to the transfer harness connector.
5. Install the breather hose up to bottom of the transfer case breather and clip them firmly.
6. Securely insert the breather hose into the cutout portion of the transfer case.



260R200001

7. Install the speedometer harness clamp to the connector bracket of the transfer case, and then connect the harness connector to the speedometer sensor.



8. Install the center exhaust pipe.

   Torque: 43 N·m (32 lb ft)

9. Connect the front and rear propeller shaft assembly to the transfer case.

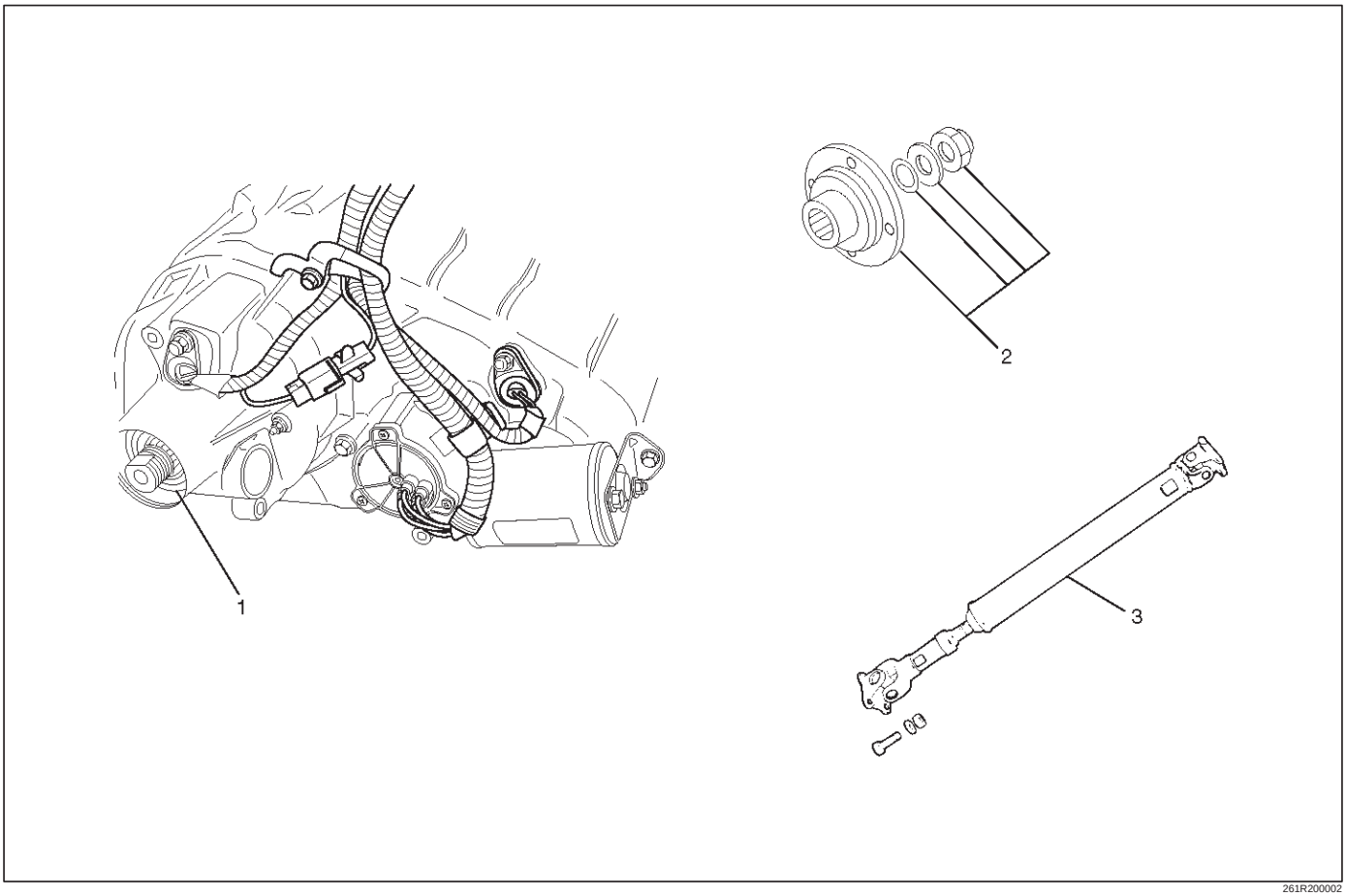
   Torque: 63 N·m (46 lb ft)

10. Install the transfer protector.

    Torque: 37 N·m (27 lb ft)

11. Connect the battery ground cable.

Transfer Rear Oil Seal



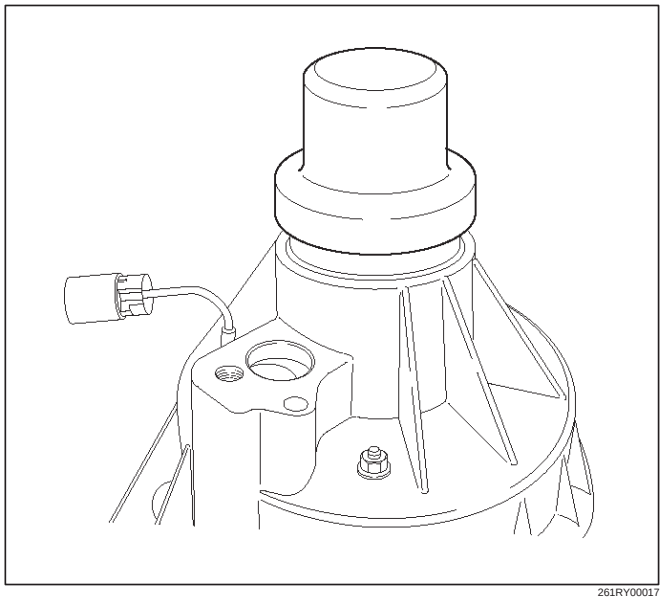
261R200002

Legend

(1) Transfer Rear Oil Seal
(2) End Nut, Washer, Oil Seal and Rear Companion Flange
(3) Rear Propeller Shaft Assembly

Removal

1. Disconnect the rear propeller shaft assembly from the transfer case.
2. Using the flange holder J–8614–11, remove the end nut.
3. Using the universal puller, remove the companion flange, washer and oil seal.
4. Remove the transfer rear oil seal from the transfer case.

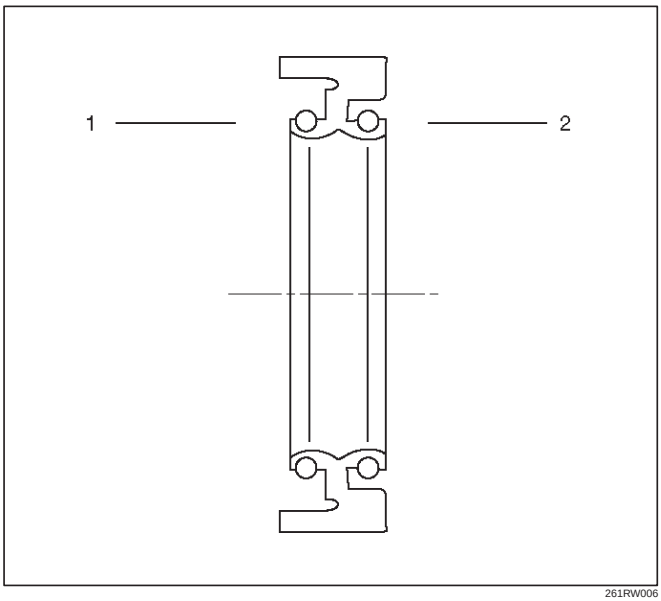


261RY00017

Installation

1. Apply oil to the circumference of the transfer rear oil seal.Fill the oil seal lip with grease (Besco L2 or its equivalent).
2. Using the oil seal installer J–42804, install the transfer rear oil seal to the transfer case.

NOTE: When installing the oil seal, pay attention to the direction.



261RW006

Legend

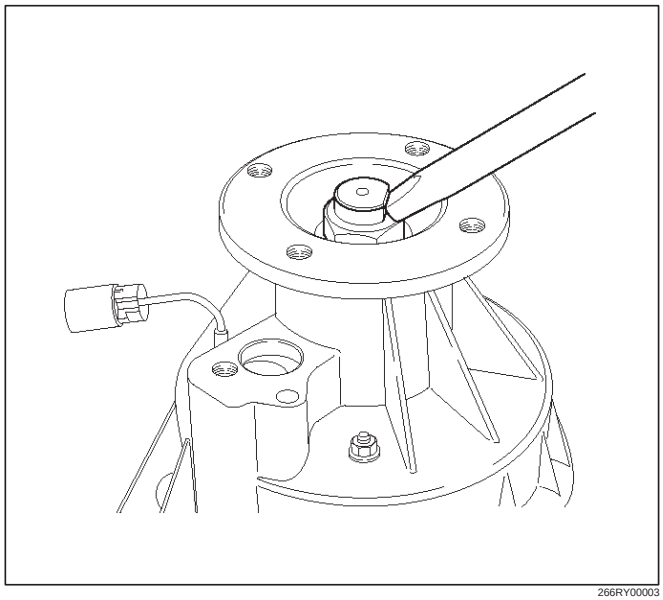
(1) Inside
(2) Outside

3. Install the companion flange.
4. Install the oil seal and washer, and using the flange holder J–8614–11, install the new end nut to the specified torque.

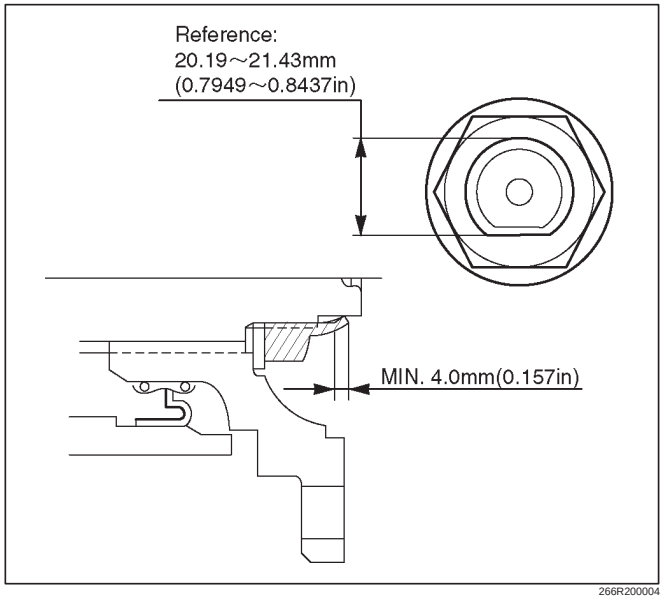
Torque: 167 N·m (123 lb ft)

5. Securely stake the end nut at one spot.

NOTE: Be sure to confirm that there is no clack at the staked portion of the end nut after staking.



266RY00003

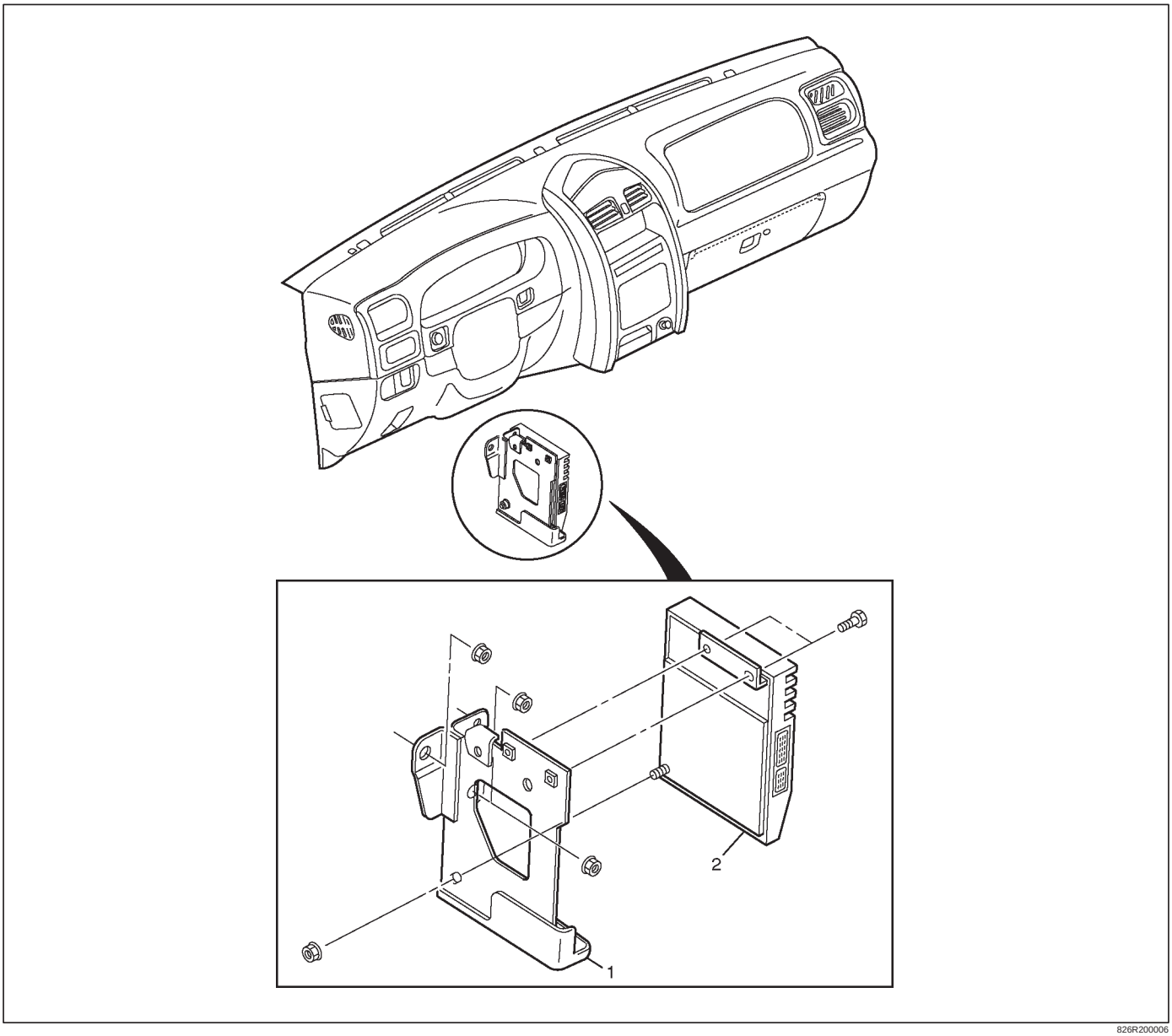


266R200004

6. Connect the rear propeller shaft assembly to the transfer case.

Torque: 63 N·m (46 lb ft)

TOD Control Unit



826R200006

Legend

(1) Bracket
(2) TOD Control Unit

Removal

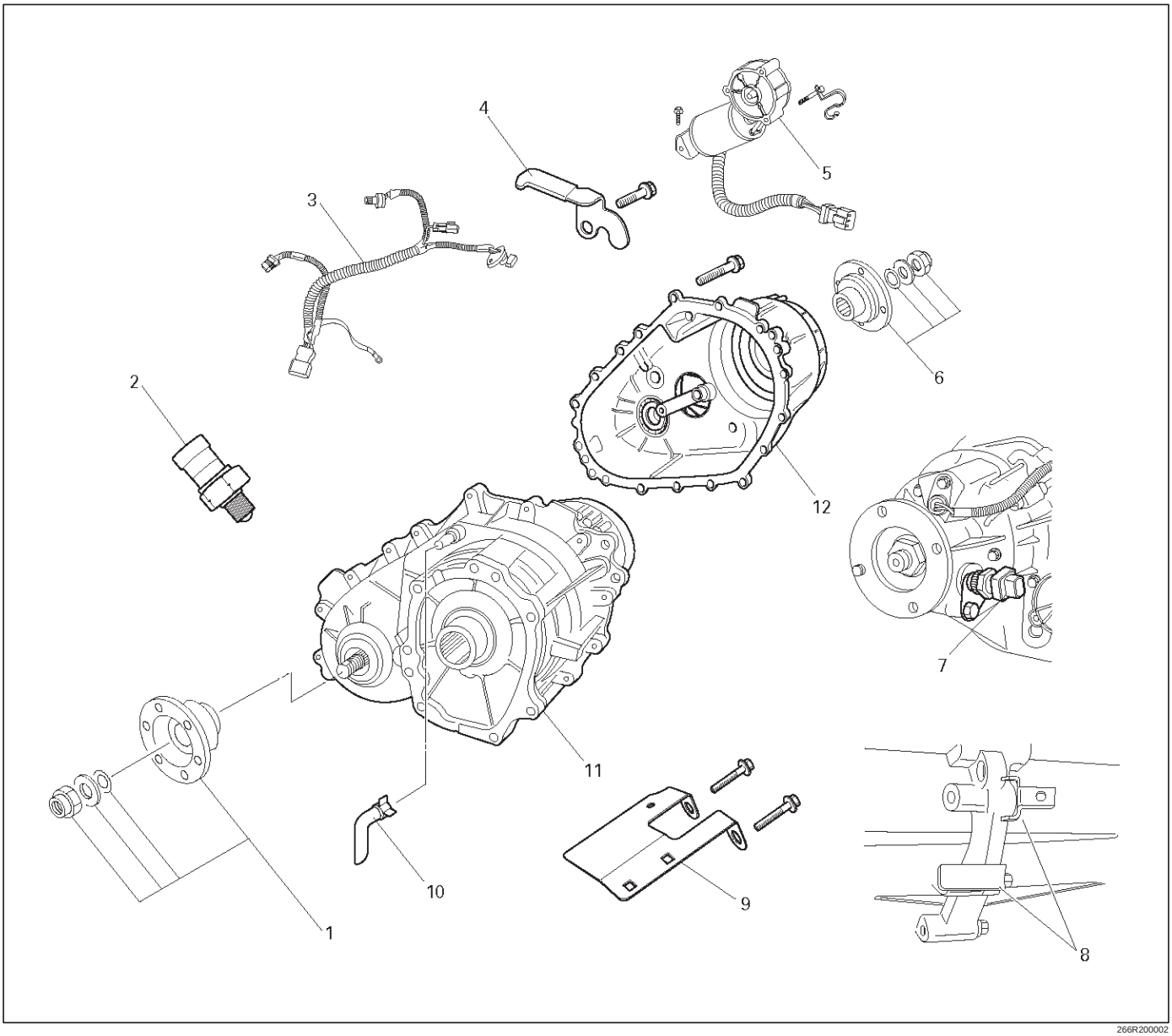
1. Disconnect the battery ground cable.
2. Disconnect the harness connector from the TOD control unit.
3. Remove the bracket retaining nuts (3 pieces) and the bracket with TOD control unit.
4. Remove the TOD control unit from the bracket.

Installation

1. Install the TOD control unit to the bracket.
2. Install the bracket with TOD control unit to the chassis.
3. Connect the harness connector to the TOD control unit.
4. Connect the battery ground cable.

Unit Repair

Disassembly and Reassembly of Major Components



266R200002

Legend

(1) Front Companion Flange, Oil Seal, Washer, and End Nut
(2) 4H and 4L Switch
(3) Harness Assembly
(4) Harness Bracket
(5) Shift Motor Assembly
(6) Rear Companion Flange, Oil Seal, Washer and End Nut
(7) Speedometer Sensor and Driven Gear
(8) Plate and Bracket
(9) Connector Bracket
(10) Breather Hose
(11) Transfer Case Assembly
(12) Transfer Cover Assembly

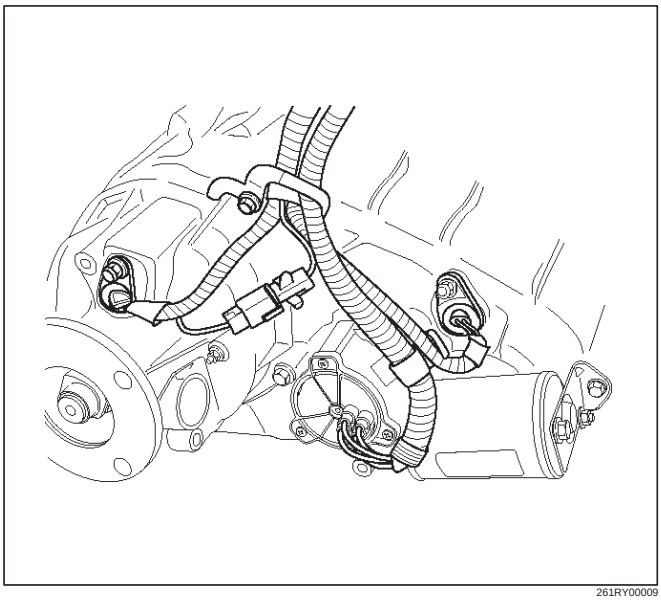
Disassembly

1. Remove the drain plug from the transfer case and drain the oil.
2. Remove the speedometer sensor and driven gear.
3. Remove the front and rear speed sensor of the harness assembly from the transfer cover assembly.

NOTE: Use care to prevent damage to speed sensor when removing speed sensor.

4. Disconnect the clutch solenoid coil, 4H and 4L switch harness connector.

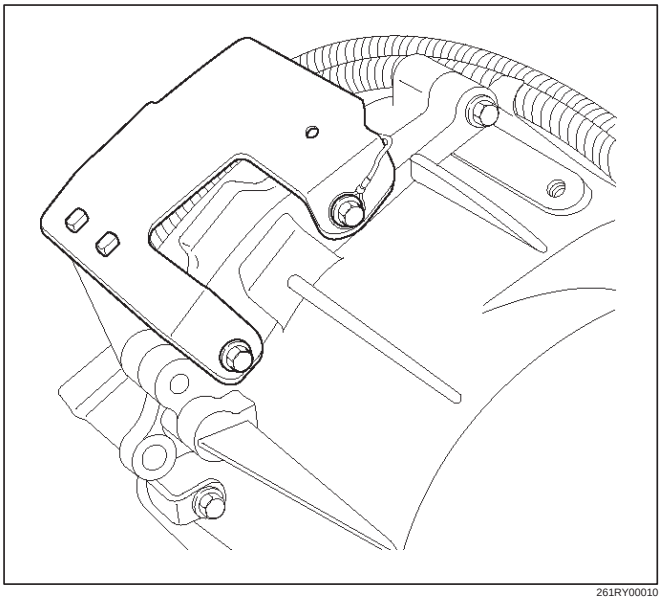
   ▼Remove the harness bracket from the transfer cover.



261RY00009

5. Remove the connector bracket from the transfer case.

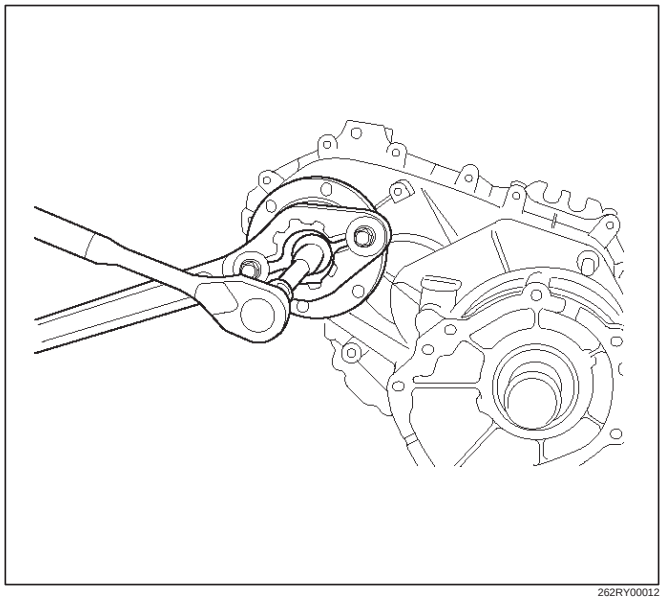
   ▼Remove the harness assembly and shift motor harness connector from the connector bracket.



261RY00010

6. Remove the 4H and 4L switch from the transfer case.
7. Remove the shift motor assembly from the transfer cover.
8. Using the flange holder J–8614–11, remove the end nut.

   Remove the washers, oil seals, front and rear companion flange.



262RY00012

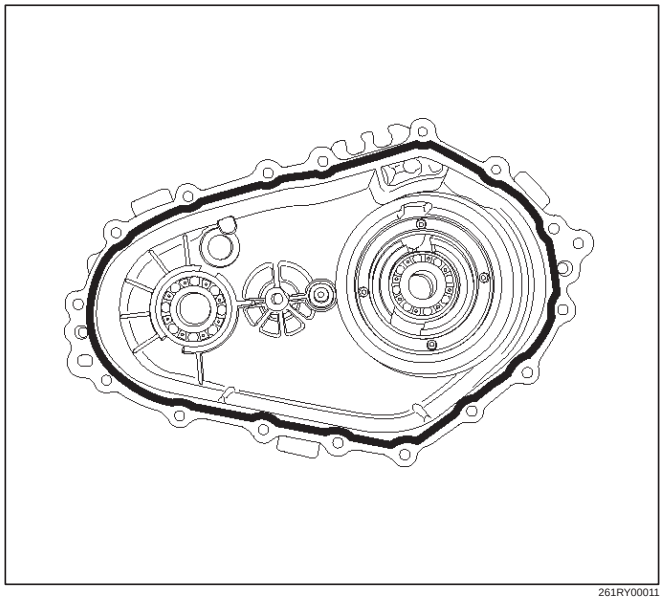
9. Remove the transfer cover retaining bolts and the transfer cover assembly from the transfer case assembly.

NOTE: When removing the transfer cover assembly, use care to prevent damage to oil seal.

10. Remove the breather hose from the transfer case.

Reassembly

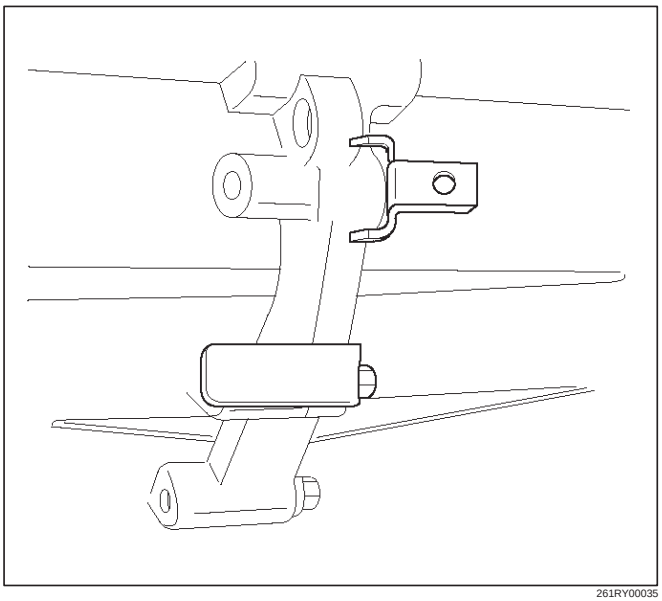
1. Apply recommended liquid gasket (LOCTITE 598 or its equivalent) uniformly to the transfer case and cover fitting surface.



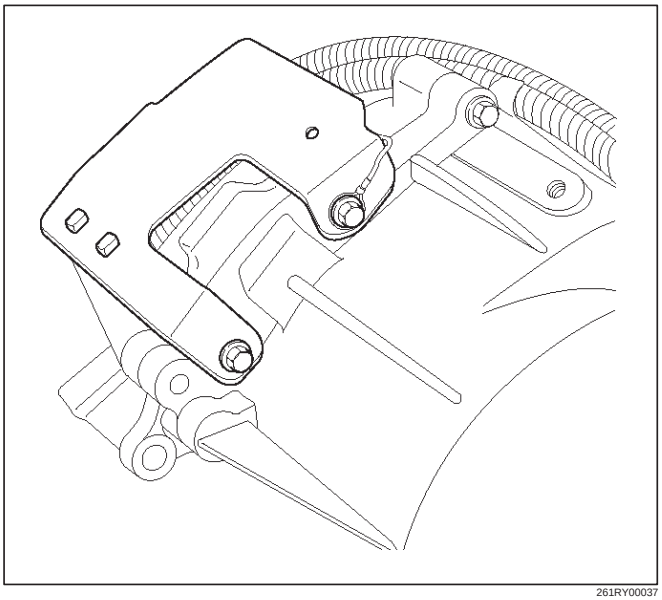
261RY00011

2. Install the plate, bracket, connector bracket and ground cable of the harness assembly, and tighten the transfer cover retaining bolts (16 pieces) to specified torque.

Torque: 31 N·m (23 lb ft)



261RY00035



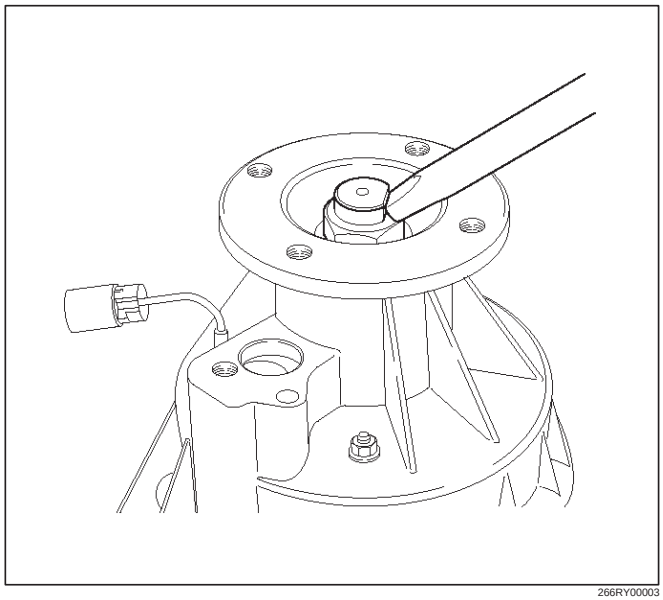
261RY00037

3. Install the front and rear companion flange.
4. Install the oil seal and washer, and using the flange holder J–8614–11, install the new end nut to the specified torque.

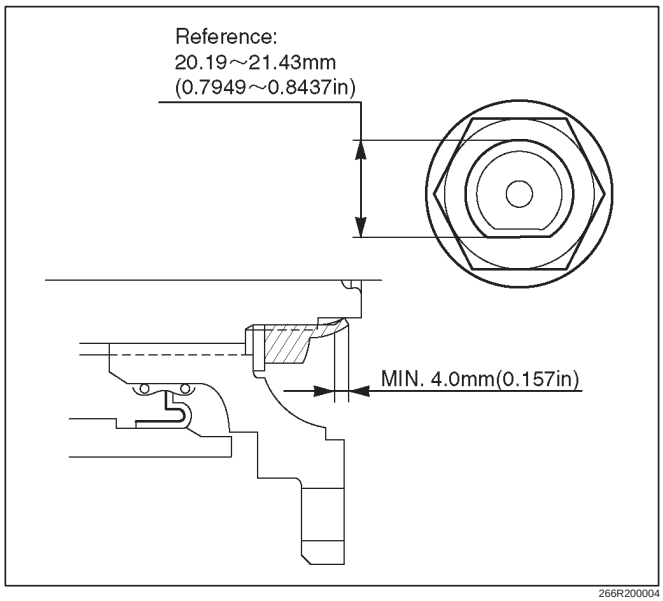
Torque: 167 N·m (123 lb ft)

5. Securely stake the end nut at one spot.

NOTE: Be sure to confirm that there is no clack at the staked portion of the end nut after staking.

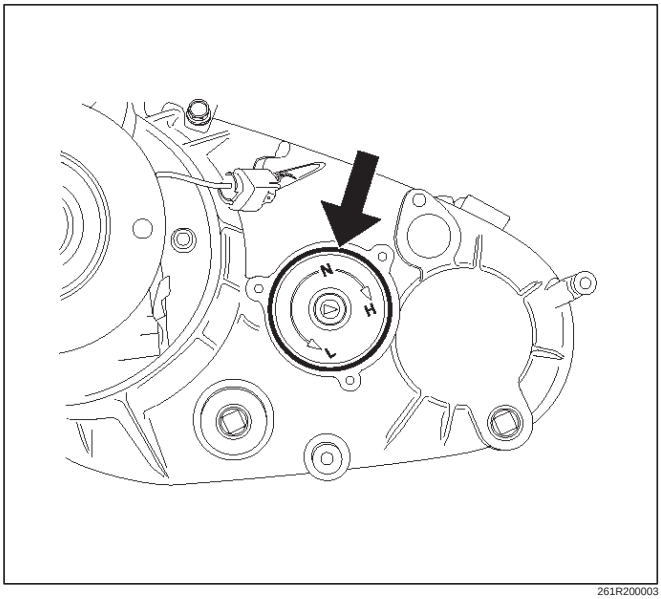


266RY00003



266R200004

6. Apply recommended liquid gasket (LOCTITE 598 or its equivalent) to the transfer cover and shift motor assembly fitting surface.



261R200003

7. Install the shift motor assembly to the transfer cover assembly.

Torque: 10 N·m (87 lb in)

8. Install the 4H and 4L switch.

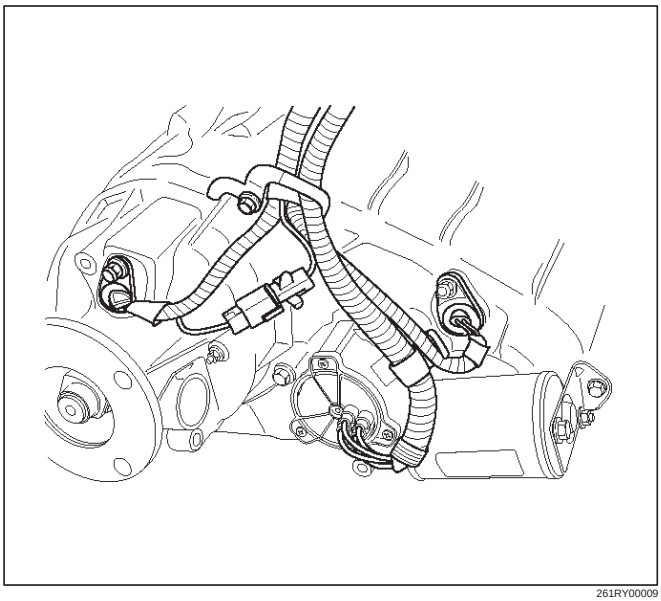
Torque: 24 N·m (17 lb ft)

9. Install the harness assembly and shift motor harness connector to the connector bracket.
10. Install the front and rear speed sensors to the transfer cover.

Torque: 5 N·m (43 lb in)

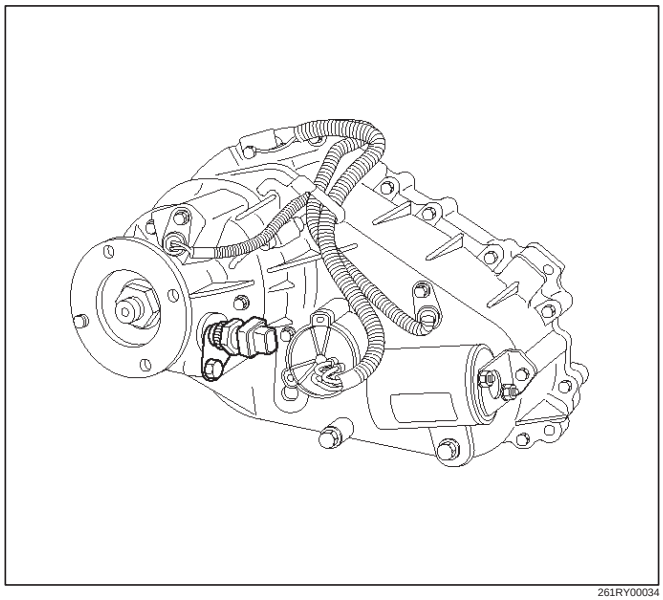
11. Connect the harness assembly connector to the clutch solenoid coil harness connector and 4H and 4L switch.

▼Fix the harness with harness bracket.


261RY00009

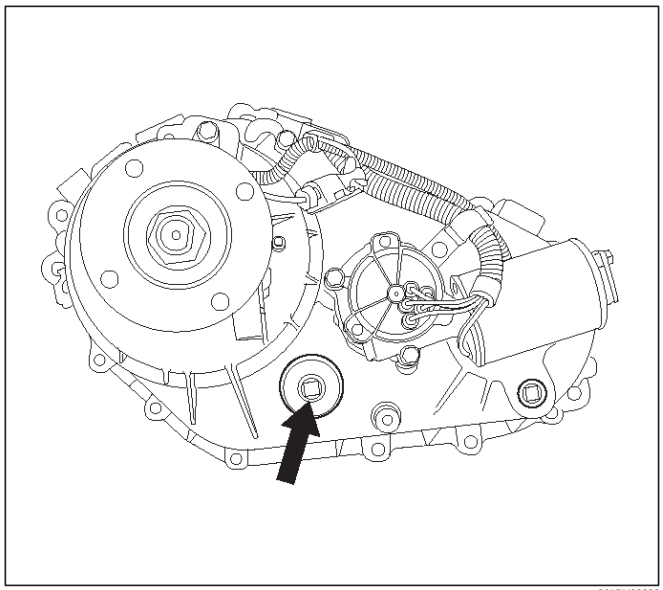
12. Install the driven gear and speedometer sensor to the transfer case.

Torque: 25 N·m (19 lb ft)


261RY00034

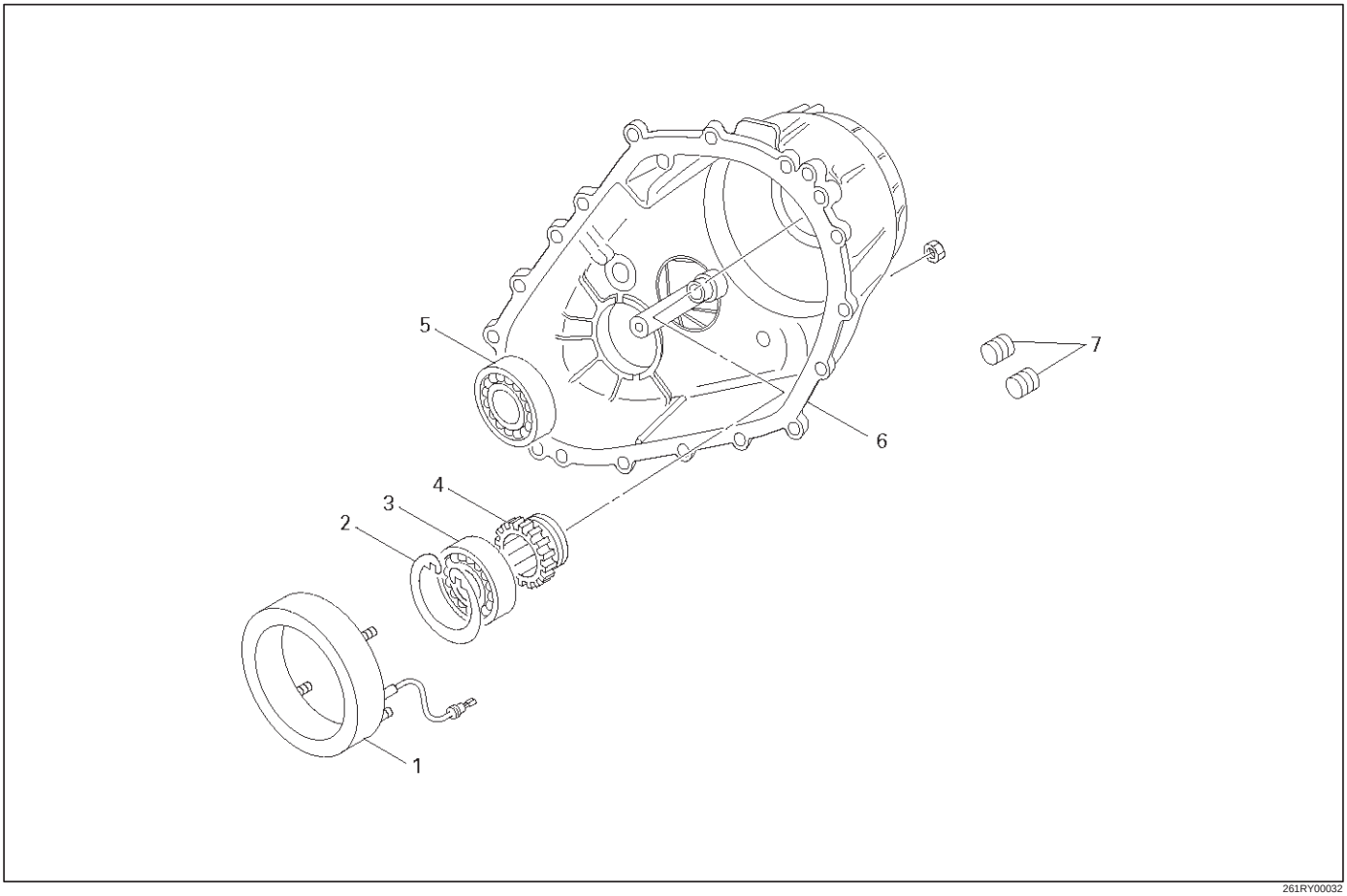
13. Remove the filler plug and fill the transfer case with ATF DEXRON®–II or III.
14. Wind the sealing tape around the filler plug thread and tighten the plug to the specified torque.

Torque: 25 N·m (19 lb ft)


261RY00026

15. Install the breather hose to the transfer case.

Transfer Cover Assembly



261RY00032

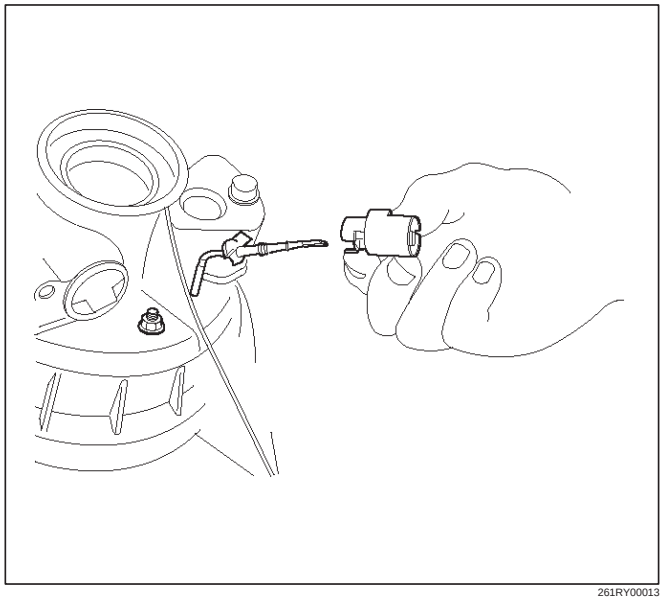
Legend

(1) Coil Assembly
(2) Snap Ring
(3) Ball Bearing
(4) Speed Gear and Tone Wheel
(5) Ball Bearing
(6) Transfer Cover (With Oil Seal)
(7) Oil Drain Plug and Oil Filler Plug

Disassembly

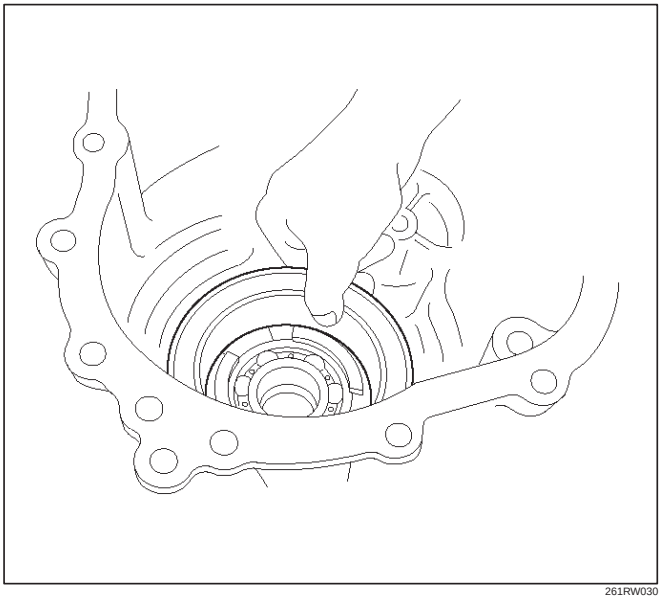
1. Using a precision screwdriver or a suitable tool, push down the lock to unlatch the terminal for the coil assembly, and pull the terminal out.

NOTE: Use care to prevent damage to harness terminal and connector.



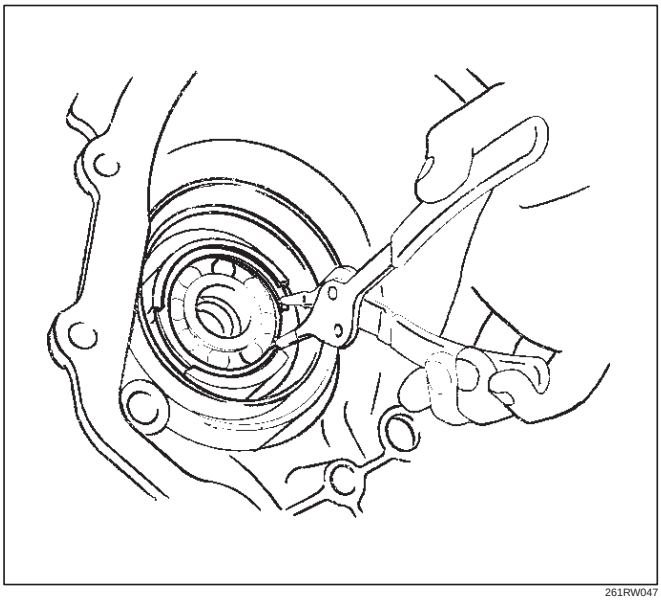
261RY00013

2. Remove the coil assembly set nuts (3 pieces) and coil assembly from the transfer cover.



261RW030

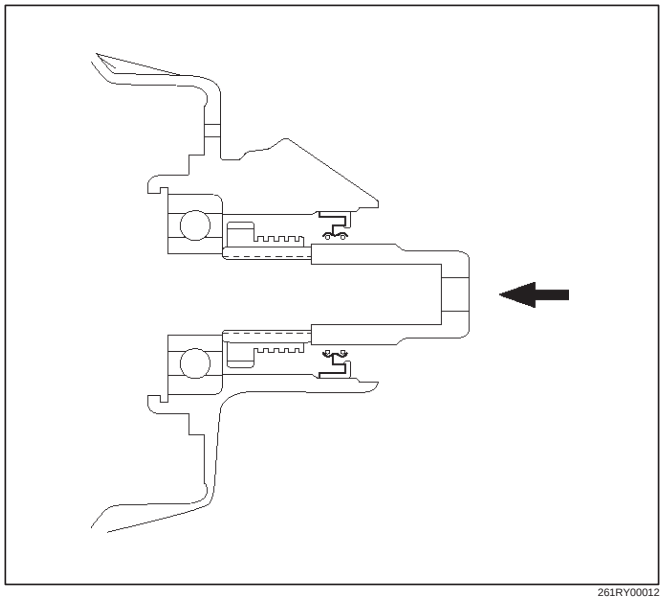
3. Using snap ring pliers, remove the snap ring from the transfer cover.



261RW047

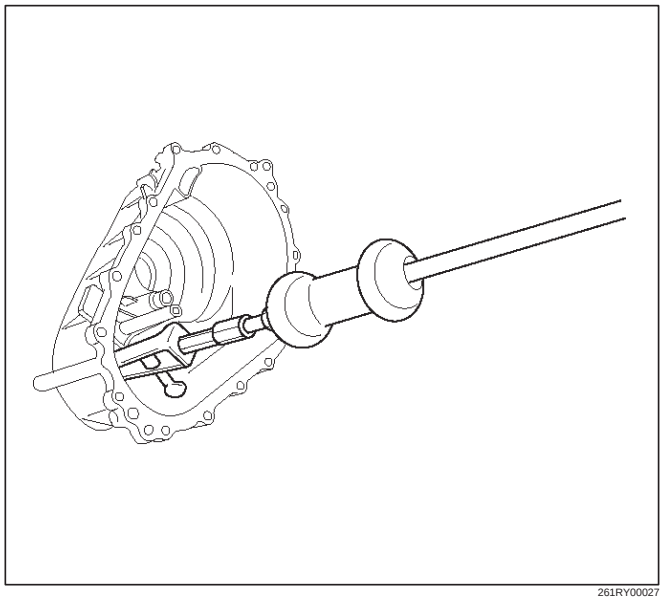
4. Strike the speed gear and tone wheel with a rod or other appropriate tool from the rear side of the transfer cover assembly, and remove the ball bearing, speed gear and tone wheel.

NOTE: Use care to prevent damage to the speed gear teeth.



261RY00012

5. Using the bearing remover J–42805 and slide hammer J–2619–01, remove the ball bearing of the front output shaft from the transfer cover.



261RY00027

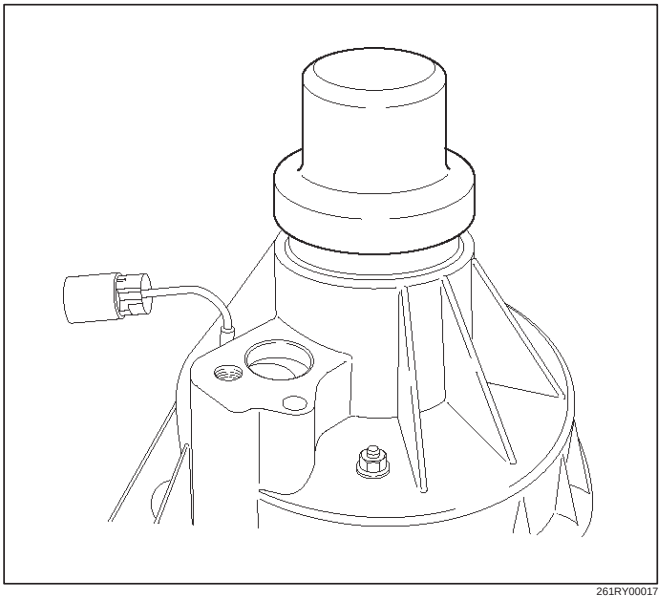
Inspection and Repair

Refer to *"Inspection and Repair (Transfer Case Assembly)" in this section.*

Reassembly

Transfer cover oil seal replacement

1. Remove the oil seal from the transfer cover assembly.
2. Apply oil to the circumference of the new oil seal and fill the lip with grease (BESCO L2 or its equivalent).
3. Using the oil seal installer J–42804, install the oil seal to the transfer cover assembly.

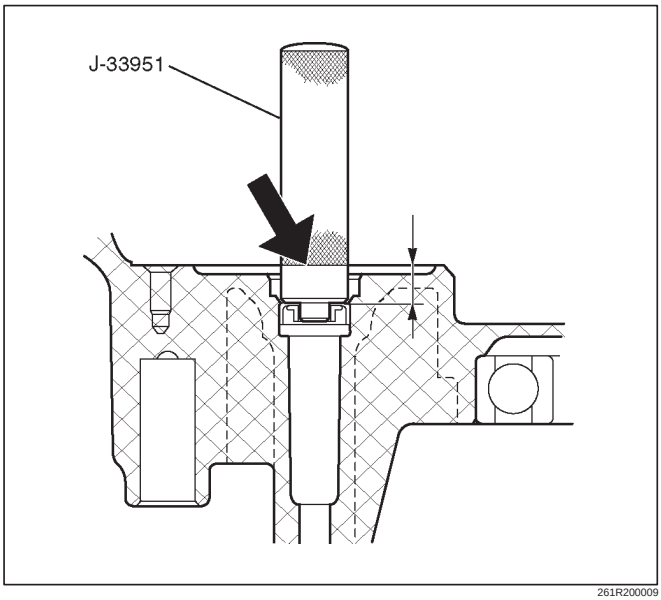


261RY00017

Shift shaft oil seal replacement

4. Remove the oil seal from the transfer cover assembly.
5. Apply oil the circumference of the new oil seal.
6. Using the oil seal installer J–33951, install the oil seal to the transfer cover assembly.
   The drive in depth must be 9.4 ~ 10.4 mm (0.370 ~ 0.409 in). The knurled end of the installer (indicated by the arrow) must be flush with the oil seal installation surface.

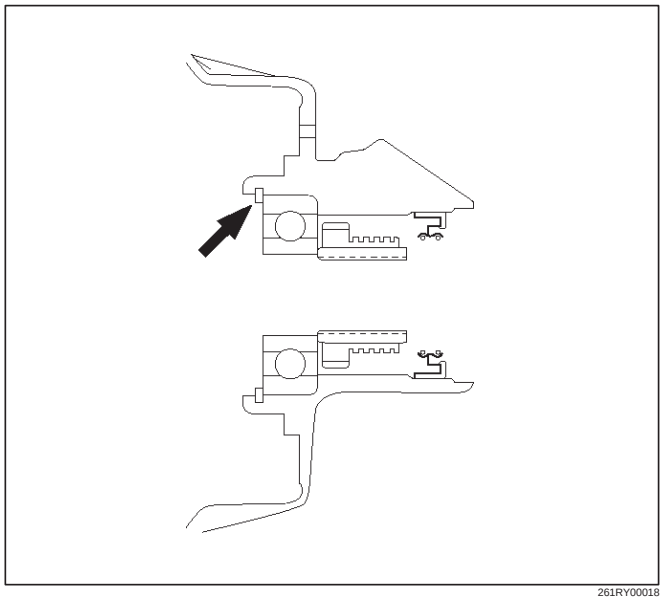
NOTE: Use care to prevent tilt to oil seal when installing oil seal to the case.



261R200009

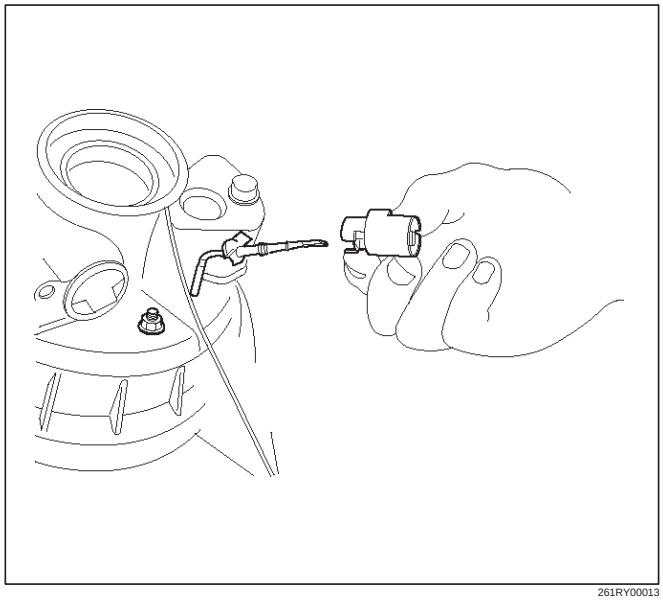
7. Install the ball bearing of the front output shaft to the transfer cover.
8. Install the speed gear and tone wheel.
9. Install the ball bearing to the transfer cover.
10. Using snap ring pliers, install the snap ring to the transfer cover.

NOTE: The snap ring must be fully inserted into the transfer cover snap ring groove.



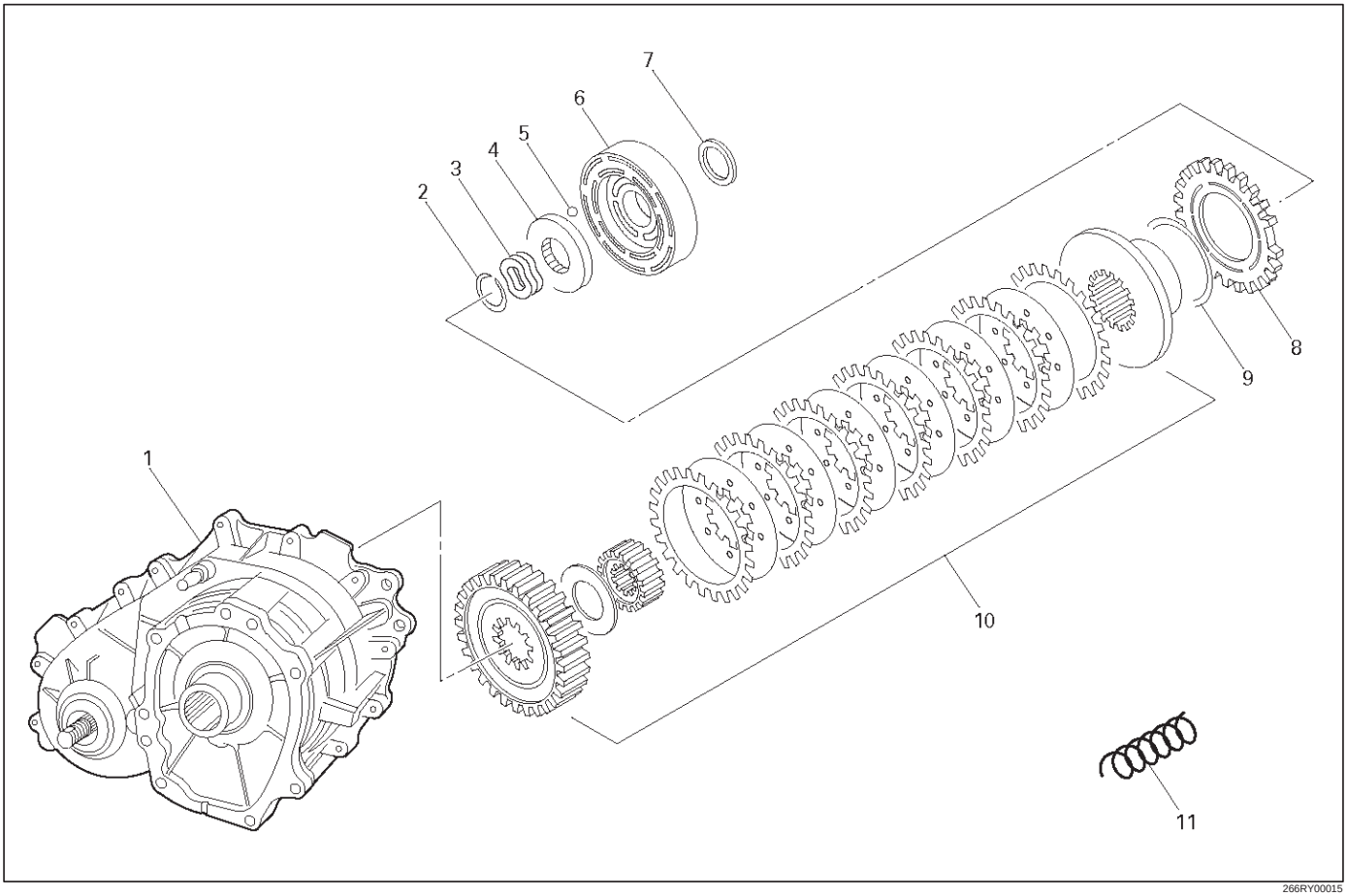
261RY00018

11. Install the coil assembly to the transfer cover and tighten the set nuts (3 pieces) to the specified torque.
    Torque: 10 N·m (87 lb in)
12. Install the connector to the harness terminal of the coil assembly.



261RY00013

Clutch Pack and Clutch Cam (Transfer Case Assembly)



266RY00015

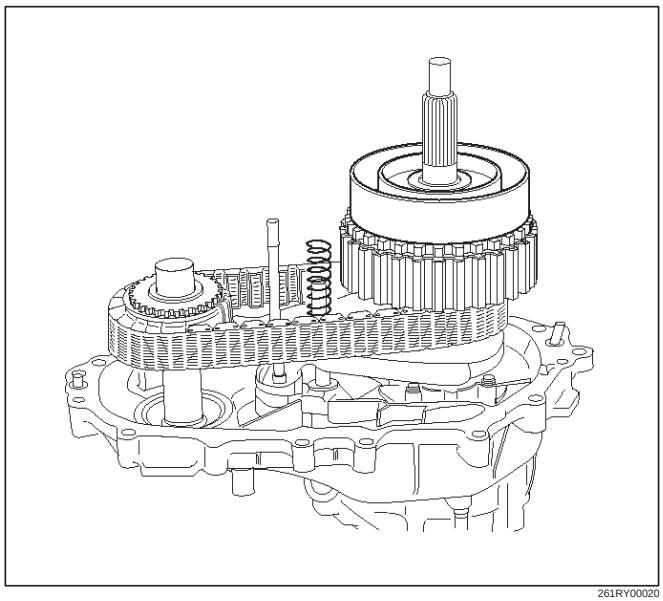
Legend

(1) Transfer Case Assembly
(2) Snap Ring
(3) Wave Spring
(4) Cam Pulley
(5) Cam Ball
(6) Cam and Coil Housing Assembly
(7) Thrust Bearing
(8) Armature Plate
(9) Insulator Washer
(10) Clutch Pack Assembly
(11) Lockup Fork Spring

Disassembly

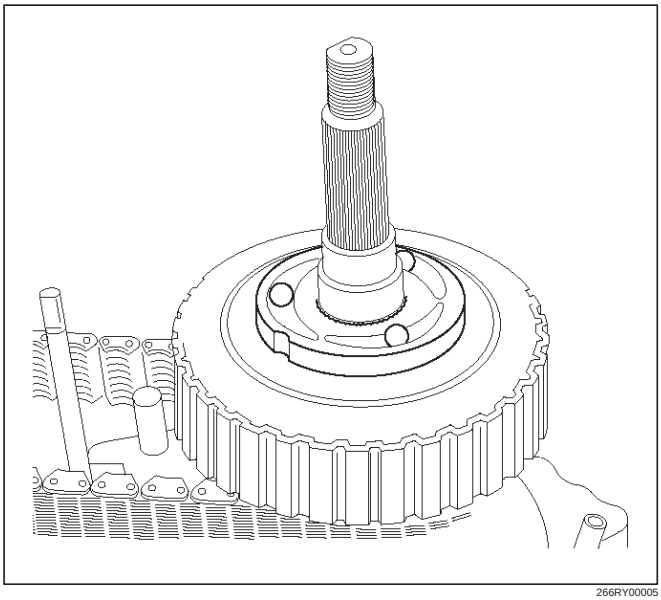
1. Remove the lockup fork spring.
2. Remove the thrust bearing and cam and coil housing assembly from the output shaft.

NOTE: When the cam and coil housing assembly is removed, the cam balls may be detached together with the housing. Pay attention not to lose the ball.



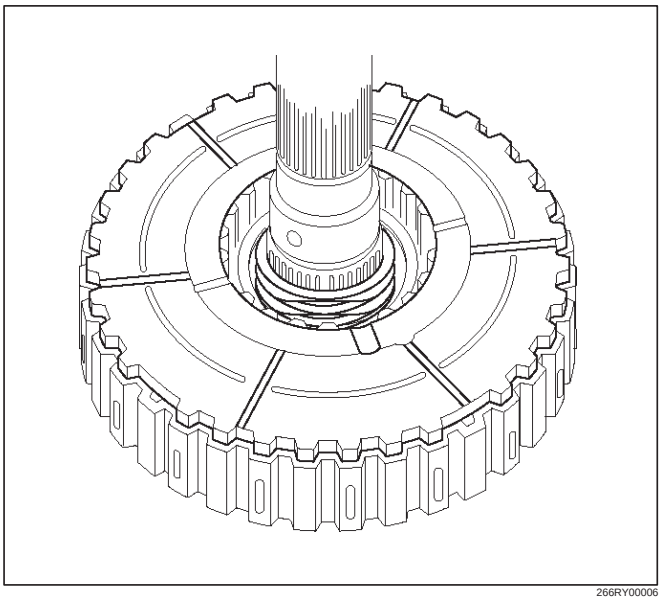
261RY00020

3. Remove the cam ball (3 pieces).
4. Remove the cam pulley.



266RY00005

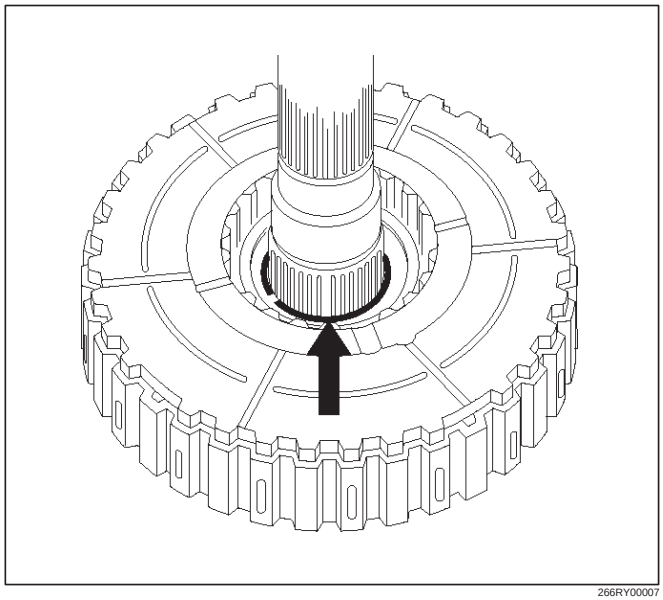
5. Remove the wave spring.



266RY00006

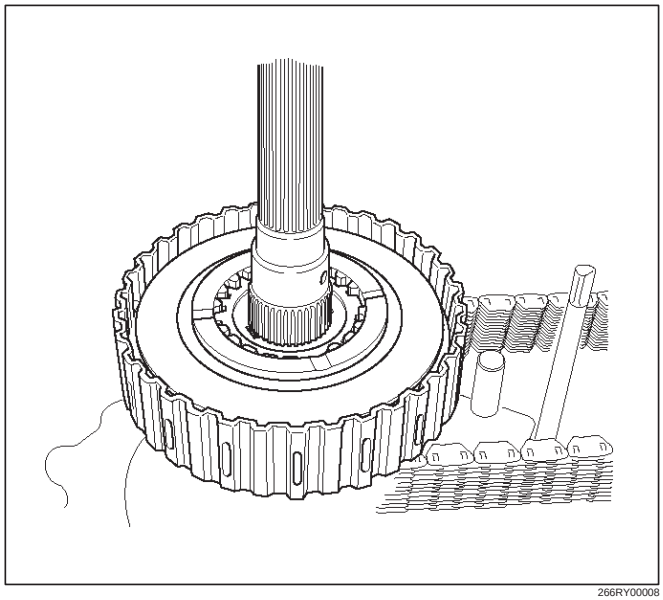
6. Using snap ring pliers, remove the snap ring.

NOTE: Use care to prevent damage to snap ring.



266RY00007

7. Remove the armature plate, insulator washer and clutch pack assembly as a package.



266RY00008

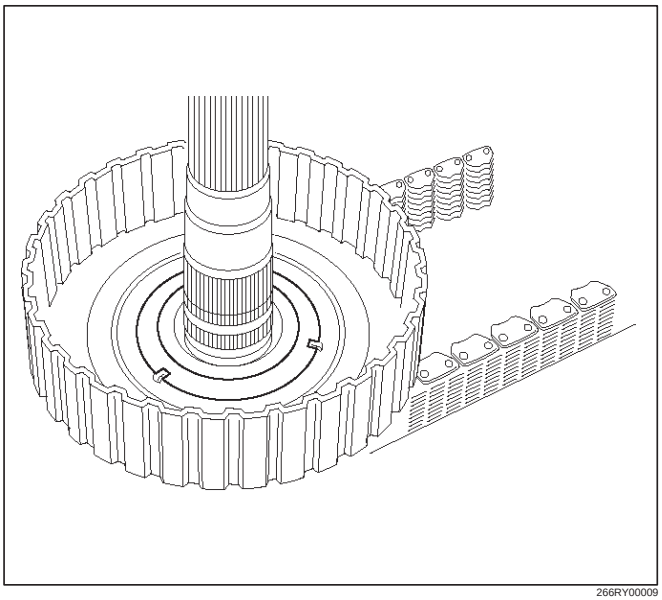
Reassembly

1. Install the clutch pack assembly which the multi clutch plate is orderly installed to the output shaft.

NOTE:

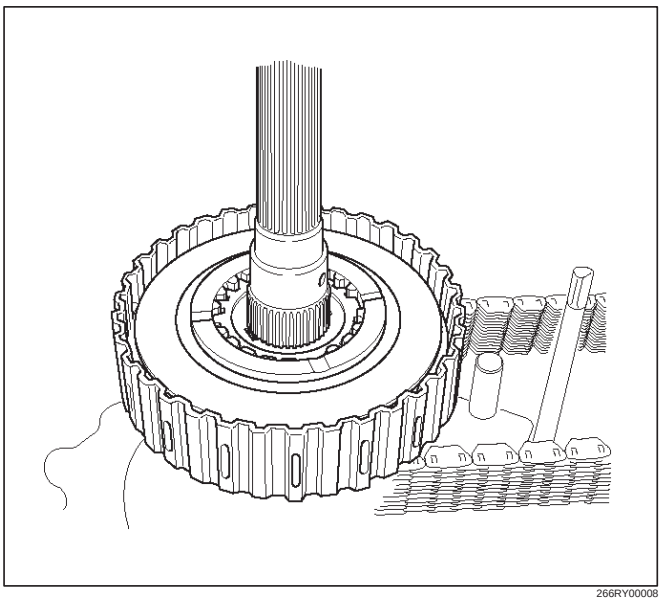
▼ Install the clutch pack assembly while adjusting the phase of both the clutch housing and drive sprocket.

▼ During installation, the plate of the clutch pack assembly may slide out of this fixed position (the correct position is shown in the illustration). If this occurs, remove all of the clutch plates of the clutch pack assembly and reinstall them to their correct position.



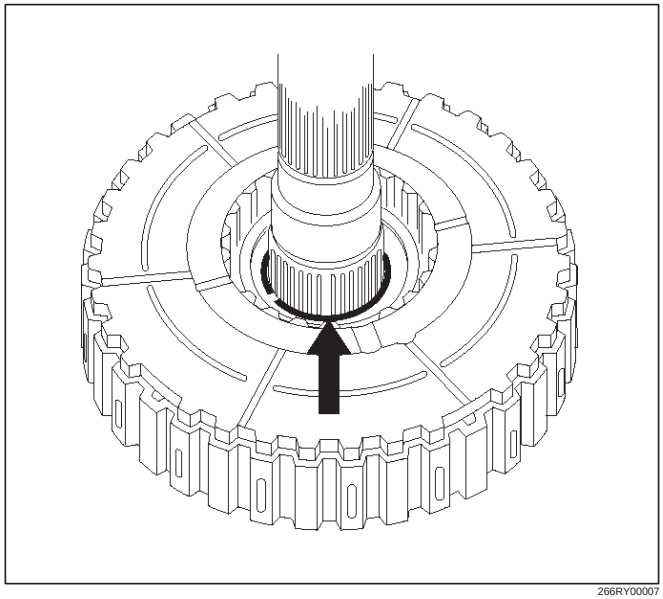
266RY00009

2. Install the insulator washer and armature plate to the clutch pack assembly.



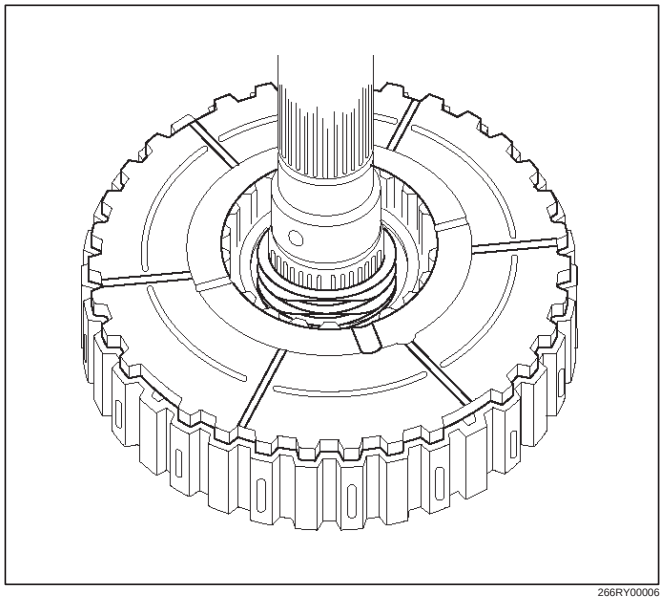
266RY00008

3. Using snap ring pliers, install the snap ring to the output shaft.



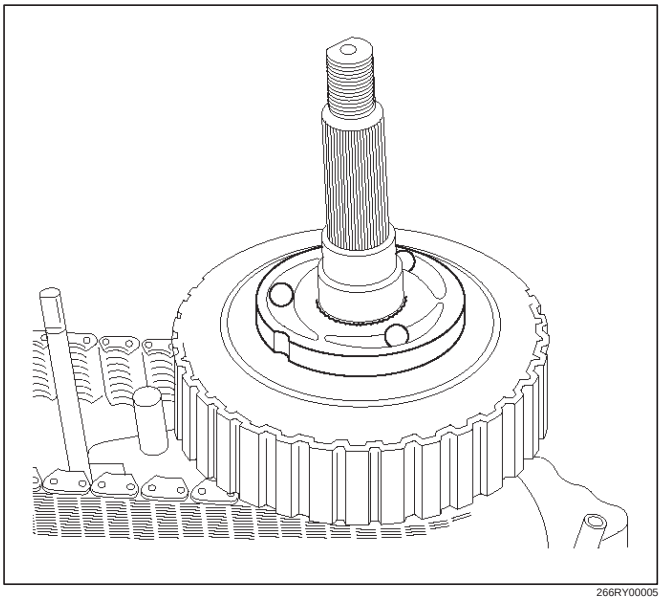
266RY00007

4. Install the wave spring to the output shaft.



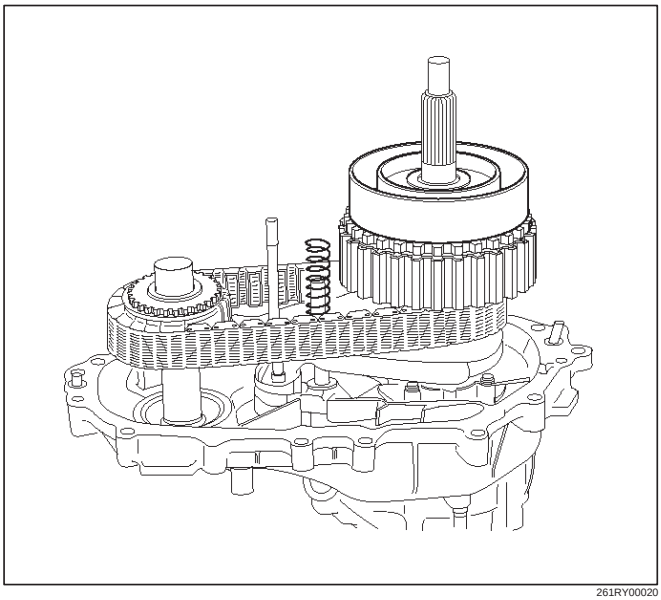
266RY00006

5. Install the cam pulley.
6. Place a ball on each groove of the cam pulley.



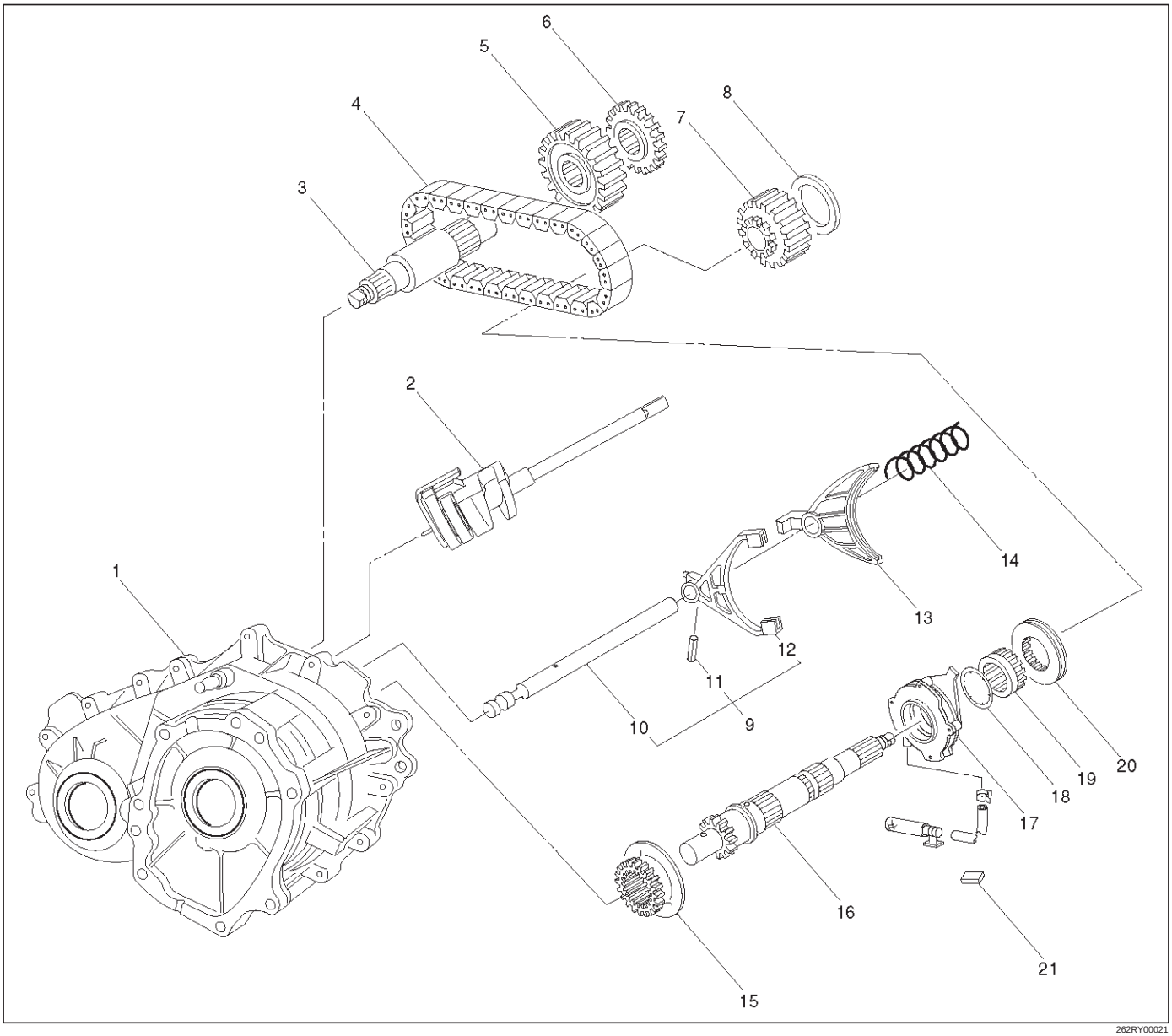
266RY00005

7. Install the cam and coil housing to the output shaft.
8. Install the thrust bearing.
9. Install the lockup fork spring.



261RY00020

Chain, Sprocket and Mechanical Lock (Transfer Case Assembly)



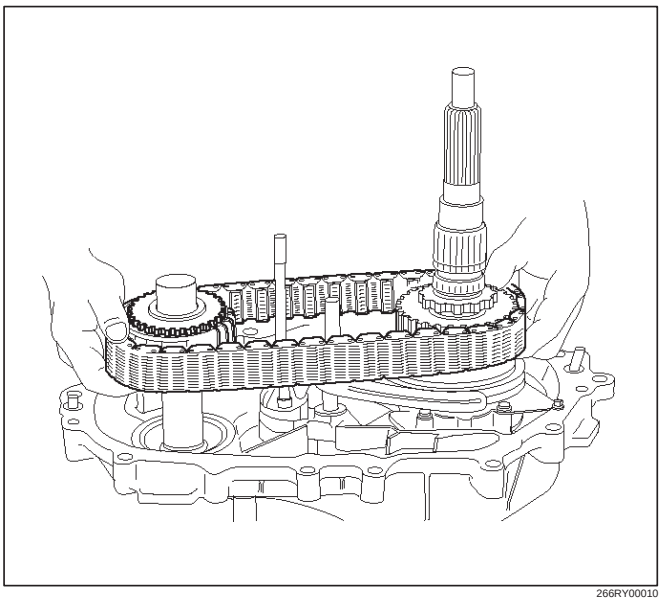
262RY00021

Legend

(1) Transfer Case Assembly
(2) Cam and Shaft Rail Assembly
(3) Front Output Shaft
(4) Chain
(5) Lower Drive Sprocket
(6) Front Tone Wheel
(7) Drive Sprocket
(8) Spacer
(9) Shift Fork and Rail Assembly
(10) Lockup Rail
(11) Spring Pin
(12) Shift Fork Assembly
(13) Lockup Fork
(14) Lockup Fork Spring
(15) Reduction Hub
(16) Rear Output Shaft
(17) Oil Pump Assembly (with Strainer)
(18) Thrust Washer
(19) Lockup Hub
(20) Lockup Collar Assembly
(21) Magnet

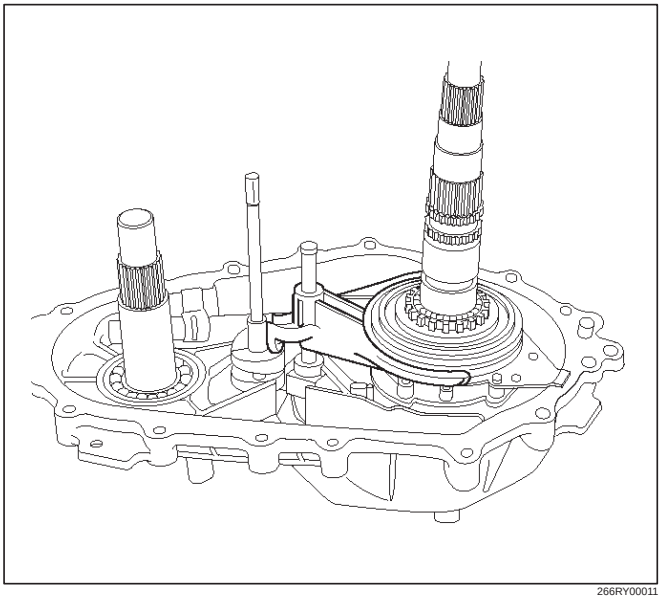
Disassembly

1. Remove the spacer.
2. Remove the front tone wheel, lower drive sprocket, drive sprocket and chain together from the front and rear output shaft.



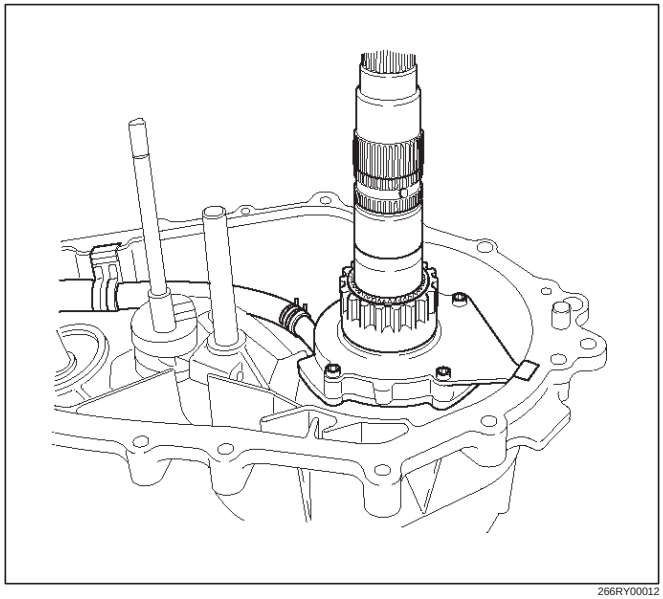
266RY00010

3. Remove the lockup collar assembly and lockup fork together.



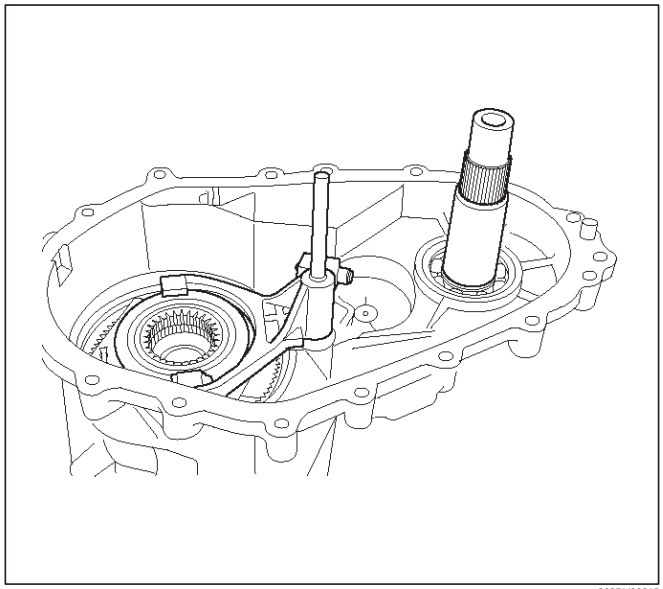
266RY00011

4. Remove the lockup hub.
5. Remove the thrust washer.
6. Remove the magnet from the strainer set position together with the oil pump assembly.



266RY00012

7. Remove the output shaft.
8. Remove the cam and shaft rail assembly.

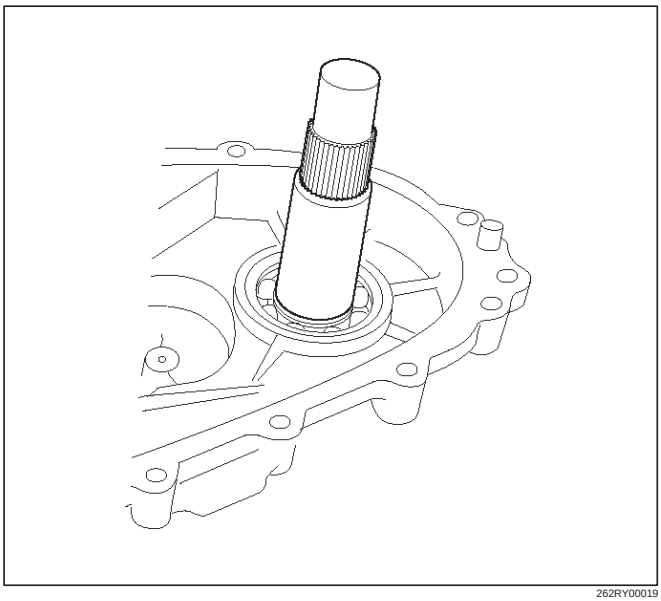


262RY00015

9. Remove the shift fork and rail assembly, and reduction hub.
10. Remove the spring pin from the shift fork and rail assembly.
11. Remove the shift fork assembly from the lockup rail.
12. Remove the front output shaft from the transfer case.

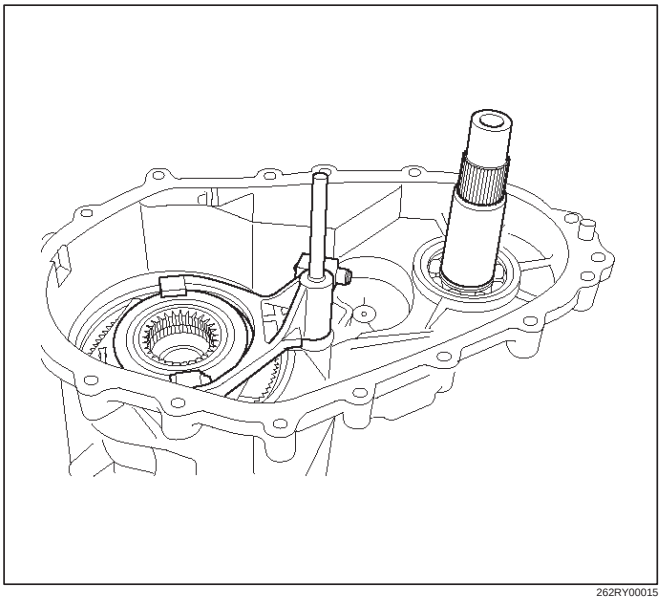
Reassembly

1. Apply ATF to the inside of the ball bearing.
2. Install the front output shaft to the transfer case.



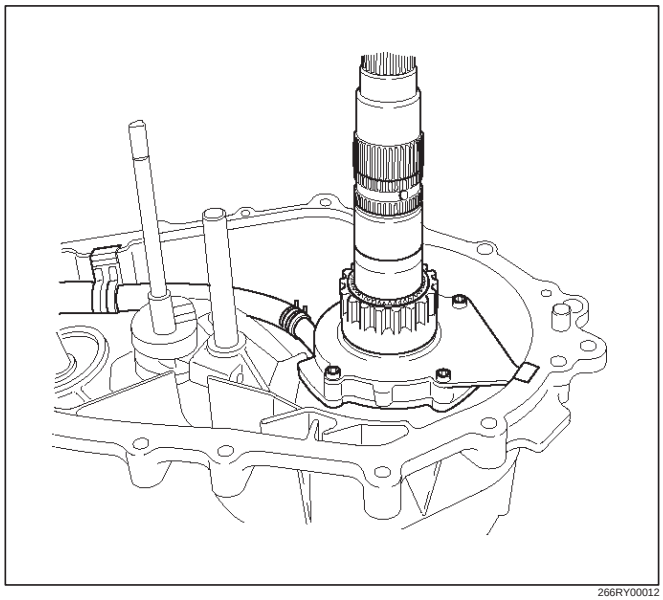
262RY00019

3. Install the shift fork assembly to the lockup rail and fix the assembly with the snap ring.
4. Install the shaft fork and rail assembly and reduction hub to the transfer case.



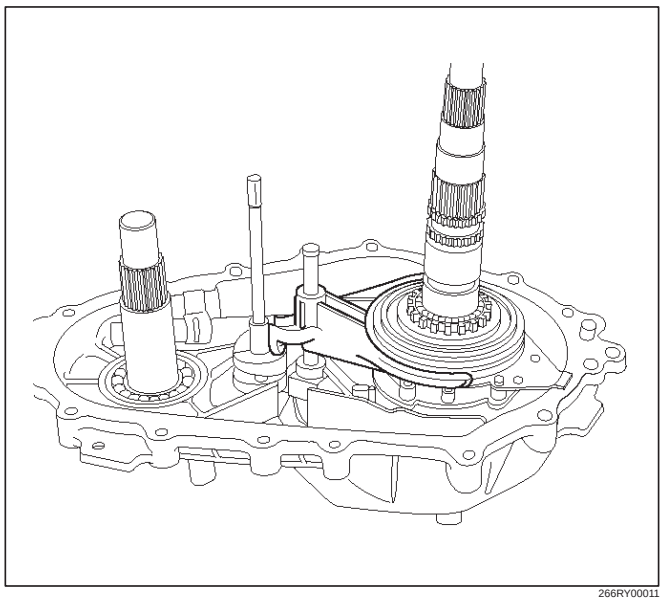
262RY00015

5. Install the output shaft to the transfer case.
6. Install the oil pump assembly to the output shaft and attach the magnet to the strainer set position.
7. Install the thrust washer.
8. Install the lockup hub.
9. Install the cam and shaft rail assembly.



266RY00012

10. Install the lockup collar assembly and lockup fork together.

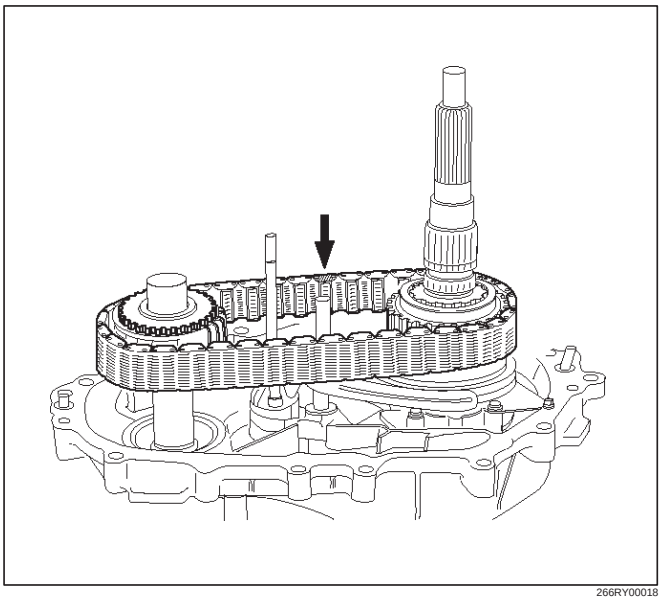


266RY00011

11. Apply ATF to the chain and engage it to both sprockets.
12. Mount the chain and sprocket assembly to both output shafts.

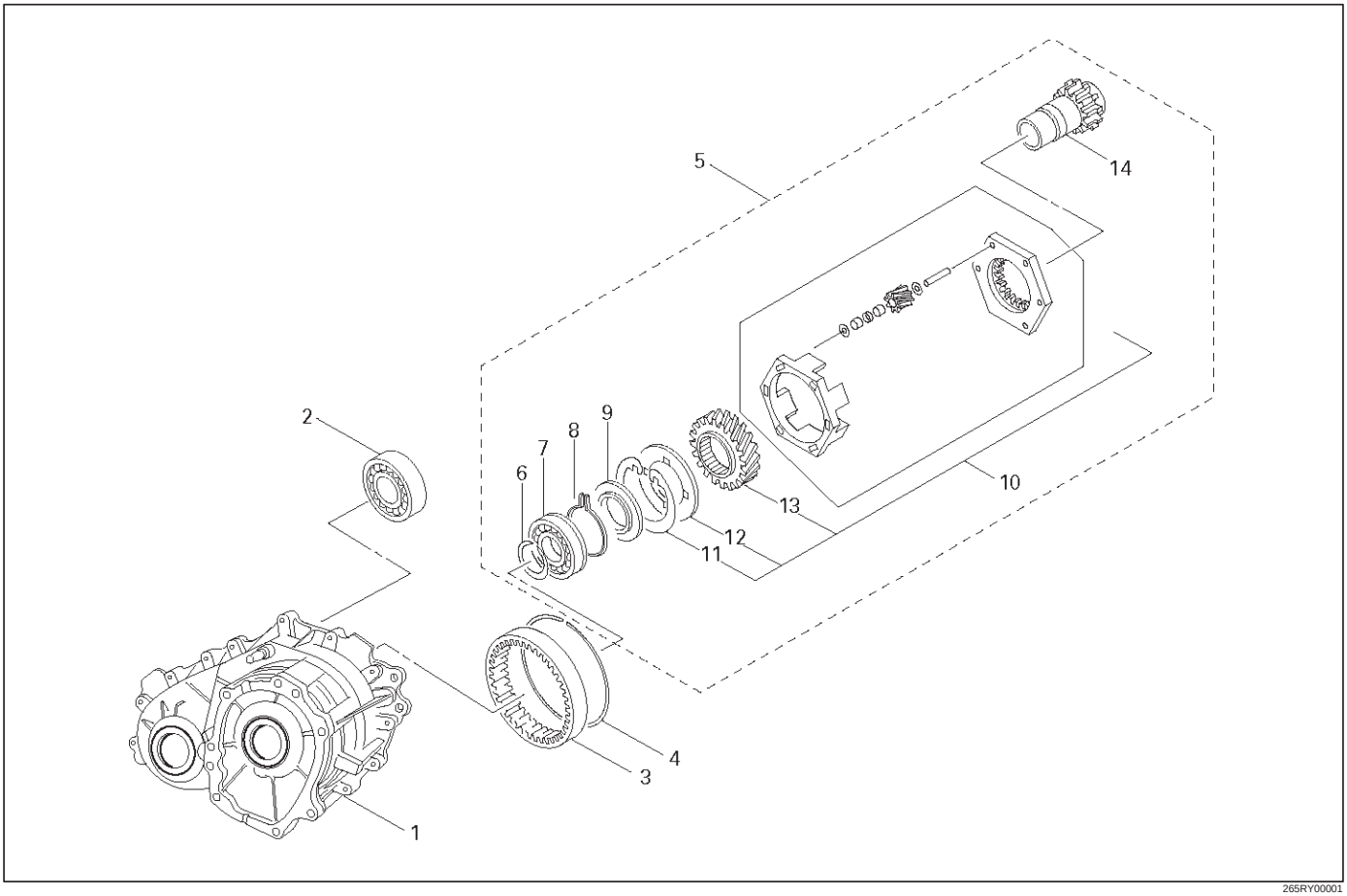
NOTE: When installing chain, the copper colored ring of the chain (indicated by the arrow) to be installed in direction of rear.

13. Install the front torn wheel to the front output shaft.
14. Install the spacer to the drive sprocket assembly.



266RY00018

Transfer Case Assembly



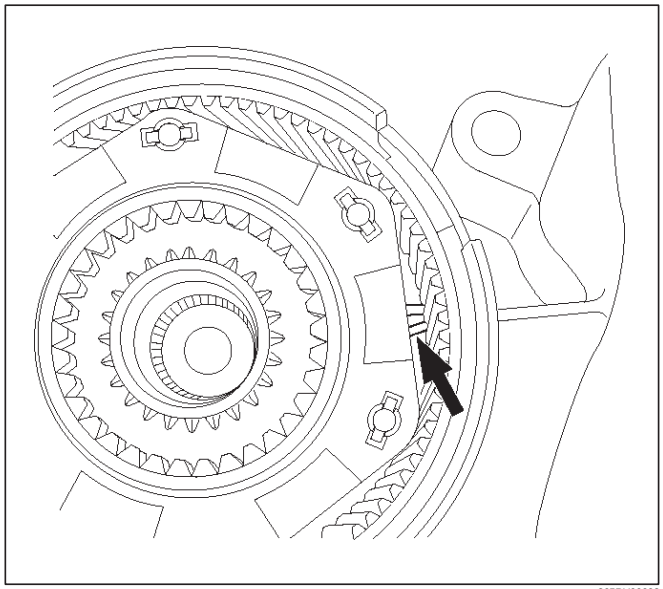
265RY00001

Legend

(1) Transfer Case (with Oil Seal)
(2) Ball Bearing
(3) Ring Gear
(4) Snap Ring
(5) Input Shaft and Carrier Assembly
(6) Snap Ring
(7) Ball Bearing
(8) Snap Ring
(9) Circular Hub
(10) Carrier Assembly
(11) Snap Ring
(12) Thrust Plate
(13) Sun Gear
(14) Input Shaft Assembly (with Bearing and Bushing)

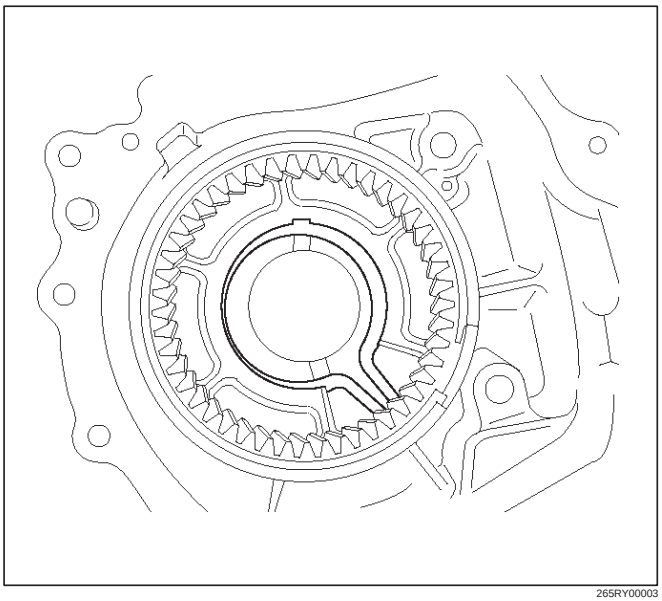
Disassembly

1. Using snap ring pliers, open the snap ring from the gap on the carrier assembly.
   While opening the snap ring, remove the input shaft assembly, carrier assembly and thrust plate together from the transfer case.



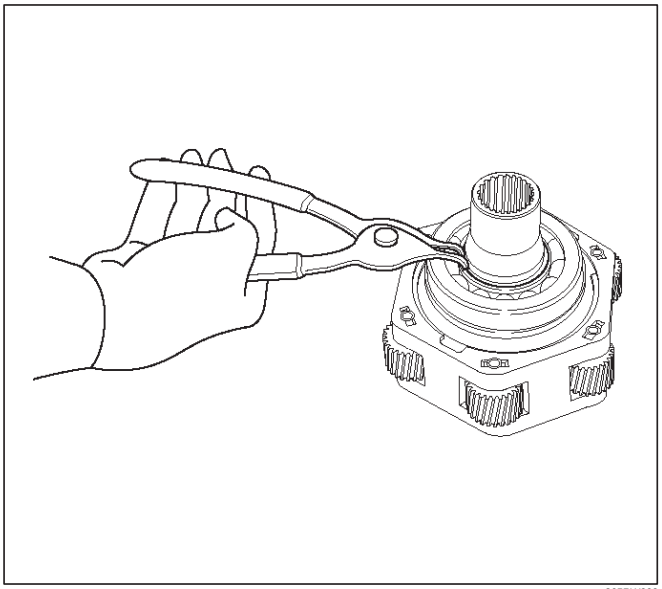
265RY00002

2. Remove the snap ring from the transfer case.



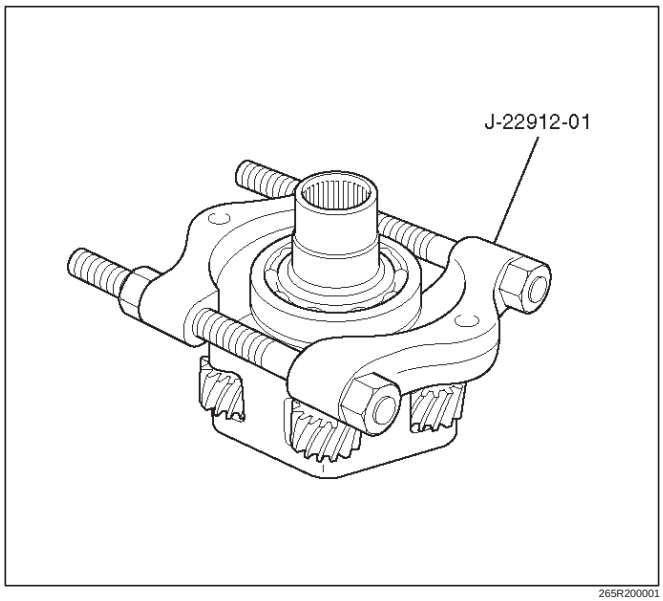
265RY00003

3. Using snap ring pliers, remove the snap ring.



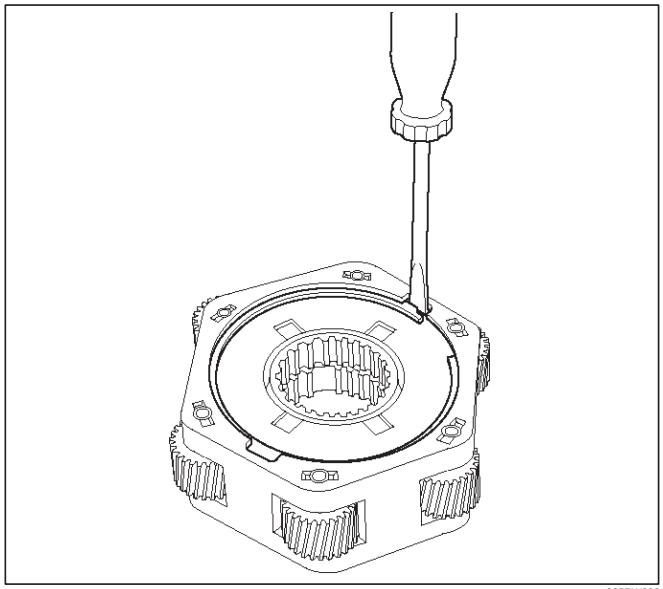
265RW009

4. Using the bearing remover J–22912–01, remove the ball bearing from the input shaft.



265R200001

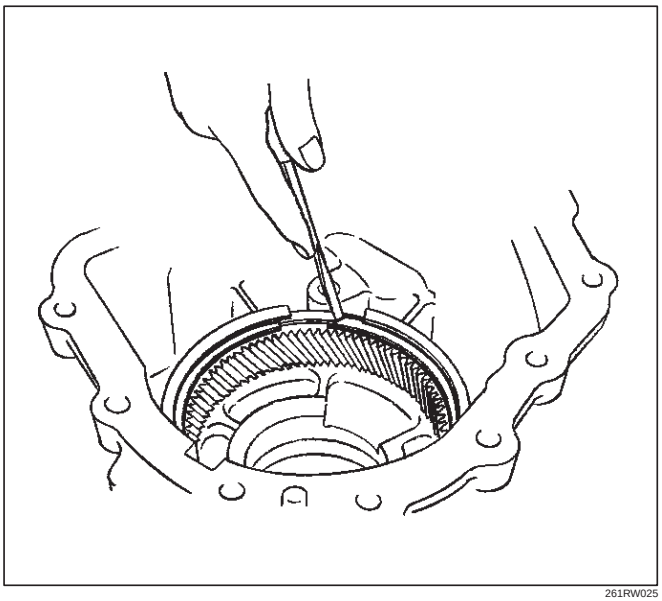
5. Remove the circular hub.
6. Remove the snap ring from the carrier assembly.



265RW006

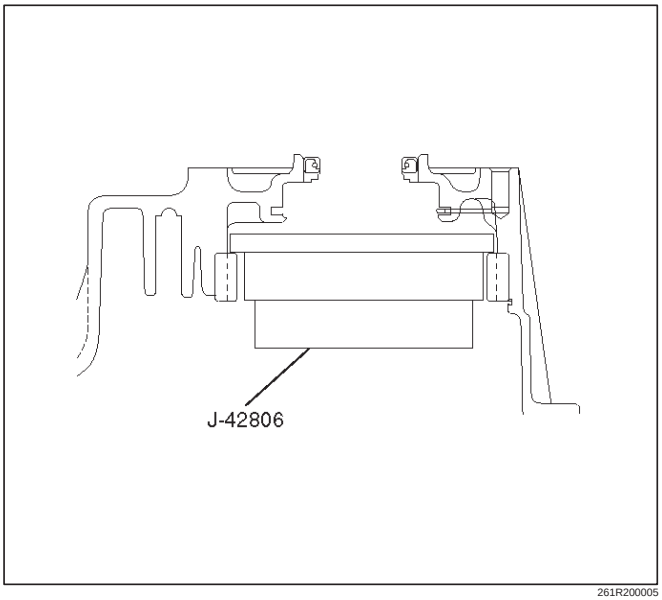
7. Remove the thrust plate from the carrier assembly.

8. Remove the snap ring before the ring gear.



261RW025

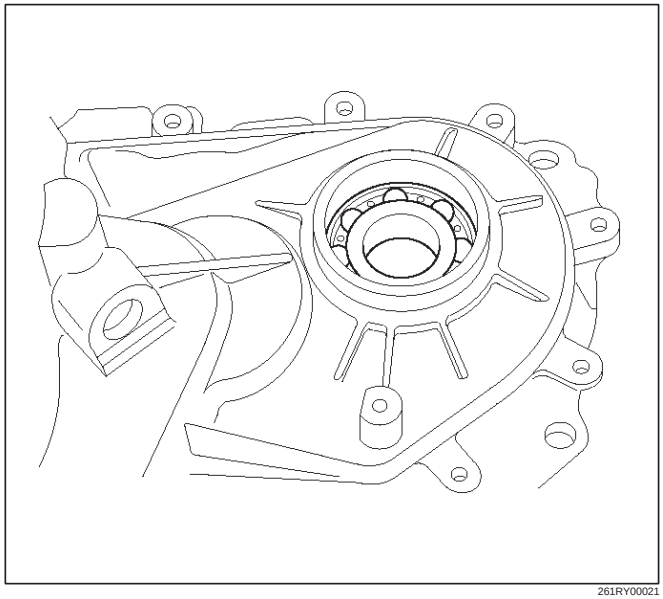
9. Using the ring gear remover J–42806 and a bench press, remove the ring gear from the transfer case.



261R200005

NOTE: Removing ring gear needs a high-load press.
This means the transfer case may be damaged.
To remove and replace the ring gear, it is recommended that the transfer case assembly should be replaced.

10. Remove the ball bearing of the front output shaft from the transfer case.

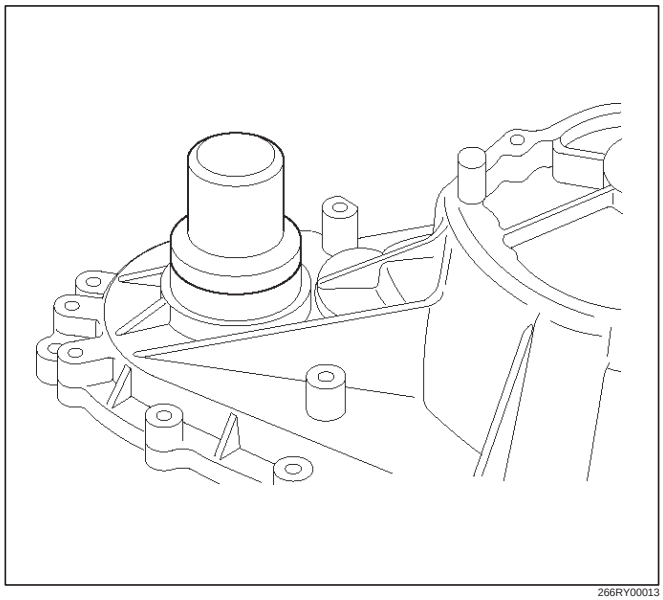


261RY00021

Reassembly

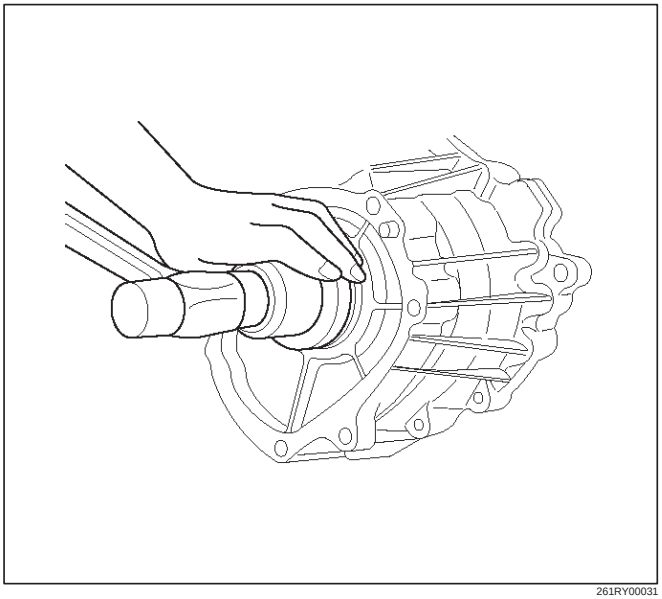
Oil Seal Replacement

1. Remove the oil seal of the front output shaft and input shaft from the transfer case.
2. Apply the circumference of the new oil seal and fill the lip with grease (BESCO L2 or its equivalent).
3. Using the oil seal installer J–42807, install the front output shaft oil seal to the transfer case.



266RY00013

4. Using the oil seal installer J–42808, install the input shaft oil seal to the transfer case.


261RY00031

5. Using the ring gear installer J–42809 and a bench press, install the ring gear to the transfer case.

NOTE: Pay attention to the following points.

▼Identify the correct direction of gear.

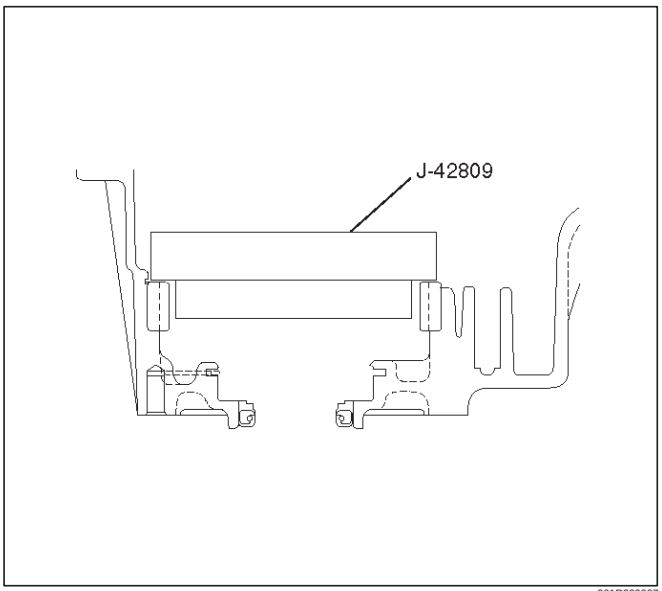
▼Do not damage the gear.

▼Do not press-fit the ring gear slantingly.

▼Press-fit the ring gear to the innermost.

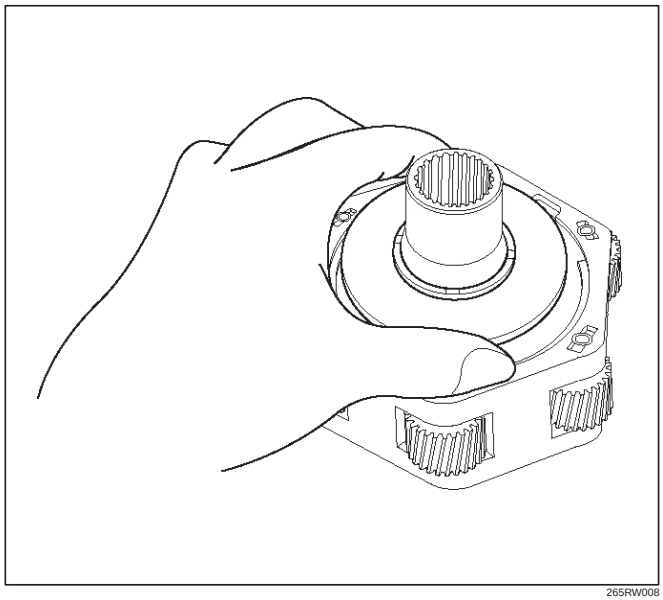
▼Remove burrs generated by press-fitting.

▼If the transfer case has serrations, match them with those of the gear and press-fit the gear.

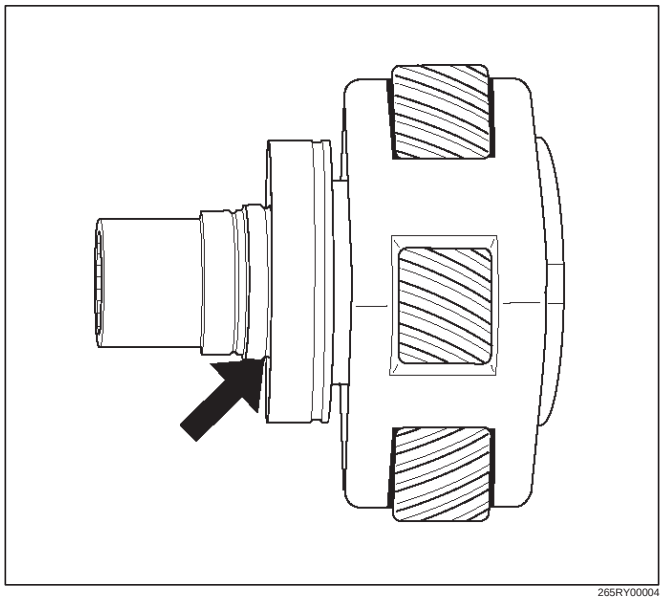


261R200007

6. Install the snap ring.
7. Install the thrust plate to the carrier assembly. Attach the snap ring to the carrier assembly.
8. Install the carrier assembly to the input shaft.
9. With care the direction of circular hub, mount it to the input shaft.

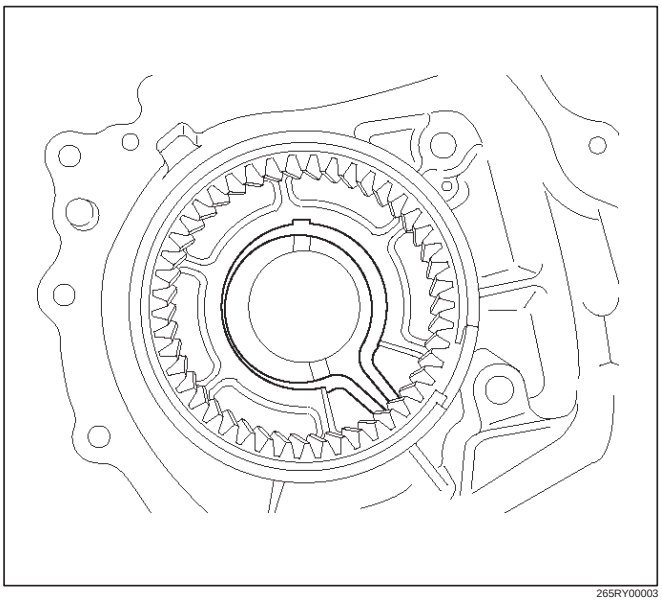

265RW008

10. Press the ball bearing to the input shaft so that the snap ring will be attached to the input shaft.

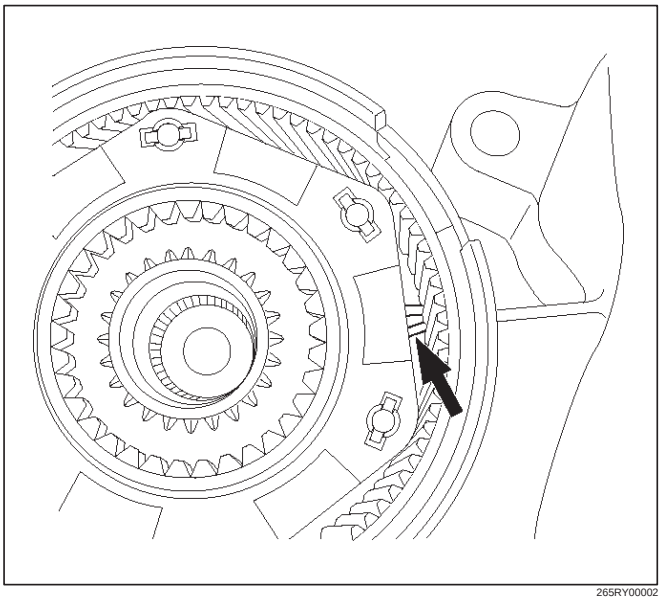

265RY00004

11. Install the snap ring to the input shaft.
12. Install the ball bearing of the front output shaft to the transfer case.

13. Install the snap ring of the input shaft bearing to the transfer case.


265RY00003

14. Using snap ring pliers, open the snap ring from the gap on the carrier assembly.
    While opening the snap ring, securely attach the input shaft and carrier assembly to the transfer case.


265RY00002

Inspection and Repair (Transfer Case Assembly)

When wear, damage, or any other defects are observed during the inspection, the part or parts must be repaired or replaced. Wash all the parts with clean detergent, and check that old oil, metallic particles, dirt, or foreign materials are completely removed. Blow the air into oil holes and grooves to remove foreign materials or residual detergent.

Chain

- ▼ Check whether the face that contacts the sprocket is free from excessive wear or damage. If defects are observed, replace the part.
- ▼ If the chain interference mark is found on the inside wall of the transfer cover or the chain is so slack that a skipped engagement occurs between the chain and sprocket, replace the chain.

Sprocket

- ▼ Check whether the sprocket tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline. Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.
- ▼ If excessive wear or damage is observed on the sprocket inside sliding surface, replace the part.

Gear

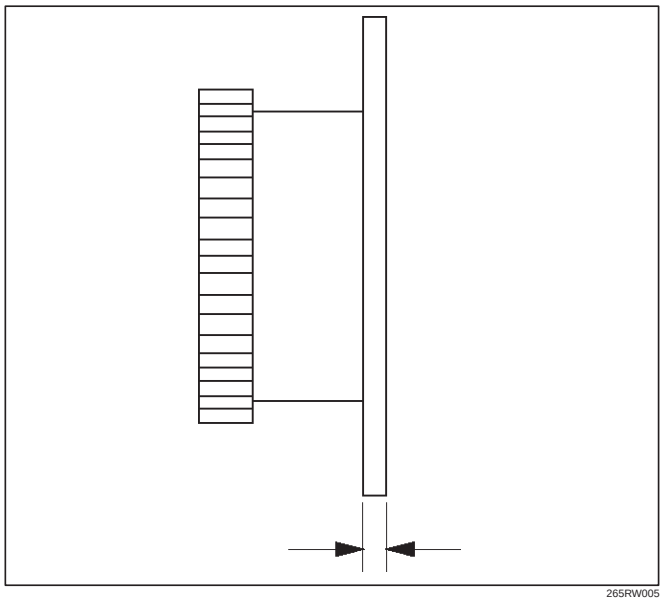
- ▼ Check whether the gear tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline.
  Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.

Thickness of Reduction Hub

- ▼ Measure the thickness with a micrometer.
- ▼ If the measurement exceeds the limit, replace the reduction hub.

Standard : 3.05–3.30 mm (0.120–0.130 in)

Allowable limit : 2.5 mm (0.098 in)


265RW005

Lockup Collar Assembly

▼ Install the lockup hub, drive sprocket assembly, and lockup collar assembly to the output shaft.

▼ If the lockup collar assembly does not move smoothly, replace the lockup collar assembly.

NOTE: Apply ATF to the rear engaging the gear.

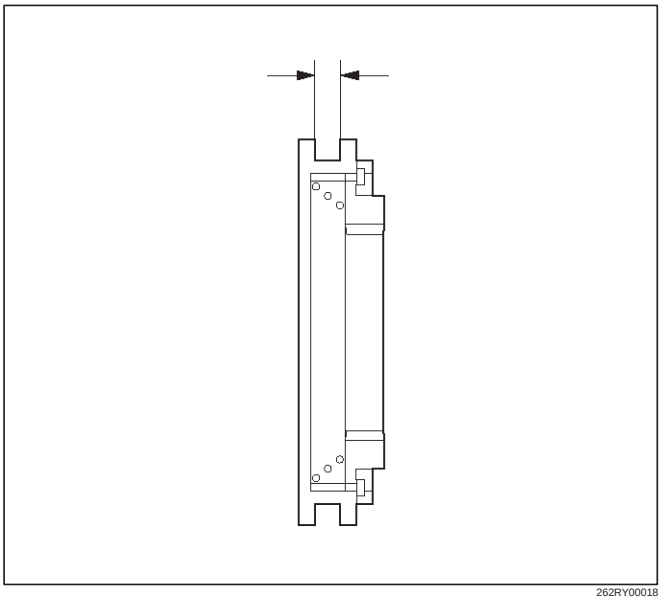
Width of Lockup Collar

▼ Using calipers, measure the lockup collar groove for width of wear.

▼ If the measurement exceeds the limit, replace the lockup collar assembly.

Standard : 7.16–7.32 mm (0.282–0.288 in)

Allowable limit : 7.9 mm (0.311 in)



262RY00018

Shift Fork and Rail Assembly

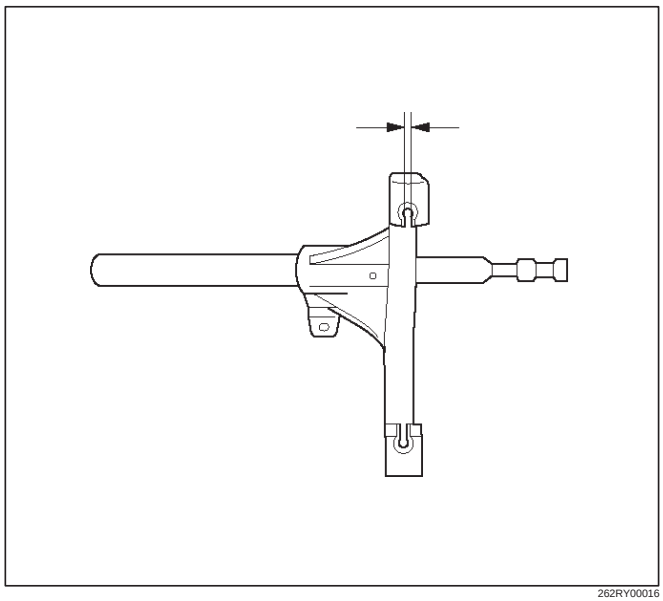
Check the shift fork and rail for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness of Shift Fork

▼ If the measurement exceeds the limit, replace the shift fork.

Standard : 3.41–3.79 mm (0.134–0.149 in)

Allowable limit : 4.4 mm (0.173 in)



262RY00016

Lockup Fork and Rail

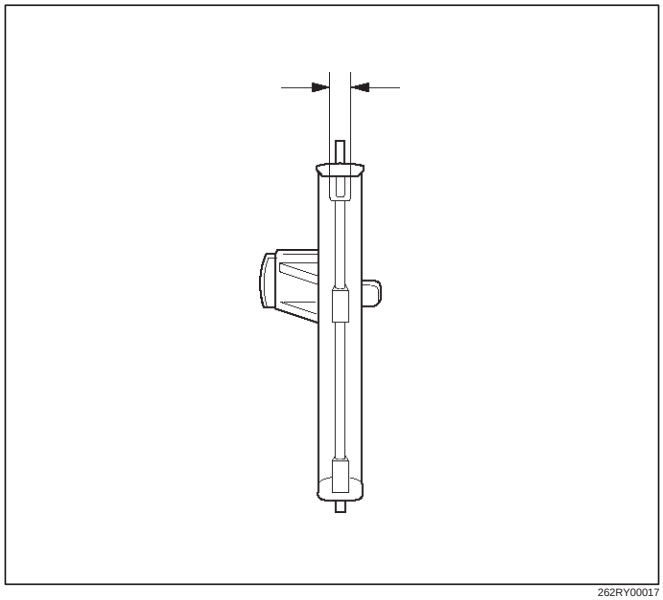
▼ Check the lockup fork and rail for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness Lockup Fork

If the measurement exceeds the limit, replace the lockup fork.

Standard : 6.99–7.09 mm (0.275–0.279 in)

Allowable limit : 6.3 mm (0.248 in)



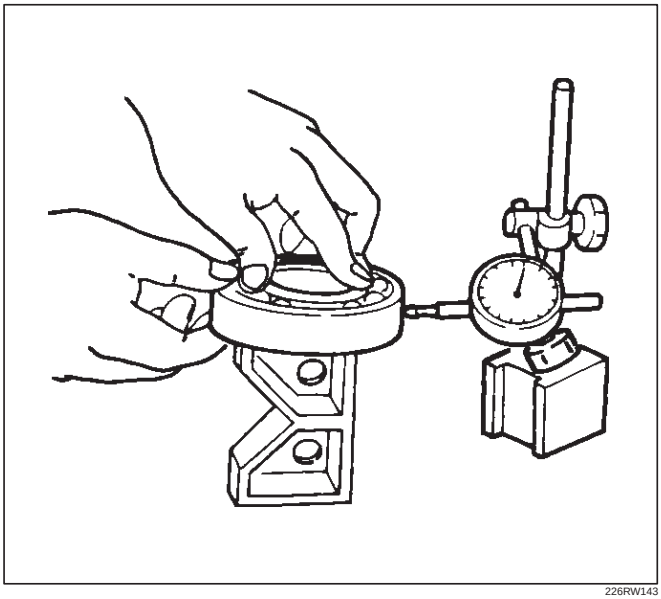
262RY00017

Bearing

Check the profile of the needle, roller, ball, and thrust bearings. Wash the bearings with clean detergent completely, and dry with air.

NOTE: If the bearing is rotated excessively, the rollers may be damaged. So, rotate the bearing slowly with your hand. Apply grease to the bearing, and check the smoothness of the bearing while slowly rotating the race with your hand.

Allowable limit : 0.23 mm (0.009 in)



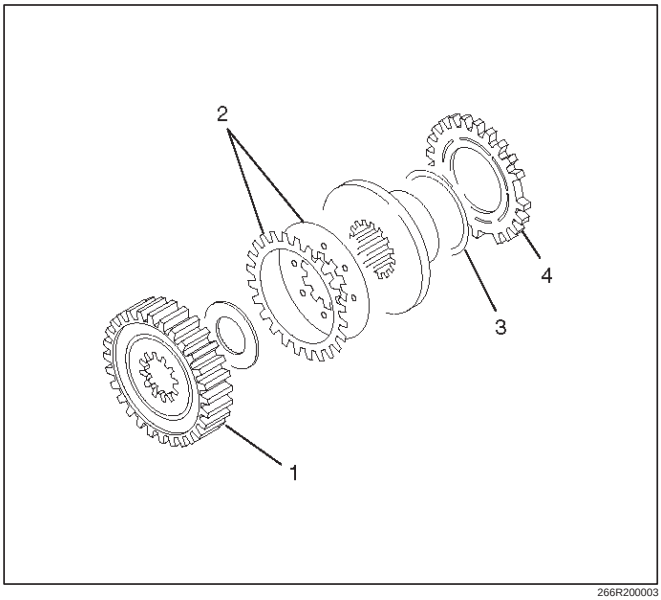
226RW143

Lockup Fork Spring

Check the lockup fork spring for distortion, cracking, and wear. If defects are observed, replace the part.

Multi Plate Disk Clutch

▼If the burned, mirror-surfaced clutch facing, or scraping is observed on the clutch plates, clutch housing, armature plate, and insulator washer, replace the parts.



266R200003

Legend

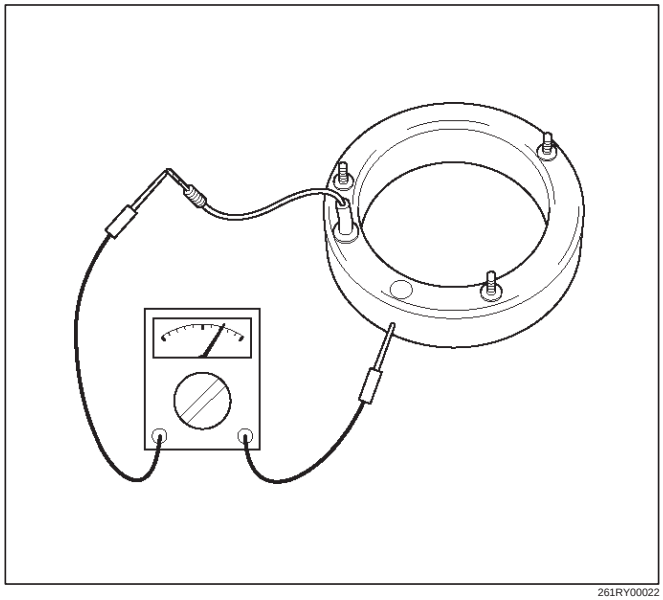
(1) Clutch Housing
(2) Clutch Plate
(3) Insulator Washer
(4) Armature Plate

Coil Assembly

▼Check the resistance of the coil with a tester. If defects are observed, replace the coil assembly.

Standard : 1.7±0.3Ω (at ordinary temperature)

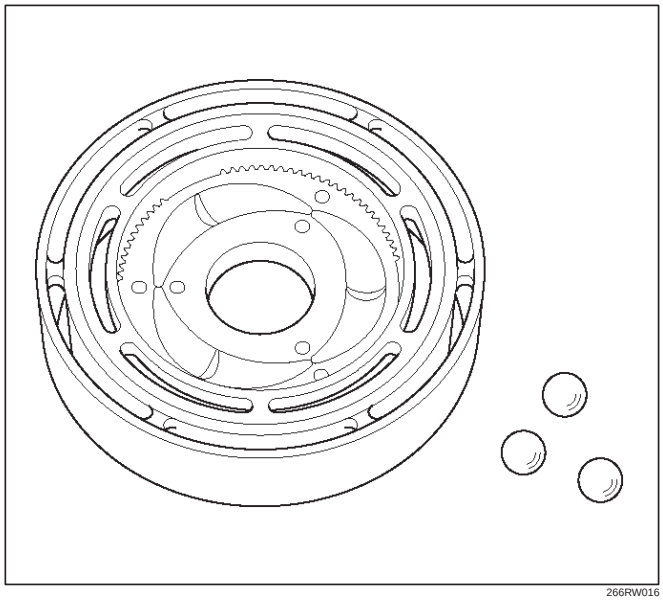
Allowable limit : 1.0~5.0Ω



261RY00022

Cam Pulley, Cam Ball, and Cam & Coil Housing

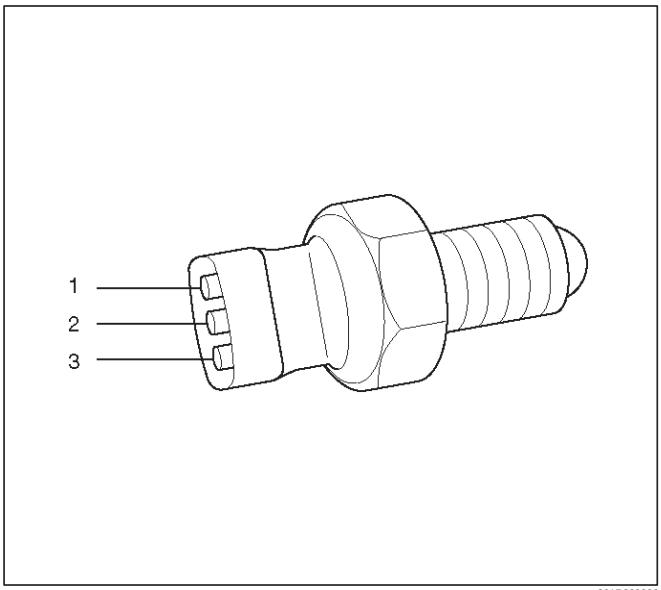
▼Check the cam balls and cam for excessive wear or damage. If defective, replace the parts.



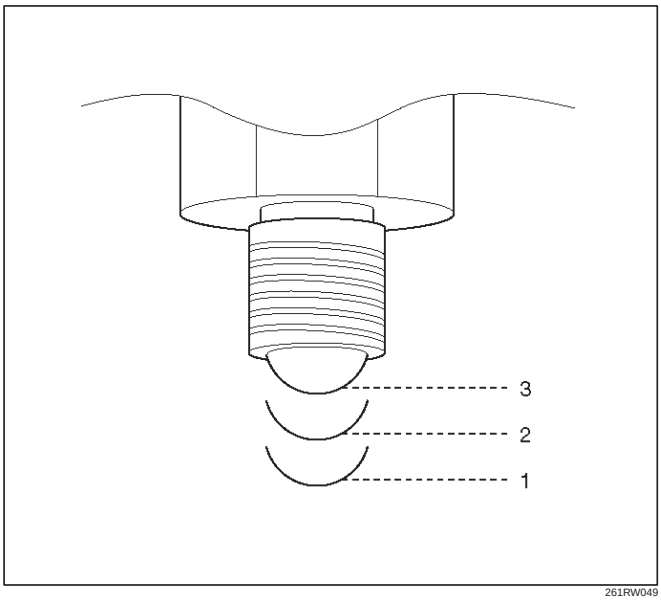
266RW016

4H and 4L Switch

▼ Check the continuity of 4H and 4L switch.
If defects are observed, replace the 4H and 4L switch.



261R200006



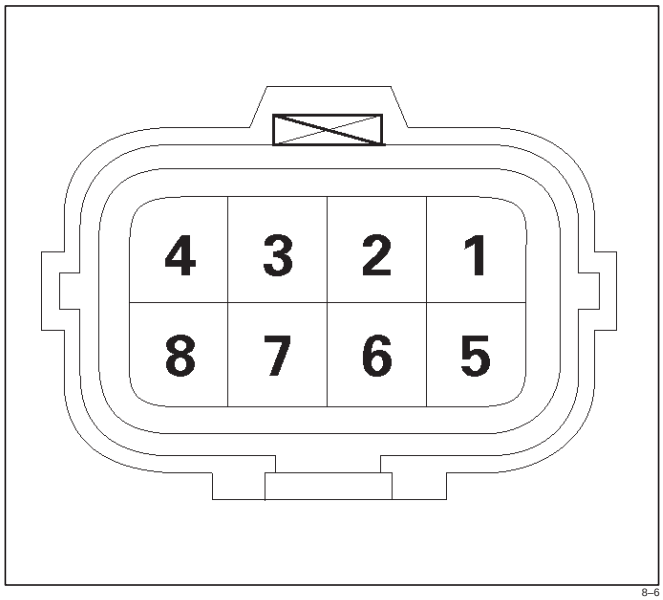
261RW049

Switch Stroke	4H Switch Signal	4L Switch Signal	The corresponding position of TOD switch
	Terminal 2 to Switch Body	Terminal 1 to 3	
1	Open	Open	2H, TOD
2	Open	Close	4L
3	Close	Close	Neutral

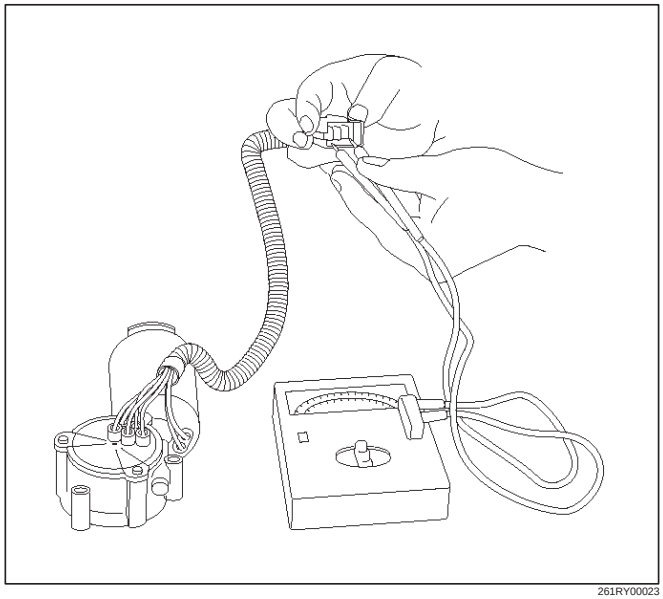
Shift Motor Assembly

▼ Check the resistance of the shift motor assembly (between terminal 4 to 7) with a tester.
If defects are observed, replace the shift motor assembly.

Standard : 0.63±0.2Ω (at ordinary temperature)



8–6



261RY00023

Oil Pump

▼ Remove foreign materials from the strainer. If the strainer is damaged, replace it.

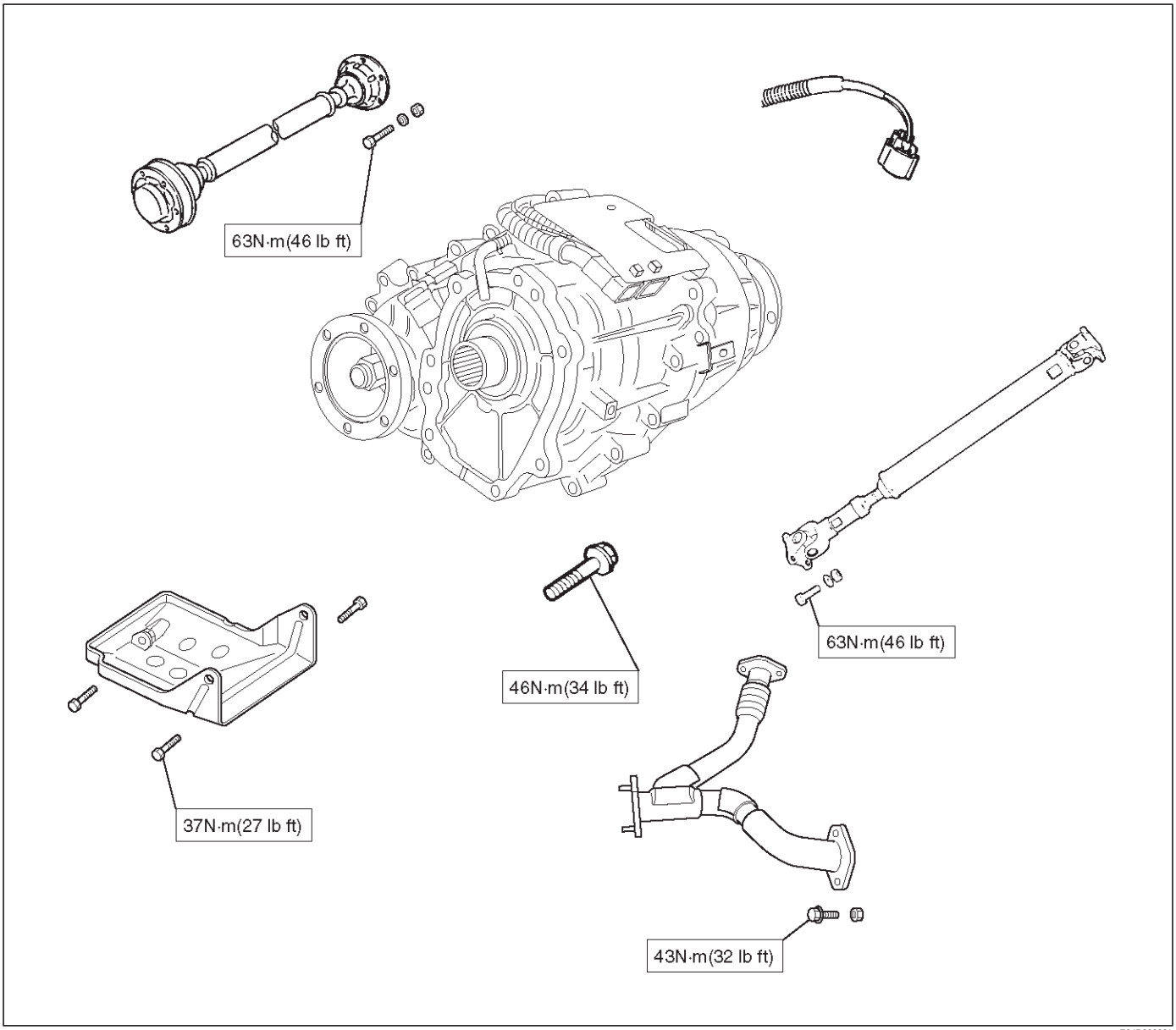
▼ If the area into which the shaft is inserted is excessively worn or damaged, replace the oil pump assembly.

Main Data and Specification

General Specification

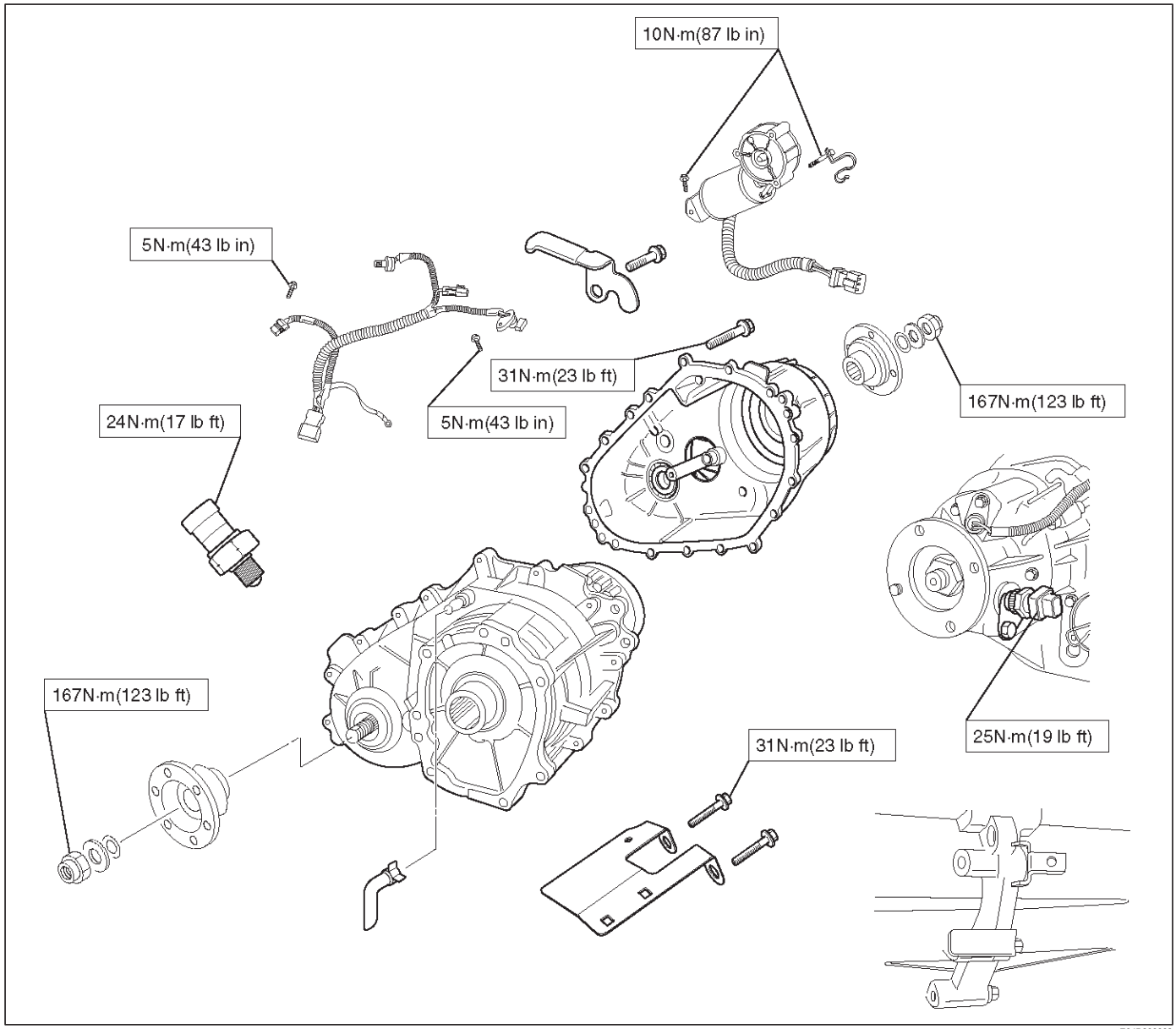
Type	Electronically controlled torque split four wheel drive with two wheel drive.
	2WD: Rear two wheel drive
	TOD: Electronically controlled torque split four wheel drive.
	4L: Low speed mechanical lockup four wheel drive.
	Rear drive: Direct drive
	Front drive: Chain drive
	Low range deceleration: Planetary gear drive
Control system	Switch control
Gear ratio	High: 1.000
	Low: 2.480
Lubrication system	Built-in oil pump
	Forced lubrication
Type of lubricant	ATF DEXRON®–II or III
Oil capacity	1.35 liters. (1.43 US.quart)
Clutch discs number	13
Planetary gear teeth number	Sun gear: 58
	Pinion gear: 15
	Ring gear: 86

Torque Specifications

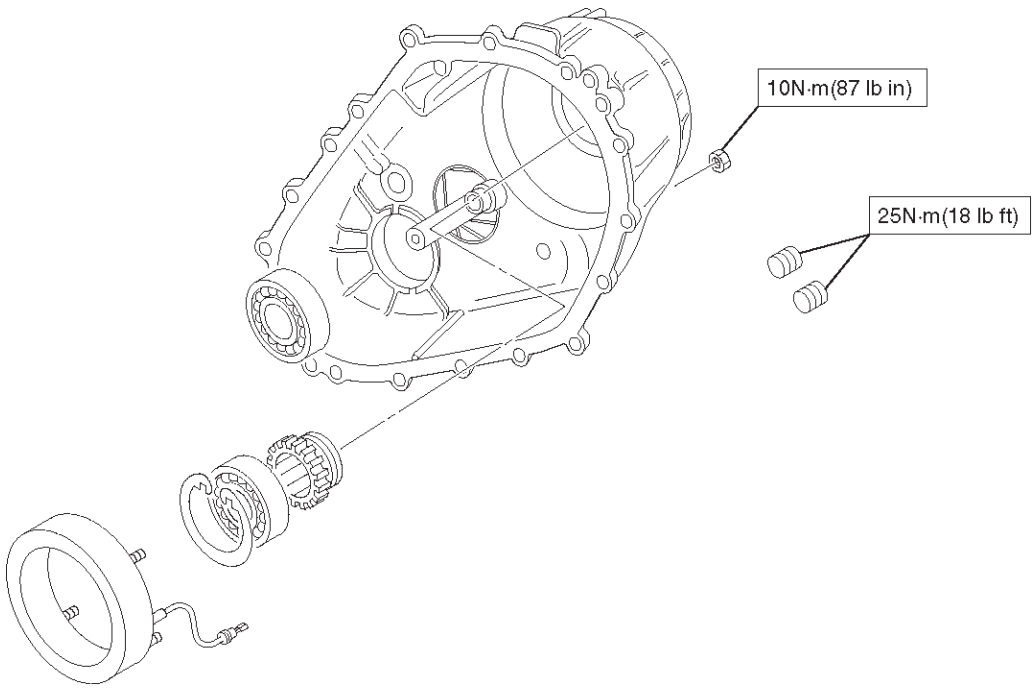


E04R200001

Torque Specifications (Cont'd)



Torque Specifications (Cont'd)



E04R200003

Special Tools

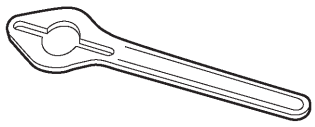
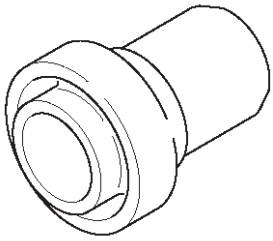
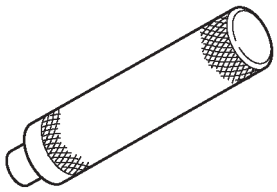
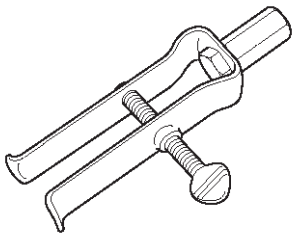
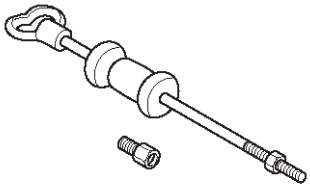
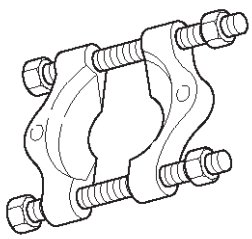
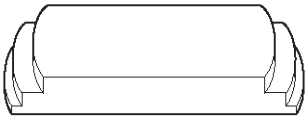
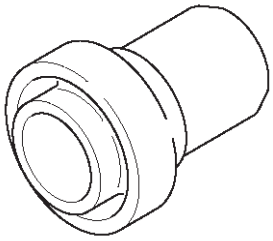
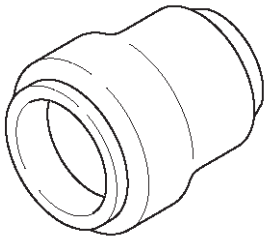
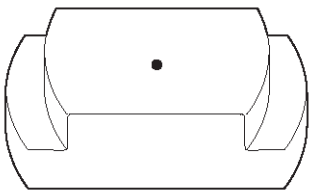
ILLUSTRATION	TOOL NO. TOOL NAME
 901RW071	**J–8614–11** Flange Holder
 901RW095	**J–42804** Rear Oil Seal Installer
 5884003520	**J–33951** Shift Shaft Oil Seal Installer
 901RW094	**J–42805** Bearing Remover
 901RW096	**J–2619–01** Slide Hammer
 901RW091	**J–22912–01** Bearing Remover

ILLUSTRATION	TOOL NO. TOOL NAME
 901RW093	**J–42806** Ring Gear Remover
 901RW095	**J–42807** Front Output Shaft Oil Seal Installer
 901RW097	**J–42808** Input Shaft Oil Seal Installer
 901RW098	**J–42809** Ring Gear Installer

AXIOM

BRAKES

CONTENTS

Brake Control System 5A–1
Anti–lock Brake System 5B–1
Power–assisted Brake System 5C–1
Parking Brakes (4x4 Model) 5D1–1
Parking Brakes (4x2 Model) 5D2–1

Brake Control System

CONTENTS

Service Precaution 5A–2
General Description 5A–3
Functional Description 5A–4
System Components 5A–10
Electronic Hydraulic Control Unit (EHCU) . 5A–10
ABS Warning Light 5A–10
Wheel Speed Sensor 5A–10
G-Sensor 5A–10
Normal and Anti-lock Braking 5A–10
Brake Pedal Travel 5A–10
Acronyms and Abbreviations 5A–11
General Diagnosis 5A–11
General Information 5A–11
ABS Service Precautions 5A–11
Computer System Service Precautions . . . 5A–11
General Service Precautions 5A–11
Note on Intermittents 5A–11
Test Driving ABS Complaint Vehicles 5A–12
“ABS” Warning Light 5A–12
Normal Operation 5A–12
Tech 2 Scan Tool 5A–13
DATA LIST 5A–16
ACTUATOR TEST 5A–17
Tech 2 Service Bleed 5A–21
Basic Diagnostic Flow Chart 5A–22
Basic Inspection Procedure 5A–23
EHCU Connector Pin-out Checks 5A–24
Circuit Diagram 5A–25
Connector List 5A–28
Part Location 5A–29
Symptom Diagnosis 5A–30
Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate 5A–30
Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use TECH 2) 5A–31
Chart A-2 Uneven Braking Occurs While ABS Works 5A–31
Chart TA-2 Uneven Braking Occurs While ABS Works (Use TECH 2) 5A–31
Chart A-3, TA-3 The Wheels Are Locked . 5A–32
Chart A-4 Brake Pedal Feed Is Abnormal . 5A–32
Chart A-5, TA-5 Braking Sound (From EHCU) Is Heard While Not Braking 5A–33
Diagnostic Trouble Codes 5A–34
Diagnosis By “ABS” Warning Light Illumination Pattern 5A–36
Diagnostic Trouble Codes (DTCs) 5A–37
Chart B-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated. 5A–39
Chart B-2 CPU Error (DTC 14 (Flash out) / C0271, C0272, C0273, C0284 (Serial communications)) 5A–39
Chart B-3 Low or High Ignition Voltage (DTC 15 (Flash out) / C0277, 0278 (Serial communications)) 5A–40
Chart B-4 Excessive Dump Time (DTC 17 (Flash out) / C0269 (Serial communications)) 5A–40
Chart B-5 Excessive Isolation Time (DTC 18 (Flash out) / C0274 (Serial communications)) 5A–40
Chart B-6 G-Sensor Output Failure (DTC 21 (Flash out) / C0276 (Serial communications)) 5A–41
Chart B-7 Brake Switch Failure (DTC 22 (Flash out) / C0281 (Serial communications)) 5A–41
Chart B-8 2WD Controller in 4WD Vehicle Controller (DTC 13 (Flash out) / C0285 (Serial communications)), 4WD State Input Signal Failure (DTC 24 (Flash out) / C0282 (Serial communications)) 5A–42
Chart B-9 Pump Motor Failure (DTC 32 (Flash out) / C0267, C0268 (Serial communications)) 5A–42
Chart B-10 EHCU Valve Relay Failure (DTC 35 (Flash out) / C0265, C0266 (Serial communications)) 5A–43
Chart B-11 FL Isolation Solenoid Coil Failure (DTC 41 (Flash out) / C0245, C0247 (Serial communications)) 5A–43
Chart B-12 FL Dump Solenoid Coil Failure (DTC 42 (Flash out) / C0246, C0248 (Serial communications)) 5A–43

Chart B-13 FR Isolation Solenoid Coil Failure (DTC 43 (Flash out) / C0241, C0243 (Serial communications)) 5A–44
Chart B-14 FR Dump Solenoid Coil Failure (DTC 44(Flash out) / C0242, C0244 (Serial communications)) 5A–44
Chart B-15 Rear Isolation Solenoid Coil Failure (DTC 45 (Flash out) / C0251, C0253 (Serial communications)) 5A–44
Chart B-16 Rear Dump Solenoid Coil Failure (DTC 46 (Flash out) / C0252, C0254 (Serial communications)) 5A–45
Chart B-17 FL Speed Sensor Open or Shorted (DTC 51 (Flash out) / C0225 (Serial communications)) 5A–45
Chart B-18 FR Speed Sensor Open or Shorted (DTC 52 (Flash out) / C0221 (Serial communications)) 5A–46
Chart B-19 Rear Speed Sensor Open or Shorted (DTC 53 (Flash out) / C0235 (Serial communications)) 5A–47
Chart B-20 FL Speed Sensor Missing Signal (DTC 61 (Flash out) / C0226, C0227 (Serial communications)) 5A–48
Chart B-21 FR Speed Sensor Missing Signal (DTC 62 (Flash out) / C0222, C0223 (Serial communications)) 5A–49
Chart B-22 Rear Speed Sensor Missing Signal (DTC 63 (Flash out) / C0236, C0237 (Serial communications)) 5A–50
Chart B-23 Simultaneous Drop-out of Front Speed Sensor Signal (DTC 64 (Flash out) / C0229 (Serial communications)) 5A–51
Chart B-24 Wheel Speed Input Abnormality (DTC 65 (Flash out) / C0238 (Serial communications)) 5A–52
Unit Inspection Procedure 5A–53
Chart C-1-1 FL Sensor Output Inspection Procedure 5A–53
Chart C-1-2 FR Sensor Output Inspection Procedure 5A–54
Chart C-1-3 Rear Sensor Output Inspection Procedure 5A–54
Chart TC-1 Sensor Output Inspection Procedure 5A–55
Special Tools 5A–56

Service Precaution

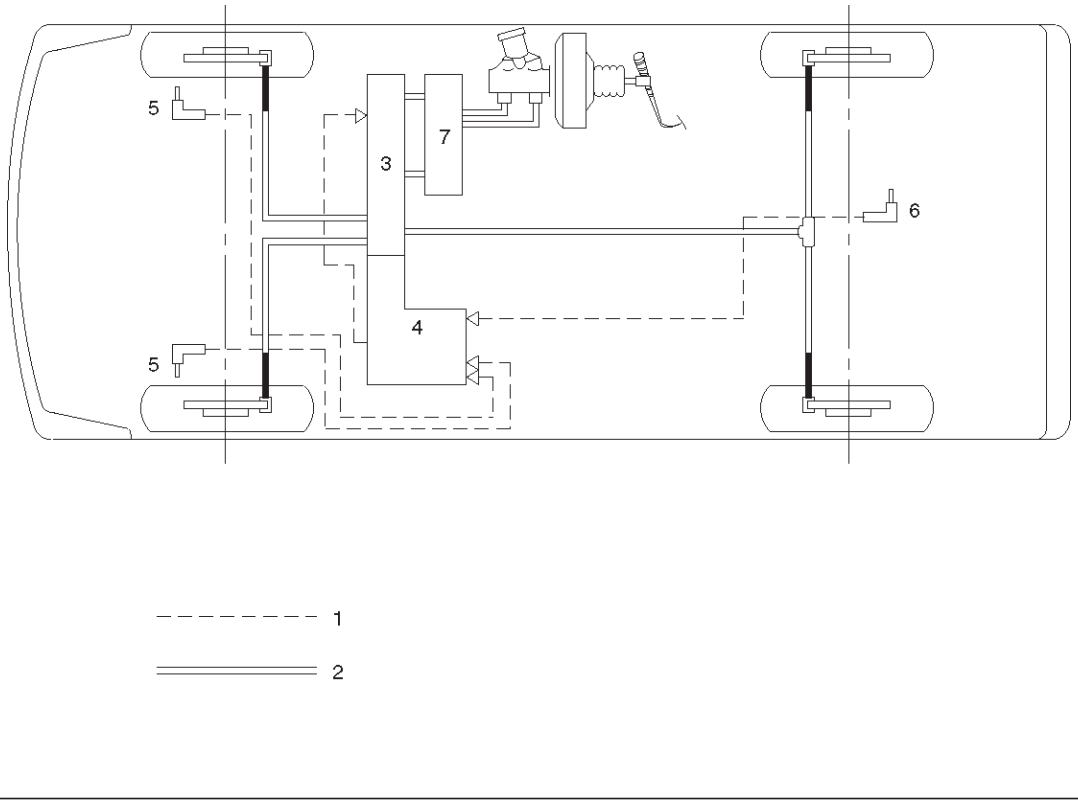
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCU) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.
This system helps the driver maintain greater control of the vehicle under heavy braking conditions.

NOTE: The Electronic Hydraulic Control Unit (EHCU) comprises the Hydraulic Unit (H/U) and the coil Integrated Module.



C05RW004

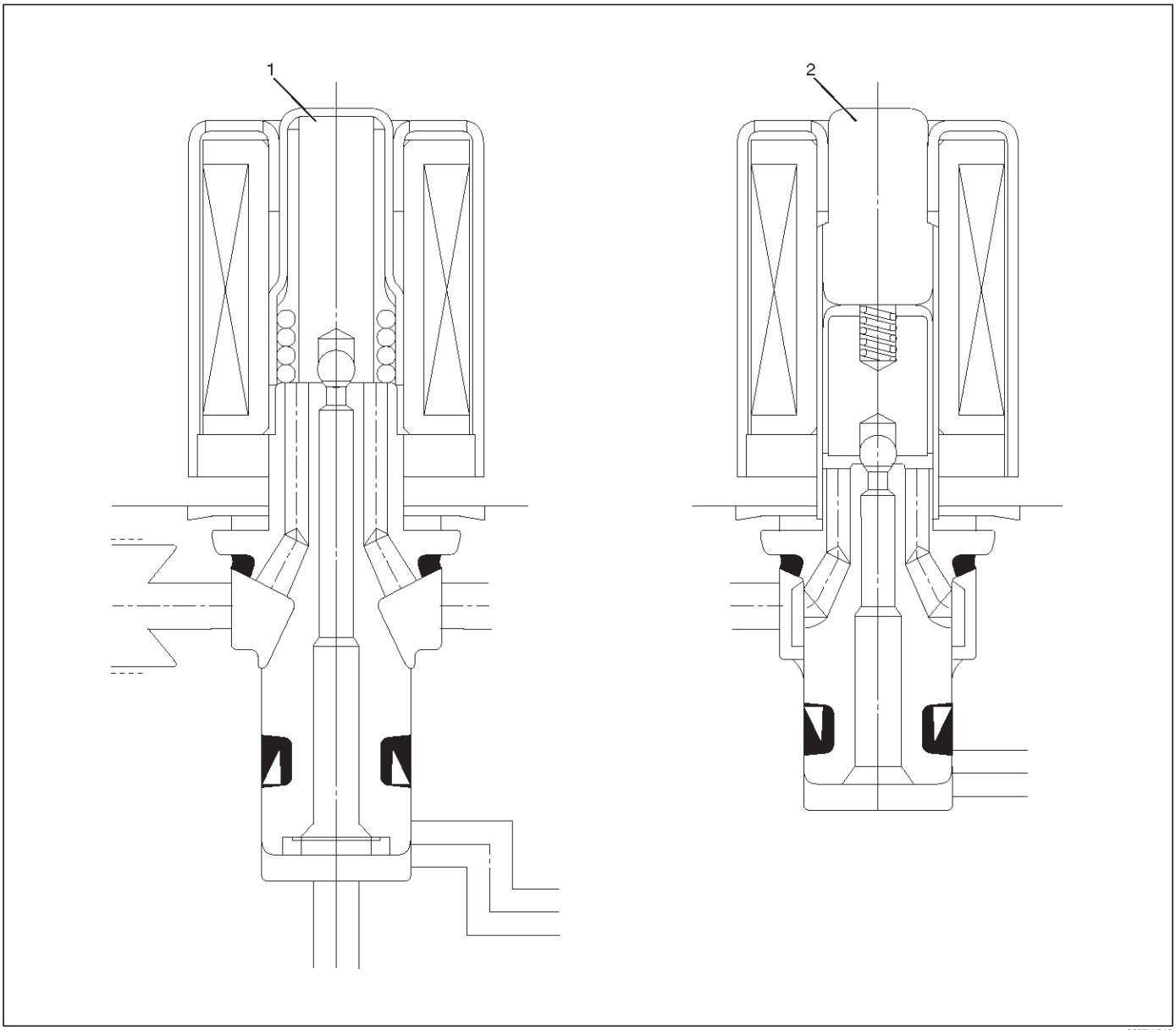
Legend

(1) Electronic Line
(2) Hydraulic Line
(3) Hydraulic Unit (H/U)
(4) Coil Integrated Module
(5) Front Wheel Speed Sensor
(6) Rear Wheel Speed Sensor
(7) Proportioning and Bypass (P&B) Valve

Functional Description

Hydraulic Unit (H/U)

Solenoid Valve



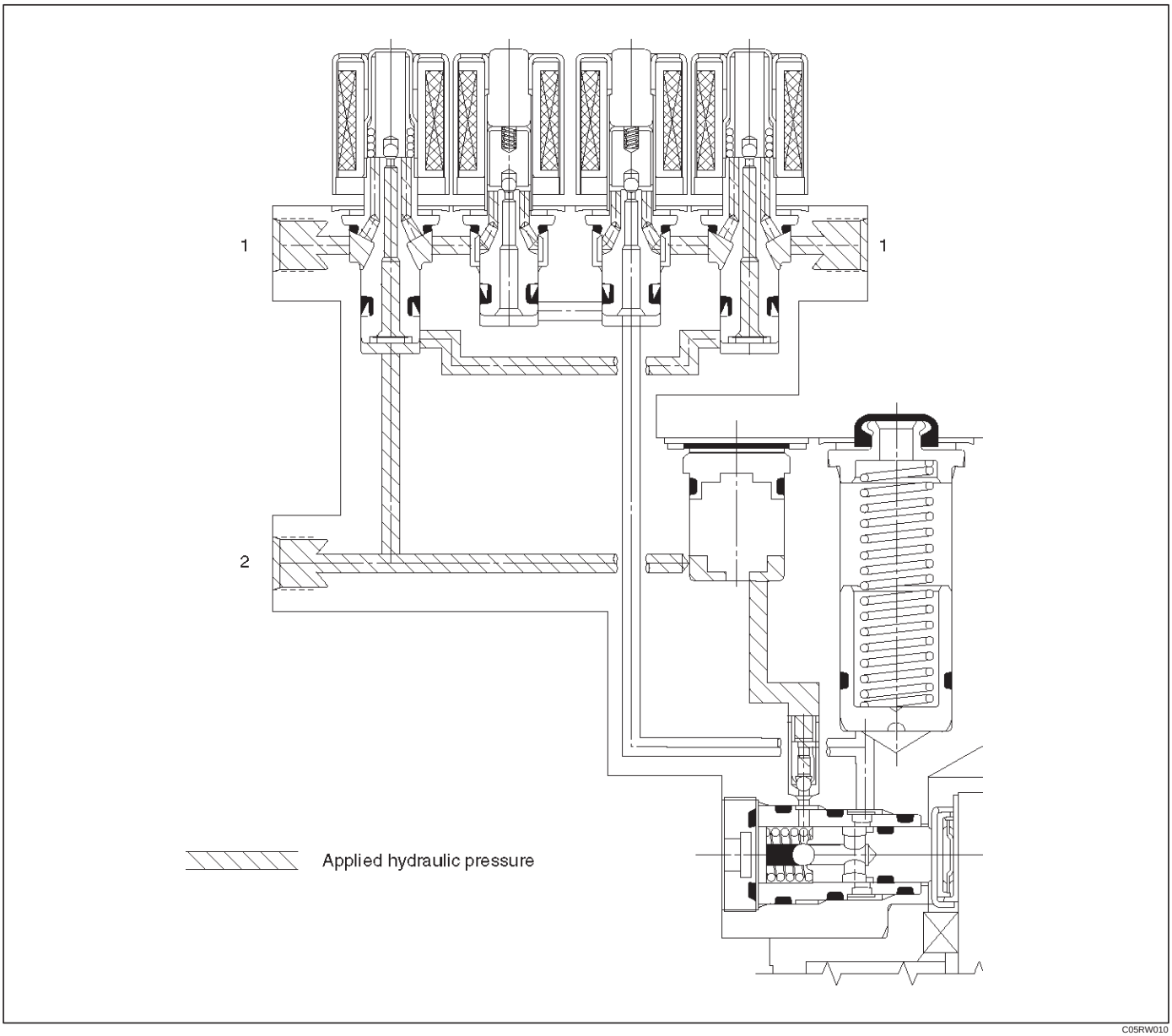
C05RW012

Legend

(1) Isolation Valve
(2) Dump valve

Normal Braking

During normal (non anti-lock) braking, the solenoid valves has current flow. The dump valve is closed and the isolation valve is opened due to spring force.
Brake fluid travels through the centre of the isolation valve (normally open) around the dump valve (normally closed) then to the brake pistons.

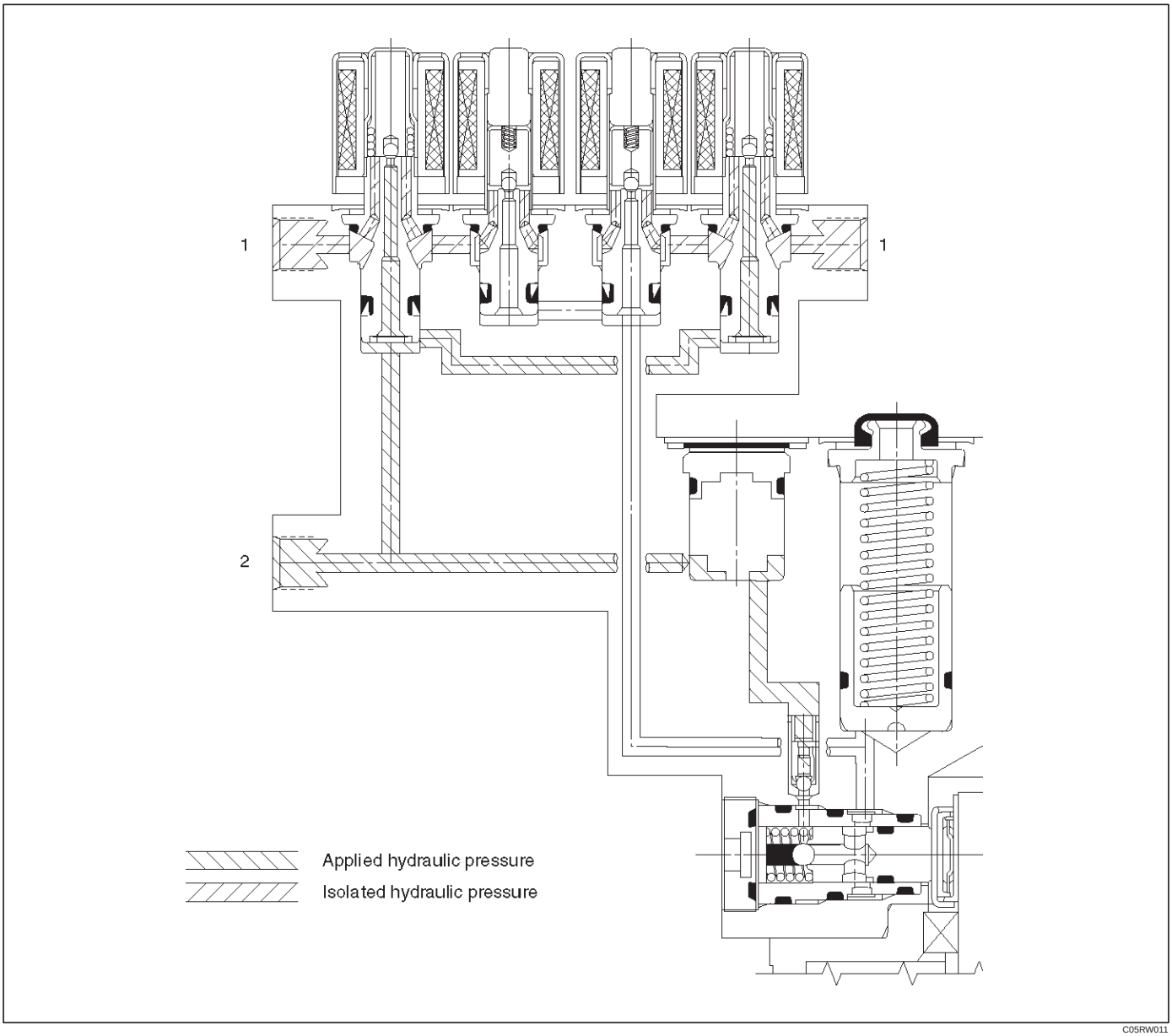


Legend

(1) Brake
(2) Master Cylinder

Pressure Isolation (Pressure Maintain)

The electro-hydraulic control unit is activated when the brakes are applied.
If the information from the wheel speed sensors indicates excessive wheel deceleration (imminent lockup), the first step in the anti-lock sequence is to isolate the brake pressure being applied by the brake pedal.
The microprocessor in the coil integrated module sends a voltage to the coil to energize and close the isolation valve. This prevents any additional fluid pressure applied by the brake pedal from reaching the wheel. With the isolation valves closed, unnecessary increase in the brake pressure is prevented.



C05RW011

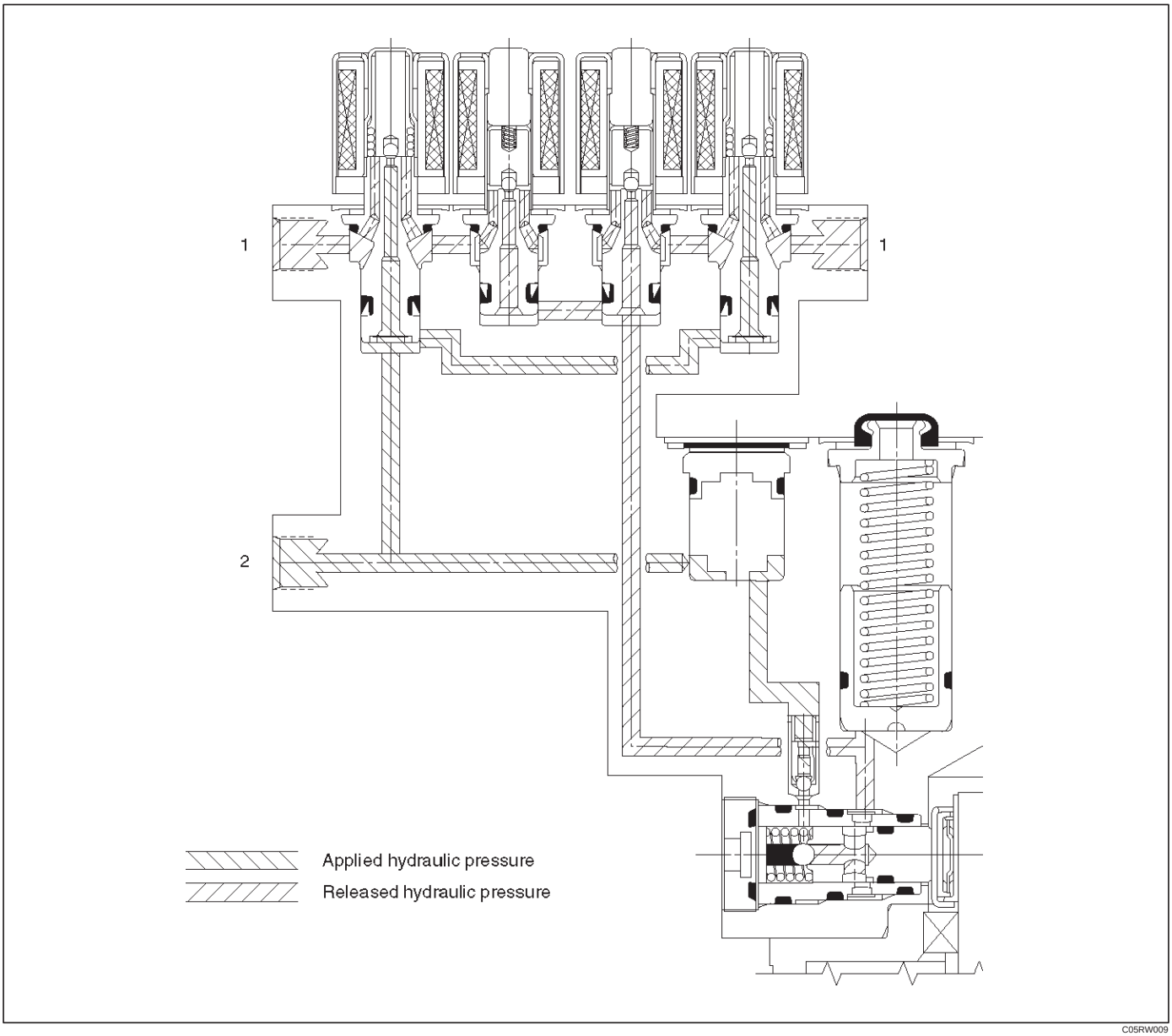
Legend

(1) Brake
(2) Master Cylinder

Pressure Reduction

Once the brake pressure is isolated, it must be reduced to allow the wheels to unlock. This is accomplished by dumping a portion of the brake fluid pressure into a low pressure accumulator.

The microprocessor activates the normally closed dump valve to open, allowing fluid from the wheels to be dumped into the accumulator. This is done with very short activation pulses opening and closing the dump valve passageway. Brake pressure is reduced at the wheel and allows the wheel to begin rotating again. The fluid from the brake piston is stored in the accumulator against spring pressure and a portion of this fluid also primes the pump. The dump valves are operated independently to control the deceleration of the wheel.



Legend

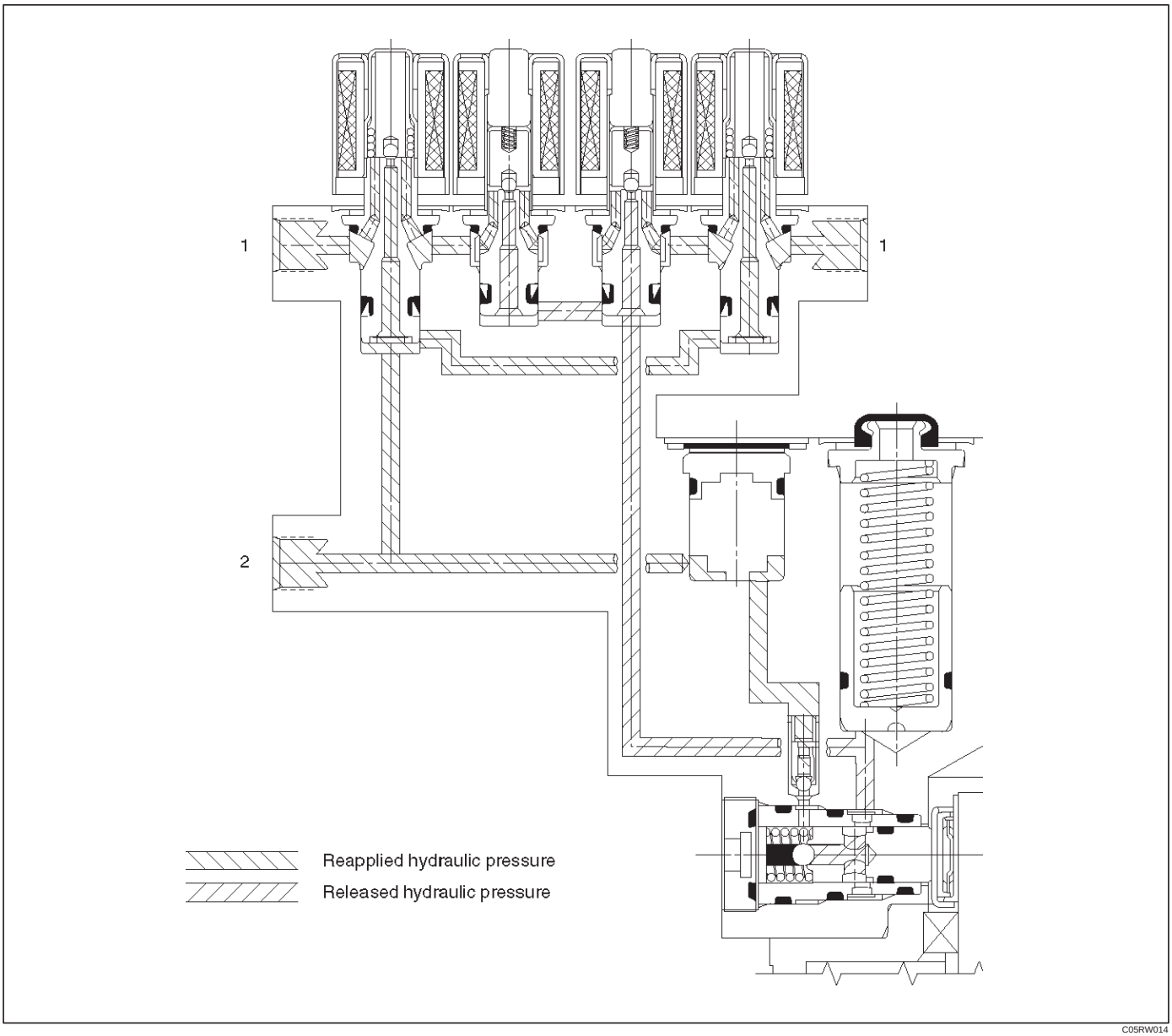
(1) Brake
(2) Master Cylinder

Pressure Increase (Re-apply)

The re-apply sequence is initiated to achieve optimum braking. The isolation valve is momentarily opened to allow master cylinder and pump pressure to reach the brakes. This controlled pressure rise continues until the wheel is at optimum brake output or until the brake pressure is brought up to the master cylinder output pressure.

If more pressure is required, more fluid is drawn from the master cylinder and applied to the brakes. The driver may feel slight pedal pulsations, or pedal drop, this is normal and expected.

As fluid is re-applied to the brakes, the wheel speed will reduce. If the wheels approach imminent lockup again, the module will isolate, dump and re-apply again. This cycle occurs in millisecond intervals, allowing several cycles to occur each second. It is a much faster and more controlled way of “pumping the pedal”.



C05RW014

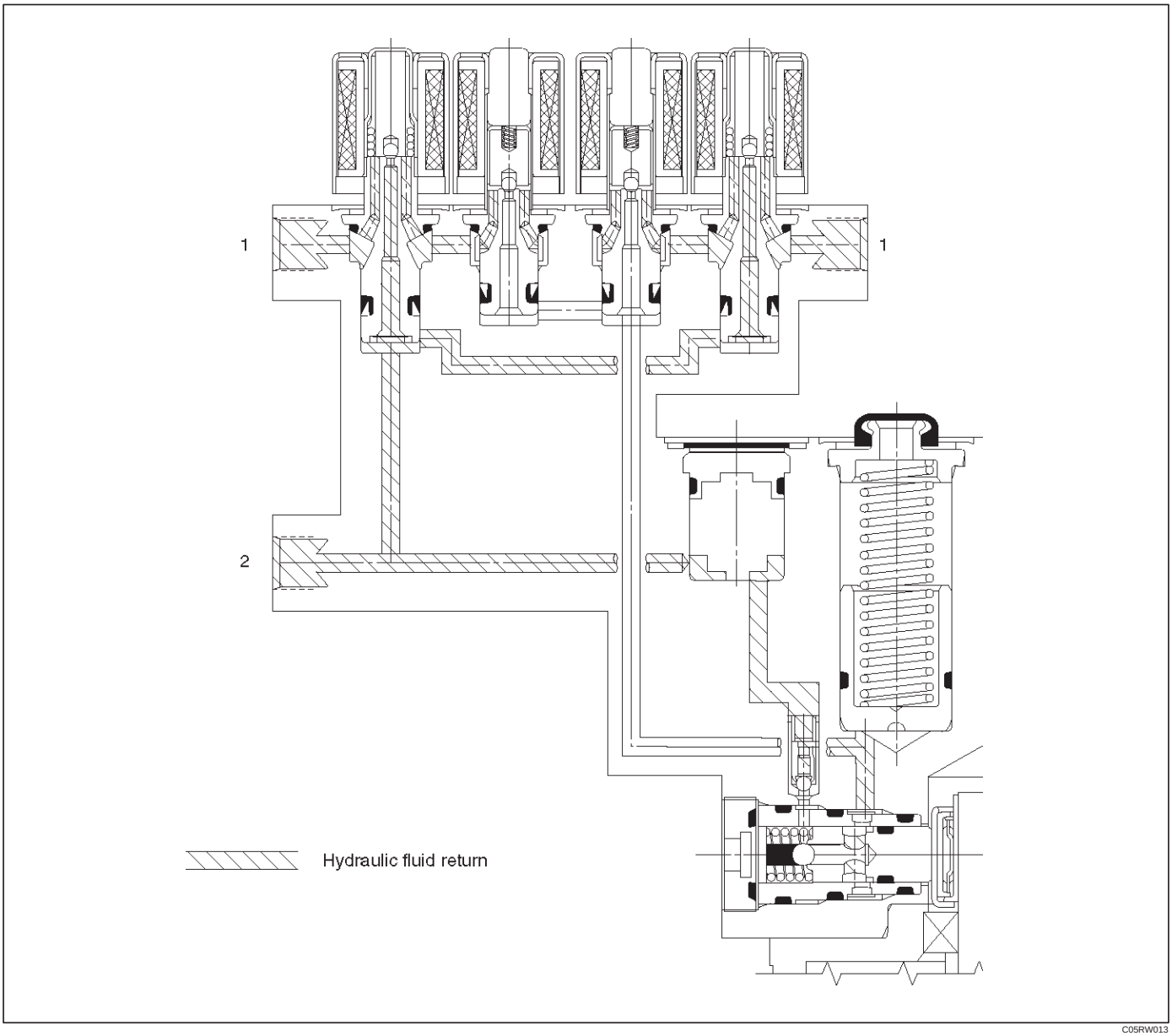
Legend

(1) Brake
(2) Master Cylinder

Brake Release

At the end of the anti-lock stop, when the brake pedal is released, the pump will remain running for a short time to help drain any fluid from the accumulators. As this fluid returns into the system, the spring forces the piston back to its original position.

The isolation valve opens and fluid may return to the master cylinder. Conventional braking is then resumed.



C05RW013

Legend

(1) Brake
(2) Master Cylinder

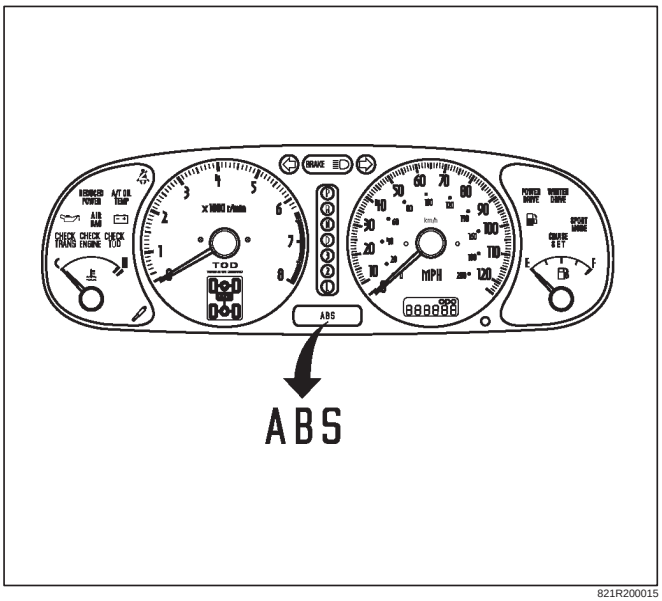
System Components

Electronic Hydraulic Control Unit (EHCU), three Wheel Speed Sensors, Warning Light, and G-sensor.

Electronic Hydraulic Control Unit (EHCU)

The EHCU consists of ABS control circuits, fault detector, and a fail-safe. The signal received from each sensor activates the hydraulic unit accordingly and cancels the ABS to return to normal braking if a malfunction occurs in the ABS system.
The EHCU has a self-diagnosing function which can indicate faulty circuits during diagnosis.
The EHCU is mounted on the engine compartment rear right side. It consists of a Motor, Plunger Pump, Solenoid Valves.
Solenoid Valves: Reduces or holds the caliper fluid pressure for each front disc brake or both rear disc brakes according to the signal sent from the EHCU.
Reservoir: Temporarily holds the brake fluid that returns from the front and rear disc brake caliper so that pressure of front disc brake caliper can be reduced smoothly.
Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.
Motor: Drives the pump according to the signal from EHCU.
Check Valve: Controls the brake fluid flow.

ABS Warning Light



821R200015

Vehicles equipped with the Anti-lock Brake System have an amber “ABS” warning light in the instrument panel. The “ABS” warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCU).In case of an electronic malfunction, the EHCU will turn “ON” the “ABS” warning light and disable the Anti-lock braking function.
The “ABS” light will turn “ON” for approximately three seconds after the ignition switch is turned to the “ON” position.
If the “ABS” light stays “ON” after the ignition switch is turned to the “ON” position, or comes “ON” and stays “ON” while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the rear axle case on the rear differential.
The front sensor rotor is attached to the each brake rotor by bolts.
The rear rotor is press-fit in the differential case.
The magnetic flux generated from electrodes magnetized by a magnet in the sensor varies due to rotation of the rotor, and the electromagnetic induction generates alternating voltage in the coil. This voltage draws a “sine curve” with the frequency proportional to rotor speed and it allows detection of wheel speed.

G-Sensor

The G-sensor installed inside the EHCU detects the vehicle deceleration speed and sends a signal to the EHCU. In 4WD operation, all four wheels may be decelerated in almost the same phase, since all wheels are connected mechanically.
This tendency is noticeable particularly on roads with low friction coefficient, and the ABS control is adversely affected.
The G-sensor judges whether the friction coefficient of road surface is low or high, and changes the EHCU’s operating system to ensure ABS control.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal “bump” will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.
When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a constant force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor. This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS
Anti-lock Brake System

CIM
Coil Integrated Module

CKT
Circuit

DLC
Data Link Connector

EHCU
Electronic Hydraulic Control Unit

FL
Front Left

FR
Front Right

GEN
Generator

H/U
Hydraulic Unit

MV
Millivolts

RR
Rear

RPS
Revolution per Second

VDC
DC Volts

VAC
AC Volts

W/L
Warning Light

WSS
Wheel Speed Sensor

General Diagnosis

General Information

ABS troubles can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.
In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.
Please refer to *Section 5C* for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- ▼ Box Wrench
- ▼ Brake Fluid
- ▼ Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCU) which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCU circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position.
Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-lock Brake System damage.

- ▼ If welding work is to be performed on the vehicle using an electric arc welder, the EHCU and valve block connectors should be disconnected before the welding operation begins.
- ▼ The EHCU and valve block connectors should never be connected or disconnected with the ignition "ON" .
- ▼ If only the rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

If the battery has been discharged

The engine may stall if the battery has been completely discharged and the engine is started via jumper cables. This is because the Anti-lock Brake System (ABS) requires a large quantity of electricity. In this case, wait until the battery is recharged, or set the ABS to a non-operative state by removing the fuse for the ABS (50A). After the battery has been recharged, stop the engine and install the ABS fuse. Start the engine again, and confirm that the ABS warning light does not light.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or

circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspected circuits for damage:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

Test Driving ABS Complaint Vehicles

In case of an intermittent ABS lamp illumination, see "Diagnosis by ABS Warning Light illumination Pattern" or go to 5A–37. In some cases, the vehicle may need to be test driven by following the test procedure below.

1. Start the engine and make sure that the "ABS" W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.

NOTE: The DTC cannot be cleared if the vehicle speed does not exceed 12 km/h (8 mph) at DTC, even though the repair operation is completed.

2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.
3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.
8. If the abnormality has been detected, repair in accordance with the "SYMPTOM DIAGNOSIS" .

NOTE:

- Be sure to give a test drive on a wide, even road with a small traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

"ABS" Warning Light

When ABS trouble occurs to actuate "ABS" warning light, the trouble code corresponding to the trouble is stored in the EHCU. Only ordinary brake is available with ABS being unactuated. Even when "ABS" warning light is actuated, if the starter switch is set ON after setting it OFF once, the EHCU checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light is lit normally even though the trouble code is stored.

NOTE: Illumination of the "ABS" warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

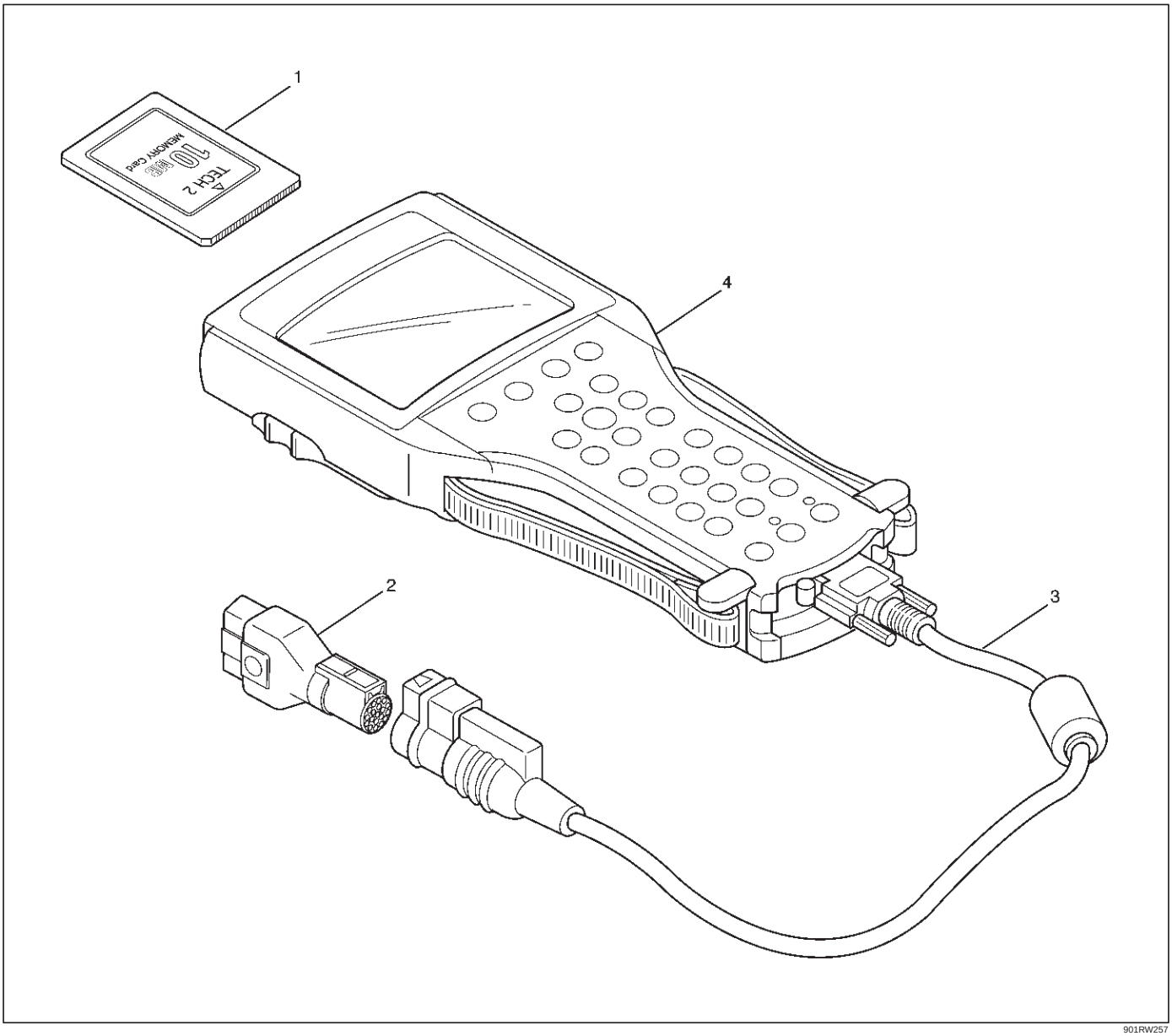
Normal Operation

"ABS" Warning Light

When the ignition is first moved from "OFF" to "RUN" , the amber "ABS" warning light will turn "ON" . The "ABS" warning light will turn "ON" during engine starting and will usually stay "ON" for approximately three seconds after the ignition switch is returned to the "ON" position. The warning light should remain "OFF" at all other times.

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW257

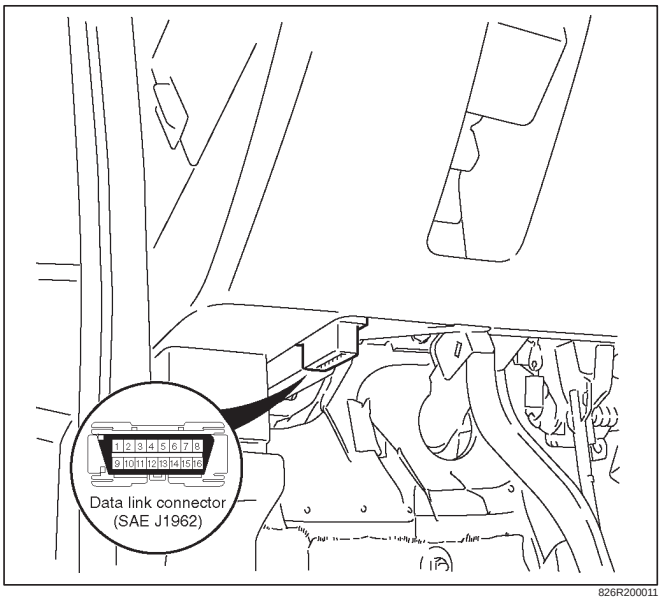
Legend

(1) PCMCIA Card
(2) SAE 16/19 Adaptor
(3) DLC Cable
(4) Tech–2

Getting Started

▼ Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (4).
2. Connect the SAE 16/19 adapter (2) to the DLC cable (3).
3. Connect the DLC cable to the Tech 2 (4).
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



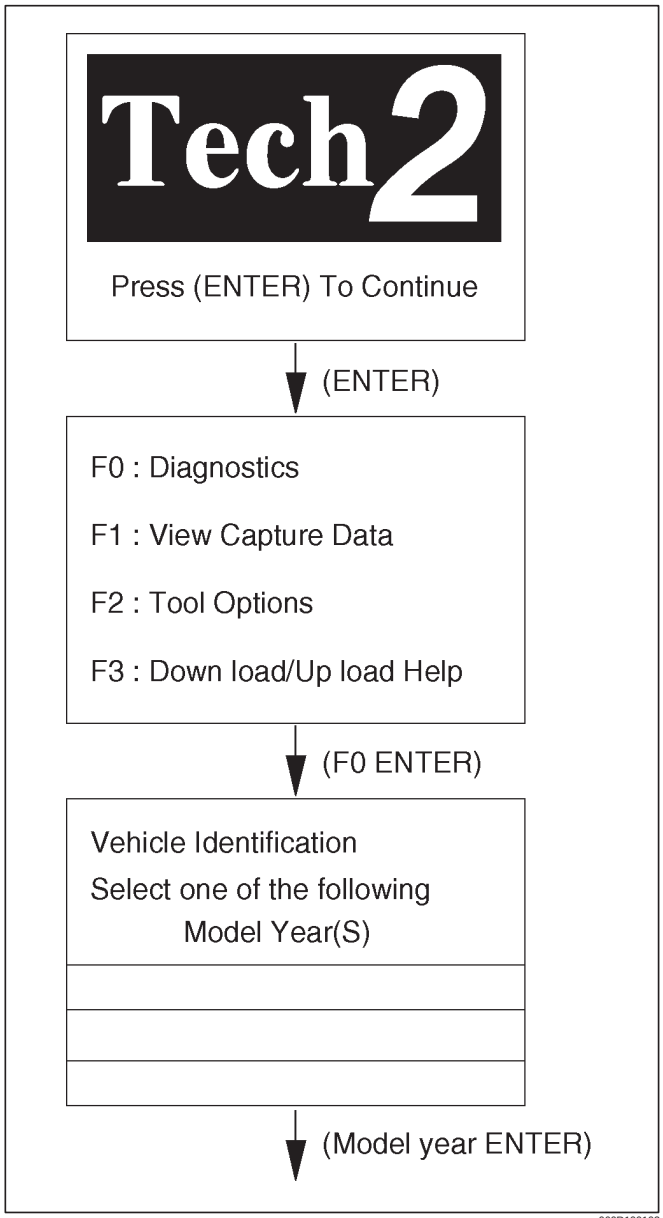
826R200011

6. The vehicle ignition turns on.
7. Power up the Tech 2.
8. Verify the Tech 2 power up display.

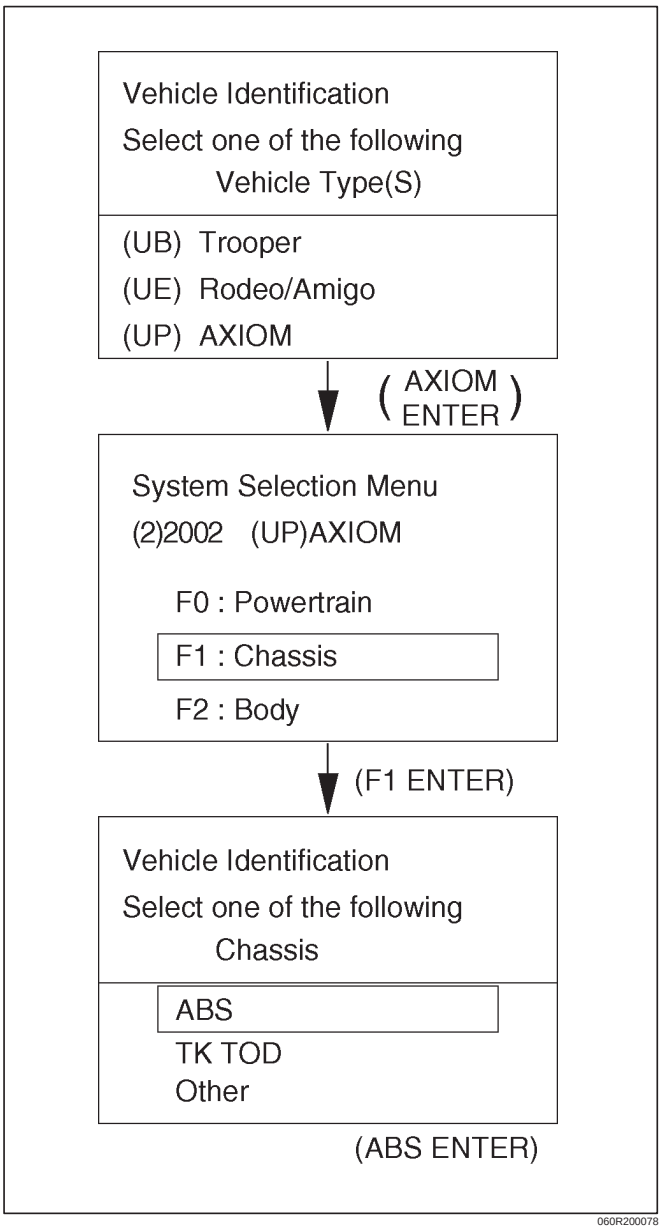
060RW009

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060R100102


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper
(UE) Rodeo/Amigo
(UP) AXIOM
(AXIOM ENTER)
System Selection Menu
(2)2002 (UP)AXIOM
F0 : Powertrain
F1 : Chassis
F2 : Body
(F1 ENTER)
Vehicle Identification
Select one of the following
Chassis
ABS
TK TOD
Other
(ABS ENTER)
060R200078

DATA LIST

The data displayed by DATA LIST are as follows:

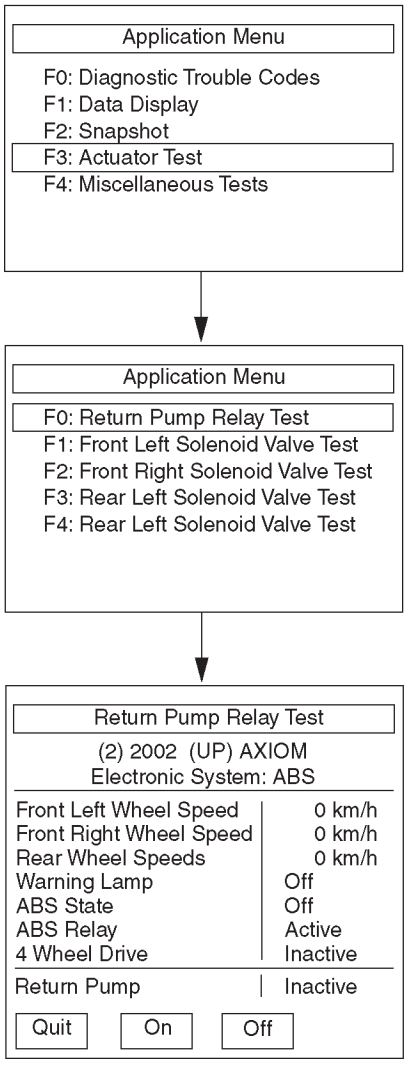
Display	Content	OK/NG Criteria for Data
Front Left Wheel Speed Front Right Wheel Speed Rear Wheel Speeds	km/h (MPH)	▼Start the vehicle and make sure of linear change in each wheel speed. ▼Turn each wheel by hand and make sure that each speed data change.
Warning Lamp	ON/OFF	▼To be OFF usually
ABS State	ON/OFF	▼To be OFF usually
ABS Relay	Active/Inactive	▼To be Active usually
4 Wheel Drive	Active/Inactive	▼2WD: Inactive ▼4WD: Active
Brake Switch	Active/Inactive	▼Inactive (Released) ▼Active (Pressed)
Brake Fluid Level	Normal or not	▼To be Normal usually
Return Pump	Active/Inactive	▼To be Inactive usually
DRP (Dynamic Rear Proportioning)	Active/Inactive	▼To be Inactive usually
Rear Dump Valve Commanded	Active/Inactive	▼To be Inactive usually
Rear Dump Valve Feedback		
Rear Isolation Valve Commanded		
Rear Isolation Valve Feedback		
FL Dump Valve Commanded	Active/Inactive	▼To be Inactive usually
FL Dump Valve Feedback		
FL Isolation Valve Commanded		
FL Isolation Valve Feedback		
FR Dump Valve Commanded	Active/Inactive	▼To be Inactive usually
FR Dump Valve Feedback		
FR Isolation Valve Commanded		
FR Isolation Valve Feedback		
G–Sensor	Voltage	▼2.50V when vehicle is stopped
Battery Voltage	Voltage	▼Between 10–16.9V

ACTUATOR TEST

This mode is used to exercise the ABS actuators and make sure they operate normally. Prior to the test, pay attention to the cautions below. (When checking the solenoid valve system, be sure to jack up the vehicle.)

CAUTION:

- ▼ Before testing, be sure that the brakes work normally.
- ▼ Make sure that the battery is fully charged.Conduct the test by two persons (A TECH 2 operator and a vehicle checker).
- ▼ Be sure to start ACTUATOR TEST with the engine stopped.
- ▼ Before testing, make sure that electrical trouble, if any, has been completely repaired. Conducting tests of ABS solenoid with electrical circuit problem remaining uncorrected could damage the control unit.

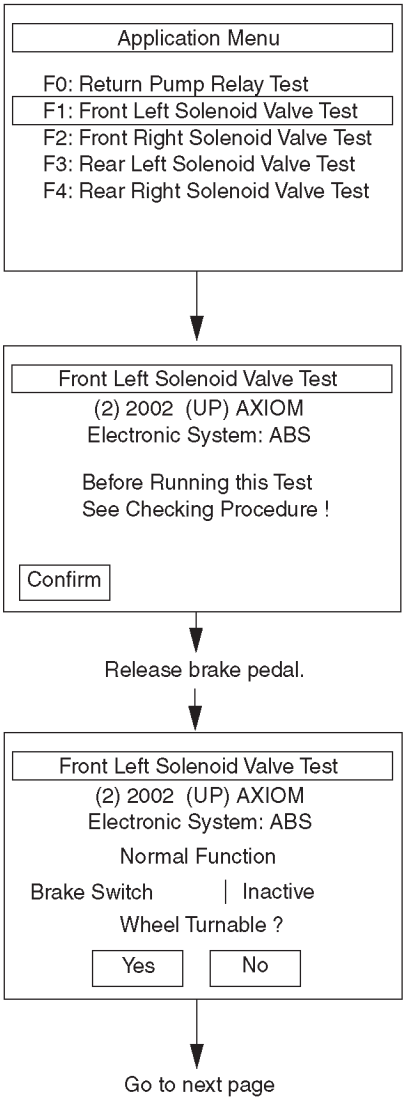


Select "F3: Actuator Test" by function key from Application Menu, and push enter key.

Return Pump Relay Test:
Select "F0: Return Pump Relay Test" and push enter key.

Using soft key, check the return pump function.

F05R200001

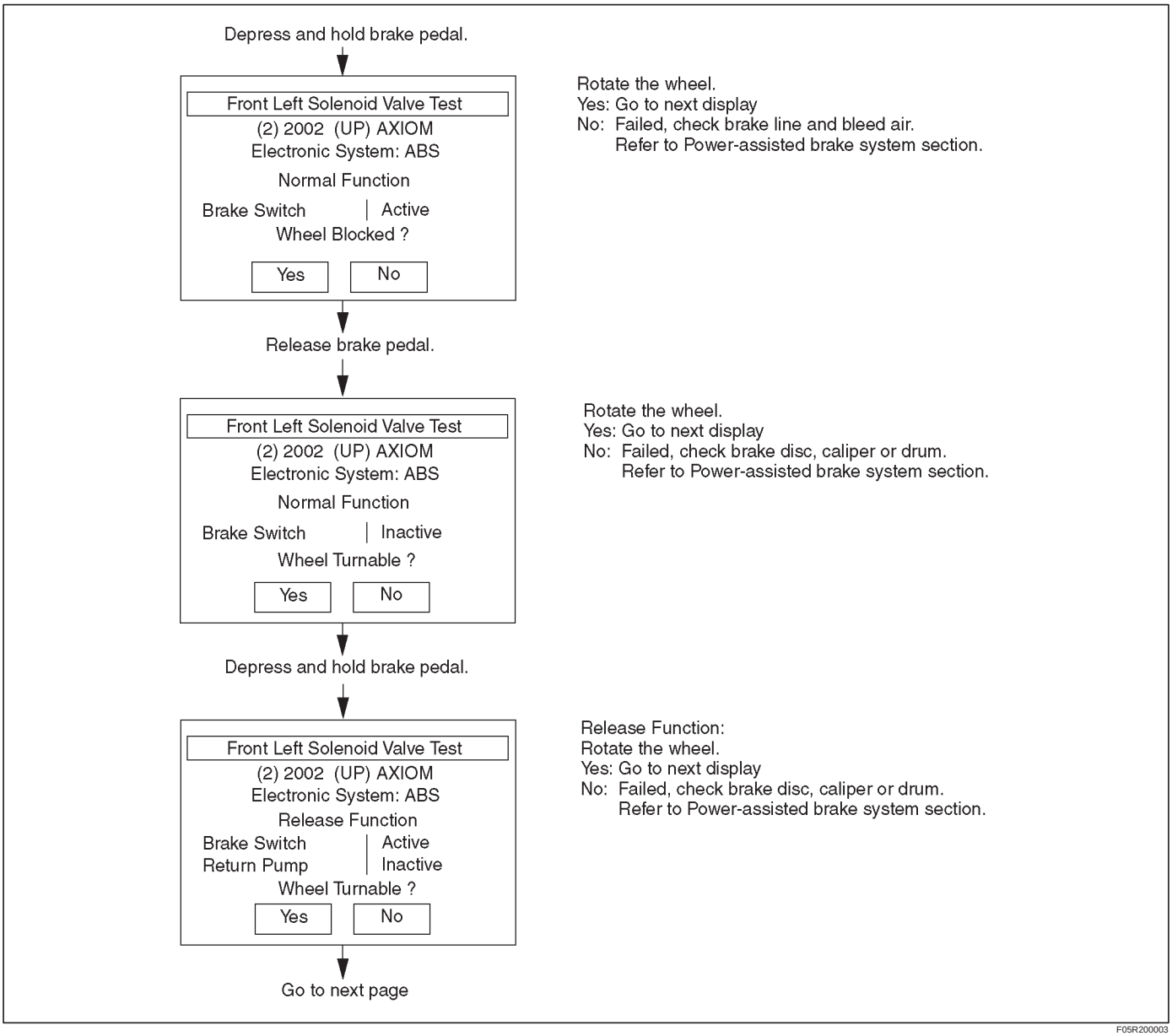


Solenoid Valve Test:
Select required Solenoid Valve Test and push the enter key.

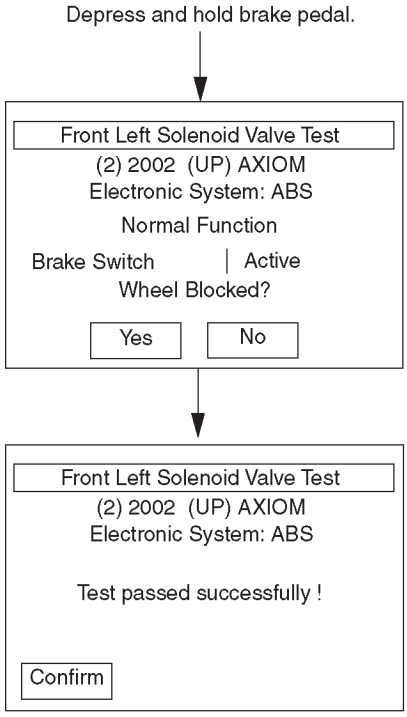
Push the soft key under "Confirm" box.

Normal Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check hydraulic brake system.
Refer to Power-assisted brake system section.

F05R200002


Depress and hold brake pedal.
Front Left Solenoid Valve Test
(2) 2002 (UP) AXIOM
Electronic System: ABS
Normal Function
Brake Switch | Active
Wheel Blocked ?
Yes
No
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake line and bleed air.
Refer to Power-assisted brake system section.
Release brake pedal.
Front Left Solenoid Valve Test
(2) 2002 (UP) AXIOM
Electronic System: ABS
Normal Function
Brake Switch | Inactive
Wheel Turnable ?
Yes
No
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake disc, caliper or drum.
Refer to Power-assisted brake system section.
Depress and hold brake pedal.
Front Left Solenoid Valve Test
(2) 2002 (UP) AXIOM
Electronic System: ABS
Release Function
Brake Switch | Active
Return Pump | Inactive
Wheel Turnable ?
Yes
No
Release Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake disc, caliper or drum.
Refer to Power-assisted brake system section.
Go to next page

F05R200003

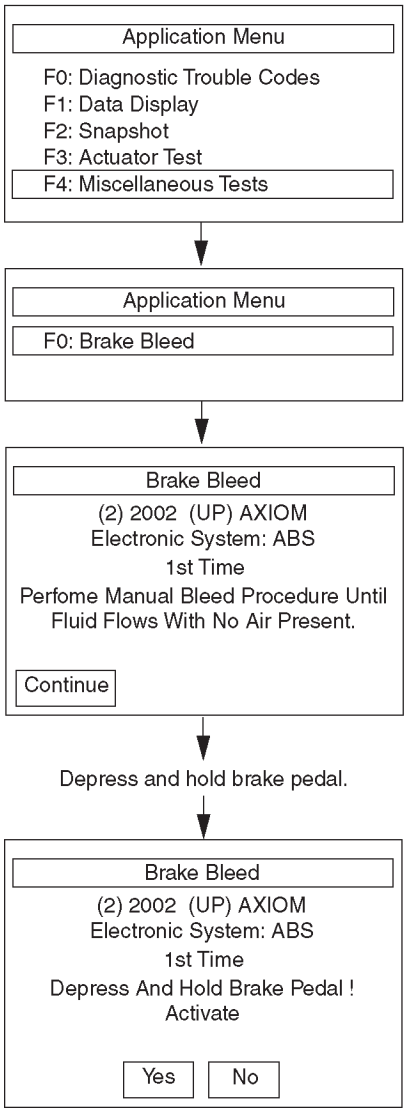


Reapply Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake line and bleed air.
Refer to Power-assisted brake system section.

Test completed.
To return Application Menu, push the soft key under "Confirm" box.

F05R200004

Tech 2 Service Bleed



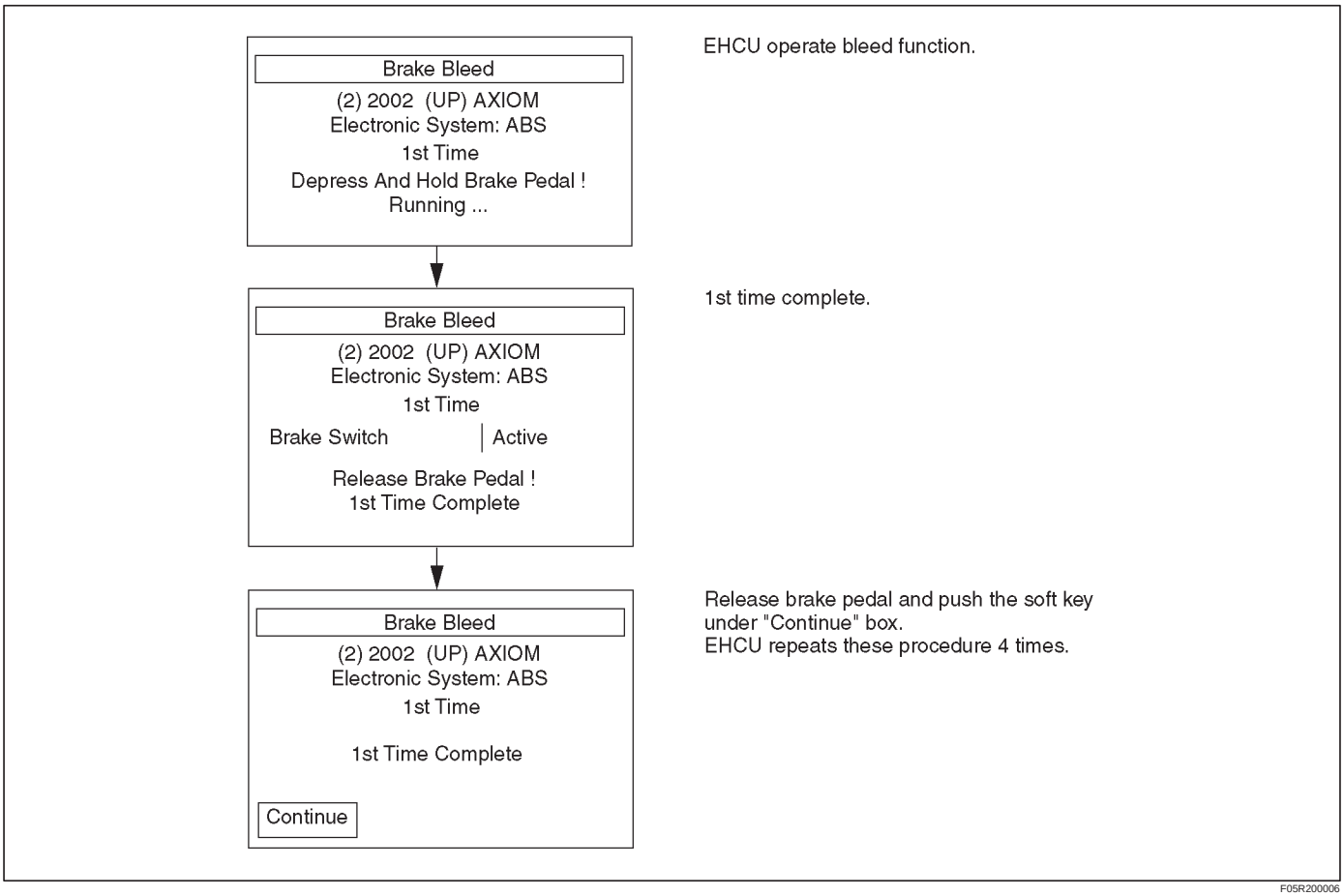
Select "F4: Miscellaneous Tests" by function key from Application Menu, and push enter key.
NOTE: Apply parking brake firmly while servicing. When operate EHCU by using Tech 2, start the engine.

Push enter key.

Push the soft key under "Continue" box.

To start brake bleed, push the soft key under "Yes" box.

F05R200005



Basic Diagnostic Flow Chart

Step	Action	Yes	No
1	1. Verify complaint with the customer. 2. Questioning to customer. 3. Basic inspection (Refer to *Basic inspection procedure*) Using TECH 2?	Go to *Step 2*	Go to *Step 4*
2	Verify DTC through: “F0: Diagnostic Trouble Codes.” Is the DTC stored in the EHCU?	Clear code and check for repeatability. Go to *Step 3*	Go to *Step 5*
3	1. Repair of faulty part. 2. Clear DTC. 3. Inspection of “ABS” W/L Illumination pattern with ignition SW “ON”. 4. Test drive. Does trouble repeat?	Repeat the diagnosis it the symptom or DTC appears again Go to *Step 1*	Go to *Step 5*
4	Verify DTC through: “F0: Diagnostic Trouble Codes.” Is the DTC stored in the EHCU?	Clear code and check for repeatability Go to *Step 3*	Trouble diagnosis based on symptom (Refer to *Symptom Diagnosis*) Go to *Step 3*
5	1. Reconnect all components. Ensure that all component are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Finished	Go to *Step 5*

Basic Inspection Procedure

1. Basic Inspection of Service Brake

Step	Action	Yes	No
1	Is the fluid level normal?	Go to *Step 2*	Replenish with fluid Go to *Step 2*
2	Does fluid leak?	Repair Go to *Step 3*	Go to *Step 3*
3	Is the booster functioning properly?	Go to *Step 4*	Repair Go to *Step 4*
4	Is the pad and rotor within specs?	Go to *Step 5*	Repair Go to *Step 5*
5	Reconnect all components. Ensure all component are properly mounted. Was this step finished?	Finished	Go to *Step 5*

2. Ground Inspection

Step	Action	Yes	No
1	Is there good contact with the ABS ground points?	Go to *Step 2*	Repair Go to *Step 2*
2	Reconnect all components. Ensure that all component are properly mounted.	Finished	Go to *Step 2*

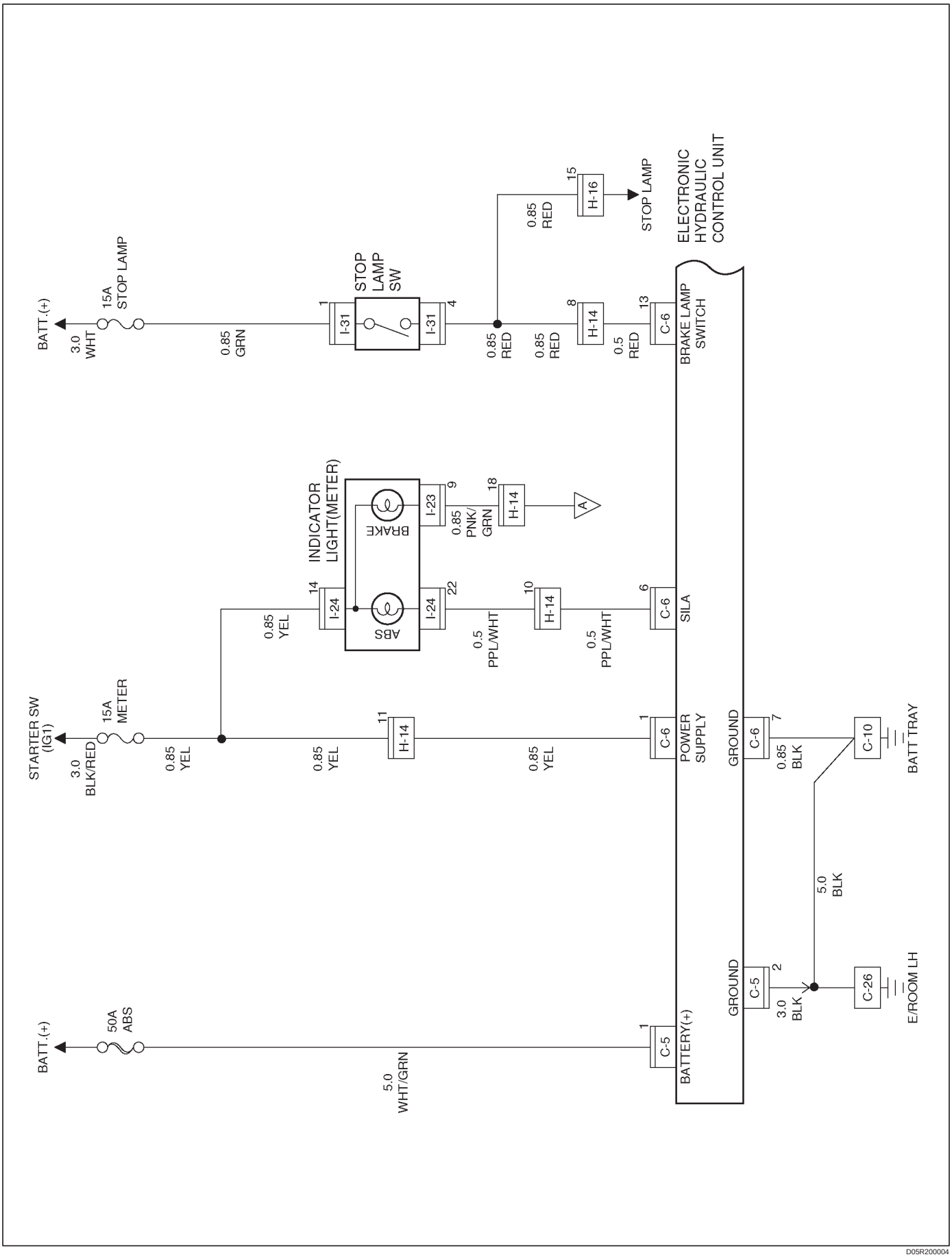
EHCU Connector Pin-out Checks

▼ Disconnect Electronic Hydraulic Control Module.

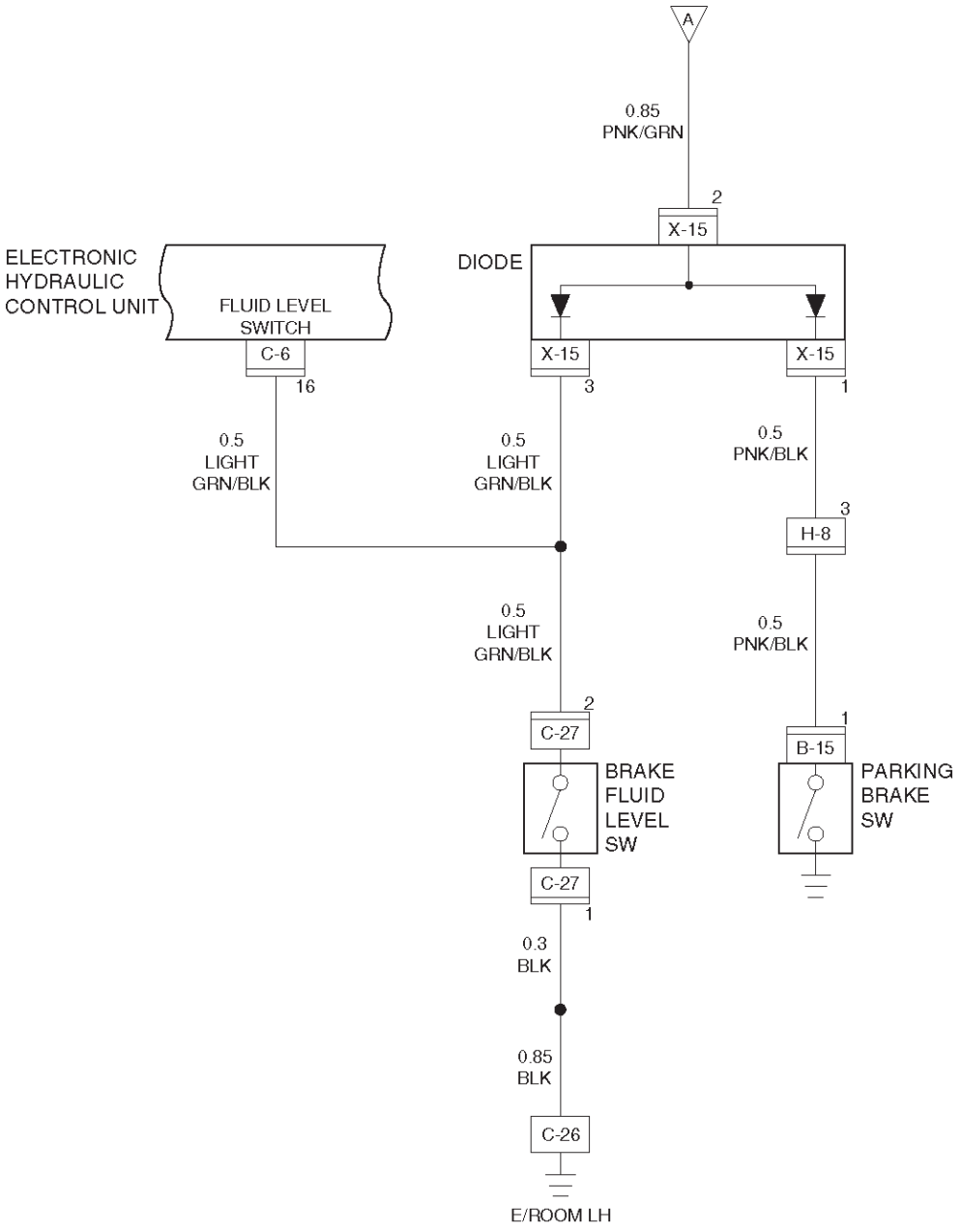
▼ Perform checks with high impedance digital multimeter J-39200 or equivalent.

No.	Circuit to be Tested	Ignition Switch Position	Multimeter Scale/Range	Measure between Pin Number	Nominal Value	Note
1	Power supply	OFF	20DCV	1 (C–5) 2 (C–5)	11.5V to 14.5V	
2	Ignition enable	OFF	20DCV	1 (C–6) 7 (C–6)	0V to 0.1V	
		ON	20DCV	1 (C–6) 7 (C–6)	11.5V to 14.5V	
3	Stoplamp switch	OFF	20DCV	13 (C–6) 7 (C–6)	10.5V to 14.5V	Press brake pedal
4	Ground connection	OFF	200Ω	7 (C–6) Ground	Less than 2Ω	
		OFF	1Ω	2 (C–5) Ground	Less than 0.2Ω	
5	FL speed sensor	OFF	2kΩ	2 (C–6) 10 (C–6)	2.0kΩ to 2.8kΩ	Internal Resistance
		OFF	200kΩ	2 (C–6) 7 (C–6)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	2 (C–6) 10 (C–6)	more than 200mV	Turn wheel at 1RPS
6	FR speed sensor	OFF	2kΩ	3 (C–6) 11 (C–6)	2.0kΩ to 2.8kΩ	Internal Resistance
		OFF	200kΩ	3 (C–6) 7 (C–6)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	3 (C–6) 11 (C–6)	more than 200mV	Turn wheel at 1RPS
7	RR speed sensor	OFF	2kΩ	4 (C–6) 12 (C–6)	1.2kΩ to 2.0kΩ	Internal Resistance
		OFF	200kΩ	4 (C–6) 7 (C–6)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	4 (C–6) 12 (C–6)	more than 200mV	Turn wheel at 1RPS

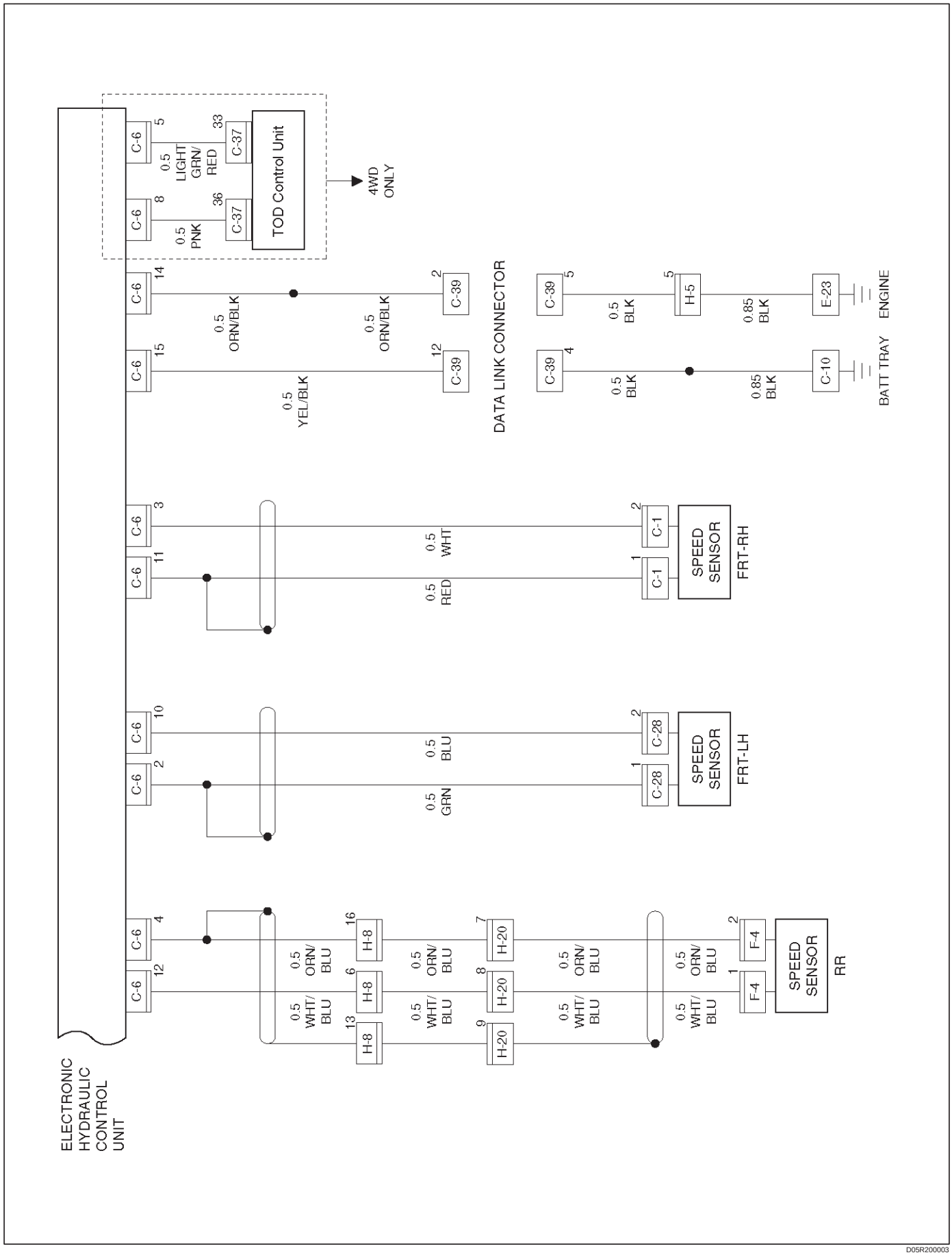
Circuit Diagram



D05R200004

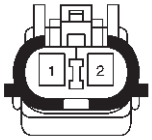
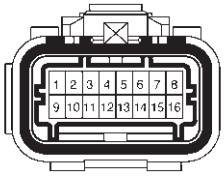
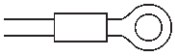
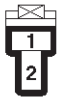
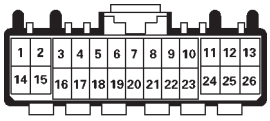
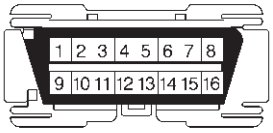
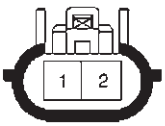

A
0.85
PNK/GRN
2
X-15
ELECTRONIC
HYDRAULIC
CONTROL UNIT
FLUID LEVEL
SWITCH
C-6
16
DIODE
X-15
3
X-15
1
0.5
LIGHT
GRN/BLK
0.5
LIGHT
GRN/BLK
0.5
PNK/BLK
3
H-8
0.5
LIGHT
GRN/BLK
0.5
PNK/BLK
2
C-27
1
B-15
BRAKE
FLUID
LEVEL
SW
PARKING
BRAKE
SW
C-27
1
0.3
BLK
0.85
BLK
C-26
E/ROOM LH

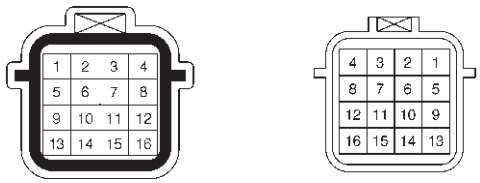
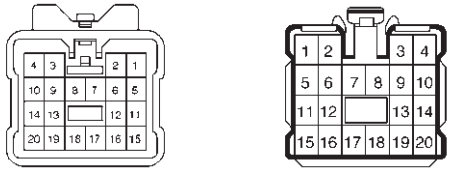
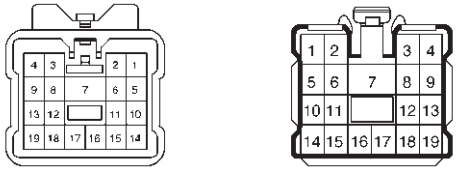
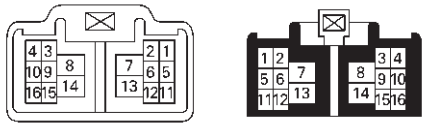
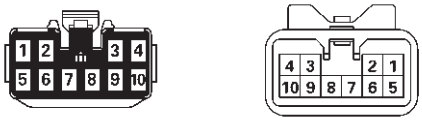
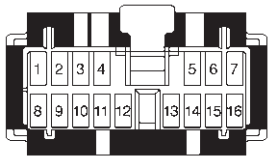
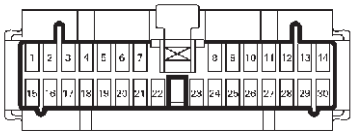
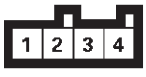
D05R200002


ELECTRONIC HYDRAULIC CONTROL UNIT
C-6
TOD Control Unit
C-37
4WD ONLY
0.5 LIGHT GRN/RED
0.5 PNK
0.5 ORN/BLK
0.5 YEL/BLK
C-39
DATA LINK CONNECTOR
0.5 BLK
0.85 BLK
H-5
E-23
C-10
BATT TRAY
ENGINE
0.5 WHT
0.5 RED
C-1
SPEED SENSOR
FRT-RH
0.5 BLU
0.5 GRN
C-28
FRT-LH
0.5 ORN/BLU
0.5 WHT/BLU
H-8
H-20
F-4
RR

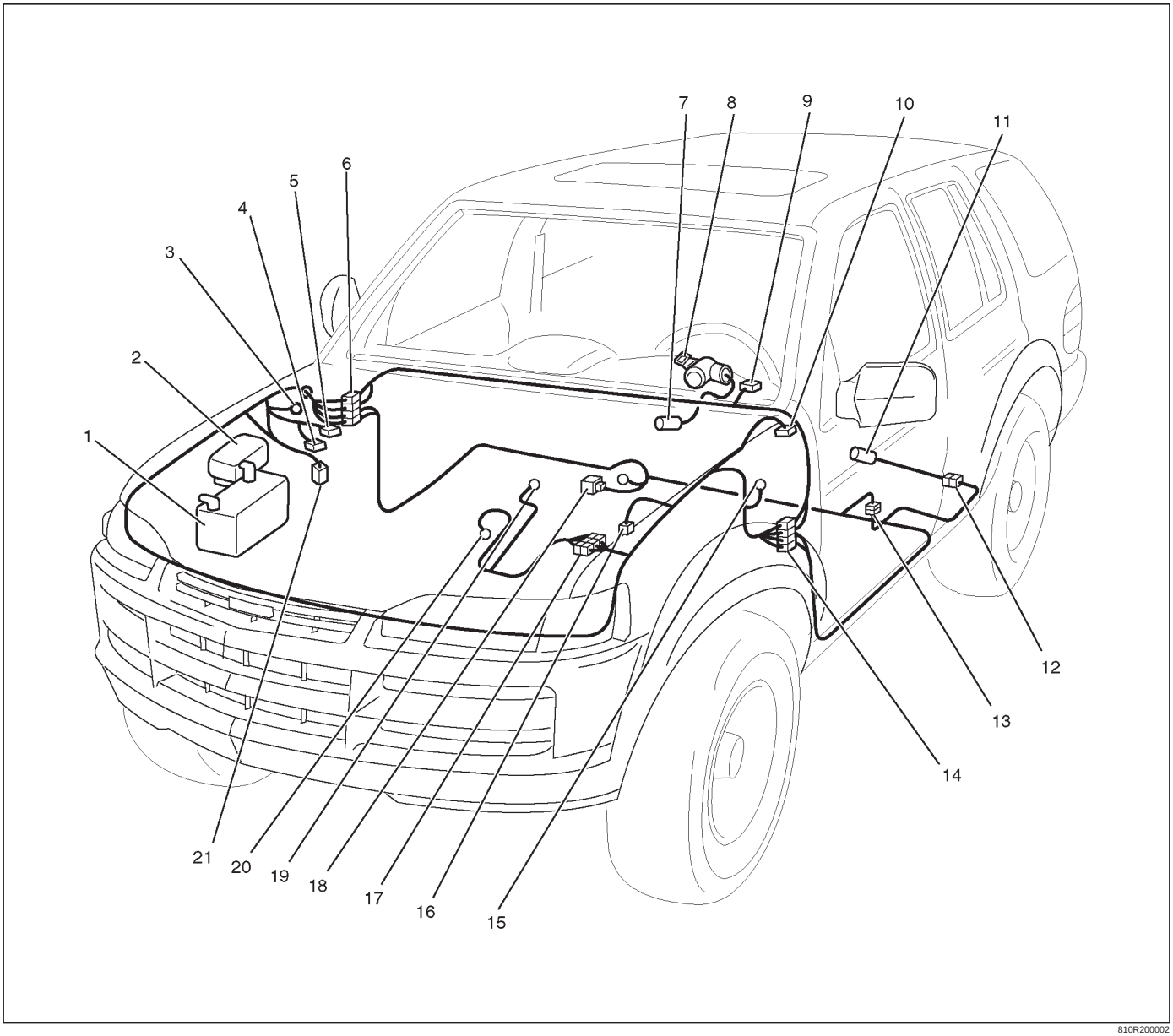
D05R200003

Connector List

No.	Connector face
B-15	
C-1 C-28	
C-5	
C-6	
C-10 C-16 E-23	
C-27	
C-37	
C-39	
F-4	

No.	Connector face
H-5	
H-8	
H-14	
H-16	
H-20	
I-18	
I-23	
I-24	
X-15	

Part Location



810R200002

Legend

(1) Battery
(2) Fuse & Relay Box
(3) C–16
(4) C–5
(5) C–6
(6) H–8, 14
(7) I–18
(8) Starter Switch
(9) I–24
(10) C–39
(11) F–4
(15) C–10
(16) C–28
(17) H–5
(19) E–23
(21) C–1

Symptom Diagnosis

The symptoms that cannot be indicated by warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.
4. Brake pedal feel is abnormal.
5. Braking sound (from EHCU) is heard while not braking.

These are all attributed to problems which cannot be detected by EHCU self-diagnosis. Use the customer complaint and test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without TECH 2	With TECH 2
1	ABS works frequently but vehicle does not decelerate.	Chart A-1	Chart TA-1
2	Uneven braking occurs while ABS works.	Chart A-2	Chart TA-2
3	The wheels are locked.	Chart A-3	Chart TA-3
4	Brake pedal feel is abnormal.	Chart A-4	—
5	Braking sound (from EHCU) is heard while not braking.	Chart A-5	Chart TA-5

Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Yes	No
1	Is braking force distribution normal between front and rear of vehicle?	Go to *Step 2*	Repair brake parts. Go to *Step 7*
2	Are axle parts installed normally?	Go to *Step 3*	Repair axle parts. Go to *Step 7*
3	Is there play in each or any wheel speed sensor?	Repair wheel speed sensor. Go to *Step 7*	Go to *Step 4*
4	Is there damage, or powdered iron sticking to each or any wheel speed sensor/sensor ring?	Replace or repair sensor or sensor ring. Go to *Step 7*	Go to *Step 5*
5	Is the output of each wheel speed sensor normal? (Refer to *Chart C-1 or TC-1*)	Go to *Step 6*	Replace wheel speed sensor or repair harness. Go to *Step 7*
6	Is the input of TOD control unit normal?	Go to *Step 7*	Replace TOD control unit or repair harness. Go to *Step 7*
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 7*

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each sensor. Is the output of each sensor normal?	Go to *Step 2*	Replace wheel speed sensor. Go to *Step 3*
2	Return to Chart A-1. Was the Chart A-1 finished?	Go to *Step 3*	Go to *Step 2*
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Yes	No
1	Is there play in each or any sensor?	Repair. Go to *Step 5*	Go to *Step 2*
2	Damage or powdered iron sticking to each or any sensor/sensor ring?	Repair. Go to *Step 5*	Go to *Step 3*
3	Is the output of each sensor normal? (Refer to *Chart C-1 or TC-1*)	Go to *Step 4*	Replace sensor or repair harness. Go to *Step 5*
4	Is brake pipe connecting order correct?	Replace H/U. Go to *Step 5*	Reconnect brake pipe correctly. Go to *Step 5*
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 5*

Chart TA-2 Uneven Braking Occurs While ABS Works (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each sensor. Is the output of each sensor normal?	Go to *Step 2*	Go to *Step 3*
2	Check piping by TECH 2 ACTUATOR TEST Is the piping normal?	Replace EHCU. Go to *Step 4*	Repair the pipe. Go to *Step 4*
3	Repair and check the wheel speed sensor (Refer to *Chart B-20 to B-23 , C-1 or TC-1*). Was the each chart finished?	Go to *Step 4*	Go to *Step 3*
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 4*

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Yes	No
1	Is ABS working?	Go to *Step 2*	Go to *Step 4*
2	Is vehicle speed under 10 km/h (6mph)?	Go to *Step 3*	Normal.
3	Is sensor output normal? (Chart C-1 or TC-1)	Go to *Step 4*	Replace sensor or repair harness. Go to *Step 6*
4	Is front TOD control unit normal?	Go to *Step 5*	Replace TOD control unit or repair harness. Go to *Step 6*
5	Is hydraulic unit grounded properly?	Replace EHCU. Go to *Step 6*	Repair. Go to *Step 6*
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

Chart A-4 Brake Pedal Feed Is Abnormal

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to *Step 2*	Go to *Step 3*
2	1. Turn the ignition switch off. 2. Disconnected EHCU connector. Is the check voltage EHCU connector terminals 13 to 7 when brake pedal is depressed than battery voltage?	Go to *Step 4*	Harness NG between brake SW and EHCU. Go to *Step 6*
3	Is stop light fuse normal?	Go to *Step 5*	Replace stop light fuse. Go to *Step 6*
4	Is the check continuity between EHCU connector terminals, 7 to body grounded?	Go to *Step 6*	Repair body grounded harness. Go to *Step 6*
5	Is brake SW normal?	Repair stop light harness. Go to *Step 6*	Replace brake SW. Go to *Step 6*
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

Chart A-5, TA-5 Braking Sound (From EHCU) Is Heard While Not Braking

Step	Action	Yes	No
1	Is this the first vehicle start after engine start?	Normal. (It is self checking sound.)	Go to *Step 2*
2	Is vehicle speed under 10 km/h (6 mph)?	Normal. (It is self checking sound.)	Go to *Step 3*
3	Check for the following condition: ▼ At the time of shift down or clutch operation. ▼ At the time of low road friction drive (ice or snow road) or rough road drive. ▼ At the time of high-speed turn. ▼ At the time of passing curb. ▼ At the time of operating electrical equipment switches. ▼ At the time of racing the engine (over 5000 rpm). Did it occur under any one condition above?	ABS may sometimes be actuated even when brake pedal is not applied.	Go to *Step 4*
4	Is there play in each or any sensor/wheel speed sensor rings?	Repair. Go to *Step 7*	Go to *Step 5*
5	Damage or powdered iron sticking to each or any sensor/wheel speed sensor ring?	Repair. Go to *Step 7*	Go to *Step 6*
6	Is each sensor output normal? (Refer to *Chart C-1 or TC-1*).	Check harness/ connector for suspected disconnection If no disconnection is found, replace Coil integrated module. Go to *Step 7*	Repair. Go to *Step 7*
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 7*

Diagnostic Trouble Codes

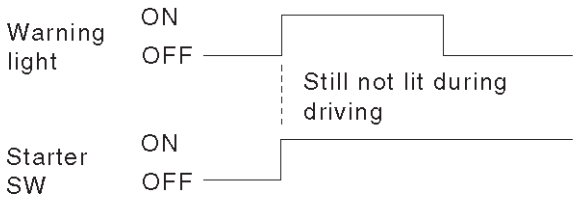
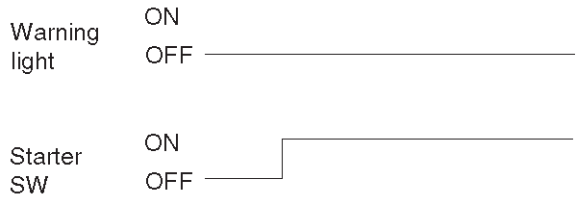
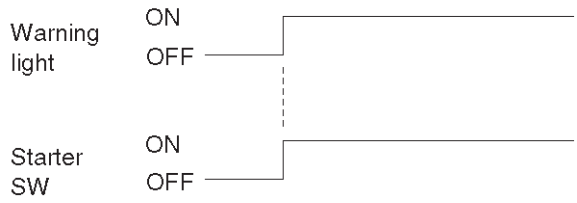
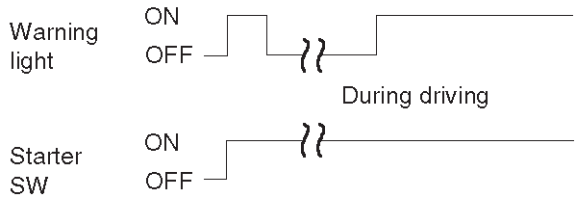
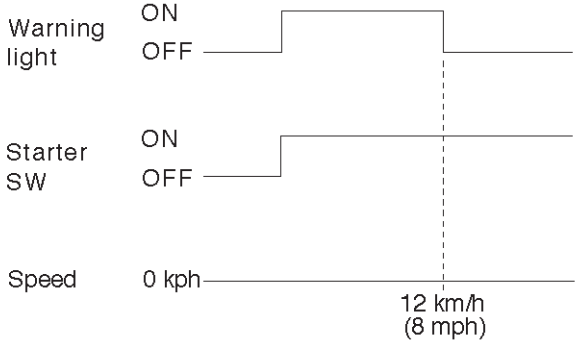
Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

Code		Diagnosis	Item	Chart No.
Flash out	Serial Communications			
12	—	—	—	—
13	C0285	2 WD Controller in 4WD Vehicle Controller	Wiring	B-8
14	C0271	RAM read/write error	Coil Integrated Module	B-2
	C0272	ROM checksum error		
	C0270	ALU function error		
	C0273	Inoperative isolation item		
	C0284	Loop time overrun		
15	C0277	Low ignition voltage	Wiring	B-3
	C0278	High ignition voltage		
17	C0269	Excessive dump time	Coil Integrated Module	B-4
18	C0274	Excessive isolation time		B-5
21	C0276	G-Sensor Failure		B-6
22	C0281	Brake switch Failure		B-7
24	C0282	Open or shorted 4×4 input signal (4WD only)	Wiring	B-8
32	C0267	Open motor circuit or shorted ECU output	Motor	B-9
	C0268	Stalled motor or open ECU output		
35	C0265	Open relay circuit	Relay	B-10
	C0266	Shorted relay circuit		
41	C0245	FL Open isolation solenoid or shorted ECU output	Solenoid	B-11
	C0247	FL Shorted isolation solenoid or open ECU output		
42	C0246	FL Open dump solenoid or shorted ECU output		B-12
	C0248	FL Shorted dump solenoid or open ECU output		
43	C0241	FR Open isolation solenoid or shorted ECU output		B-13
	C0243	FR Shorted isolation solenoid or open ECU output		
44	C0242	FR Open dump solenoid or shorted ECU output		B-14
	C0244	FR Shorted dump solenoid or open ECU output		
45	C0251	Rear Open isolation solenoid or shorted ECU output		B-15
	C0253	Rear Shorted isolation solenoid or open ECU output		
46	C0252	Rear Open dump solenoid or shorted ECU output		B-16
	C0254	Rear Shorted dump solenoid or open ECU output		

Code		Diagnosis	Item	Chart No.
Flash out	Serial Communications			
51	C0225	FL Open or shorted sensor	Sensor or Wiring	B-17
52	C0221	FR Open or shorted sensor		B-18
53	C0235	Rear Open or shorted sensor		B-19
61	C0226	FL Missing sensor signal		B-20
	C0227	FL Sensor signal dropout		
62	C0222	FR Missing sensor signal		B-21
	C0223	FR Sensor signal dropout		
63	C0236	Rear Missing sensor signal		B-22
	C0237	Rear Sensor signal dropout		
64	C0229	Simultaneous dropout of front sensor signal		B-23
65	C0238	Wheel speed error	Vehicle or Sensor	B-24
—	C0286	Shorted indicator lamp	Wiring	—

Diagnosis By “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated while driving, refer to the flow chart below for the correct diagnostic procedure.

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally		Normal
2	Warning light is not lit		Warning light lighting circuit trouble→Go to Chart B-1
3	Warning light remains ON		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
4	Warning light is actuated while driving		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
5	Warning light goes at 12 km/h (8 mph) or higher (After repairing the faulty part)		Even after repairing the faulty part the warning light (W/L) dose not go out if vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCU stores the fault identification and disables the ABS.

How to display and erase DTCs:

NOTE:

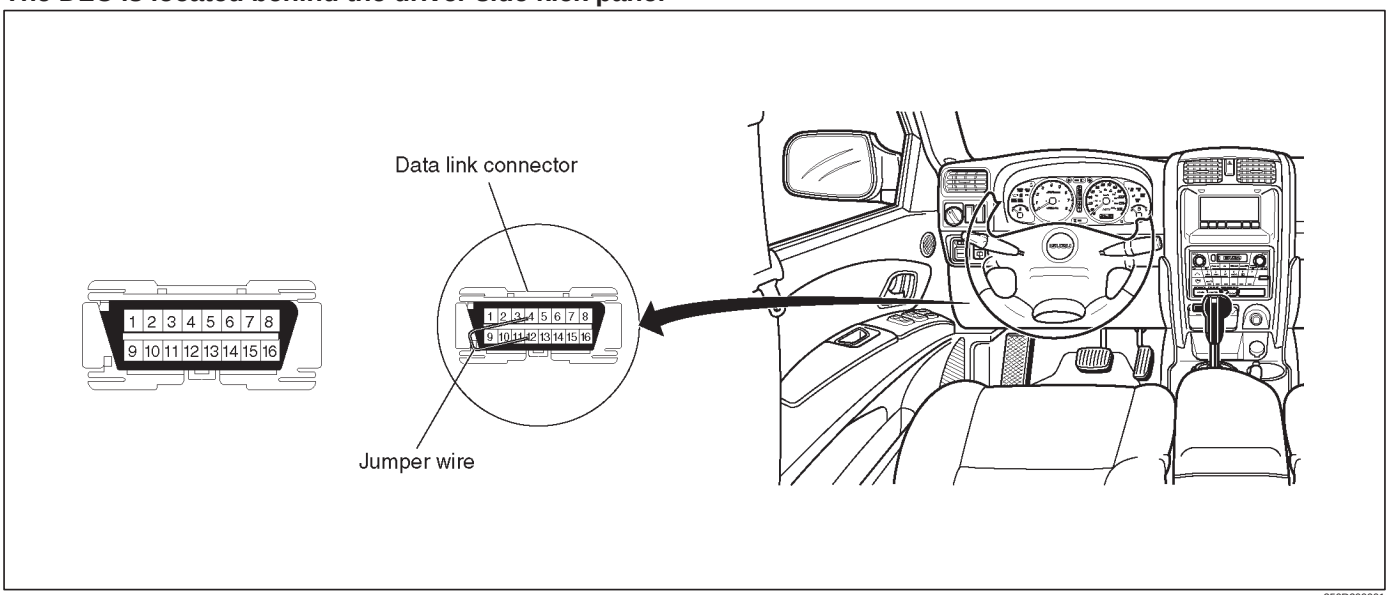
▼DTCs can be displayed also by TECH 2. Use “Diagnostic Trouble Codes” mode.

1. How to start DTC display:

▼Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed. (Unless these two condition are satisfied, DTC display cannot be started.)

▼With IGN OFF, connect #12 terminal with #4 terminal or # 5 terminal (GND) . Then turn IGN ON.

The DLC is located behind the driver side kick panel



350R200001

▼Keep #12 terminal connected with #4 terminal or # 5 terminal (GND) during DTC display. (If #12 terminal is separated from #4 terminal or # 5 terminal (GND) during display, display will stop.)

2. DTC display:

▼DTC is displayed by blinking warning light.

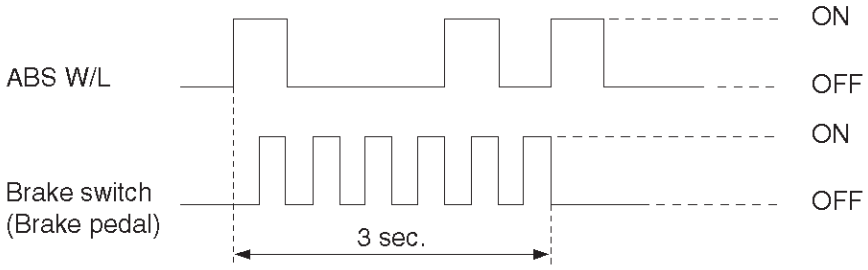
▼Double-digit display.

▼First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)

3. How to erase code:

▼Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.

▼The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedaled).



B05RW005

4. Notes

▼If the following should occur during Diagnostic Trouble Code (DTC) display, the display will be discontinued. After initial check, the status that is under the control of ABS will be returned :

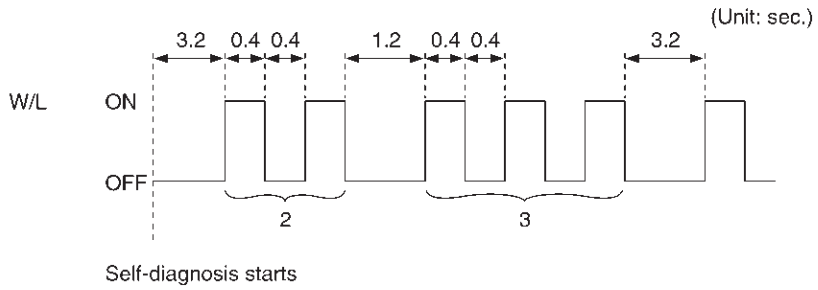
– The vehicle starts (The wheels turn) or the brake pedal is depressed.

▼Up to 3 different codes can be stored.

▼If the ABS should turn OFF due to an intermittent defect, the system will be restored at the next key cycle, if the initial check finds no abnormality (when IGN is switched from OFF to ON).

5. An example of DTC display

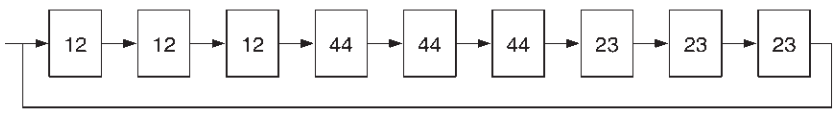
<Display of DTC 23>



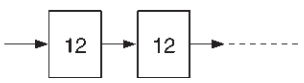
B05R100001

After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)

<In case where there are two or more DTCs: 44 & 23>



<In case no DTC has been stored>



B05R100002

The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes after)

Chart B-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Yes	No
1	Is W/L fuse disconnected?	Replace fuse. Go to *Step 5*	Go to *Step 2*
2	Is W/L burnt out?	Replace W/L bulb. Go to *Step 5*	Go to *Step 3*
3	1. Turn the key off. 2. Disconnect coil integrated module connector (C-6). 3. Turn the key ON. Is the check voltage between coil integrated module connector (C-6) terminals 6 and 7 the battery voltage?	Go to *Step 4*	Repair harness and connector. Go to *Step 5*
4	Is there the continuity between coil integrated module connector (C-6) terminals, 1 and 7 and body ground.	Check harness for suspected disconnection No fault found: Replace EHCU. Go to *Step 5*	Repair harness and connector. Go to *Step 5*
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 5*

Chart B-2 CPU Error (DTC 14 (Flash out) / C0271, C0272, C0273, C0284 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnected coil integrated module connector. 3. Inspect coil integrated module ground. Is there the continuity between the coil integrated module connector terminals, 2 (C-5) and 7 (C-6) and body ground?	Go to *Step 2*	Repair the body ground harness. Go to *Step 3*
2	1. Turn the key off, connect the coil integrated module connector. 2. Erase the trouble code. 3. Turn Ignition off, then on, to perform system self-check. 4. If warning light remains on, display trouble codes once again. Is the trouble code the DTC 14 (Flash out) / C0271, C0272, C0273, C0284 (Serial communications)?	Replace EHCU. Go to *Step 3*	Inspect in accordance with the DTC displayed.
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-3 Low or High Ignition Voltage (DTC 15 (Flash out) / C0277, 0278 (Serial communications))

Step	Action	Yes	No
1	Is the battery voltage normal? (Battery capacity check)	Go to *Step 2*	Charge or replace battery. Go to *Step 2*
2	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Turn the key on. Is the voltage between coil integrated module connector (C-6) terminals 1 and 7, higher than 10V?	Check harness connector for suspected disconnection Fault found: Repair, and perform system self-check No fault found: replace EHCU. Go to *Step 3*	Repair harness or connector. Go to *Step 3*
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-4 Excessive Dump Time (DTC 17 (Flash out) / C0269 (Serial communications))

Step	Action	Yes	No
1	Check for anything causing extended ABS activation, such as locked brakes or an erratic speed sensor signal. Was a problem found?	Repair or Replace	Go to *Step 2*
2	1. The key turned off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 2*

Chart B-5 Excessive Isolation Time (DTC 18 (Flash out) / C0274 (Serial communications))

Step	Action	Yes	No
1	Check for anything causing extended ABS activation, such as locked brakes or an erratic speed sensor signal. Was a problem found?	Repair or Replace	Go to *Step 2*
2	1. The key turned off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 2*

Chart B-6 G-Sensor Output Failure (DTC 21 (Flash out) / C0276 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 1*

Chart B-7 Brake Switch Failure (DTC 22 (Flash out) / C0281 (Serial communications))

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to *Step 2*	Go to *Step 4*
2	1. Turn the key off. 2. Disconnected coil integrated module connector. Is the check voltage between coil integrated module connector (C-6) terminals 13 to 7 when brake pedal is depressed the battery voltage?	Go to *Step 3*	Harness between brake SW and coil integrated module is faulty. Go to *Step 6*
3	Is the check that pins C-5 connector 2, and C-6 connector 7 have good ground?	Check harness / connector for disconnection Fault found: Repair, and perform system self-check. No fault found: replace EHCU. Go to *Step 6*	Repair. Go to *Step 6*
4	Is stop light fuse normal?	Go to *Step 5*	Replace. Go to *Step 6*
5	Is brake SW normal?	Abnormal harness in stop light circuit. Repair the harness. Go to *Step 6*	Replace. Go to *Step 6*
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

Chart B-8 2WD Controller in 4WD Vehicle Controller (DTC 13 (Flash out) / C0285 (Serial communications)), 4WD State Input Signal Failure (DTC 24 (Flash out) / C0282 (Serial communications))

Step	Action	Yes	No
1	Remove coil integrated module connector. Is the coil integrated module connector (C-6) terminal 8 line normally?	Go to *Step 2*	Repair. Go to *Step 3*
2	Is the TOD control unit normally?	Replace EHCU. Go to *Step 3*	Replace TOD control unit. Go to *Step 3*
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-9 Pump Motor Failure (DTC 32 (Flash out) / C0267, C0268 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the voltage between terminal 1 of the coil integrated module connector (C-5) and body ground. Is the voltage equal to the battery voltage?	Go to *Step 2*	Repair fuse/harness between battery and coil integrated module connector (C-5) terminal 1. Go to *Step 5*
2	Is the harness from the hydraulic unit connected to the coil integrated module connector?	Go to *Step 3*	Connect to the connector. Go to *Step 3*
3	Is the hydraulic unit harness in good condition?	Go to *Step 4*	Replace EHCU. Go to *Step 5*
4	Is the resistance of hydraulic unit connector terminals 1 and 2 between 0.2 and 1.0 ohms?	Replace EHCU. Go to *Step 5*	Replace EHCU. Go to *Step 5*
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 5*

Chart B-10 EHCU Valve Relay Failure (DTC 35 (Flash out) / C0265, C0266 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the voltage between terminal 1 of the coil integrated module connector (C-5) and body ground. Is the voltage equal to the battery voltage?	Replace EHCU. Go to *Step 2*	Repair fuse and harness between coil integrated module connector (C-5) terminal 1 and battery. Go to *Step 2*
2	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 2*

Chart B-11 FL Isolation Solenoid Coil Failure (DTC 41 (Flash out) / C0245, C0247 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-12 FL Dump Solenoid Coil Failure (DTC 42 (Flash out) / C0246, C0248 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-13 FR Isolation Solenoid Coil Failure (DTC 43 (Flash out) / C0241, C0243 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-14 FR Dump Solenoid Coil Failure (DTC 44(Flash out) / C0242, C0244 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-15 Rear Isolation Solenoid Coil Failure (DTC 45 (Flash out) / C0251, C0253 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-16 Rear Dump Solenoid Coil Failure (DTC 46 (Flash out) / C0252, C0254 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to *Step 2*	Go to *“EHCU Connector Pin–out Checks.”*
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to *Step 3*	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-17 FL Speed Sensor Open or Shorted (DTC 51 (Flash out) / C0225 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-6) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace coil integrated module. Go to *Step 3*	Go to *Step 2*
2	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 3*	Replace sensor. Go to *Step 3*
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-18 FR Speed Sensor Open or Shorted (DTC 52 (Flash out) / C0221 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-6) terminals 3 and 11. Is the resistance between 2.0k and 2.8k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace coil integrated module. Go to *Step 3*	Go to *Step 2*
2	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 3*	Replace sensor. Go to *Step 3*
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-19 Rear Speed Sensor Open or Shorted (DTC 53 (Flash out) / C0235 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-6) terminals 4 and 12. Is the resistance between 1.0k and 1.7k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to *Step 3*	Go to *Step 2*
2	Measure the Rear speed sensor resistance at the sensor connector. Is the resistance between 1.0k and 1.7k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 3*	Replace sensor. Go to *Step 3*
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart B-20 FL Speed Sensor Missing Signal (DTC 61 (Flash out) / C0226, C0227 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FL speed sensor resistance between coil integrated module connector (C-6) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Go to *Step 2*	Go to *Step 3*
2	Is there play sensor/sensor rotor?	Repair. Go to *Step 6*	Go to *Step 4*
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 6*	Replace sensor. Go to *Step 6*
4	Damage and powdered iron sticking to sensor/sensor ring?	Repair. Go to *Step 6*	Go to *Step 5*
5	Is sensor output normal? (Chart C-1-1 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to *Step 6*	Replace sensor. Go to *Step 6*
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-21 FR Speed Sensor Missing Signal (DTC 62 (Flash out) / C0222, C0223 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FR speed sensor resistance between coil integrated module connector (C-6) terminals 3 and 11. Is the resistance between 2.0k and 2.8k ohms?	Go to *Step 2*	Go to *Step 3*
2	Is there play sensor/sensor rotor?	Repair. Go to *Step 6*	Go to *Step 4*
3	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 6*	Replace sensor. Go to *Step 6*
4	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to *Step 6*	Go to *Step 5*
5	Is sensor output normal? (Chart C-1-2 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to *Step 6*	Replace sensor. Go to *Step 6*
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-22 Rear Speed Sensor Missing Signal (DTC 63 (Flash out) / C0236, C0237 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the Rear speed sensor resistance between coil integrated module connector (C-6) terminals 4 and 12. Is the resistance between 1.0k and 1.7k ohms?	Go to *Step 2*	Go to *Step 3*
2	Is there play sensor/sensor rotor?	Repair. Go to *Step 6*	Go to *Step 4*
3	Measure the rear speed sensor resistance at the sensor connector. Is the resistance between 1.0k and 1.7k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 6*	Replace sensor. Go to *Step 6*
4	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to *Step 6*	Go to *Step 5*
5	Is sensor output normal? (Chart C-1-3 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to *Step 6*	Replace sensor. Go to *Step 6*
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-23 Simultaneous Drop-out of Front Speed Sensor Signal (DTC 64 (Flash out) / C0229 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FL speed sensor resistance between coil integrated module connector (C-6) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Go to *Step 2*	Go to *Step 3*
2	Measure the FR speed sensor resistance between coil integrated module connector (C-6) terminals 3 and 11. Is the resistance between 2.0k and 2.8 k ohms?	Go to *Step 5*	Go to *Step 4*
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 2*	Replace sensor. Go to *Step 2*
4	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to *Step 5*	Replace sensor. Go to *Step 5*
5	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to *Step 6*	Go to *Step 6*
6	Is there play sensor/sensor rotor?	Repair. Go to *Step 7*	Go to *Step 7*
7	Is sensor output normal? (Chart C-1-1&C-1-2 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to *Step 8*	Replace sensor. Go to *Step 8*
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat “Basic diagnostic flow chart”	Go to *Step 8*

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-24 Wheel Speed Input Abnormality (DTC 65 (Flash out) / C0238 (Serial communications))

Step	Action	Yes	No
1	Using TECH 2?	Go to *Step 2*	Go to *Step 3*
2	1. Connect TECH 2. 2. Select Snap shot manual trigger. 3. With wheel speed data displayed, run the vehicle when speed has arrived at 30 km/h (18 mph). 4. Check speed data on each wheel (refer to the criterion given below). * 1 Is the abnormal sensor condition found?	Replace. Go to *Step 8*	Go to *Step 3* All the sensors should follow the following flowchart (without using TECH 2).
3	Is there play in sensor/sensor ring?	Repair. Go to *Step 8*	Go to *Step 4*
4	Is there powdered iron sticking to sensor/sensor ring?	Repair. Go to *Step 8*	Go to *Step 5*
5	Is there a broken tooth or indentation in sensor ring?	Replace sensor ring. Go to *Step 8*	Go to *Step 6*
6	Is there play in wheel bearing?	Adjust or repair. Go to *Step 8*	Go to *Step 7*
7	Is the check wiring between sensor and coil integrated module normal?	Replace EHCU. Go to *Step 8*	Repair, and perform system self-check. Go to *Step 8*
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat ‘Basic diagnostic flow chart”	Go to *Step 8*

Sensor Signal Abnormality Criteria using TECH 2

1. While driving, the speed of one or two wheels is 25% or more higher or lower than that of the other wheels.
2. The speed of one or two wheels is 10 km/h (6 mph) or more higher or lower than that of the other wheels.
3. During steady driving, wheel speed changes abruptly.

*1 The vehicle must run on a level paved road.

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop.

Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

It is important to verify that the correct tires are installed on vehicle.

Unit Inspection Procedure

This section describes the following inspection procedures referred to during *Symptom Diagnosis* and *Diagnosis By "ABS" Warning Light Illumination Pattern*

	without TECH 2	with TECH 2
Sensor Output Inspection	Chart C-1-1 to C-1-3	Chart TC-1

Chart C-1-1 FL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between coil integrated module connector terminals while turning FL wheel at a speed of 1 RPS: Is the voltage between coil integrated module connector (C-6) terminals 2 and 10 less than 200 mV?	Go to *Step 2*	OK. Go to *Step 3*
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (C-28) terminals 1 and 2 within 2.0k - 2.8k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to *Step 3*	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to *Step 3*
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to *Step 3*

Chart C-1-2 FR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between coil integrated module connector terminals while turning FR wheel at a speed of 1 RPS: Is the voltage between coil integrated module connector (C-6) terminals 3 and 11 less than 200 mV?	Go to *Step 2*	OK. Go to *Step 3*
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (C-1) terminals 1 and 2 within 2.0k - 2.8k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to *Step 3*	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to *Step 3*
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

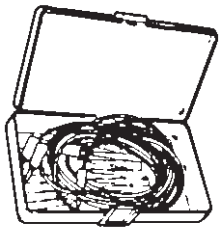
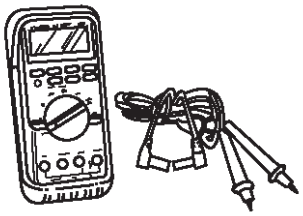
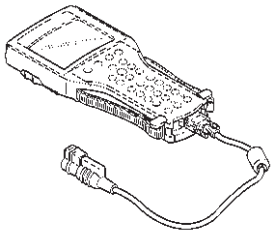
Chart C-1-3 Rear Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground measure the AC voltage between coil integrated module connector terminals while turning Rear wheel at a speed of 1 RPS: Is the check between coil integrated module connector (C-6) terminals 4 and 12 than under 200 mV?	Go to *Step 2*	OK. Go to *Step 3*
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (F-4) terminals 1 and 2 within 1.0k - 1.7k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to *Step 3*	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to *Step 3*
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 3*

Chart TC-1 Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Check the wheel speed of each sensor by Data List. Is the vehicle speed normal?	Go to *Step 6*	Go to *Step 2*
2	Check the sensor harness for suspected disconnection (check while shaking harness/connector). Is the sensor harness connection normal?	Replace speed sensor. Go to *Step 4*	Repair. Go to *Step 3*
3	Check the wheel speed of each sensor by Data List. Is the vehicle speed normal?	Go to *Step 6*	Go to *Step 4*
4	Check the sensor rotor. Is the sensor rotor normal?	Replace speed sensor. Go to *Step 5*	Replace sensor rotor. Go to *Step 5*
5	Check the harness between coil integrated module and speed sensor. Is the harness connection normal?	Go to *Step 6*	Repair harness or connector between coil integrated module and speed sensor. Go to *Step 6*
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to *Step 6*

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW074	**J–35616** Connector test adapter kit
 901RS153	**J–39200** High impedance multimeter
	**7000086–ISU** Tech 2 Set (1) PCMCIA Card (2) SAE 16/19 Adapter (3) DLC Cable (4) Tech 2

AXIOM

BRAKES

ANTI-LOCK BRAKE SYSTEM

CONTENTS

Service Precaution 5B–1
Electronic Hydraulic Control Unit 5B–2
Electronic Hydraulic Control Unit and Associated Parts 5B–2
Removal 5B–2
Disassembled View 5B–3
Disassembly 5B–3
Reassembly 5B–3
Installation 5B–3
Front Wheel Speed Sensor 5B–4
Front Wheel Speed Sensor and Associated Parts 5B–4
Removal 5B–4
Inspection and Repair 5B–4
Installation 5B–4
Rear Wheel Speed Sensor 5B–5
Removal 5B–5
Inspection and Repair 5B–5
Installation 5B–5

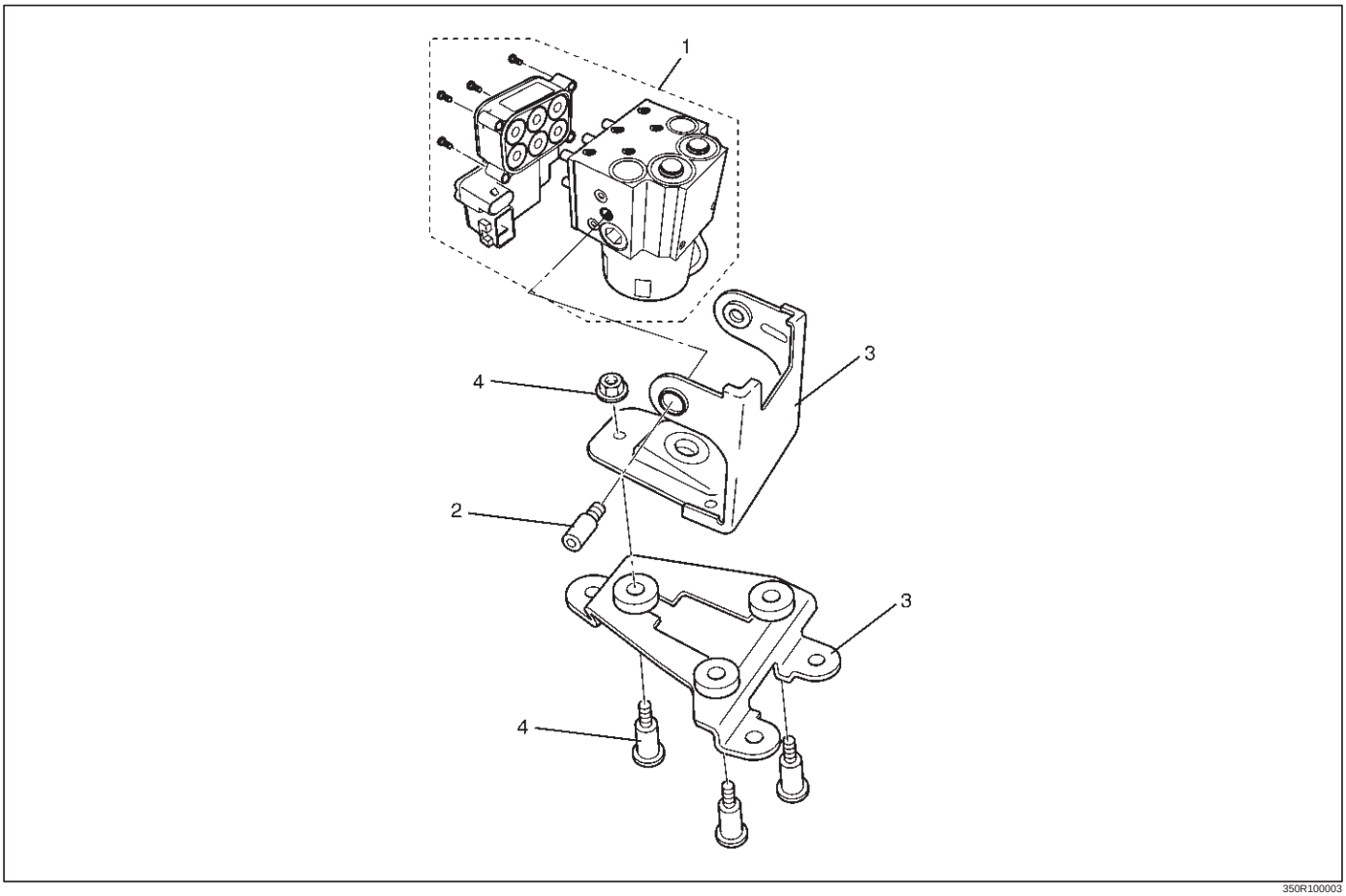
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Electronic Hydraulic Control Unit

Electronic Hydraulic Control Unit and Associated Parts



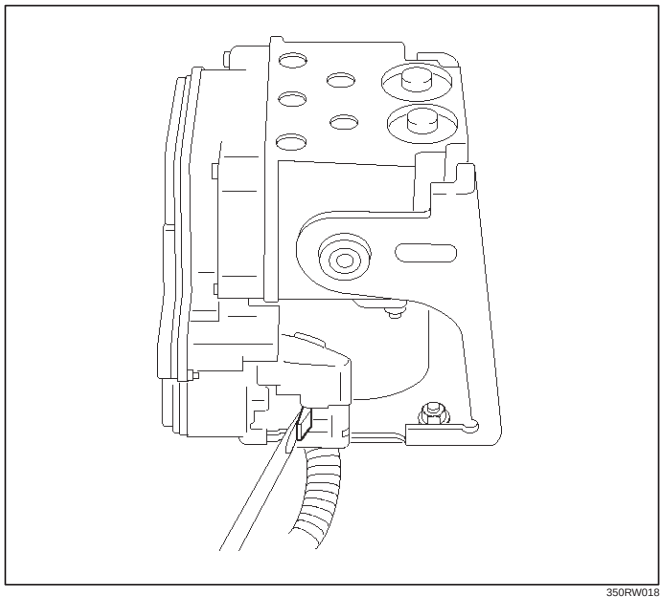
350R100003

Legend

(1) EHCU
(2) Bolt
(3) Bracket
(4) Bolt and Nut

Removal

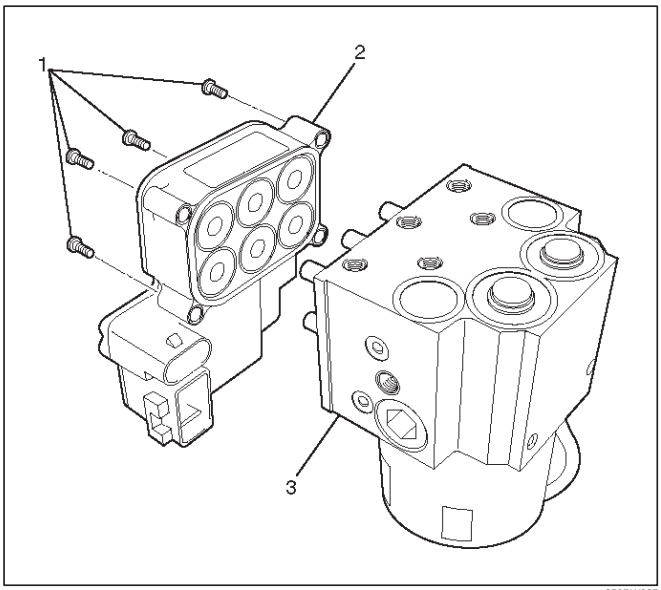
1. Remove brake pipes.
   ▼After disconnecting brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
2. Remove three bracket fixing bolts.
3. Disconnect red clip from harness connector.



350RW018

4. Remove harness connector.
5. Remove EHCU ASM.
6. Remove EHCU.

Disassembled View



350RW025

Legend

(1) Fixing Bolts
(2) Coil Integrated Module
(3) Hydraulic Unit (H/U)

Disassembly

1. Remove fixing bolts from EHCU.
2. Remove coil integrated module from hydraulic unit.

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following points:

Torque

Fixing bolts: 4.4 N·m (39 lb in)

Installation

To install, follow the removal steps in the reverse order, noting the following points:

Torque

Hydraulic unit fixing nuts : 22 N·m (16 lb ft)

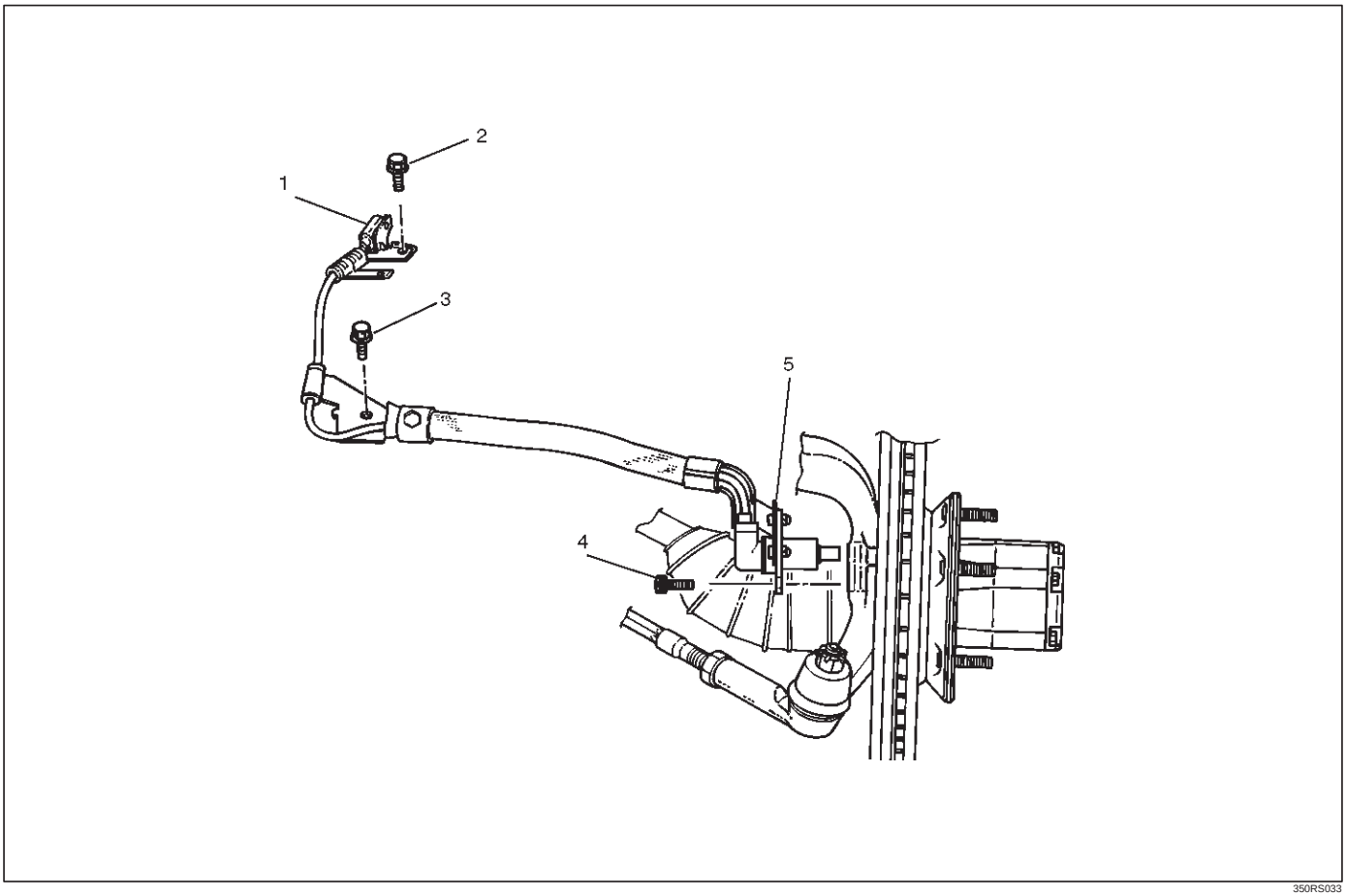
Ground cable : 14 N·m (10 lb ft)

Brake pipe (joint bolts) : 16 N·m (12 lb ft)

▼ After installing the hydraulic unit, bleed brakes completely. See *Section 5A "Hydraulic Brakes".*

Front Wheel Speed Sensor

Front Wheel Speed Sensor and Associated Parts



Legend

(1) Speed Sensor Connector
(2) Sensor Cable Fixing Bolt (Upper side)
(3) Sensor Cable Fixing Bolt (Lower side)
(4) Sensor Cable Fixing Bolt (Sensor side)
(5) Speed Sensor

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolt (Upper side).
3. Remove sensor cable fixing bolt (Lower side).
4. Remove the speed sensor cable fixing bolt.
5. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary.
   To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the sensor ring assembly. Refer to removal of the sensor ring in Section *4C "Front hub and disc".*

Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.
   Torque: 11 N·m (95 lb in)
3. Install speed sensor cable fixing bolt (Lower side) and tighten the fixing bolt to the specified torque.
   Torque : 24 N·m (17 lb ft)
4. Install speed sensor cable fixing bolt (Upper side) and tighten the fixing bolt to the specified torque.
   Torque : 6 N·m (52 lb in)

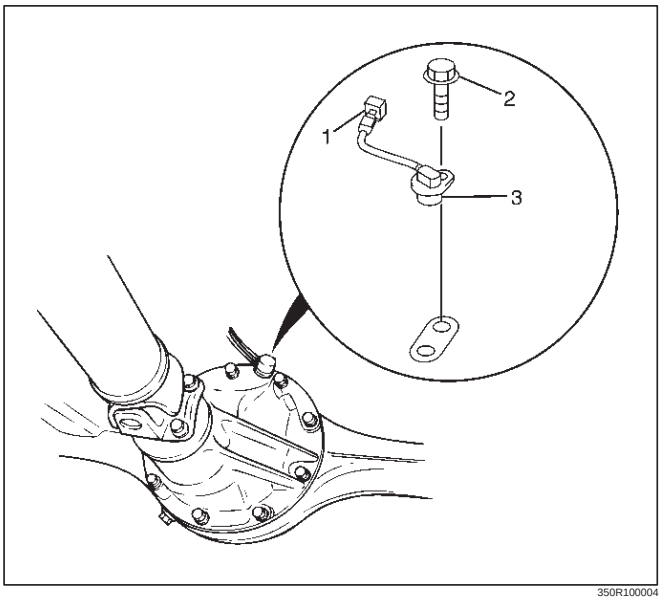
NOTE: Confirm that a white line marked on the cable is not twisted when connecting the speed sensor cable.

5. Install speed sensor connector.

Rear Wheel Speed Sensor

Removal

1. Disconnect harness connector (1).
2. Remove sensor fixing bolt (2) .
3. Remove speed sensor (3).



350R100004

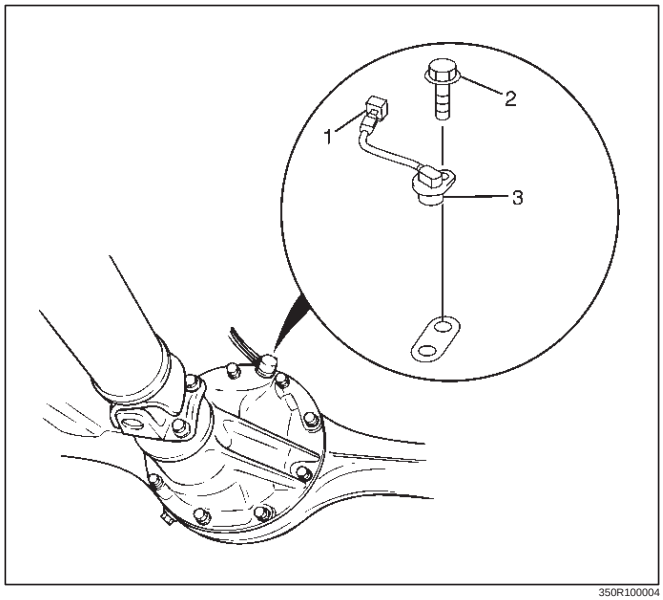
Inspection and Repair

1. Check speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage, and replace speed sensor if necessary.
3. Check speed sensor cable for short or open, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the axle shaft assembly. Refer to removal of the sensor ring in Section *4A2 “Differential (Rear)”.*

Installation

1. Install speed sensor (3).
2. Tighten the sensor fixing bolt (2) to the specified torque.

   Torque : 24 N·m (17 lb ft)
3. Connect harness connector (1).



350R100004

AXIOM (Vehicles Produced Before July/31/2001)

BRAKES

POWER-ASSISTED BRAKE SYSTEM

CONTENTS

Service Precaution 5C–2
General Description 5C–2
Diagnosis 5C–6
General Diagnosis 5C–7
Hydraulic Brakes 5C–10
Filling Master Cylinder Reservoir 5C–10
Deterioration of Brake Fluid 5C–10
Leakage of Brake Fluid 5C–10
Bleeding Brake Hydraulic System 5C–10
Flushing Brake Hydraulic System 5C–11
Brake Pipes and Hoses 5C–11
Brake Hose Inspection 5C–11
Front Caliper Brake Hose 5C–12
Front Caliper Brake Hose and Associated Parts 5C–12
Removal 5C–12
Installation 5C–12
Rear Axle Brake Hose 5C–13
Rear Axle Brake Hose and Associated Parts 5C–13
Removal 5C–13
Installation 5C–13
Brake Pipe 5C–14
Removal 5C–14
Installation 5C–14
P & B (Proportioning and Bypass) Valve 5C–15
P & B (Proportioning and Bypass) Valve Sectional View 5C–15
Removal 5C–15
Installation 5C–15
Main Data and Specifications 5C–16
Brake Pedal 5C–17
Checking Pedal Height 5C–17
Checking Pedal Travel 5C–17
Brake Pedal and Associated Parts 5C–18
Removal 5C–18
Installation 5C–18
Stoplight Switch 5C–19
Parts Location 5C–19
Removal 5C–19
Installation 5C–19
Main Data and Specifications 5C–20
Fluid Reservoir Tank 5C–21
Fluid Reservoir Tank and Associated Parts 5C–21
Removal 5C–21
Installation 5C–21
Master Cylinder Assembly 5C–22
Master Cylinder Assembly and Associated Parts 5C–22
Removal 5C–22
Inspection and Repair 5C–22
Installation 5C–23
Main Data and Specifications 5C–24
Special Tools 5C–24
Vacuum Booster Assembly 5C–25
Vacuum Booster Assembly and Associated Parts 5C–25
Removal 5C–25
Inspection and Repair 5C–26
Installation 5C–26
Exterior Components 5C–28
Exterior Components and Associated Parts 5C–28
Removal 5C–28
Inspection and Repair 5C–29
Installation 5C–29
Vacuum Booster Overhaul 5C–29
Vacuum Booster 5C–29
Main Data and Specifications 5C–30
Special Tools 5C–31
Front Disc Brake Pads 5C–32
Front Disc Brake Pads Inspection 5C–32
Front Disc Brake Pads and Associated Parts 5C–32
Removal 5C–33
Installation 5C–33
Front Disc Brake Rotor 5C–35
Inspection 5C–35
Replacing Brake Rotors 5C–35
Refinishing Brake Rotors 5C–35
Front Disc Brake Caliper Assembly 5C–36
Front Disc Brake Caliper Assembly and Associated Parts 5C–36
Removal 5C–37
Installation 5C–37
Front Disc Brake Caliper 5C–39
Front Disc Brake Caliper Disassembled View 5C–39
Disassembly 5C–39

Inspection and Repair 5C–40
Reassembly 5C–40
Main Data and Specifications 5C–42
Rear Disc Brake Pads (4×4 Model) 5C–43
Brake Pads Inspection 5C–43
Brake Pads and Associated Parts 5C–43
Removal 5C–44
Installation 5C–44
Rear Disc Brake Rotor (4×4 Model) 5C–46
Inspection 5C–46
Replacing Brake Rotors 5C–46
Refinishing Brake Rotors 5C–46
Rear Drum (In Disc) Inside Diameter Check 5C–47
Rear Disc Brake Caliper Assembly (4×4 Model) 5C–48
Rear Disc Brake Caliper Assembly and Associated Parts 5C–48
Removal 5C–48
Installation 5C–49
Rear Disc Brake Caliper (4×4 Model) 5C–50
Rear Disc Brake Caliper Disassembled View 5C–50
Disassembly 5C–51
Inspection and Repair 5C–51
Reassembly 5C–51
Main Data and Specifications (4×4 Model) 5C–53
Brake Lining 5C–54
Brake Lining and Associated Parts 5C–54
Removal 5C–54
Brake Lining Inspection 5C–55
Installation 5C–55
Drum Brake Adjustment (4×2 Model) 5C–56
Servicing The Brake Drum 5C–56
Wheel Cylinder Assembly (4×2 Model) 5C–57
Wheel Cylinder Assembly and Associated Parts 5C–57
Removal 5C–57
Installation 5C–57
Disassembled View 5C–58
Disassembly 5C–58
Inspection and Repair 5C–58
Reassembly 5C–58
Main Data and Specifications 5C–60

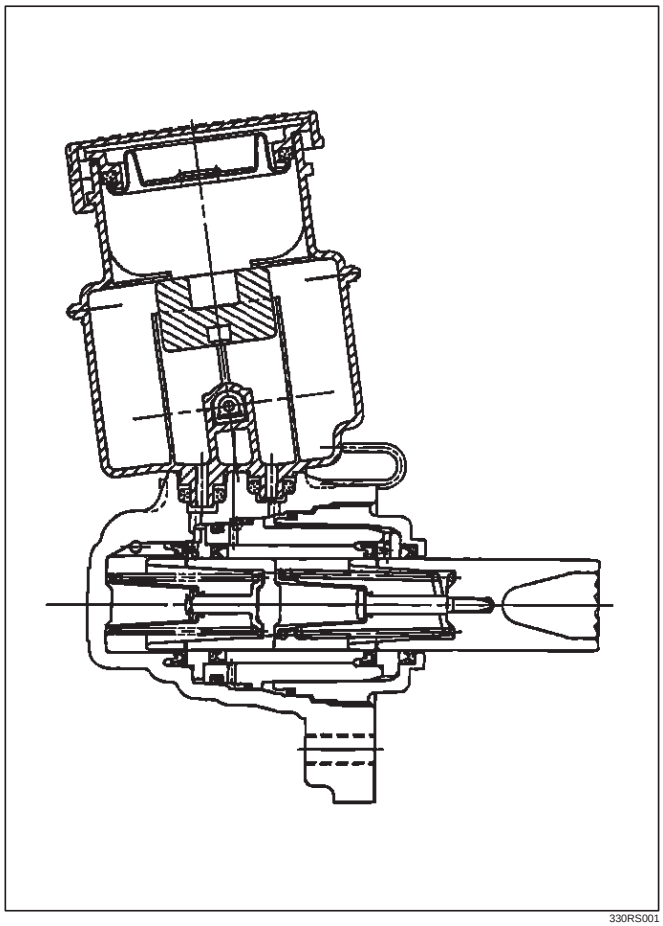
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Master Cylinder Assembly



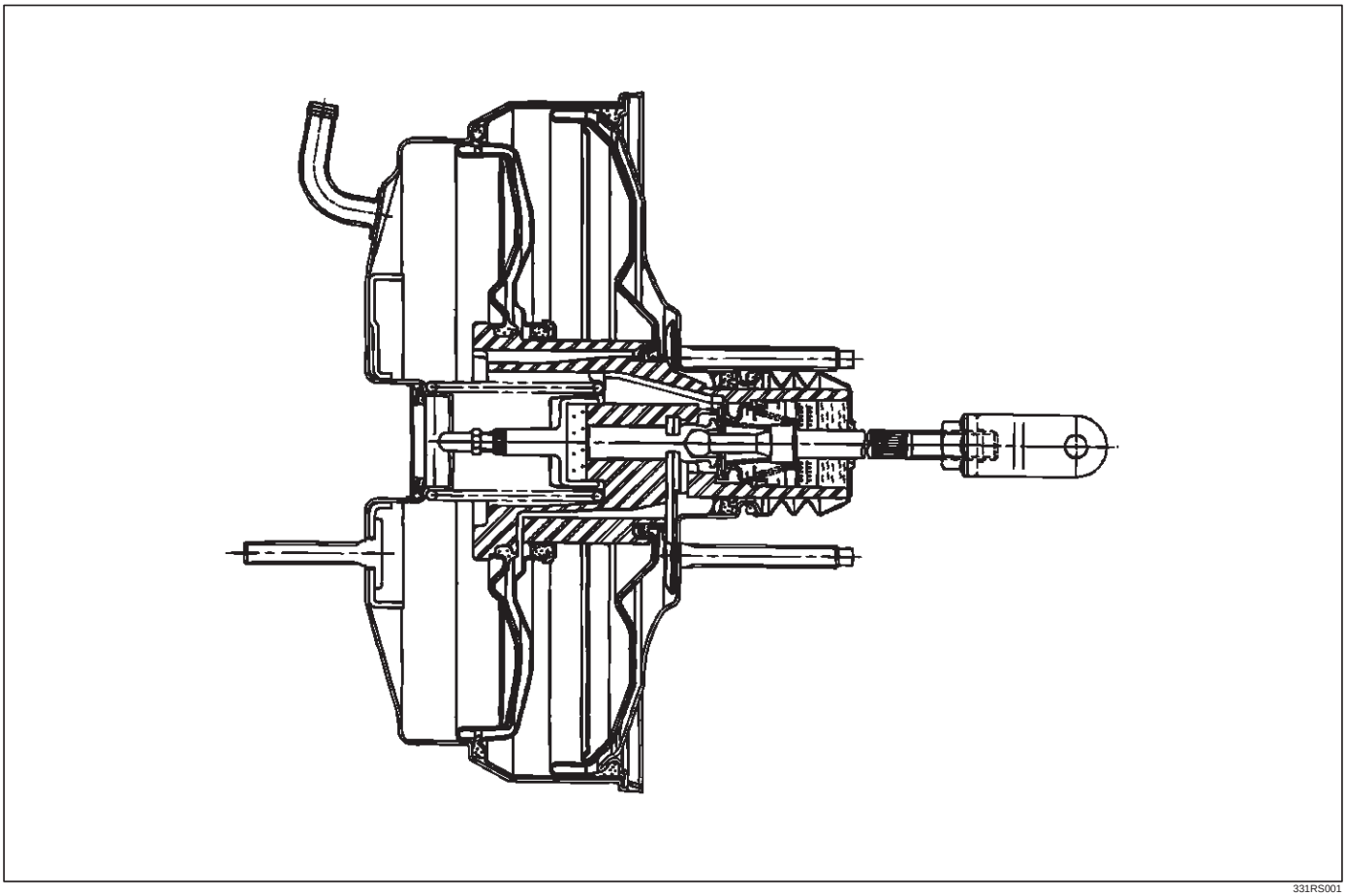
330RS001

The master cylinder contains two pistons that supply the hydraulic pressure for a dual–circuit braking system. The primary piston provides the fluid pressure to the front brakes, while the secondary piston provides the fluid pressure to the rear brakes. If the pressure is lost from either system, the remaining system will function to stop the vehicle.

CAUTION:

1. **The master cylinder is not repairable. If found defective, it must be replaced as a complete assembly.**
2. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. (Refer to *Bleeding Brake Hydraulic System* in this section.)**
3. **The torque values specified are for dry, unlubricated fasteners.**
4. **Perform service operations on a clean bench free from all mineral oil materials.**

Brake Booster



331RS001

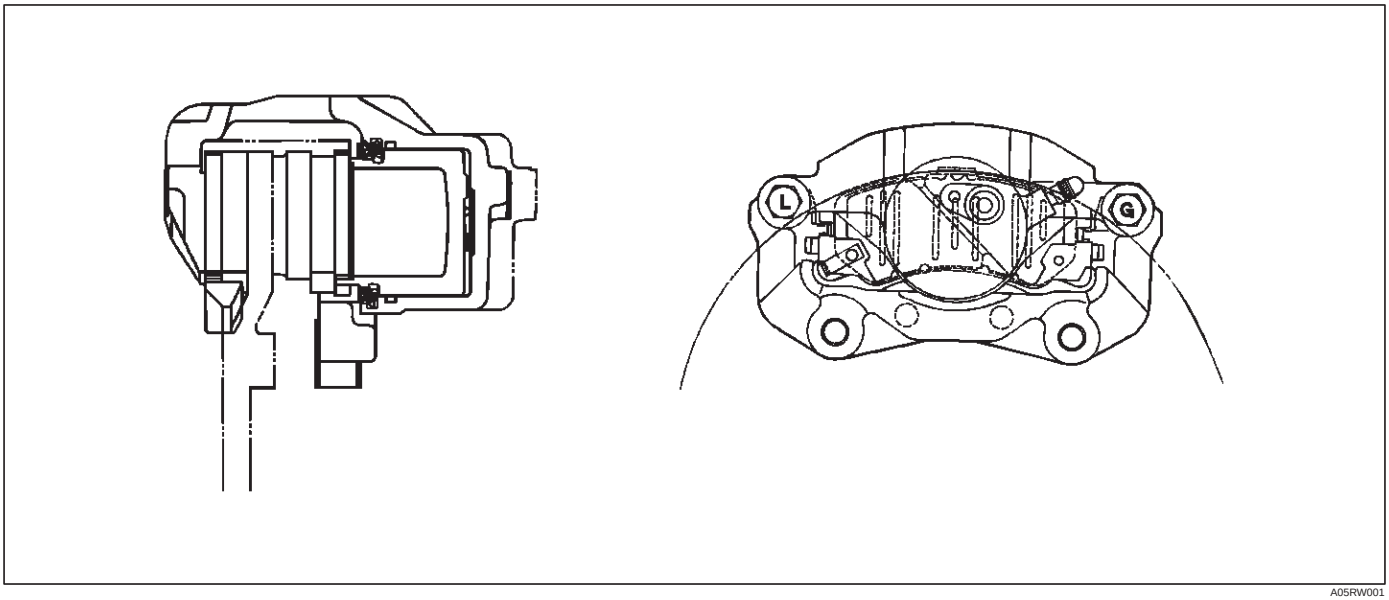
This booster is a tandem vacuum unit with a diaphragm effective diameter 205mm (8.072 in) + 230mm (9.056 in). In normal operating mode, with the service brakes in the released position, the tandem vacuum booster operates with vacuum on both sides of its diaphragms. When the brakes are applied, air at atmospheric pressure is admitted to both sides of the diaphragm to provide the power assist. When the service brake is released, the atmospheric air is shut off from both sides of the diaphram. The air is then drawn from the booster through the vacuum check valve to the vacuum source.

CAUTION:

1. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.**
2. **The torque values specified are for dry, unlubricated fasteners.**
3. **The vacuum booster is not repairable and must be replaced as complete assembly.**

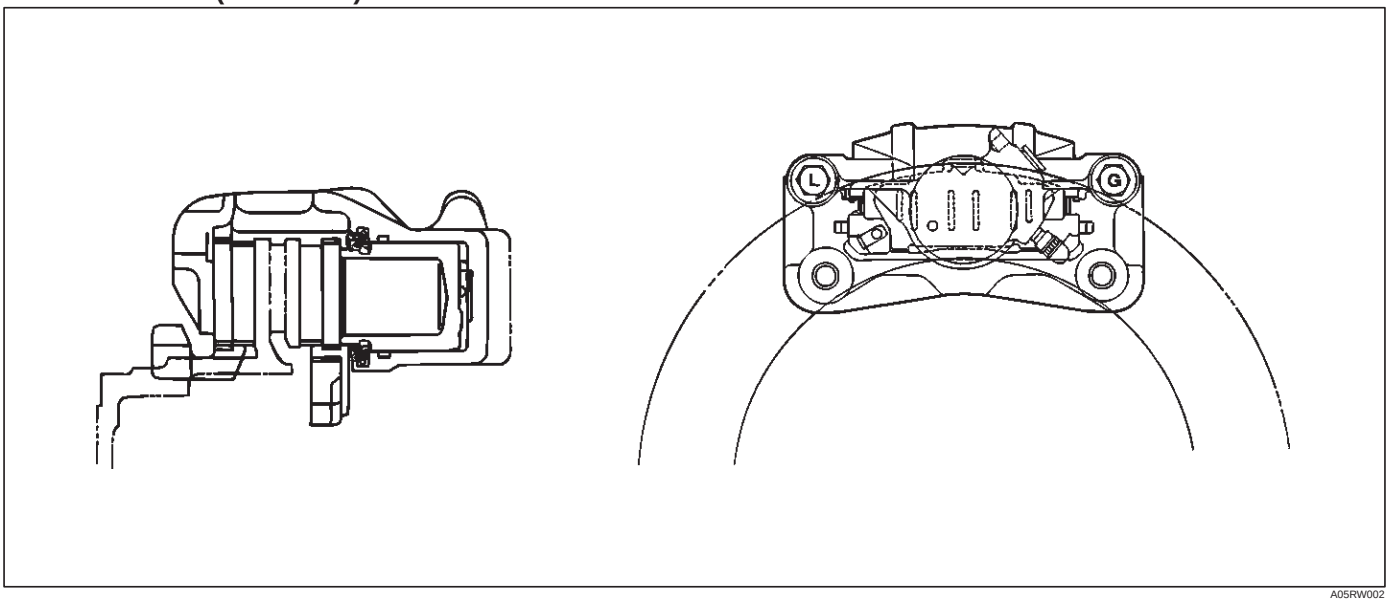
Disc Brake

Front Disc Brake



A05RW001

Rear Disc Brake (4×4 Model)



A05RW002

The disc brake assembly consists of a caliper, piston, rotor, pad assembly and support bracket. The caliper assembly has a single bore and is mounted to the support bracket with two mounting bolts. The support bracket allows the caliper to move laterally against the rotor. The caliper is a one–piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

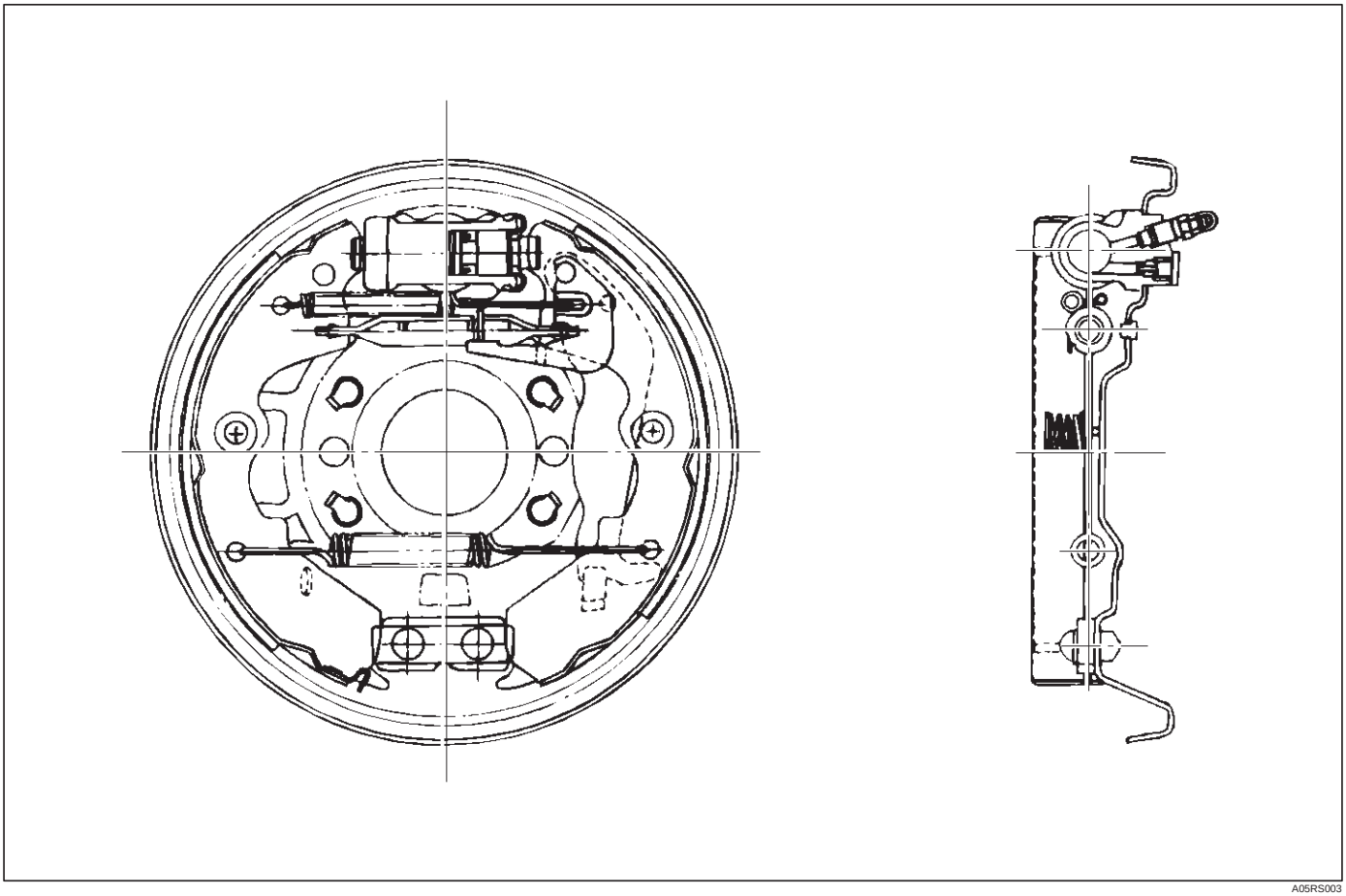
NOTE:

1. Replace all components included in repair kits used to service this caliper.
2. Lubricate rubber parts with clean brake fluid to ease assembly.
3. If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
4. Replace pads in axle sets only.
5. The torque values specified are for dry, unlubricated fasteners.
6. Perform the service operation on a clean bench free from all mineral oil materials.

Operation

Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force creates a clamping action of the piston pressing towards the rotors (outward) and the caliper slides inward toward the vehicle. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Leading/Trailing Drum Brakes (4×2 Model)



A05RS003

This drum brake assembly is a leading/trailing shoe design. Both brake shoes are held against the wheel cylinder pistons by the upper return spring and to the fixed anchor plate by the lower return spring. When the brakes are applied, the wheel cylinder pistons expand pushing both shoes out contact the drum.

With forward wheel rotation, the forward brake shoe will wrap into the drum and becomes self-energized.

With reverse wheel rotation, the rear brake shoe is self-energized. Force from the brake shoes is transferred to the anchor plate through the braking plate to the axle flange. Adjustment is automatic and occurs on any service brake application. Also, with leading/trailing brakes, it is normal for the front shoe to wear at a faster rate than the rear shoe.

Diagnosis

Road Testing The Brakes

Brake Test

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt where all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight of the vehicle toward wheels on one side or if the roadway is so rough that wheels tend to bounce. Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires. Braking without locking the tires will stop the vehicle in less distance than braking to a skid (which has no brake efficiency). More tire to road friction is present while braking without locking the tires than braking to a skid.

The standard brake system is designed and balanced to avoid locking the wheels except at very high deceleration levels.

It is designed this way because the shortest stopping distance and best control is achieved without brake lock–up.

Because of high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

External Conditions That Affect Brake Performance

1. Tires: Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, identical in size, and the thread pattern of right and left tires must be approximately equal.
2. Vehicle Loading: A heavily loaded vehicle requires more braking effort.
3. Wheel Alignment: Misalignment of the wheels, particularly in regard to excessive camber and caster, will cause the brakes to pull to one side.

Brake Fluid Leaks

With engine running at idle and the transmission in “Neutral”, depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking.

Check the master cylinder fluid level. While a slight drop in the reservoir level will result from normal lining wear, an abnormally low level in reservoir indicates a leak in the system. The hydraulic system may be leaking internally as well as externally. Refer to *Master Cylinder Inspection*. Also, the system may appear to pass this test but still have slight leakage. If fluid level is normal, check the vacuum booster push rod length. If an incorrect length push rod is found, adjust or replace the push rod. Check the brake pedal travel and the parking brake adjustment. When checking the fluid level, the master cylinder fluid level may be lower than the “MAX” mark if the front and rear linings are worn. This is normal.

Warning Light Operation

When the ignition switch is in the START position, the “BRAKE” warning light should turn on and go off when the ignition switch returns to the ON position.

The following conditions will activate the “BRAKE” light:

1. Parking brake applied. The light should be on whenever the parking brake is applied and the ignition switch is on.
2. Low fluid level. A low fluid level in the master cylinder will turn the “BRAKE” light on.
3. During engine cranking the “BRAKE” light should remain on. This notifies the driver that the warning circuit is operating properly.

General Diagnosis

Condition	Possible cause	Correction
Brake Pull	Tire inflation pressure is unequal.	Adjust
	Front wheel alignment is incorrect.	Adjust
	Unmatched tires on same axle.	Tires with approx. the same amount of tread should be used on the same axle.
	Restricted brake pipes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new double“walled steel brake piping.
	Water or oil on the brake pads.	Clean or replace.
	Brake pads hardened.	Replace
	Brake pads worn excessively.	Replace
	Brake rotor worn or scored.	Grind or replace.
	Disc brake caliper malfunctioning.	Clean or replace.
	Front hub bearing preload incorrect.	Adjust or replace.
	Loose suspension parts.	Check all suspension mountings.
	Loose calipers.	Check and tighten the bolts to specifications.
Brake Roughness or Chatter (Pulsates)	Excessive lateral runout.	Check per instructions. If not within specifications, replace or machine the rotor.
	Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the rotor.
	Wheel bearings not adjusted.	Adjust wheel bearings to correct specifications
	Pad reversed (steel against iron).	Replace the brake pad and machine rotor to within specifications.
Excessive Pedal Effort	Malfunctioning vacuum booster.	Check the vacuum booster operation and repair, if necessary.
	Partial system failure.	Check the front and rear brake system for failure and repair. Also, check the brake warning light. If a failed system is found, the light should indicate failure.
	Excessively worn pad.	Check and replace pads in sets.
	Piston in caliper stuck or sluggish.	Remove caliper and rebuild.
	Fading brakes due to incorrect pad.	Remove and replace with original equipment pad or equivalent.
	Vacuum leak to vacuum booster.	Check for ruptured or loose hose.
	Check the direction of check valve within vacuum hose.	Correct vacuum hose direction.
	Grease on the brake pads.	Replace or clean.

Condition	Possible cause	Correction
Excessive Brake Pedal Travel	Air in hydraulic circuit.	Bleed the hydraulic circuit.
	Level of brake fluid in the reservoir too low.	Replenish brake fluid reservoir to specified level and bleed hydraulic circuit as necessary.
	Master cylinder push rod clearance excessive.	Adjust
	Leakage in hydraulic system.	Correct or replace defective parts.
Brake Drag	Master cylinder pistons not returning correctly.	Adjust the stop light switch and vacuum booster push rod. If necessary, rebuild.
	Restricted brake pipes or hoses.	Check for soft hoses or damaged pipes, and replace with new hoses and new double–walled steel brake piping.
	Parking brake maladjusted.	Adjust
	Parking brake lining clearance insufficient.	Adjust
	Brake pedal free play insufficient.	Adjust the brake pedal height or power cylinder operating rod.
	Piston in the master cylinder sticking.	Replace
	Piston in the disc brake caliper sticking.	Replace piston seals.
	Brake pads sticking in caliper.	Clean
	Return spring weakened.	Replace
	Parking brake binding.	Overhaul the parking brakes and correct.
	Front hub bearing preload incorrect.	Adjust or replace.
	Parking brake shoes not returning.	Correct or replace the brake back plate and brake shoe as necessary.
	Obstructions in hydraulic circuit.	Clean
	Rotor warped excessively.	Grind or replace.
	Rear brake drum distorted.	Grind or replace.
	Parking cable sticking.	Grind or replace.
Grabbing or Uneven Braking Action (All conditions listed under “Pulls”)	Malfunctioning vacuum booster.	Check operation and correct as necessary.
	Binding brake pedal mechanism.	Check and lubricate, if necessary.
	Corroded caliper assembly.	Clean and lubricate.
Brake Noisy	Brake pads are worn.	Replace
	Brake pads are hardened.	Replace
	Brake pads are in poor contact with rotor.	Correct
	Brake disc(s) warped, worn or damaged.	Grind or replace.
	Disc brake anti–squeak shims fatigued.	Replace
	Front hub bearings are loose or preload is incorrect.	Adjust or replace.
	Brake disc is rusted.	Grind or replace.

Condition	Possible cause	Correction
Poor Brake Action	Master cylinder faulty.	Correct or replace.
	Vacuum booster faulty.	Correct or replace.
	Level of brake fluid in reservoir too low.	Replenish and bleed.
	Air in hydraulic circuit.	Bleed
	Disc brake caliper faulty.	Clean or replace.
	Water or oil on brake pads.	Clean or replace.
	Brake pads in poor contact with the rotor.	Correct
	Brake pads worn.	Replace
	Brake disc rusted.	Grind or replace.
	Check valve in vacuum hose faulty.	Correct or replace.

Hydraulic Brakes

Filling Master Cylinder Reservoir

CAUTION: Use only specified brake fluid. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluid will cause swelling and distortion of rubber parts in the hydraulic brake system. Water mixed with brake fluid lowers the fluid boiling point. Keep all fluid containers capped to prevent contamination.

Always fill the master cylinder reservoir when the engine is cold.

Never allow the brake fluid to come in contact with the painted surfaces.

The master cylinder reservoir must be kept properly filled to ensure adequate reserve and to prevent air and moisture from entering the hydraulic system. However, because of expansion due to heat absorbed from the brakes and the engine, the reservoir must not be overfilled. The brake fluid reservoir is on the master cylinder, which is located under the hood on the left side of the cowl. Thoroughly clean reservoir cap before removal to avoid getting dirt into reservoir. Remove the diaphragm. Add fluid as required to bring level to the "MAX" mark on the reservoir tank. Use "DOT 3" Hydraulic Brake Fluid. If the fluid cap diaphragm is stretched, return it to the original position before installing.

Deterioration of Brake Fluid

Using any other brake fluid than specified or brake fluid with mineral oil or water mixed in will drop the boiling point of brake fluid. It may, in turn, result in vapor lock or deteriorated rubber parts of the hydraulic system. Be sure to change the brake fluid at specified intervals.

If the rubber parts are deteriorated, remove all the system parts and clean them with alcohol. Prior to reassembly, dry the cleaned parts with air to remove the alcohol. Replace all the hoses and rubber parts of the system.

Leakage of Brake Fluid

With engine idling, set shift lever in the neutral position and continue to depress brake pedal at a constant pedal application force.

Should the pedal stroke become deeper gradually, leakage from the hydraulic pressure system is possible. Perform visual inspection for any signs of leakage.

Bleeding Brake Hydraulic System

A bleeding operation is necessary to remove air from the hydraulic brake system whenever air is introduced into the hydraulic system. It may be necessary to bleed the hydraulic system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder. If a brake pipe is disconnected at one wheel, only that wheel cylinder/caliper needs to be bled. If the pipes are disconnected at any fitting located between the master cylinder and brakes, then the brake system served by the disconnected pipe must be bled.

1. For 4–Wheel Antilock Brake System (ABS) equipped vehicle, be sure to remove the ABS main fuse 60A located at the relay and fuse box before bleeding air. If you attempt to bleed air without removing the main fuse, air cannot be let out thoroughly, and this may cause damage to the hydraulic unit. After bleeding air, be sure to replace the ABS main fuse back to its original position.
2. Set the parking brake completely, then start the engine.

NOTE: The vacuum booster will be damaged if the bleeding operation is performed with the engine off.

3. Remove the master cylinder reservoir cap.
4. Fill the master cylinder reservoir with brake fluid. Keep the reservoir at least half full during the air bleeding operation
5. Always use new brake fluid for replenishment.
6. When replenishing the brake fluid reservoir, carefully pour in the brake fluid to prevent air bubbles from entering the brake system.

   When the master cylinder is replaced or overhauled, first bleed the air from the master cylinder, then from each wheel cylinder and caliper following the procedures described below.

Bleeding the Master Cylinder

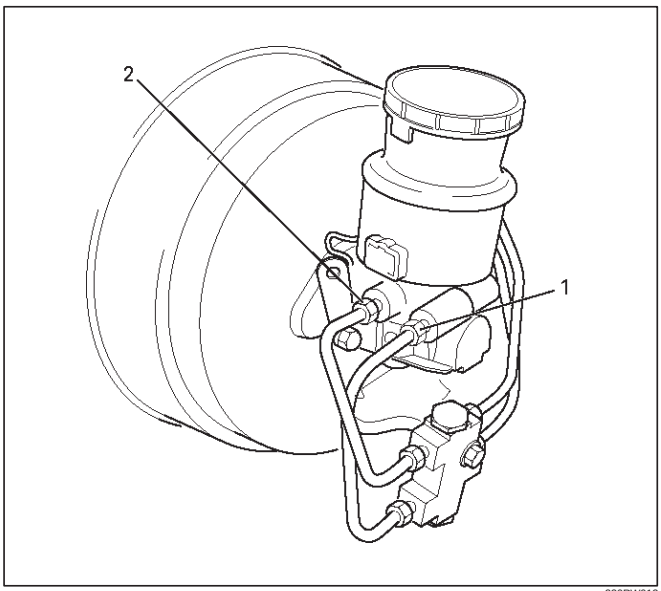
7. Disconnect the rear wheel brake pipe (1) from the master cylinder.

   Check the fluid level and replenish as necessary. If replenished, leave the system for at least one minute.
8. Depress the brake pedal slowly once and hold it depressed.
9. Completely seal the delivery port of the master cylinder with your finger, where the pipe was disconnected then release the brake pedal slowly.
10. Release your finger from the delivery port when the brake pedal returns completely.
11. Repeat steps 8 through 10 until the brake fluid comes out of the delivery port during step 8.

NOTE: Do not allow the fluid level in the reservoir to go below the half–way mark.

12. Reconnect the brake pipe (1) to the master cylinder and tighten the pipe.
13. Depress the brake pedal slowly once and hold it depressed.
14. Loosen the rear wheel brake pipe (1) at the master cylinder.
15. Retighten the brake pipe, then release the brake pedal slowly.
16. Repeat steps 13 through 15 until no air comes out of the port when the brake pipe is loosened

NOTE: Be very careful not to allow the brake fluid to come in contact with painted surfaces.



17. Bleed the air from the front wheel brake pipe connection (2) by repeating steps 7 through 16.

Bleeding the Caliper

18. Bleed the air from each wheel in the order listed below:

    ▼Right rear caliper or wheel cylinder

    ▼Left rear caliper or wheel cylinder

    ▼Right front caliper

    ▼Left front caliper

    Conduct air bleeding from the wheels in the above order. If no brake fluid comes out, it suggests that air is mixed in the master cylinder. In this case, bleed air from the master cylinder in accordance with steps 7 through 17, and then bleed air from the caliper or wheel cylinder.

19. Place the proper size box end wrench over the bleeder screw.
20. Cover the bleeder screw with a transparent tube, and submerge the free end of the transparent tube in a transparent container containing brake fluid.
21. Pump the brake pedal slowly three (3) times (once/sec), then hold it depressed.
22. Loosen the bleeder screw until fluid flows through the tube.
23. Retighten the bleeder screw.
24. Release the brake pedal slowly.
25. Repeat steps 21 through 24 until the air is completely removed.

    It may be necessary to repeat the bleeding procedure 10 or more times for front wheels and 15 or more times for rear wheels.

26. Go to the next wheel in the sequence after each wheel is bled.

    Be sure to monitor reservoir fluid level.

27. Depress the brake pedal to check if you feel “sponginess” after the air has been removed from all wheel cylinders and calipers.

    If the pedal feels “spongy”, the entire bleeding procedure must be repeated.

28. After the bleeding operation is completed on the each individual wheel, check the level of the brake fluid in the reservoir and replenish up to the “MAX” level as necessary.
29. Attach the reservoir cap.

    If the diaphragm inside the cap is deformed, reform it and install.

30. Stop the engine.

Flushing Brake Hydraulic System

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Approximately one quart of fluid is required to flush the hydraulic system. The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contains the slightest trace of mineral oil. All rubber parts that have been subjected to a contaminated fluid must be replaced.

Brake Pipes and Hoses

The hydraulic brake system components are interconnected by special steel piping and flexible hoses. Flexible hoses are used between the frame and the front calipers, the frame and rear axle case and the rear axle and the rear calipers.

When the hydraulic pipes have been disconnected for any reason, the brake system must be bled after reconnecting the pipe. Refer to *Bleeding the Brake Hydraulic System* in this section.

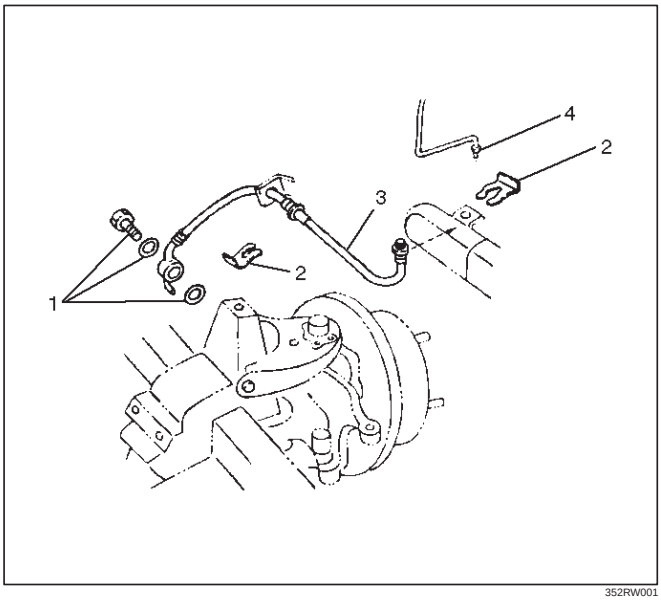
Brake Hose Inspection

The brake hose should be inspected at least twice a year. The brake hose assembly should be checked for road hazard, cracks and chafing of the outer cover, and for leaks and blisters. Inspect for proper routing and mounting of the hose. A brake hose that rubs on suspension components will wear and eventually fail. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

CAUTION: Never allow brake components such as calipers to hang from the brake hoses, as damage to the hoses may occur.

Front Caliper Brake Hose

Front Caliper Brake Hose and Associated Parts



352RW001

Legend

(1) Bolt and Gasket
(2) Clip
(3) Hose
(4) Brake Pipe

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove the wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove bolt and gasket.
7. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 19 N·m (14 lb ft)

2. Tighten the bolt to the specified torque.

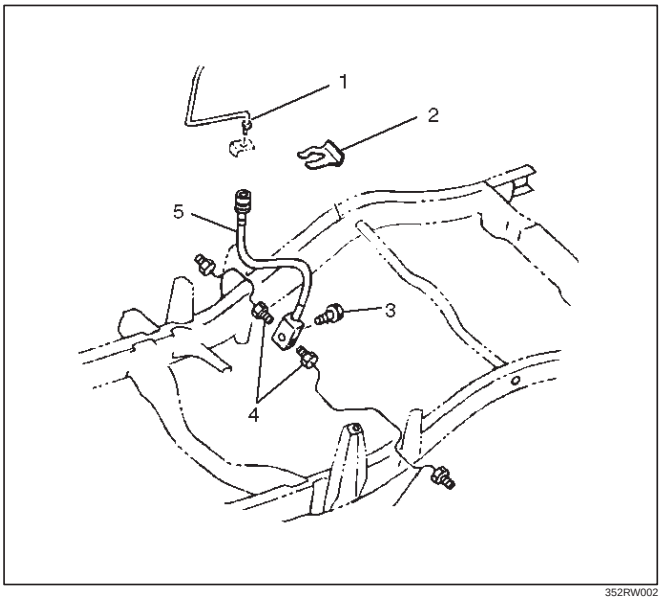
   Torque: 35 N·m (26 lb ft)

NOTE: Always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity.

After installing the brake hoses, bleed the brakes as described in this section.

Rear Axle Brake Hose

Rear Axle Brake Hose and Associated Parts



352RW002

Legend

(1) Brake Pipe
(2) Clip
(3) Bolt
(4) Brake Pipe
(5) Hose

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove brake pipe.
7. Remove bolt.
8. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 19 N·m (14 lb ft)

2. Tighten the bolt to the specified torque.

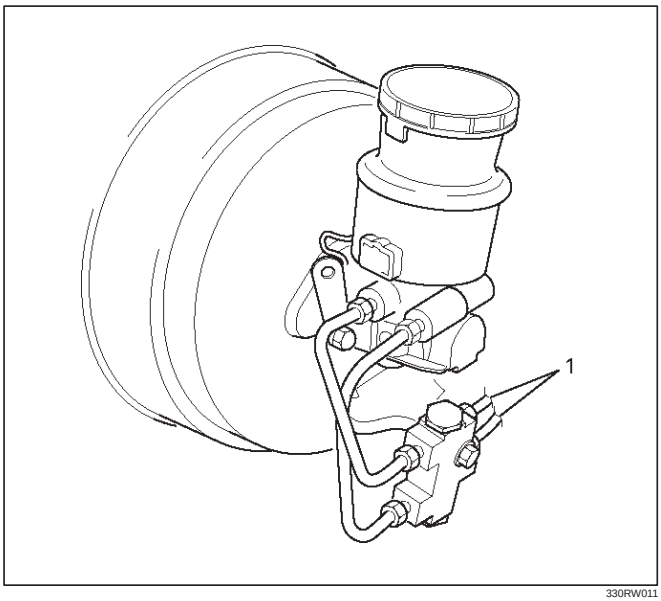
   Torque: 15 N·m (11 lb ft)

After installing the brake hoses, bleed the brakes as described in this section.

Brake Pipe

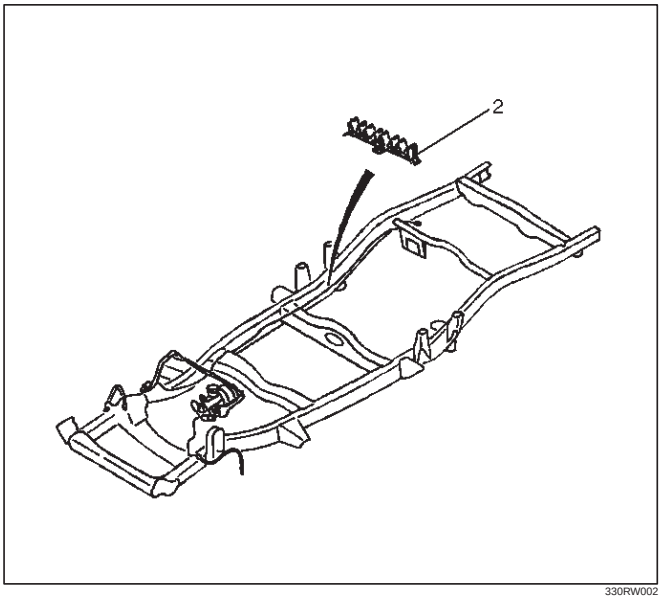
Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly as necessary.
3. Clean dirt, grease, and other foreign material off the pipe fittings at both ends.
4. Remove brake pipe (1).



330RW011

5. Remove plastic clip (2).



330RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque.

   Master cylinder and Proportioning and Bypass valve sides

   Torque: 15 N·m (11 lb ft)

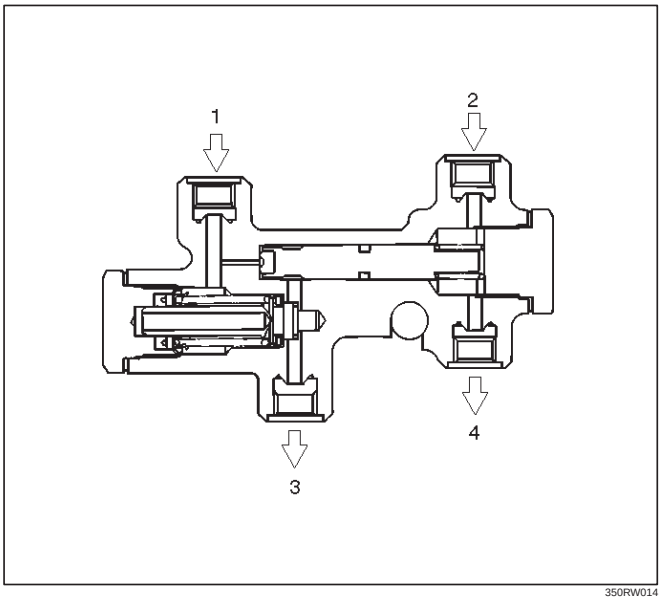
   Others

   Torque: 16 N·m (12 lb ft)

After installing the brake pipes, bleed the brakes as described in this section.

P & B (Proportioning and Bypass) Valve

P & B (Proportioning and Bypass) Valve Sectional View



350RW014

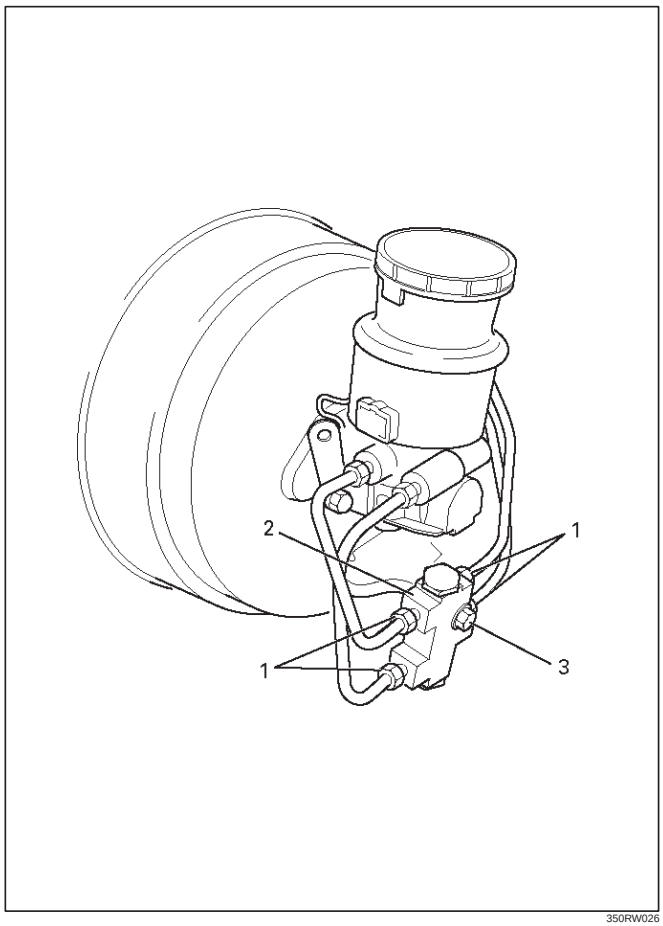
Legend

(1) Master Cylinder (Secondary)
(2) Master Cylinder (Primary)
(3) Rear Brake
(4) Front Brake

The P&B valve contains two sections, each serving a different function.
The proportioning section of the P&B valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock up on the vehicles with light rear wheel loads. The valve has a by–pass feature which assures full system pressure to the rear brakes in the event of front brake system malfunction. Also full front pressure is retained in the event of rear brake malfunction.
The P&B valve is not repairable and must be replaced as complete assembly.

Removal

1. The P&B valve is not repairable and must be replaced as a complete assembly. Care must be taken to prevent brake fluid from contacting any painted surface.
2. Remove hydraulic pipes (1) and plug the pipes (1) to prevent the loss of fluid or the entrance of dirt.
3. Remove bolt (3).
4. Remove P&B valve (2).



350RW026

Installation

1. Install P&B valve (2).
2. Install bolt (3) and tighten the bolt to the specified torque.

   Torque: 22 N·m (16 lb ft)

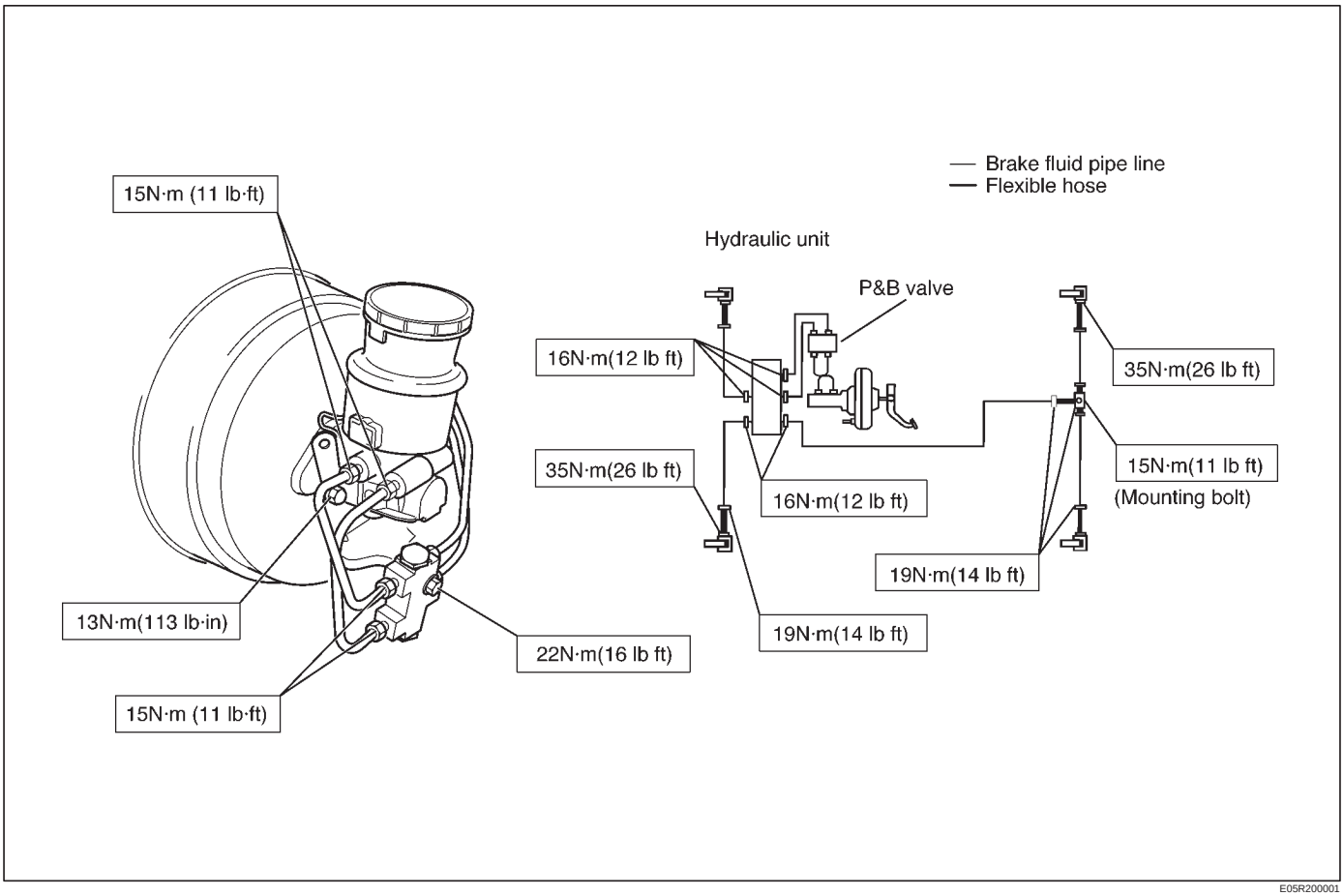
3. Install hydraulic pipes (1) and tighten the bolt to the specified torque.

   Torque: 15 N·m (11 lb ft)

4. After installing the brake pipes, bleed the brakes as refer to *Bleeding Brake Hydraulic System* in this section.

Main Data and Specifications

Torque Specifications



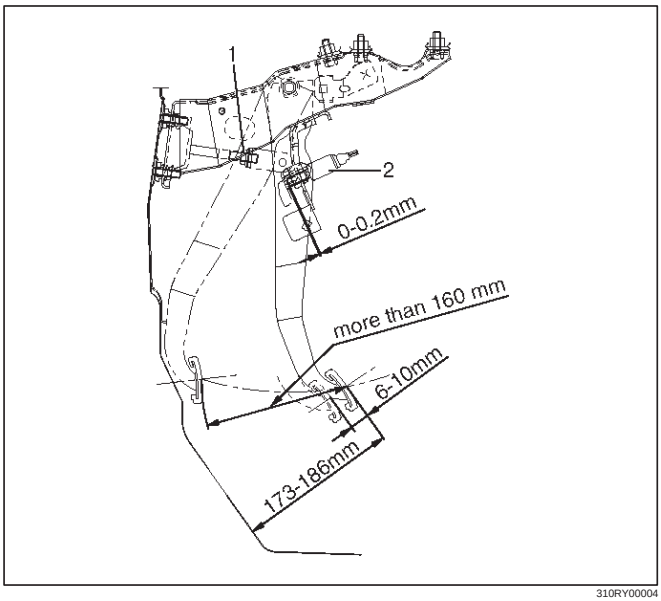
E05R200001

Brake Pedal

Checking Pedal Height

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows:

Adjust Brake Pedal



310RY00004

1. Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring.
   Pedal height must be measured after starting the engine and receiving it several times.

   Pedal Free Play: 6-10 mm (0.23-0.39 in)

   Pedal Free Play: 173-185 mm (6.81-7.28 in)

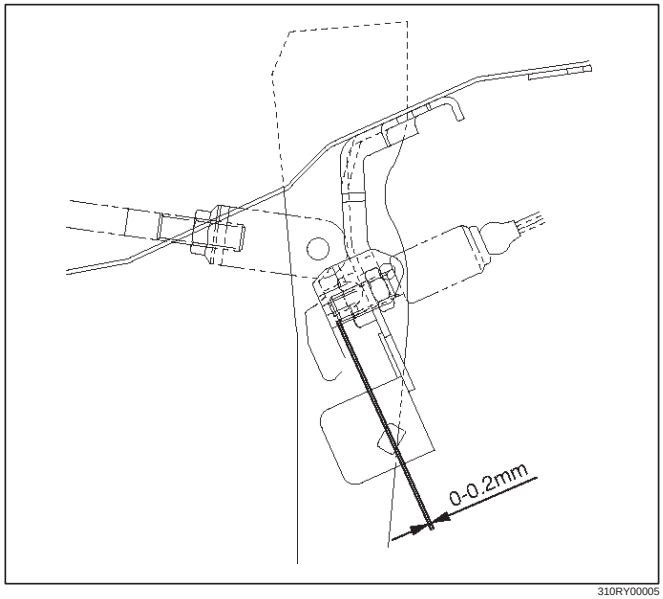
NOTE: Pedal free play must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

2. If the measured value is not within the above range, adjust the brake pedal as follows:
   a. Disconnect the stoplight switch connector.
   b. Loosen the stoplight switch lock nut.
   c. Rotate the stoplight switch so that it moves away from the brake pedal.
   d. Loosen the lock nut (1) on the push rod.
   e. Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.
   f. Tighten the lock nut to the specified torque.

   Torque: 20 N·m (15 lb ft)

   g. Adjust the stoplight switch (2) to the specified clearance (between the switch housing and the brake pedal) by rotating the switch housing.

   Clearance: 0.5–1.0 mm (0.02–0.04 in)

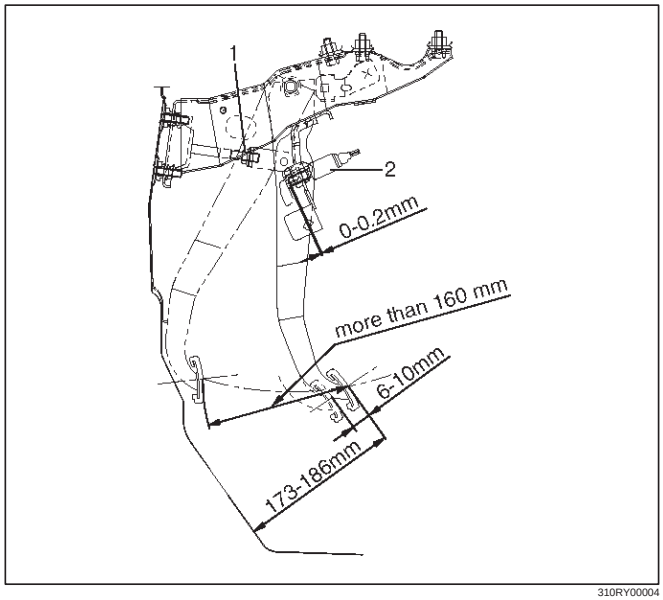


310RY00005

NOTE: While adjusting the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

   h. Tighten the stoplight switch lock nut.
   i. Connect the stoplight switch connector.

Checking Pedal Travel



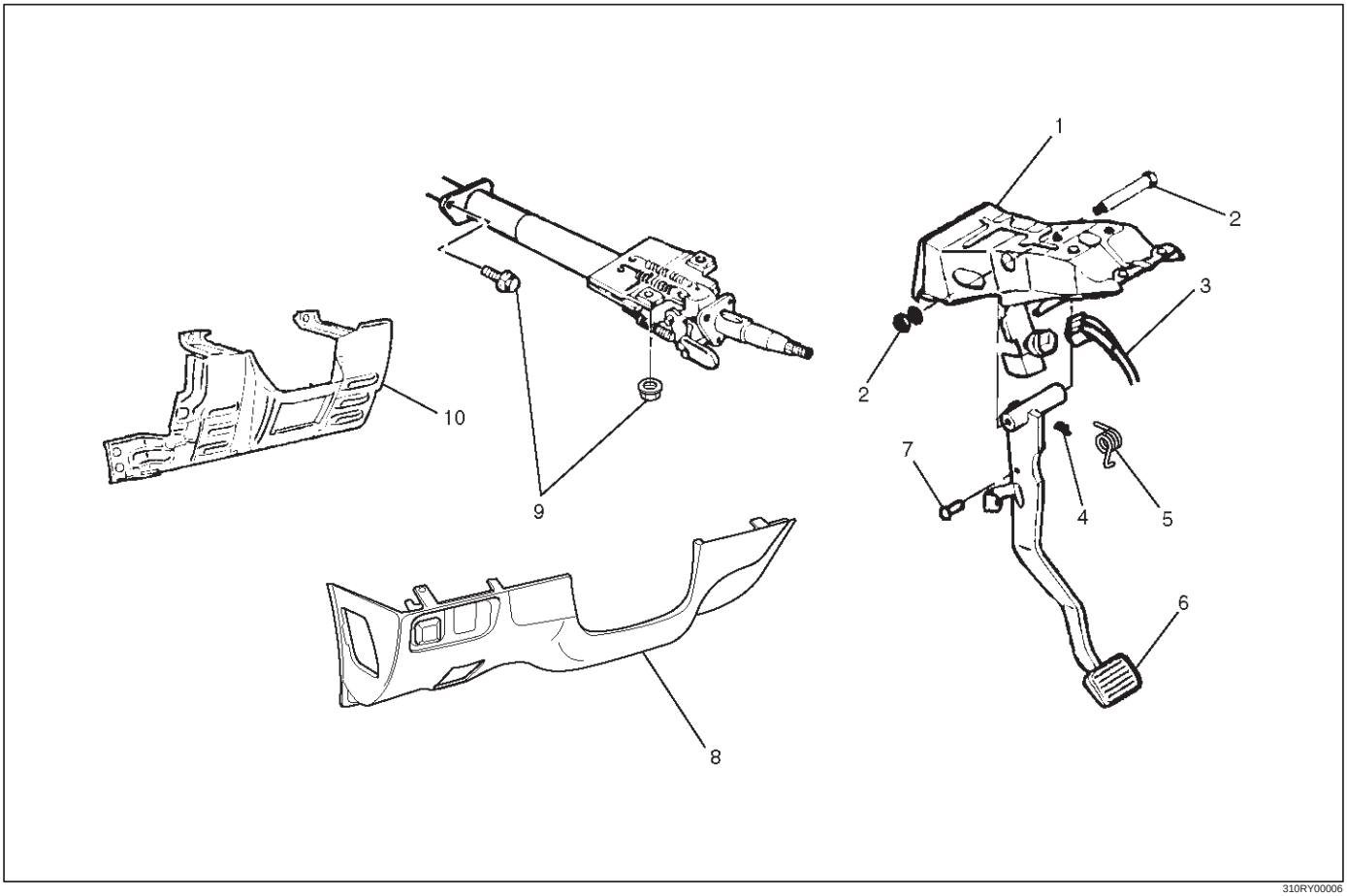
310RY00004

1. Pedal height must be measured after starting the engine and revving it several times to apply vacuum to the vacuum booster fully.

NOTE: Pedal height must be 95 mm (3.7 in) or more when about 50 kg (110.25 lb) of stepping force is applied.

2. If the measured value is lower than the above range, air may still be present in the hydraulic system Perform the bleeding procedure.

Brake Pedal and Associated Parts



310RY00006

Legend

(1) Brake Pedal Bracket Assembly
(2) Fulcrum Pin and Nut
(3) Connector
(4) Snap Pin
(5) Return Spring
(6) Peadl Assembly
(7) Push Rod Pin
(8) Lower Cover
(9) Bolts and Nut
(10) Driver Knee Bolster

Removal

1. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
2. Disconnect the yellow 3 way SRS connector located under the steering column.
3. Remove the engine hood opening lever.
4. Remove lower cover (8).
5. Remove driver knee bolster (10).
6. Disconnect the stop light switch connector (3).
   Disconnect the anti-theft control module connector. Refer to *Body and Accessories* section in this Manual.
7. Remove snap pin (4) and push rod pin (7).
8. Remove the steering column shaft fixing bolt and nut (9) on the steering wheel side, and lower the steering column shaft.
9. Remove the brake pedal bracket assembly (1).
10. Remove return spring (5).
11. Remove fulcrum pin and nut (2).
12. Remove pedal assembly (6).

Installation

1. Apply grease to the entire circumference of the fulcrum pin.
2. Install pedal assembly (6) and fulcrum pin and nut (2). Tighten the nut (2) to the specified torque.

   Torque: 35 N·m (26 lb ft)
3. Install the brake pedal bracket assembly (1). Tighten the bolts and nuts soecified torque.

   Torque: 15 N·m (11 lb ft)
4. Install return spring (5).
5. Adjust pedal free travel.
   Refer to *Brake Pedal Adjustment* in this section.
6. Tighten the steering column fixing bolt (9) (dash panel) to the specified torque.

   Torque: 20 N·m (14 lb ft)

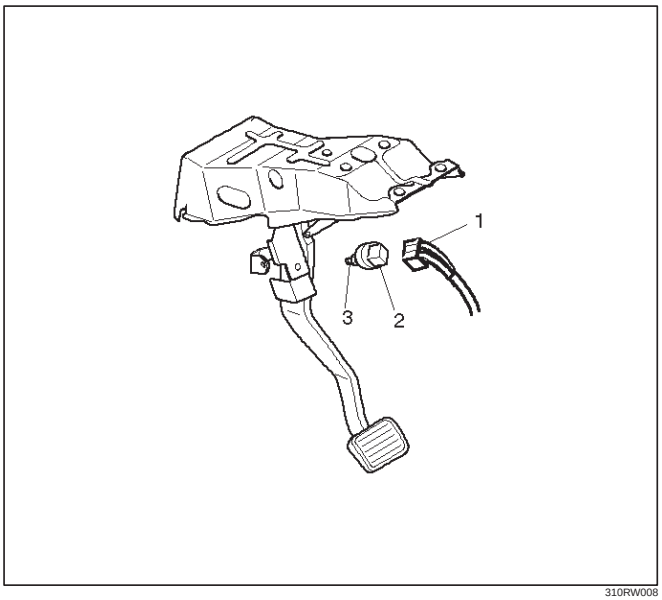
7. Tighten the steering column fixing nut (9) (Cross Beam) to the specified torque.

   Torque: 17 N·m (12 lb ft)

8. Apply grease to the entire circumference of the Push rod pin (7).
9. Install push rod pin (7).
10. Install snap pin (4).
11. Connect the anti-theft control module connector. Refer to *Body and Accessories* section in this manual.
12. Connect the stop light switch connector (3).
13. Install driver knee bolster (10) and lower cover (8).
14. Install the engine hood opening lever.
15. Connect the yellow 3 way SRS connector located under the steering column.
16. Connect the battery "–" terminal cable.

Stoplight Switch

Parts Location



310RW008

Legend

(1) Connector
(2) Switch
(3) Lock Nut

Removal

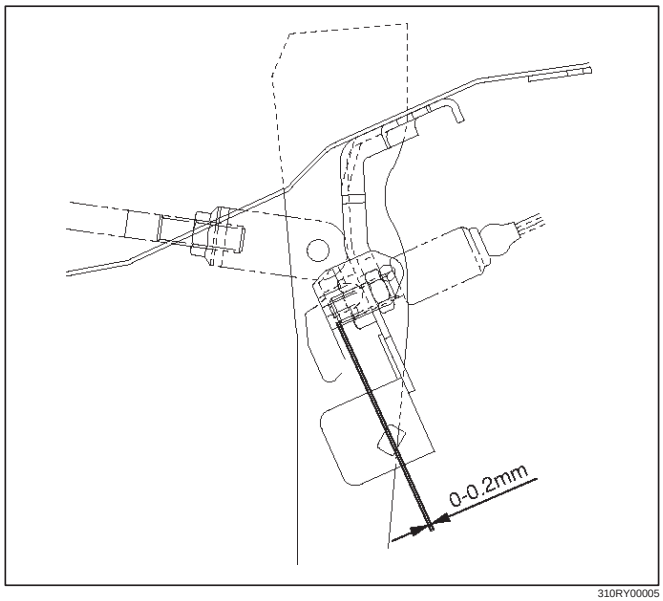
1. Disconnect connector (1)
2. Remove lock nut (3).
3. Remove switch (2).

Installation

1. Adjust the stop light switch to the specified clearance (between switch housing and brake pedal) by rotating the switch housing.

   Clearance : 0-0.2 mm (0-0.08 in)

NOTE: Do not attempt to force the push rod into position during the stop light switch installation and adjustment procedure.



310RY00005

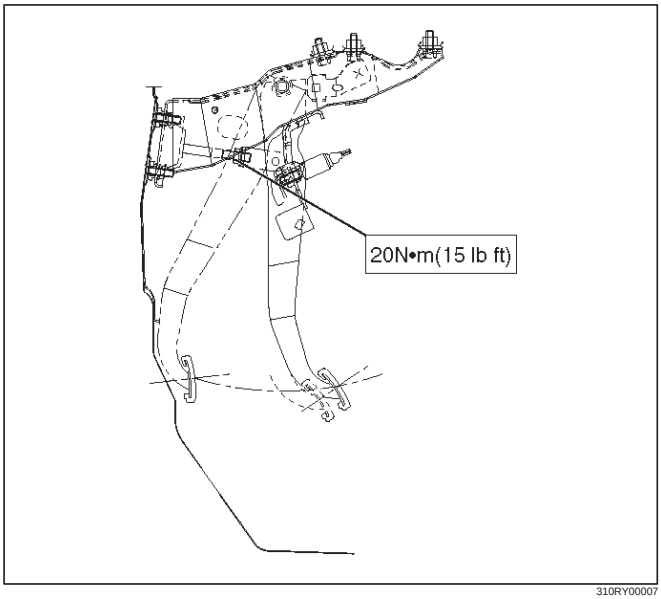
2. Connect connector (1).
3. Install lock nut (3).

Main Data and Specifications

General Specifications

Pedal free play	6–10 mm (0.23 –0.39 in)
Pedal Height	173–185 mm (6.81–7.28 in)

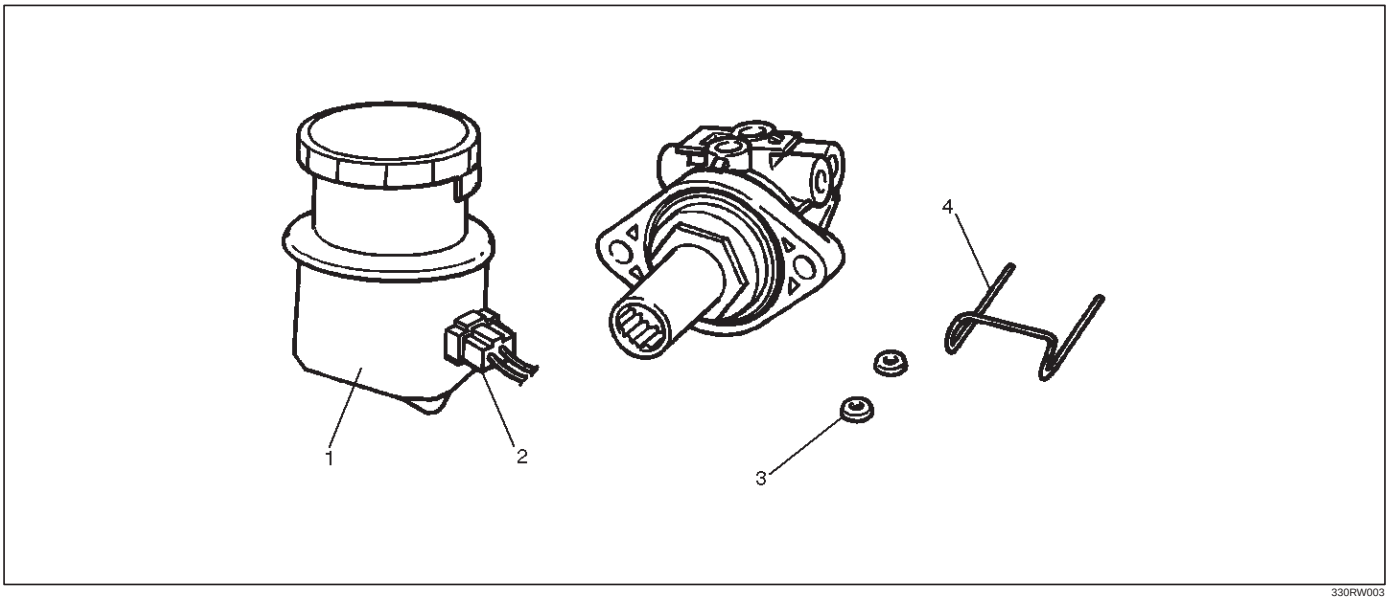
Torque Specifications



310RY00007

Fluid Reservoir Tank

Fluid Reservoir Tank and Associated Parts



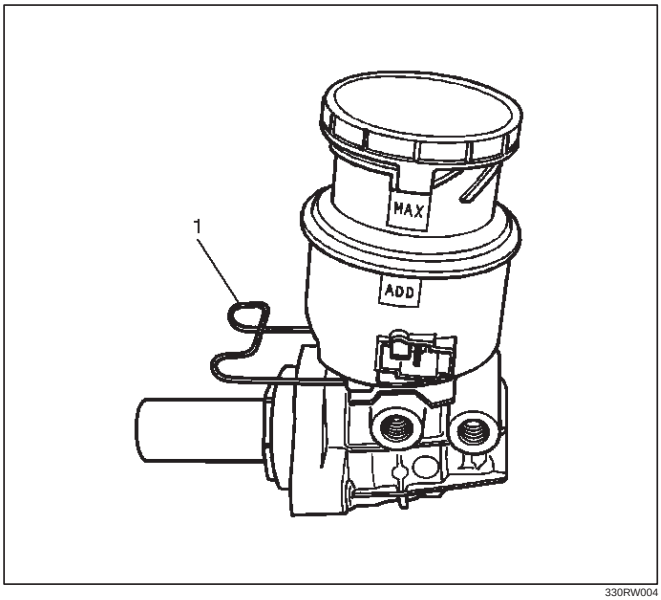
330RW003

Legend
(1) Fluid Reservoir
(2) Electrical Connector
(3) O–ring
(4) Retainer

Removal

NOTE: Before removing the fluid reservoir, remove the brake fluid from the fluid reservoir.

1. Disconnect electrical connector.
2. Remove retainer (1).



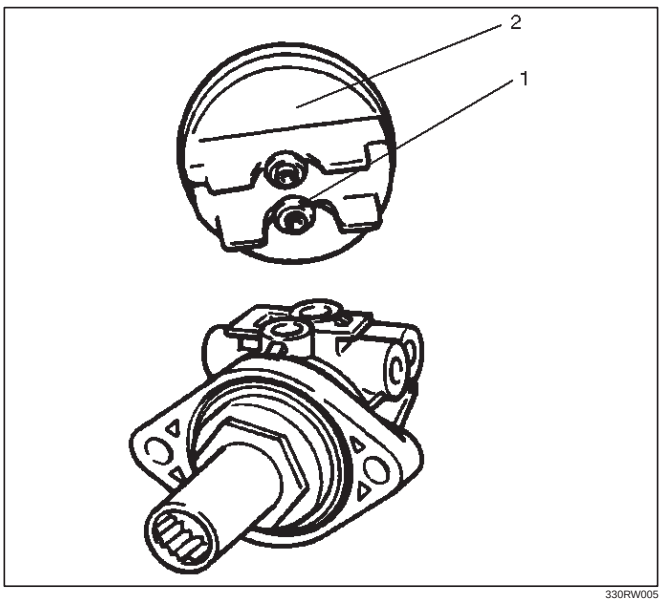
330RW004

3. Remove fluid reservoir and the fluid level sensor built into the fluid reservoir. The fluid level sensor cannot be removed for servicing.
4. Remove O–ring.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

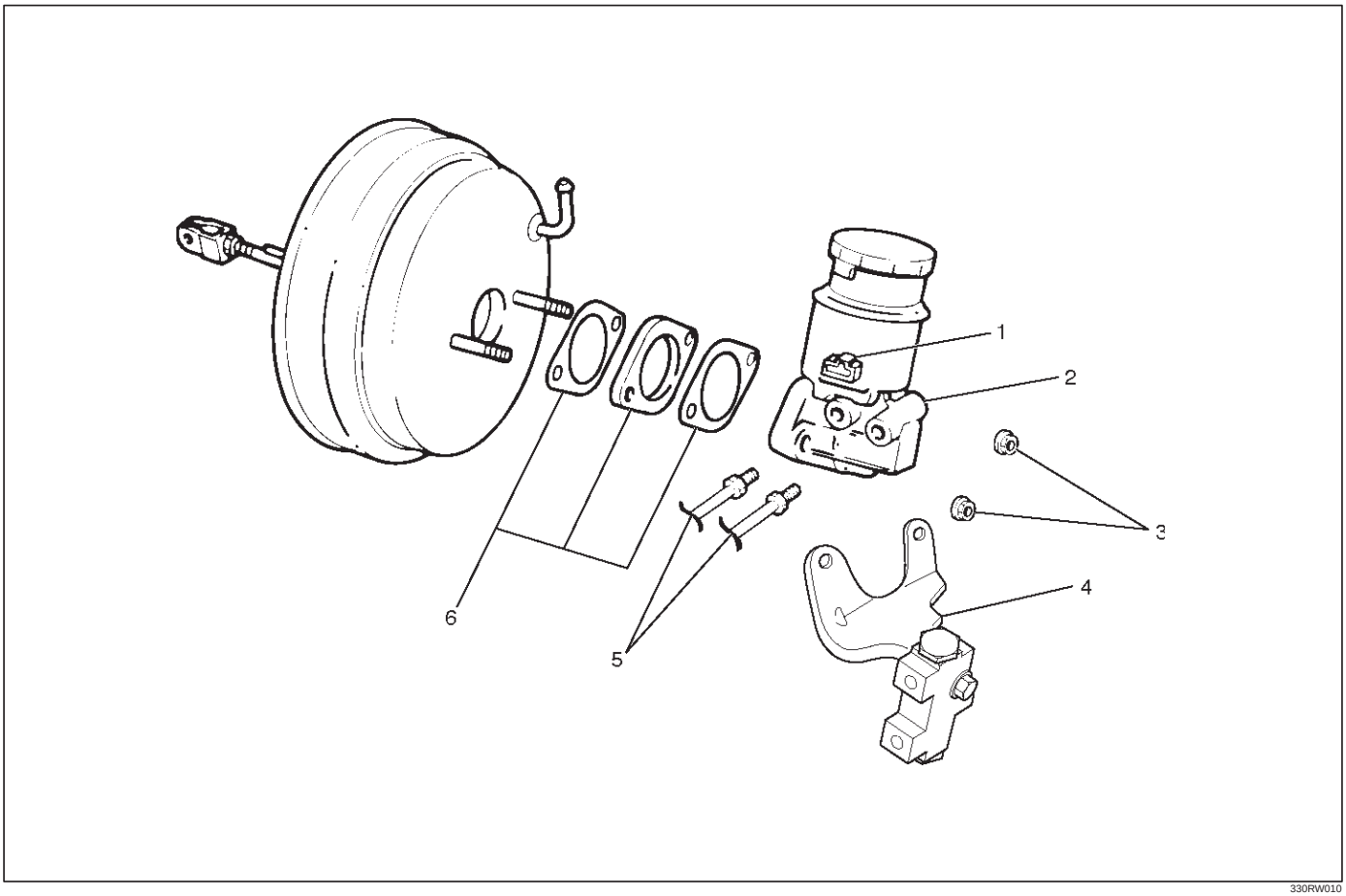
1. O–ring (1) must be set onto the fluid reservoir (2), before installing fluid reservoir.



330RW005

Master Cylinder Assembly

Master Cylinder Assembly and Associated Parts



330RW010

Legend

(1) Electrical Connector
(2) Master Cylinder
(3) 2 attaching Nuts
(4) P&B Valve and Bracket
(5) Brake Pipes
(6) Spacer and 2 gaskets

Removal

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

1. Disconnect electrical connector.
2. Remove brake pipes and after disconnecting the brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
3. Remove 2 attaching nuts.
4. Remove P&B valve and bracket.
5. Remove master cylinder.
6. Remove spacer and the 2 gaskets.

Inspection and Repair

Master Cylinder

The master cylinder is not repairable and must be replaced as a complete assembly if found defective.

Inspection

Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check:

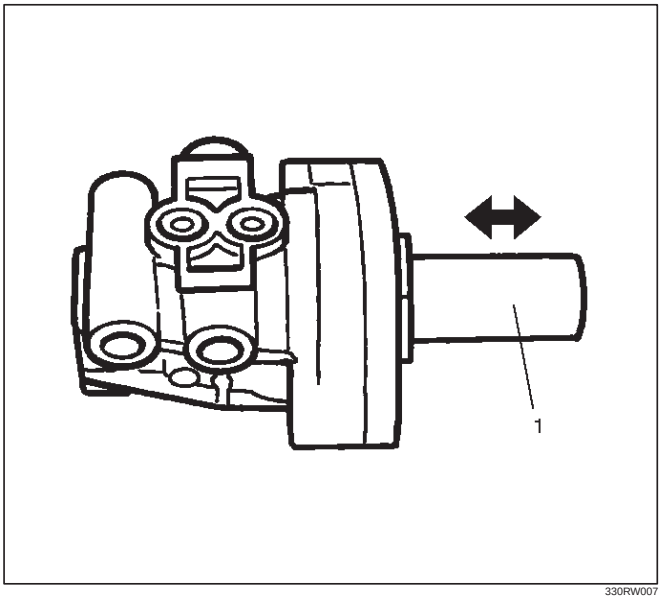
Visual Check

Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection:

▼ Master cylinder body
▼ Fluid reservoir
▼ O–ring

Functional Inspection of Master Cylinder Piston

Push the primary piston (1) with your fingers to check that it travels smoothly. If the motion is questionable, replace the master cylinder as a complete assembly.

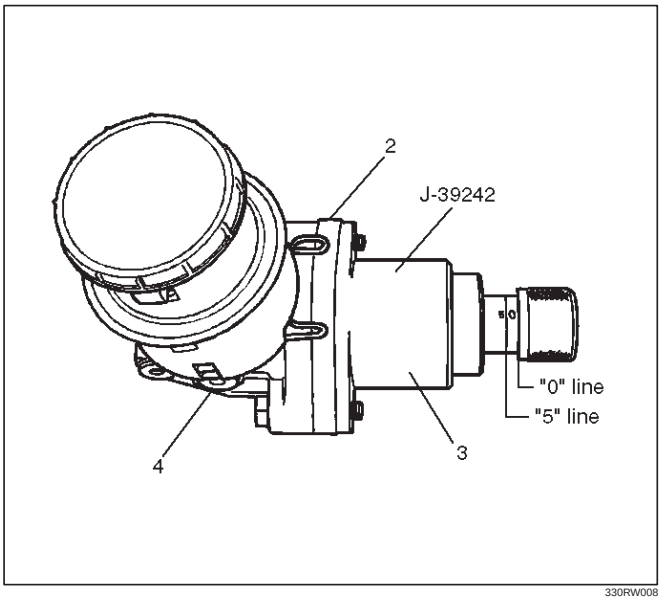


330RW007

Functional Inspection of Master Cylinder

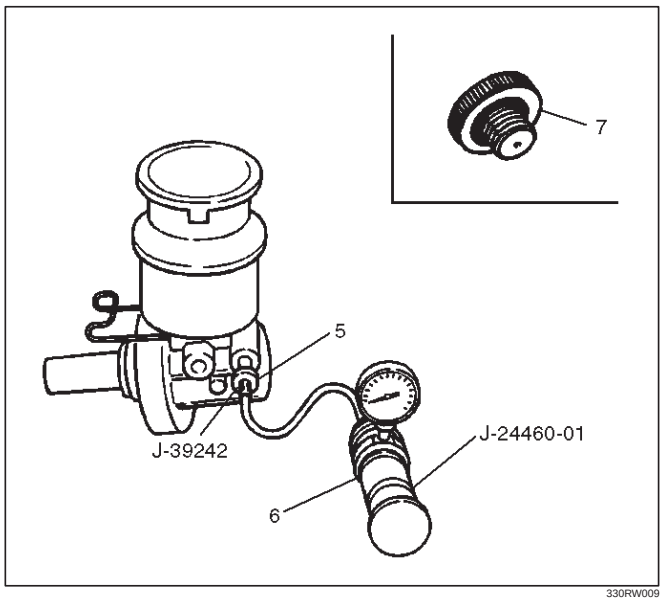
Inspect the master cylinder for functionality described below. Replace if necessary.

Install the primary piston holder (3) J–39242 (including the master cylinder attachment (5) and master cylinder plug (7)) onto the master cylinder (4). Make sure the spacer (2) (2 bolts) with its adjusting bolt is screwed in up to the “0” line



330RW008

Connect the master cylinder attachment (5) J–39242 with the end of the radiator cap tester (6) J–24460–01, and apply air pressure with the cap tester. Make sure there is no rise in pressure while adjusting the bolt to the “5” line. There should be a pressure increase of 0.5 kg/cm^2 or more.



330RW009

NOTE: When checking the front (or primary) side, be sure to mount the master cylinder plug in the rear (or secondary) port.

	“0” Line	“5” Line
Apply air pressure to the front and rear ports	No pressure rise.	Pressure increase of 0.5 kg/cm^2 or more
Remarks	Checks port into the atmospheric pressure chamber	Checks air tightness of the pressure chamber

NOTE:

1. Do not use an air compressor, as the air from the compressor is mixed with compressor oil.
2. When installing the master cylinder onto the vacuum booster, always adjust the vacuum booster push rod. (Refer to *Vacuum Booster* in this section).
3. After the master cylinder is installed onto the vehicle, check for leakage, pedal travel and pedal free play.

Installation

1. Install spacer and the 2 gaskets.
2. Install master cylinder.
   When replacing the master cylinder or vacuum booster or both, always measure the vacuum booster push rod protrusion and adjust it as necessary (Refer to *Vacuum Booster* in section).
3. Install P&B valve and bracket.
4. Install 2 attaching nuts and tighten the attaching nuts to the specified torque.

   Torque: 13 N·m (113 lb in)

5. Install brake pipes and tighten the brake pipe to the specified torque.

   Master cylinder and P&B valve sides

   Torque: 15 N·m (11 lb ft)

   Others

   Torque: 16 N·m (12 lb ft)

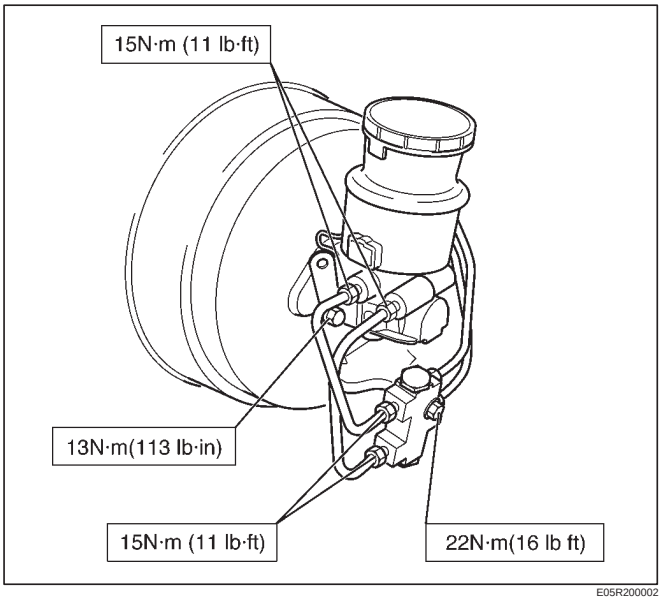
6. Connect electrical connector.

Main Data and Specifications

General Specifications

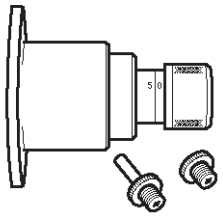
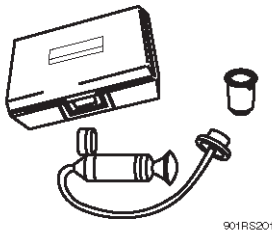
Type	Dual–circuit
Piston bore diameter	25.4 mm (1.000 in)

Torque Specifications



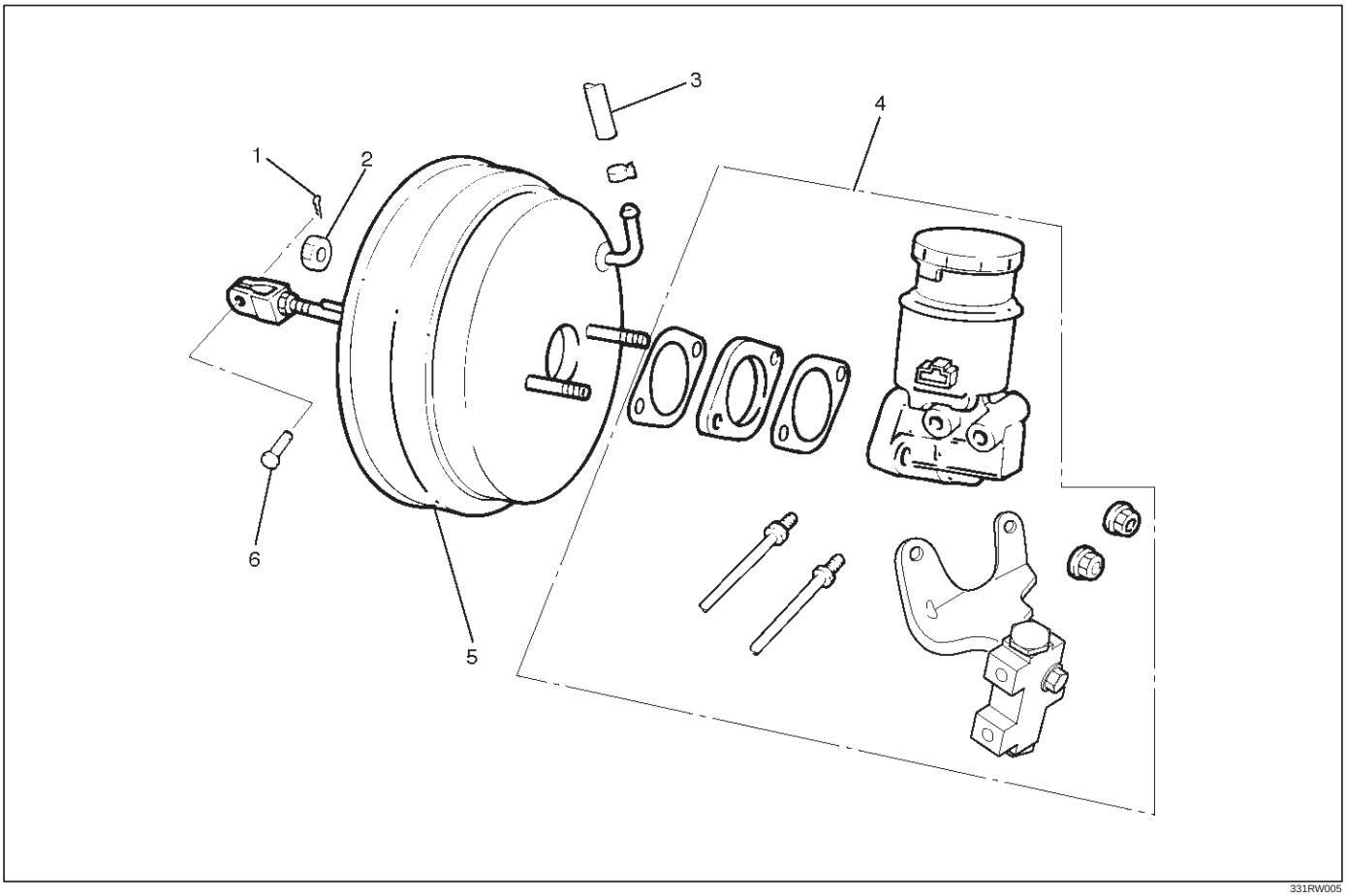
E05R200002

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS200	**J-39242** Primary Piston Holder (including master cylinder attachment and master cylinder plug
 901RS201	**J-24460-01** Radiator Cap Tester

Vacuum Booster Assembly

Vacuum Booster Assembly and Associated Parts



331RW005

Legend

(1) Pin
(2) Vacuum Booster Fixing Nut
(3) Vacuum Hose
(4) Master Cylinder
(5) Vacuum Booster
(6) Snap Pin

Removal

1. Before removing the vacuum booster assembly, disconnect and remove the brake pipes.
2. Remove master cylinder, refer to *Master Cylinder Removal* in this section.

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

Do not hold the piston while removing the master cyliner, the piston can be easily pulled out.

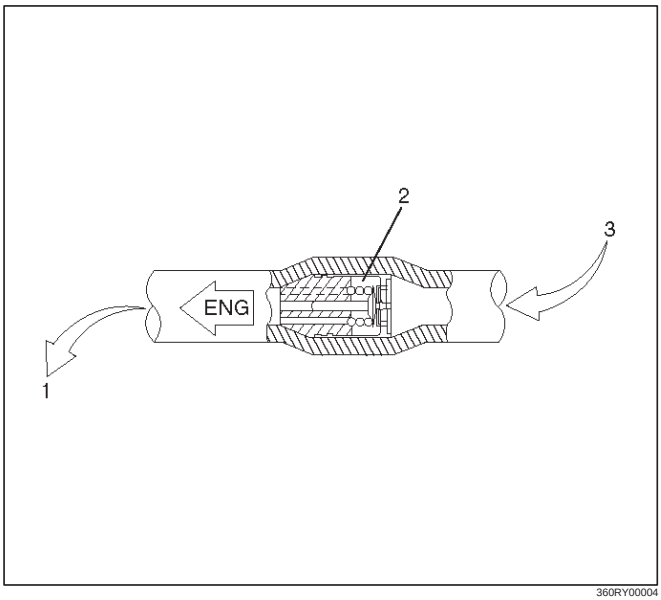
Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

3. Remove vacuum hose.
4. Disconnect the yoke clevis from the brake pedal.
5. Remove vacuum booster fixing nut.
6. Remove vacuum booster.

Inspection and Repair

Vacuum Hose (The built in check valve)

1. Inspect the check valve (2), which is installed inside the vacuum hose.
2. Air should pass freely from the vacuum booster (3) to the engine (1).
3. Air should not pass from the engine (1) to the vacuum booster (3). If it does, the check valve is inoperative and the vacuum hose built in the check valve must be replaced.



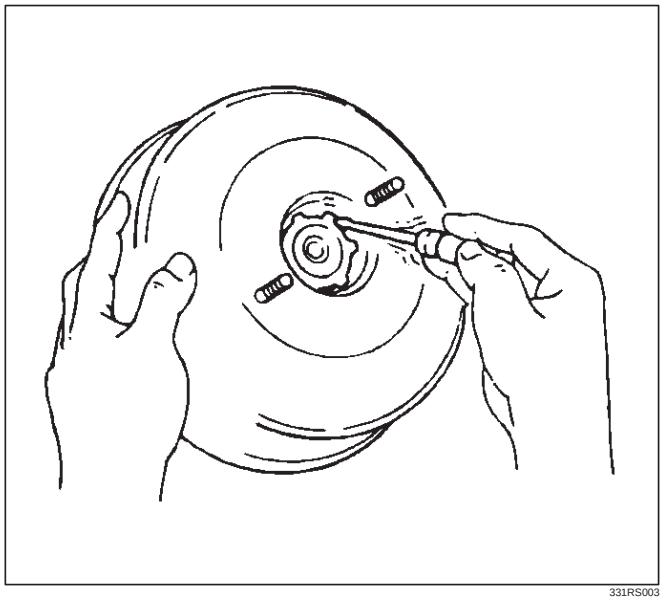
360RY00004

Installation

1. Perform vacuum booster and vacuum booster push rod adjustment.

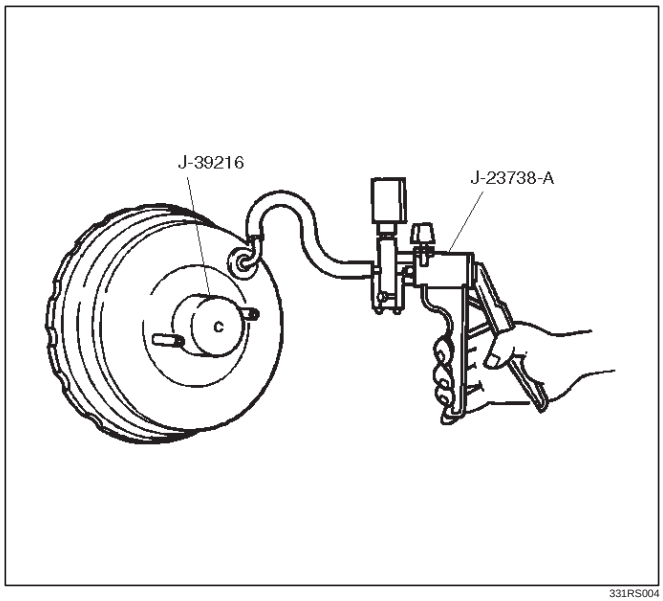
NOTE: When replacing either the master cylinder or vacuum booster, be sure to measure push rod, and adjust if required.

2. Remove retainer from vacuum booster front shell using a small screwdriver. Then gently draw plate and seal assembly out of the shell inside.


331RS003

3. Set push rod gauge J–39216 on vacuum booster, and apply negative pressure by means of vacuum pump J–23738–A so that the pressure in the vacuum booster becomes 500 mm Hg.

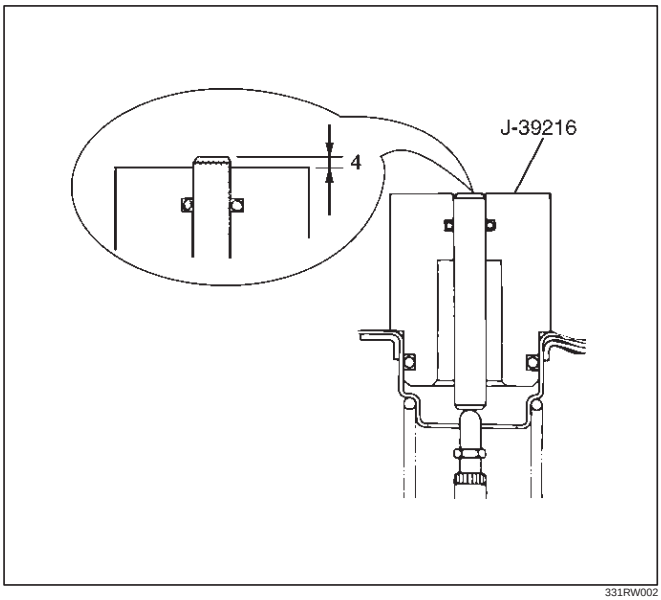
NOTE: Be sure to apply NEGATIVE pressure after installing a push rod gauge on the vacuum booster.



331RS004

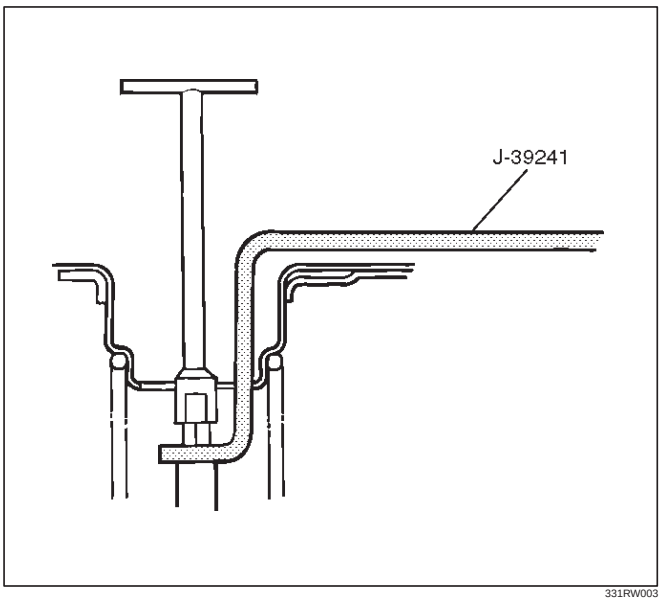
4. Measure dimension (4).

Dimension (4) (Standard): –0.1–0.1 mm (–0.0039–0.0039 in)



331RW002

5. If dimension (4) is out of the standard range, adjust push rod using the Push Rod Support J–39241.



331RW003

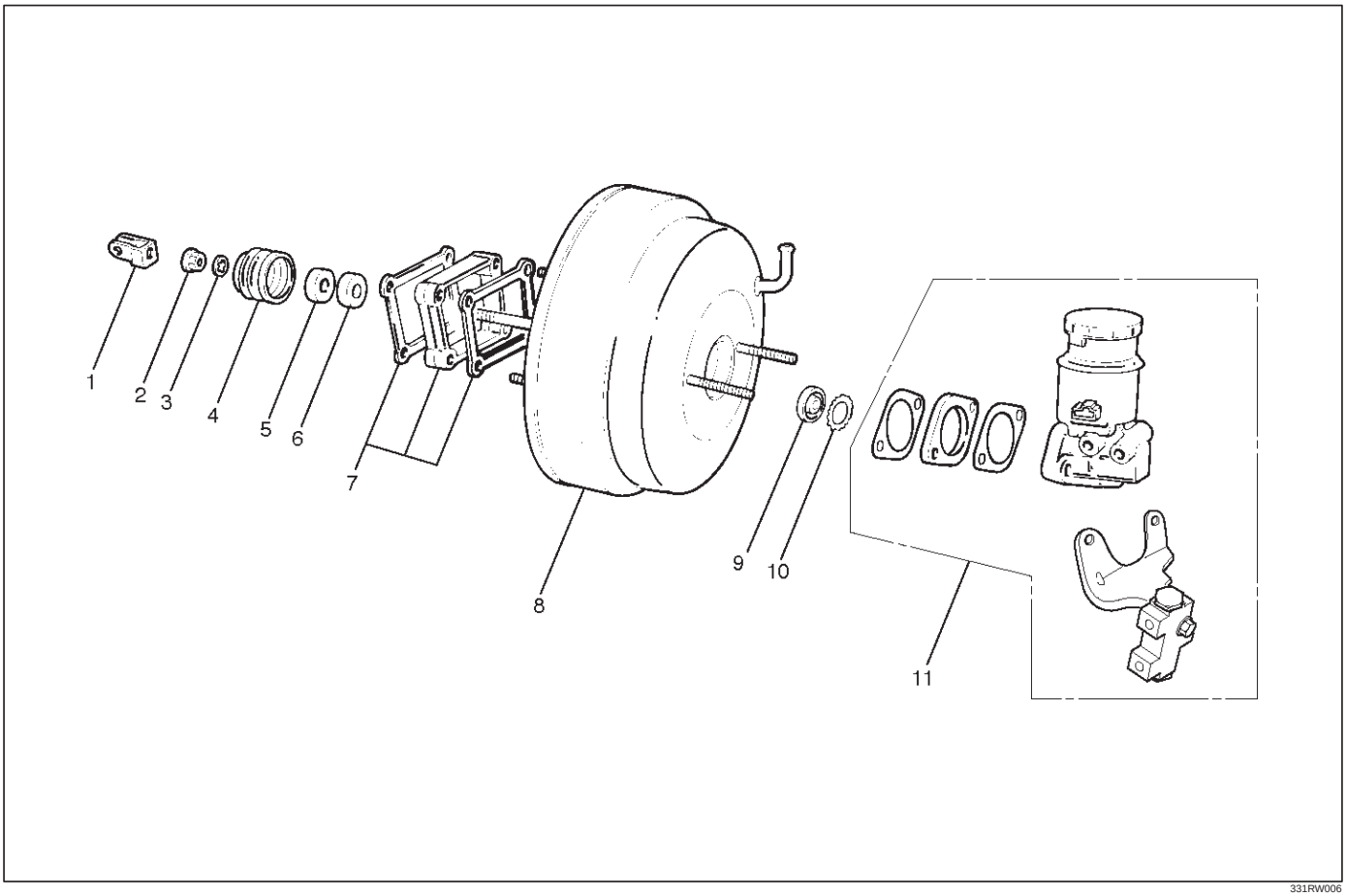
6. Mount plate and seal assembly in vacuum booster front shell. Then install the retainer.
7. Install vacuum booster fixing nut and tighten the specified torque.

Torque: 15 N·m (11 lb ft)

8. Install yoke clevis.
9. Connect vacuum hose and make sure that the arrow on the hose points in the direction of the engine.
10. Install master cylinder, refer to *Master Cylinder Installation* in this section.

Exterior Components

Exterior Components and Associated Parts



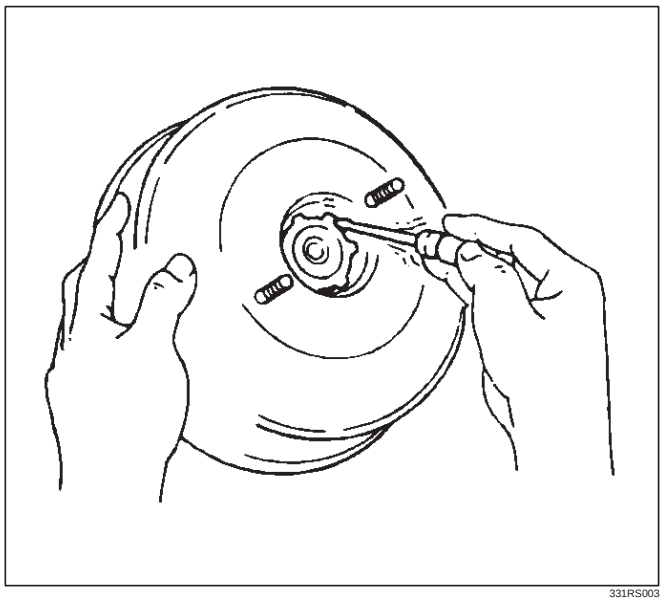
331RW006

Legend

(1) Yoke Clevis
(2) Lock Nut
(3) Retaining Clip
(4) Valve Body Guard
(5) Silencer
(6) Filter
(7) 2 Gaskets and Spacer
(8) Vacuum Booster
(9) Retainer
(10) Plate and Seal Assembly
(11) Master Cylinder

Removal

1. Remove master cylinder. Refer to *Master Cylinder* in this section.
2. Remove vacuum booster. Refer to *Vacuum Booster* in this section.
3. Remove yoke clevis.
4. Remove lock nut.
5. Remove retaining clip.
6. Remove valve body guard.
7. Remove silencer.
8. Remove filter.
9. Remove 2 gaskets and spacer.
10. Remove retainer, using a small screwdriver to pry out the retainer. Gently pull out the plate and seal assembly from the shell.



331RS003

Inspection and Repair

Visual Check

Make necessary parts replacement if cuts, nicks, excessive wear, or other abnormal conditions are found through inspection. Check the following parts:

- ▼ Yoke clevis
- ▼ Valve body guard
- ▼ Silencer
- ▼ Filter plate and seal assembly

Installation

1. Install plate and seal assembly.
2. Install retainer.
3. Install 2 gaskets and spacer.
4. Install filter.
5. Install silencer.
6. Install valve body guard.
7. Install retainer.
8. Install lock nut and yoke clevis and tighten to the specified torque.

   Torque: 20 N·m (15 lb ft)
9. Install vacuum booster, refer to *Vacuum Booster* in this section.
10. Install master cylinder, refer to *Master Cylinder* in this section and after installation, perform brake pedal check and adjustment. Refer to *Brake Pedal* in this section.

Vacuum Booster Overhaul

Vacuum Booster

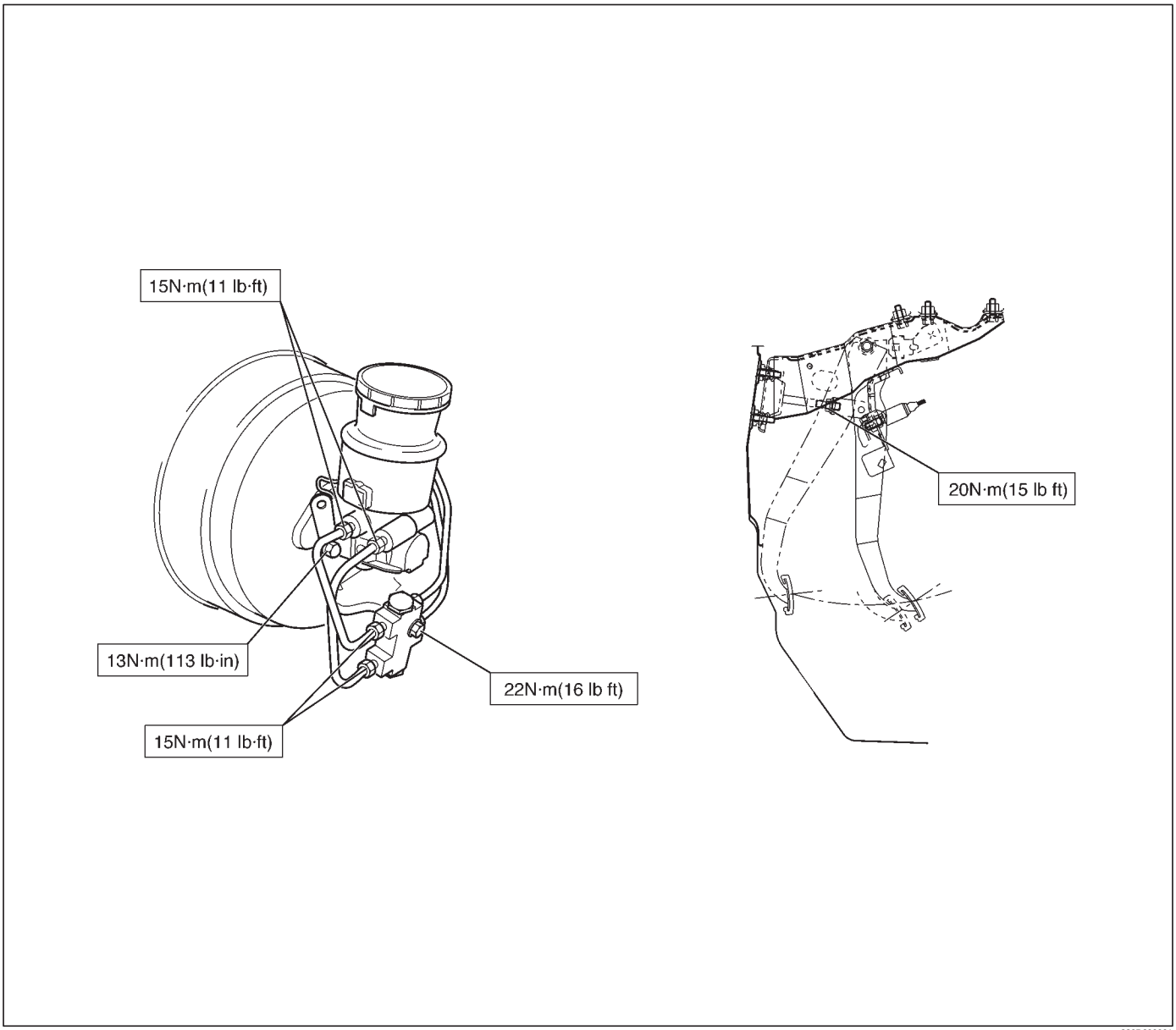
The vacuum booster cannot be disassembled for repair. Replace a defective vacuum booster with a new one.

Main Data and Specifications

General Specifications

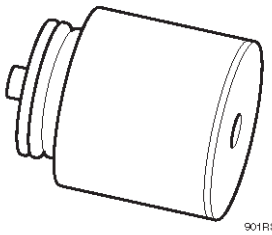
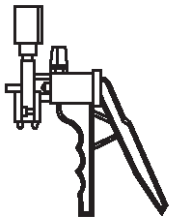
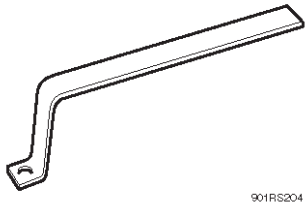
Vacuum booster diaphragm diameter (Front)	205 mm (8.07 in)
Vacuum booster diaphragm diameter (Rear)	230 mm (9.06 in)
Push rod stroke	More than 32.0 mm (1.26 in)
Plunger diameter	10.25 mm (0.40 in)
Push rod diameter	27.4 mm (1.08 in)

Torque Specifications



330R200001

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS202	**J-39216** Push Rod Gauge
 901RS203	**J-23738-A** Vacuum Pump
 901RS204	**J-39241** Push Rod Support

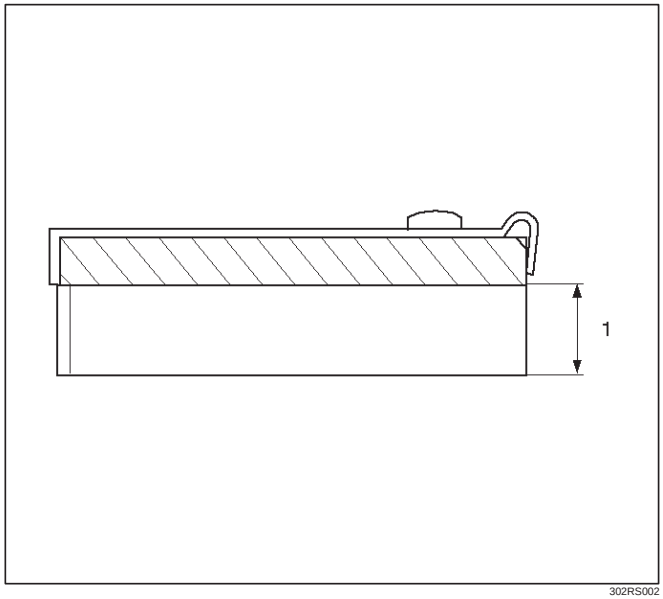
Front Disc Brake Pads

Front Disc Brake Pads Inspection

Check the outer pad by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole on the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.00 mm (0.039 in) of the pad itself.

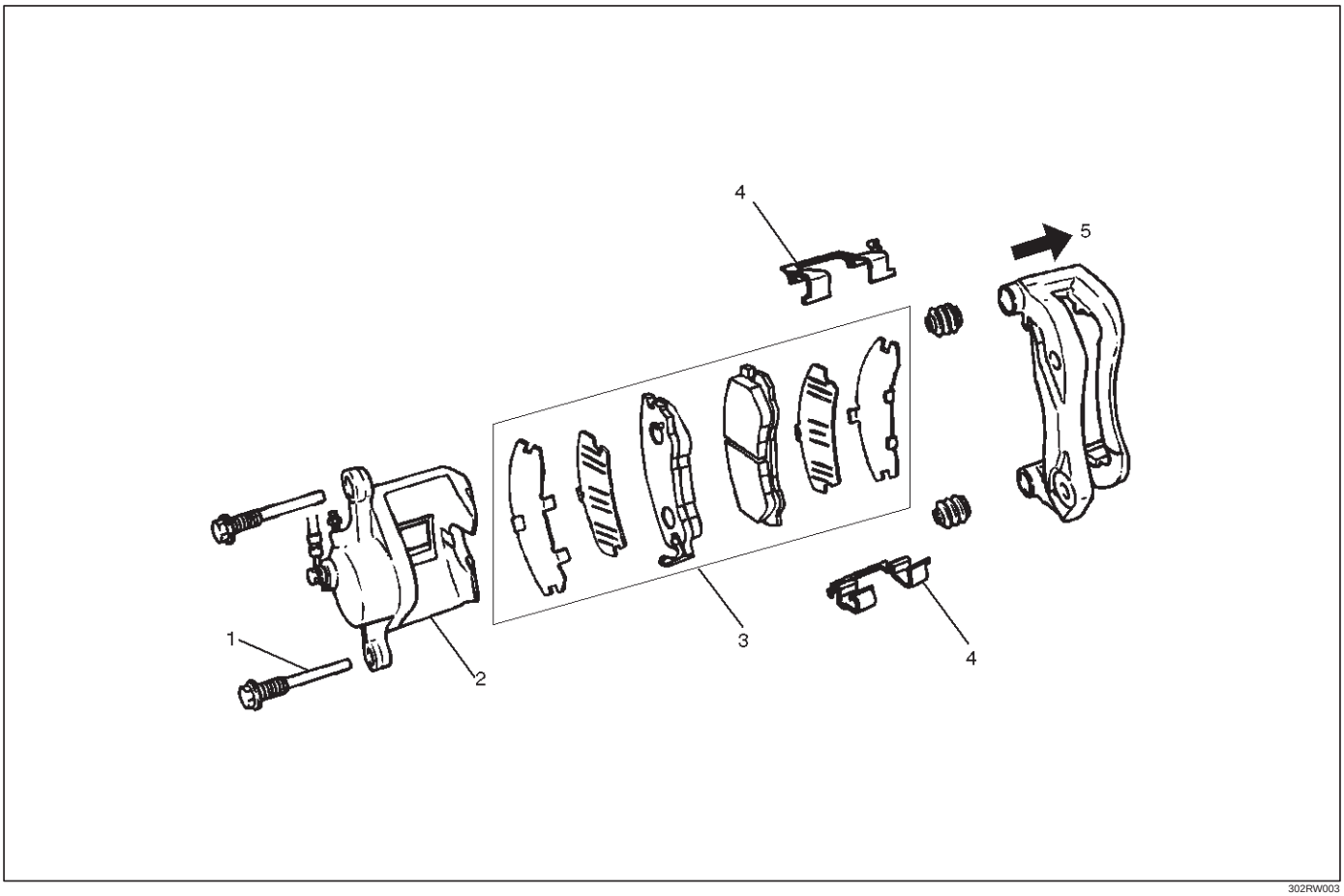
Wear indicators are installed on disc brake pads, disc brake pads need replacement when the wear indicator is heard.

Minimum limit (1): 1.0 mm (0.039 in)



302RS002

Front Disc Brake Pads and Associated Parts



302RW003

Legend

(1) Lock Bolt
(2) Caliper Assembly
(3) Pad Assembly
(4) Clip
(5) Outer Side

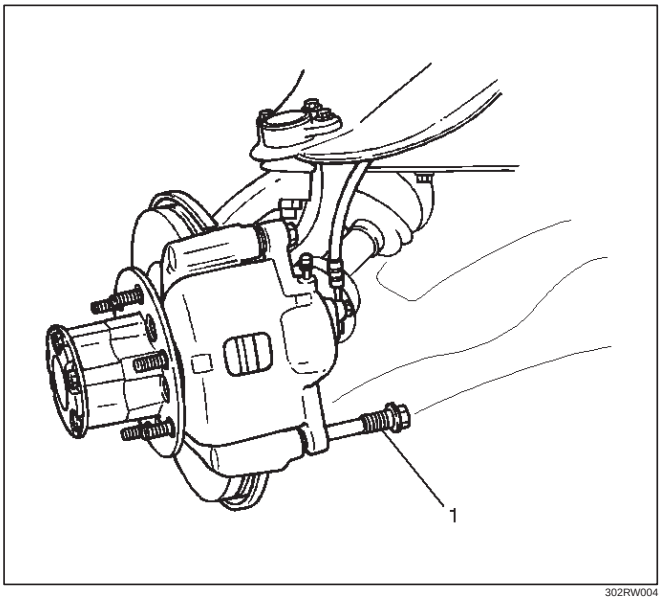
Removal

NOTE: If a squealing noise occurs from the front brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

▼ Draw out two–thirds of the brake fluid from the reservoir.

▼ Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
2. Remove lock bolt (1).

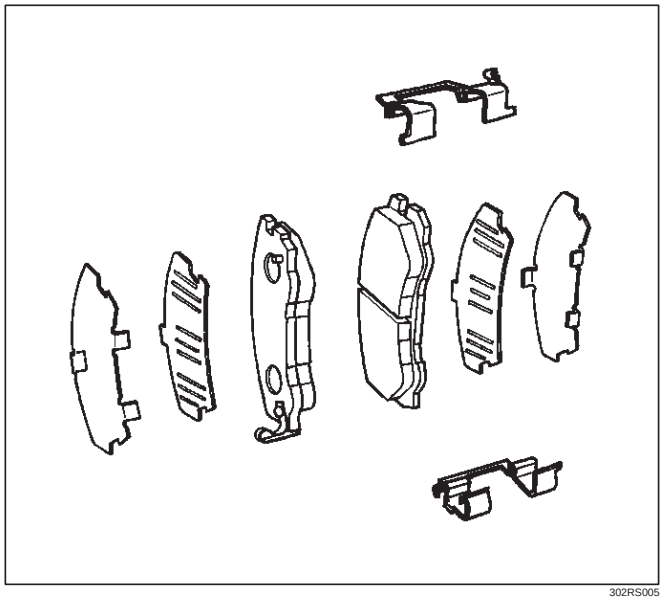


302RW004

3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove Clip.

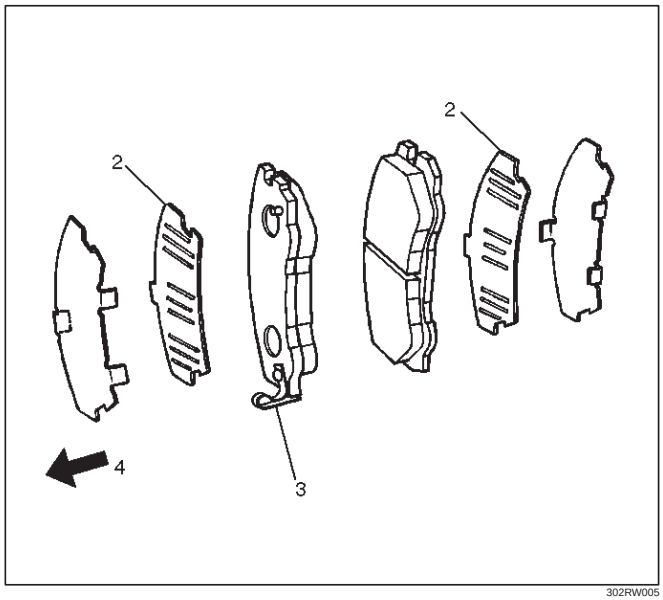
Installation

1. Install clip.



302RS005

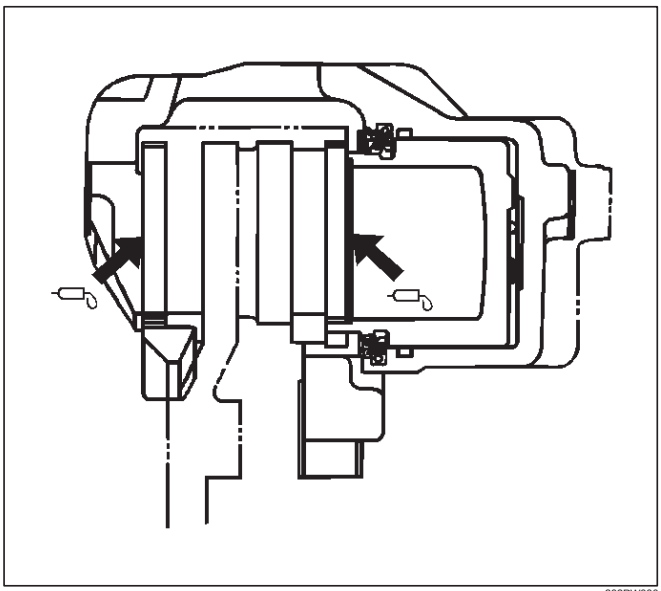
2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (2). Wipe off extruded grease after installing. Install pad assembly with shim.



302RW005

Legend

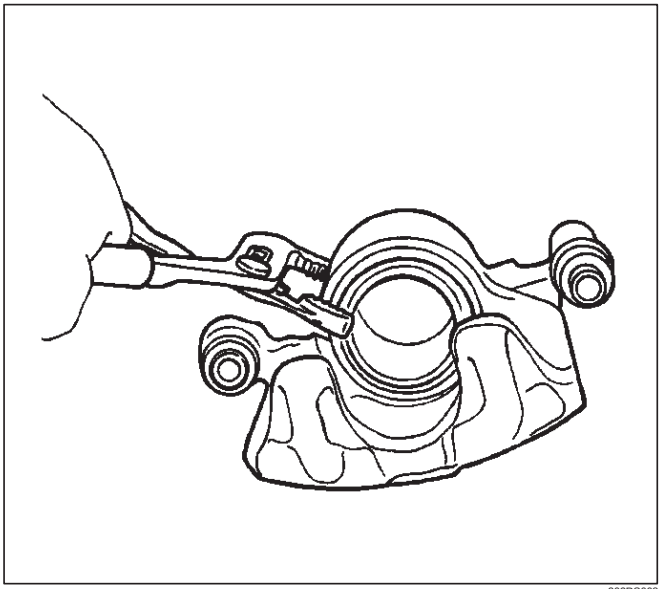
(2) Inner Shim
(3) Wear Indicator
(4) Inner Side


302RW006

3. Carefyully use adjustable pliers to bottom the piston into the caliper bore. Do not pull or twist the flexible hose or damage will occur.

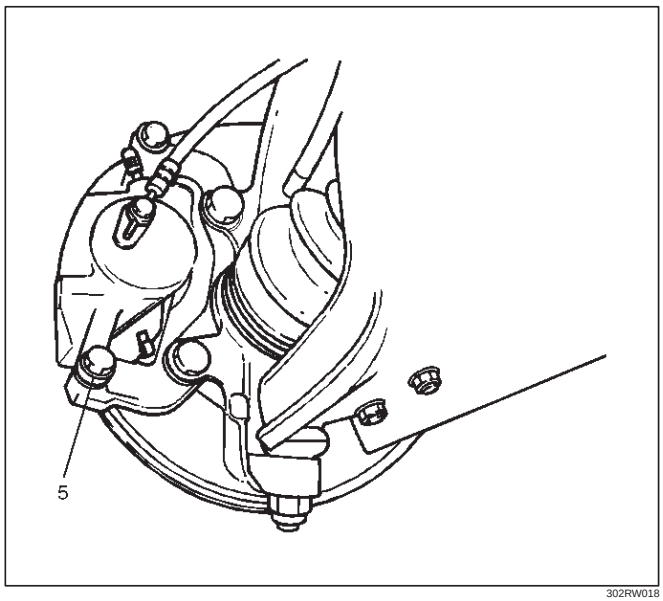
   Install caliper assembly.

   Set caliper assembly in place.


302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

   Torque: 74 N·m (54 lb ft)



302RW018

5. Install wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Front Disc Brake Rotor

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

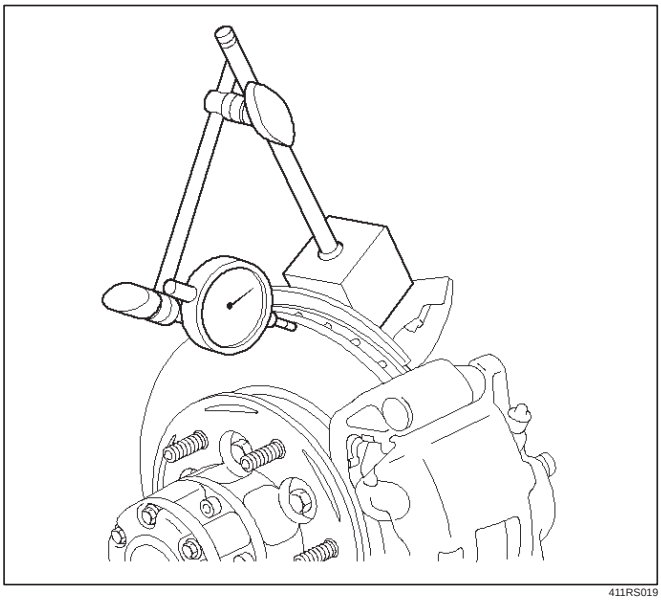
Lateral Runout

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to *Differential* in Section 4A1.
2. Attach the dial indicator accordingly so that the stem contacts the rotor surface to approximately 29mm (1.14 in) from the rotor edge.
3. Rotate the rotor one complete turn and inspect for signs of lateral runout. Lateral runout should not exceed 0.13 mm (0.005 in).

Maximum runout: 0.13 mm (0.005 in)

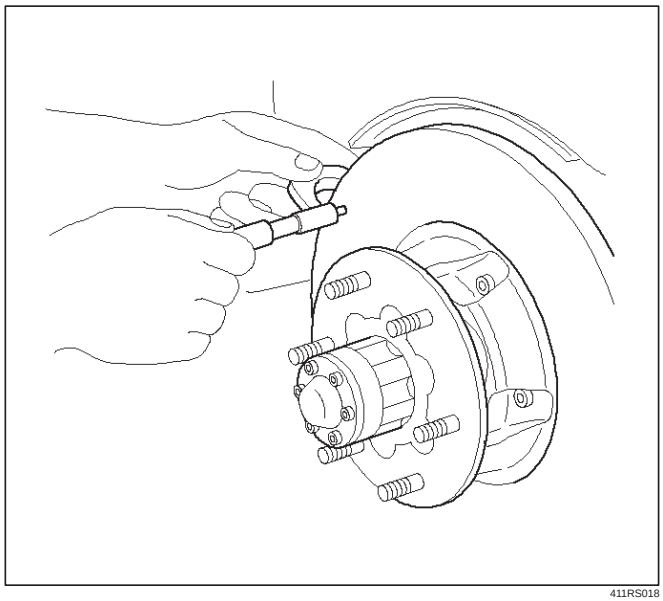


411RS019

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 29 mm (1.14 in) from the edge of the rotor.
The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum runout: 0.010 mm (0.0004 in)



411RS018

Replacing Brake Rotors

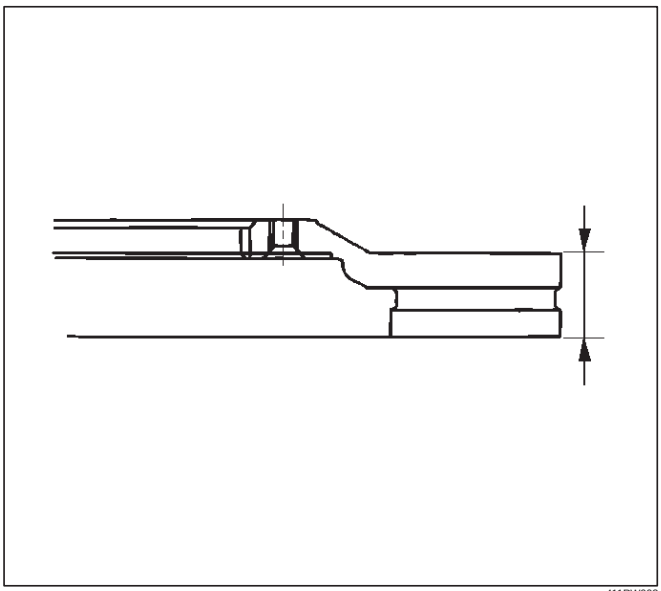
When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 24.60 mm (0.969 in). The minimum refinish dimension is 24.97 mm (0.983 in).
When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.
After refinishing, replace any rotor that does not meet the minimum thickness of 24.97 mm (0.983 in). Do not use a brake rotor that exceeds the manufacturers specifications.

Minimum wear dimension: 24.60 mm (0.969 in)

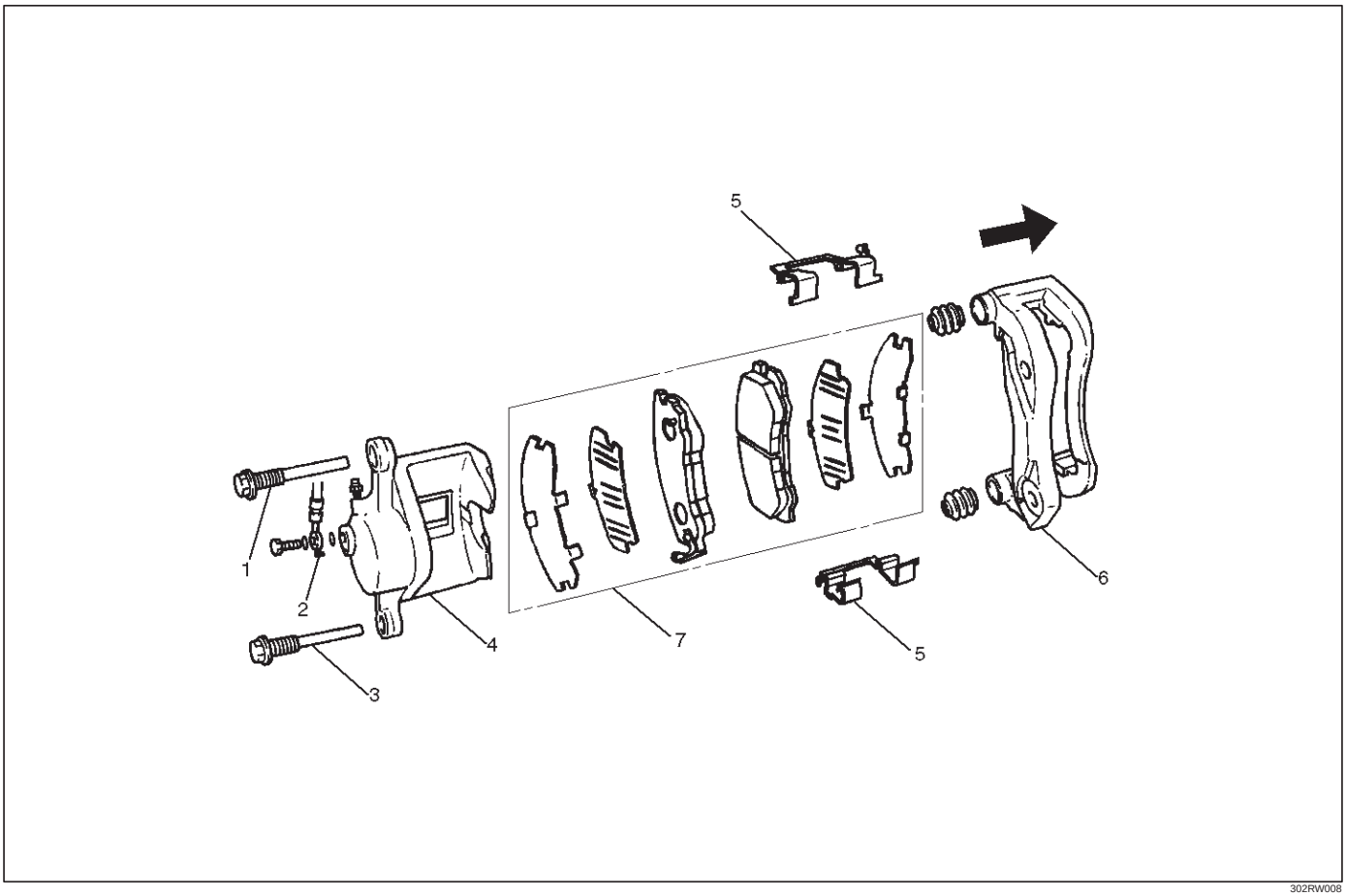
Refinish dimension: 24.97 mm (0.983 in)



411RW003

Front Disc Brake Caliper Assembly

Front Disc Brake Caliper Assembly and Associated Parts



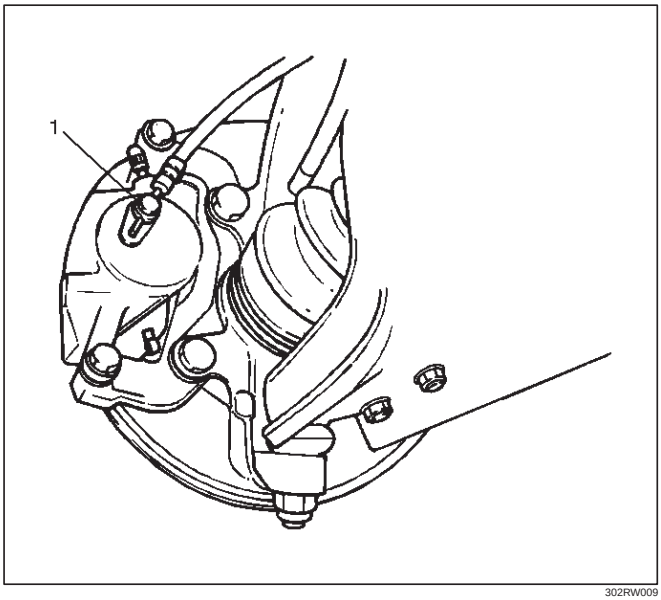
302RW008

Legend

(1) Guide Bolt
(2) Brake Flexible Hose
(3) Lock Bolt
(4) Caliper Assembly
(5) Clip
(6) Support Bracket with Pad Assembly
(7) Pad Assembly

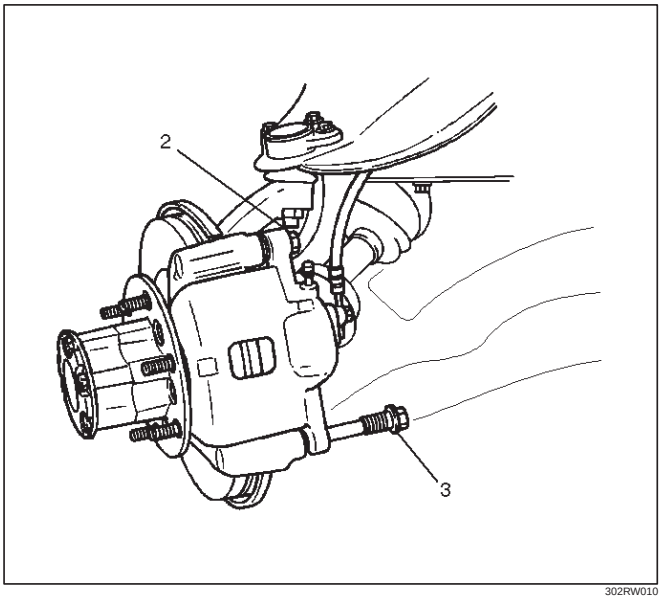
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Concernig wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



302RW009

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove guide bolt (2).
6. Remove lock bolt (3).

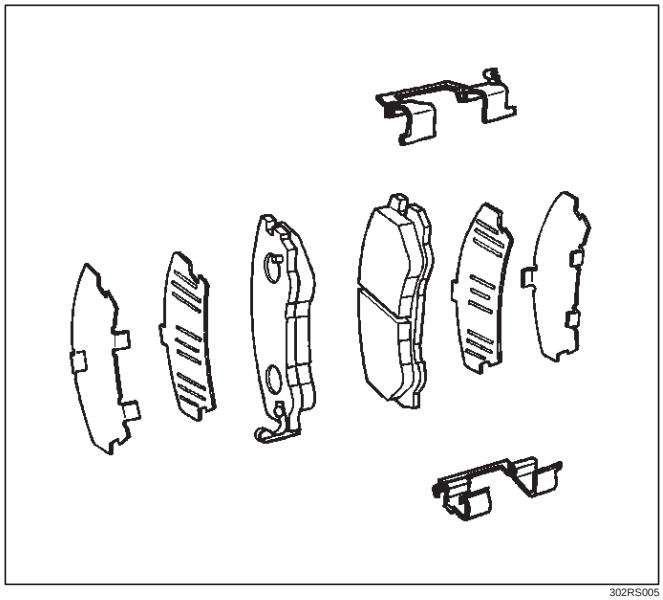


302RW010

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.
10. Remove clip.

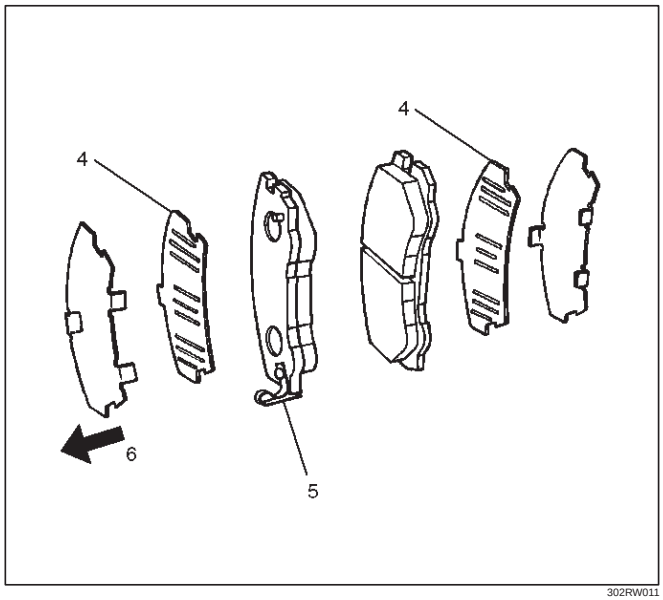
Installation

1. Install clip.



302RS005

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (4). Wipe off extruded grease after installing. Install pad assembly with shim.



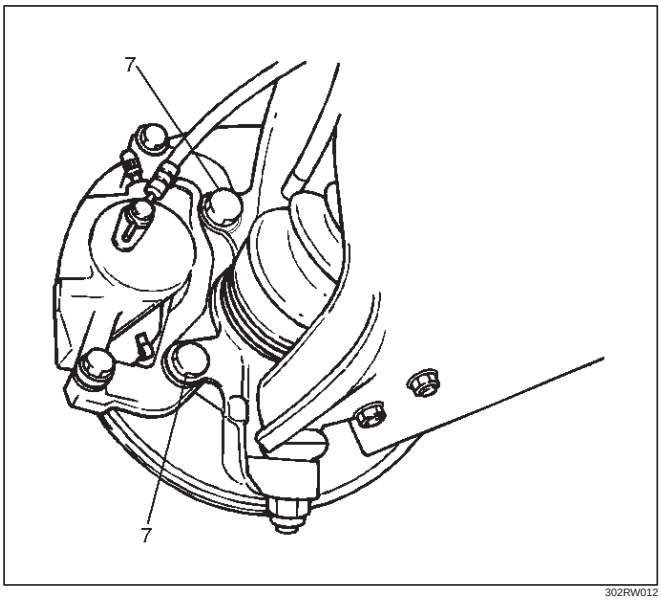
302RW011

Legend

(4) Inner Shim
(5) Wear Indicator
(6) Inner Side

3. Install support bracket and tighten the bolt (7) to the specified torque.

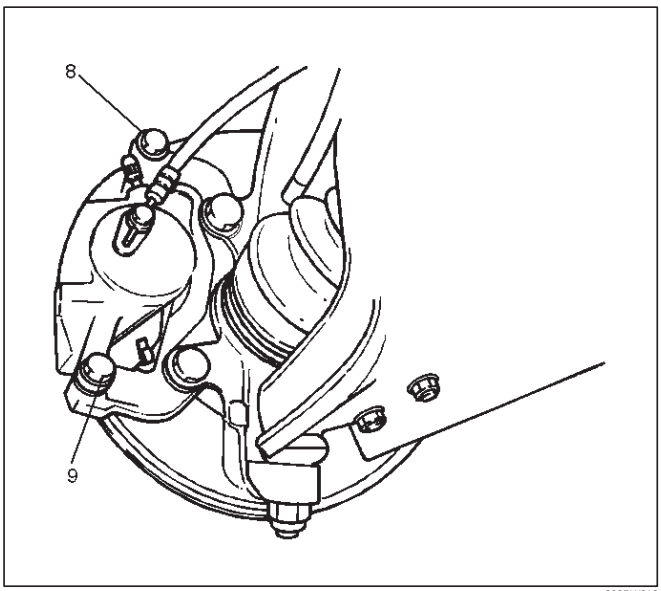
Torque: 155 N·m (115 lb ft)



302RW012

4. Install caliper assembly.
5. Install lock bolt (9) and guide bolt (8) and tighten the bolt to the specified torque.

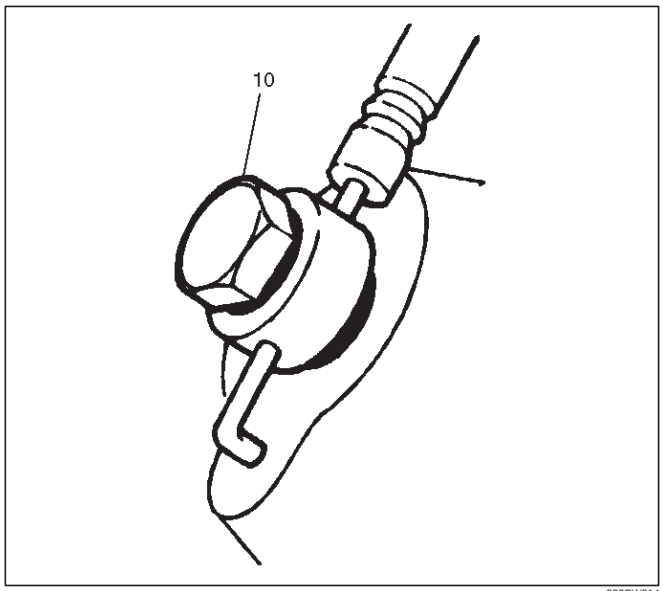
Torque: 74 N·m (54 lb ft)



302RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the l–bolt (10) to the specified torque.

Torque: 35 N·m (26 lb ft)

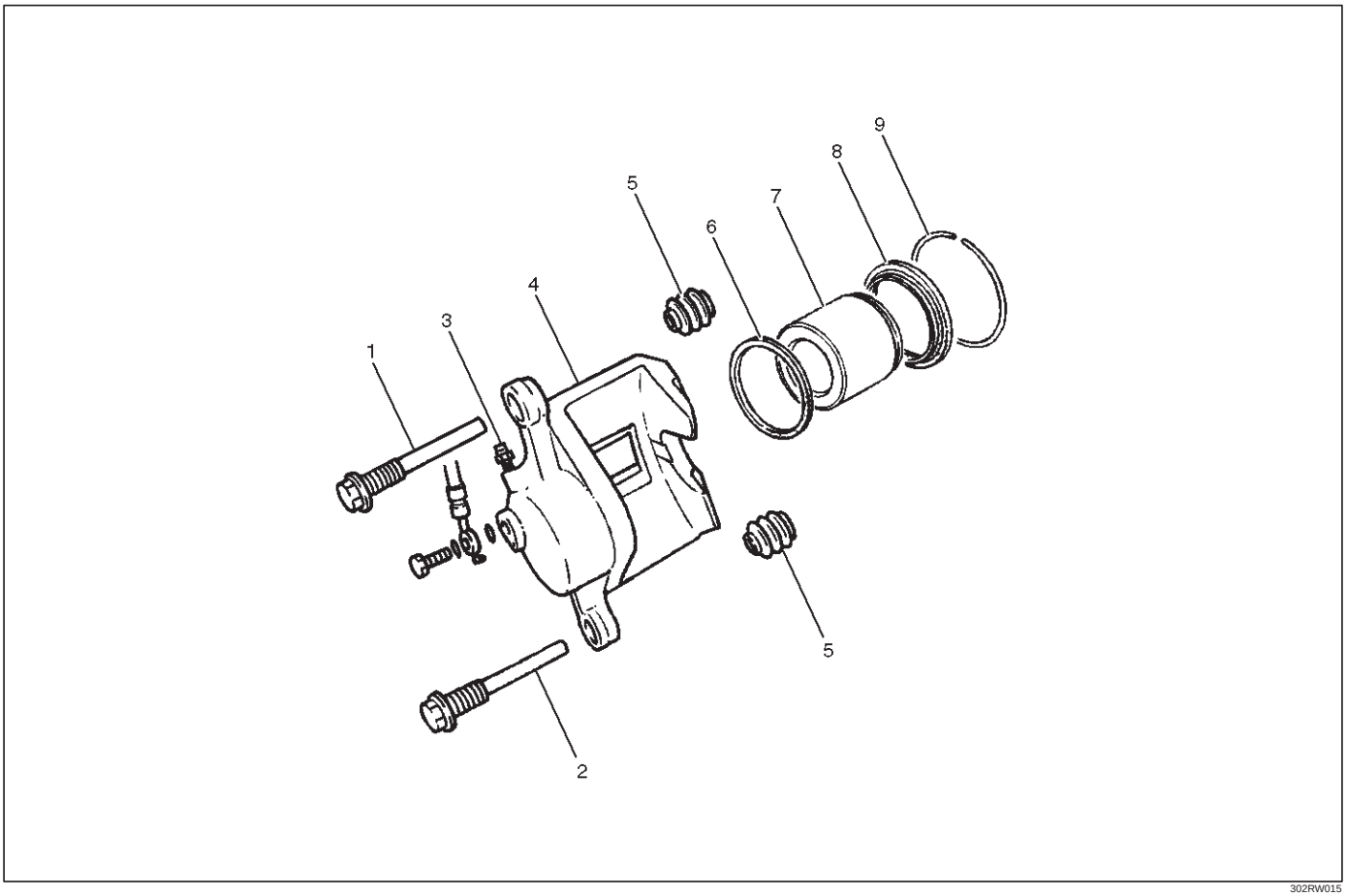


302RW014

7. Install wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
8. Bleed brakes. Refer to *Hydraulic Brakes* in this section.

Front Disc Brake Caliper

Front Disc Brake Caliper Disassembled View



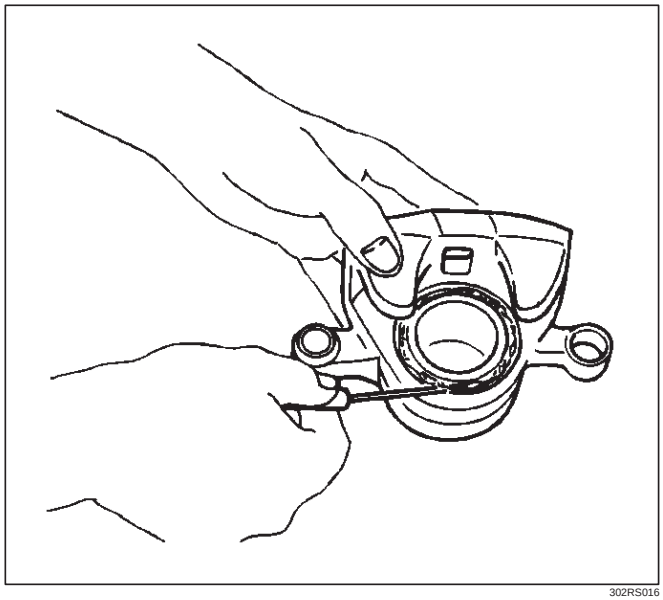
302RW015

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Dust Boot: Guide Bolt and Lock Bolt
(6) Piston Seal
(7) Piston
(8) Dust Boot: Piston
(9) Dust Boot Ring

Disassembly

1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot: guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver.

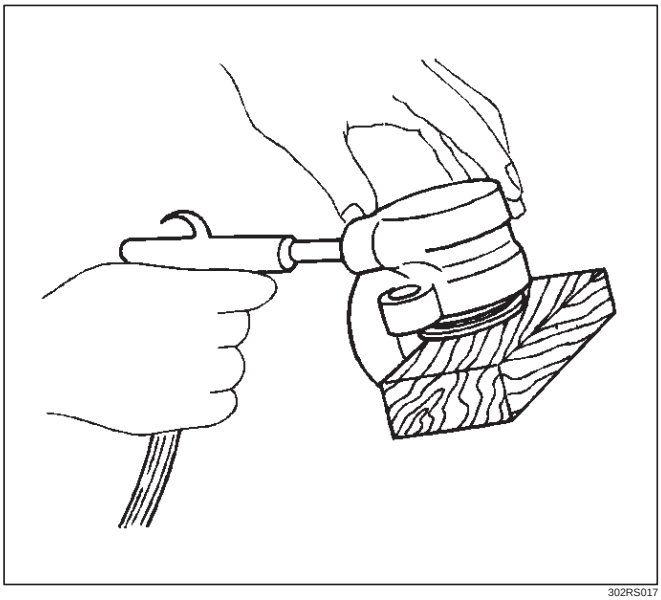


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.


302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- ▼ Rotor
- ▼ Cylinder body
- ▼ Cylinder bore
- ▼ Piston
- ▼ Guide bolt, lock bolt
- ▼ Support bracket

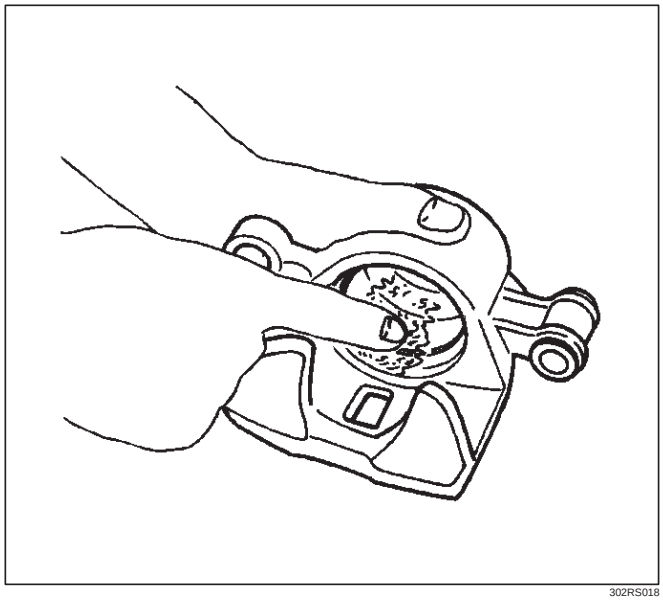
NOTE: The piston seal, boot ring and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace them with new ones.

Reassembly

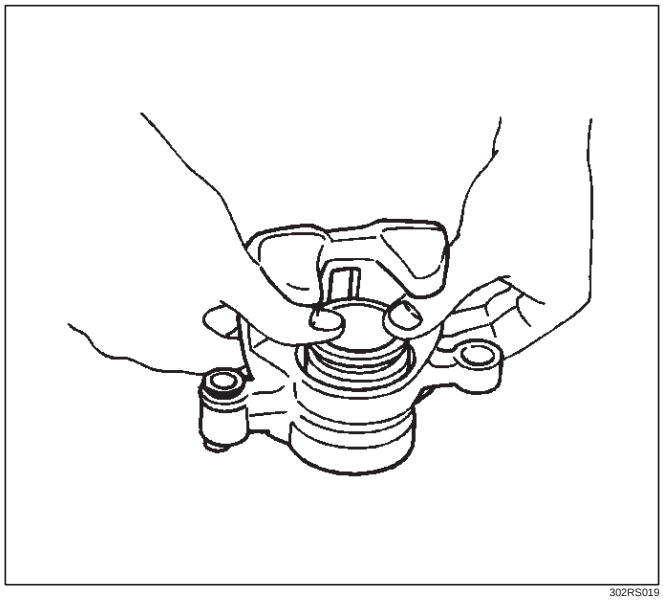
1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

   Torque: 8 N·m (69 lb in)

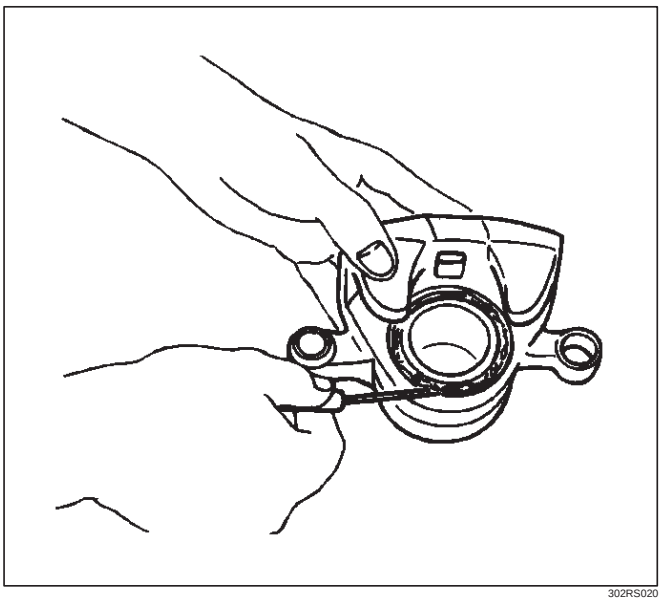
3. Apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.


302RS018

4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.

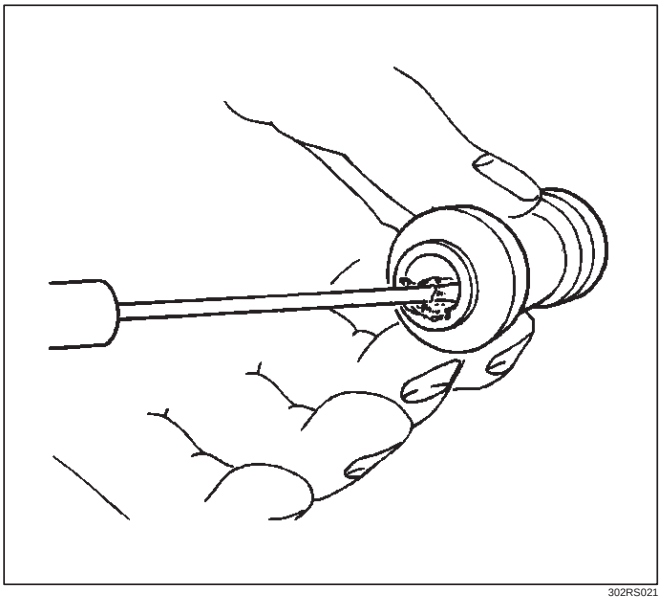

302RS019

5. Apply special grease (approximately 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.



302RS020

6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (approximately 1 g) onto the dust boot inner surface. Apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.



302RS021

8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

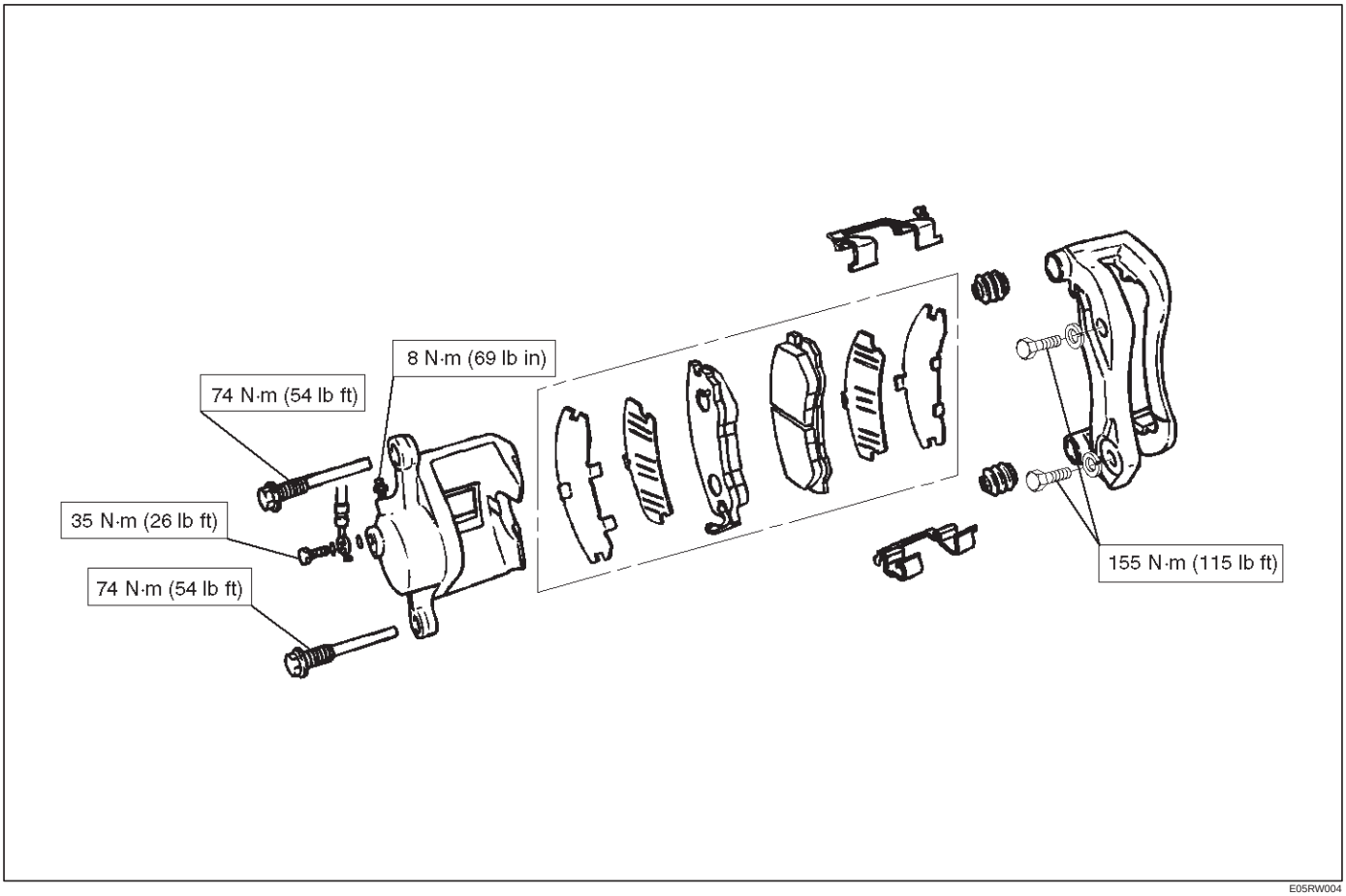
Torque: 74 N·m (54 lb ft)

Main Data and Specifications

General Specifications

Type	Floating, pin slide
Pad dimension	55 cm^2 (8.52 in^2)
Adjusting method	Self–adjusting
Piston diameter	60.33 mm (2.38 in)
Disc type	Ventilated
Disc thickness	26 mm (1.02 in)
Disc effective diameter	222 mm (8.74 in)

Torque Specifications



E05RW004

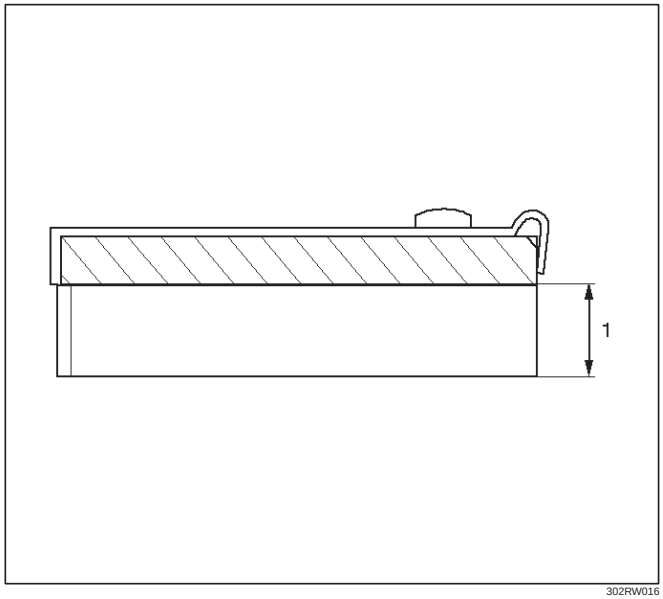
Rear Disc Brake Pads (4×4 Model)

Brake Pads Inspection

Check the outer pads by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.0 mm (0.039 in) of the pad itself.

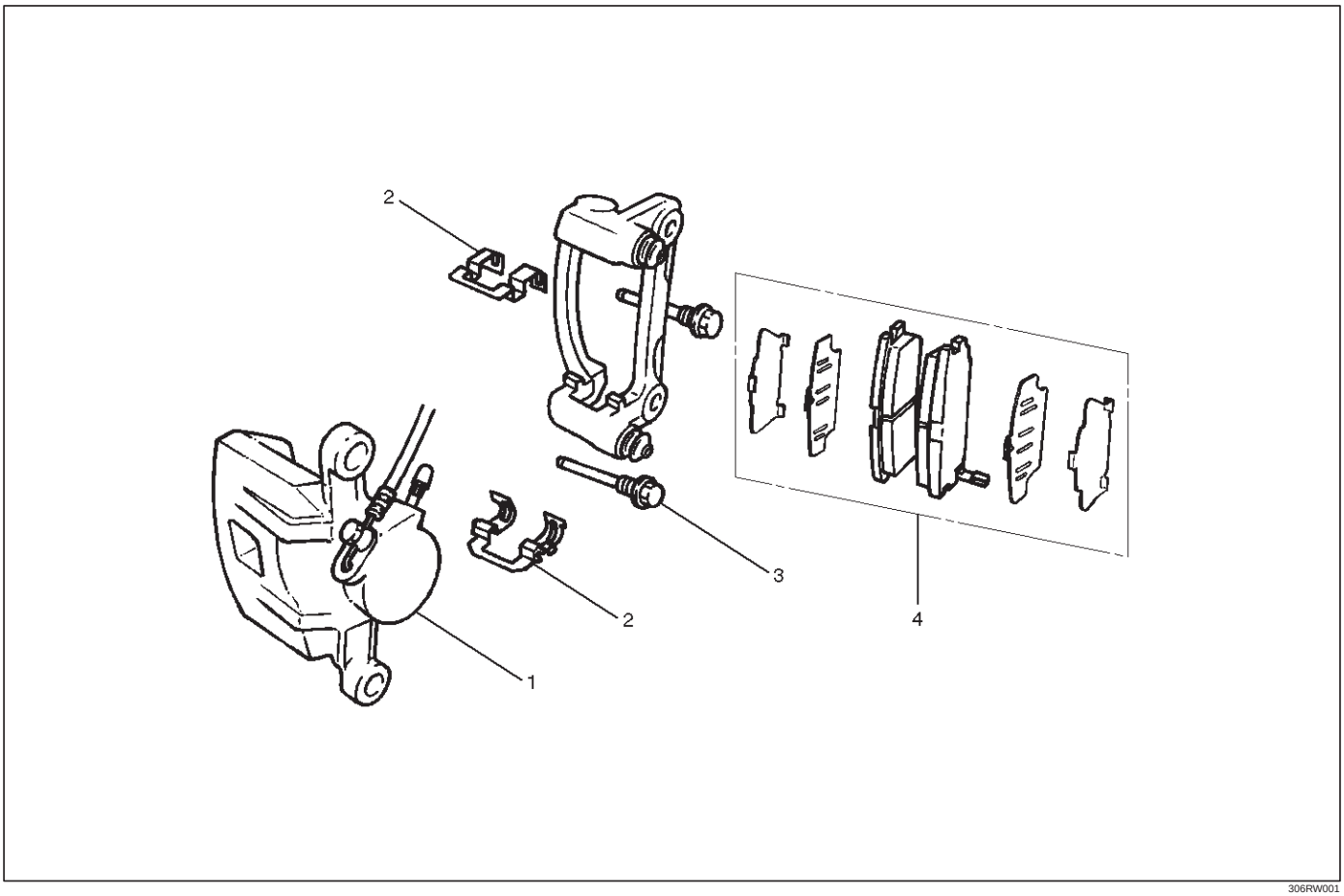
Wear indicators are installed on disc brake pads, disc brake pads need replacement when the wear indicator is heard.

Minimum limit (1): 1.0 mm (0.039 in)



302RW016

Brake Pads and Associated Parts



306RW001

Legend

(1) Caliper Assembly
(2) Clip
(3) Lock Bolt
(4) Pad Assembly

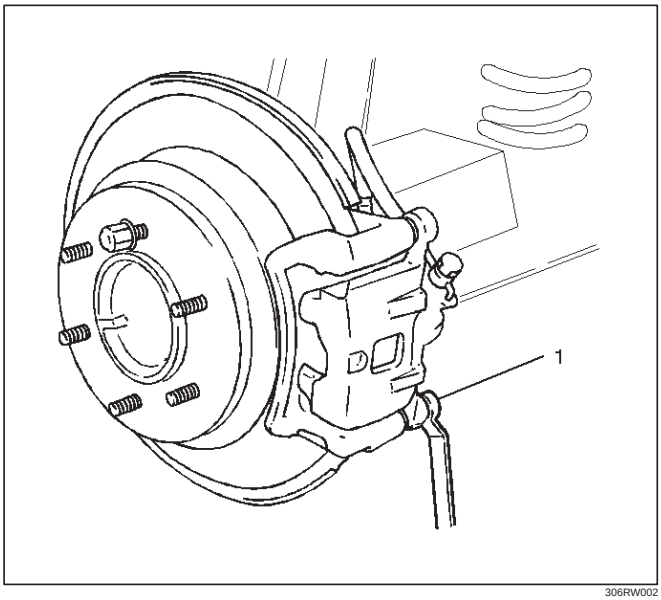
Removal

NOTE: If a squealing noise occurs from the rear brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

▼ Draw out two–thirds of the brake fluid from the reservoir.

▼ Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
2. Remove lock bolt (1)

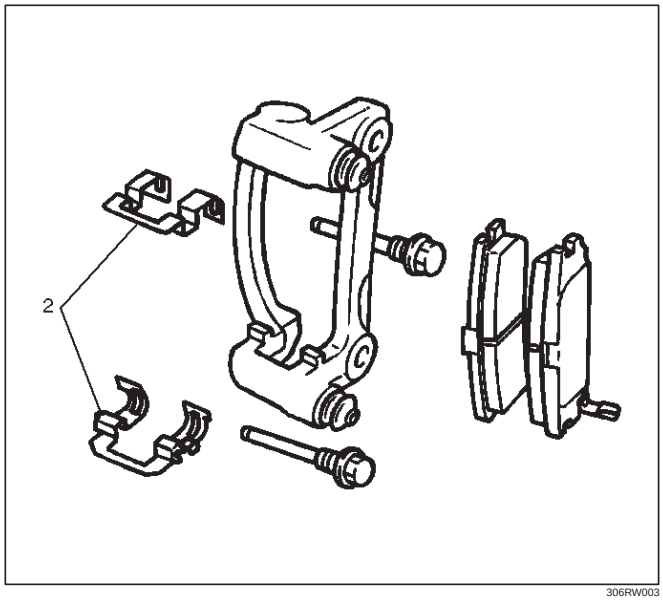


306RW002

3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove clip.

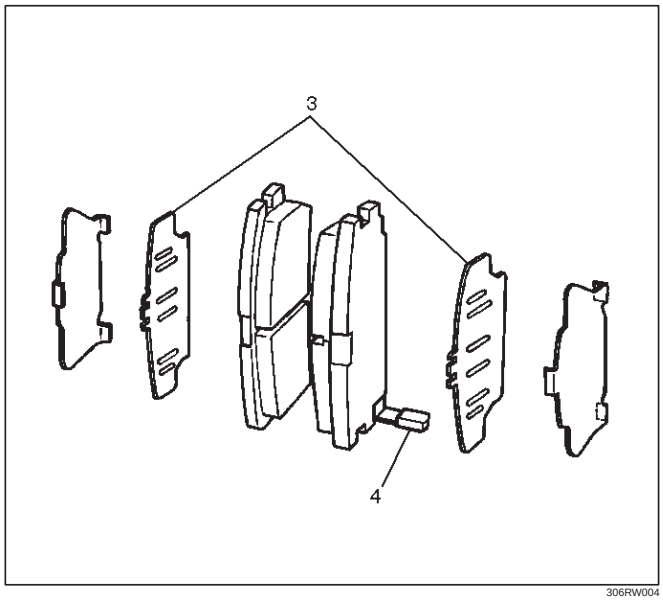
Installation

1. Install clip (2).



306RW003

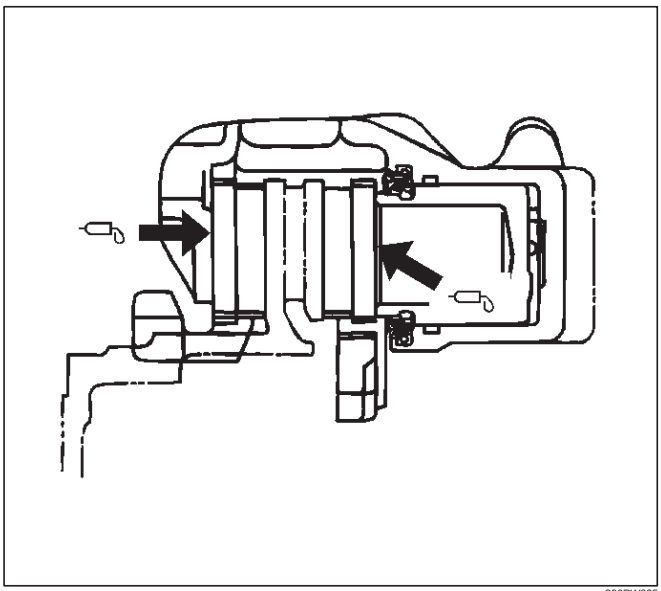
2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims. Wipe off extruded grease after installing. Install pad assembly with shim.

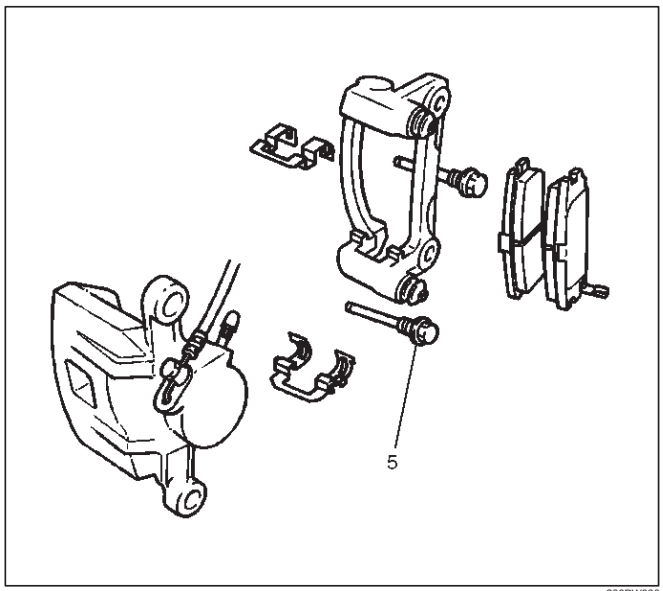


306RW004

Legend

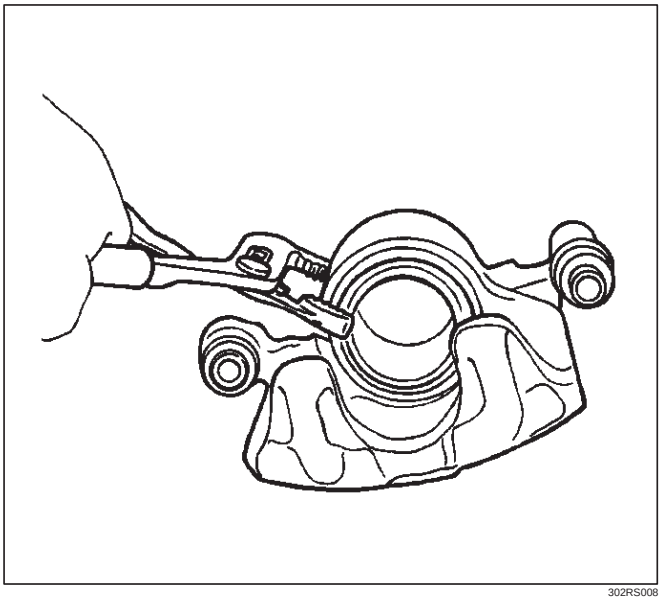
(3) Inner Shim
(4) Wear Indicator


306RW005



306RW006

3. Carefyully use adjustable pliers to bottom the piston into the caliper bore. Do not pull or twist the flex hose or damage will occur.


302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 44 N·m (32 lb ft)

5. Install wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Rear Disc Brake Rotor (4×4 Model)

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

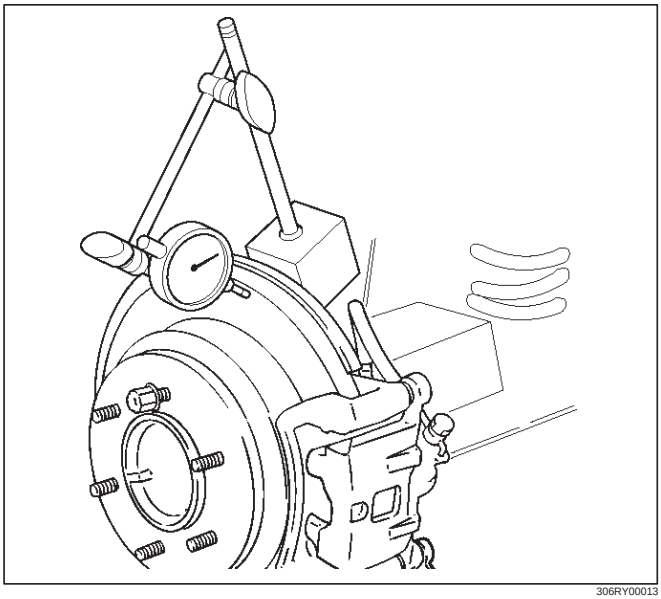
Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to *Differential* in Section 4A1.
2. Attach the dial indicator accordingly so that the stem contacts the rotor surface to approximately 29mm (1.14 in) from the rotor edge.
3. Rotate the rotor one complete turn and inspect for signs of lateral runout. Lateral runout should not exceed 0.13 mm (0.005 in).

1. The lateral runout should not exceed 0.13 mm (0.005 in)

Maximum runout: 0.13 mm (0.005 in)

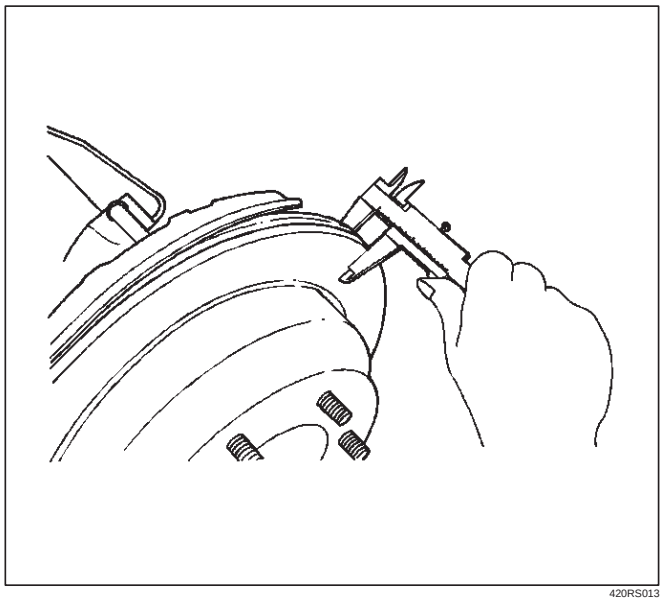


306RY00013

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 22 mm (0.87 in) from the edge of the rotor.
The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum parallelism: 0.010 mm (0.0004 in)



420RS013

Replacing Brake Rotors

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

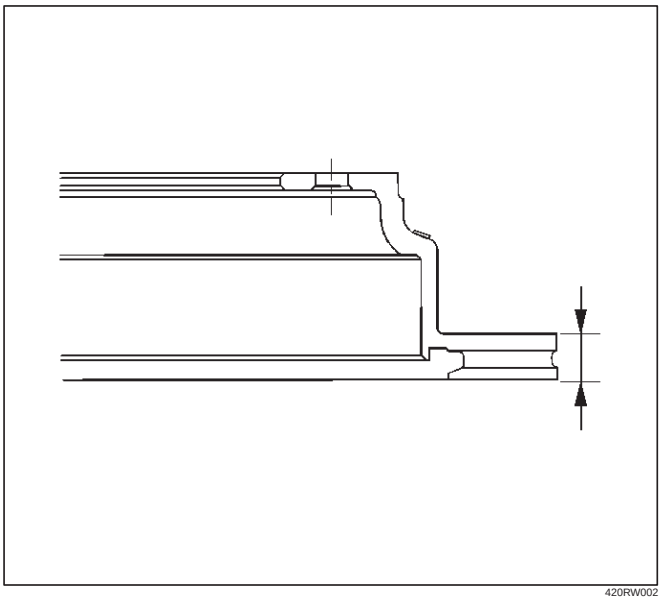
Refinishing Brake Rotors

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 16.6 mm (0.654 in). The minimum refinish dimension is 16.97 mm (0.668 in).
When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 16.97 mm (0.668 in). Do not use a brake rotor that exceeds the manufacturers specifications.

Minimum wear dimension: 16.6 mm (0.654 in)

Refinish dimension: 16.97 mm (0.668 in)



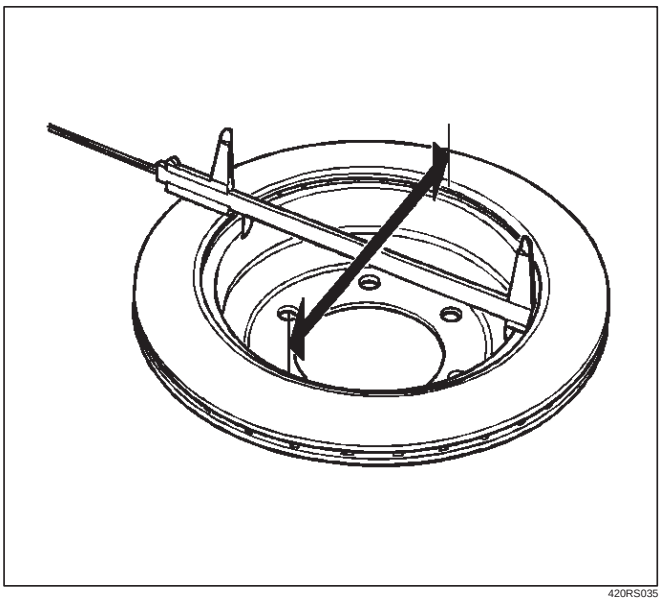
420RW002

Rear Drum (In Disc) Inside Diameter Check

Check the rear drum inside diameter by measuring at more than two portions as shown in the illustration.
If the inside diameter is greater than the limit, replace the rear rotor.

Standard: 210.0 mm (8.27 in)

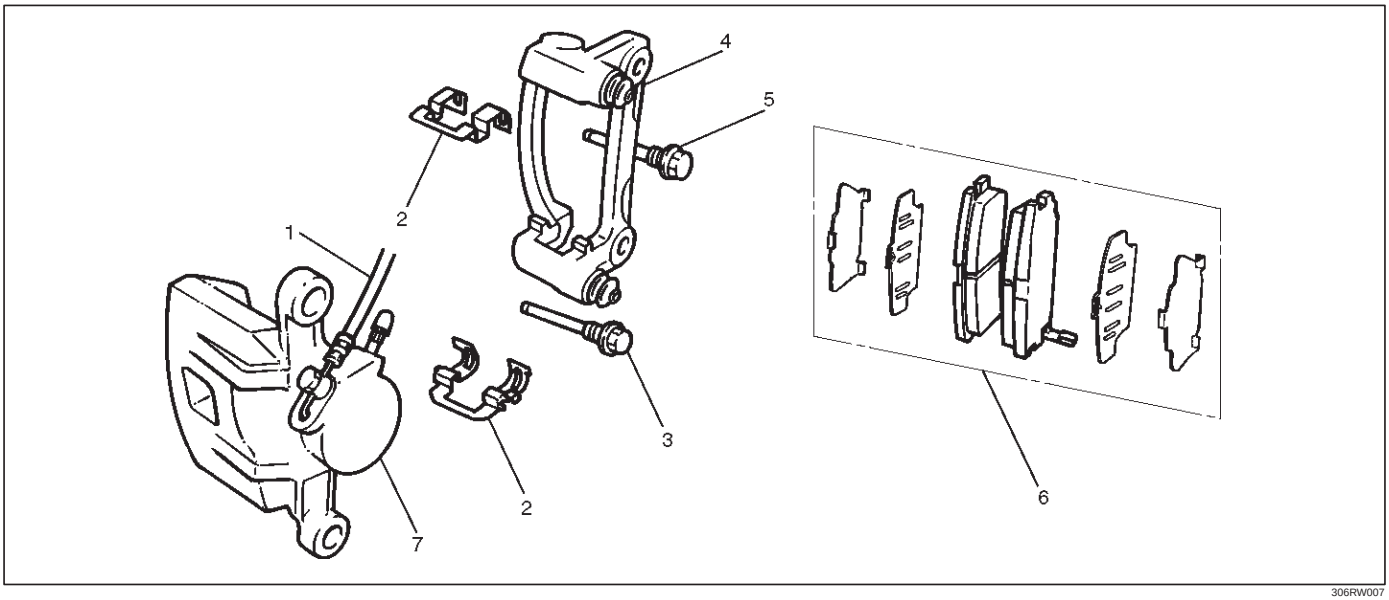
Limit: 211.4 mm (8.32 in)



420RS035

Rear Disc Brake Caliper Assembly (4×4 Model)

Rear Disc Brake Caliper Assembly and Associated Parts



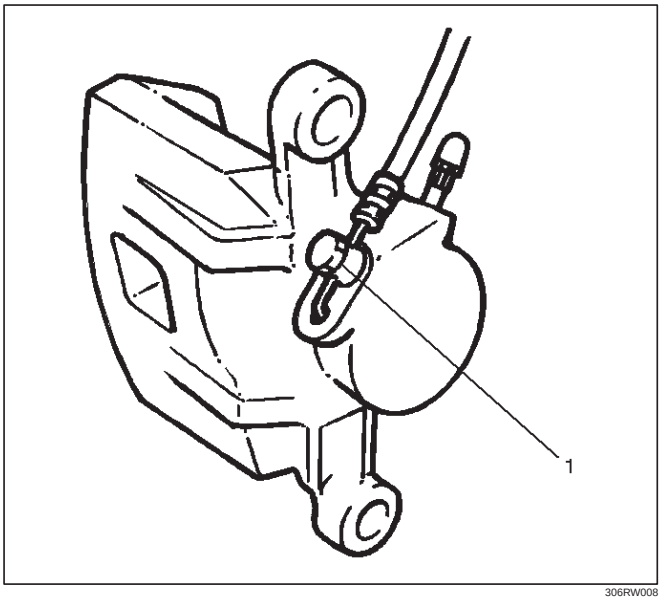
306RW007

Legend

(1) Brake Flexible Hose
(2) Clip
(3) Lock Bolt
(4) Support Bracket
(5) Guide Bolt
(6) Pad Assembly with Shim
(7) Caliper Assembly

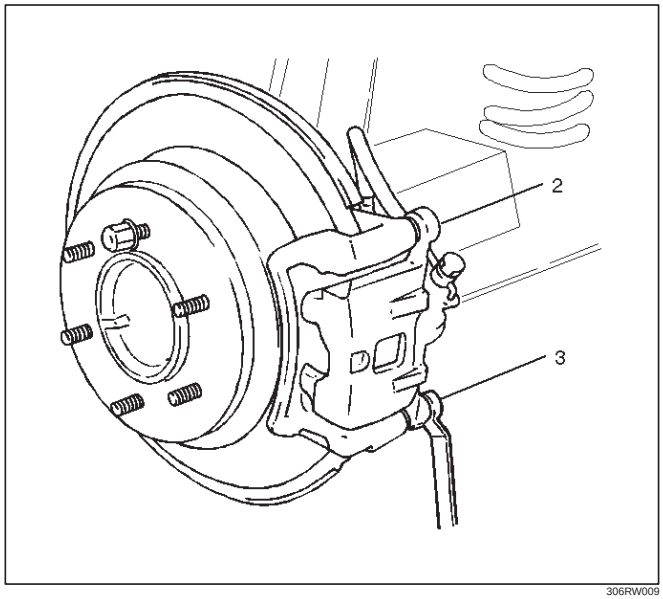
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



306RW008

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove lock bolt (3).
6. Remove guide bolt (2).

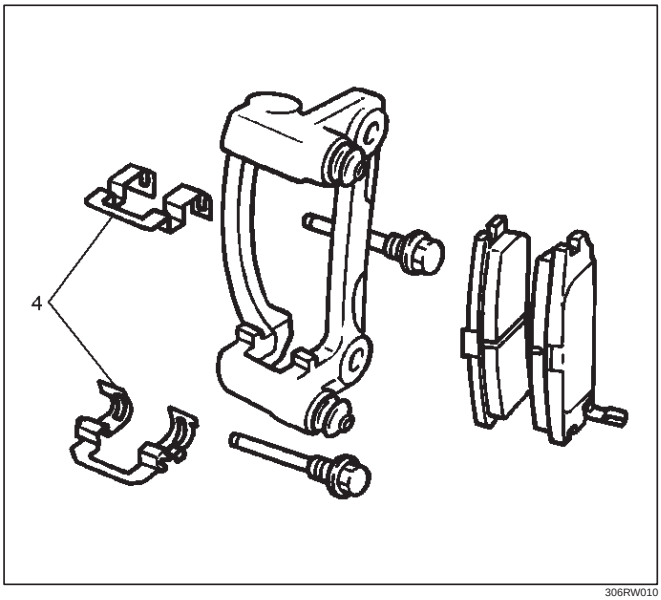


306RW009

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.
10. Remove clip.

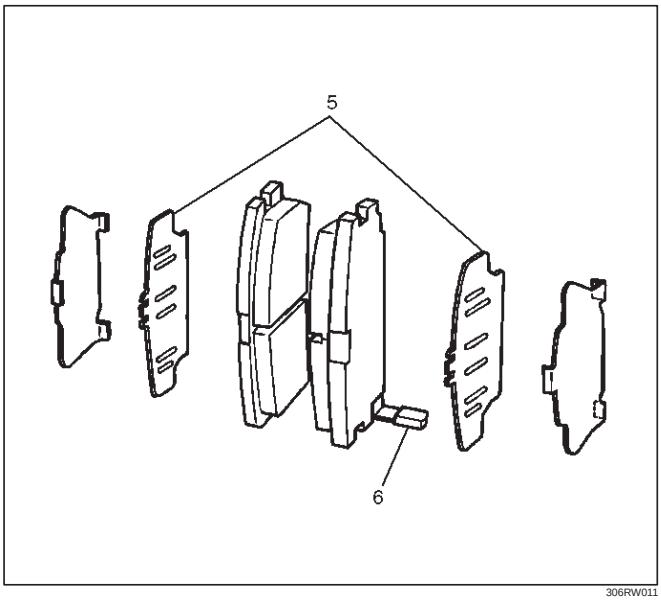
Installation

1. Install clip (4).



306RW010

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (5). Wipe off extruded grease after installing. Install pad assembly with shim.



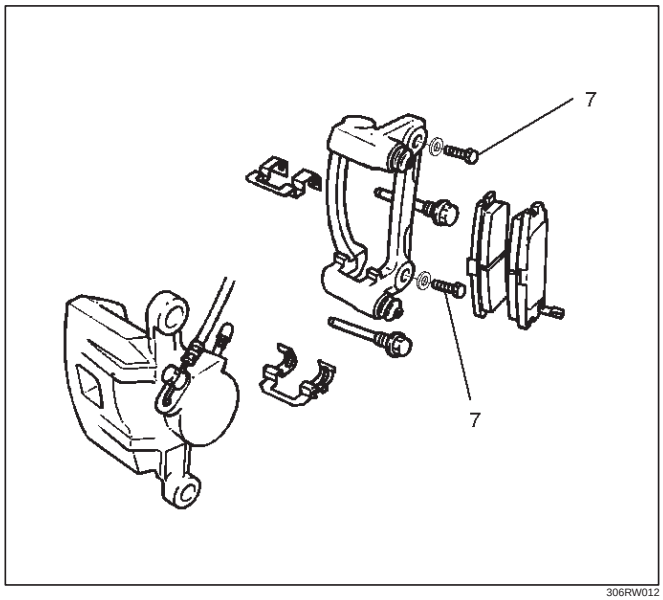
306RW011

Legend

(5) Inner Shim
(6) Wear indicator

3. Install support bracket and tighten the bolt (7) to the specified torque.

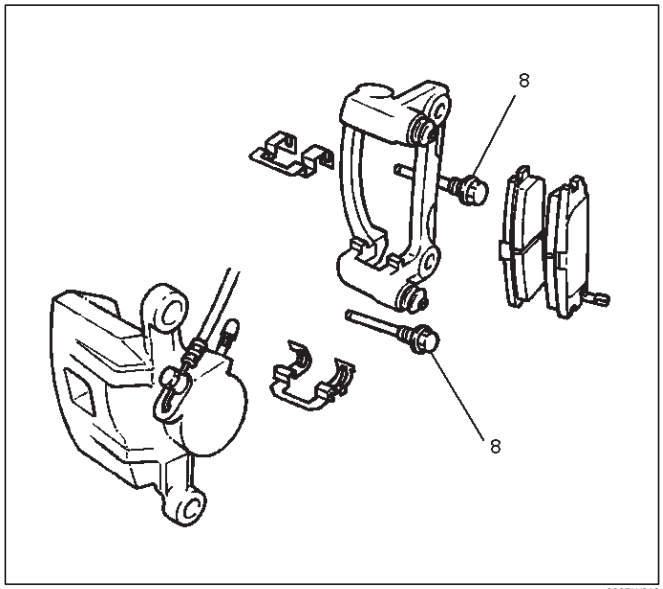
Torque: 103 N·m (76 lb ft)



306RW012

4. Install caliper assembly.
5. Install lock bolt and guide bolt (8) and tighten the bolt to the specified torque.

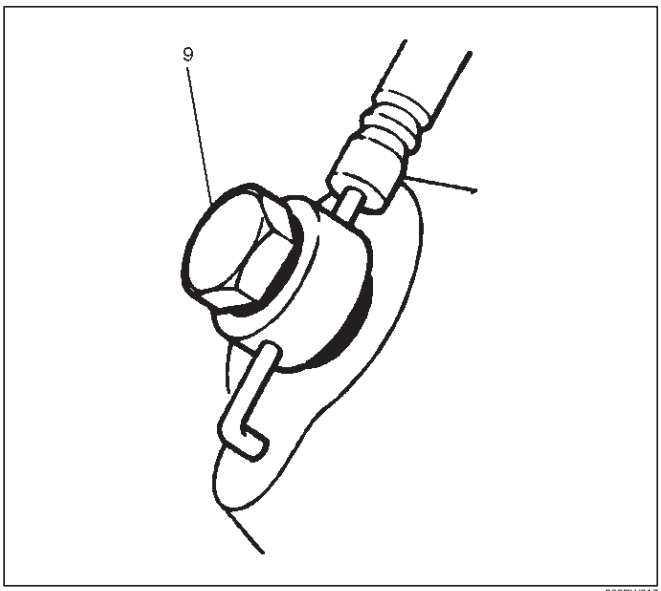
Torque: 44 N·m (32 lb ft)



306RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the eye–bolt (9) to the specified torque.

Torque: 35 N·m (26 lb ft)

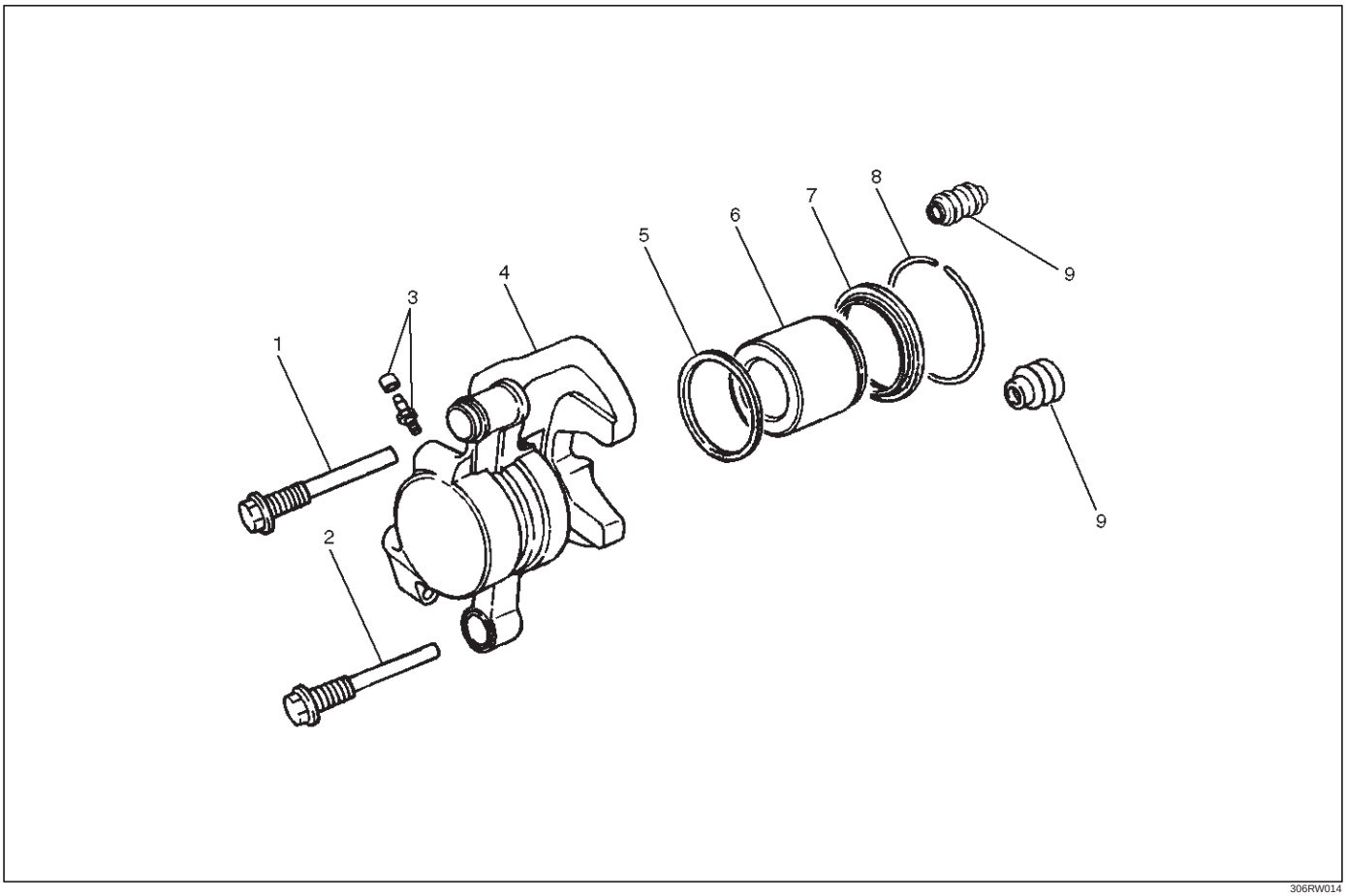


302RW017

7. Install the wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
8. Bleed brakes. Refer to *Hydraulic Brakes* in this section.

Rear Disc Brake Caliper (4×4 Model)

Rear Disc Brake Caliper Disassembled View



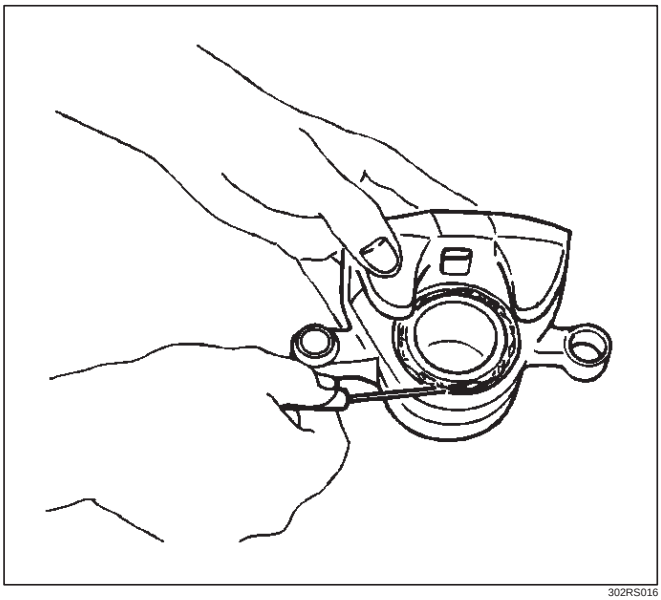
306RW014

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Piston Seal
(6) Piston
(7) Dust Boot: Piston
(8) Dust Boot Ring
(9) Dust Boot: Guide Bolt and Lock Bolt

Disassembly

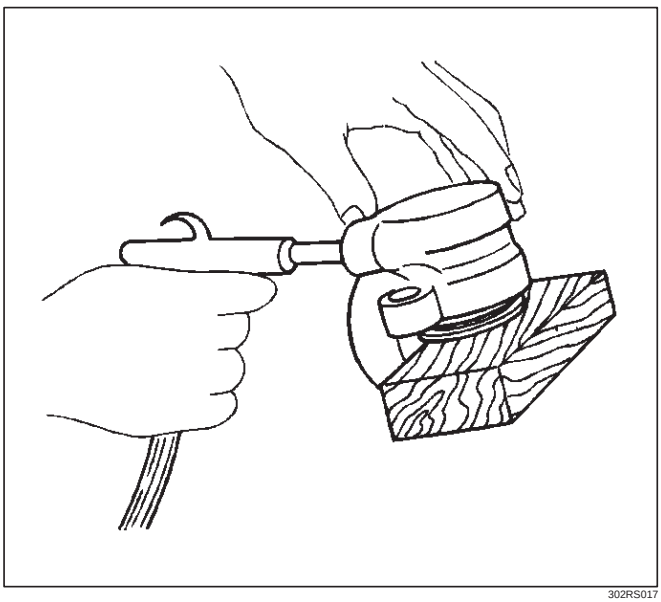
1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot; guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver.


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.


302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- ▼ Rotor
- ▼ Cylinder body
- ▼ Cylinder bore
- ▼ Piston
- ▼ Guide bolt, lock bolt
- ▼ Support bracket

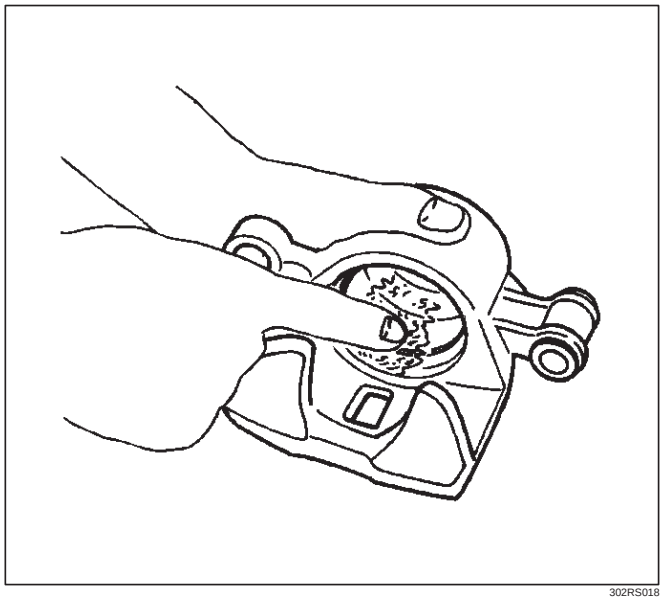
NOTE: The piston dust seal and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

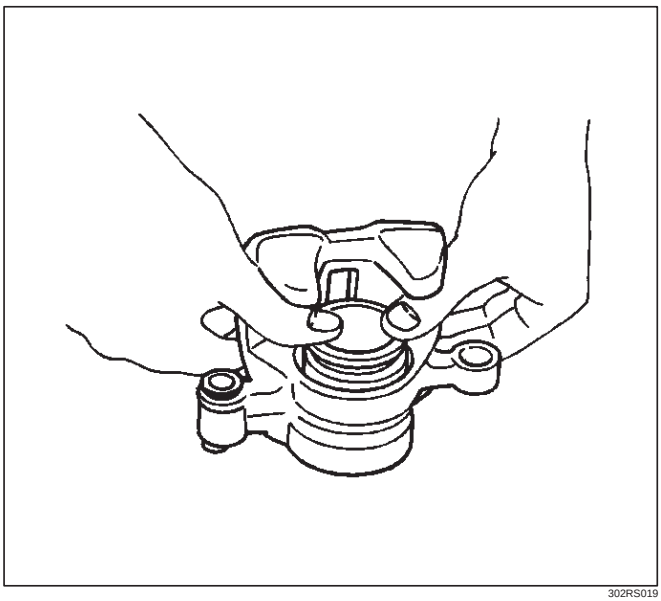
1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

   Torque: 8 N·m (69 lb ft)

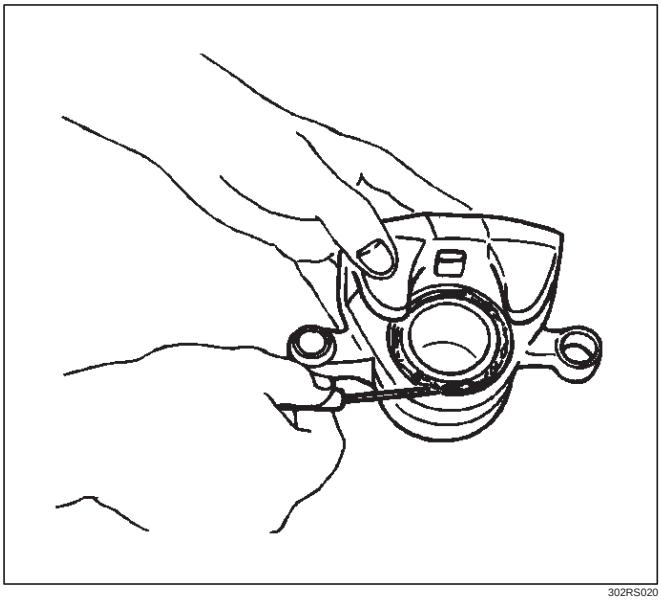
3. Install piston seal and apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.


302RS018

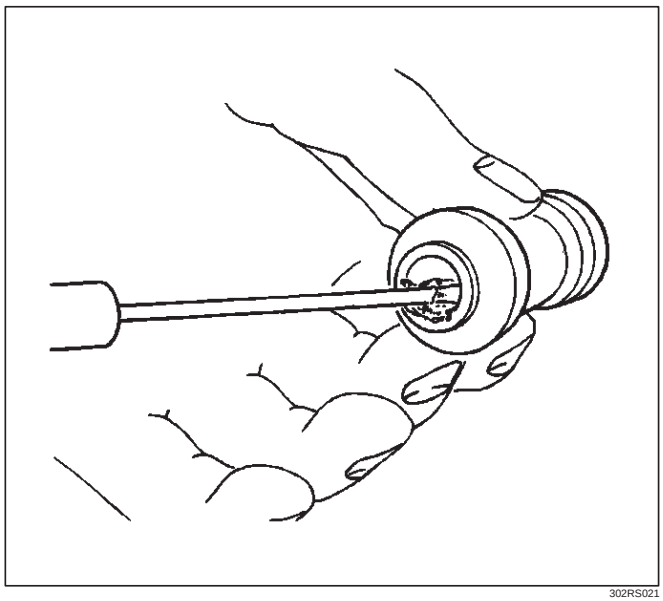
4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.


302RS019

5. Apply special grease (approximately 1g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.


302RS020

6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (Approx. 1g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.


302RS021

8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

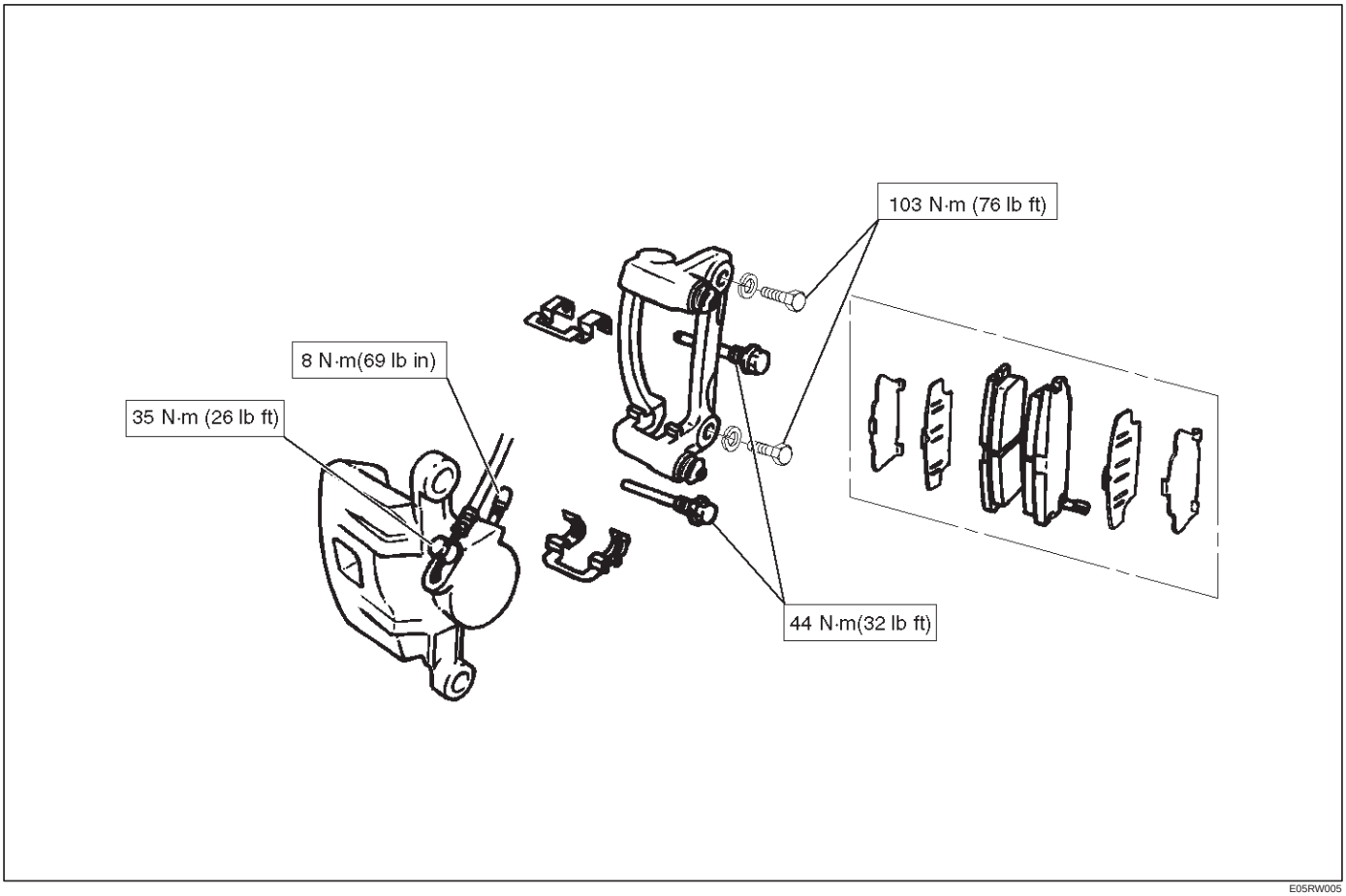
Torque: 44 N·m (32 lb ft)

Main Data and Specifications (4×4 Model)

General Specifications

Type	Floating, pin slide
Pad dimension	33 cm^2 (5.11 in^2)
Adjusting method	Self–adjusting
Piston diameter	41.3 mm (1.63 in)
Disc type	Ventilated
Disc thickness	18 mm (0.71 in)
Disc effective diameter	269.2 mm (10.60 in)

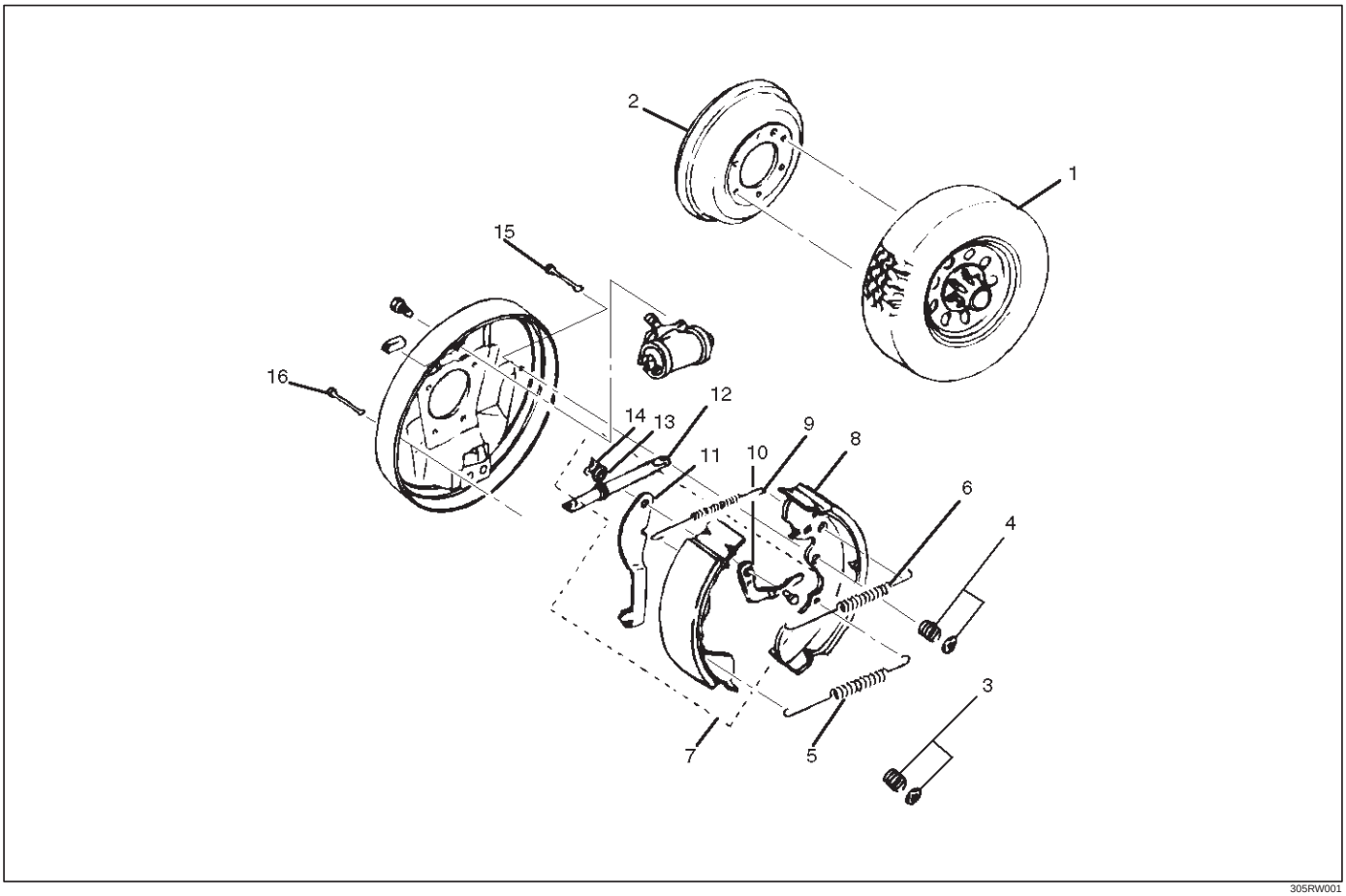
Torque Specifications



E05RW005

Brake Lining

Brake Lining and Associated Parts



305RW001

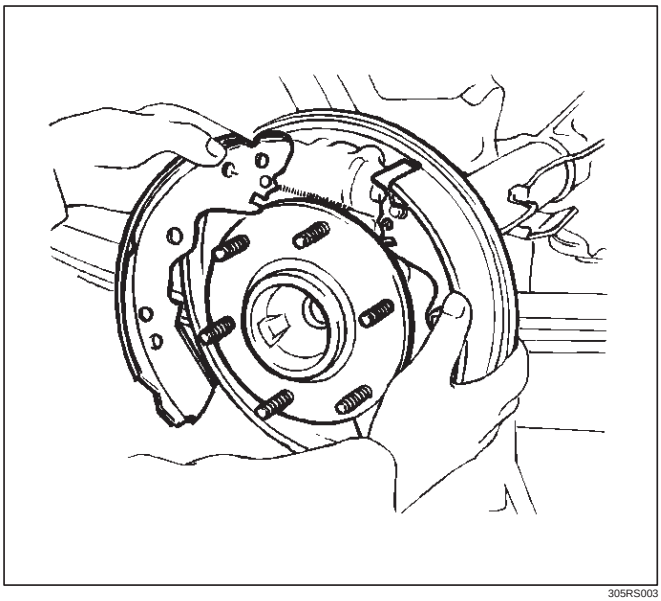
Legend

(1) Wheel and Tire Assembly
(2) Drum
(3) Hold-down Spring and Cup
(4) Hold-down Spring and Cups
(5) Lower Return Spring
(6) Upper (other) Return Spring
(7) Trailing Shoe Assembly with Parking Brake Lever
(8) Leading Shoe Assembly with Upper (inner) Return Spring
(9) Upper (inner) Return Spring
(10) Auto Adjuster Lever
(11) Parking Brake Lever
(12) Adjuster Assembly
(13) Wave Washer
(14) Retainer
(15) Hold-down Pin
(16) Hold-down Pin

Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly (1).
   ▼Refer to *"Wheel and Tires" in Wheel and Tire System* section.
3. Remove Drum (2).
   ▼If difficulty is encountered in removing the drum:
   – Mark the position of the drum to the axle.
   – Make sure the parking brake is released.
   – Use a rubber mallet to tap gently on the outer rim of the drum and/or around the inner drum. Be careful to avoid damaging the drum.
4. Remove upper (other) return spring (6) and auto adjuster lever.
5. Remove lower return spring (5).
6. Remove hold-down spring and cups (4) and hold-down pin (15).
7. Remove adjuster assembly (12)
8. Remove leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



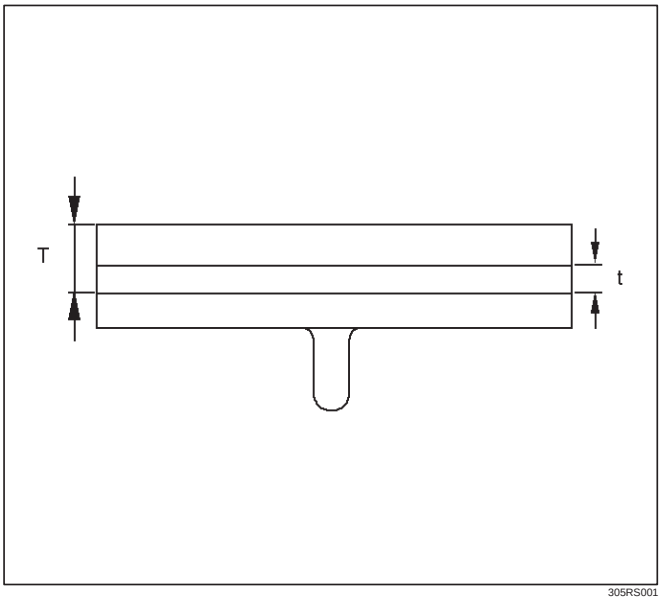
305RS003

9. Remove upper (inner) return spring (9).
10. Remove hold-down spring and cup (3) and hold-down pin (16).
11. Remove Trailing shoe assembly (7) with parking brake lever (16).
12. Remove parking brake cable from parking brake lever (11).
13. Remove retainer (14), wave washer (13), and parking brake lever (11).

Brake Lining Inspection

Check the shoe assemblies for wear by removing brake drum.
Replace the shoe assemblies, if lining thickness is less than 1.0 mm (0.039 in).
The shoe assemblies have a wear indicator that makes a noise when the linings wear to a degree where replacement is required.

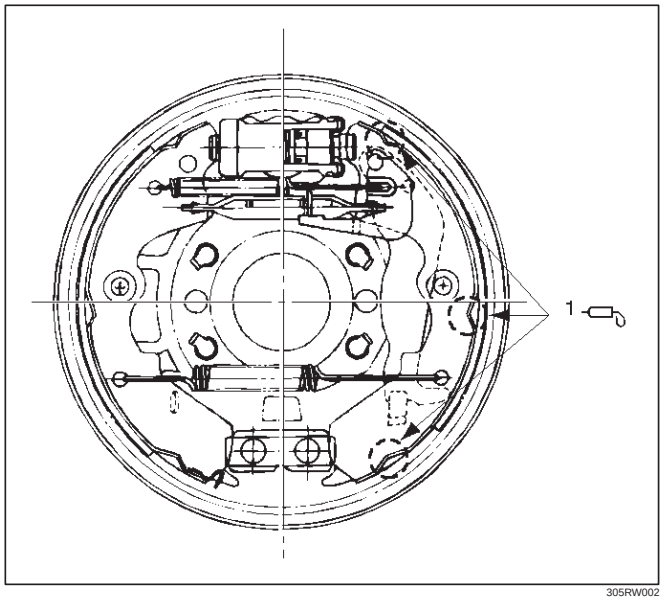
Minimum limit: 1.0 mm (0.039 in)



305RS001

Installation

1. Apply grease lightly to back place A.



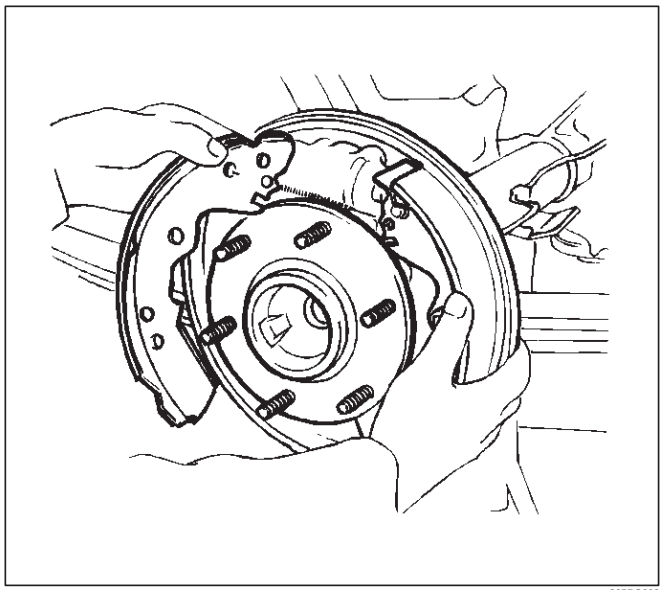
305RW002

Legend

(1) Place A (3 portions for each side)

2. Install parking brake lever (11), wave washer (13), and retainer (14).
3. Install trailing shoe assembly (7) with parking brake lever (16).
4. Install the parking brake cable to parking brake lever (11).
5. Install hold-down pin (16) and hold-down spring and cup (3).
6. Install upper (inner) return spring (9).
7. Install leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



305RS003

8. Install adjuster assembly (12).
9. Install hold-down pin (15) and hold-down spring and cups (4).

10. Install lower return spring (5).
    ▼Use brake spring tool.
11. Install auto adjuster lever (10).
12. Install upper (outer) return spring (6).
    ▼Use brake spring tool.
13. Install brake drum (2).
    ▼Adjust the brakes, refer to *Drum Brake Adjustment* in this section.
14. Install wheel and tire assembly (1).
    ▼Refer to *"Wheels and Tires " in wheel and Tire System* section.

Drum Brake Adjustment (4×2 Model)

NOTE: All brakes are self-adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto adjuster, in the rear brake, produces a clicking sound.

The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

1. Move the parking brake handle to its fully released position.
2. Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.)
3. Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.
   If the difference between the brake drum inside diameter and diameter of the brake shoes is adjusted to be 0,5 mm, the number of times for depressing the brake pedal can be reduced.
4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.
   Shoe clearance: 0.25-0.4 mm (0.0098-0.0157 in)
   If incorrect, check the brake auto-adjusting system.
5. Rotate the adjust nut until all slack disappears from the cable. Set the adjust nut.
6. Applying about 30 kg (66 lb) of force, pull the parking brake handle to its fully set position three or four times.
7. If the parking brake is properly adjusted, the travel between the fully disengaged position and the fully engaged position will be between 9 and 11 notches.
   If the traveling range is not within these limits, again repeat steps 1 through 5.
   After adjusting has been done, check to see if the rear wheel rotates smoothly without drag when turned by hand.

Servicing The Brake Drum

Whenever the brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves and out-of-round.

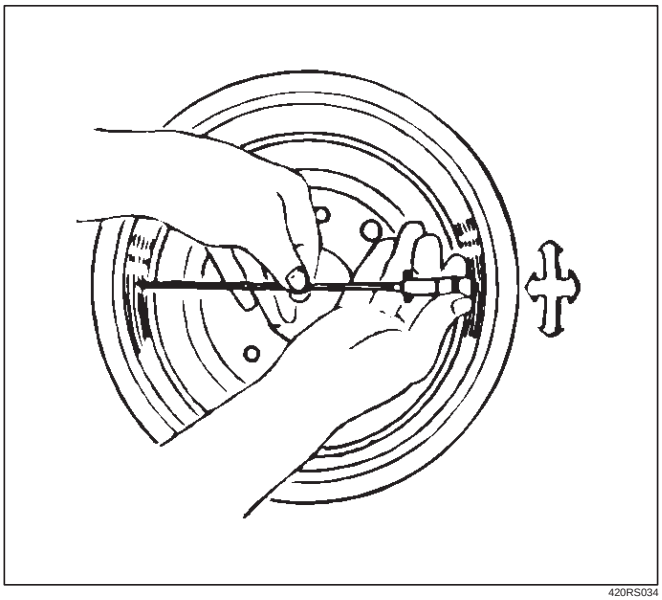
Cracked, Scored or Grooved Drum

A cracked drum is unsafe and must be replaced.
Do not attempt to weld a cracked drum.
Smooth any slight scores. Heavy or extensive scoring will cause excessive brake lining wear, and it will probably be necessary to machine the drum braking surface.
If the brake linings are slightly worn and the drum is grooved, the drum should be polished with fine emery cloth but should not be machined. At this stage, eliminating all the grooves in the drum and smoothing the ridges on the lining would require the removal of too much metal and lining. If left alone, the grooves and ridges match and satisfactory service can be obtained. If brake linings are to be replaced, a grooved drum should be machined. Using a grooved drum with new linings will create inefficient braking performance and cause the linings to wear quicker.

Out-Of-Round Drum

An out-of-round drum makes accurate brake shoe adjustment impossible and is likely to cause excessive wear to other parts of the brake mechanism due to its eccentric action. An out-of-round drum can also cause severe and irregular tire tread wear as well as a pulsing brake pedal. When the braking surface of a brake drum exceeds the specification limit of 0.15 mm (0.006 in) in out-of-round, the drum should be machined to true up the braking surface. Out-of-round can be accurately measured with an inside micrometer fitted with proper extension rods. When measuring a drum for out-of-round and wear, take measurements at the open and closed edges of machines surfaces and at right angles to each other.

Maximum out-of-round: 0.15 mm (0.006 in)



420RS034

Machining The Drum

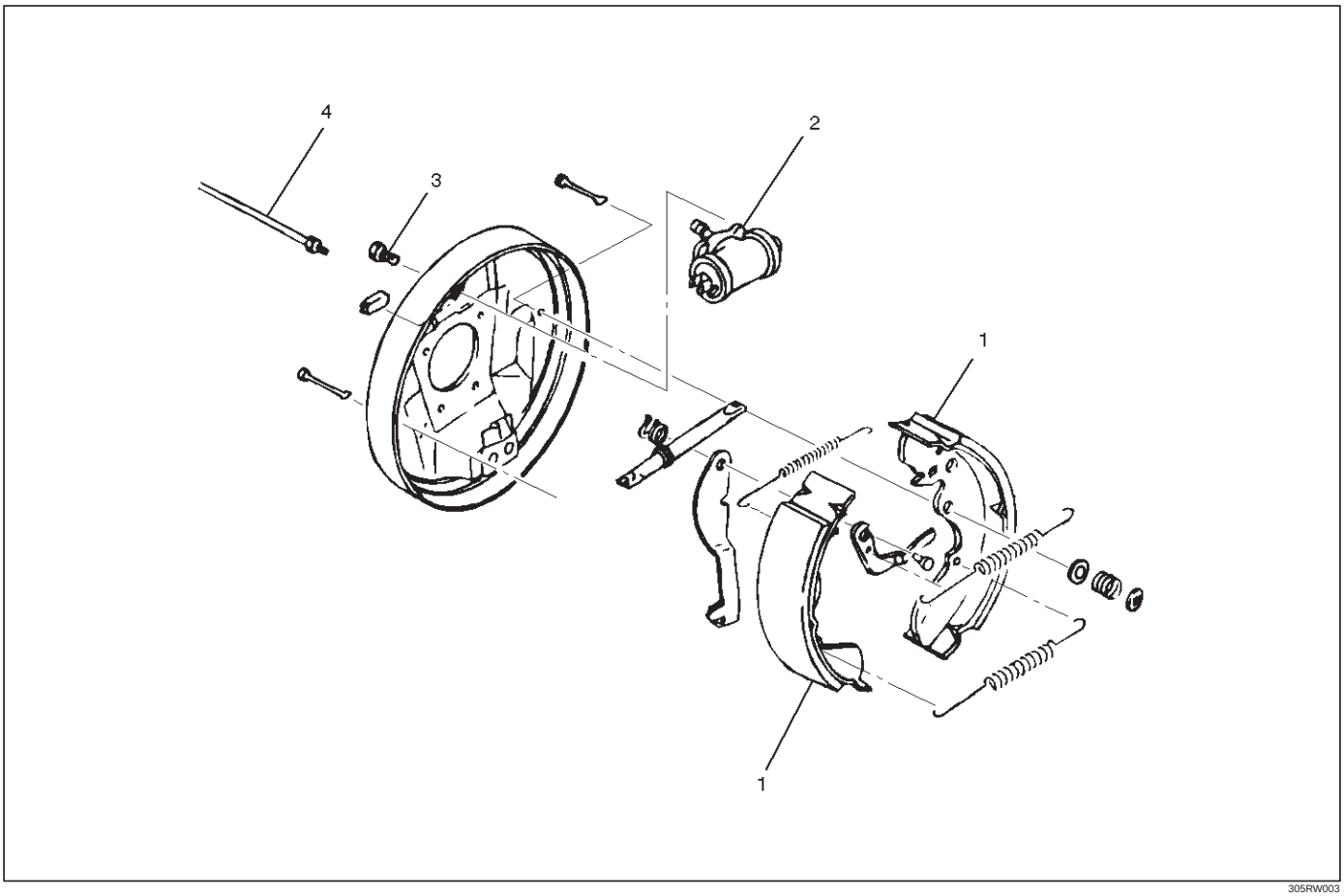
If a drum is to be machined, only enough metal should be removed to obtain a true, smooth braking surface. If a drum does not clean-up when machined to a maximum diameter, it must be replaced. Removal of more metal will affect dissipation of heat and may cause distortion of the drum.

After refinishing, replace any drum that exceeds a maximum inside diameter of 296.5 mm (11.673 in). Do not use a brake drum that is not within the specification.

Maximum inside diameter: 296.5 mm (11.673 in)

Wheel Cylinder Assembly (4×2 Model)

Wheel Cylinder Assembly and Associated Parts



305RW003

Legend

(1) Brake Linings
(2) Wheel Cylinder
(3) Bolts
(4) Brake Pipe

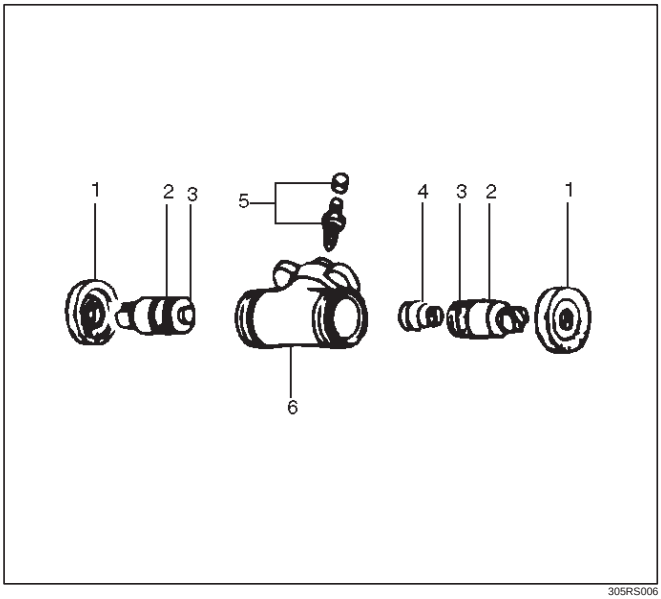
Removal

1. Remove brake linings (1).
   ▼Refer to *Brake Lining and Associated Parts* in this section.
2. Remove brake pipe (4).
   ▼Plug the opening in the line to prevent fluid loss and contamination.
3. Remove bolts (3) and wheel cylinder (2).

Installation

1. Install wheel cylinder (2) and tighten bolts (3) to the specified torque.
   Torque: 10 N·m (8 lb ft)
2. Install brake pipe (4) and tighten the nut to the specified torque.
   Torque: 16 N·m (12 lb ft)
3. Install brake linings (1).
   ▼Refer to *Brake Lining Replacement* in this section.
   ▼Bleed brake system. Refer to *Hydraulic Brake* in this section.

Disassembled View



305RS006

Legend

(1) Boot
(2) Piston Assembly
(3) Piston Cup
(4) Return Spring
(5) Bleeder
(6) Wheel Cylinder

Disassembly

1. Remove boot (1) and piston assembly (2).
2. Remove piston cup (3) from piston assembly (2).
3. Remove return spring (4) and bleeder (5) from wheel cylinder (6).

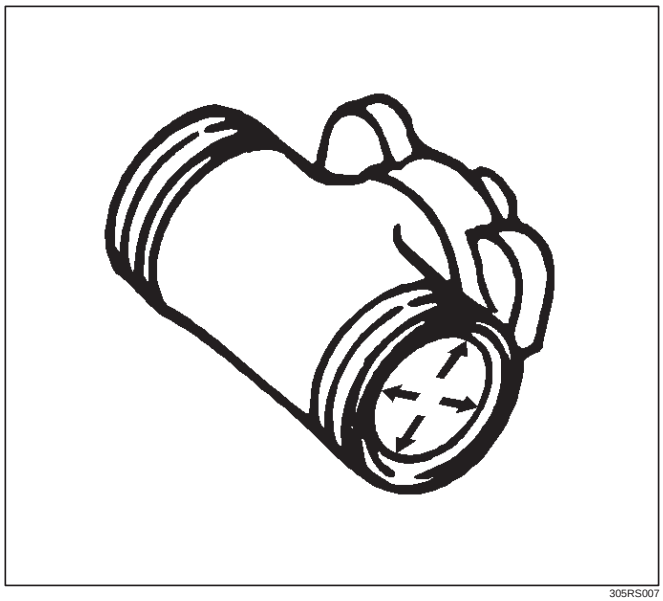
Inspection and Repair

1. Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
   Check the following parts;
   ▼Wheel cylinder body
   ▼Cylinder bore
   ▼Piston
   ▼Return spring
   ▼Bleeder

NOTE: Replace the piston cups and boots each time the wheel cylinder is overhauled. Discard these used rubber parts and replace with new ones.

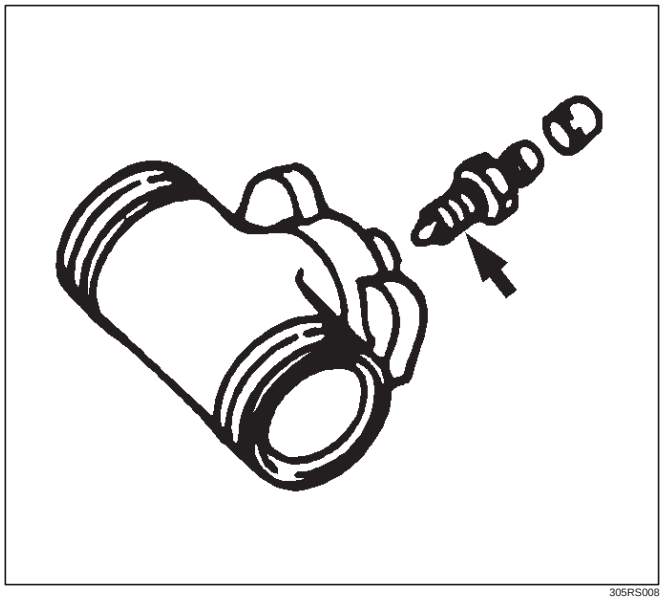
Reassembly

1. Lubricate the cylinder bore with clean rubber grease.



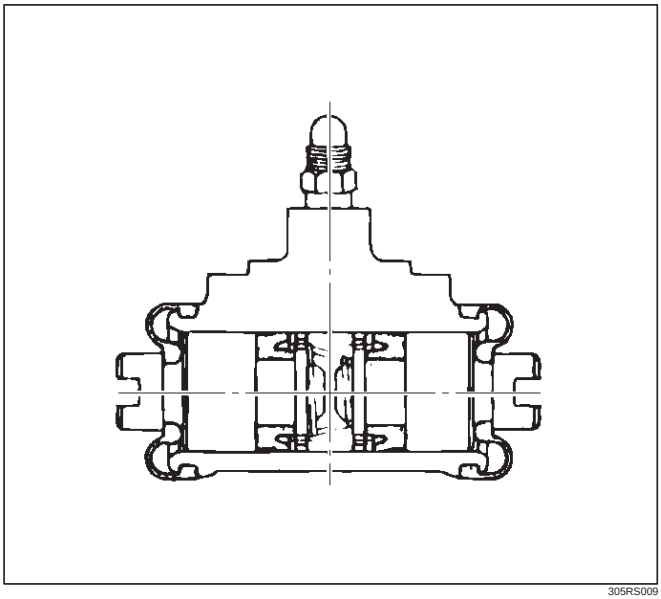
305RS007

2. Install bleeder (5) to wheel cylinder (6).
   Torque: 10 N·m (8 lb ft)



305RS008

3. Install new piston cups (3) on each piston so that the flared end of the cups are turned to the inboard side of the pistons.
   Attach the return spring (4) and the boot (1) to the piston.



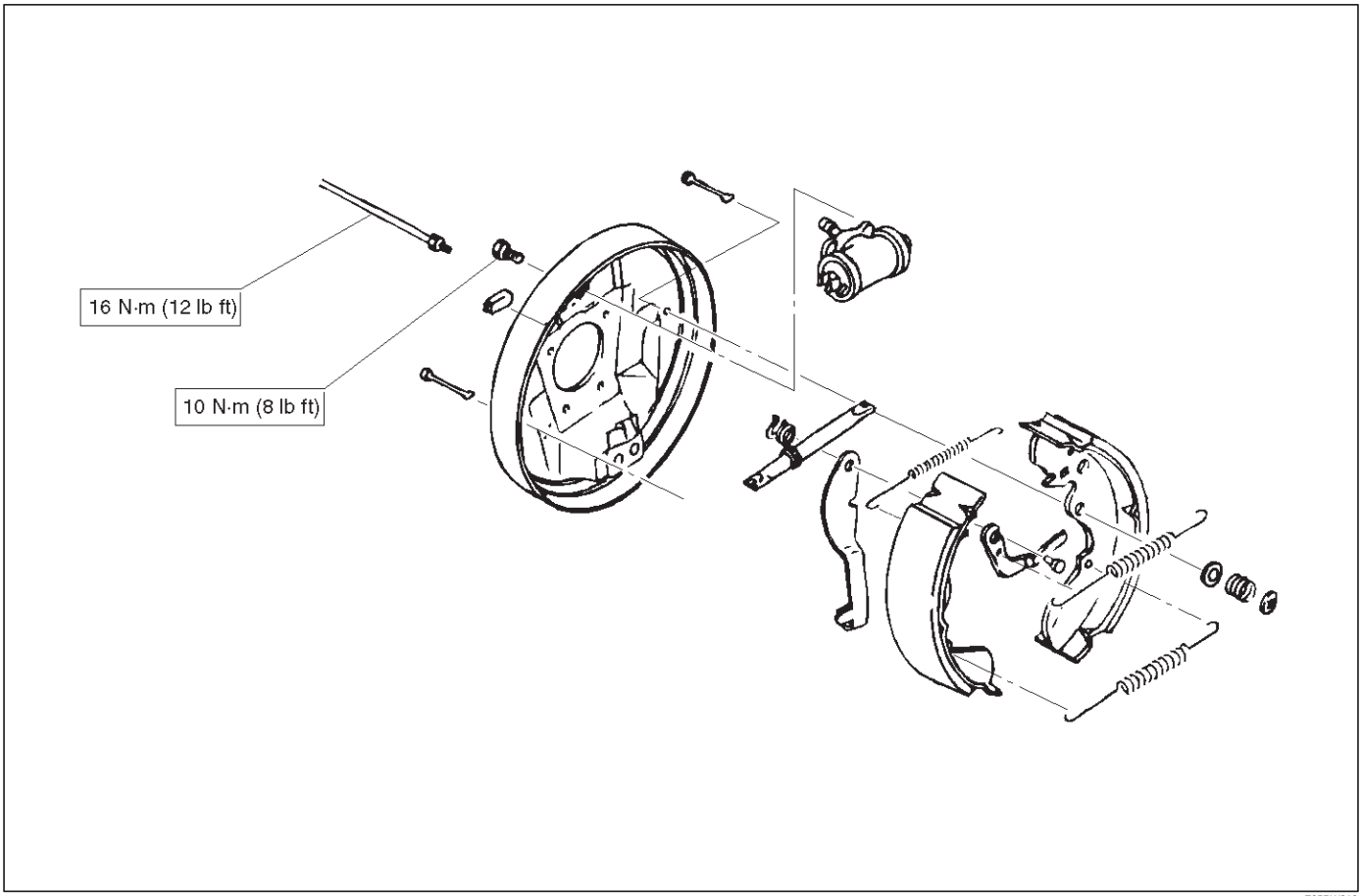
4. Apply DELCO silicone lube No. 5459912 (or equivalent) to the piston and the inner face of the boots.
5. Install piston assembly (2) to wheel cylinder (6).

Main Data and Specifications

General Specifications

Rear drum brake	
Type	Leading-trailing, non-servo
Drum inside diameter	295 mm (11.6 in)
Wheel cylinder diameter	22.22 mm (7/8 in)

Torque Specifications



E05RW010

AXIOM (Vehicles Produced After Aug./1/2001)

POWER-ASSISTED BRAKE SYSTEM

CONTENTS

Service Precaution 5C–62
General Description 5C–62
Diagnosis 5C–66
General Diagnosis 5C–67
Hydraulic Brakes 5C–70
Filling Master Cylinder Reservoir 5C–70
Deterioration of Brake Fluid 5C–70
Leakage of Brake Fluid 5C–70
Bleeding Brake Hydraulic System 5C–70
Flushing Brake Hydraulic System 5C–71
Brake Pipes and Hoses 5C–71
Brake Hose Inspection 5C–71
Front Caliper Brake Hose 5C–72
Front Caliper Brake Hose and Associated Parts 5C–72
Removal 5C–72
Installation 5C–72
Rear Axle Brake Hose 5C–73
Rear Axle Brake Hose and Associated Parts 5C–73
Removal 5C–73
Installation 5C–73
Brake Pipe 5C–74
Removal 5C–74
Installation 5C–74
P & B (Proportioning and Bypass) Valve 5C–75
Removal 5C–75
Installation 5C–75
Main Data and Specifications 5C–76
Brake Pedal 5C–77
Checking Pedal Height 5C–77
Checking Pedal Travel 5C–77
Brake Pedal and Associated Parts 5C–78
Removal 5C–78
Installation 5C–78
Stoplight Switch 5C–79
Parts Location 5C–79
Removal 5C–79
Installation 5C–79
Main Data and Specifications 5C–80
Master Cylinder Assembly 5C–81
Master Cylinder Assembly and Associated Parts 5C–81
Removal 5C–81
Inspection 5C–81
Master Cylinder Assembly 5C–82
Master Cylinder Assembly Desassembled View 5C–82
Desassembly 5C–82
Inspection 5C–82
Reassembly 5C–83
Installation 5C–83
Main Data and Specifications 5C–84
Vacuum Booster Assembly 5C–85
Vacuum Booster Assembly and Associated Parts 5C–85
Removal 5C–85
Inspection and Repair 5C–86
Exterior Components 5C–87
Exterior Components and Associated Parts 5C–87
Removal 5C–87
Inspection and Repair 5C–88
Installation 5C–88
Vacuum Booster Overhaul 5C–88
Vacuum Booster 5C–88
Main Data and Specifications 5C–89
Front Disc Brake Pads 5C–90
Front Disc Brake Pads Inspection 5C–90
Front Disc Brake Pads and Associated Parts 5C–90
Removal 5C–91
Installation 5C–91
Front Disc Brake Rotor 5C–93
Inspection 5C–93
Replacing Brake Rotors 5C–93
Refinishing Brake Rotors 5C–93
Front Disc Brake Caliper Assembly 5C–95
Front Disc Brake Caliper Assembly and Associated Parts 5C–95
Removal 5C–95
Installation 5C–96
Front Disc Brake Caliper 5C–98
Front Disc Brake Caliper Disassembled View 5C–98
Disassembly 5C–98
Inspection and Repair 5C–99
Reassembly 5C–99
Main Data and Specifications 5C–100
Rear Disc Brake Pads (4×4 Model) 5C–101

Brake Pads Inspection 5C–101
Brake Pads and Associated Parts 5C–101
Removal 5C–102
Installation 5C–102
Rear Disc Brake Rotor (4×4 Model) 5C–104
Inspection 5C–104
Replacing Brake Rotors 5C–104
Refinishing Brake Rotors 5C–104
Rear Drum (In Disc) Inside Diameter Check 5C–105
Rear Disc Brake Caliper Assembly (4×4 Model) 5C–106
Rear Disc Brake Caliper Assembly and Associated Parts 5C–106
Removal 5C–106
Installation 5C–107
Rear Disc Brake Caliper (4×4 Model) 5C–108
Rear Disc Brake Caliper Disassembled View 5C–108
Disassembly 5C–109
Inspection and Repair 5C–109
Reassembly 5C–109
Main Data and Specifications (4×4 Model) 5C–111
Brake Lining 5C–112
Brake Lining and Associated Parts 5C–112
Removal 5C–112
Brake Lining Inspection 5C–113
Installation 5C–113
Drum Brake Adjustment (4×2 Model) 5C–114
Servicing The Brake Drum 5C–114
Wheel Cylinder Assembly (4×2 Model) 5C–115
Wheel Cylinder Assembly and Associated Parts 5C–115
Removal 5C–115
Installation 5C–115
Disassembled View 5C–116
Disassembly 5C–116
Inspection and Repair 5C–116
Reassembly 5C–116
Main Data and Specifications 5C–118

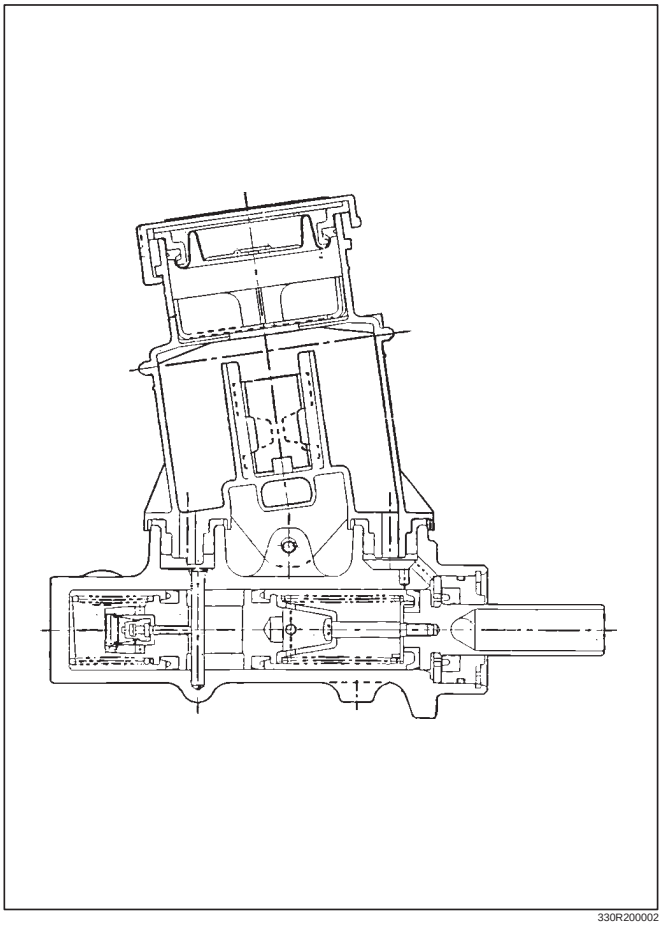
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE *SRS COMPONENT AND WIRING LOCATION VIEW* IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE *SRS SERVICE INFORMATION.* FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Master Cylinder Assembly



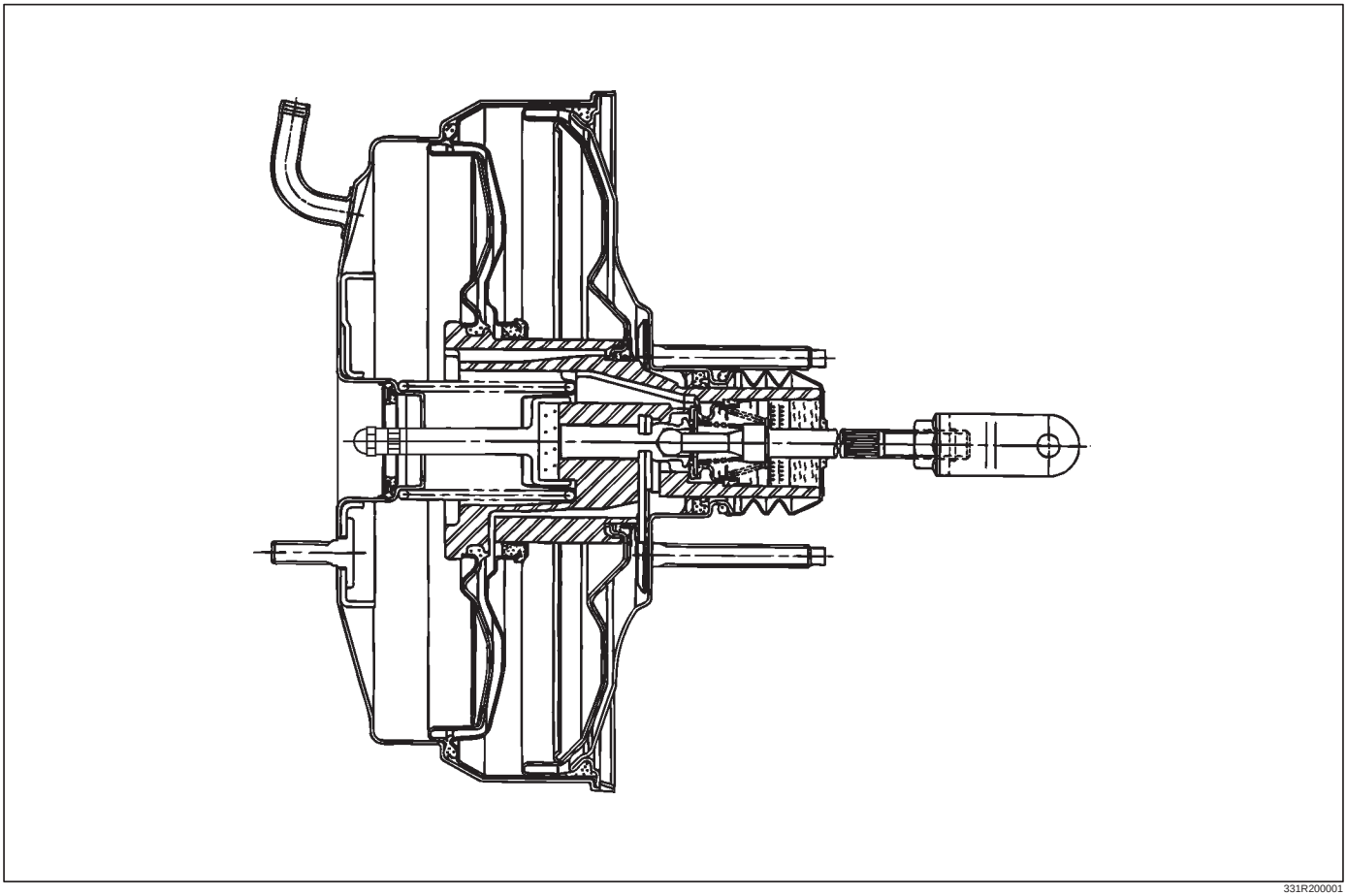
330R200002

The master cylinder contains two pistons that supply the hydraulic pressure for a dual–circuit braking system. The primary piston provides the fluid pressure to the front brakes, while the secondary piston provides the fluid pressure to the rear brakes. If the pressure is lost from either system, the remaining system will function to stop the vehicle.

CAUTION:

1. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. (Refer to *Bleeding Brake Hydraulic System* in this section.)**
2. **The torque values specified are for dry, unlubricated fasteners.**
3. **Perform service operations on a clean bench free from all mineral oil materials.**

Brake Booster



331R200001

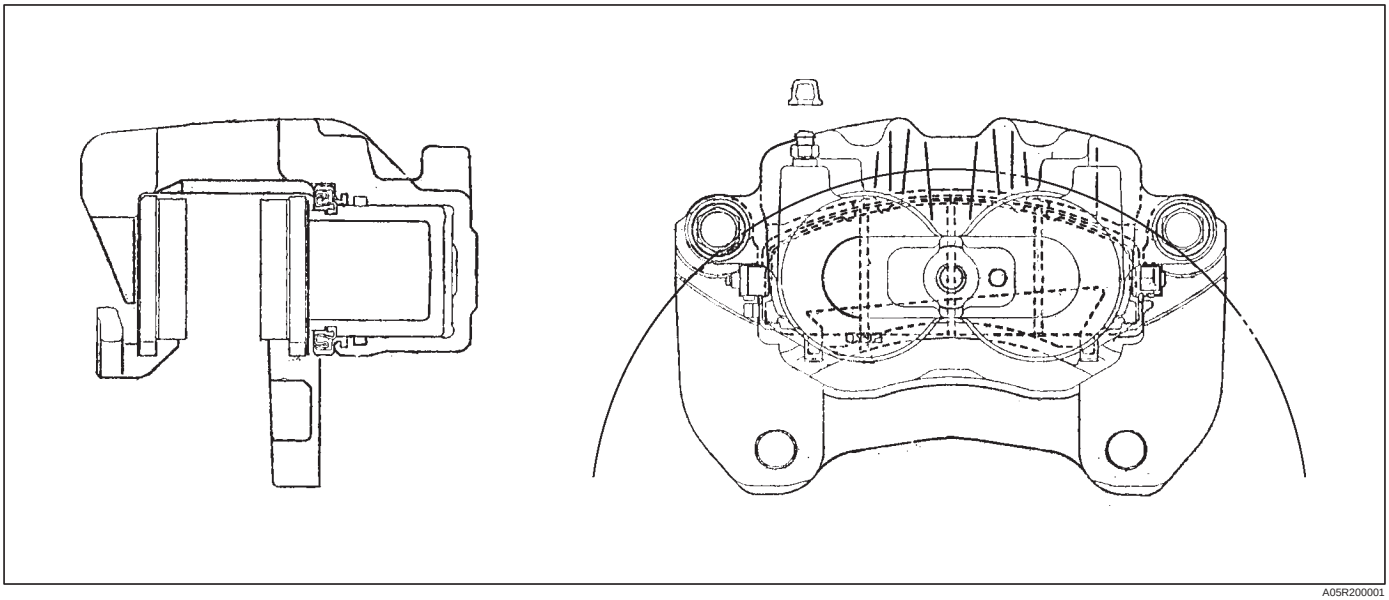
This booster is a tandem vacuum unit with a diaphragm effective diameter 205mm + 230mm (8.07in + 9.06in). In normal operating mode, with the service brakes in the released position, the tandem vacuum booster operates with vacuum on both sides of its diaphragms. When the brakes are applied, air at atmospheric pressure is admitted to both sides of the diaphragm to provide the power assist. When the service brake is released, the atmospheric air is shut off from both sides of the diaphram. The air is then drawn from the booster through the vacuum check valve to the vacuum source.

CAUTION:

1. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.**
2. **The torque values specified are for dry, unlubricated fasteners.**
3. **The vacuum booster is not repairable and must be replaced as complete assembly.**

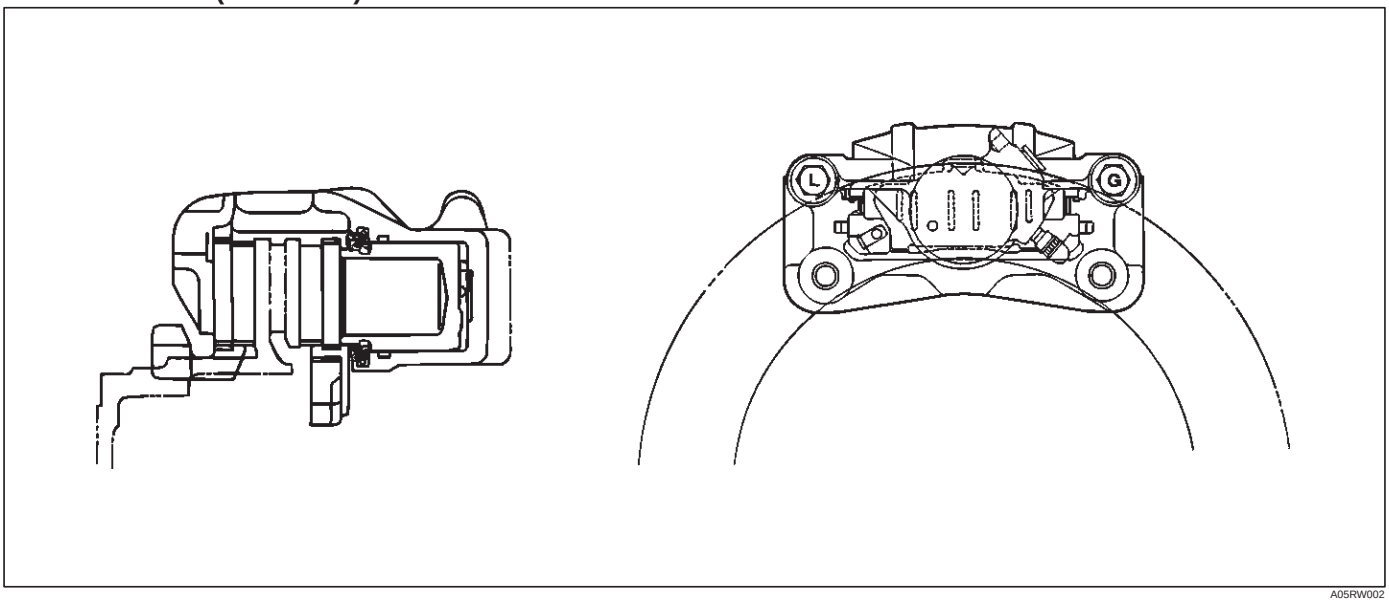
Disc Brake

Front Disc Brake



A05R200001

Rear Disc Brake (4×4 Model)



A05RW002

The disc brake assembly consists of a caliper, piston, rotor, pad assembly and support bracket. The caliper assembly has a fornt dual bore, rear single bore and is mounted to the support bracket with two mounting bolts. The support bracket allows the caliper to move laterally against the rotor. The caliper is a one–piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

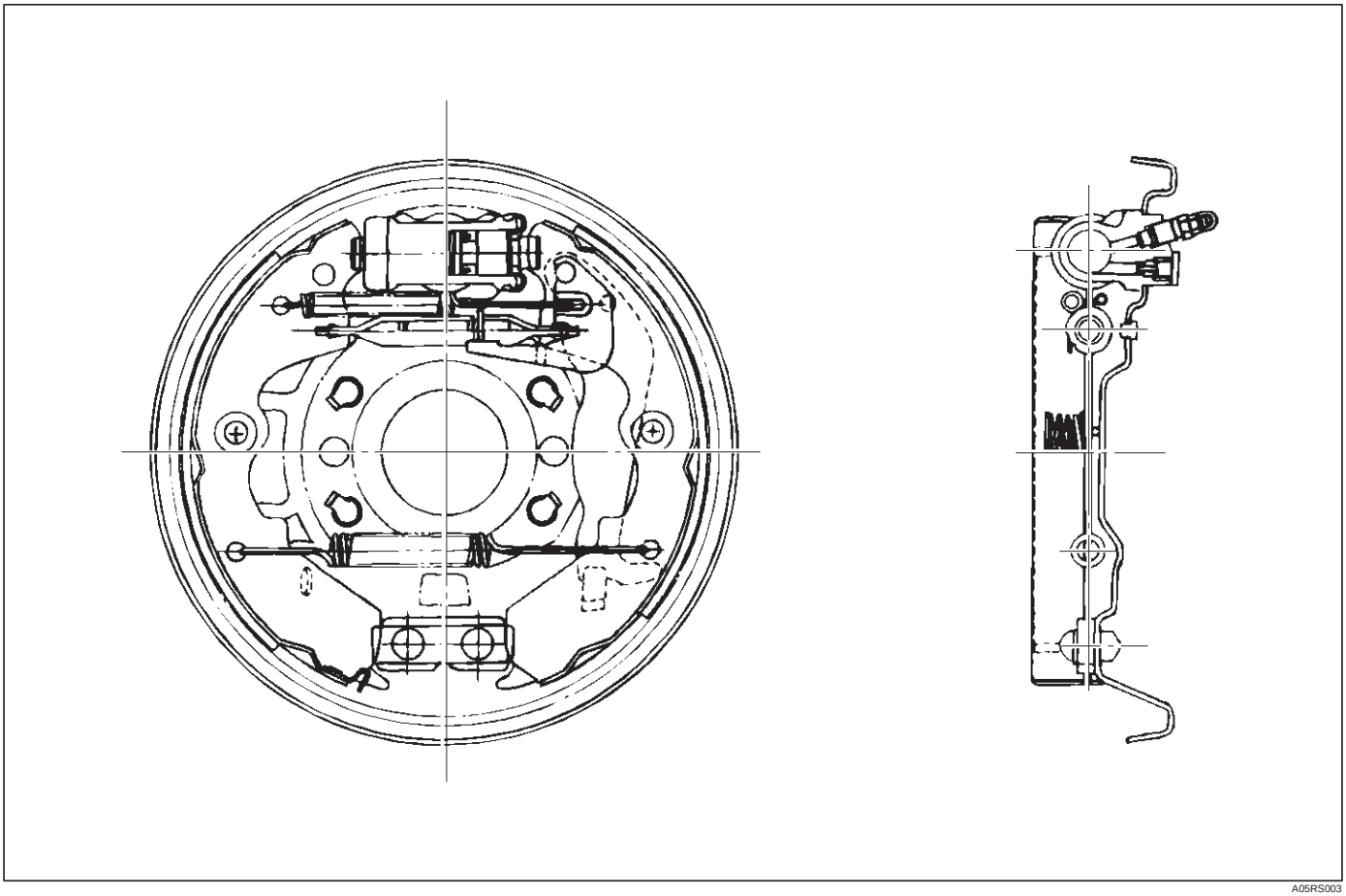
NOTE:

1. Replace all components included in repair kits used to service this caliper.
2. Lubricate rubber parts with clean brake fluid to ease assembly.
3. If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
4. Replace pads in axle sets only.
5. The torque values specified are for dry, unlubricated fasteners.
6. Perform the service operation on a clean bench free from all mineral oil materials.

Operation

Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force creates a clamping action of the piston pressing towards the rotors (outward) and the caliper slides inward toward the vehicle. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Leading/Trailing Drum Brakes (4×2 Model)



A05RS003

This drum brake assembly is a leading/trailing shoe design. Both brake shoes are held against the wheel cylinder pistons by the upper return spring and to the fixed anchor plate by the lower return spring. When the brakes are applied, the wheel cylinder pistons expand pushing both shoes out contacting the drum.

With forward wheel rotation, the forward brake shoe will wrap into the drum and becomes self-energized.

With reverse wheel rotation, the rear brake shoe is self-energized. Force from the brake shoes is transferred to the anchor plate through the braking plate to the axle flange. Adjustment is automatic and occurs on any service brake application. Also, with leading/trailing brakes, it is normal for the front shoe to wear at a faster rate than the rear shoe.

Diagnosis

Road Testing The Brakes

Brake Test

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt where all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight of the vehicle toward wheels on one side or if the roadway is so rough that wheels tend to bounce. Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires. Braking without locking the tires will stop the vehicle in less distance than braking to a skid (which has no brake efficiency). More tire to road friction is present while braking without locking the tires than braking to a skid.

The standard brake system is designed and balanced to avoid locking the wheels except at very high deceleration levels.

It is designed this way because the shortest stopping distance and best control is achieved without brake lock–up.

Because of high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

External Conditions That Affect Brake Performance

1. Tires: Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, identical in size, and the thread pattern of right and left tires must be approximately equal.
2. Vehicle Loading: A heavily loaded vehicle requires more braking effort.
3. Wheel Alignment: Misalignment of the wheels, particularly in regard to excessive camber and caster, will cause the brakes to pull to one side.

Brake Fluid Leaks

With engine running at idle and the transmission in “Neutral”, depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking.

Check the master cylinder fluid level. While a slight drop in the reservoir level will result from normal lining wear, an abnormally low level in reservoir indicates a leak in the system. The hydraulic system may be leaking internally as well as externally. Refer to *Master Cylinder Inspection*. Also, the system may appear to pass this test but still have slight leakage. If fluid level is normal, check the vacuum booster push rod length. If an incorrect length push rod is found, adjust or replace the push rod. Check the brake pedal travel and the parking brake adjustment. When checking the fluid level, the master cylinder fluid level may be lower than the “MAX” mark if the front and rear linings are worn. This is normal.

Warning Light Operation

When the ignition switch is in the START position, the “BRAKE” warning light should turn on and go off when the ignition switch returns to the ON position.

The following conditions will activate the “BRAKE” light:

1. Parking brake applied. The light should be on whenever the parking brake is applied and the ignition switch is on.
2. Low fluid level. A low fluid level in the master cylinder will turn the “BRAKE” light on.
3. During engine cranking the “BRAKE” light should remain on. This notifies the driver that the warning circuit is operating properly.

General Diagnosis

Condition	Possible cause	Correction
Brake Pull	Tire inflation pressure is unequal.	Adjust
	Front wheel alignment is incorrect.	Adjust
	Unmatched tires on same axle.	Tires with approx. the same amount of tread should be used on the same axle.
	Restricted brake pipes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new double walled steel brake piping.
	Water or oil on the brake pads.	Clean or replace.
	Brake pads hardened.	Replace
	Brake pads worn excessively.	Replace
	Brake rotor worn or scored.	Grind or replace.
	Disc brake caliper malfunctioning.	Clean or replace.
	Front hub bearing preload incorrect.	Adjust or replace.
	Loose suspension parts.	Check all suspension mountings.
	Loose calipers.	Check and tighten the bolts to specifications.
Brake Roughness or Chatter (Pulsates)	Excessive lateral runout.	Check per instructions. If not within specifications, replace or machine the rotor.
	Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the rotor.
	Pad reversed (steel against iron).	Replace the brake pad and machine rotor to within specifications.
Excessive Pedal Effort	Malfunctioning vacuum booster.	Check the vacuum booster operation and repair, if necessary.
	Partial system failure.	Check the front and rear brake system for failure and repair. Also, check the brake warning light. If a failed system is found, the light should indicate failure.
	Excessively worn pad.	Check and replace pads in sets.
	Piston in caliper stuck or sluggish.	Remove caliper and rebuild.
	Fading brakes due to incorrect pad.	Remove and replace with original equipment pad or equivalent.
	Vacuum leak to vacuum booster.	Check for ruptured or loose hose.
	Check the direction of check valve within vacuum hose.	Correct vacuum hose direction.
	Grease on the brake pads.	Replace or clean.
Excessive Brake Pedal Travel	Air in hydraulic circuit.	Bleed the hydraulic circuit.
	Level of brake fluid in the reservoir too low.	Replenish brake fluid reservoir to specified level and bleed hydraulic circuit as necessary.
	Master cylinder push rod clearance excessive.	Adjust
	Leakage in hydraulic system.	Correct or replace defective parts.

Condition	Possible cause	Correction
Brake Drag	Master cylinder pistons not returning correctly.	Adjust the stop light switch and vacuum booster push rod. If necessary, rebuild.
	Restricted brake pipes or hoses.	Check for soft hoses or damaged pipes, and replace with new hoses and new double–walled steel brake piping.
	Parking brake maladjusted.	Adjust
	Parking brake lining clearance insufficient.	Adjust
	Brake pedal free play insufficient.	Adjust the brake pedal height or power cylinder operating rod.
	Piston in the master cylinder sticking.	Replace
	Piston in the disc brake caliper sticking.	Replace piston seals.
	Brake pads sticking in caliper.	Clean
	Return spring weakened.	Replace
	Parking brake binding.	Overhaul the parking brakes and correct.
	Front hub bearing preload incorrect.	Adjust or replace.
	Parking brake shoes not returning.	Correct or replace the brake back plate and brake shoe as necessary.
	Obstructions in hydraulic circuit.	Clean
	Rotor warped excessively.	Grind or replace.
	Rear brake drum distorted.	Grind or replace.
	Parking cable sticking.	Grind or replace.
Grabbing or Uneven Braking Action (All conditions listed under “Pulls”)	Malfunctioning vacuum booster.	Check operation and correct as necessary.
	Binding brake pedal mechanism.	Check and lubricate, if necessary.
	Corroded caliper assembly.	Clean and lubricate.
Brake Noisy	Brake pads are worn.	Replace
	Brake pads are hardened.	Replace
	Brake pads are in poor contact with rotor.	Correct
	Brake disc(s) warped, worn or damaged.	Grind or replace.
	Disc brake anti–squeak shims fatigued.	Replace
	Front hub bearings are loose or preload is incorrect.	Adjust or replace.
	Brake disc is rusted.	Grind or replace.

Condition	Possible cause	Correction
Poor Brake Action	Master cylinder faulty.	Correct or replace.
	Vacuum booster faulty.	Correct or replace.
	Level of brake fluid in reservoir too low.	Replenish and bleed.
	Air in hydraulic circuit.	Bleed
	Disc brake caliper faulty.	Clean or replace.
	Water or oil on brake pads.	Clean or replace.
	Brake pads in poor contact with the rotor.	Correct
	Brake pads worn.	Replace
	Brake disc rusted.	Grind or replace.
	Check valve in vacuum hose faulty.	Correct or replace.

Hydraulic Brakes

Filling Master Cylinder Reservoir

CAUTION: Use only specified brake fluid. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluid will cause swelling and distortion of rubber parts in the hydraulic brake system. Water mixed with brake fluid lowers the fluid boiling point. Keep all fluid containers capped to prevent contamination.

Always fill the master cylinder reservoir when the engine is cold.

Never allow the brake fluid to come in contact with the painted surfaces.

The master cylinder reservoir must be kept properly filled to ensure adequate reserve and to prevent air and moisture from entering the hydraulic system. However, because of expansion due to heat absorbed from the brakes and the engine, the reservoir must not be overfilled. The brake fluid reservoir is on the master cylinder, which is located under the hood on the left side of the cowl. Thoroughly clean reservoir cap before removal to avoid getting dirt into reservoir. Remove the diaphragm. Add fluid as required to bring level to the "MAX" mark on the reservoir tank. Use "DOT 3" Hydraulic Brake Fluid. If the fluid cap diaphragm is stretched, return it to the original position before installing.

Deterioration of Brake Fluid

Using any other brake fluid than specified or brake fluid with mineral oil or water mixed in will drop the boiling point of brake fluid. It may, in turn, result in vapor lock or deteriorated rubber parts of the hydraulic system. Be sure to change the brake fluid at specified intervals.

If the rubber parts are deteriorated, remove all the system parts and clean them with alcohol. Prior to reassembly, dry the cleaned parts with air to remove the alcohol. Replace all the hoses and rubber parts of the system.

Leakage of Brake Fluid

With engine idling, set shift lever in the neutral position and continue to depress brake pedal at a constant pedal application force.

Should the pedal stroke become deeper gradually, leakage from the hydraulic pressure system is possible. Perform visual inspection for any signs of leakage.

Bleeding Brake Hydraulic System

A bleeding operation is necessary to remove air from the hydraulic brake system whenever air is introduced into the hydraulic system. It may be necessary to bleed the hydraulic system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder. If a brake pipe is disconnected at one wheel, only that wheel cylinder/caliper needs to be bled. If the pipes are disconnected at any fitting located between the master cylinder and brakes, then the brake system served by the disconnected pipe must be bled.

1. For 4–Wheel Antilock Brake System (ABS) equipped vehicle, be sure to remove the ABS main fuse 60A located at the relay and fuse box before bleeding air. If you attempt to bleed air without removing the main fuse, air cannot be let out thoroughly, and this may cause damage to the hydraulic unit. After bleeding air, be sure to replace the ABS main fuse back to its original position.
2. Set the parking brake completely, then start the engine.

NOTE: The vacuum booster will be damaged if the bleeding operation is performed with the engine off.

3. Remove the master cylinder reservoir cap.
4. Fill the master cylinder reservoir with brake fluid. Keep the reservoir at least half full during the air bleeding operation
5. Always use new brake fluid for replenishment.
6. When replenishing the brake fluid reservoir, carefully pour in the brake fluid to prevent air bubbles from entering the brake system.

   When the master cylinder is replaced or overhauled, first bleed the air from the master cylinder, then from each wheel cylinder and caliper following the procedures described below.

Bleeding the Master Cylinder

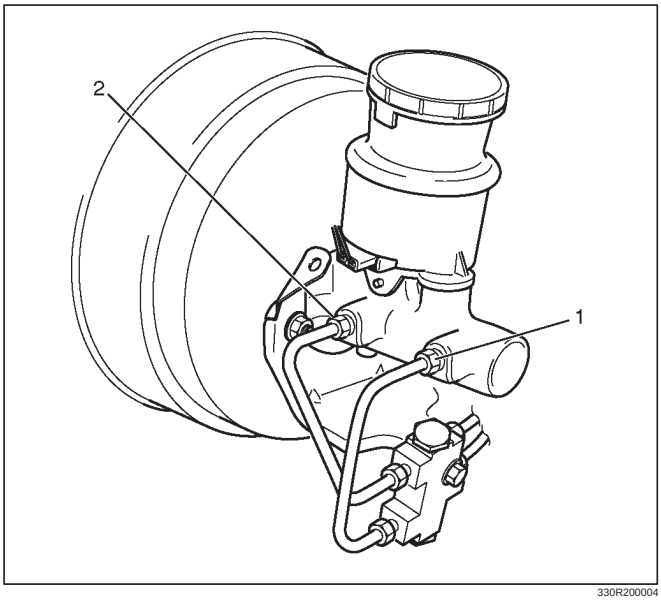
7. Disconnect the rear wheel brake pipe (1) from the master cylinder.

   Check the fluid level and replenish as necessary. If replenished, leave the system for at least one minute.
8. Depress the brake pedal slowly once and hold it depressed.
9. Completely seal the delivery port of the master cylinder with your finger, where the pipe was disconnected then release the brake pedal slowly.
10. Release your finger from the delivery port when the brake pedal returns completely.
11. Repeat steps 8 through 10 until the brake fluid comes out of the delivery port during step 8.

NOTE: Do not allow the fluid level in the reservoir to go below the half–way mark.

12. Reconnect the brake pipe (1) to the master cylinder and tighten the pipe.
13. Depress the brake pedal slowly once and hold it depressed.
14. Loosen the rear wheel brake pipe (1) at the master cylinder.
15. Retighten the brake pipe, then release the brake pedal slowly.
16. Repeat steps 13 through 15 until no air comes out of the port when the brake pipe is loosened

NOTE: Be very careful not to allow the brake fluid to come in contact with painted surfaces.



330R200004

17. Bleed the air from the front wheel brake pipe connection (2) by repeating steps 7 through 16.

Bleeding the Caliper

18. Bleed the air from each wheel in the order listed below:

    ▼Right rear caliper or wheel cylinder

    ▼Left rear caliper or wheel cylinder

    ▼Right front caliper

    ▼Left front caliper

    Conduct air bleeding from the wheels in the above order. If no brake fluid comes out, it suggests that air is mixed in the master cylinder. In this case, bleed air from the master cylinder in accordance with steps 7 through 17, and then bleed air from the caliper or wheel cylinder.
19. Place the proper size box end wrench over the bleeder screw.
20. Cover the bleeder screw with a transparent tube, and submerge the free end of the transparent tube in a transparent container containing brake fluid.
21. Pump the brake pedal slowly three (3) times (once/sec), then hold it depressed.
22. Loosen the bleeder screw until fluid flows through the tube.
23. Retighten the bleeder screw.
24. Release the brake pedal slowly.
25. Repeat steps 21 through 24 until the air is completely removed.

    It may be necessary to repeat the bleeding procedure 10 or more times for front wheels and 15 or more times for rear wheels.
26. Go to the next wheel in the sequence after each wheel is bled.

    Be sure to monitor reservoir fluid level.
27. Depress the brake pedal to check if you feel “sponginess” after the air has been removed from all wheel cylinders and calipers.

    If the pedal feels “spongy”, the entire bleeding procedure must be repeated.
28. After the bleeding operation is completed on the each individual wheel, check the level of the brake fluid in the reservoir and replenish up to the “MAX” level as necessary.
29. Attach the reservoir cap.

    If the diaphragm inside the cap is deformed, reform it and install.
30. Stop the engine.

Flushing Brake Hydraulic System

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Approximately one quart of fluid is required to flush the hydraulic system. The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contains the slightest trace of mineral oil. All rubber parts that have been subjected to a contaminated fluid must be replaced.

Brake Pipes and Hoses

The hydraulic brake system components are interconnected by special steel piping and flexible hoses. Flexible hoses are used between the frame and the front calipers, the frame and rear axle case and the rear axle and the rear calipers.
When the hydraulic pipes have been disconnected for any reason, the brake system must be bled after reconnecting the pipe. Refer to *Bleeding the Brake Hydraulic System* in this section.

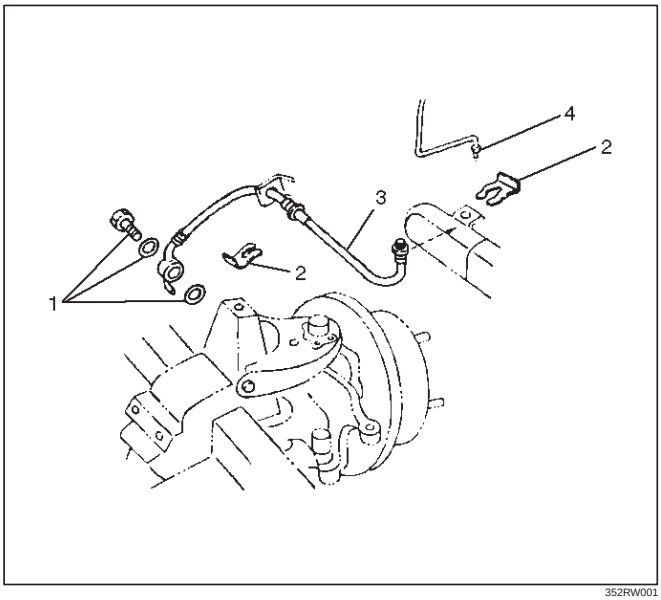
Brake Hose Inspection

The brake hose should be inspected at least twice a year. The brake hose assembly should be checked for road hazard, cracks and chafing of the outer cover, and for leaks and blisters. Inspect for proper routing and mounting of the hose. A brake hose that rubs on suspension components will wear and eventually fail. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

CAUTION: Never allow brake components such as calipers to hang from the brake hoses, as damage to the hoses may occur.

Front Caliper Brake Hose

Front Caliper Brake Hose and Associated Parts



352RW001

Legend

(1) Bolt and Gasket
(2) Clip
(3) Hose
(4) Brake Pipe

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove the wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove bolt and gasket.
7. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)

2. Tighten the bolt to the specified torque.

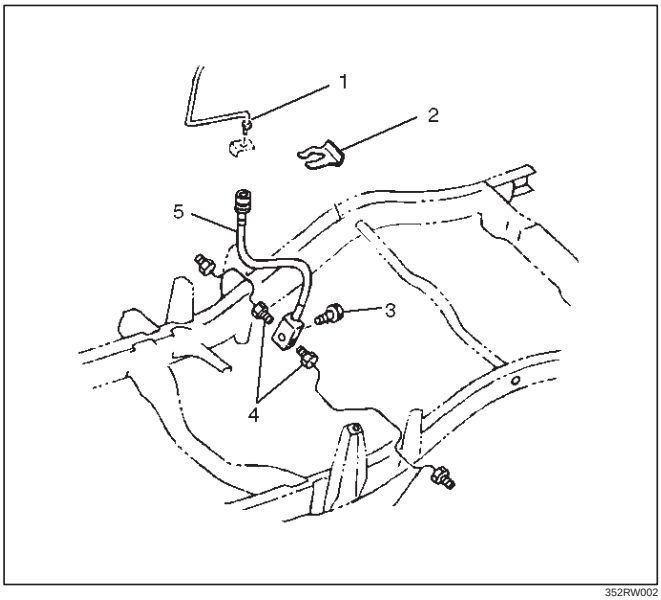
   Torque: 35 N·m (26 lb ft)

NOTE: Always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity.

After installing the brake hoses, bleed the brakes as described in this section.

Rear Axle Brake Hose

Rear Axle Brake Hose and Associated Parts



352RW002

Legend

(1) Brake Pipe
(2) Clip
(3) Bolt
(4) Brake Pipe
(5) Hose

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove brake pipe.
7. Remove bolt.
8. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)

2. Tighten the bolt to the specified torque.

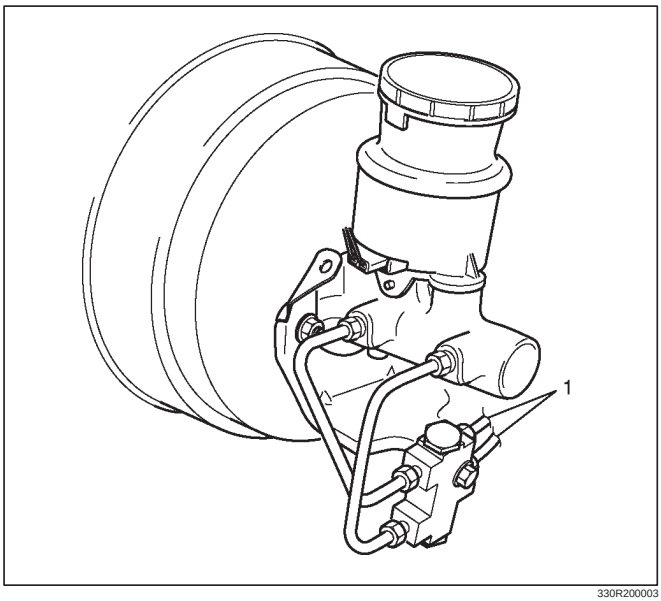
   Torque: 15 N·m (11 lb ft)

After installing the brake hoses, bleed the brakes as described in this section.

Brake Pipe

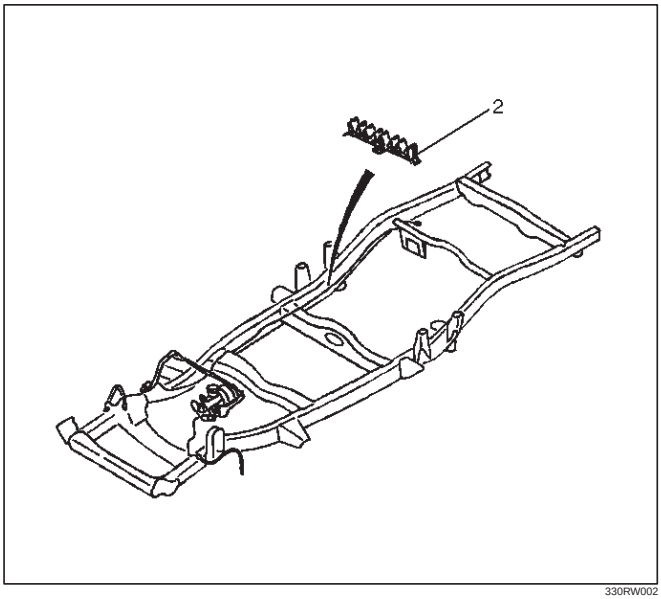
Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly as necessary.
3. Clean dirt, grease, and other foreign material off the pipe fittings at both ends.
4. Remove brake pipe (1).



330R200003

5. Remove plastic clip (2).



330RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque.

   Master cylinder and P&B valve sides

   Torque: 12 N·m (104 lb in)

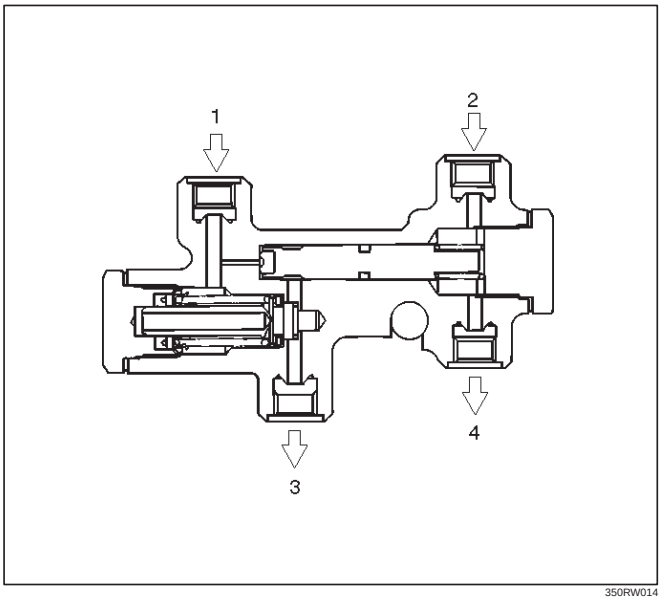
   Others

   Torque: 16 N·m (12 lb ft)

After installing the brake pipes, bleed the brakes as described in this section.

P & B (Proportioning and Bypass) Valve

P & B (Proportioning and Bypass) Valve Sectional View



350RW014

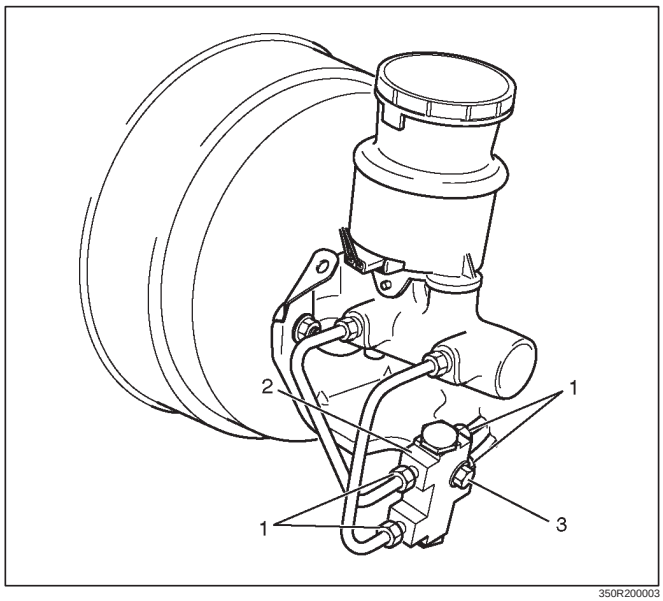
Legend

(1) Master Cylinder (Secondary)
(2) Master Cylinder (Primary)
(3) Rear Brake
(4) Front Brake

The P&B valve contains two sections, each serving a different function.
The proportioning section of the P&B valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock up on the vehicles with light rear wheel loads. The valve has a by–pass feature which assures full system pressure to the rear brakes in the event of front brake system malfunction. Also full front pressure is retained in the event of rear brake malfunction.
The P&B valve is not repairable and must be replaced as complete assembly.

Removal

1. The P&B valve is not repairable and must be replaced as a complete assembly. Care must be taken to prevent brake fluid from contacting any painted surface.
2. Remove hydraulic pipes (1) and plug the pipes (1) to prevent the loss of fluid or the entrance of dirt.
3. Remove bolt (3).
4. Remove P&B valve (2).



350R200003

Installation

1. Install P&B valve (2).
2. Install bolt (3) and tighten the bolt to the specified torque.

   Torque: 22 N·m (16 lb ft)

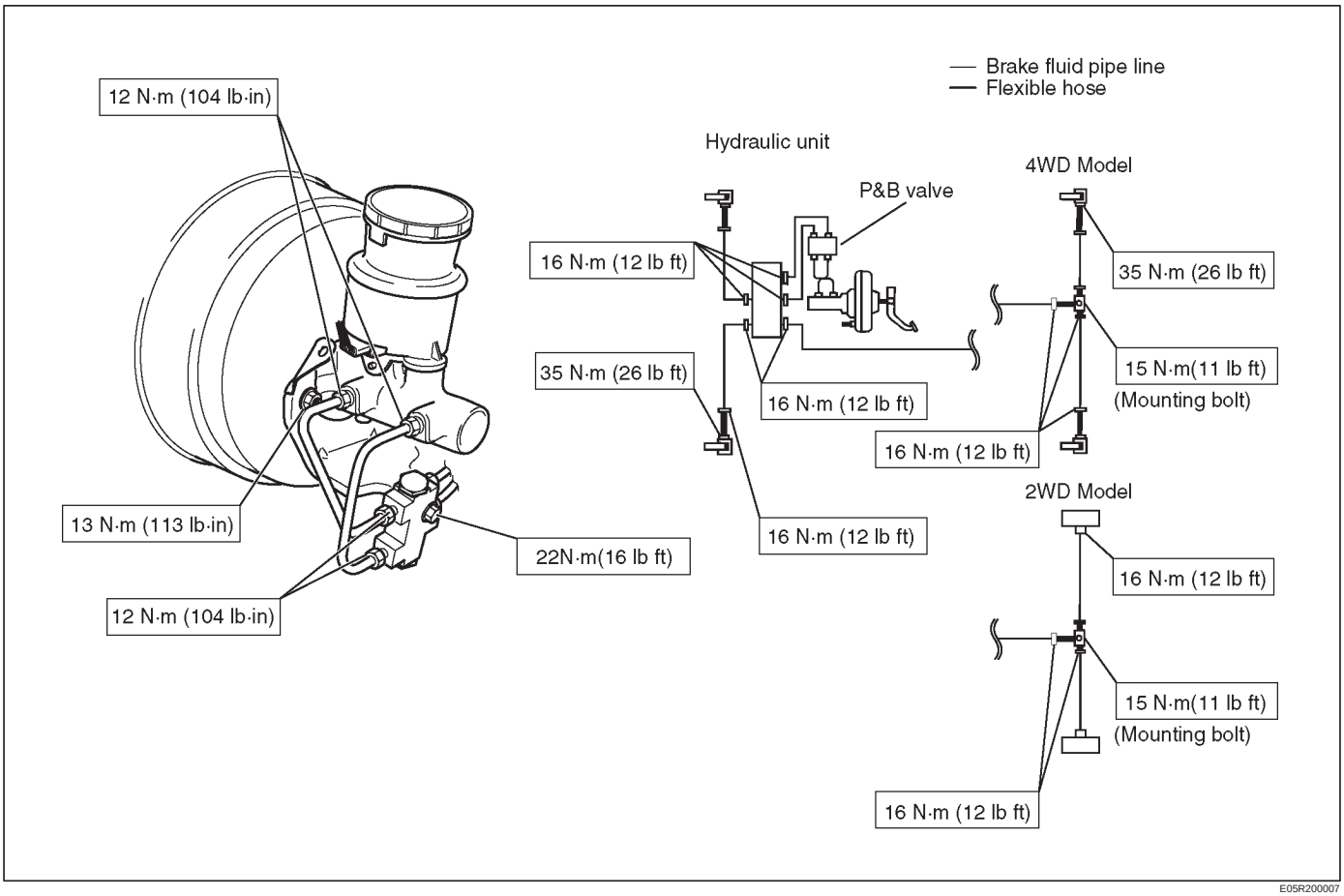
3. Install hydraulic pipes (1) and tighten the bolt to the specified torque.

   Torque: 12 N·m (104 lb in)

4. After installing the brake pipes, bleed the brakes as described in *Bleeding Brake Hydraulic System* in this section.

Main Data and Specifications

Torque Specifications



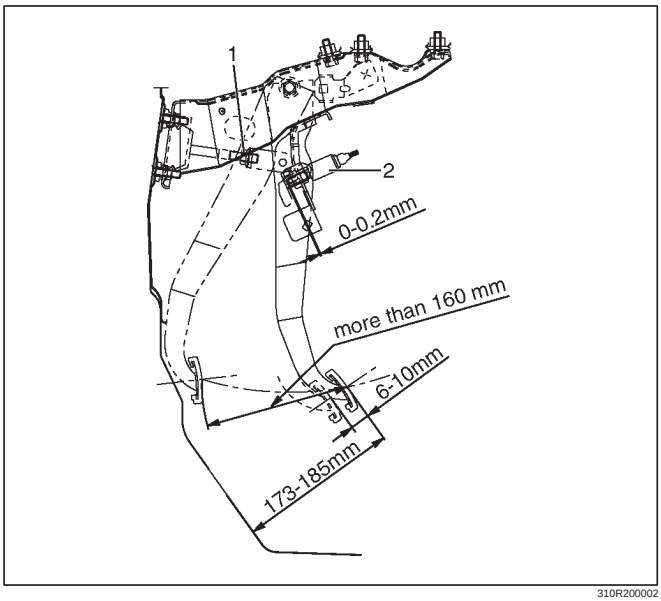
E05R200007

Brake Pedal

Checking Pedal Height

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows:

Adjust Brake Pedal



310R200002

1. Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring.
   Pedal height must be measured after starting the engine and stepping on it several times.

   Pedal Free Play: 6-10 mm (0.23-0.39 in)

   Pedal Height: 173-185 mm (6.81-7.28 in)

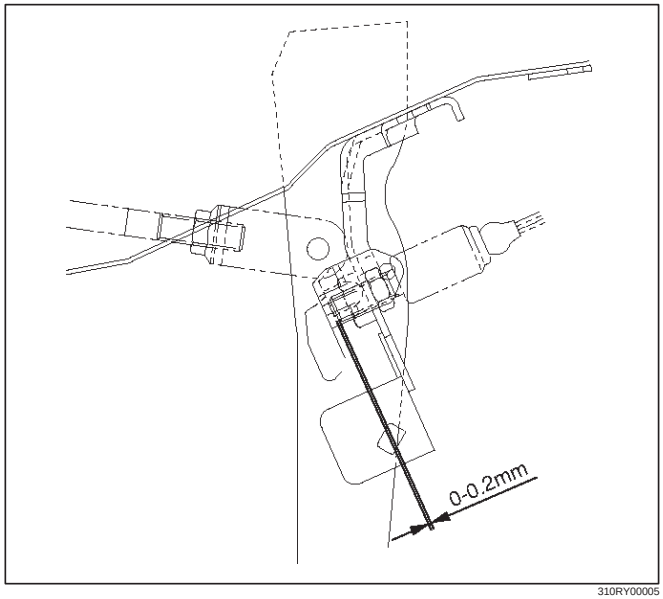
NOTE: Pedal free play must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

2. If the measured value is not within the above range, adjust the brake pedal as follows:
   a. Disconnect the stoplight switch connector.
   b. Loosen the stoplight switch lock nut.
   c. Rotate the stoplight switch so that it moves away from the brake pedal.
   d. Loosen the lock nut (1) on the push rod.
   e. Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.
   f. Tighten the lock nut to the specified torque.

   Torque: 20 N·m (15 lb ft)

   g. Adjust the stoplight switch (2) to the specified clearance (between the switch housing and the brake pedal) by rotating the switch housing.

   Clearance: 0.5–1.0 mm (0.02–0.04 in)

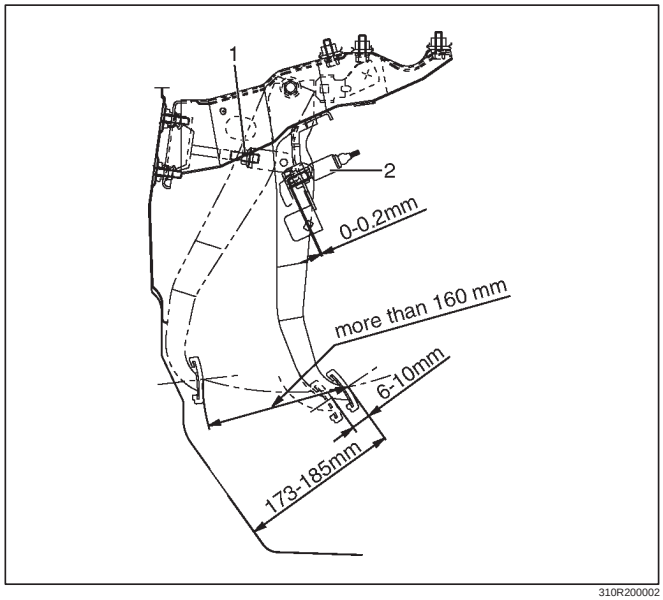


310RY00005

NOTE: While adjusting the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

   h. Tighten the stoplight switch lock nut.
   i. Connect the stoplight switch connector.

Checking Pedal Travel



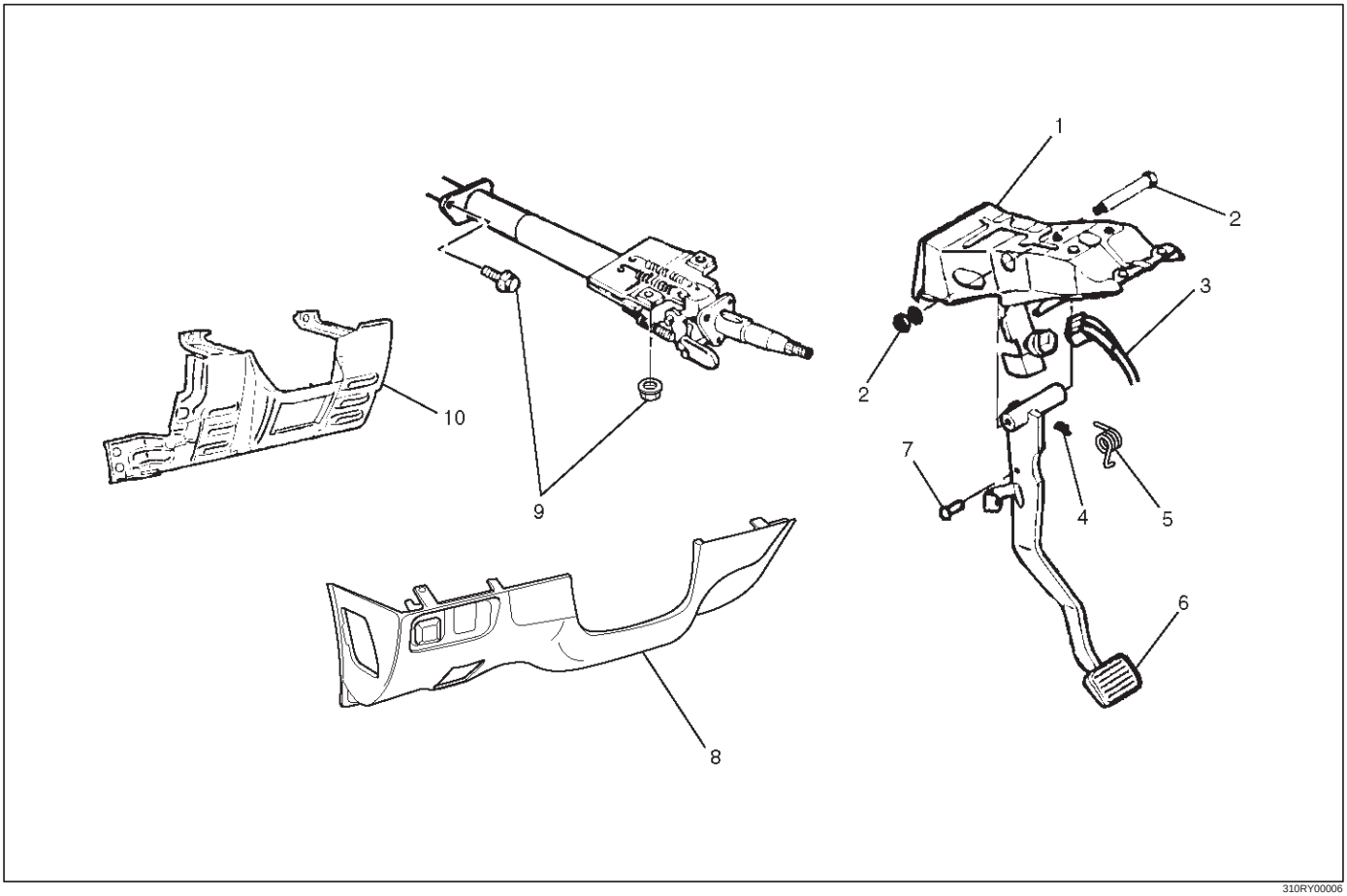
310R200002

1. Pedal height must be measured after starting the engine and revving it several times to apply vacuum to the vacuum booster fully.

NOTE: Pedal height must be 95 mm (3.7 in) or more when about 50 kg (110.25 lb) of stepping force is applied.

2. If the measured value is lower than the above range, air may still be present in the hydraulic system Perform the bleeding procedure.

Brake Pedal and Associated Parts



310RY00006

Legend

(1) Brake Pedal Bracket Assembly
(2) Fulcrum Pin and Nut
(3) Connector
(4) Snap Pin
(5) Return Spring
(6) Peadl Assembly
(7) Push Rod Pin
(8) Lower Cover
(9) Bolts and Nut
(10) Driver Knee Bolster

Removal

1. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
2. Disconnect the yellow 3 way SRS connector located under the steering column.
3. Remove the engine hood opening lever.
4. Remove lower cover (8).
5. Remove driver knee bolster (10).
6. Disconnect the stop light switch connector (3).
   Disconnect the anti-theft control module connector. Refer to *Body and Accessories* section.
7. Remove snap pin (4) and push rod pin (7).
8. Remove the steering column shaft fixing bolt and nut (9) on the steering wheel side, and lower the steering column shaft.
9. Remove the brake pedal bracket assembly (1).
10. Remove return spring (5).
11. Remove fulcrum pin and nut (2).
12. Remove pedal assembly (6).

Installation

1. Apply grease to the entire circumference of the fulcrum pin.
2. Install pedal assembly (6) and fulcrum pin and nut (2). Tighten the nut (2) to the specified torque.

   Torque: 35 N·m (26 lb ft)
3. Install the brake pedal bracket assembly (1). Tighten the bolts and nuts soecified torque.

   Torque: 15 N·m (11 lb ft)
4. Install return spring (5).
5. Adjust pedal free travel.
   Refer to *Brake Pedal Adjustment* in this section.
6. Tighten the steering column fixing bolt (9) (dash panel) to the specified torque.

   Torque: 20 N·m (14 lb ft)

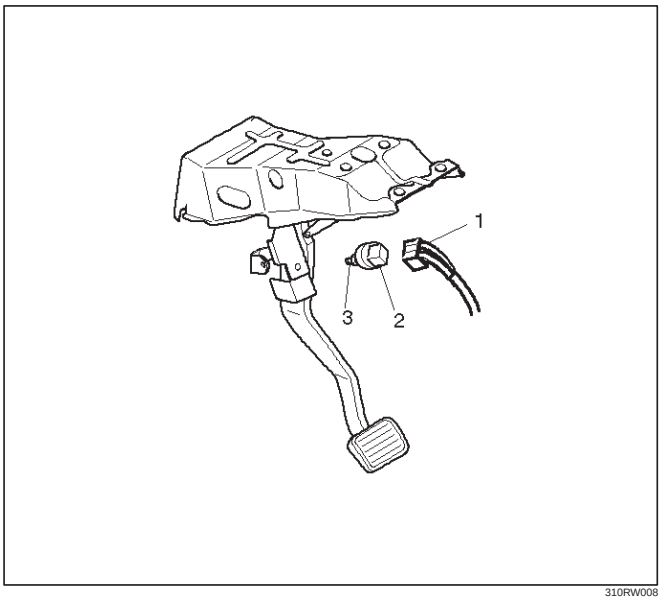
7. Tighten the steering column fixing nut (9) (Cross Beam) to the specified torque.

   Torque: 17 N·m (12 lb ft)

8. Apply grease to the entire circumference of the Push rod pin (7).
9. Install push rod pin (7).
10. Install snap pin (4).
11. Connect the anti-theft control module connector. Refer to *Body and Accessories* section.
12. Connect the stop light switch connector (3).
13. Install driver knee bolster (10) and lower cover (8).
14. Install the engine hood opening lever.
15. Connect the yellow 3 way SRS connector located under the steering column.
16. Connect the battery "–" terminal cable.

Stoplight Switch

Parts Location



310RW008

Legend

(1) Connector
(2) Switch
(3) Lock Nut

Removal

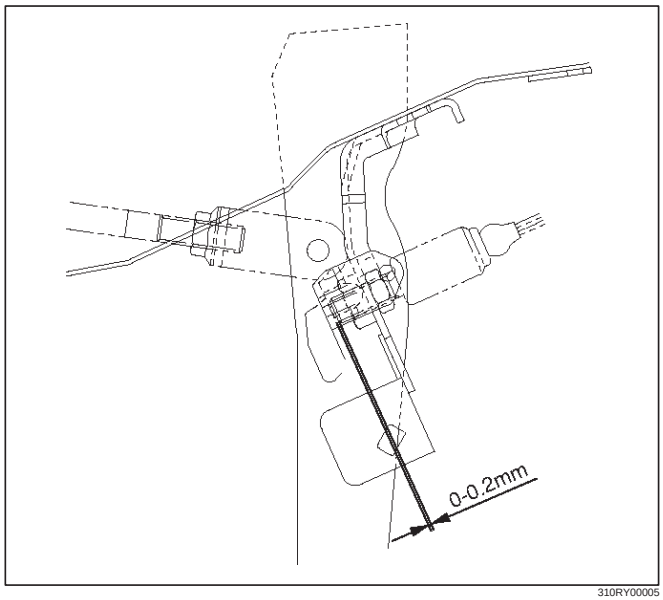
1. Disconnect connector (1)
2. Remove lock nut (3).
3. Remove switch (2).

Installation

1. Adjust the stop light switch to the specified clearance (between switch housing and brake pedal) by rotating the switch housing.

   Clearance : 0-0.2 mm (0-0.08 in)

NOTE: Do not attempt to force the push rod into position during the stop light switch installation and adjustment procedure.



310RY00005

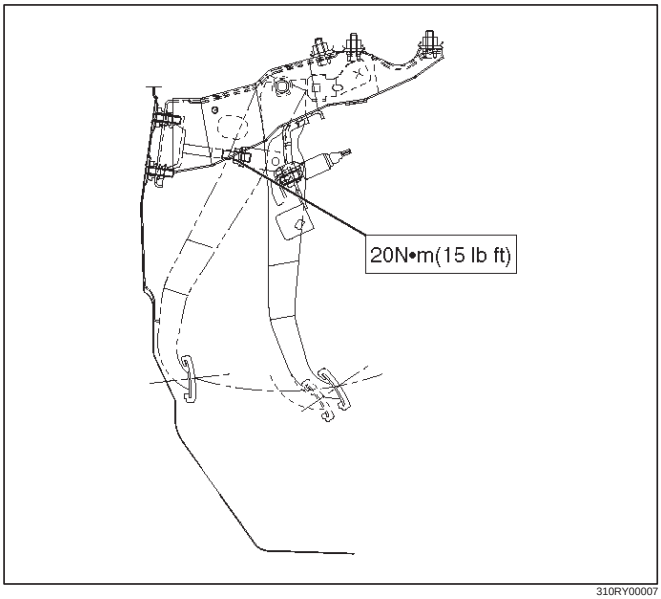
2. Connect connector (1).
3. Install lock nut (3).

Main Data and Specifications

General Specifications

Pedal free play	6–10 mm (0.23 –0.39 in)
Pedal Height	173–185 mm (6.81–7.28 in)

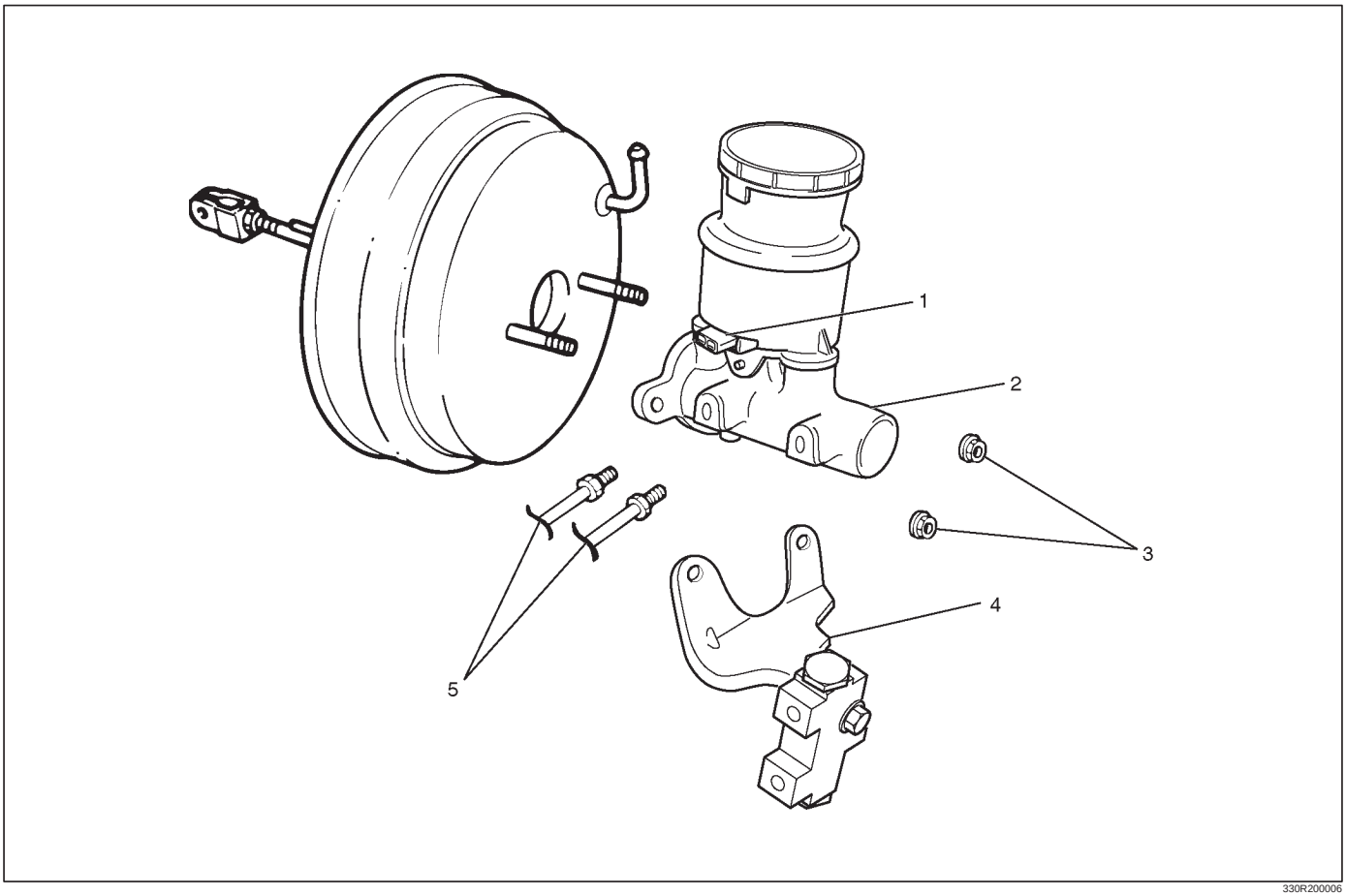
Torque Specifications



310RY00007

Master Cylinder Assembly

Master Cylinder Assembly and Associated Parts



330R200006

Legend

(1) Electrical Connector
(2) Master Cylinder
(3) 2 attaching Nuts
(4) P&B Valve and Bracket
(5) Brake Pipes

Removal

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

1. Disconnect electrical connector.
2. Remove brake pipes and after disconnecting the brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
3. Remove 2 attaching nuts.
4. Remove P&B valve and bracket.
5. Remove master cylinder.

Inspection

Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check:

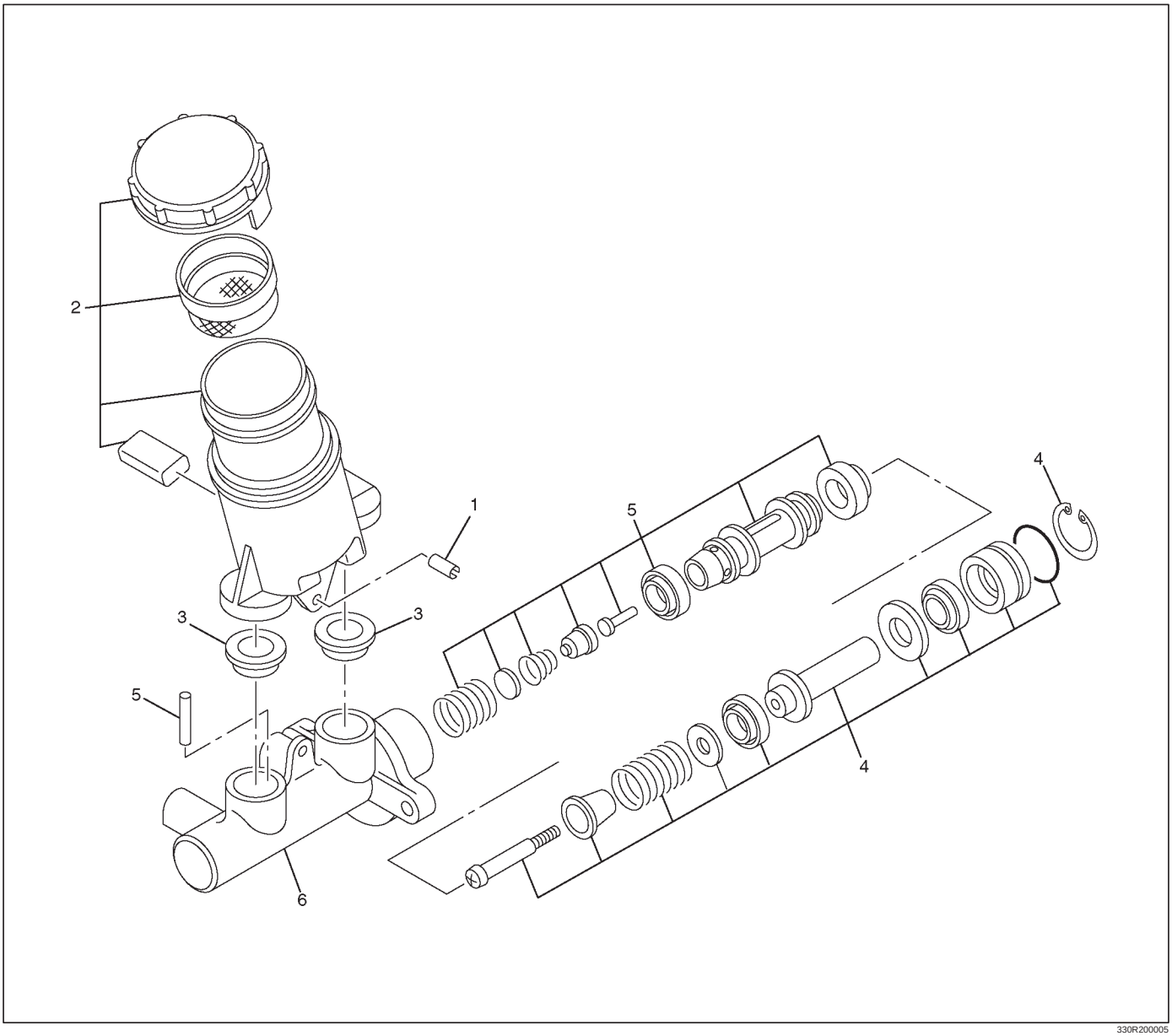
Visual Check

Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection:

- ▼ Master cylinder body
- ▼ Fluid reservoir
- ▼ O–ring

Master Cylinder Assembly

Master Cylinder Assembly Desassembled View



330R200005

Legend

(1) Spring Pin
(2) Reserve Tank and Reserve Tank Cap
(3) O–ring
(4) Primary Piston Assembly
(5) Secondary Piston Assembly
(6) Cylinder Body

Desassembly

1. Remove the spring pin.
2. Remove the reserve tank and the reserve tank cap.

The brake fulid level switch is built–in to the reserve tank and cannot be removed.

3. Remove the O–ring.
4. Remove the snap ring.
5. Remove the primary piston assembly.
6. Invert the cylinder body and push on the secondary piston until the pin falls free.
7. Remove the secondary piston assembly.
8. Remove the cylinder body.

Inspection

Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check:

Visual Check

Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection:

- ▼ Master cylinder body
- ▼ Fluid reservoir
- ▼ O–ring
- ▼ Wash each part in brake fluid before beginning the inspection procedure.
- ▼ Check the inside surfaces of the master cylinder for abrasion, corrosion, and other damage. Replace the cylinder if necessary.
- ▼ Check the return port for clogging. Clean the port with a wire and compressed air if nesessay.
- ▼ Check the piston and piston cup for abrasion, damage, and wear. Replace the piston assembly if any of these conditions exist.
- ▼ Check the return spring. Replace the spring if it is weak.
- ▼ Check the snap ring. Replace the snap ring if it is stretched or weak.

Reassembly

1. Wash each master cylinder internal part in brake fluid before beginning installation.
2. Install the cylinder body.
3. Press the secondary piston assembly into the cylinder body and hold it. Thread the pin through the long hole of the piston to secure the piston assembly.
4. Install the primary piston assembly.
5. Install the snap ring.
6. Install the O–ring
7. Install the reserve tank and the reserve tank cap.
8. Install the spring pin.

Installation

1. Install master cylinder.
   When replacing the master cylinder or vacuum booster or both, always measure the vacuum booster push rod protrusion and adjust it as necessary (Refer to *Vacuum Booster* in section).
2. Install P&B valve and bracket.
3. Install 2 attaching nuts and tighten the attaching nuts to the specified torque.

   Torque: 13 N·m (113 lb in)
4. Install brake pipes and tighten the brake pipe to the specified torque.

   Master cylinder and P&B valve sides

   Torque: 12 N·m (104 lb in)

   Others

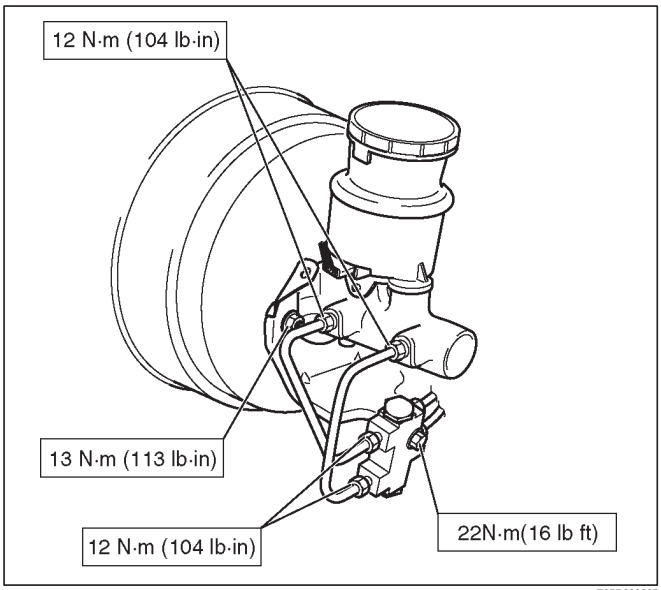
   Torque: 16 N·m (12 lb in)
5. Connect electrical connector.

Main Data and Specifications

General Specifications

Type	Dual–circuit
Piston bore diameter	25.4 mm (1.000 in)

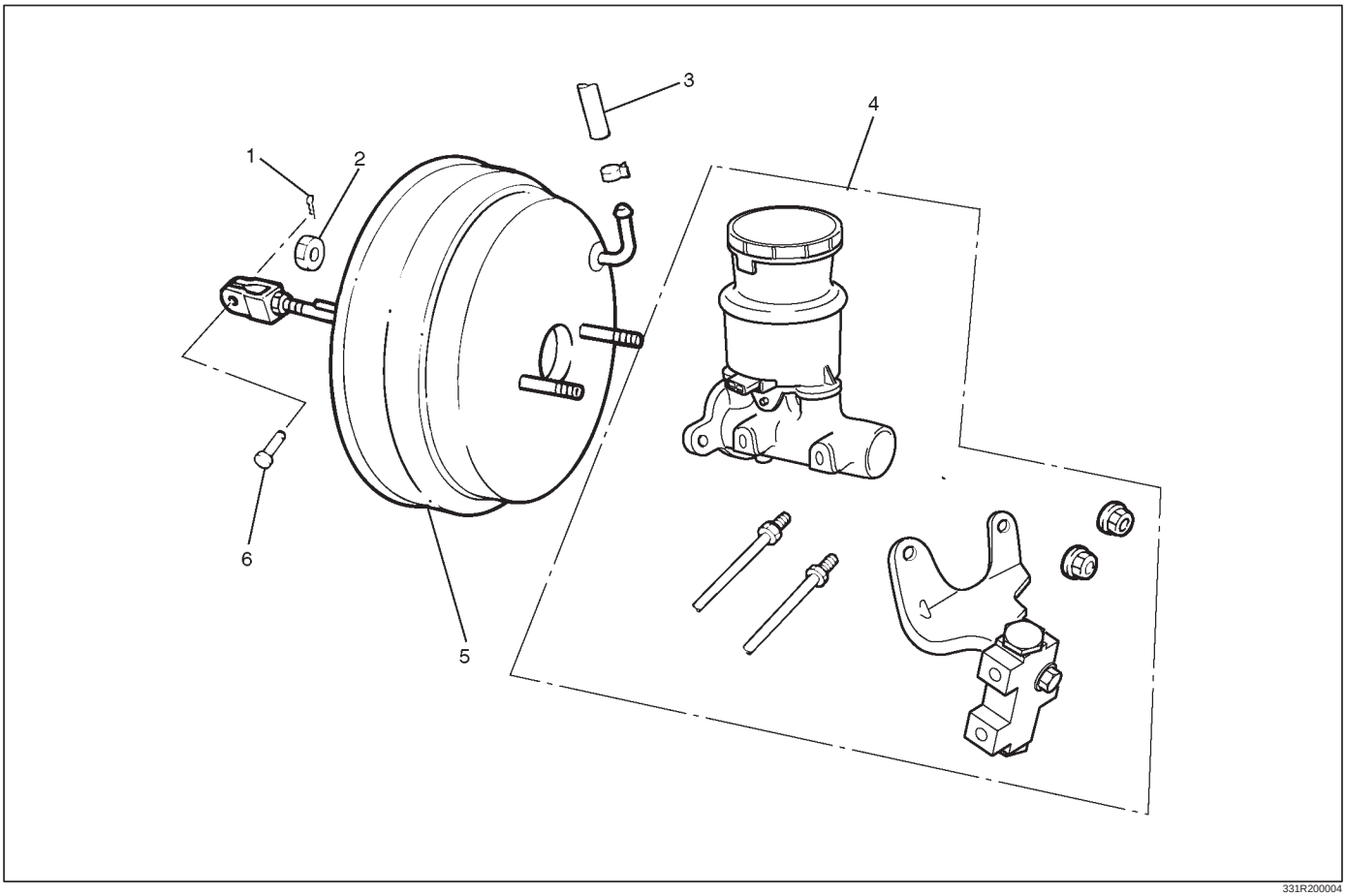
Torque Specifications



E05R200005

Vacuum Booster Assembly

Vacuum Booster Assembly and Associated Parts



331R200004

Legend

(1) Snap Pin
(2) Vacuum Booster Fixing Nut
(3) Vacuum Hose
(4) Master Cylinder
(5) Vacuum Booster
(6) Pin

Removal

1. Before removing the vacuum booster assembly, disconnect and remove the brake pipes.
2. Remove master cylinder, refer to *Master Cylinder Removal* in this section.

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

Do not hold the piston while removing the master cyliner, the piston can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

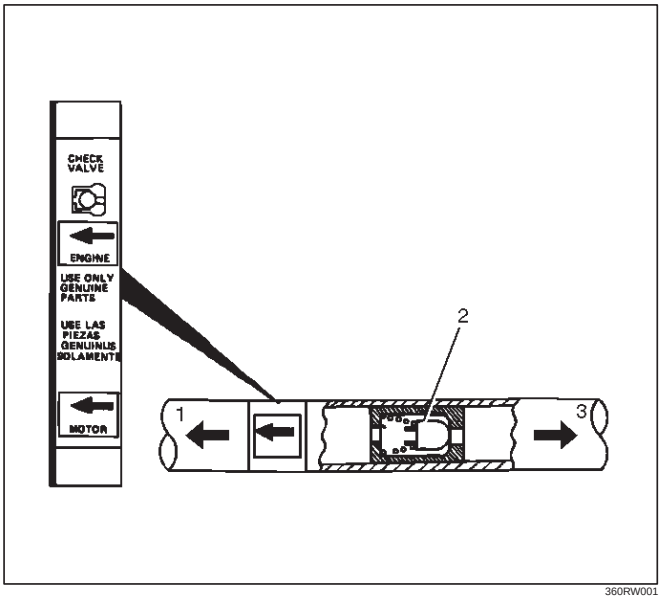
3. Remove vacuum hose.
4. Disconnect the yoke clevis from the brake pedal.
5. Remove vacuum booster fixing nut.
6. Remove vacuum booster.

Inspection and Repair

Vacuum Hose (The built in check valve)

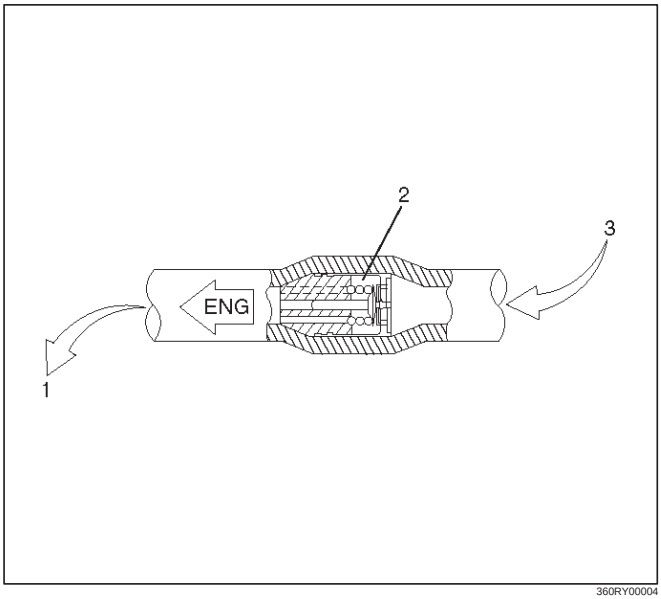
1. Inspect the check valve (2), which is installed inside the vacuum hose.
2. Air should pass freely from the vacuum booster (3) to the engine (1).
3. Air should not pass from the engine (1) to the vacuum booster (3). If it does, the check valve is inoperative and the vacuum hose built in the check valve must be replaced.

HEC ENGINE



360RW001

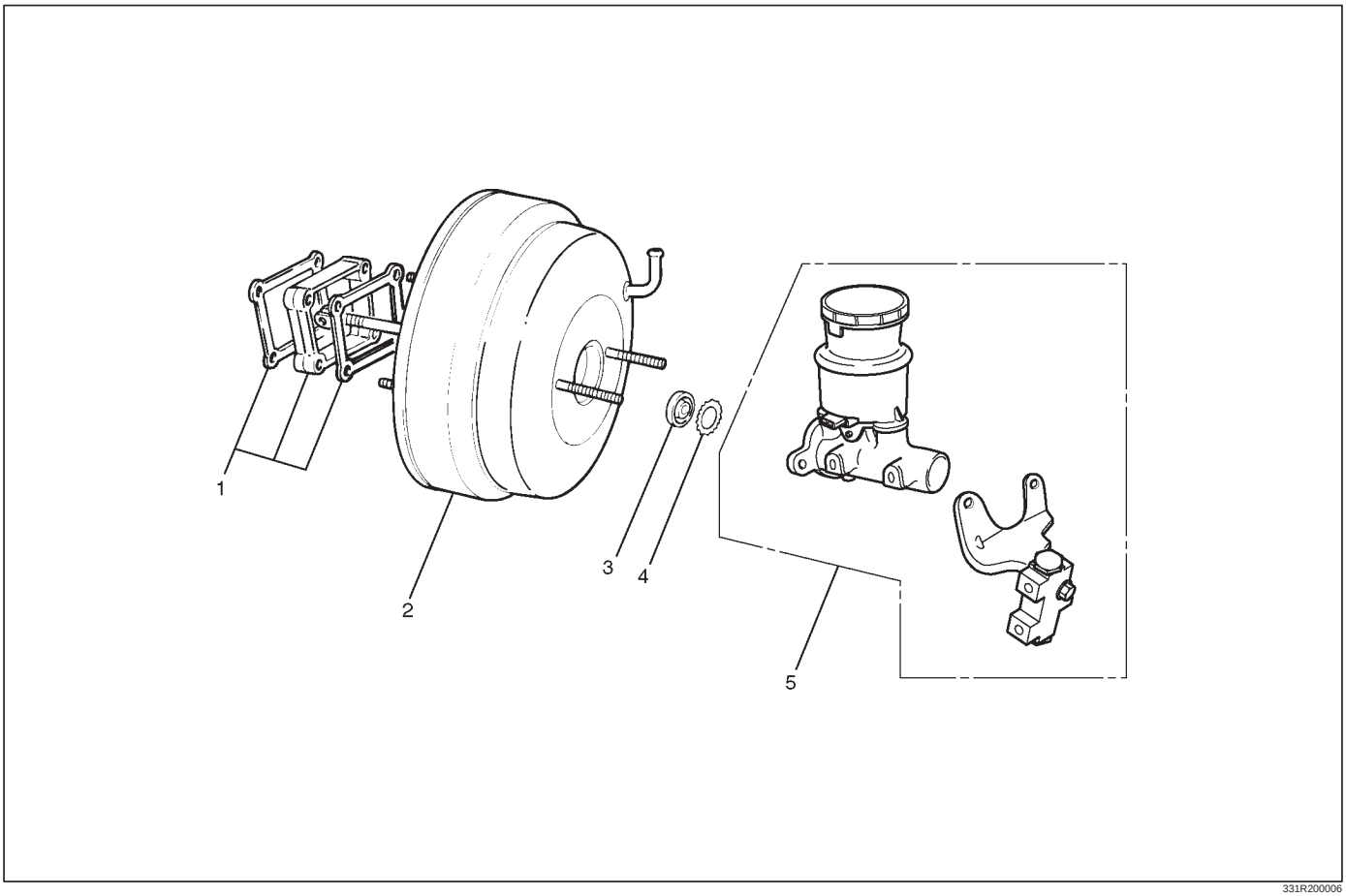
6VD1 ENGINE



360RY00004

Exterior Components

Exterior Components and Associated Parts



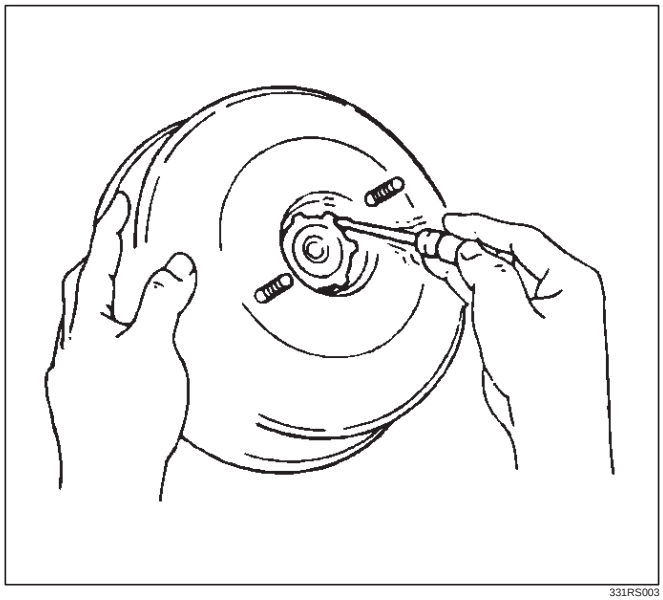
331R200006

Legend

(1) 2 Gaskets and Spacer
(2) Vacuum Booster
(3) Plate and Seal Assembly
(4) Retainer
(5) Master Cylinder

Removal

1. Remove master cylinder. Refer to *Master Cylinder* in this section.
2. Remove vacuum booster. Refer to *Vacuum Booster* in this section.
3. Remove 2 gaskets and spacer.
4. Remove retainer, plate and seal assembly.



331RS003

Inspection and Repair

Visual Check

Make necessary parts replacement if cuts, nicks, excessive wear, or other abnormal conditions are found through inspection.

NOTE: The parts listed below must be replaced with new ones whenever the master cylinder is removed.

1. Plate and seal assembly
2. Retainer

Installation

1. Install plate and seal assembly.
2. Install retainer.
3. Install vacuum booster, refer to *Vacuum Booster* in this section.
4. Install master cylinder, refer to *Master Cylinder* in this section and after installation, perform brake pedal check and adjustment. Refer to *Brake Pedal* in this section.

Vacuum Booster Overhaul

Vacuum Booster

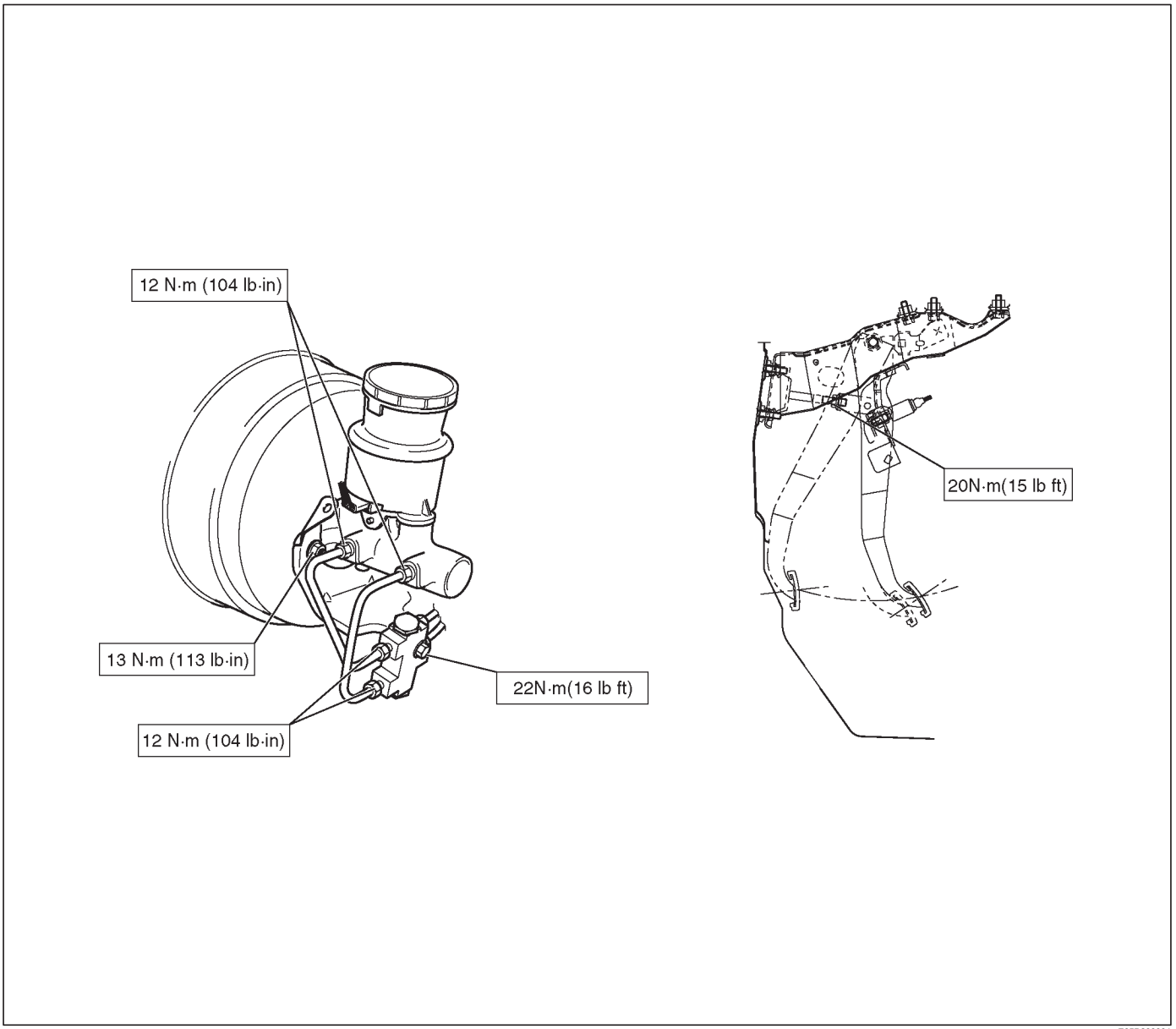
The vacuum booster cannot be disassembled for repair. Replace a defective vacuum booster with a new one.

Main Data and Specifications

General Specifications

Vacuum booster diaphragm diameter (Front)	205 mm (8.07 in)
Vacuum booster diaphragm diameter (Rear)	230 mm (9.06 in)
Push rod stroke	More than 32.0 mm (1.26 in)
Plunger diameter	10.25 mm (0.40 in)
Push rod diameter	27.4 mm (1.08 in)

Torque Specifications



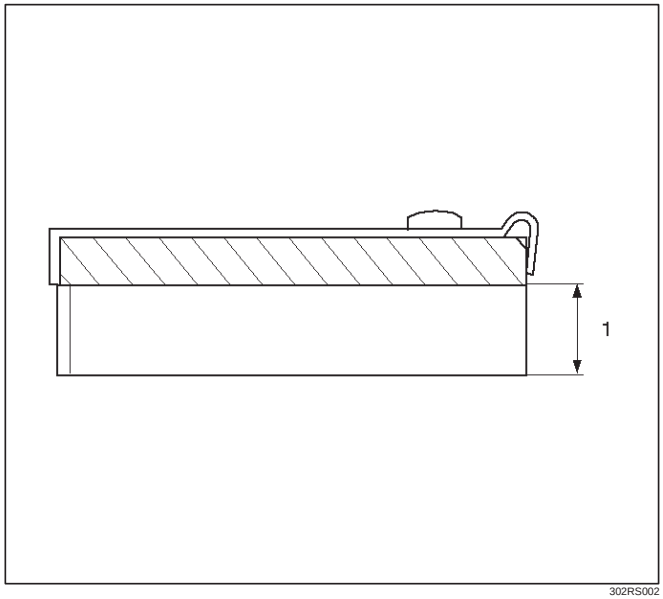
E05R200004

Front Disc Brake Pads

Front Disc Brake Pads Inspection

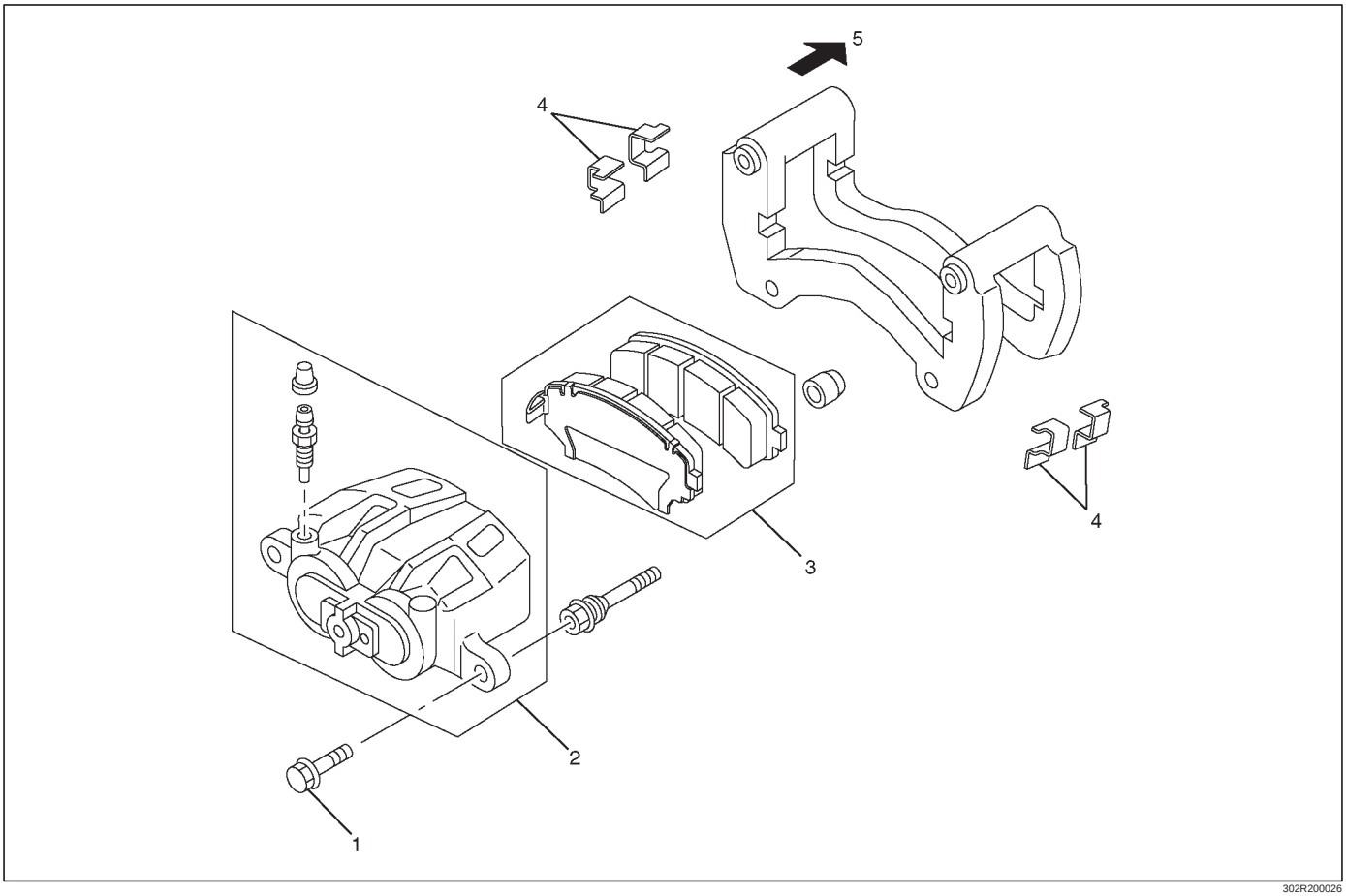
Check the outer pad by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.00 mm (0.039 in) of the pad itself.
Wear indicators are installed on disc brake pads, disc brake pads need replacement when the wear indicator is heard.

Minimum limit (1): 1.0 mm (0.039 in)



302RS002

Front Disc Brake Pads and Associated Parts



302R200026

Legend

(1) Pin Bolt
(2) Caliper Assembly
(3) Pad Assembly
(4) Clip
(5) Outer Side

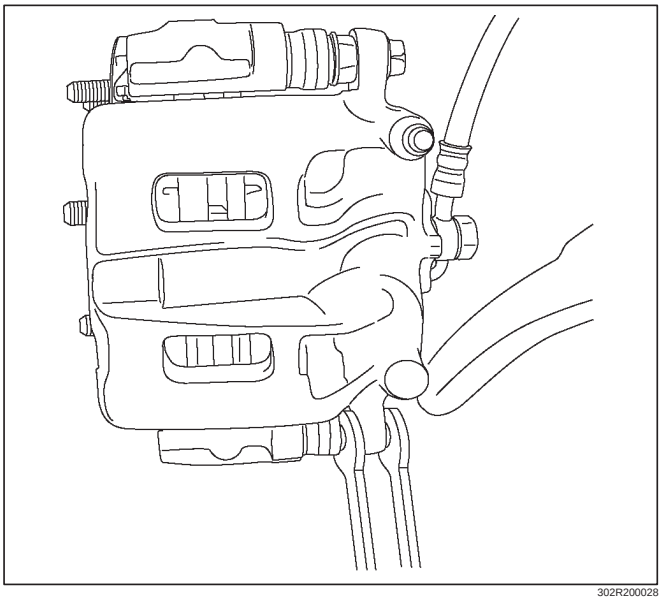
Removal

NOTE: If a squealing noise occurs from the front brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

▼ Draw out two–thirds of the brake fluid from the reservoir.

▼ Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
2. Remove pin bolt (1).

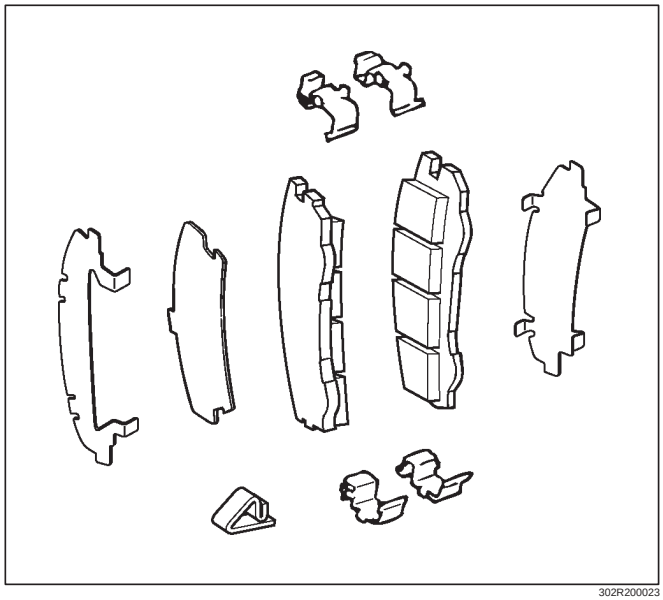


302R200028

3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove Clip.

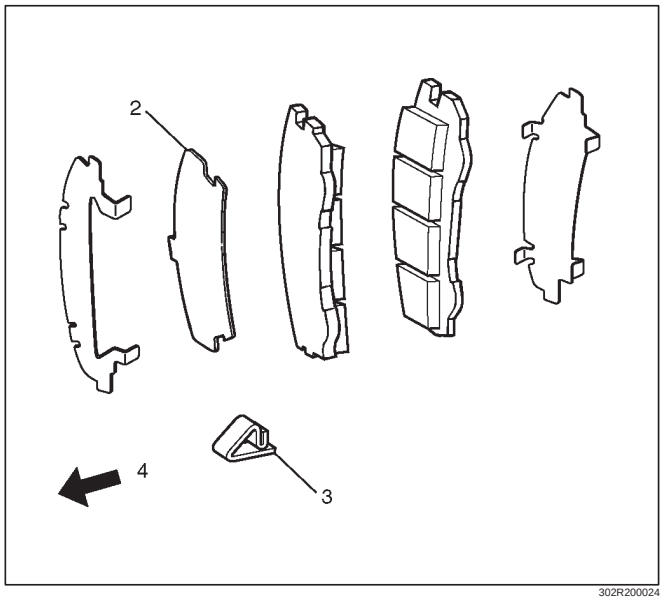
Installation

1. Install clip.



302R200023

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (2). Wipe off extruded grease after installing. Install pad assembly with shim.



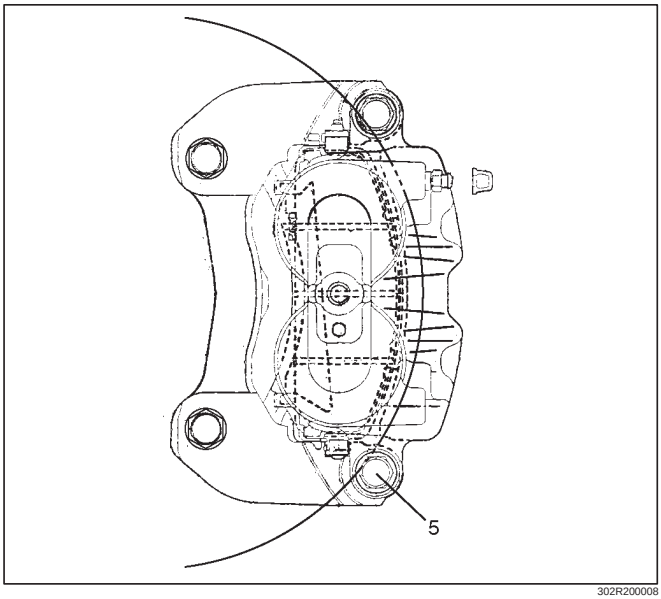
302R200024

Legend

(2) Inner Shim
(3) Wear Indicator
(4) Inner Side

3. Carefyully use adjustable pliers to bottom the piston into the caliper bore. Do not pull or twist the flexible hose or damage will occur.
   Install caliper assembly.
   Set caliper assembly in place.
4. Install lock bolt (5) and tighten the bolt to the specified torque.

   Torque: 45 N·m (33 lb ft)



302R200008

5. Install wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Front Disc Brake Rotor

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

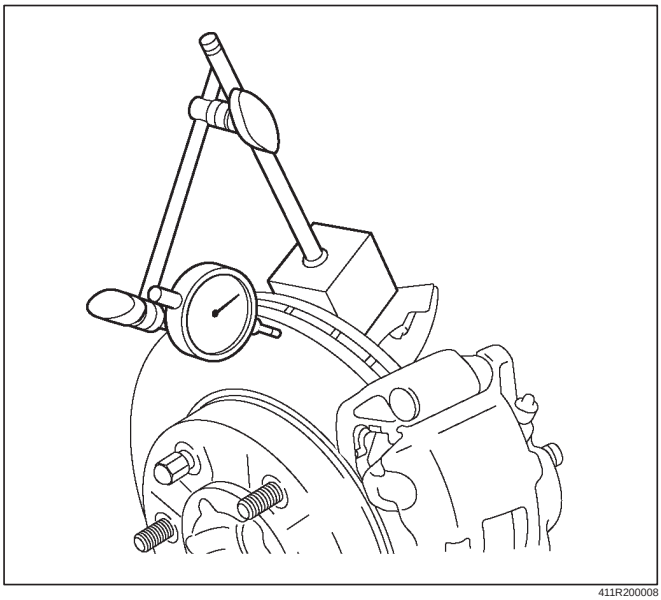
Lateral Runout

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to *Differential* in Section 4A.
2. Attach the dial indicator accordingly so that the stem contacts the rotor surface to approximately 29mm (1.14 in) from the rotor edge.
3. Rotate the rotor one complete turn and inspect for signs of lateral runout. Lateral runout should not exceed 0.13 mm (0.005 in).

Maximum runout: 0.13 mm (0.005 in)

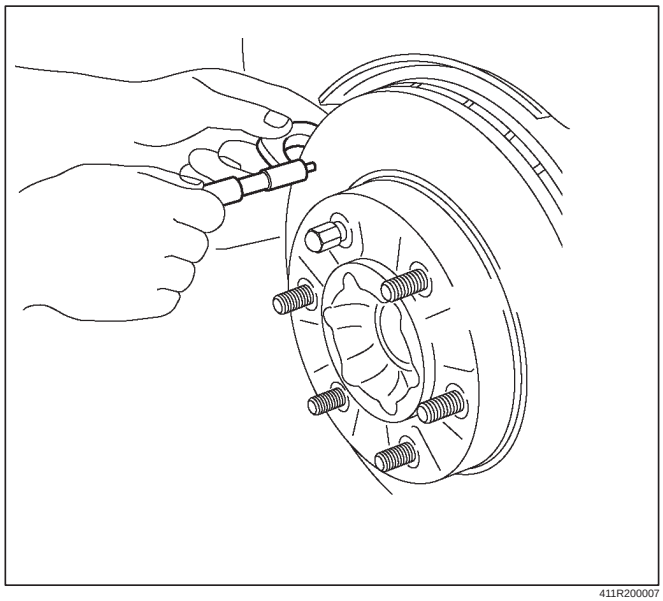


411R200008

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 29 mm (1.14 in) from the edge of the rotor.
The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum runout: 0.010 mm (0.0004 in)



411R200007

Replacing Brake Rotors

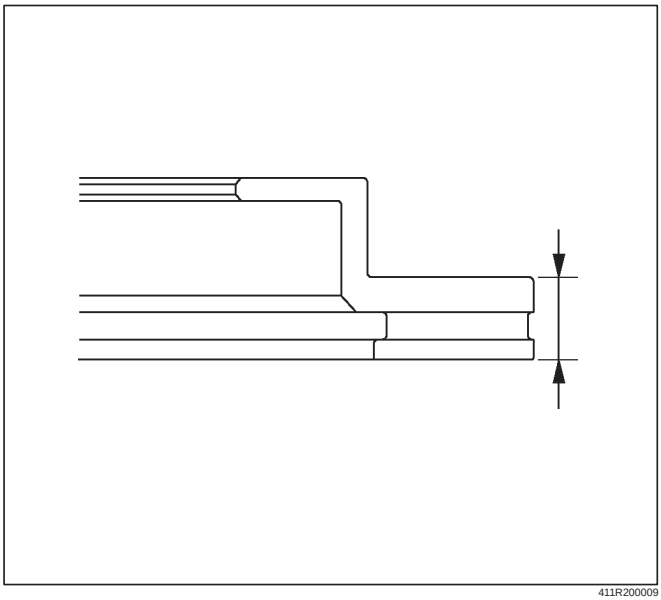
When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 24.60 mm (0.969 in). The minimum refinish dimension is 26.00 mm (1.024 in).
When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.
After refinishing, replace any rotor that does not meet the minimum thickness of 26.00 mm (1.024 in). Do not use a brake rotor that exceeds the manufacturers specifications.

Minimum wear dimension: 24.60 mm (1.024 in)

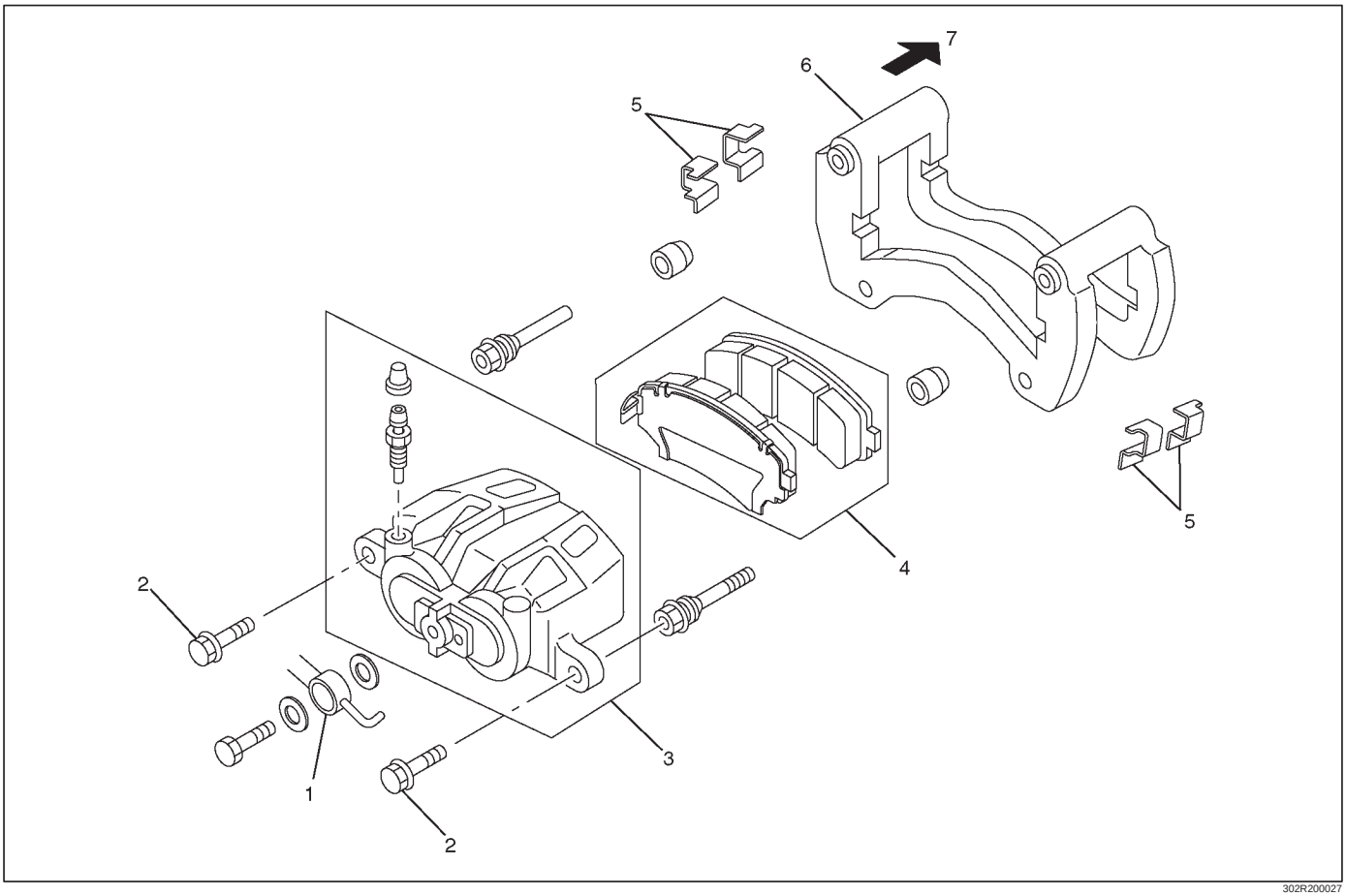
Refinish dimension: 26.00 mm (1.024 in)



411R200009

Front Disc Brake Caliper Assembly

Front Disc Brake Caliper Assembly and Associated Parts



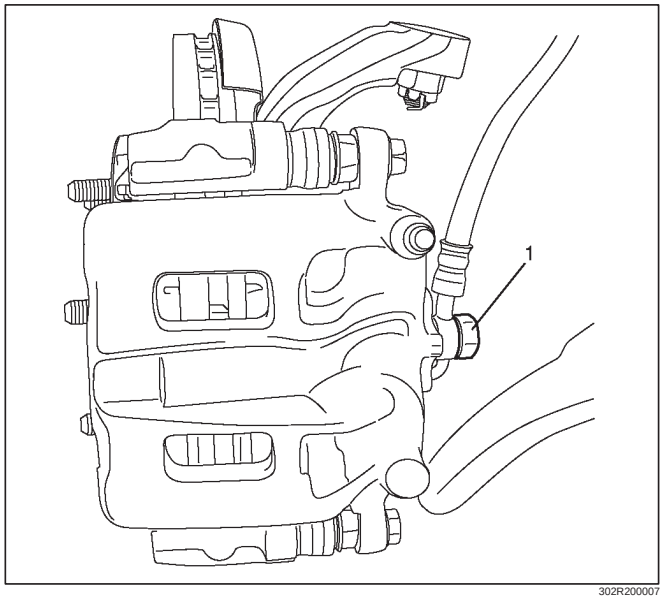
302R200027

Legend

(1) Brake Flexible Hose
(2) Pin Bolt
(3) Caliper Assembly
(4) Pad Assembly
(5) Clip
(6) Support Bracket with Pad Assembly
(7) Outer Side

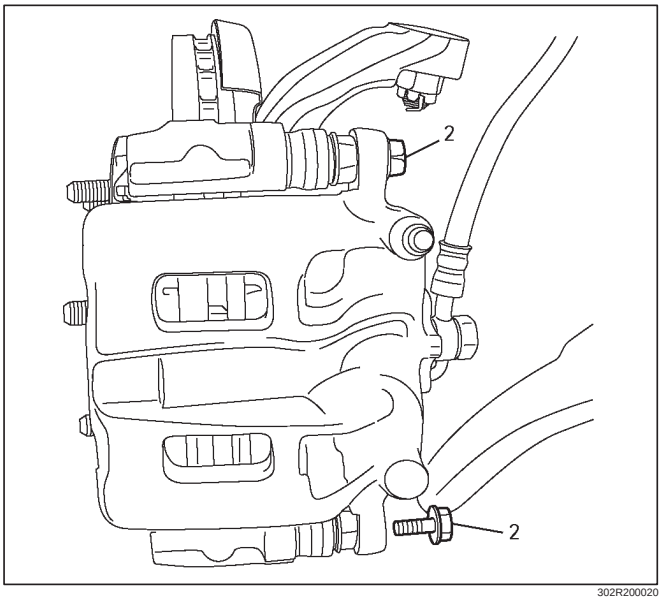
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly, refer to *Wheels and Tires System* in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



302R200007

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove pin bolt (2).

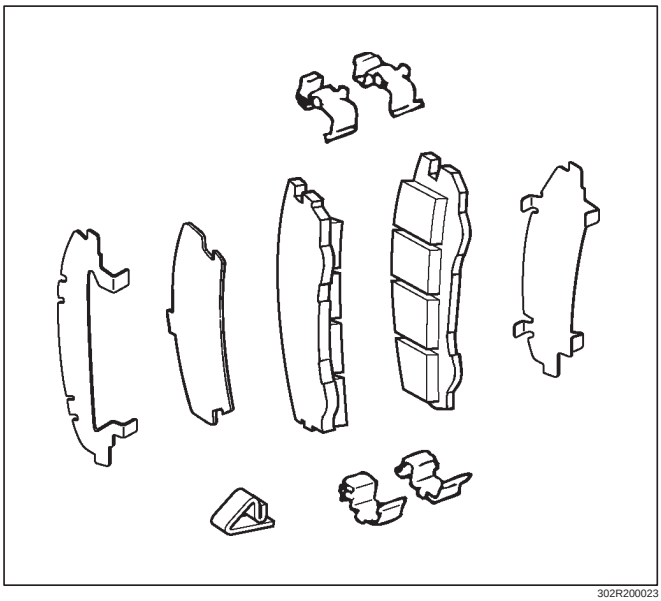


302R200020

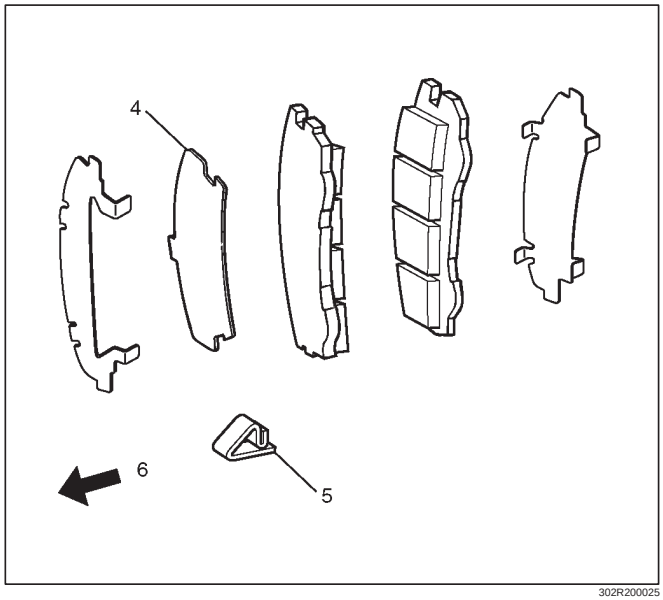
6. Remove caliper assembly.
7. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
8. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.
9. Remove clip.

Installation

1. Install clip.


302R200023

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (4). Wipe off extruded grease after installing. Install pad assembly with shim.



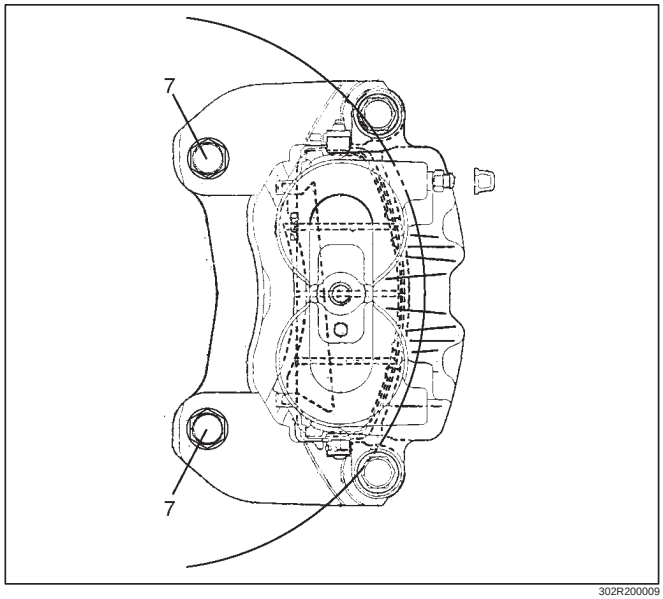
302R200025

Legend

(4) Inner Shim
(5) Wear Indicator
(6) Inner Side

3. Install support bracket and tighten the bolt (7) to the specified torque.

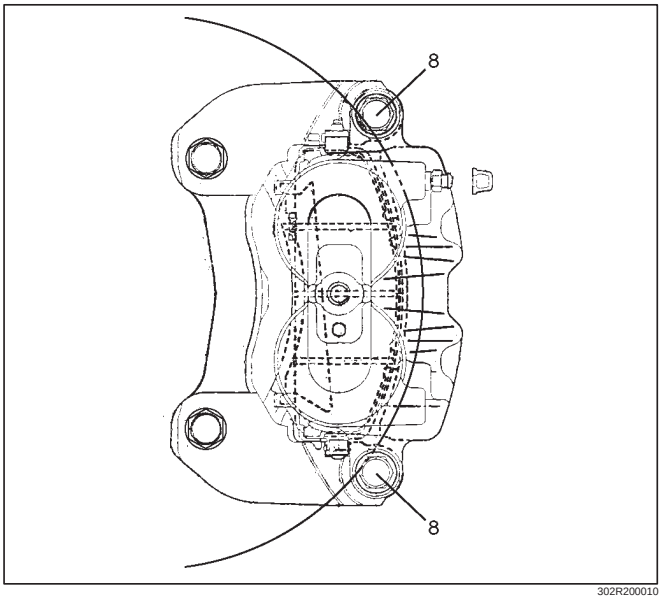
Torque: 155 N·m (115 lb ft)



302R200009

4. Install caliper assembly.
5. Install pin bolt (8) and tighten the bolt to the specified torque.

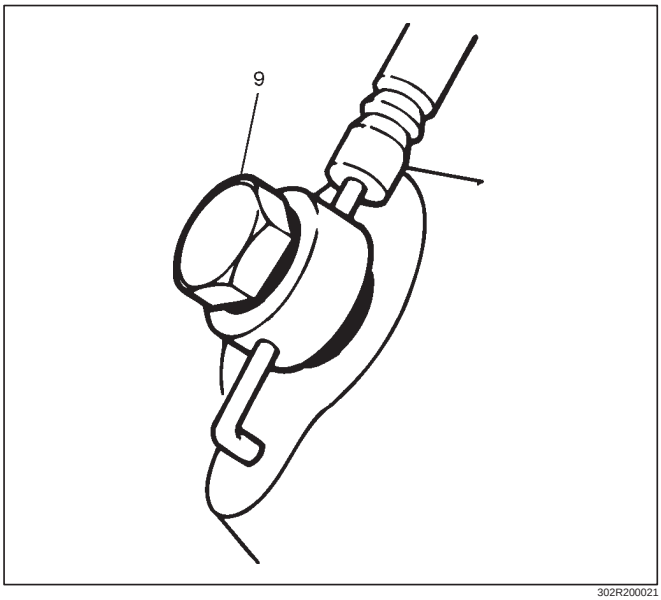
Torque: 45 N·m (33 lb ft)



302R200010

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the I–bolt (9) to the specified torque.

Torque: 35 N·m (26 lb ft)

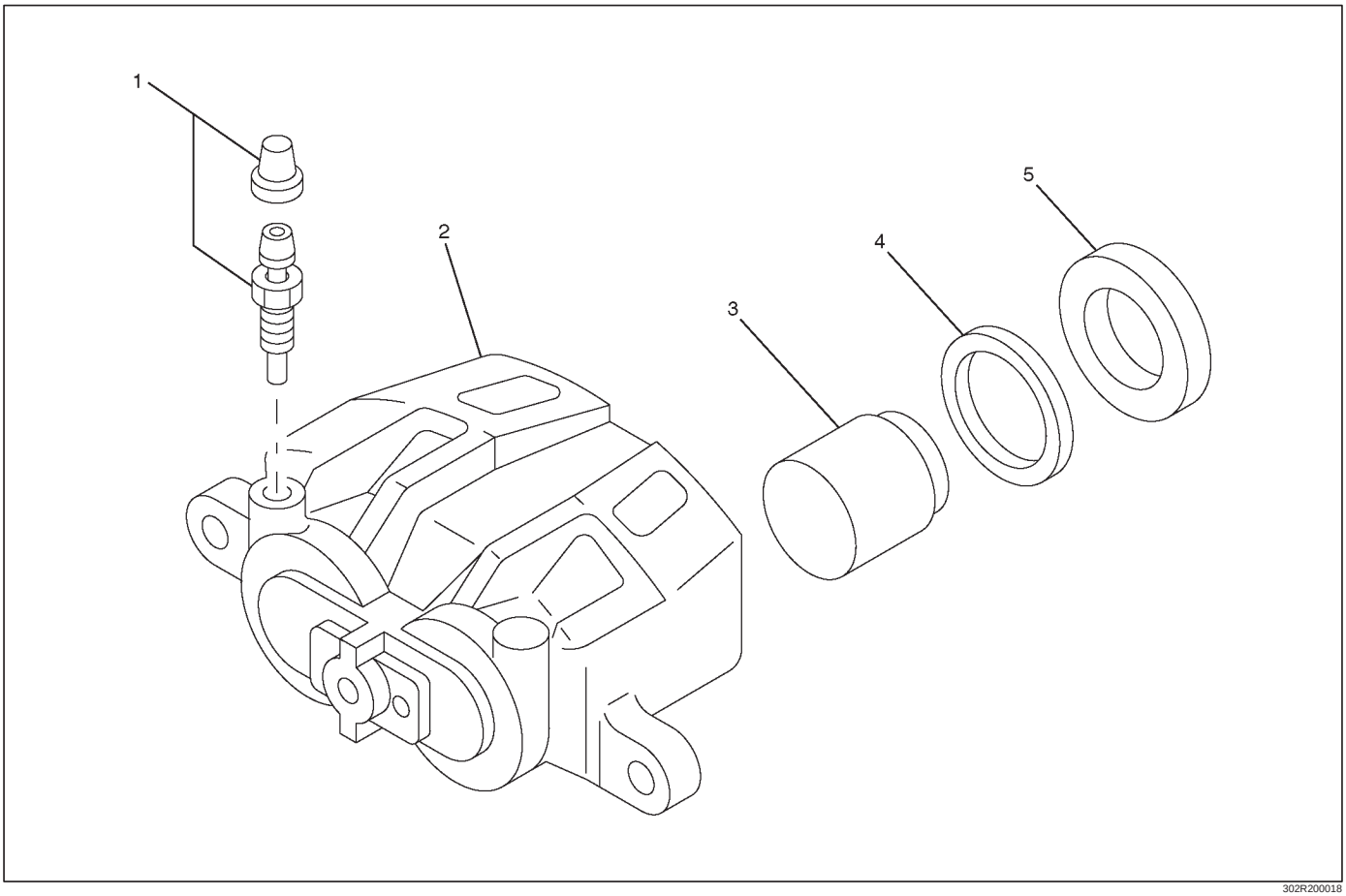


302R200021

7. Install wheel and tire assembly, referring to *Wheels and Tires System* in Section 3E.
8. Bleed brakes. Refer to *Hydraulic Brakes* in this section.

Front Disc Brake Caliper

Front Disc Brake Caliper Disassembled View



302R200018

Legend

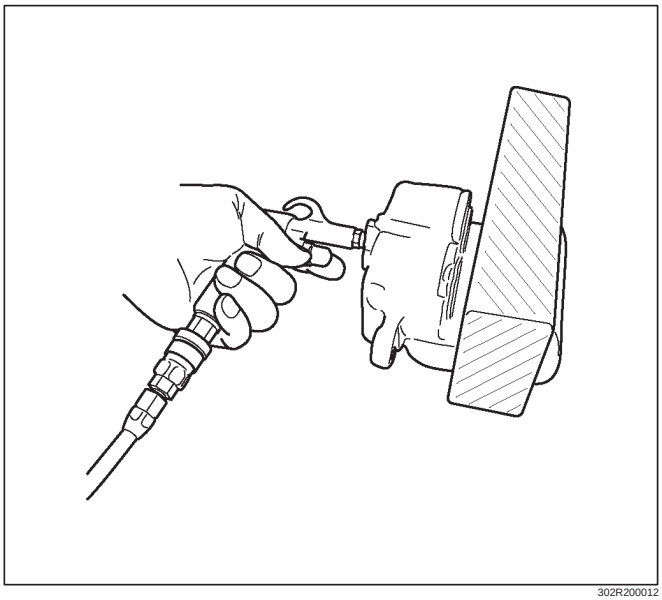
(1) Bleeder with Cap
(2) Caliper Body
(3) Piston
(4) Piston Seal
(5) Dust Boot: Piston

Disassembly

1. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.



302R200012

2. Remove dust boot: piston.
3. Remove piston seal.
4. Remove bleeder with cap.
5. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

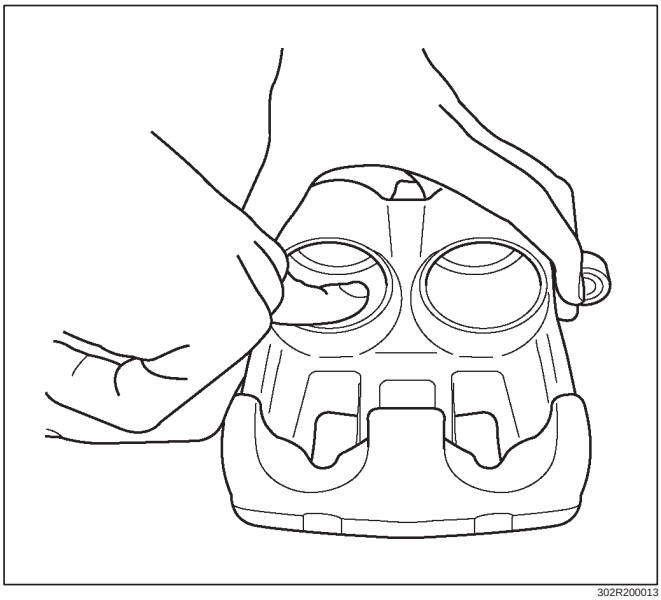
- ▼ Rotor
- ▼ Cylinder body
- ▼ Cylinder bore
- ▼ Piston
- ▼ Guide pin, lock pin
- ▼ Support bracket

NOTE: The piston seal, boot ring and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace them with new ones.

Reassembly

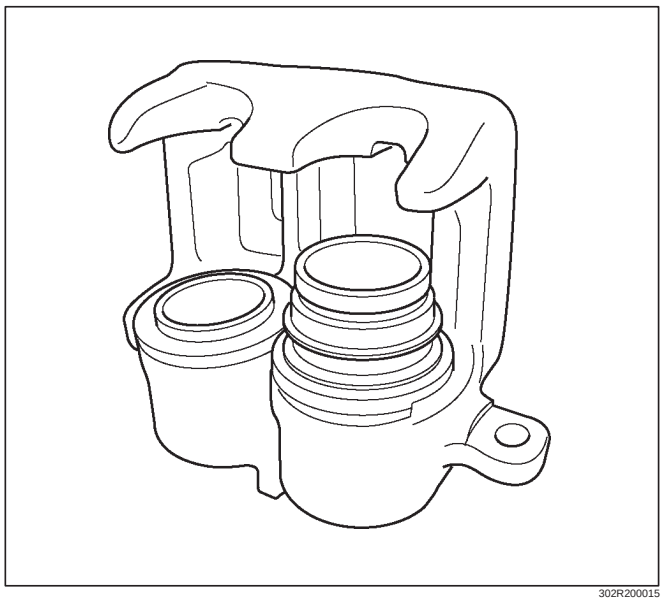
1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

   Torque: 8 N·m (69 lb in)
3. Apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



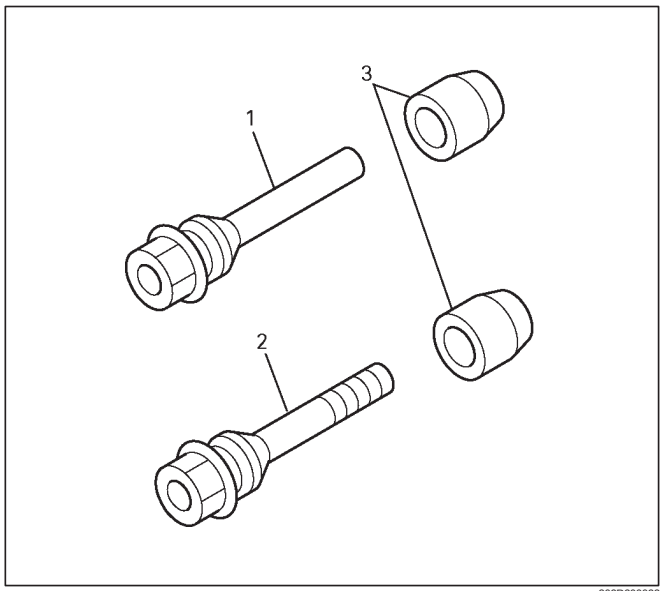
302R200013

4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.



302R200015

5. Apply special grease (approximately 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.
6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (approximately 1 g) onto the dust boot inner surface. Apply special grease onto the lock pin and guide pin setting hole of the support bracket.



302R200022

Legend

(1) Guide Pin
(2) Lock Pin
(3) Pin Boot

8. Install pin bolt and tighten the bolt to the specified torque.

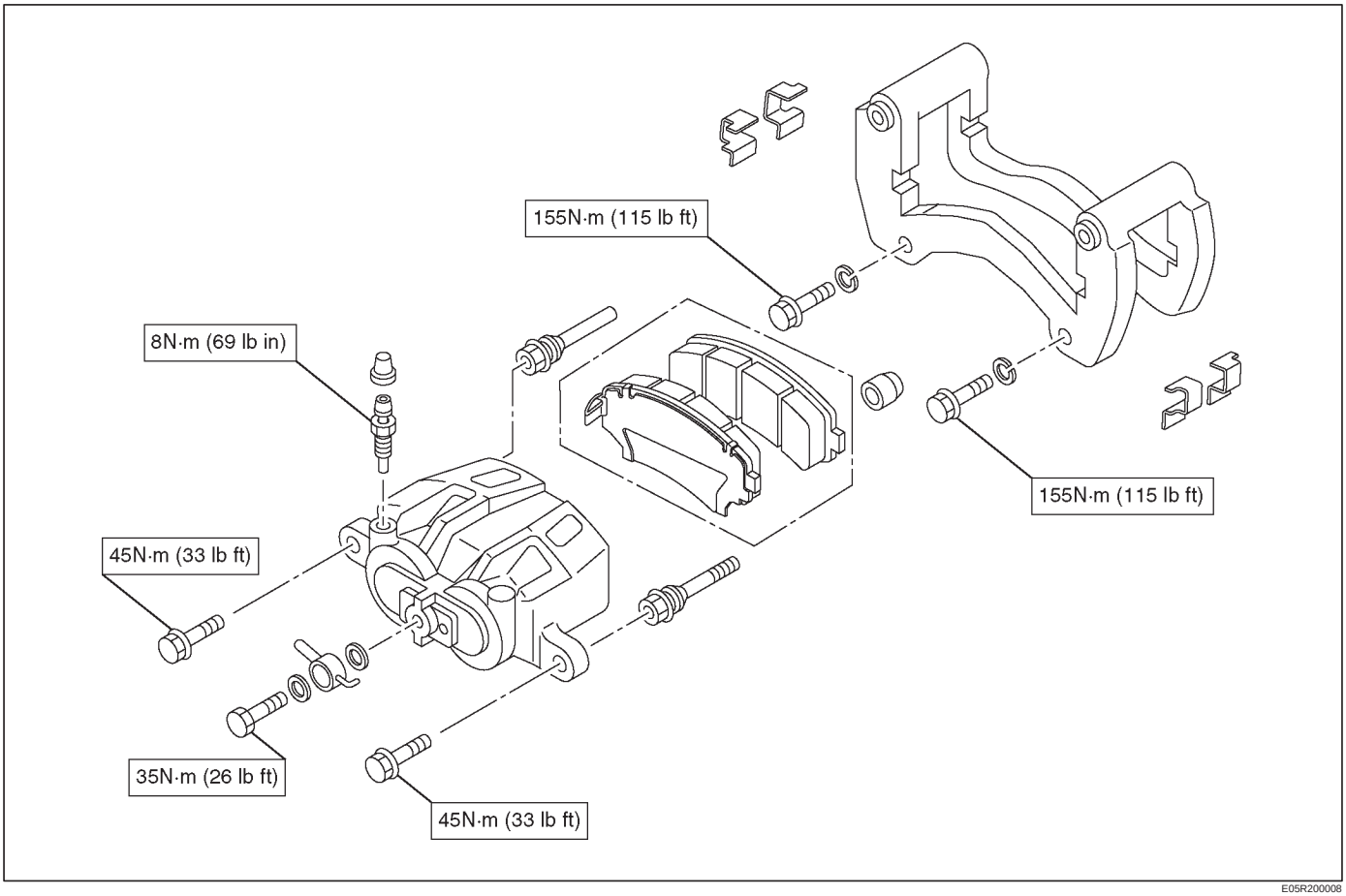
   Torque: 45 N·m (33 lb ft)

Main Data and Specifications

General Specifications

Type	Floating, pin slide
Pad dimension	48.7 cm^2 (7.55 in^2)
Adjusting method	Self–adjusting
Piston diameter	45.4 mm (1.79 in) ×2
Disc type	Ventilated
Disc thickness	26 mm (1.02 in)
Disc effective diameter	242 mm (9.53 in)

Torque Specifications



E05R200008

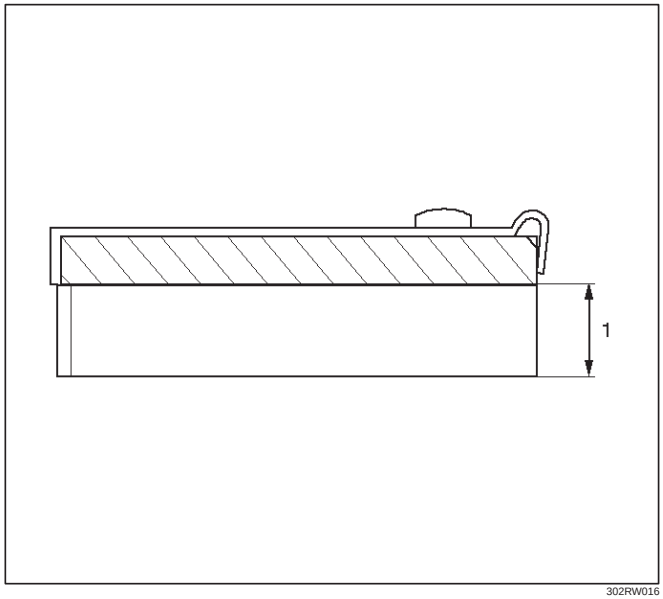
Rear Disc Brake Pads (4×4 Model)

Brake Pads Inspection

Check the outer pads by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.0 mm (0.039 in) of the pad itself.

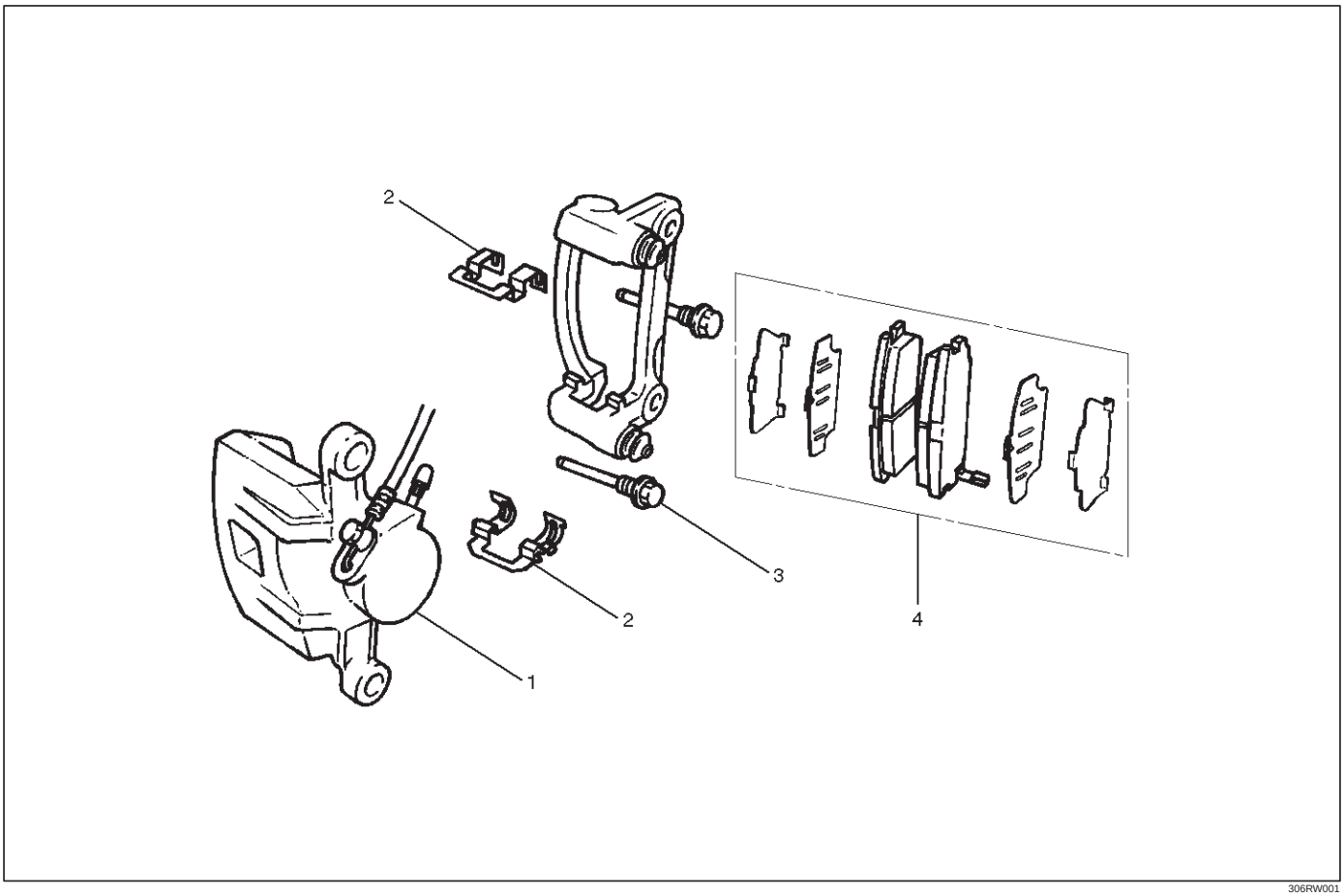
Wear indicators are installed on disc brake pads, disc brake pads need replacement when the wear indicator is heard.

Minimum limit (1): 1.0 mm (0.039 in)



302RW016

Brake Pads and Associated Parts



306RW001

Legend

(1) Caliper Assembly
(2) Clip
(3) Lock Bolt
(4) Pad Assembly

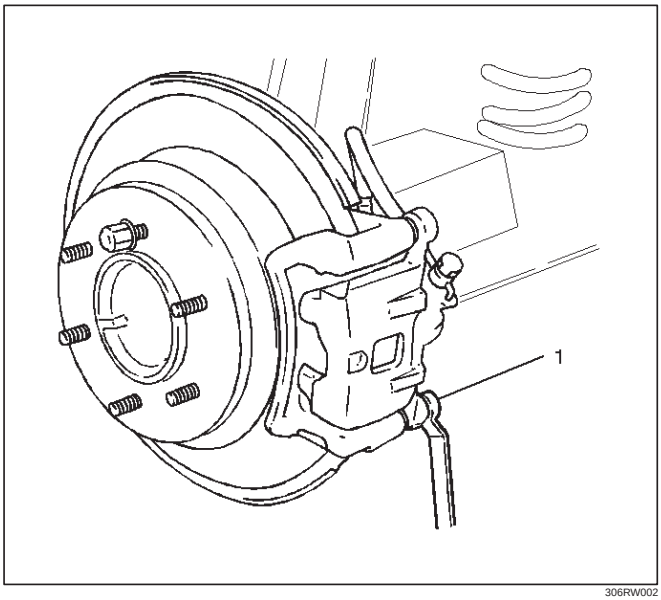
Removal

NOTE: If a squealing noise occurs from the rear brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

▼ Draw out two–thirds of the brake fluid from the reservoir.

▼ Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, referring to *Wheels and Tires System* in Section 3E.
2. Remove lock bolt (1)

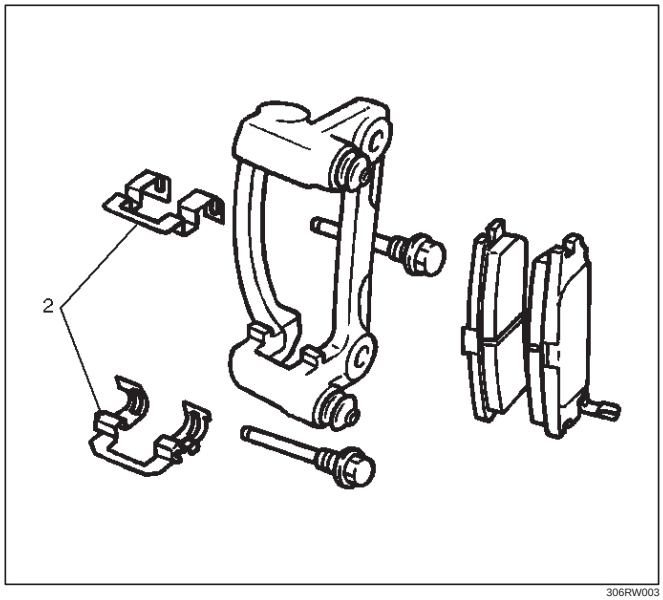


306RW002

3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove clip.

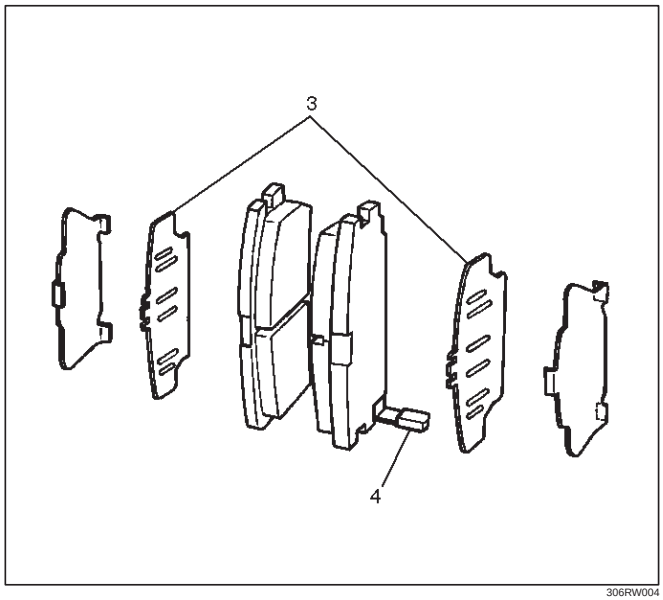
Installation

1. Install clip (2).



306RW003

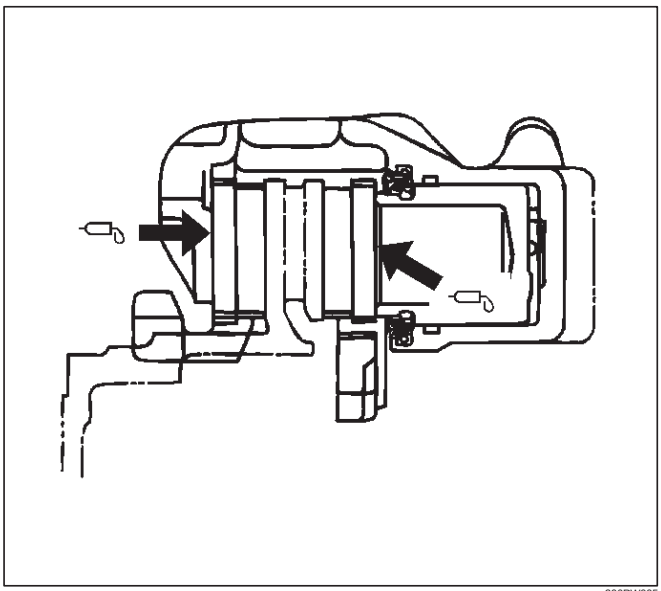
2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims. Wipe off extruded grease after installing. Install pad assembly with shim.



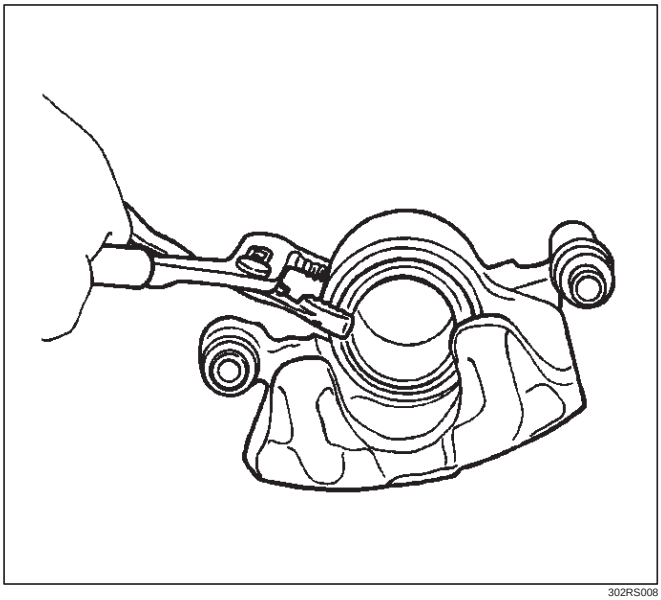
306RW004

Legend

(3) Inner Shim
(4) Wear Indicator

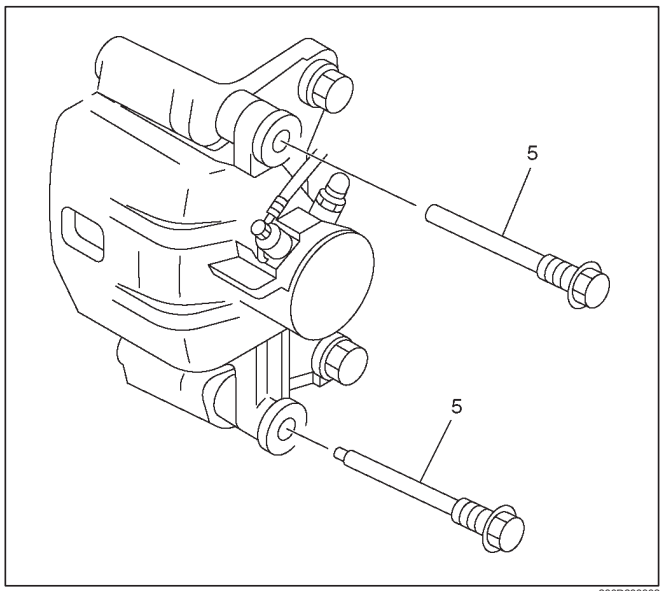

306RW005

3. Carefyully use adjustable pliers to bottom the piston into the caliper bore. Do not pull or twist the flex hose or damage will occur.


302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 44 N·m (32 lb ft)



306R200003

5. Install wheel and tire assembly, referring to *Wheels and Tires System* in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Rear Disc Brake Rotor (4×4 Model)

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

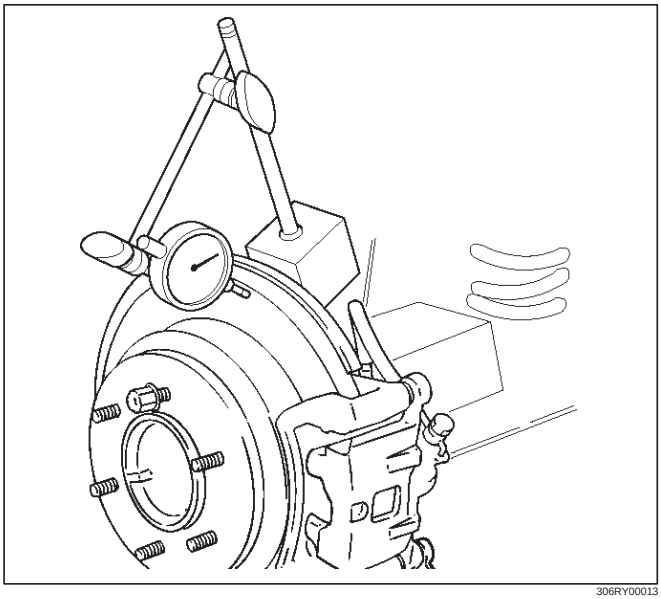
Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, referring to *Differential* in Section 4A.
2. Attach the dial indicator accordingly so that the stem contacts the rotor surface to approximately 29mm (1.14 in) from the rotor edge.
3. Rotate the rotor one complete turn and inspect for signs of lateral runout. Lateral runout should not exceed 0.13 mm (0.005 in).

1. The lateral runout should not exceed 0.13 mm (0.005 in)

Maximum runout: 0.13 mm (0.005 in)

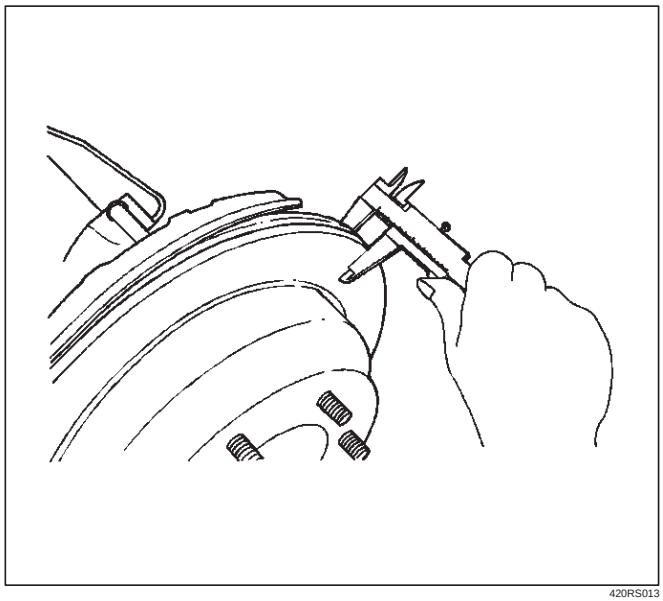


306RY00013

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 22 mm (0.87 in) from the edge of the rotor.
The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum parallelism: 0.010 mm (0.0004 in)



420RS013

Replacing Brake Rotors

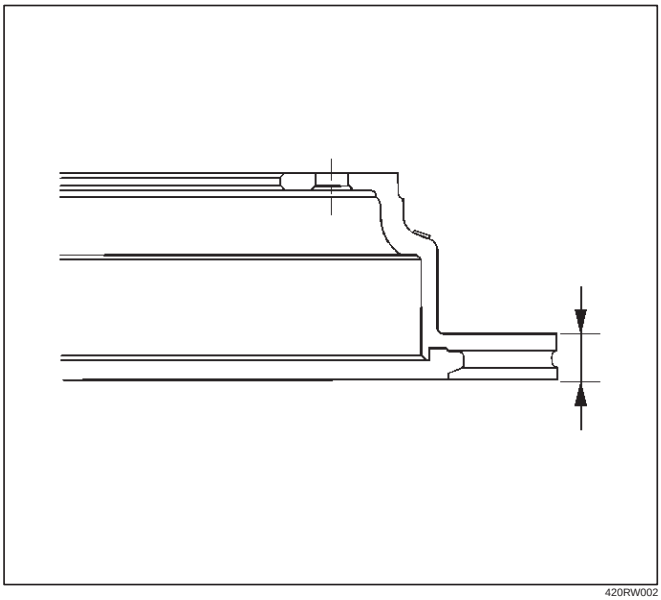
When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 16.6 mm (0.654 in). The minimum refinish dimension is 16.97 mm (0.668 in).
When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.
After refinishing, replace any rotor that does not meet the minimum thickness of 16.97 mm (0.668 in). Do not use a brake rotor that exceeds the manufacturers specifications.

Minimum wear dimension: 16.6 mm (0.654 in)

Refinish dimension: 16.97 mm (0.668 in)



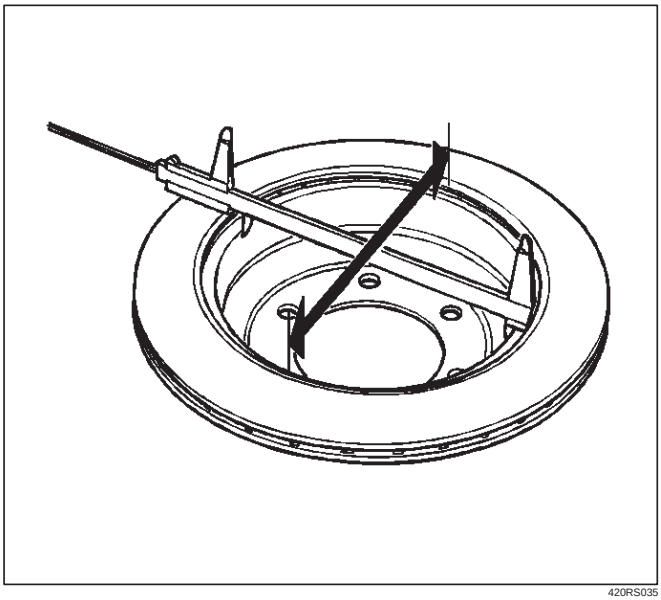
420RW002

Rear Drum (In Disc) Inside Diameter Check

Check the rear drum inside diameter by measuring at more than two portions as shown in the illustration.
If the inside diameter is greater than the limit, replace the rear rotor.

Standard: 210.0 mm (8.27 in)

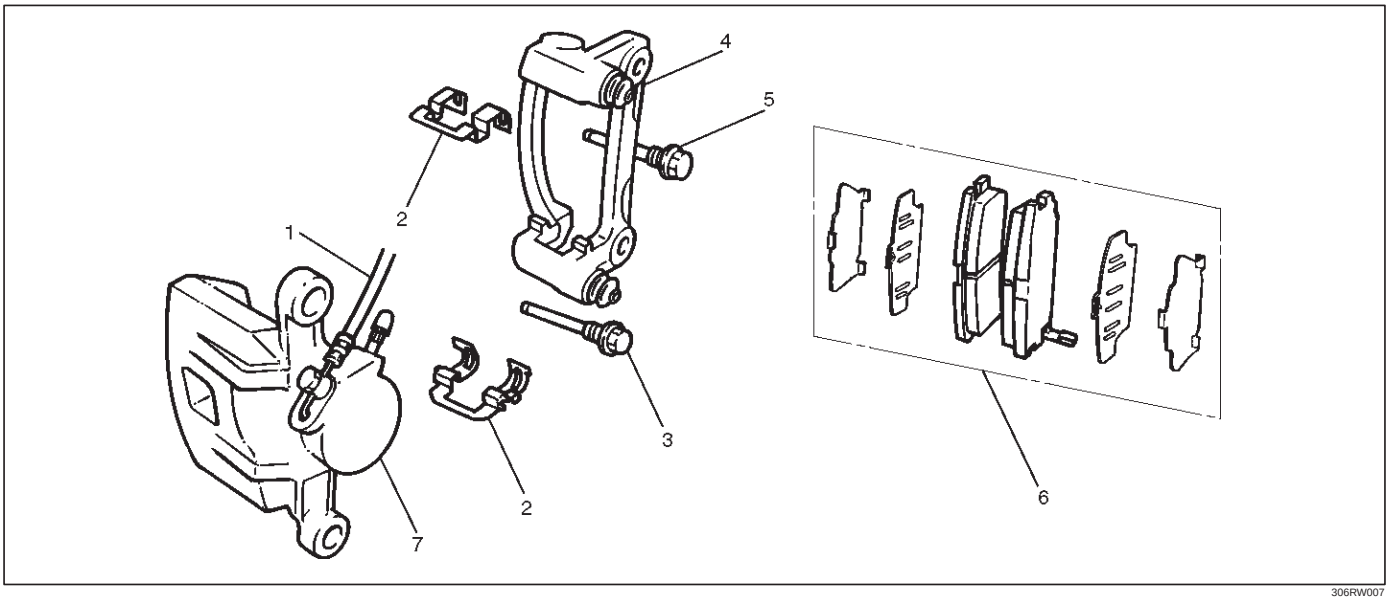
Limit: 211.4 mm (8.32 in)



420RS035

Rear Disc Brake Caliper Assembly (4×4 Model)

Rear Disc Brake Caliper Assembly and Associated Parts



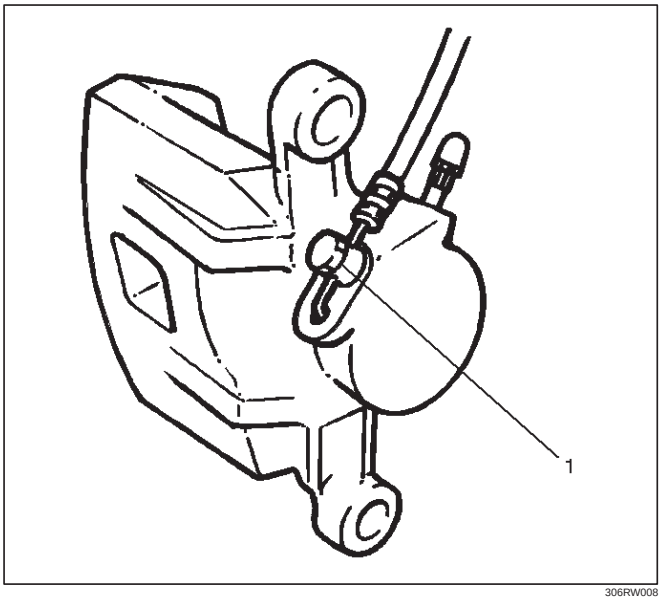
306RW007

Legend

(1) Brake Flexible Hose
(2) Clip
(3) Lock Bolt
(4) Support Bracket
(5) Guide Bolt
(6) Pad Assembly with Shim
(7) Caliper Assembly

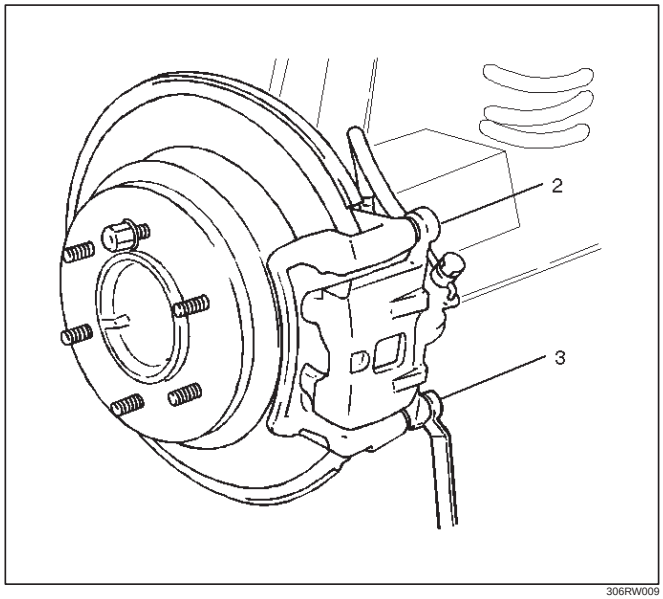
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly, referring to *Wheels and Tires System* in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



306RW008

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove lock bolt (3).
6. Remove guide bolt (2).



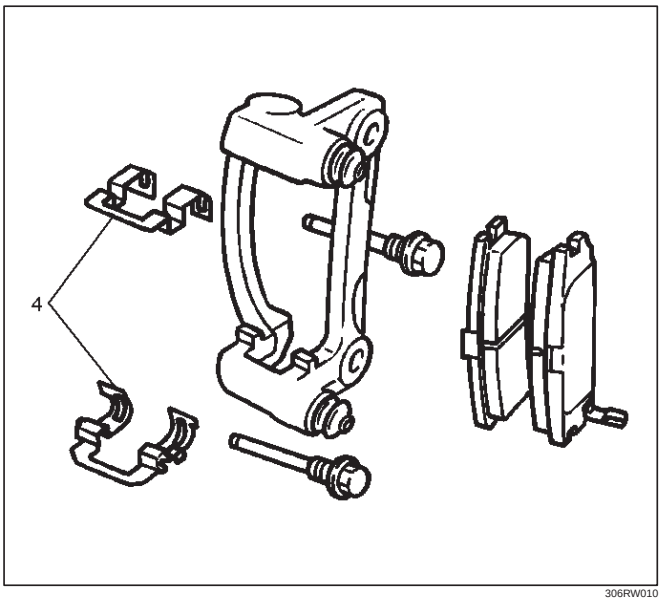
306RW009

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.

10. Remove clip.

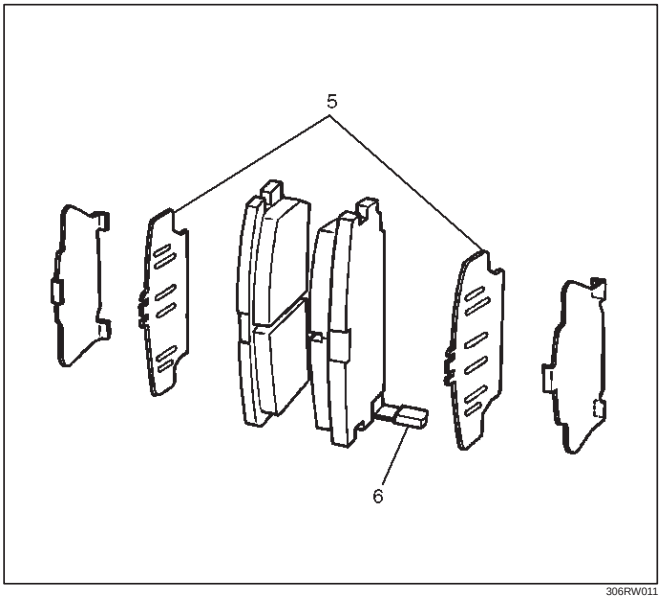
Installation

1. Install clip (4).



306RW010

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (5). Wipe off extruded grease after installing. Install pad assembly with shim.



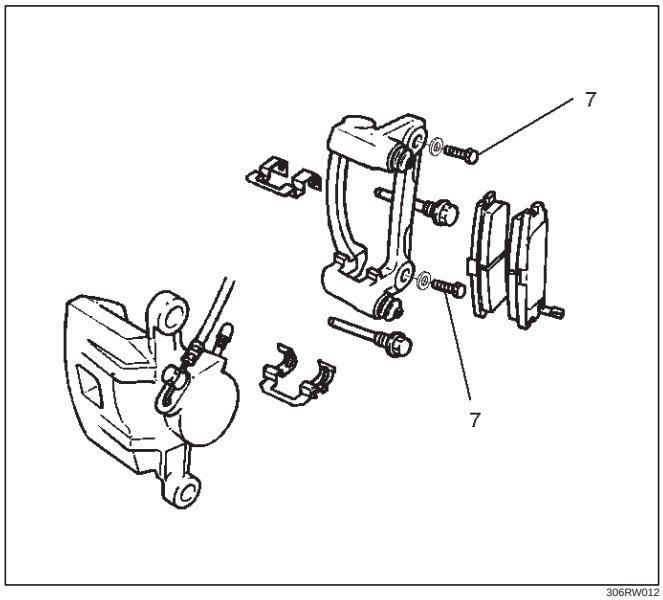
306RW011

Legend

(5) Inner Shim
(6) Wear indicator

3. Install support bracket and tighten the bolt (7) to the specified torque.

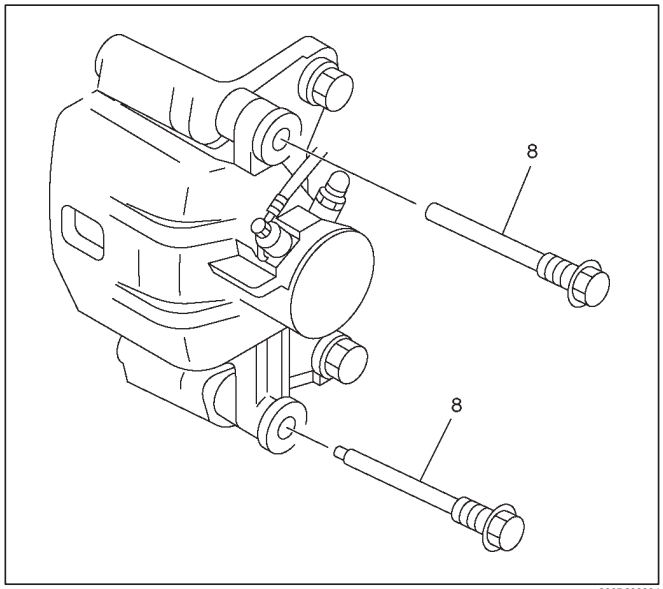
Torque: 103 N·m (76 lb ft)



306RW012

4. Install caliper assembly.
5. Install lock bolt and guide bolt (8) and tighten the bolt to the specified torque.

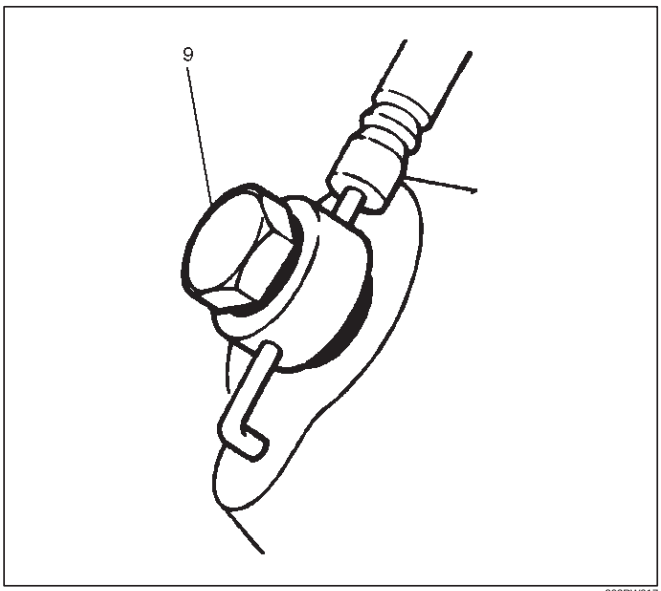
Torque: 44 N·m (32 lb ft)



306R200004

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the eye–bolt (9) to the specified torque.

Torque: 35 N·m (26 lb ft)

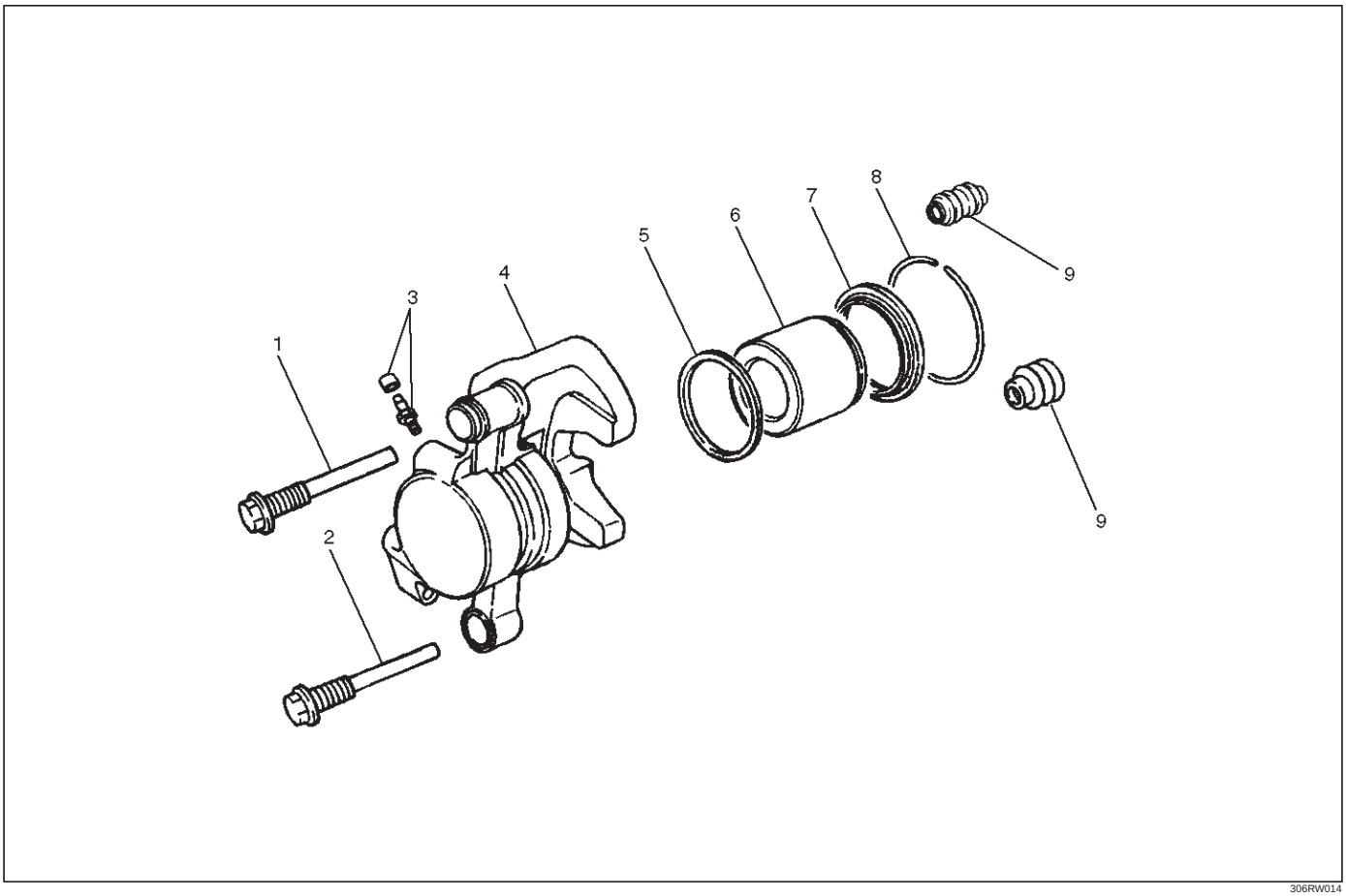


302RW017

7. Install the wheel and tire assembly, referring to *Wheels and Tires System* in Section 3E.
8. Bleed brakes. Refer to *Hydraulic Brakes* in this section.

Rear Disc Brake Caliper (4×4 Model)

Rear Disc Brake Caliper Disassembled View



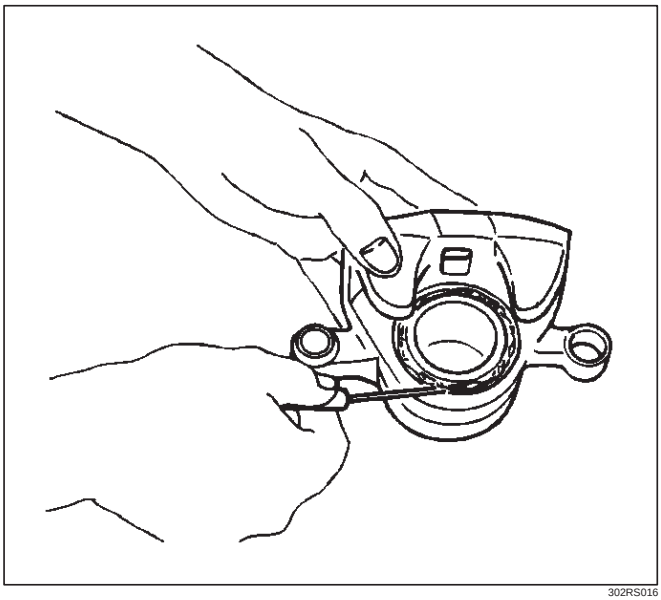
306RW014

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Piston Seal
(6) Piston
(7) Dust Boot: Piston
(8) Dust Boot Ring
(9) Dust Boot: Guide Bolt and Lock Bolt

Disassembly

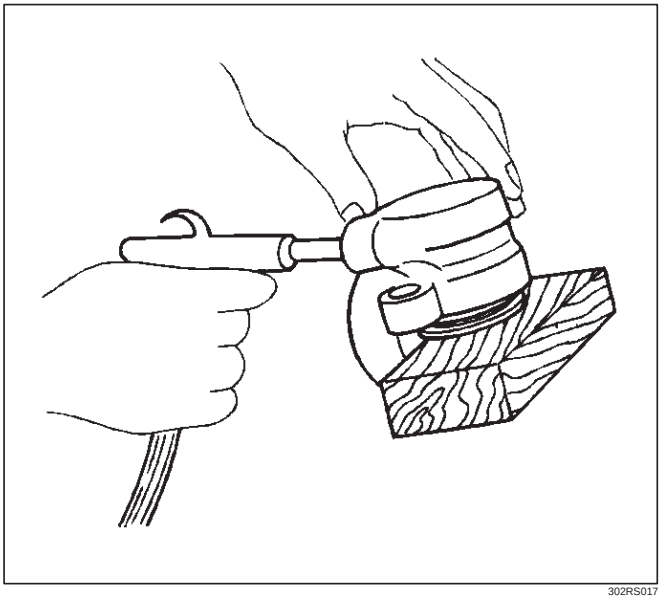
1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot; guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver.


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.


302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- ▼ Rotor
- ▼ Cylinder body
- ▼ Cylinder bore
- ▼ Piston
- ▼ Guide bolt, lock bolt
- ▼ Support bracket

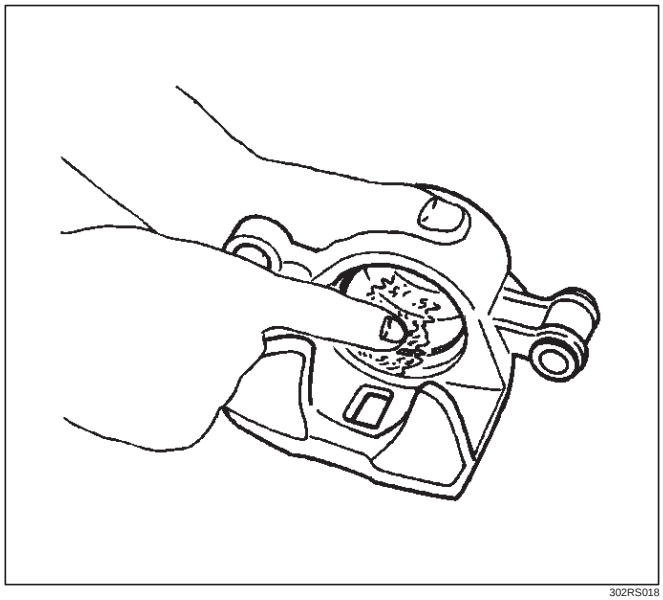
NOTE: The piston dust seal and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

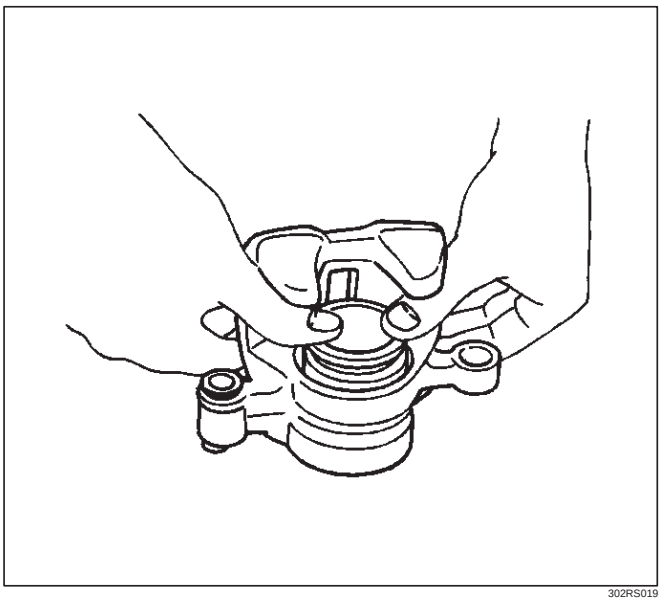
1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

   Torque: 8 N·m (69 lb ft)

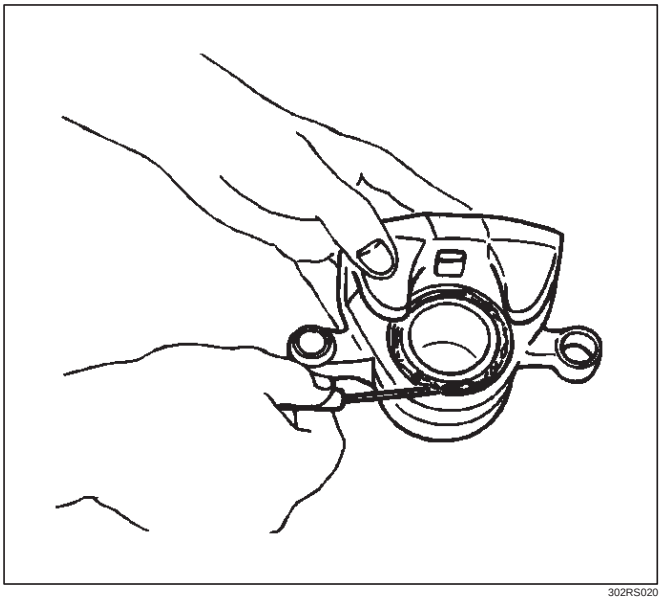
3. Install piston seal and apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.


302RS018

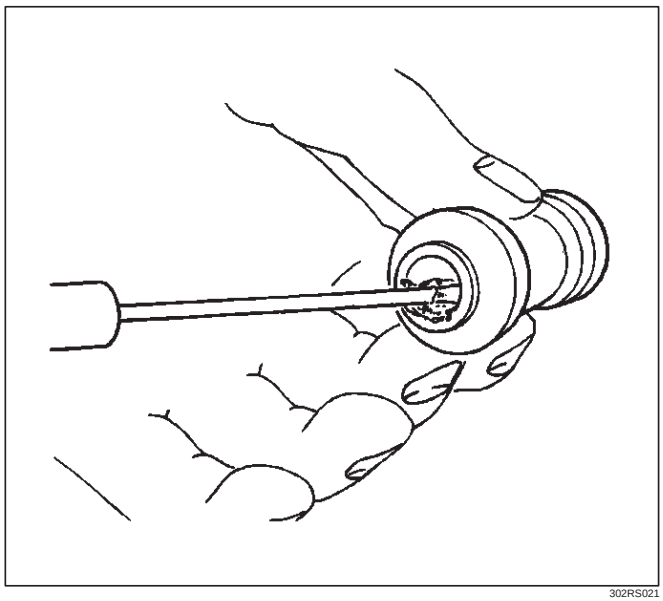
4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.


302RS019

5. Apply special grease (approximately 1g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.


302RS020

6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (Approx. 1g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.


302RS021

8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

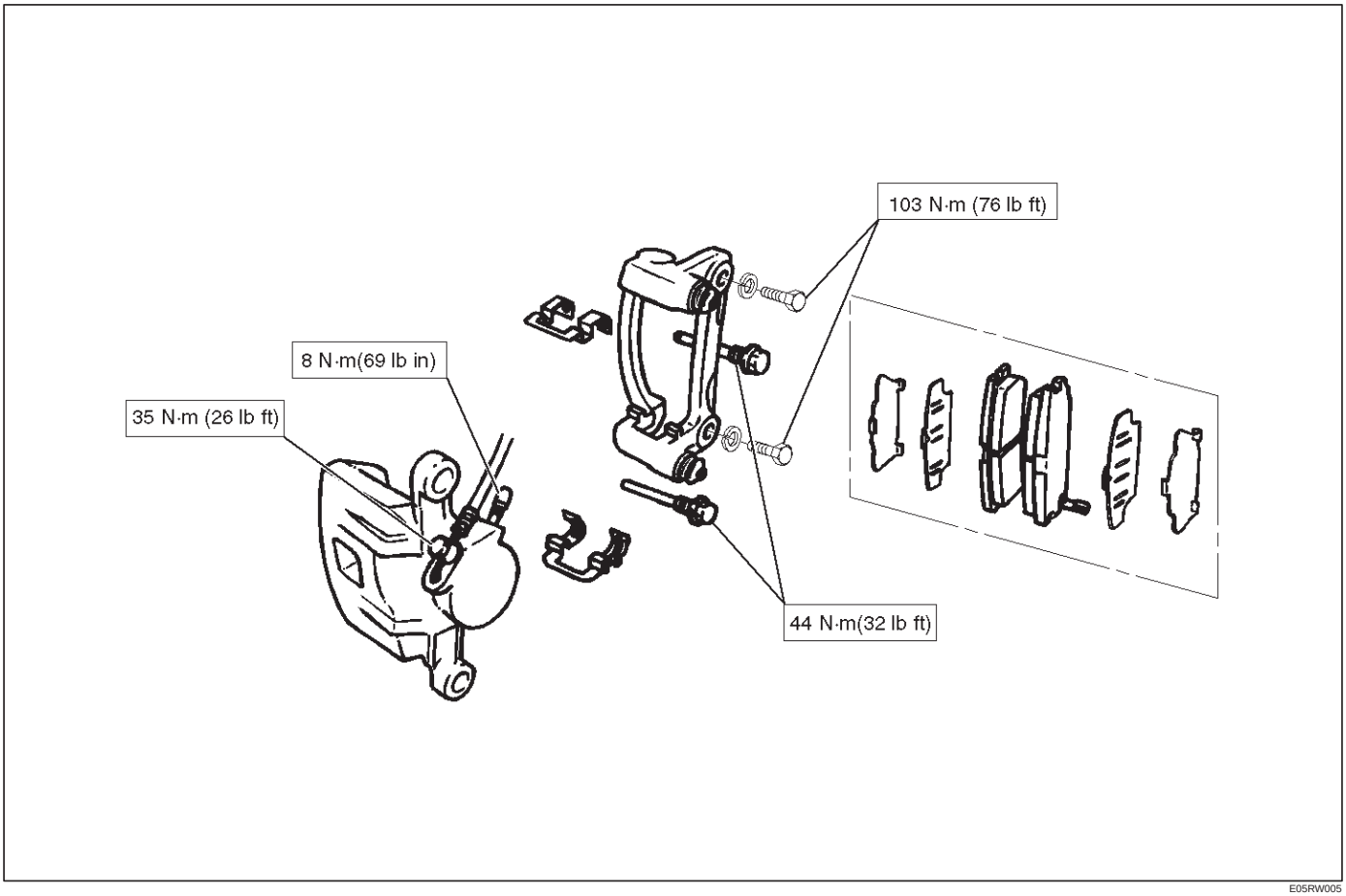
Torque: 44 N·m (32 lb ft)

Main Data and Specifications (4×4 Model)

General Specifications

Type	Floating, pin slide
Pad dimension	33 cm^2 (5.11 in^2)
Adjusting method	Self–adjusting
Piston diameter	41.3 mm (1.63 in)
Disc type	Ventilated
Disc thickness	18 mm (0.71 in)
Disc effective diameter	269.2 mm (10.60 in)

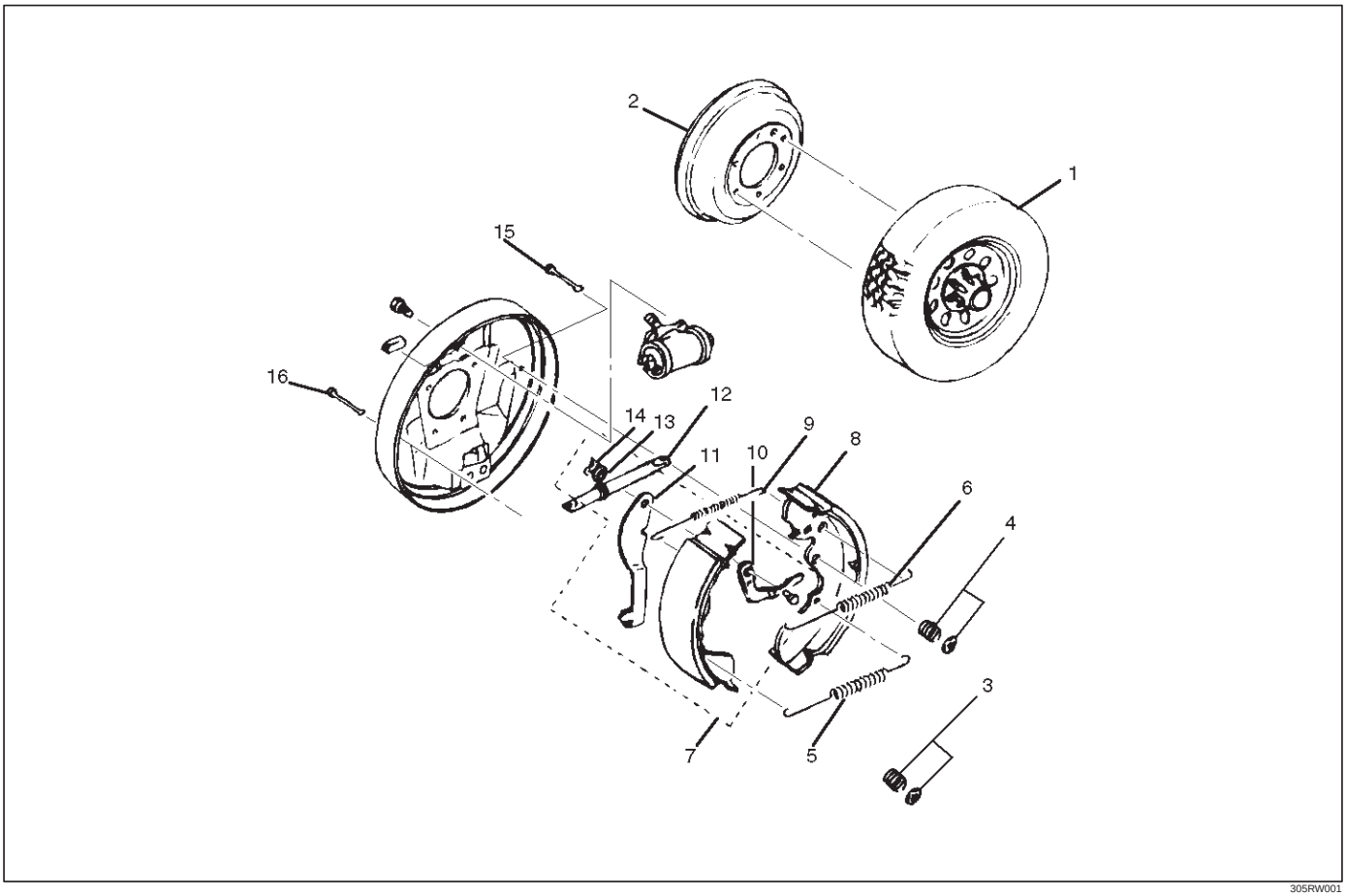
Torque Specifications



E05RW005

Brake Lining

Brake Lining and Associated Parts



305RW001

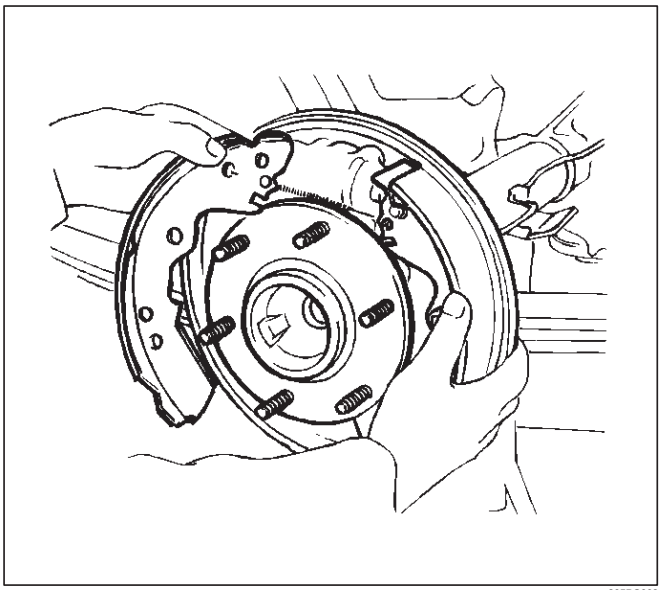
Legend

(1) Wheel and Tire Assembly
(2) Drum
(3) Hold-down Spring and Cup
(4) Hold-down Spring and Cups
(5) Lower Return Spring
(6) Upper (other) Return Spring
(7) Trailing Shoe Assembly with Parking Brake Lever
(8) Leading Shoe Assembly with Upper (inner) Return Spring
(9) Upper (inner) Return Spring
(10) Auto Adjuster Lever
(11) Parking Brake Lever
(12) Adjuster Assembly
(13) Wave Washer
(14) Retainer
(15) Hold-down Pin
(16) Hold-down Pin

Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly (1).
   ▼Refer to *Wheel and Tires* in Wheel and Tire System section.
3. Remove Drum (2).
   ▼If difficulty is encountered in removing the drum:
   – Mark the position of the drum to the axle.
   – Make sure the parking brake is released.
   – Use a rubber mallet to tap gently on the outer rim of the drum and/or around the inner drum. Be careful to avoid damaging the drum.
4. Remove upper (other) return spring (6) and auto adjuster lever.
5. Remove lower return spring (5).
6. Remove hold-down spring and cups (4) and hold-down pin (15).
7. Remove adjuster assembly (12)
8. Remove leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



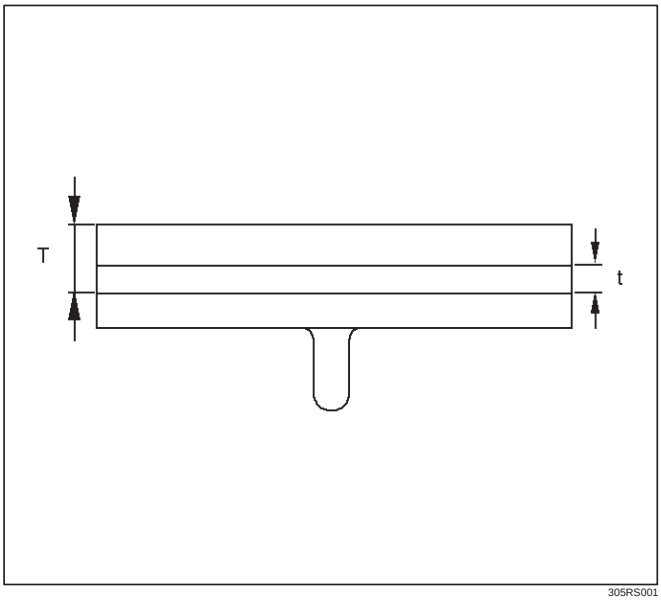
305RS003

9. Remove upper (inner) return spring (9).
10. Remove hold-down spring and cup (3) and hold-down pin (16).
11. Remove Trailing shoe assembly (7) with parking brake lever (16).
12. Remove parking brake cable from parking brake lever (11).
13. Remove retainer (14), wave washer (13), and parking brake lever (11).

Brake Lining Inspection

Check the shoe assemblies for wear by removing brake drum.
Replace the shoe assemblies, if lining thickness is less than 1.0 mm (0.039 in).
The shoe assemblies have a wear indicator that makes a noise when the linings wear to a degree where replacement is required.

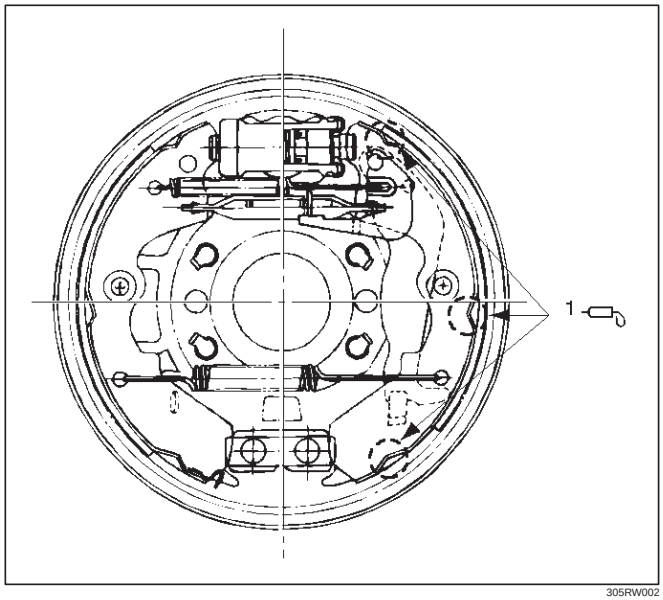
Minimum limit: 1.0 mm (0.039 in)



305RS001

Installation

1. Apply grease lightly to back place A.



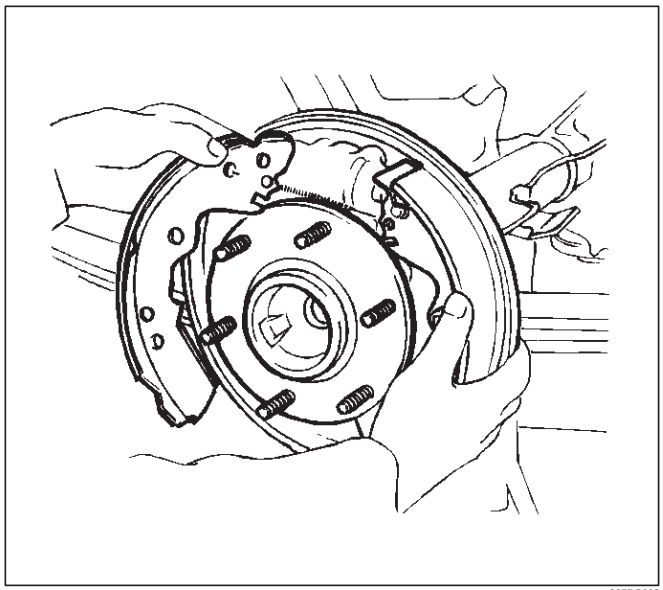
305RW002

Legend

(1) Place A (3 portions for each side)

2. Install parking brake lever (11), wave washer (13), and retainer (14).
3. Install trailing shoe assembly (7) with parking brake lever (16).
4. Install the parking brake cable to parking brake lever (11).
5. Install hold-down pin (16) and hold-down spring and cup (3).
6. Install upper (inner) return spring (9).
7. Install leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



305RS003

8. Install adjuster assembly (12).
9. Install hold-down pin (15) and hold-down spring and cups (4).
10. Install lower return spring (5).
    ▼Use brake spring tool.
11. Install auto adjuster lever (10).
12. Install upper (outer) return spring (6).
    ▼Use brake spring tool.
13. Install brake drum (2).
    ▼Adjust the brakes, refer to the *Drum Brake Adjustment* in this section.
14. Install wheel and tire assembly (1).
    ▼Refer to *Wheels and Tires* in wheel and Tire System section.

Drum Brake Adjustment (4×2 Model)

NOTE: All brakes are self-adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto adjuster, in the rear brake, produces a clicking sound.

The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

1. Move the parking brake handle to its fully released position.
2. Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.)
3. Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.
   If the difference between the brake drum inside diameter and diameter of the brake shoes is adjusted to be 0,5 mm, the number of times for depressing the brake pedal can be reduced.
4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.
   Shoe clearance: 0.25-0.4 mm (0.0098-0.0157 in)
   If incorrect, check the brake auto-adjusting system.
5. Rotate the adjust nut until all slack disappears from the cable. Set the adjust nut.
6. Applying about 30 kg (66 lb) of force, pull the parking brake handle to its fully set position three or four times.
7. If the parking brake is properly adjusted, the travel between the fully disengaged position and the fully engaged position will be between 9 and 11 notches.
   If the traveling range is not within these limits, again repeat steps 1 through 5.
   After adjusting has been done, check to see if the rear wheel rotates smoothly without drag when turned by hand.

Servicing The Brake Drum

Whenever the brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves and out-of-round.

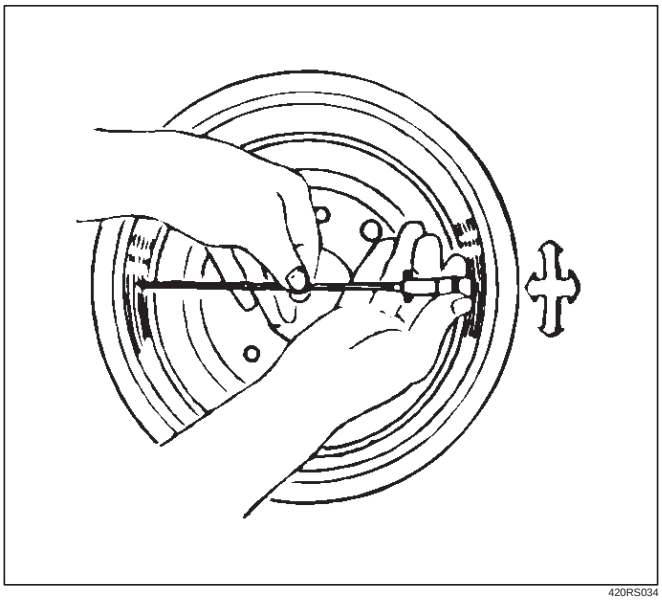
Cracked, Scored or Grooved Drum

A cracked drum is unsafe and must be replaced.
Do not attempt to weld a cracked drum.
Smooth any slight scores. Heavy or extensive scoring will cause excessive brake lining wear, and it will probably be necessary to machine the drum braking surface.
If the brake linings are slightly worn and the drum is grooved, the drum should be polished with fine emery cloth but should not be machined. At this stage, eliminating all the grooves in the drum and smoothing the ridges on the lining would require the removal of too much metal and lining. If left alone, the grooves and ridges match and satisfactory service can be obtained. If brake linings are to be replaced, a grooved drum should be machined. Using a grooved drum with new linings will create inefficient braking performance and cause the linings to wear quicker.

Out-Of-Round Drum

An out-of-round drum makes accurate brake shoe adjustment impossible and is likely to cause excessive wear to other parts of the brake mechanism due to its eccentric action. An out-of-round drum can also cause severe and irregular tire tread wear as well as a pulsing brake pedal. When the braking surface of a brake drum exceeds the specification limit of 0.15 mm (0.006 in) in out-of-round, the drum should be machined to true up the braking surface. Out-of-round can be accurately measured with an inside micrometer fitted with proper extension rods. When measuring a drum for out-of-round and wear, take measurements at the open and closed edges of machines surfaces and at right angles to each other.

Maximum out-of-round: 0.15 mm (0.006 in)



420RS034

Machining The Drum

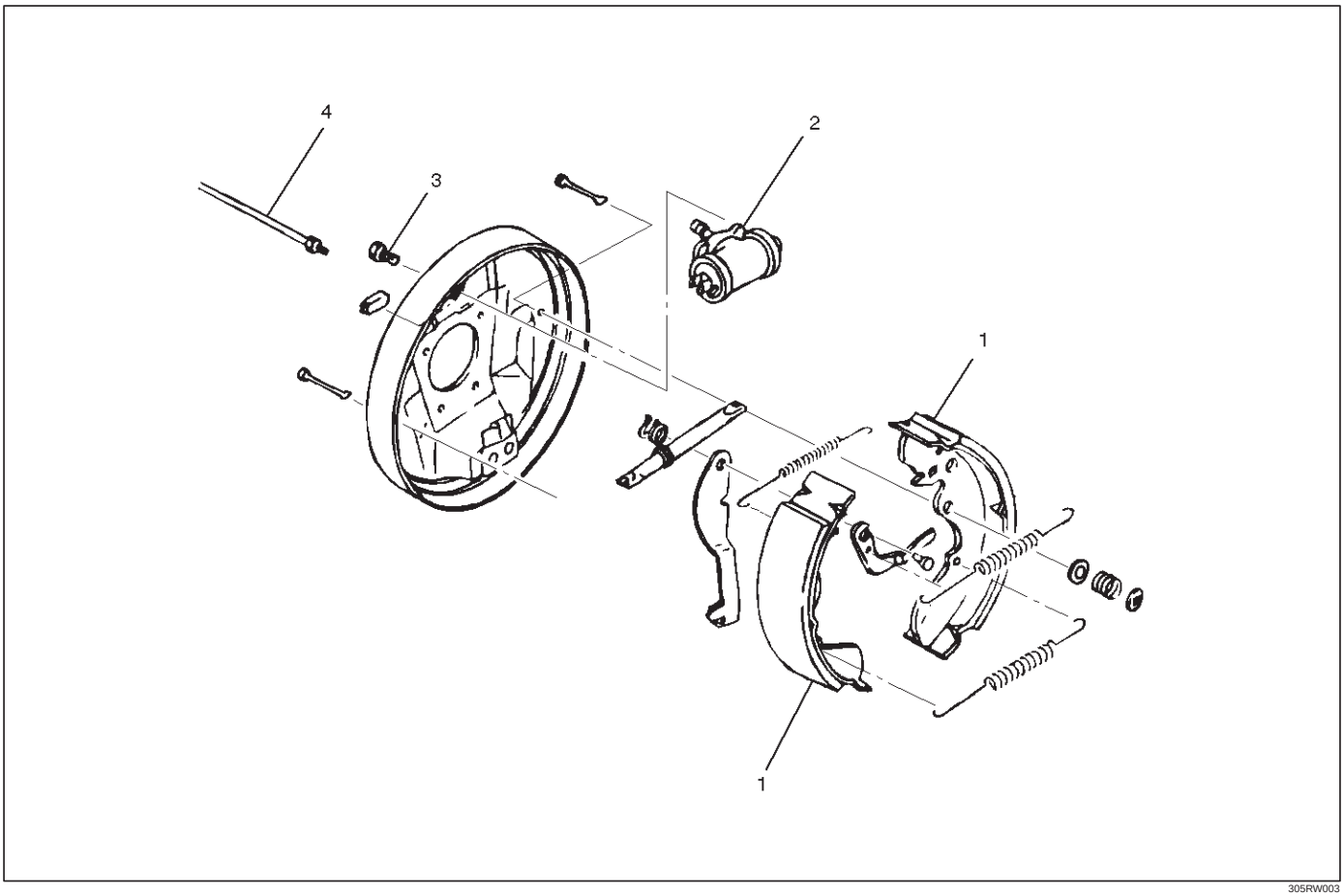
If a drum is to be machined, only enough metal should be removed to obtain a true, smooth braking surface. If a drum does not clean-up when machined to a maximum diameter, it must be replaced. Removal of more metal will affect dissipation of heat and may cause distortion of the drum.

After refinishing, replace any drum that exceeds a maximum inside diameter of 296.5 mm (11.673 in). Do not use a brake drum that is not within the specification.

Maximum inside diameter: 296.5 mm (11.673 in)

Wheel Cylinder Assembly (4×2 Model)

Wheel Cylinder Assembly and Associated Parts



305RW003

Legend

(1) Brake Linings
(2) Wheel Cylinder
(3) Bolts
(4) Brake Pipe

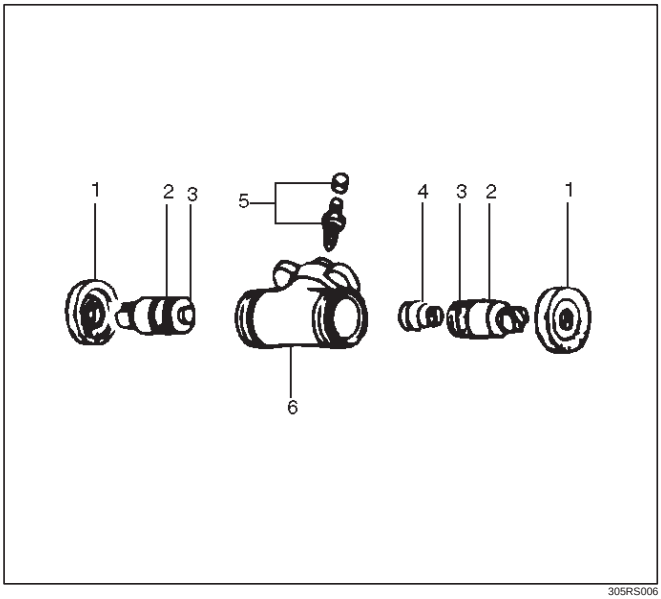
Removal

1. Remove brake linings (1).
   ▼Refer to *Brake Lining and Associated Parts* in this section.
2. Remove brake pipe (4).
   ▼Plug the opening in the line to prevent fluid loss and contamination.
3. Remove bolts (3) and wheel cylinder (2).

Installation

1. Install wheel cylinder (2) and tighten bolts (3) to the specified torque.
   Torque: 10 N·m (8 lb ft)
2. Install brake pipe (4) and tighten the nut to the specified torque.
   Torque: 16 N·m (12 lb ft)
3. Install brake linings (1).
   ▼Refer to *Brake Lining Replacement* in this section.
   ▼Bleed brake system. Refer to *Hydraulic Brake* in this section.

Disassembled View



305RS006

Legend

(1) Boot
(2) Piston Assembly
(3) Piston Cup
(4) Return Spring
(5) Bleeder
(6) Wheel Cylinder

Disassembly

1. Remove boot (1) and piston assembly (2).
2. Remove piston cup (3) from piston assembly (2).
3. Remove return spring (4) and bleeder (5) from wheel cylinder (6).

Inspection and Repair

1. Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
   Check the following parts;
   ▼Wheel cylinder body
   ▼Cylinder bore
   ▼Piston
   ▼Return spring
   ▼Bleeder

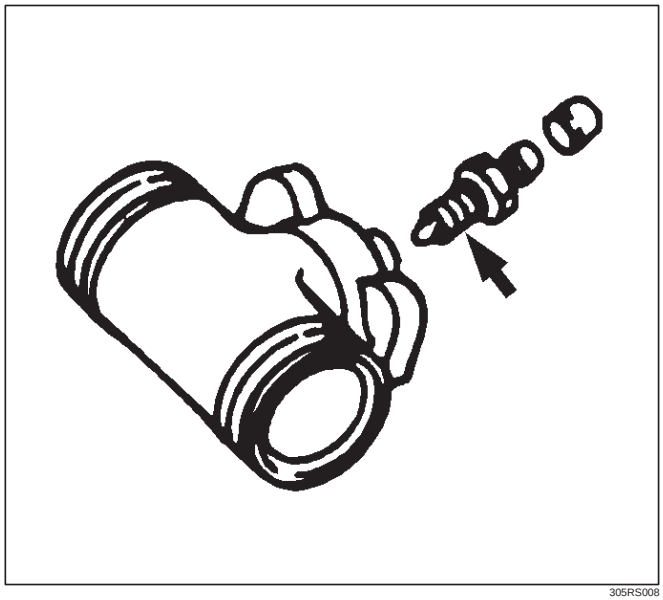
NOTE: Replace the piston cups and boots each time the wheel cylinder is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

1. Lubricate the cylinder bore with clean rubber grease.

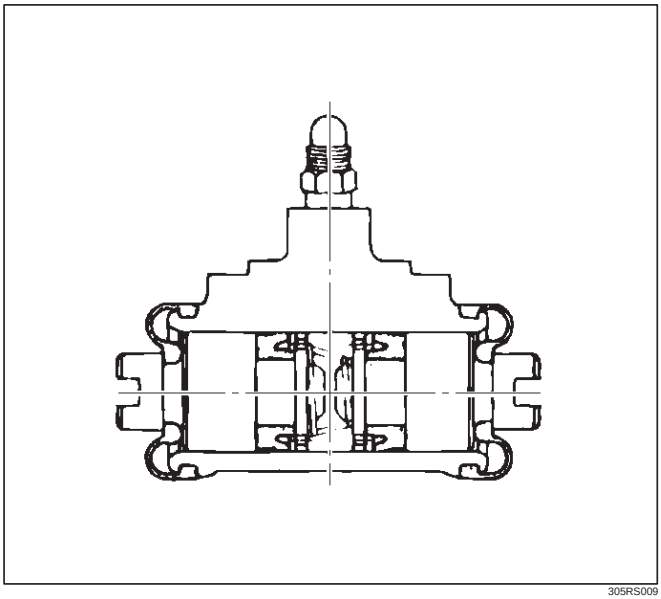
305RS007

2. Install bleeder (5) to wheel cylinder (6).
   Torque: 10 N·m (8 lb ft)



305RS008

3. Install new piston cups (3) on each piston so that the flared end of the cups are turned to the inboard side of the pistons.
   Attach the return spring (4) and the boot (1) to the piston.



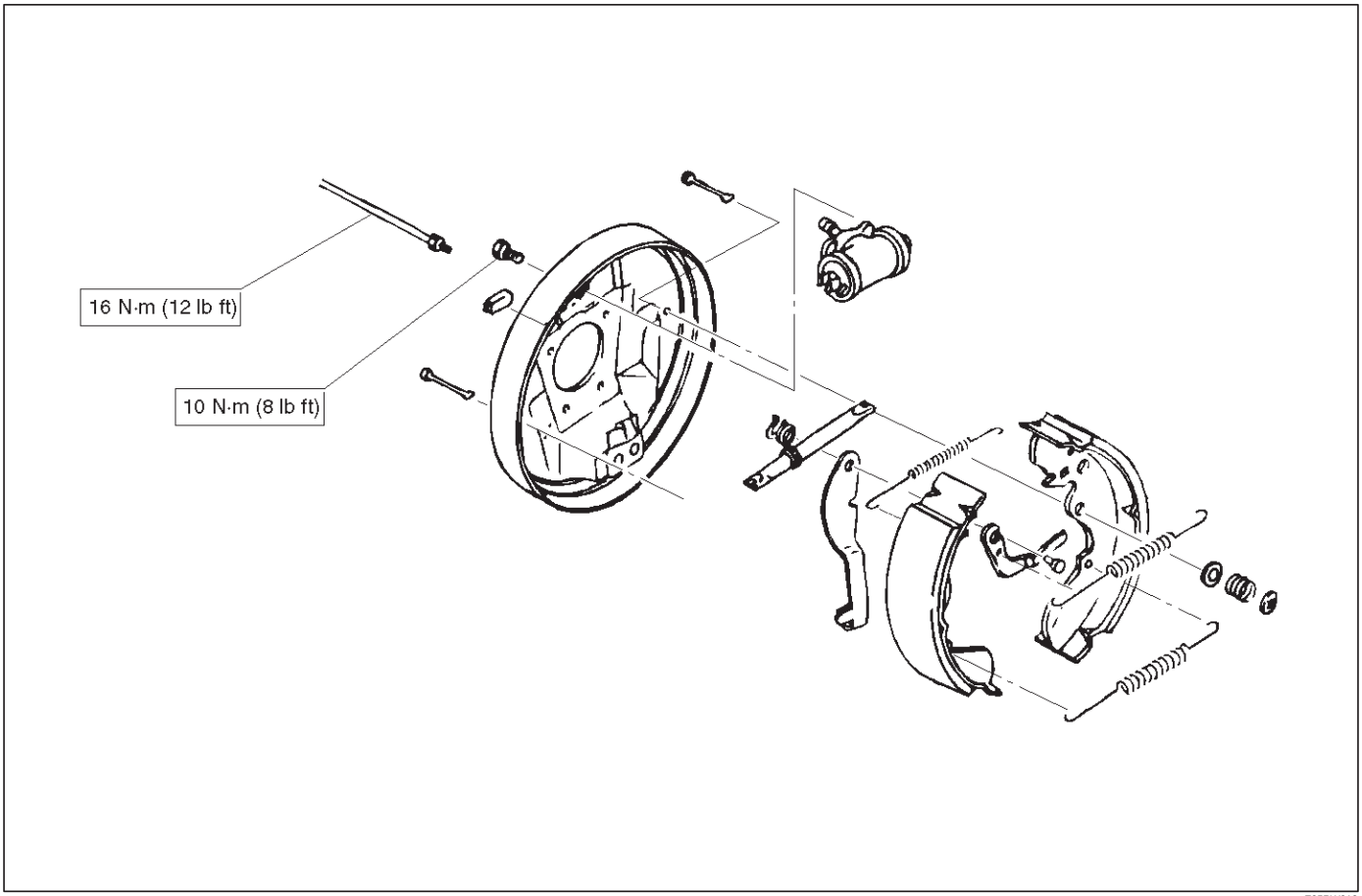
4. Apply DELCO silicone lube No. 5459912 (or equivalent) to the piston and the inner face of the boots.
5. Install piston assembly (2) to wheel cylinder (6).

Main Data and Specifications

General Specifications

Rear drum brake	
Type	Leading-trailing, non-servo
Drum inside diameter	295 mm (11.6 in)
Wheel cylinder diameter	22.22 mm (7/8 in)

Torque Specifications



E05RW010

AXIOM

BRAKES

PARKING BRAKE SYSTEM (4×4 Model)

CONTENTS

Service Precaution 5D1–1
General Description 5D1–1
Operation 5D1–2
Parking Brake Lever and Front Cable 5D1–3
Parking Brake Lever Assembly and Associated Parts 5D1–3
Removal 5D1–3
Installation 5D1–3
Parking Brake Rear Cable 5D1–4
Parking Brake Rear Cable and Associated Parts 5D1–4
Removal 5D1–5
Installation 5D1–5
Inspection and Repair 5D1–6
Parking Brake Adjustment 5D1–6
Main Data and Specifications 5D1–7

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

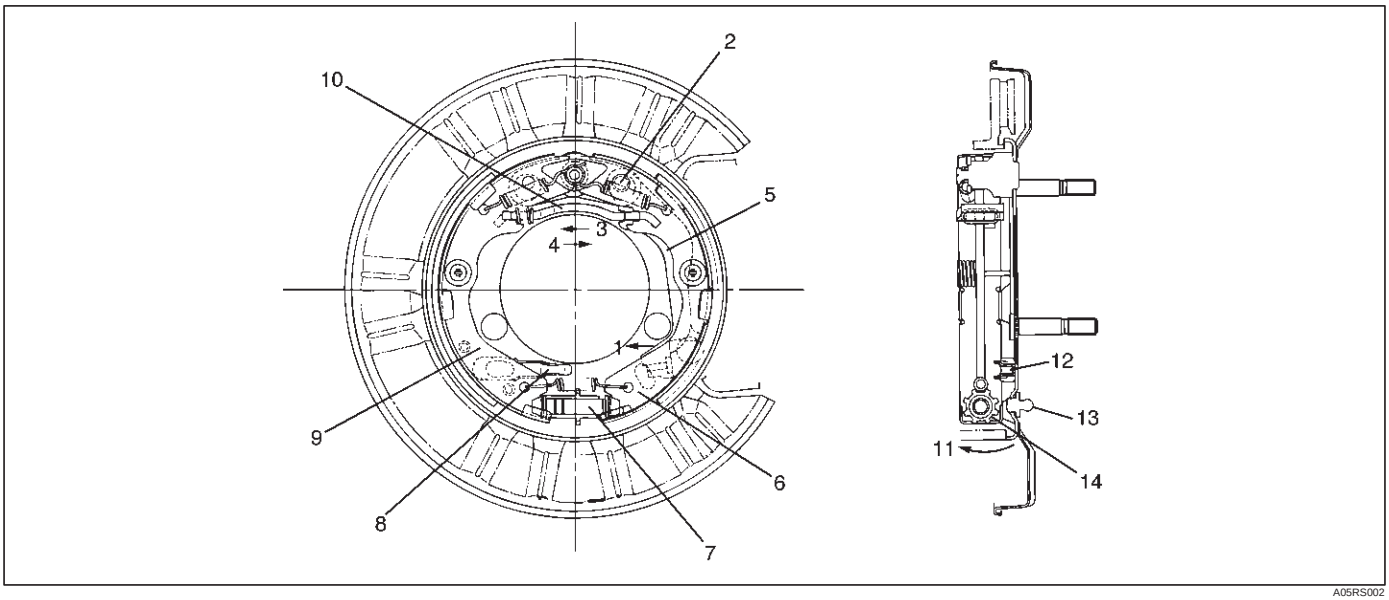
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Pulling up the parking brake lever by hand will set the parking brake. By means of a ratchet type lock, the lever can be held in that position until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed to obtain sufficient braking force even when parking on slopes. When the parking brake is set, or when the ignition SW is in the“ON” position, the brake warning light illuminates. The rear wheel parking brake is a duo–servo brake (mechanical inside expansion type) built in the rear disc brake. Parking brake adjustment is made through the adjusting hole (bored through back plate). Parking brake lever stroke should be adjusted to 6–8 notches. Refer to *Parking Brake Adjustment* in this section.

Operation

When pulled in the direction “A”, the parking lever presses the secondary shoe against the brake drum using the lever/shoe joint “B” as a fulcrum and pushes the strut in the direction “C”. The strut ,in turn, presses the primary shoe against the brake drum. Counter force “D” to the primary shoe is transmitted again to the secondary shoe through the fulcrum “B”. The secondary shoe contacts the drum thereby producing braking effect. Clearance which may result from worn parking brake shoe lining can be adjusted by turning the adjusting screw. Refer to *Parking Brake Adjustment* in this Section.



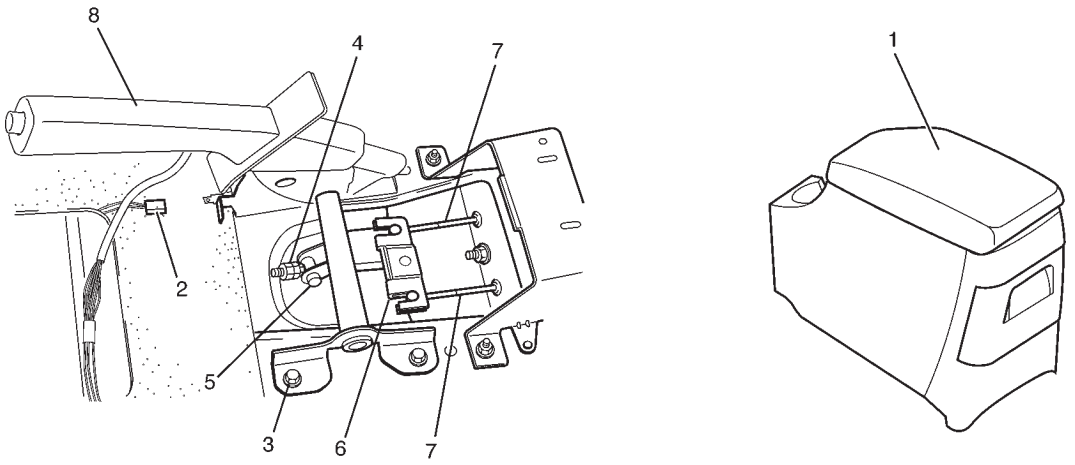
A05RS002

Legend

(1) Direction “A”
(2) Lever/Shoe Joint “B” as a fulcrum
(3) Direction “C”
(4) Counter Force “D”
(5) Parking Lever
(6) Secondary Shoe
(7) Adjusting Screw Notch
(8) Parking Cable Guide
(9) Primary Shoe
(10) Strut
(11) Shoe Expanding Direction
(12) Parking Brake Cable Guide
(13) Adjusting Hole Plug
(14) Adjusting Screw Notch

Parking Brake Lever and Front Cable

Parking Brake Lever Assembly and Associated Parts



311R200001

Legend

(1) Rear Console
(2) Switch Connector
(3) Bolt
(4) Adjust Nut and Lock Nut
(5) Trunnion Pin
(6) Equalizer
(7) Parking Brake Rear Cable
(8) Parking Brake Lever

Removal

1. Remove rear console (1).
   ▼Refer to *Body and Accessories* section in this manual.
2. Disconnect switch connector (2).
3. Remove bolt (3).
4. Remove adjust nut and lock nut (4).
5. Pull out equalizer (6) from trunnion pin (5).
6. Disconnect trunnion pin (5) from Parking brake lever (8).
7. Disconnect parking brake rear cable (7).

Installation

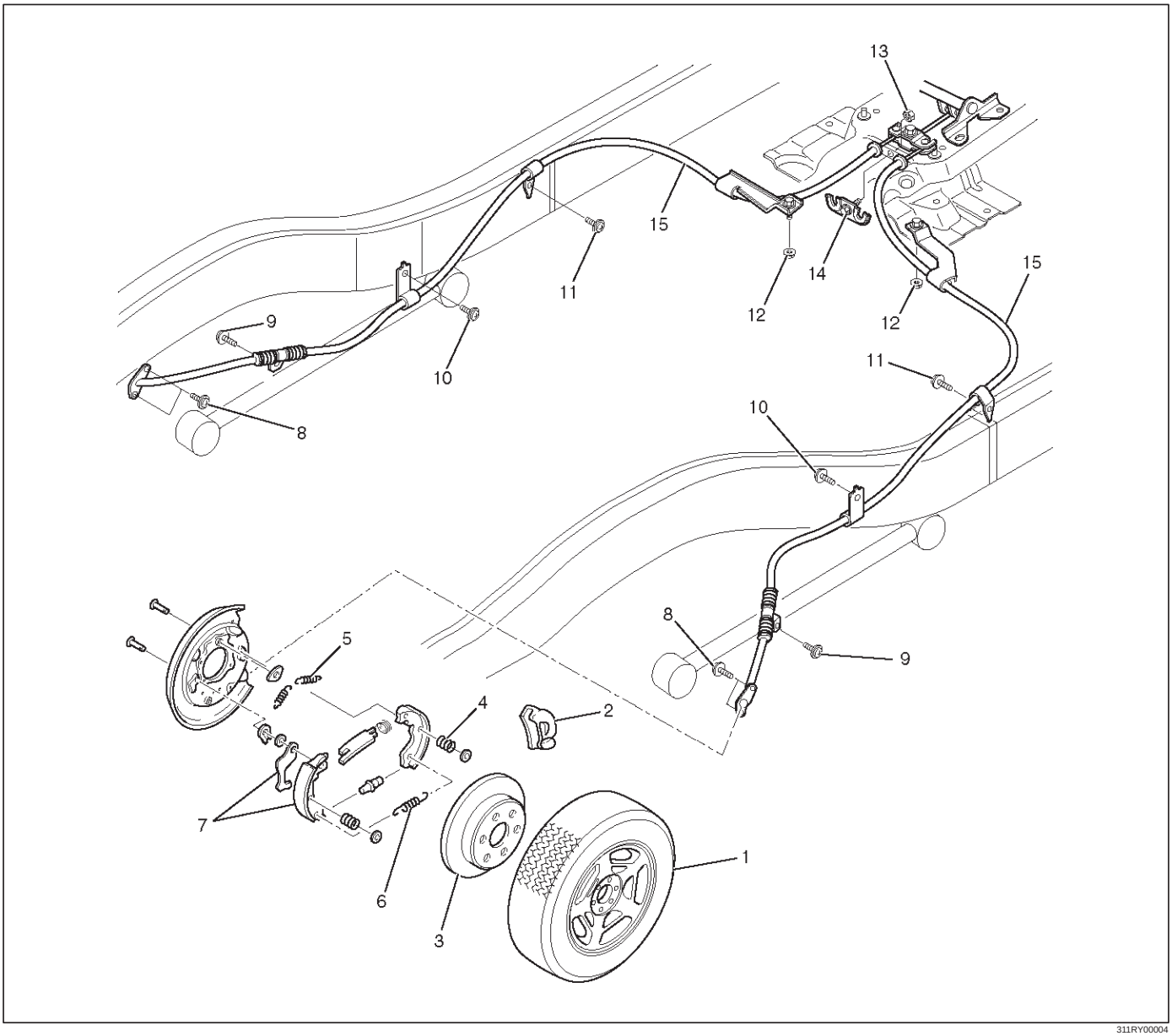
1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable (7) and equalizer (6).
2. Connect parking brake rear cable (7) to equalizer
3. Install trunnion pin (5) to parking brake lever (8).
4. Insert equalizer (6) into trunnion pin (5) and tighten adjust nut and lock nut (4).
   ▼To adjust the parking brake lever, see “Parking Brake Adjustment” in this section.

   Lock Nut Torque: 13 N·m (113 lb in)
5. Tighten the parking brake lever fixing bolt (3) to the specified torque.

   Torque: 15 N·m (11 lb ft)
6. Connect switch connector (2).
7. Install rear console (1).
   ▼Refer to *Body and Accessories* section in this manual.

Parking Brake Rear Cable

Parking Brake Rear Cable and Associated Parts



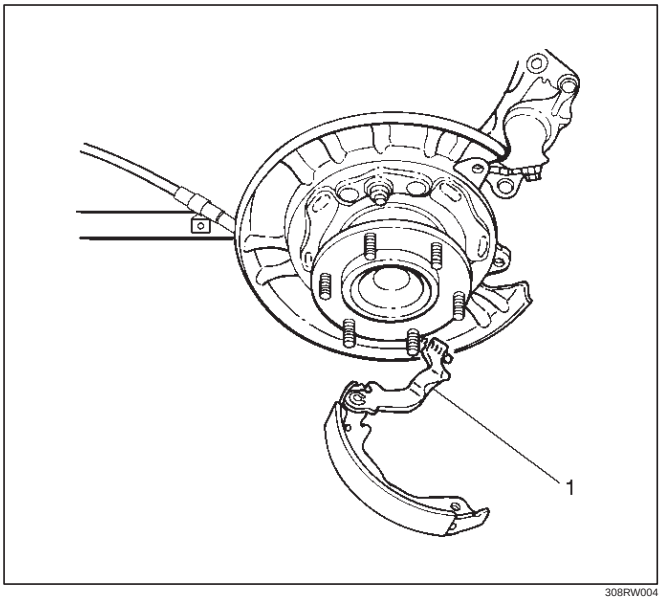
311RY00004

Legend

(1) Rear Wheels
(2) Caliper Assembly
(3) Rotor (Drum)
(4) Holding Spring
(5) Upper Return Spring
(6) Lower Return Spring
(7) Shoe Assembly
(8) Cable Fixing Bolt
(9) Bolt
(10) Bolt
(11) Bolt (Only Long Wheel Base Model)
(12) Nut
(13) Nut
(14) Retainer
(15) Rear Cable

Removal

1. Remove rear wheels (1).
2. Remove 2 bolts to remove the caliper assembly (2) from the support bracket. Refer to *"Rear Disc Brakes" in Power Assisted Brake System* section. Temporarily hang the caliper with wire etc.
3. Remove rotor (drum) (3).
4. Remove holding spring (4), upper return spring (5) and lower return spring (6).
5. Previously remove the rear cable from the parking brake lever, then remove the brake shoe assembly (7).



308RW004

Legend
(1) Parking Brake Lever

6. Remove cable fixing bolt (8) and bolt (9) (10) (11).
7. Remove nut (12).
8. Remove nut (13) and retainer (14).
9. Remove rear cable (15).

Installation

1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable and equalizer. Install rear cable (15).
2. Install retainer (14).

   ▼Tighten nut (13) to the specified torque.

   Torque: 41N·m (30lb ft)
3. Tighten nut (12) to the specified torque.

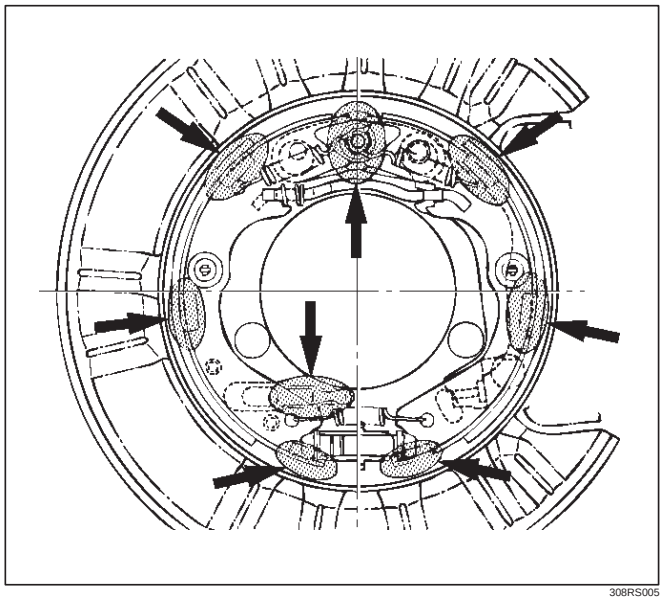
   Torque: 15N·m (11lb ft)
4. Tighten bolt (11) (10) (9) to the specified torque.

   Torque: 6.5N·m (57lb in)

   ▼To adjust the parking brake, refer to *Parking Brake Adjustment* in this section.
5. Tighten the cable fixing bolt (8) to the specified

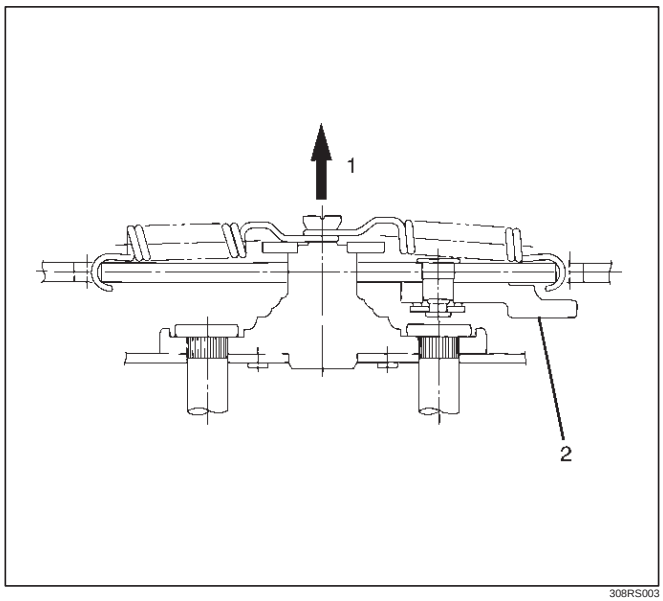
   Torque: 6.5N·m (57lb in)
6. Install shoe assembly (7).

   After installation of the shoe and cable assembly, apply special grease (included in the repair kit) to the following portions indicated in the figure.


308RS005

7. Install lower return spring (6) and upper return spring (5).

   The parking brake lever side (secondary side) return spring must be installed on the outer side of the primary side return spring.



308RS003

Legend
(1) Outer Side
(2) Parking Lever

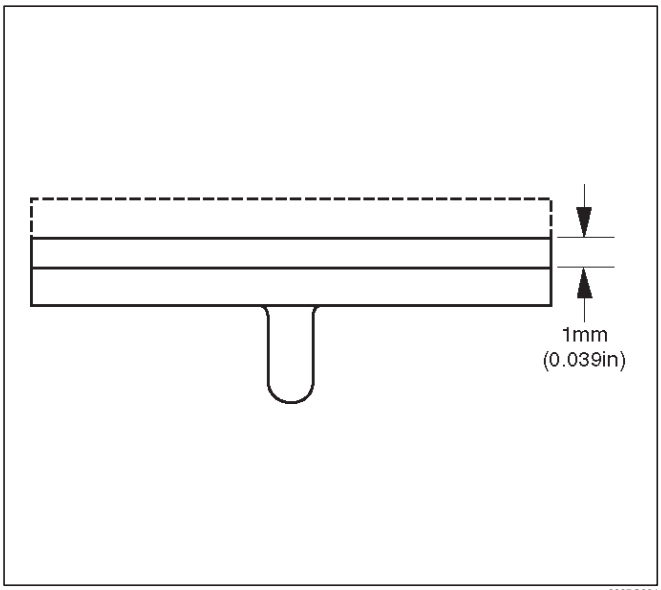
8. Install holding spring (4).
9. Install rotor (drum) (3).
10. Install caliper assembly (2).
11. Install rear wheels (1).

Inspection and Repair

Parking Brake Lining Inspection

Check the shoe assemblies for wear by removing the brake drum.
Replace the shoe assemblies if the lining thickness is less than 1.0 mm (0.039 in).

Minimum limit: 1.0 m (0.039 in)



Parking Brake Rotor (Drum) Inspection

Refer to *"Rear Disc Brakes" in Power-Assisted Brake System* section for inspection procedure of the rotor (drum).

Parking Brake Adjustment

1. Prior to lever stroke adjustment, adjust rear brake shoe/rotor (drum) gap. Perform this procedure with loosening the adjust nut of the hand brake lever.
2. Remove the adjusting hole plug (rubber) and turn the shoe adjusting screw downward with a small screwdriver so that shoes will expand until they get into close touch with the rotor. (Turn down the adjusting screw notch by notch until the rotor does not turn.)
3. Turn the adjusting screw in the opposite direction (upward) until the rotor can be turned lightly. Standard number of notches to turn upward: 7 or 8 notches
   Turn the rotor and make sure that there is no brake dragging.
4. After the rear brake shoe/rotor (drum) gap has been adjusted, perform parking brake cable adjustment.
5. Turn the adjusting nut so that the parking brake lever travels 6–8 notches when pulled up with a force of 30 kg (66 lb).
6. Make sure there is no brake dragging. Then tighten the cable lock nut

   Torque : 13 N·m (113 lb in)
7. When poor braking effect possibly resulting from insufficient break–in is felt, or just after replacement of parking brake shoe, be sure to conduct break–in as follows:
8. Forward 50 km/h (30 mph) × 400 m (About 30 seconds) with a lever pull force of 15 kg (33 lb).
9. Backward 10 km/h (6 mph) × 50 m (About 18 seconds) with a lever pull force of 15 kg (33 lb).

NOTE: Break–in procedures must be performed under safe conditions and traffic rules.

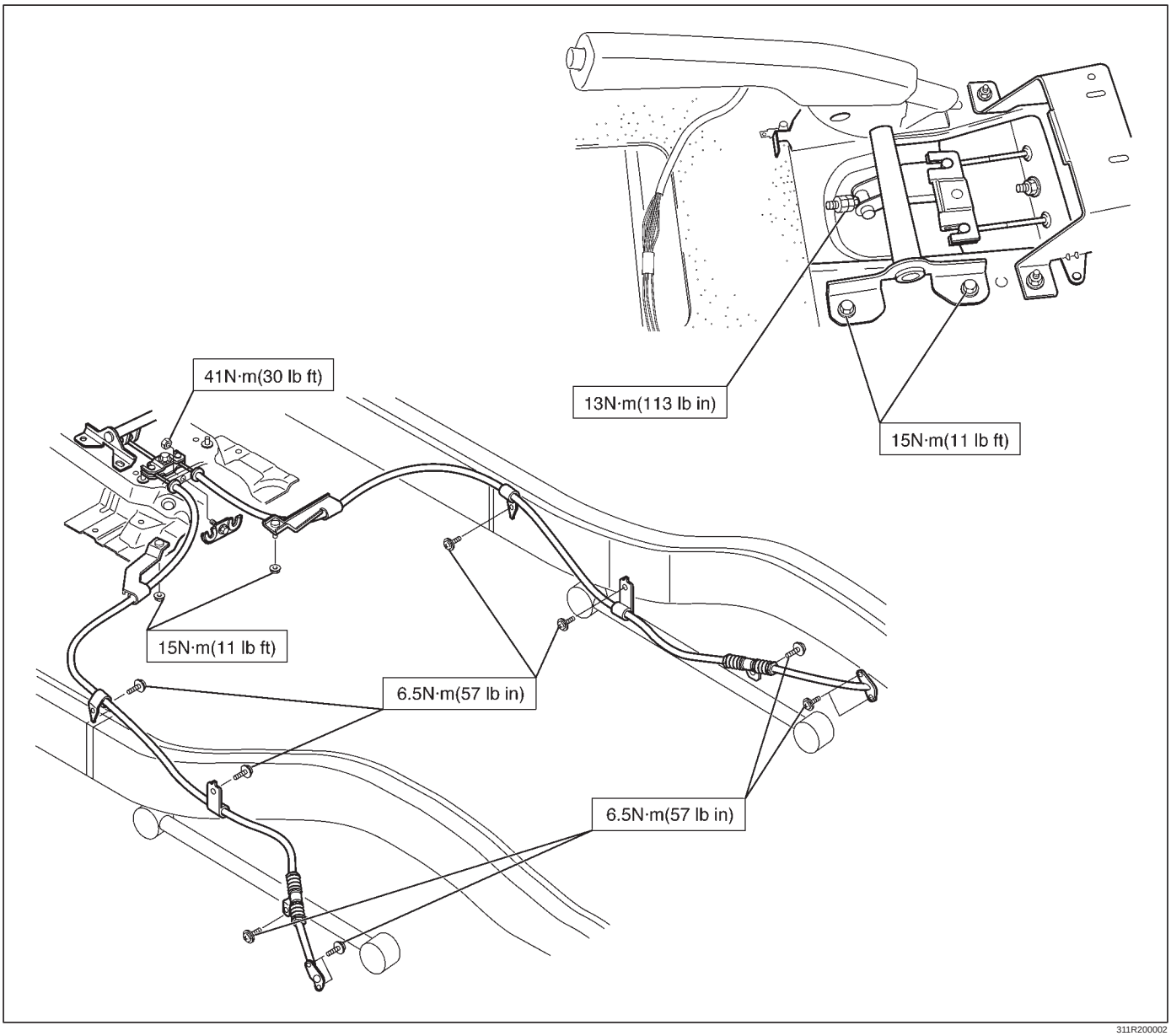
- If braking effect still remains poor after the above break–in, wait for some time until parking brake shoe cools down and repeat the procedures 8. and 9. noted above.
- On completion of break–in, inspect parking brake lever stroke, and if the lever does not come within the specified number of notches when pulled up, readjust.
- Excessive break–in may cause premature wear of the parking brake lining.

Main Data and Specifications

General Specifications

	Model
Type	Duo–servo
Drum inside diameter	210 mm(8.27 in)
Parking brake lever stroke	6–8 notches When pulled with a force of 30 kg (66 lb)

Torque Specifications



311R200002

AXIOM

BRAKES

PARKING BRAKE SYSTEM (4×2 Model)

CONTENTS

Service Precaution 5D2–1
General Description 5D2–1
Parking Brake Lever 5D2–2
Parking Brake Lever Assembly and Associated Parts 5D2–2
Removal 5D2–2
Installation 5D2–2
Parking Brake Rear Cable 5D2–3
Parking Brake Rear Cable and Associated Parts 5D2–3
Removal 5D2–4
Installation 5D2–4
Parking Brake Adjustment 5D2–4
Main Data and Specifications 5D2–5

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

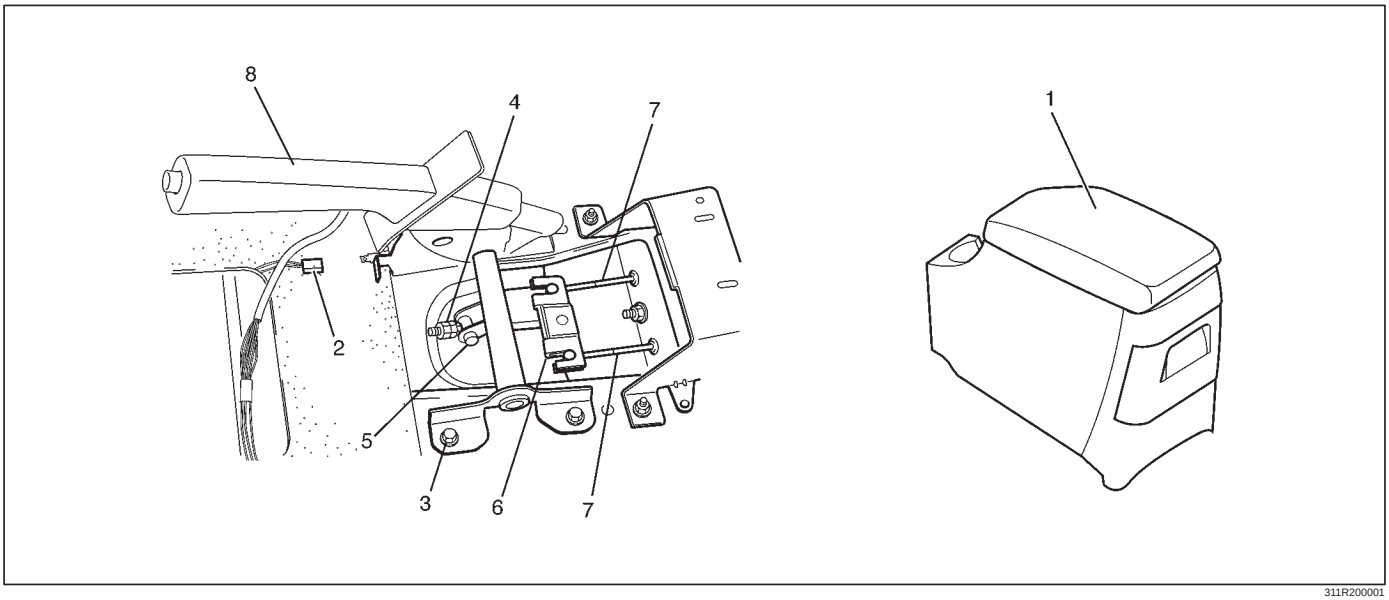
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Pulling up the parking brake lever by hand will set the parking brake. By means of a ratchet type lock, the lever can be held in that position until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed to obtain sufficient braking force even when parking on slopes. When the parking brake is set, or when the ignition SW is in the“ON” position, the brake warning light illuminates. The rear wheel parking brake is a leading/trailing brake (mechanical inside expansion type). Parking brake adjustment is made through the adjusting hole (bored through back plate). Parking brake lever stroke should be adjusted to 6 notches. Refer to *Parking Brake Adjustment* in this section.

Parking Brake Lever

Parking Brake Lever Assembly and Associated Parts



311R200001

Legend

(1) Rear Console
(2) Switch Connector
(3) Bolt
(4) Adjust Nut and Lock Nut
(5) Trunnion Pin
(6) Equalizer
(7) Parking Brake Rear Cable
(8) Parking Brake Lever

Removal

1. Remove rear console (1).
   ▼Refer to *Body and Accessories* section in this manual.
2. Disconnect switch connector (2).
3. Remove bolt (3).
4. Remove adjust nut and lock nut (4).
5. Pull out equalizer (6) from trunnion pin (5).
6. Disconnect trunnion pin (5) from parking brake lever (8).
7. Disconnect parking brake rear cable (7).

Installation

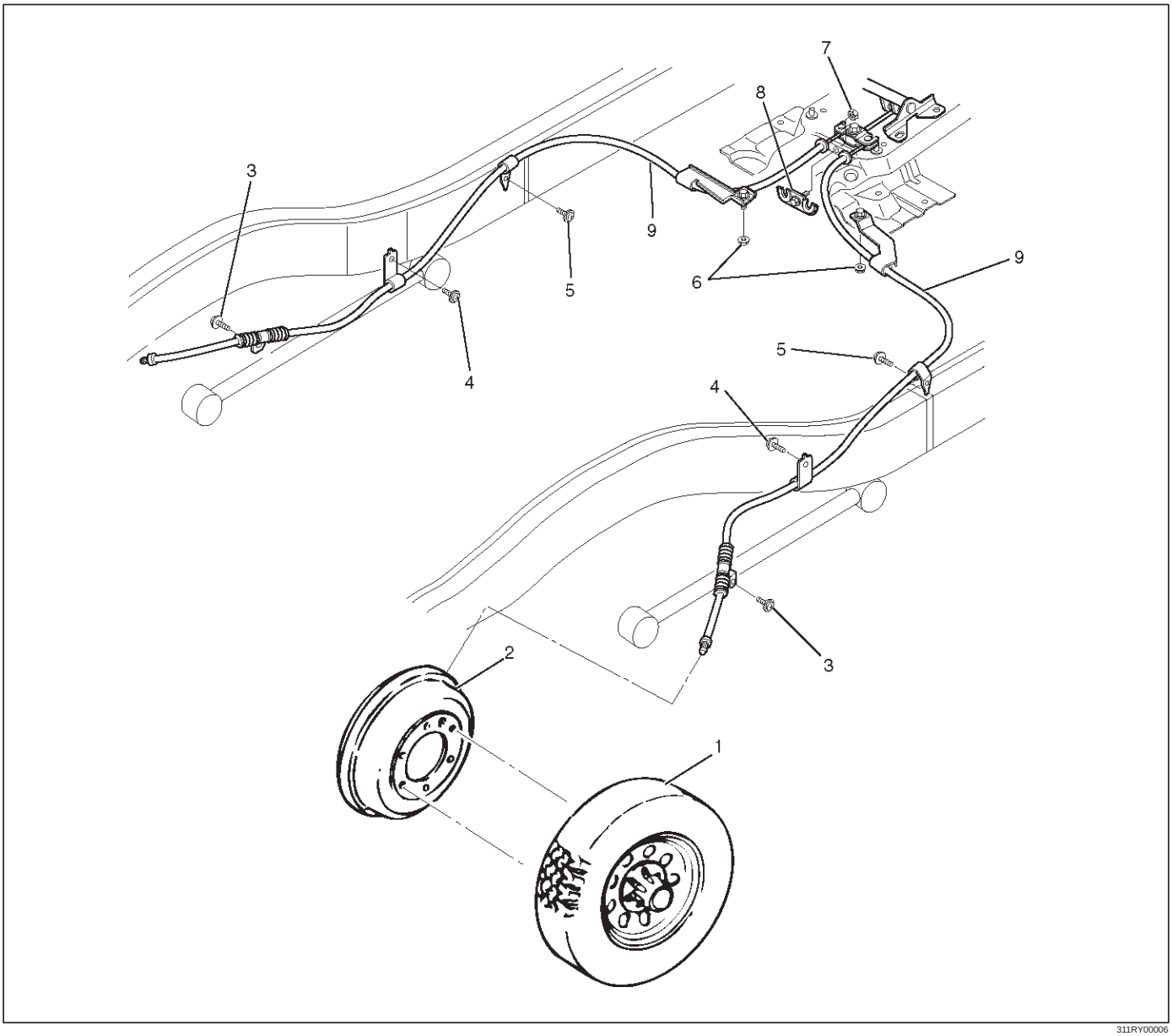
1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable (7) and equalizer (8).
2. Connect parking brake rear cable (7) to equalizer (6).
3. Install trunnion pin (5) to parking brake lever (8).
4. Insert equalizer (6) into trunnion pin (5) and tighten adjust nut and lock nut (4).
   ▼To adjust the parking brake lever, see “Parking Brake Adjustment” in this section.

   Lock Nut Torque: 13 N·m (113 lb in)
5. Tighten parking lever fixing bolt (3) to the specified torque.

   Torque: 15 N·m (11 lb ft)
6. Connect switch connector (2).
7. Install rear console (1).
   ▼Refer to *Body and Accessories* section in this manual.

Parking Brake Rear Cable

Parking Brake Rear Cable and Associated Parts



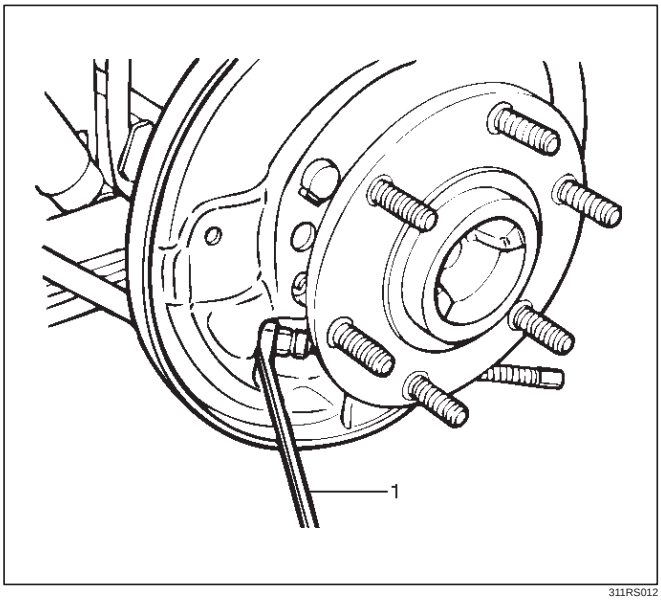
311RY00006

Legend

(1) Rear Wheels
(2) Drums
(3) Clip and Bolt
(4) Clip and Bolt
(5) Clip and Bolt (Only Long Wheel Base Model)
(6) Nut
(7) Nut
(8) Retainer
(9) Rear Cable

Removal

1. Remove rear wheels (1) and drums (2).
2. Remove bolt (3) (4) (5).
3. Remove nut (6).
4. Remove nut (7) and retainer (8).
5. Remove rear brake shoe assemblies. Refer to *"Brake Lining Assembly and Associated Parts" in Power Assisted Brake System* section.
6. Use offset box wrench (13 mm hex.) to compress the locking lugs on the cable, then remove the rear cable (9) from the Backing plate.



311RS012

Legend
(1) Offset Box Wrench

Installation

1. Install rear cable (9).
2. Install retainer (8).
3. Tighten nut (7) to the specified torque.

   Torque : 41 N·m (30 lb ft)

   ▼To adjust the parking brake, refer to *Parking Brake Adjustment* in this section.
4. Tighten nut (6) to the specified torque.

   Torque : 15 N·m (11 lb ft)
5. Tighten bolt (5) (4) (3) to the specified torque.

   Torque : 6.5 N·m (57 lb in)
6. Install rear drums (2) and wheels (1).

Parking Brake Adjustment

NOTE: All brakes are self adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto–adjuster, in the rear brake, produces a clicking sound. The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

1. Move the parking brake lever to its fully released position.
2. Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.).
3. Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.

   If the difference between the brake drum inside diameter and diameter of the brake shoes is adjusted to be 0.5 mm, the number of times for depressing the brake pedal can be reduced.
4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.

   Shoe clearance: 0.25 mm to 0.40 mm

   (0.0098 in to 0.0157 in)

   If incorrect, check the brake auto–adjusting system.
5. Rotate the adjust nut of hand brake lever until all slack disappears from the cable. Set the adjust nut.
6. Applying about 30 kg (66 lb) of force, pull the parking brake lever to its fully set position three or four times.
7. If the parking brake is properly adjusted, the travel between the fully disengaged position and the fully engaged position will be 6 notches.

   If the traveling range is not within these limits, repeat steps 1 through 5 again .

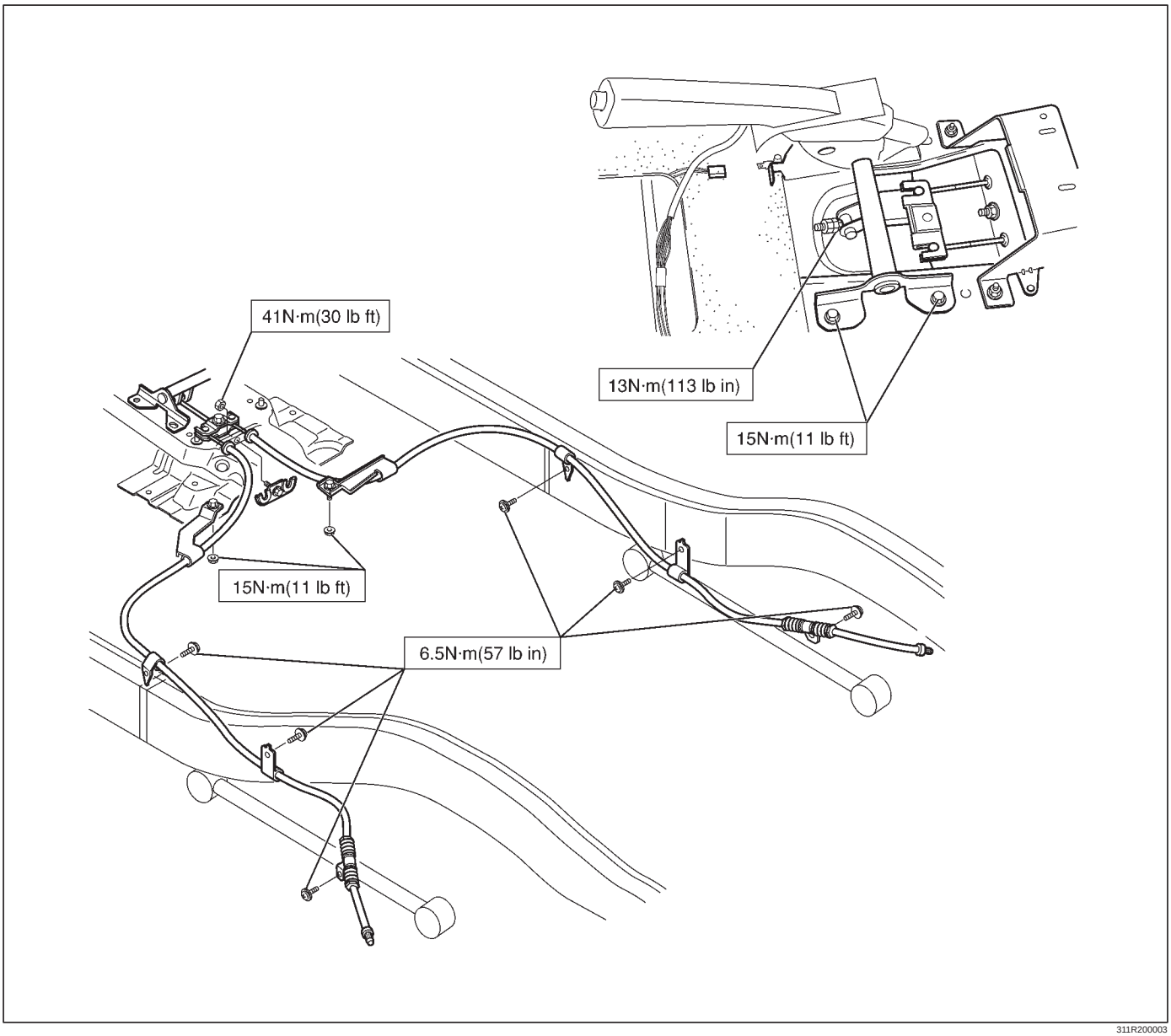
   After adjusting has been done, check to see if the rear wheel rotates smoothly without drag when turned by hand.

Main Data and Specifications

General Specifications

	Model
Type	Leading–Trailing
Drum inside diameter	295 mm (11.6 in)
Parking brake lever stroke	6–8 notches When pulled with a force of 30 kg (66 lb)

Torque Specifications



311R200003

AXIOM

ENGINE

CONTENTS

Engine Mechanical 6A
Engine Cooling 6B
Engine Fuel 6C
Engine Electrical 6D1
Ignition System 6D2
Starting and Charging System 6D3
Driveability and Emissions 6E
Engine Exhaust 6F
Engine Lubrication 6G
Engine Speed Control System 6H
Induction 6J

ENGINE MECHANICAL (6VE1 3.5L)

CONTENTS

Service Precaution 6A–2
General Description 6A–3
Engine Diagnosis 6A–4
Cylinder Head Cover LH 6A–19
Removal 6A–19
Installation 6A–20
Cylinder Head Cover RH 6A–21
Removal 6A–21
Installation 6A–21
Common Chamber 6A–22
Removal 6A–22
Installation 6A–22
Exhaust Manifold LH 6A–24
Removal 6A–24
Installation 6A–24
Exhaust Manifold RH 6A–25
Removal 6A–25
Installation 6A–25
Crankshaft Pulley 6A–26
Removal 6A–26
Installation 6A–26
Timing Belt 6A–27
Removal 6A–27
Installation 6A–28
Camshaft 6A–32
Removal 6A–32
Installation 6A–33
Cylinder Head 6A–35
Removal 6A–35
Installation 6A–35
Valve Stem Oil Controller , Valve Spring and Valve Guide 6A–37
Removal 6A–37
Installation 6A–37
Piston, Piston Ring and Connecting Rod 6A–38
Removal 6A–38
Installation 6A–39
Crankshaft and Main Bearings 6A–40
Removal 6A–40
Installation 6A–41
Rear Oil Seal 6A–45
Removal 6A–45
Installation 6A–45
Engine Assembly 6A–46
Removal 6A–46
Installation 6A–47
Cylinder Head 6A–49
Cylinder Head and Associated Parts 6A–49
Disassembly 6A–50
Clean 6A–50
Inspection and Repair 6A–50
Reassembly 6A–51
Valve Spring, Oil Controller, Valve, Valve Guide 6A–53
Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts 6A–53
Disassembly 6A–53
Inspection and Repair 6A–54
Reassembly 6A–57
Camshaft 6A–60
Camshaft and Associated Parts 6A–60
Disassembly 6A–60
Inspection and Repair 6A–61
Reassembly 6A–63
Crankshaft 6A–67
Crankshaft and Associated Parts 6A–67
Disassembly 6A–67
Inspection and Repair for Bearings 6A–68
Inspection and Repair for Crankshaft 6A–70
Reassembly 6A–71

Piston and Connecting Rod 6A–75
Piston, Connecting Rod and Associate Parts 6A–75
Disassembly 6A–75
Inspection and Repair 6A–76
Reassembly 6A–80
Cylinder Block 6A–82
Cylinder Block and Associated Parts 6A–82
Disassembly 6A–82
Inspection and Repair 6A–83
Reassembly 6A–84
Main Data and Specification 6A–87
Special Tool 6A–93

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The six cylinders of this engine are identified by numbers; Right side cylinders 1, 3 and 5, Left side cylinders 2, 4 and 6, as counted from crankshaft pulley side to flywheel side.

General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance.

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick–up unit.
- The 12–volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

Cylinder Block

The cylinder block is made of aluminum die–cast casting for 75˚V–type six cylinders. It has a rear plate integrated structure and employs a deep skirt. The cylinder liner is cast and the liner inner diameter and crankshaft journal diameter are classified into grades. The crankshaft is supported by four bearings of which width is different between No.2, No.3 and No.1, No.4; the width of No.3 bearing on the body side is different in order to support the thrust bearing. The bearing cap is made of nodular cast iron and each bearing cap uses four bolts and two side bolts.

Cylinder Head

The cylinder head, made of aluminum alloy casting employs a pent–roof type combustion chamber with a spark plug in the center. The intake and exhaust valves are placed in V–type design. The ports are cross–flow type.

Valve Train

Intake and exhaust camshaft on both banks are driven with a camshaft drive gear by the timing belt. The valves are operated by the camshaft and the valve clearance is adjusted to select suitable thickness shim.

Intake Manifold

The intake manifold system is composed of the aluminum cast common chamber and intake manifold attached with six fuel injectors.

Exhaust Manifold

The exhaust manifold is made of nodular cast iron.

Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin made of chromium steel is offset 1mm toward the thrust side, and the thrust pressure of piston to the cylinder wall varies gradually as the piston travels. The connecting rods are made of forged steel. The connecting rod bearings are graded for correct size selection.

Crankshaft and Bearings

The crankshaft is made of Ductile cast–iron. Pins and journals are graded for correct size selection for their bearing.

Engine Diagnosis

First of all the engine diagnose to check the fuel quantity, the engine level and the engine coolant level.

Hard Starting

1. Starting Motor Does Not Turn Over

Troubleshooting Procedure

Turn on headlights and starter switch.

Condition	Possible cause	Correction
Headlights go out or dim considerably	Battery run down or under charged	Recharge or replace battery
	Terminals poorly connected	Clean battery posts and terminals and connect properly
	Starting motor coil circuit shorted	Overhaul or replace
	Starting motor defective	Overhaul or replace

2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

Spark Test

Disconnect an ignition coil from any spark plug. Connect the spark plug tester (For example J–26792), start the engine, and check if a spark is generated in the spark plug tester. Before starting the engine, make sure that the spark plug tester is properly grounded. To avoid electrical shock, do not touch the part where insulation of the ignition coil is broken while the engine is running.

Condition	Possible cause	Correction
Spark jumps across gap	Spark plug defective	Clean, adjust spark gap or replace
	Ignition timing incorrect	Refer to Ignition System
	Fuel not reaching fuel injector(s) or engine	Refer to item 3 (Trouble in fuel system)
	Valve timing incorrect	Adjust
	Engine lacks compression	Refer to item 4 (Engine lacks compression)
No sparking takes place	Ignition coil disconnected or broken	Connect properly or replace
	Electronic Ignition System with module	Replace
	Poor connections in engine harness	Correct
	Powertrain Control Module cable disconnected or defective	Correct or replace

3. Trouble In Fuel System

Condition	Possible cause	Correction
Starting motor turns over and spark occurs but engine does not start.	Fuel tank empty	Fill
	Water in fuel system	Clean
	Fuel filter clogged	Replace filter
	Fuel pipe clogged	Clean or replace
	Fuel pump defective	Replace
	Fuel pump circuit open	Correct or replace
	Evaporative Emission Control System circuit clogged	Correct or replace
	Multiport Fuel Injection System faulty	Refer to “Electronic Fuel Injection” section

4. Engine Lacks Compression

Condition	Possible cause	Correction
Engine lacks compression	Spark plug loosely fitted or spark plug gasket defective	Tighten to specified torque or replace gasket
	Valve timing incorrect	Adjust
	Cylinder head gasket defective	Replace gasket
	Valve incorrectly seated	Lap valve
	Valve stem seized	Replace valve and valve guide
	Valve spring weakened or broken	Replace
	Cylinder or piston rings worn	Overhaul engine
	Piston ring seized	Overhaul engine.

Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.
   If the compression pressure obtained falls below the limit, engine overhaul is necessary.

   Limit; 1000 kPa (145 psi)

Rough Engine Idling or Engine Stalling

Condition	Possible cause	Correction
Trouble in fuel injection system	Throttle shutting off incomplete	Correct or replace
	Throttle position sensor circuit open or shorted	Correct or replace
	Fuel injector circuits open or shorted	Correct or replace
	Fuel injectors damaged	Replace
	Fuel pump relay defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or poor connections	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or poor connections	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Intake Air Temperature sensor circuit open or poor connections	Correct or replace
	Intake Air Temperature sensor defective	Replace
	Ion Sensing Module cable broken or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	Vehicle Speed Sensor circuit open or shorted	Correct or replace
	Vehicle Speed Sensor defective	Replace
Trouble in emission control system	Powertrain Control Module defective	Replace
	Exhaust Gas Recirculation Valve circuit open or poor connections	Correct or replace
	Exhaust Gas Recirculation Valve faulty	Replace
	Canister purge valve circuit open or poor connections	Correct or replace
	Canister purge valve defective	Replace
	Evaporative Emission Canister Purge control valve defective	Replace
	Trouble in ignition system	Refer to “Hard Start”
Others	Engine lacks compression	Refer to “Hard Start”
	Valve incorrectly seated	Lap valve
	Air Cleaner Filter clogged	Replace filter element
	Valve timing incorrect	Readjust
	Idle air control valve broken	Replace
	Fast idle solenoid defective	Replace
	Positive Crankcase Ventilation valve defective or clogged	Replace

Rough Engine Running

Condition	Possible cause	Correction
Engine misfires periodically	Ignition coil layer shorted	Replace
	Spark plugs fouling	Clean or install hotter type plug
	Spark plug(s) insulator nose leaking	Replace
	Fuel injector(s) defective	Replace
	Powertrain control module faulty	Replace
Engine knocks periodically	Spark plugs running too hot	Install colder type spark plugs
	Powertrain control module faulty	Replace
	Ion Sensing module faulty	Refer or replace
Engine lacks power	Spark plugs fouled	Clean
	Fuel injectors defective	Replace
	Mass Airflow Sensor or Intake Airflow Sensor circuit defective	Correct or replace
	Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective	Correct or replace
	Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective	Correct or replace
	Powertrain Control Module faulty	Replace
	Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective	Correct or replace
	Throttle Position Sensor or Throttle Position Sensor circuit defective	Correct or replace
	ION Sensing Module or ION Sensing Module circuits defective	Correct or replace

Hesitation

Condition	Possible cause	Correction
Hesitation on acceleration	Throttle Position Sensor adjustment incorrect	Replace throttle valve assembly
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure (MAP) Sensor circuit open or shorted	Correct or replace
	MAP Sensor defective	Replace
	Intake Air Temperature (IAT) Sensor circuit open or poor connections	Correct or replace
	Ion Sensing Module circuit open or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	IAT Sensor defective	Replace
Hesitation at high speeds (Fuel pressure too low)	Fuel tank strainer clogged	Clean or replace
	Fuel pipe clogged	Clean or replace
	Fuel filter clogged	Replace
	Defective fuel pump system	Check and replace
	Fuel Pressure Control Valve leaking	Replace
Hesitation at high speeds (Fuel injector not working normally)	Power supply or ground circuit for Multiport Fuel Injection System shorted or open	Check and correct or replace
	Fuel Injector defective	Replace
	Cable of Multiport Fuel Injection System circuit open or poor connections	Correct or replace

Condition	Possible cause	Correction
Hesitation at high speeds	Powertrain Control Module defective	Replace
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	MAP Sensor cable broken or poor connections	Correct or replace
	MAP Sensor defective	Replace
	IAT Sensor circuit open or poor connections	Correct or replace
	IAT Sensor defective	Replace
	Ion Sensing Module circuit open or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	Throttle valve not fully opened	Check and correct or replace
	Air Cleaner Filter clogged	Replace filter element
	Power supply voltage too low	Check and correct or replace

Engine Lacks Power

Condition	Possible cause	Correction
Trouble in fuel system	Fuel Pressure Control Valve not working normally	Replace
	Fuel injector clogged	Clean or replace
	Fuel pipe clogged	Clean
	Fuel filter clogged or fouled	Replace
	Fuel pump drive circuit not working normally	Correct or replace
	Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit	Clean or replace
	Water in fuel system	Clean
	Inferior quality fuel in fuel system	Use fuel of specified octane rating
	Powertrain Control Module supplied poor voltage	Correct circuit
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Mass Airflow Sensor not working normally	Replace
	Manifold Absolute Pressure Sensor not working normally	Replace
	Intake Air Temperature Sensor not working normally	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Powertrain Control Module defective	Replace
Trouble in intake or exhaust system	Air Cleaner Filter clogged	Replace filter element
	Air duct kinked or flattened	Correct or replace
	TWC defective	Repair
Ignition failure	————	Refer to Hard Start Troubleshooting Guide
	Heat range of spark plug inadequate	Install spark plugs of adequate heat range
	Ignition coil defective	Replace

Condition	Possible cause	Correction
Engine overheating	Level of Engine Coolant too low	Replenish
	Fan clutch defective	Replace
	Incorrect fan installed	Replace
	Thermostat defective	Replace
	Engine Coolant pump defective	Correct or replace
	Radiator clogged	Clean or replace
	Radiator filler cap defective	Replace
	Level of oil in engine crankcase too low or wrong engine oil	Change or replenish
	Resistance in exhaust system increased	Clean exhaust system or replace defective parts
	Throttle Position Sensor adjustment incorrect	Replace with Throttle Valve ASM
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Cylinder head gasket damaged	Replace
Engine overcooling	Thermostat defective	Replace (Use a thermostat set to open at 82˚C (180˚F))
Engine lacks compression	———	Refer to Hard Start
Others	Tire inflation pressure abnormal	Adjust to recommended pressures
	Brake drag	Adjust
	Clutch slipping	Adjust or replace
	Level of oil in engine crankcase too high	Correct level of engine oil
	Exhaust Gas Recirculation Valve defective	Replace

Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

Troubleshooting Procedure for Crankshaft Journals or Crankshaft Bearing Noise

Condition	Possible cause	Correction
Noise from crank journals or from crank bearings (Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating)	Oil clearance increased due to worn crank journals or crank bearings	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crankshaft out of round	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crank bearing seized	Crank bearing seized Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing

Troubleshooting Procedure for Connecting Rods or Connecting Rod Bearing Noise

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective bearing by listening for abnormal noise that stops when spark plug is shorted out.

Condition	Possible cause	Correction
Noise from connecting rods or from connecting rod bearings (Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated)	Bearing or crankshaft pin worn	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Crankpin out of round	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Connecting rod bent	Correct or replace
	Connecting rod bearing seized	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing

Troubleshooting Procedure for Piston and Cylinder Noise

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

Condition	Possible cause	Correction
Piston and cylinder noise (Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up)	Piston clearance increased due to cylinder wear	Replace piston and cylinder body
	Piston seized	Replace piston and cylinder body
	Piston ring broken	Replace piston and cylinder body
	Piston defective	Replace pistons and others

Troubleshooting Procedure for Piston Pin Noise

Short out each spark plug and listen for change in engine noise.

Condition	Possible cause	Correction
Piston pin noise (Piston makes noise each time it goes up and down)	Piston pin or piston pin hole worn	Replace piston, piston pin and connecting rod assy

Troubleshooting Procedure for Slapping or Hitting etc Noise

The slapping sound stops when spark plug on bad cylinder is shorted out.

Condition	Possible cause	Correction
Timing belt noise	Timing belt tension is incorrect	Replace pusher or adjust the tension pulley or replace timing belt
	Tensioner bearing defective	Replace
	Timing belt defective	Replace
	Timing pulley defective	Replace
	Timing belt comes in contact with timing cover	Replace timing belt and timing cover
Valve noise	Valve clearance incorrect	Replace adjusting shim
	Valve and valve guide seized	Replace valve and valve guide
	Valve spring broken or weakened	Replace
	Valve seat off–positioned	Correct
	Camshaft worn out	Replace
Crankshaft noise	Crankshaft end play excessive (noise occurs when clutch is engaged)	Replace thrust bearing
Engine knocking	Preignition due to use of spark plugs of inadequate heat range	Install Spark Plugs of adequate heat range
	Carbon deposits in combustion chambers	Clean
	Fuel too low in octane rating	Replace fuel
	Wide Open Throttle enrichment system failure	Refer to Section 6E
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Engine overheating	Refer to “Engine Lacks Power”
Others	Water pump defective	Replace
	Drive belt slipping	Replace auto tensioner or drive belt

Abnormal Combustion

Condition	Possible cause	Correction
Trouble in fuel system	Fuel pressure control valve defective	Replace
	Fuel filter clogged	Replace
	Fuel pump clogged	Clean or replace
	Fuel tank or fuel pipe clogged	Clean or replace
	Fuel injector clogged	Clean or replace
	Fuel pump relay defective	Replace
	Power supply cable for fuel pump broken or poor connections	Reconnect, correct or replace
	Mass Airflow (MAF) Sensor circuit open or defective	Correct or replace
	MAF Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or shorted	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature (ECT) Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Throttle Position Sensor adjustment incorrect	Readjust
	Throttle Position Sensor defective	Replace
	Throttle Position Sensor connector poor connections	Reconnect
	Vehicle Speed Sensor cable poor connections or defective	Correct or replace
	Vehicle Speed Sensor loosely fixed	Fix tightly
	Vehicle Speed Sensor in wrong contact or defective	Replace
	Powertrain Control Module cable poor connections or defective	Correct or replace
Trouble in emission control system	Heated Oxygen Sensor circuit open	Correct or replace
	Heated Oxygen Sensor defective	Replace
	Signal vacuum hose loosely fitted or defective	Correct or replace
	EGR Valve circuit open or shorted	Correct or replace
	Exhaust Gas Recirculation Valve defective	Replace
	ECT Sensor circuit open or shorted	Correct or replace
	Canister Purge Valve circuit open or shorted	Correct or replace
	Canister Purge Valve defective	Replace
	ECT Sensor defective	Replace
	Positive Crankcase Ventilation (PCV) valve and hose clogged	Correct or replace
	Evaporator system	Refer to Section 6E
Trouble in ignition system	———	Refer to “Engine Lacks Power”

Condition	Possible cause	Correction
Trouble in cylinder head parts	Carbon deposits in combustion chamber	Remove carbon
	Carbon deposit on valve, valve seat and valve guide	Remove carbon

Engine Oil Consumption Excessive

Condition	Possible cause	Correction
Oil leaking	Oil pan drain plug loose	Retighten or replace gasket
	Crankcase fixing bolts loosened	Retighten
	Oil pan setting bolts loosened	Retighten
	Oil pan gasket broken	Replace gasket
	Front cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Head cover fixing bolts loose or gasket broken	Retighten or replace gasket
	Oil filter adapter cracked	Replace
	Oil filter attachings bolt loose or rubber gasket broken	Retighten or replace oil filter
	Crankshaft front or rear oil seal defective	Replace oil seal
	Oil pressure unit loose or broken	Retighten or replace
	Blow–by gas hose broken	Replace hose
	Positive Crankcase Ventilation Valve clogged	Clean
	Engine/Transmission coupling failed	Replace oil seal
Oil leaking into combustion chambers due to poor seal in valve system	Valve stem oil seal defective	Replace
	Valve stem or valve guide worn	Replace valve and valve guide
Oil leaking into combustion chambers due to poor seal in cylinder parts	Cylinders and pistons worn excessively	Replace cylinder body assembly and pistons
	Piston ring gaps incorrectly positioned	Correct
	Piston rings set with wrong side up	Correct
	Piston ring sticking	Replace cylinder body assembly and pistons
	Piston ring and ring groove worn	Replace pistons and others
	Return ports in oil rings clogged	Clean piston and replace rings
Positive Crankcase Ventilation System malfunctioning	Positive Crankcase Ventilation Valve clogged	Clean
Others	Improper oil viscosity	Use oil of recommended S.A.E. viscosity
	Continuous high speed driving and/or severe usage such as trailer towing	Continuous high speed operation and/or severe usage will normally cause increased oil consumption

Fuel Consumption Excessive

Condition	Possible cause	Correction
Trouble in fuel system	Mixture too rich or too lean due to trouble in fuel injection system	Refer to “Abnormal Combustion”
	Fuel cut function does not work	Refer to “Abnormal Combustion”
Trouble in ignition system	Misfiring or abnormal combustion due to trouble in ignition system	Refer to “Hard Start” or “Abnormal Combustion”
Others	Engine idle speed too high	Reset Idle Air Control Valve
	Fuel system leakage	Correct or replace
	Clutch slipping	Correct
	Brake drag	Correct
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system	Refer to “Abnormal Combustion”

Lubrication Problems

Condition	Possible cause	Correction
Oil pressure too low	Wrong oil in use	Replace with correct engine oil
	Relief valve sticking	Replace
	Oil pump not operating properly	Correct or replace
	Oil pump strainer clogged	Clean or replace strainer
	Oil pump worn	Replace
	Oil pressure gauge defective	Correct or replace
	Crankshaft bearing or connecting rod bearing worn	Replace
Oil contamination	Wrong oil in use	Replace with correct engine oil
	Oil filter clogged	Replace oil filter
	Cylinder head gasket damage	Replace gasket
	Burned gases leaking	Replace piston and piston rings or cylinder body assembly
Oil not reaching valve system	Oil passage in cylinder head or cylinder body clogged	Clean or correct

Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
   a. Check the viscosity of the oil.
   b. Check the viscosity of the oil.
   c. Change the oil if the viscosity is outside the specified standard.
   d. Refer to the “Maintenance and Lubrication” section of this manual.
2. Check the engine oil level.
   The level should fall somewhere between the “ADD” and the “FULL” marks on the oil level dipstick.
   If the oil level does not reach the “ADD” mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80˚C).
6. Measure the oil pressure.
   Oil pressure should be:
   392–550 kPa (56.9–80.4 psi) at 3000 rpm.
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

Malfunction Indicator Lamp

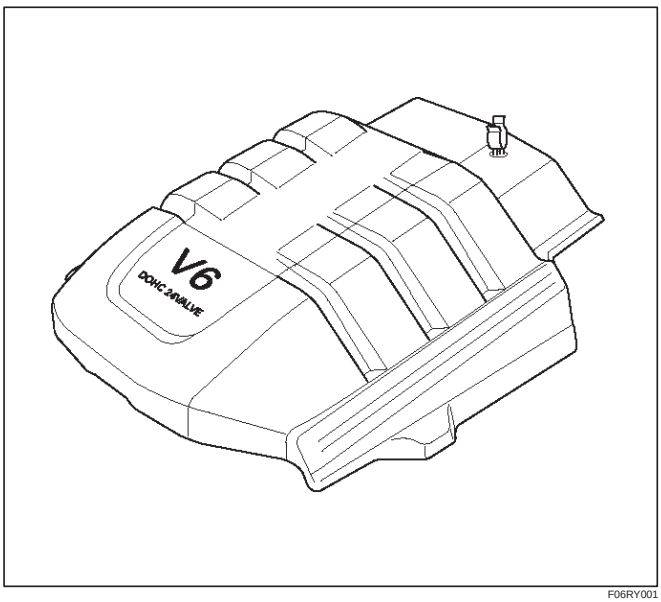
The instrument panel “CHECK ENGINE” Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

Condition	Possible cause	Correction
“CHECK ENGINE” MIL does not illuminate at the starting of engine	Bulb defective	Replace
	MIL circuit open	Correct or replace
	Command signal circuit to operate self diagnostic system shorted	Correct or replace
	Powertrain Control Module (PCM) cable loosely connected, disconnected or defective	Correct or replace
	PCM defective	Replace
“CHECK ENGINE” MIL illuminates, and stays on	Deterioration of heated oxygen sensor internal element	Replace
	Heated oxygen sensor connector terminal improper contact	Reconnect properly
	Heated oxygen sensor lead wire shorted	Correct
	Heated oxygen sensor circuit open	Correct or replace
	Deterioration of engine coolant temperature sensor internal element	Replace
	Engine coolant temperature sensor connector terminal improper contact	Reconnect properly
	Engine coolant temperature sensor lead wire shorted	Correct
	Engine coolant temperature sensor circuit open	Correct or replace
	Throttle position sensor open or shorted circuits	Correct or replace
	Deterioration of crankshaft position sensor	Replace
	Crankshaft position sensor circuit open or shorted	Correct or replace
	Vehicle speed sensor circuit open	Correct or replace
	Manifold absolute pressure sensor circuit open or shorted	Correct or replace
	Intake air temperature sensor circuit open or shorted	Correct or replace
	Fuel injector circuit open or shorted	Correct or replace
	PCM driver transistor defective	Replace PCM
	Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory)	Replace PCM

Cylinder Head Cover LH

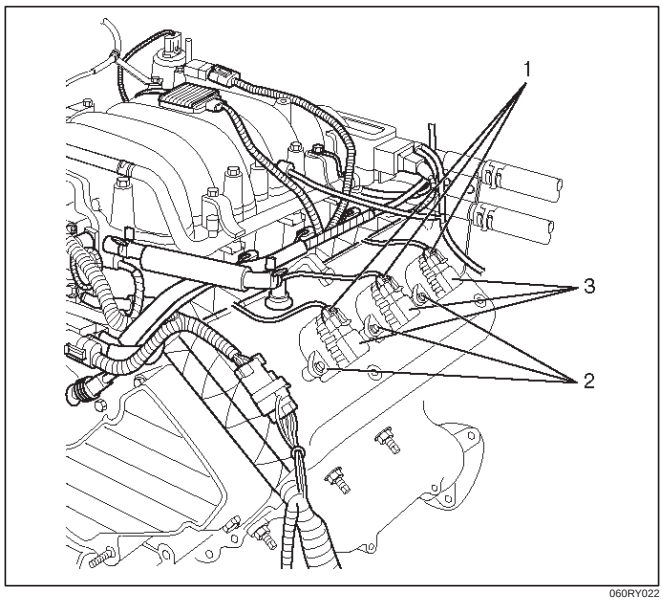
Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowels on the common chamber.



F06RY001

3. Disconnect positive crankcase ventilation hose.
4. Remove ground cable fixing bolt on cylinder head cover.
5. Ignition coil connector and ignition coil.
   - ▼Disconnect the three connectors from the ignition coils.
   - ▼Remove harness bracket bolt on cylinder head cover.
   - ▼Remove fixing bolts on ignition coils.

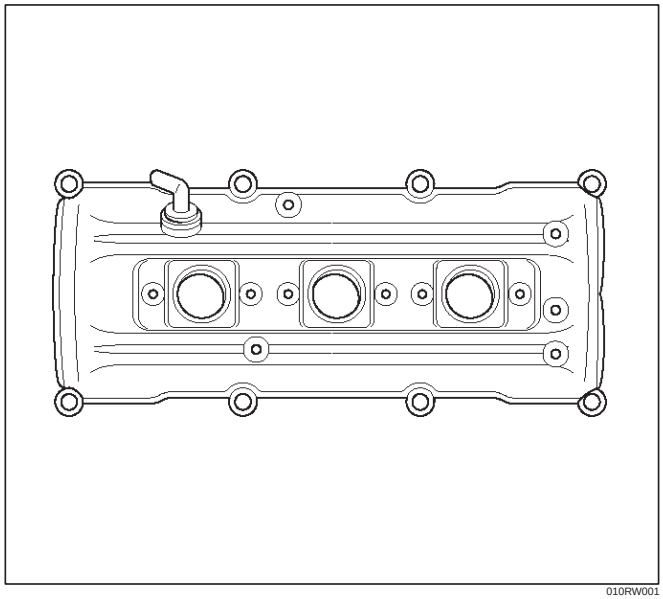


060RY022

Legend

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assemblies

6. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
7. Remove eight fixing bolts, then the cylinder head cover.



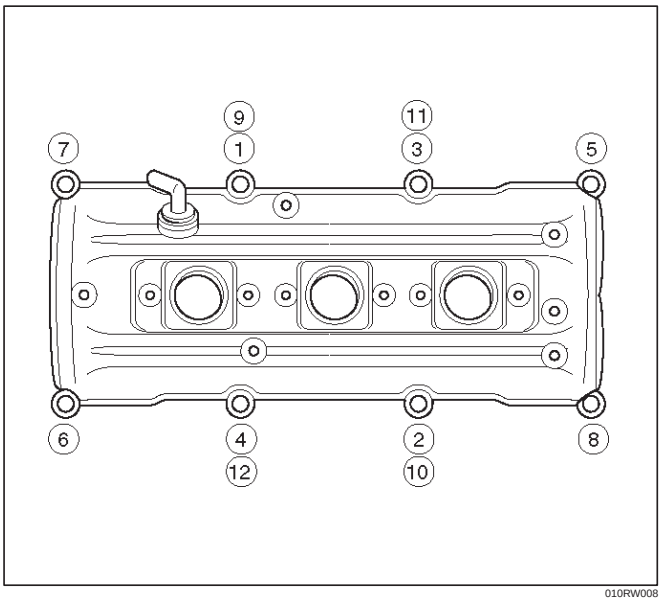
010RW001

NOTE: Where do you refer the tech in case of bolt removal difficulties.

Installation

1. Install cylinder head cover.
   ▼Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
   ▼Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bearing cap on front and rear sides.
   ▼The cylinder head cover must be installed with in 5 minutes after sealant application to prevent hardening of sealant.
   ▼Tighten bolts to the specified torque.

   Torque : 9 N·m (78 lb in)



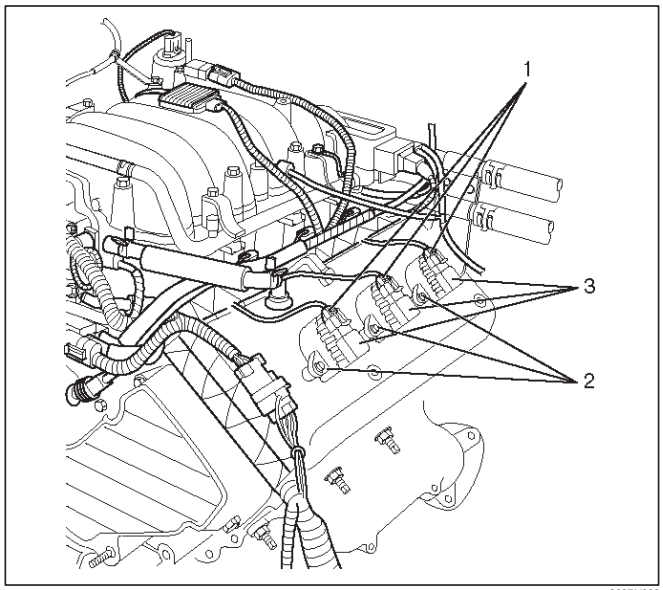
010RW008

2. Install fuel injection harness bracket and tighten bolt to the specified torque.

   Torque : 9 N·m (78 lb in)

3. Connect ignition coil connector and ignition coil, then tighten bolt to the specified torque.

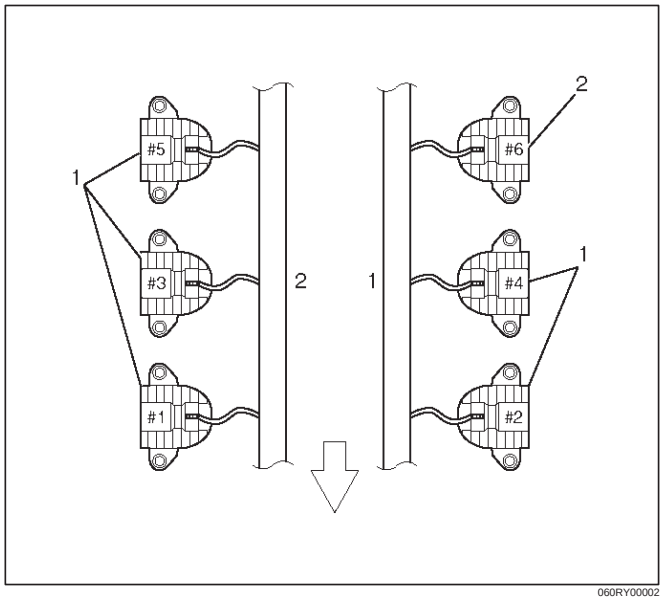
   Torque : 4 N·m (35 lb in)



060RY022

Legend
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.



060RY00002

Legend
(1) Long Type Ignition Coil Assemblies (# 1 ~ # 5)
(2) Short Type Ignition Coil Assembly (# 6)

4. Connect ground cable and tighten bolts to the specified torque.

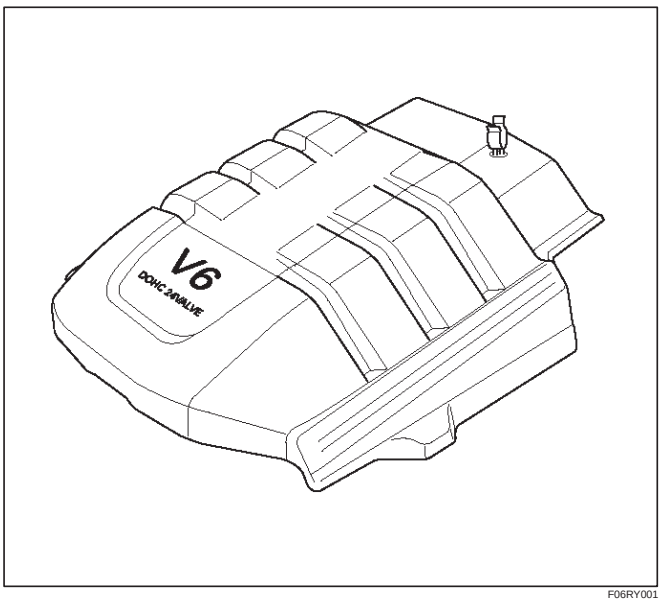
   Torque : 9 N·m (78 lb in)

5. Install positive crankcase ventilation hose.
6. Install engine cover mating with the dowels.

Cylinder Head Cover RH

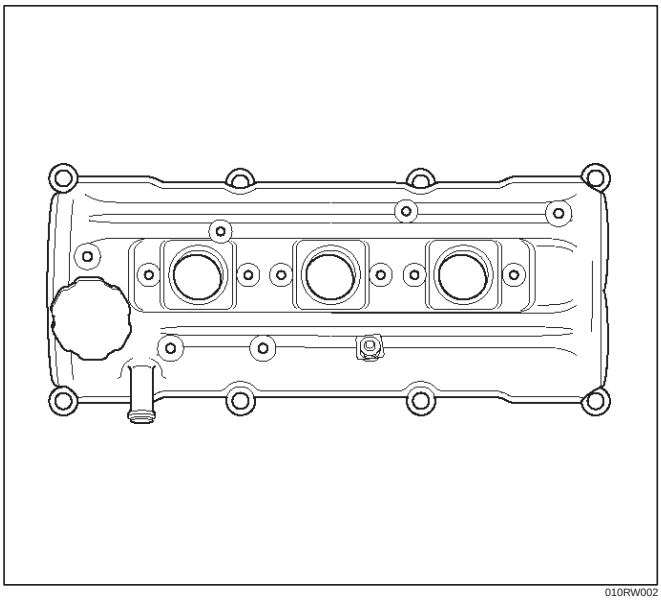
Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowele on the common chamber.



F06RY001

3. Disconnect ventilation hose from cylinder head cover.
4. Disconnect three ignition coil connectors from ignition coils and remove harness bracket bolts on cylinder head cover then remove ignition coil fixing bolts on ignition coils and remove ignition coils.
5. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
6. Remove eight fixing bolts then the cylinder head cover.



010RW002

Installation

1. Install cylinder head cover.

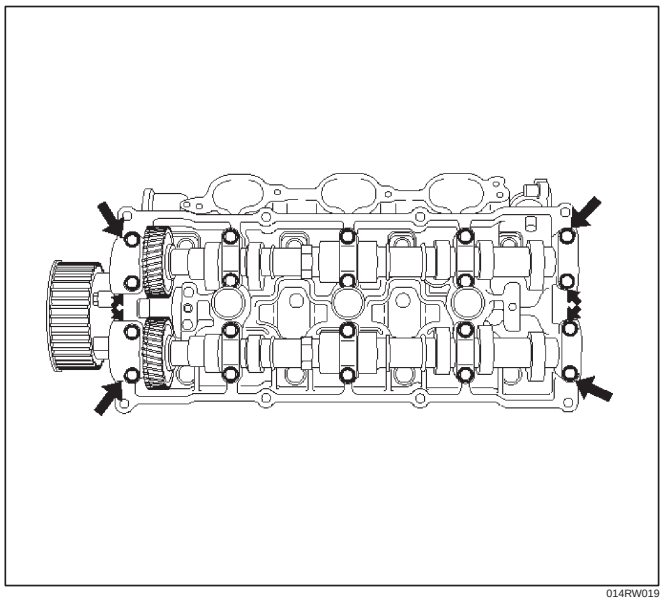
▼Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.

Apply sealant (TB-1207B or equivalent) bead (diameter 2-3 mm) at eight places of arched areas of camshaft bracket on front and rear sides.

▼The cylinder head cover must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

▼Tighten bolts to the specified torque.

Torque : 9 N·m (78 lb in)



014RW019

2. Tighten fuel injector harness bracket bolts to specified torque then reconnect fuel injector harness connector.

Torque : 7.8 N·m (69 lb in)

3. Connect ignition coil connector and tighten ignition coil fixing bolts to specified torque.

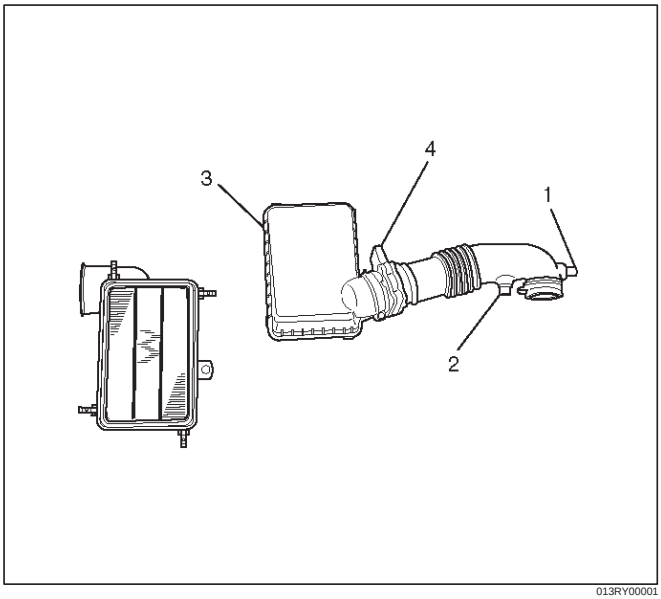
Torque : 4 N·m (35 lb in)

4. Connect ventilation hose to cylinder head.
5. Install engine cover mating with the dowels.

Common Chamber

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.

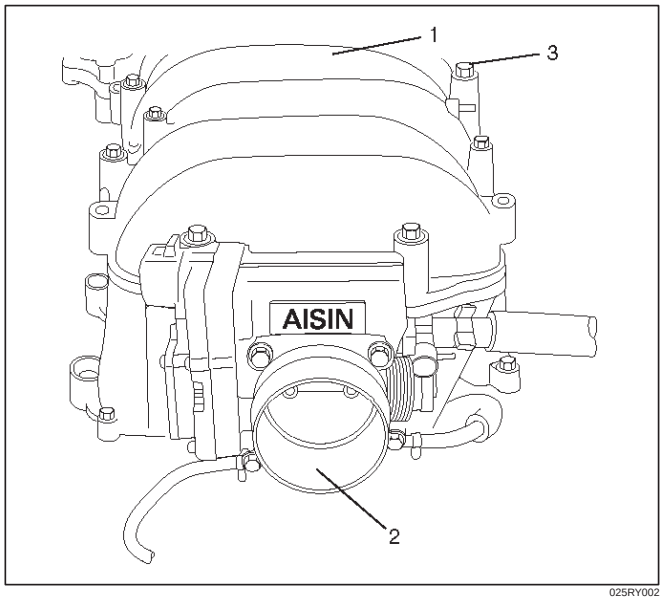


013RY00001

Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Disconnect vacuum booster hose from common chamber.
4. Disconnect connector from manifold absolute pressure sensor, Ion sensing module, throttle position sensor, solenoid valve, electric vacuum sensing valve, and EGR valve.
5. Disconnect vacuum hose on canister VSV and positive crankcase ventilation hose, fuel rail assembly with pressure control valve bracket.
6. Remove ventilation hose from throttle valve and intake duct and remove water hose.
7. Remove the four throttle body fixing bolts.
8. Remove exhaust gas recirculation valve assembly fixing bolt and nut on common chamber and remove EGR valve assembly.
9. Remove two bolts from common chamber rear side to remove fuel hose bracket.
10. Remove common chamber four bolts and four nuts then remove the common chamber.



025RY002

Legend

(1) Common Chamber
(2) Throttle Valve Assembly
(3) Bolt

Installation

1. Install common chamber and tighten bolts and nuts to the specified torque.

   Torque :

   Bolt : 25 N·m (18 lb ft)

   Nut : 25 N·m (18 lb ft)
2. Install fuel hose bracket and tighten bolts to specified torque.

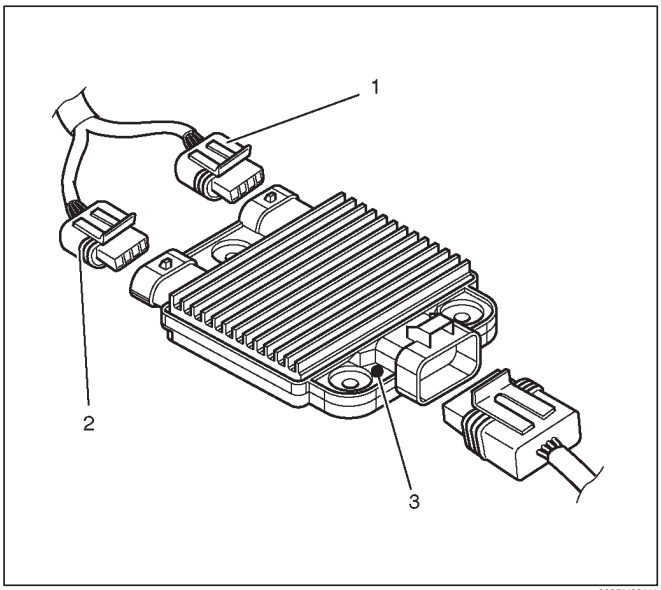
   Torque : 10 N·m (87 lb in)
3. Install exhaust gas recirculation valve assembly and tighten bolt and nut to the specified torque.

   Torque : 25 N·m (18 lb ft)
4. Install throttle body and tighten bolts to the specified torque.

   Torque : 25 N·m (18 lb ft)
5. Install ventilating hose to throttle valve and intake duct.
6. Connect vacuum hoses on canister VSV and positive crankcase ventilation hose. Tighten bolts for fuel rail assembly with pressure control valve bracket.

   Torque : 25 N·m (18 lb ft)

7. Connect each connector.
8. Connect vacuum booster hose.
9. Connect the Ion sensing module connectors as shown in the illustration.

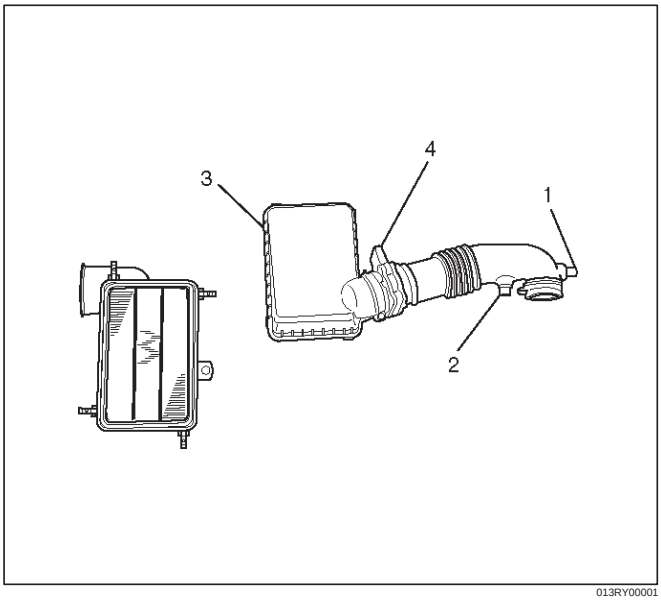


060RY00111

Legend

(1) Green Connector
(2) Blue Connector
(3) Identification Mark (6VE1 Engine Only)

10. Install air cleaner duct assembly.



013RY00001

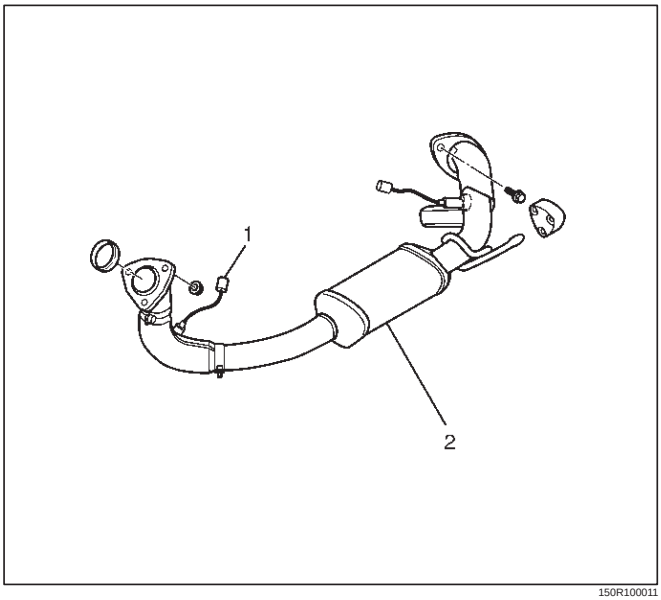
Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Mass Air Flow Sensor

Exhaust Manifold LH

Removal

1. Disconnect battery ground cable.
2. Disconnect O_2 sensor connector.
3. Remove exhaust front pipe three stud nuts from exhaust side and two bolts from rear end of exhaust front pipe.



150R100011

Legend

(1) Exhaust Front Pipe LH
(2) O_2 Sensor

4. Remove exhaust manifold eight fixing nuts and remove exhaust manifold from the engine.

Installation

1. Install exhaust manifold and tighten exhaust manifold fixing nuts to the specified torque with new nuts.

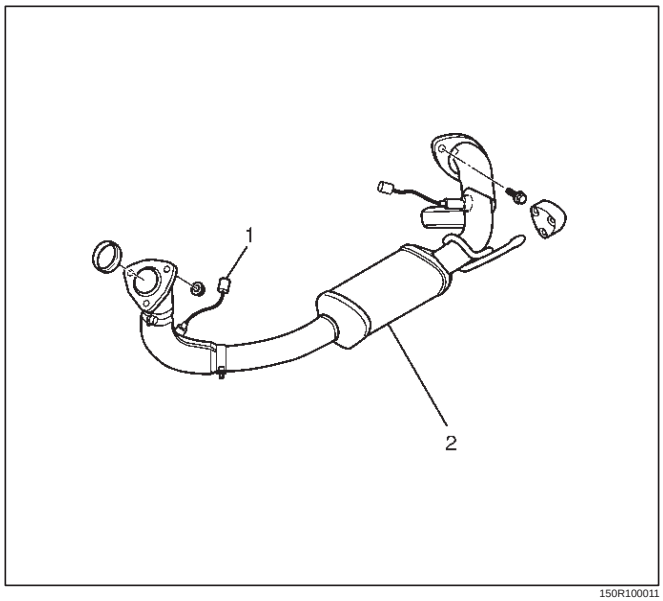
   Torque: 57 N·m (42 lb ft)

2. Install exhaust front pipe and tighten three stud nuts and two bolts to the specified torque.

   Torque :

   Stud nuts: 67 N·m (49 lb ft)

   Bolts: 43 N·m (32 lb ft)



150R100011

Legend

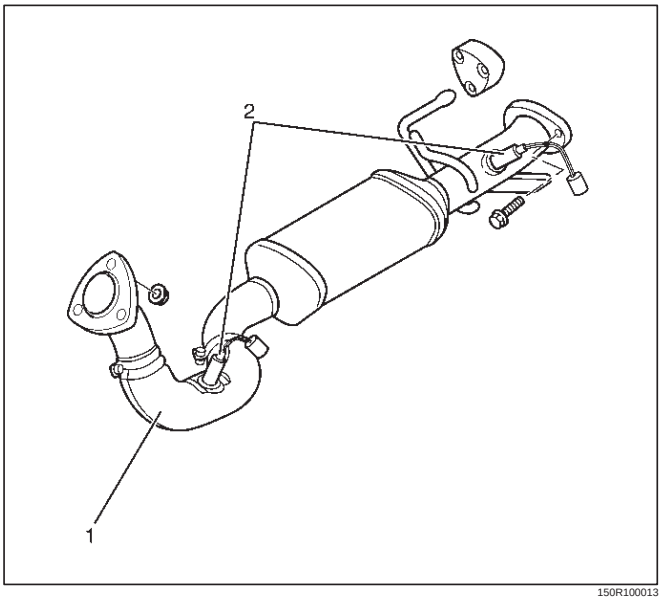
(1) O_2 Sensor
(2) Exhaust Front Pipe LH

3. Reconnect O_2 sensor connector.

Exhaust Manifold RH

Removal

1. Disconnect battery ground cable.
2. Remove torsion bar. Refer to removal procedure in Front Suspension section.
3. Remove exhaust front pipe three stud nuts and two bolts then disconnect exhaust front pipe.



150R100013

Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensor

4. Remove exhaust manifold eight fixing nuts then the exhaust manifold.

Installation

1. Install exhaust manifold and tighten nuts to the specified torque.

   Torque : 57 N·m (42 lb ft)

2. Install exhaust front pipe and tighten three stud nuts and two bolts to the specified torque.

   Torque:

   Stud nuts: 67 N·m (49 lb ft)

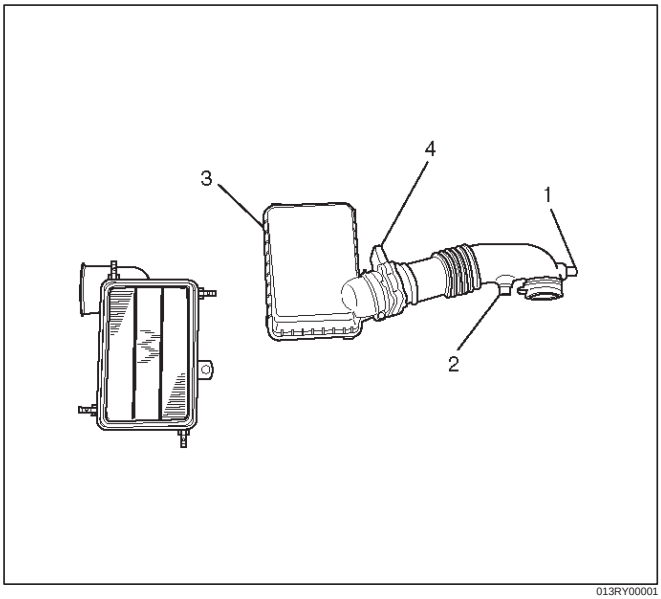
   Bolts: 43 N·m (32 lb ft)

3. Install the torsion bar and readjust the vehicle height. Refer to installation and vehicle height adjustment procedure for front suspension.

Crankshaft Pulley

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.

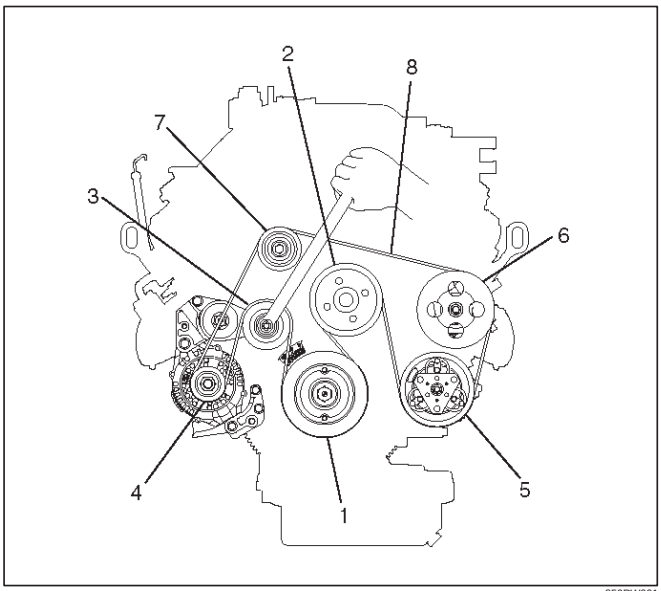


013RY00001

Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Remove radiator upper fan shroud from radiator.
4. Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



850RW001

Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Driver Belt

5. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
6. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley then remove center bolt and pulley.

Installation

1. Install crankshaft pulley using J-8614-01 crankshaft holder, hold the crankshaft pulley and tighten center bolt to the specified torque.

   Torque : 167 N·m (123 lb ft)

2. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

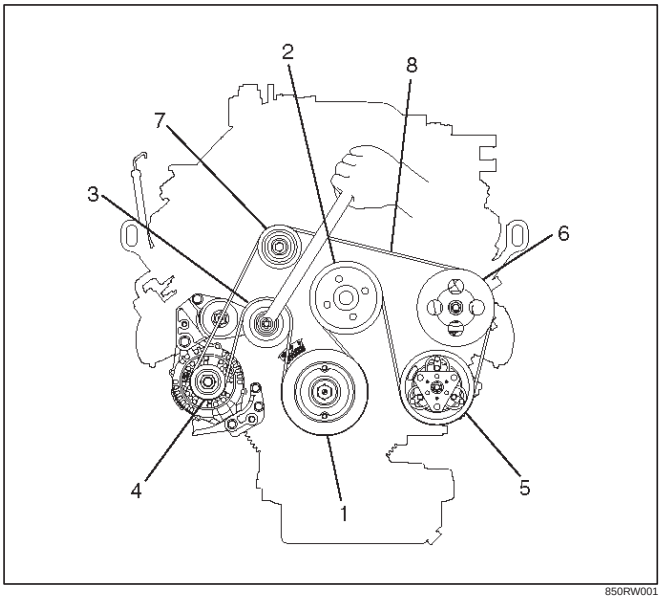
   Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

3. Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator upper fan shroud.
5. Install air cleaner assembly.

Timing Belt

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.
3. Remove radiator upper fan shroud from radiator.
4. Move drive belt tensioner to loose side using wrench then remove drive belt.



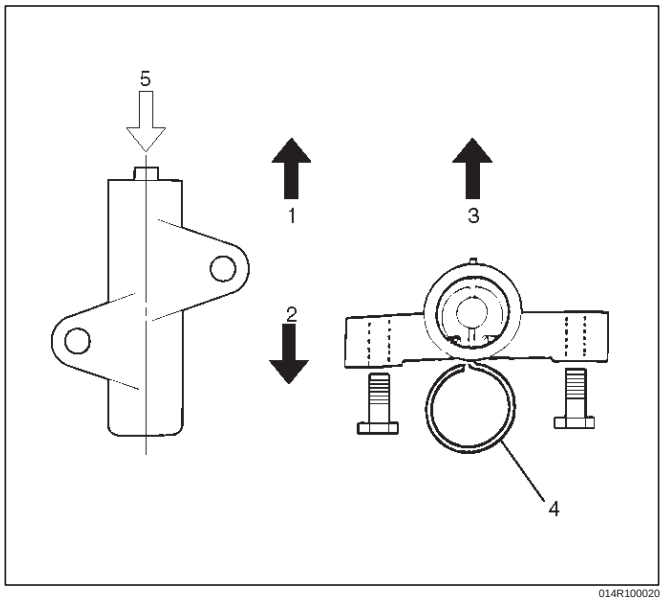
850RW001

Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

5. Remove cooling fan assembly four nuts, then the cooling fan assembly.
6. Remove cooling fan drive pulley assembly.
7. Remove idle pulley assembly.
8. Remove serpentine belt tensioner assembly.
9. Remove power steering pump assembly.
10. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley remove center bolt, then the pulley.
11. Remove right side timing belt cover then left side timing belt cover.
12. Remove lower timing belt cover
13. Remove pusher.

CAUTION: The pusher prevents air from entering the oil chamber. Its rod must always be facing upward.



014R100020

Legend

(1) Up Side
(2) Down Side
(3) Direction For Installation
(4) Locking Pin
(5) Apply a force of 980 N (220 lb) when compressing the pusher rod.

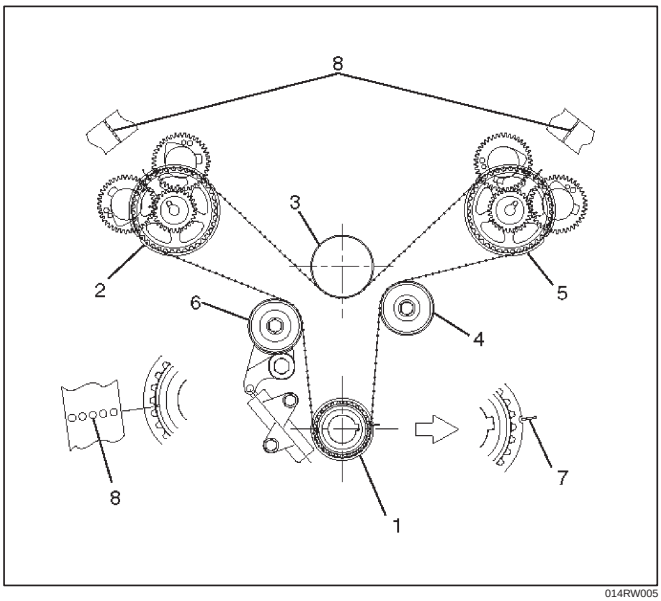
14. Remove timing belt.

CAUTION:

1. **Do not bend or twist the belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm (1.1811 in).**
2. **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
3. **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
4. **Store timing belt in a cool and dark place. Never expose the belt direct sunlight or heat.**

Installation

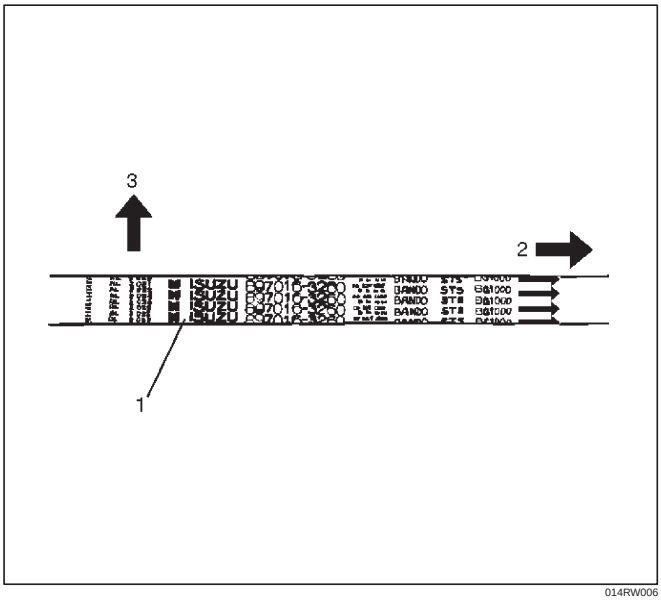
NOTE: For correct belt installation, the letter on the belt must be able to be read as viewed from the front of the vehicle.



014RW005

Legend

(1) Crankshaft Timing Pulley
(2) RH Bank Camshaft Drive Gear Pulley
(3) Water Pump Pulley
(4) Idle Pulley
(5) LH Bank Camshaft Drive Gear Pulley
(6) Tension Pulley
(7) Alignment Mark on Oil Pump.
(8) Alignment Mark on Timing Belt



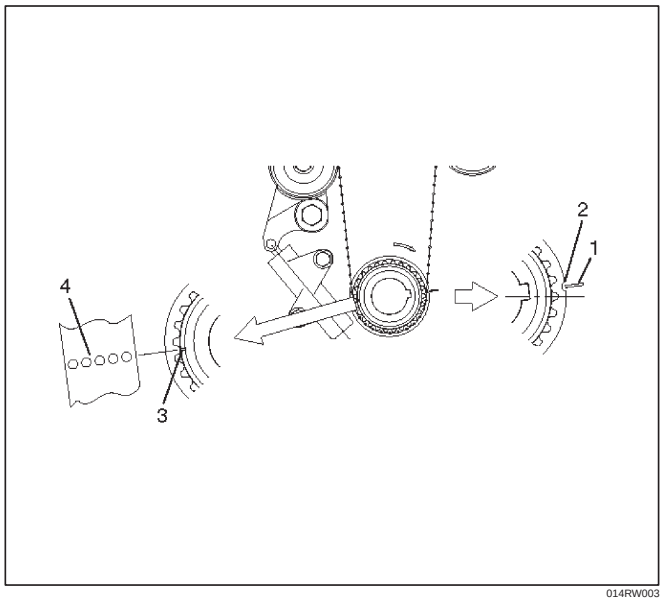
014RW006

Legend

(1) Timing Belt
(2) Engine Rotation Direction
(3) Cylinder Head Side

1. Install timing belt.
   1. Align groove of crankshaft timing pulley (2) with mark on oil pump (1).
      Align the mark on the crankshaft timing pulley (3) with alignment mark (white dotted line) on the timing belt (4).
      Secure the belt with a double clip or equivalent clip.

NOTE: When timing marks are aligned, No.2 piston will be on Top Dead Center.



014RW003

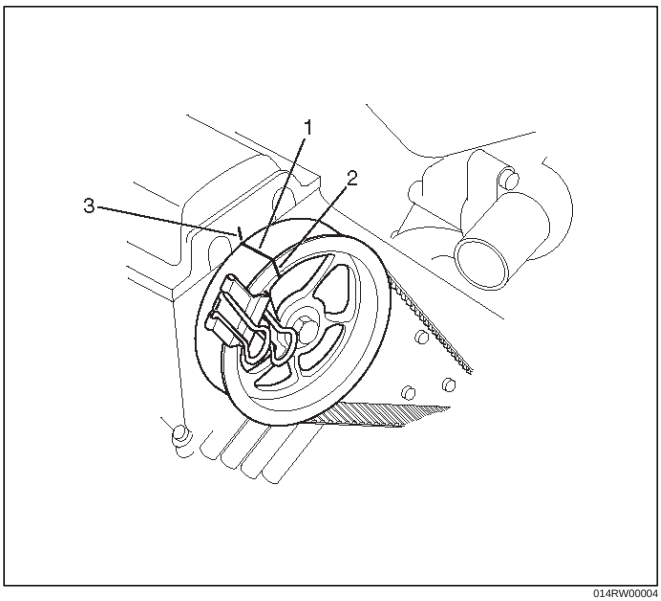
Legend

(1) Alignment Mark on Oil Pump
(2) Groove on Crankshaft Timing Pulley
(3) Alignment Mark on Crankshaft Timing Pulley
(4) Alignment Mark on Timing Belt

   2. Align the alignment mark on the RH bank camshaft drive pulley (2) to the alignment mark of the cylinder head cover RH (3).
      The camshaft pulley is not 1:1 with the camshafts. It is necessary to rotate the camshaft pulley until the camshaft lobes are in the position as shown in the diagram on page 6A–34.
      The camshaft pulley alignment mark should also align with alignment mark on the cylinder head cover.
      It may require up to four revolutions of the camshaft pulley to achieve alignment of all marks.

3. Align the alignment mark (white line) on the timing belt (1) with alignment mark on the RH bank camshaft drive pulley (2) (on the left side as viewed from the front of the vehicle) and put the timing belt on the camshaft drive pulley.

   Secure the belt with a double clip or equivalent clip.



014RW00004

Legend

(1) Alignment Mark on Timing Belt (White line).
(2) Alignment Mark on Camshaft Drive Pulley.
(3) Alignment Mark on Cylinder Head Cover RH.

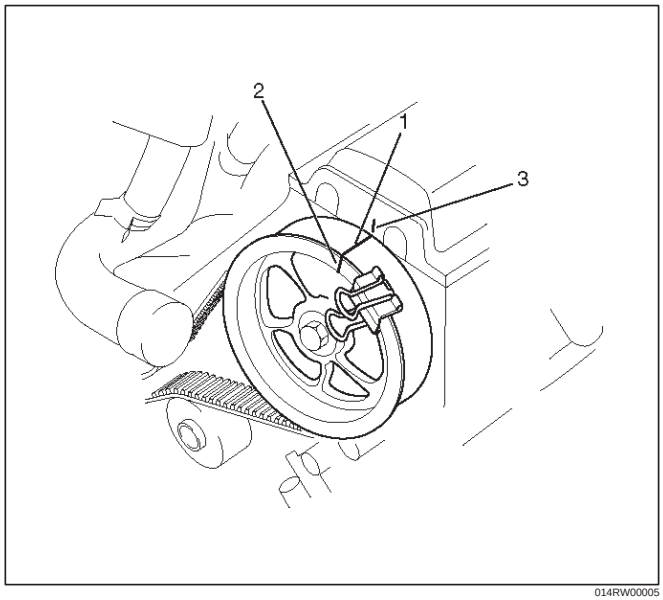
4. Align the alignment mark on the LH bank camshaft drive pulley (2) to the alignment mark of the cylinder head cover LH (3).

   The camshaft pulley is not 1:1 with the camshafts. It is necessary to rotate the camshaft pulley until the camshaft lobes are in the position as shown in the diagram on page 6A–34.
   The camshaft pulley alignment mark should also align with alignment mark on the cylinder head cover.
   It may require up to four revolutions of the camshaft pulley to achieve alignment of all marks.

5. Align the alignment mark (white line) on the timing belt (1) with the alignment mark on the LH bank camshaft drive pulley (2).

   When aligning the timing marks, use a wrench to turn the camshaft drive pulley, then set the timing mark between timing belt and camshaft drive pulley and put the timing belt on the camshaft drive pulley.
   Secure the belt with a double clip or equivalent clip.

NOTE: It is recommended for easy installation that the belt be secured with a double clip or equivalent clips after it is installed to each pulley.



014RW00005

Legend

(1) Alignment Mark on Timing Belt (White line).
(2) Alignment Mark on Camshaft Drive Pulley.
(3) Alignment Mark on Cylinder Head Cover LH.

6. Install crankshaft pulley temporarily and tighten center bolt by hand (do not use a wrench).

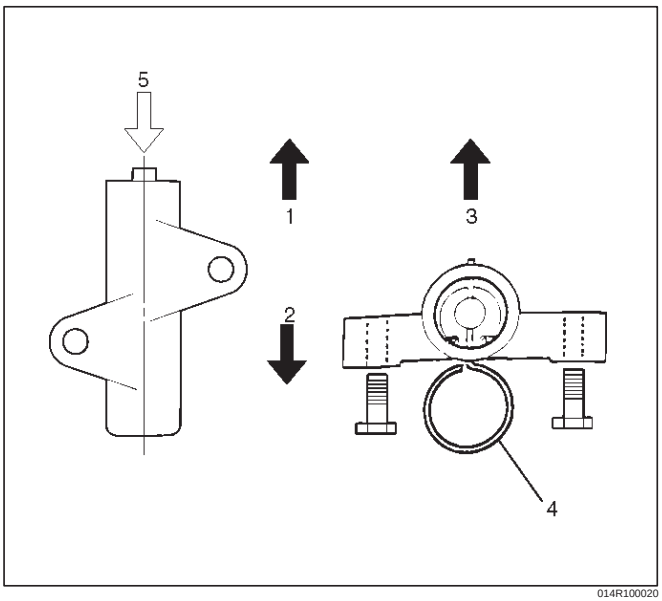
   Turn the crankshaft pulley clockwise to give some belt slack between the crankshaft timing pulley and the RH bank camshaft drive pulley.

2. Install pusher and tighten bolt to the specified torque.

Torque : 25 N·m (2.5 kg·m/18 lb ft)

1. Install the pusher while pushing the tension pulley to the belt.
2. Pull out pin from the pusher.

NOTE: When reusing the pusher, press the pusher with approximately 100Kg to retract the rod, and insert a pin (1.4 mm (0.055 in) piano wire).

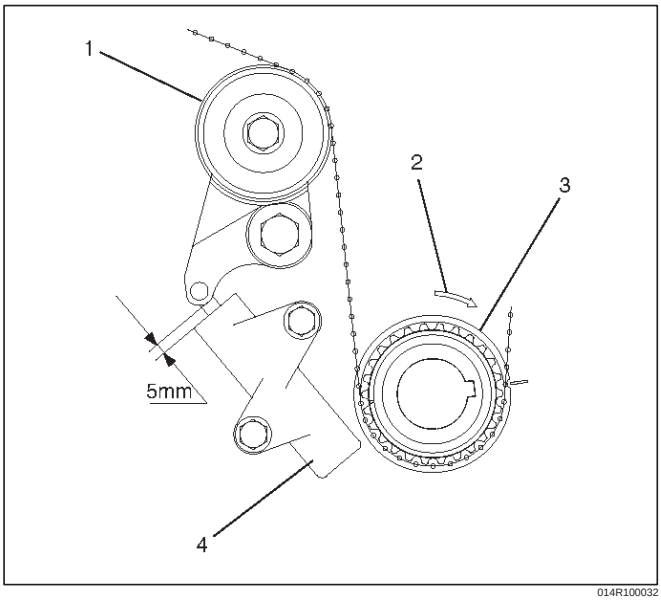


014R100020

Legend

(1) Up Side
(2) Down Side
(3) Direction for Installation
(4) Locking Pin
(5) Apply a force of 980 N (220 lb) when compressing the pusher rod.

After release the push rod from the locking pin, the rod projection is approximate 5 mm (0.1969 in).



014R100032

Legend

(1) Tensioner Pulley
(2) Crankshaft Pulley Rotation Direction
(3) Crankshaft Pulley
(4) Pusher Assembly

3. Remove double clips or equivalent clips from timing belt pulleys.

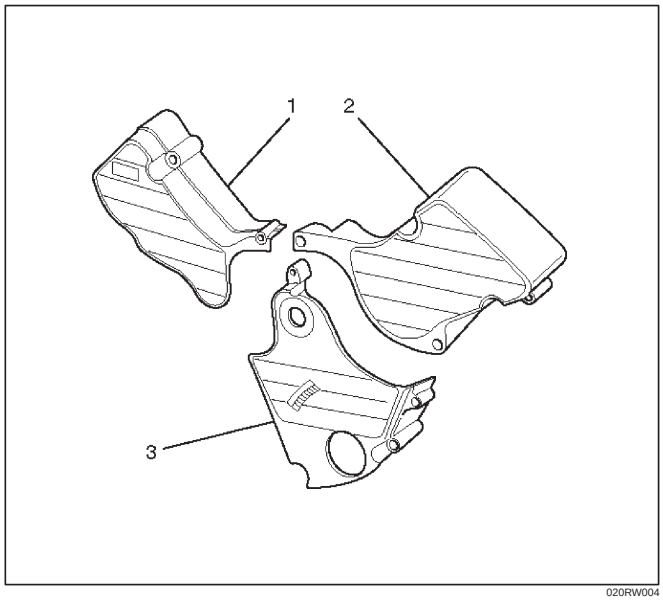
   Turn the crankshaft pulley by six turns and check for timing mark alignment.

3. Install timing belt cover.

   Remove crankshaft pulley that was installed in step 1 item 5.

   Tighten bolts to the specified torque.

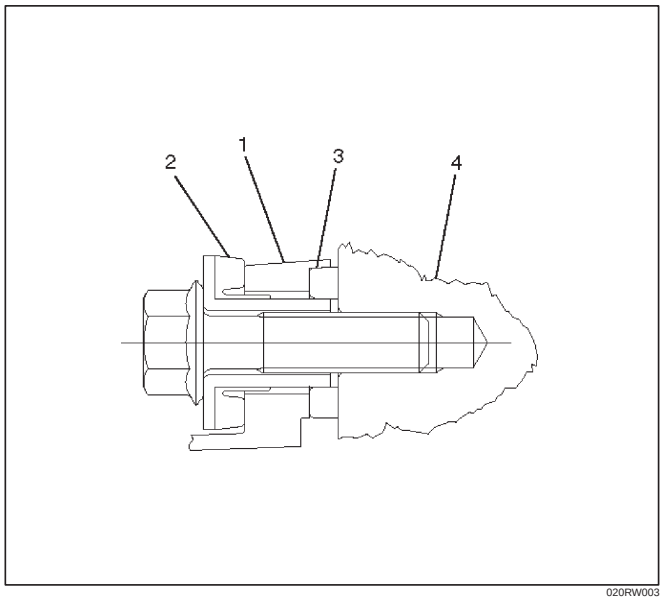
   Torque: 19 N·m (14 lb ft)



020RW004

Legend

(1) Timing Belt Cover RH
(2) Timing Belt Cover LH
(3) Timing Belt Cover Lower



020RW003

Legend

(1) Timing Belt Cover
(2) Rubber Bushing
(3) Sealing Rubber
(4) Cylinder Body

4. Install crankshaft pulley using J-8614-01, hold the crankshaft pulley and tighten center bolt to the specified torque.

   Torque : 167 N·m (123 lb ft)

5. Install fan pulley bracket and tighten fixing bolts to the specified torque.

   Torque : 22 N·m (16 lb ft)

6. Install power steering pump assembly and tighten to the specified torque.

   Torque :

   M8 bolt : 22 N·m (16 lb ft)

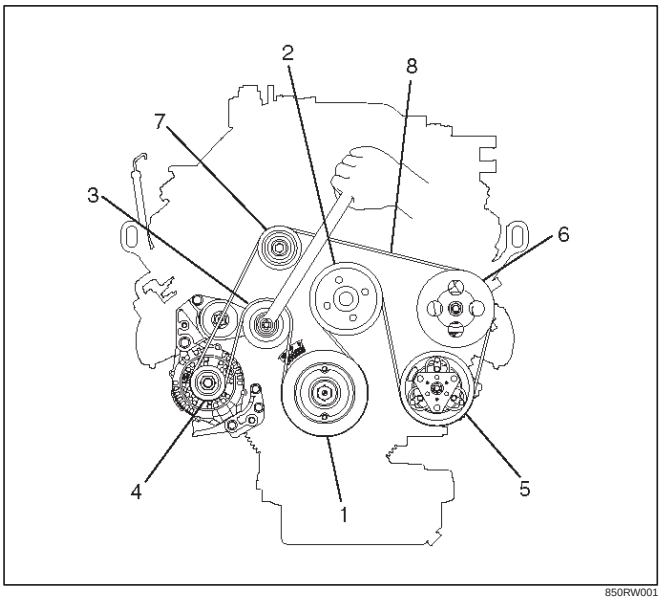
   M10 bolt : 46 N·m (34 lb ft)

7. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

   Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

8. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



850RW001

Legend

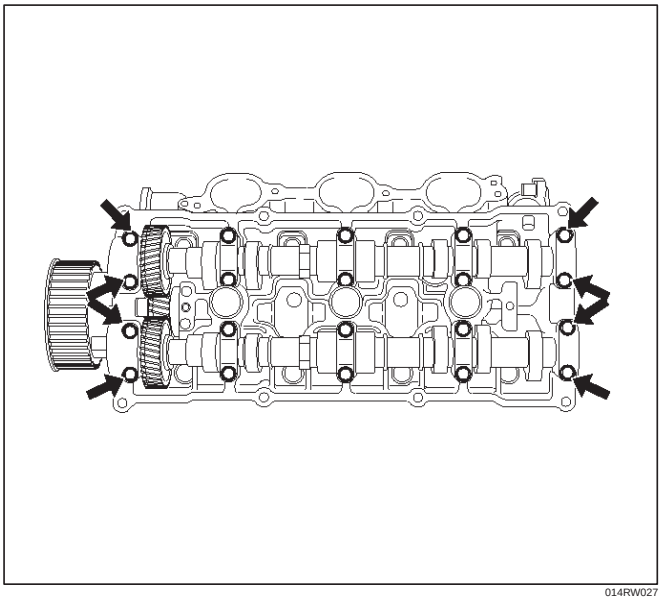
(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

9. Install radiator upper fan shroud.
10. Install air cleaner assembly.

Camshaft

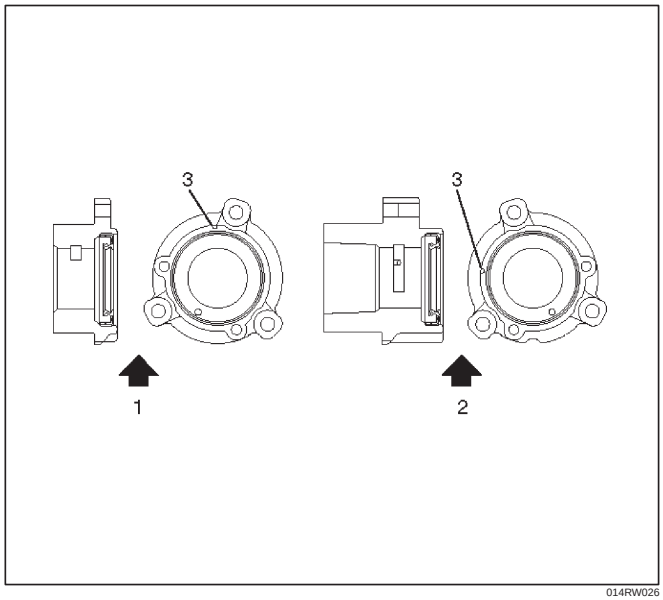
Removal

1. Disconnect battery ground cable.
2. Remove crankshaft pulley.
   ▼Refer to removal procedure for Crankshaft Pulley in this manual.
3. Remove timing belt.
   ▼Refer to removal procedure for Timing Belt in this manual.
4. Remove cylinder head cover LH.
   ▼Refer to removal procedure for Cylinder Head Cover LH in this manual.
5. Remove cylinder head cover RH.
   ▼Refer to removal procedure for Cylinder Head Cover RH in this manual.
6. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing cap.



014RW027

7. Remove camshaft assembly.
8. Remove fixing bolt for camshaft drive gear pulley.
9. Remove three fixing bolts from camshaft drive gear retainer, then camshaft drive gear assembly.



014RW026

Legend

(1) Right Bank
(2) Left Bank
(3) Timing Mark on Retainer

Installation

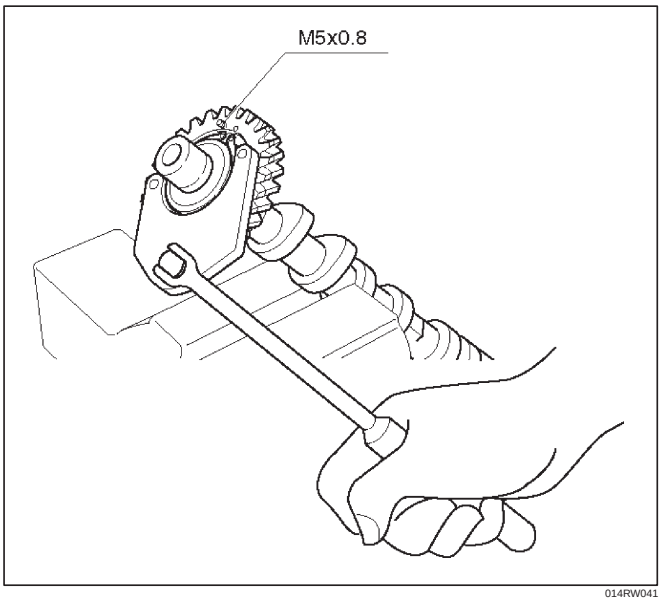
1. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   Torque : 10 N·m (87 lb in)

2. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

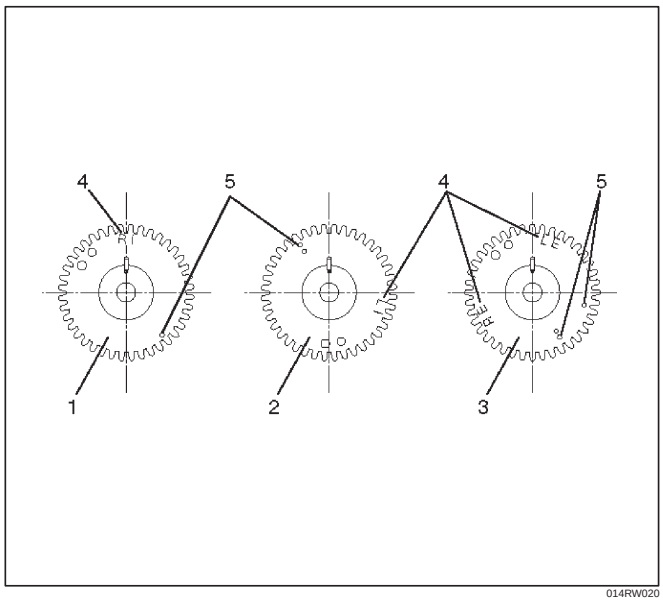
   Torque : 98 N·m (72 lb ft)

3. Tighten sub gear setting bolt.
   1. Use J-42686 to turn sub gear to right direction until it aligns with the M5 bolt hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.



014RW041

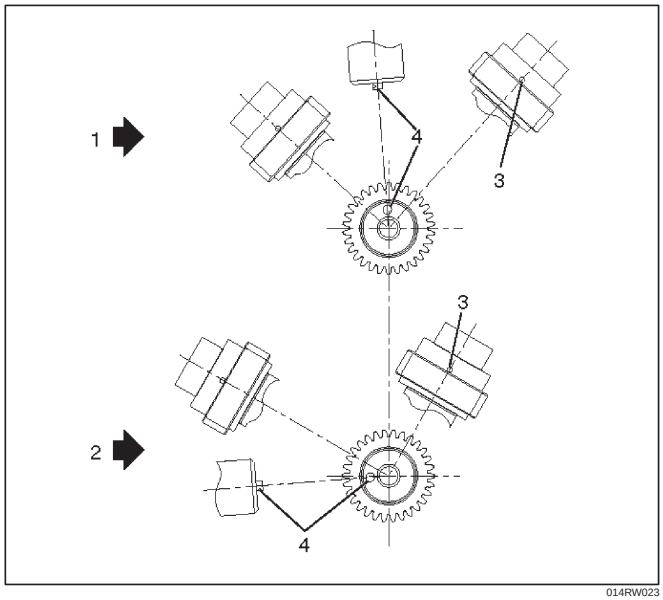
4. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing caps.
   2. Align timing mark on intake camshaft (one dot for right bank, two dot for left bank) and exhaust camshaft (one dots for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

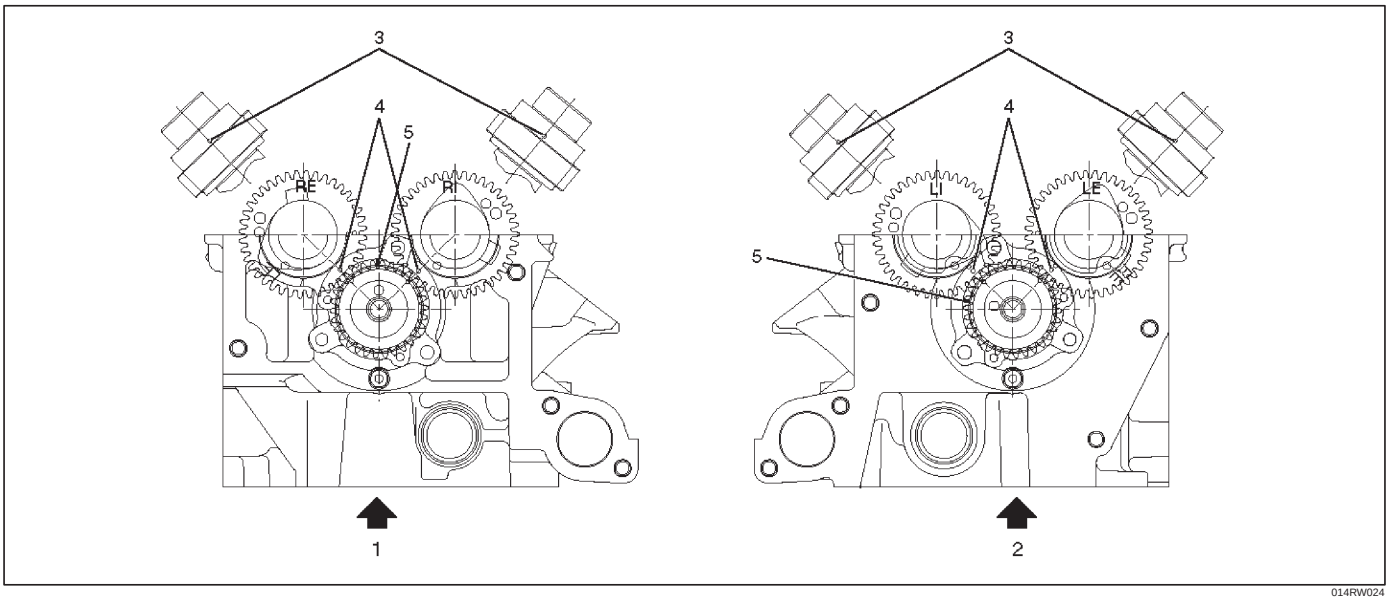
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
(LI: Left bank intake, RI: Right bank intake)
(LE: Left bank exhaust, RE: Right bank exhaust)



014RW023

Legend

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin



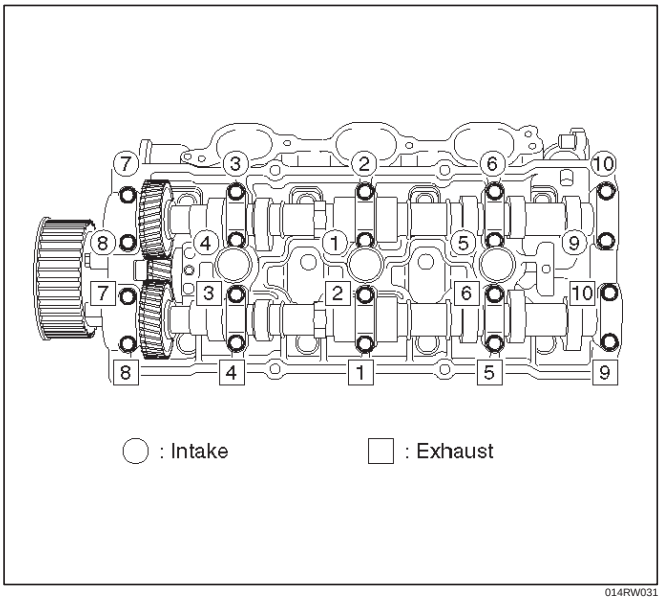
014RW024

Legend

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts on numerical order an one side bank as shown in the illustration.

Torque : 10 N·m (87 lb in)



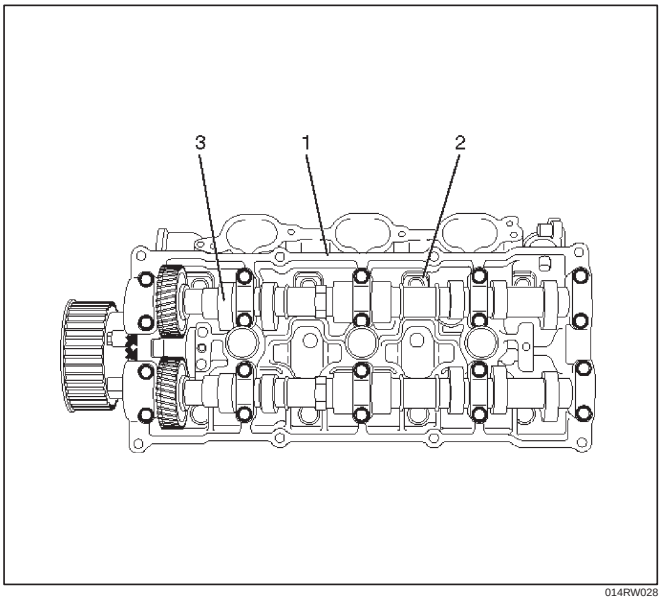
014RW031

5. Install cylinder head cover RH.
   ▼Refer to installation procedure for CYLINDER HEAD COVER RH in this manual.
6. Install cylinder head cover LH.
   ▼Refer to installation procedure for CYLINDER HEAD COVER LH in this manual.
7. Install timing belt.
   ▼Refer to installation procedure for TIMING BELT in this manual.
8. Install crankshaft pulley.
   ▼Refer to installation procedure for CRANKSHAFT PULLEY in this manual.

Cylinder Head

Removal

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Drain radiator coolant.
4. Drain engine oil.
5. Remove crankshaft pulley.
   ▼Refer to removal procedure for Crankshaft Pulley in this manual.
6. Remove timing belt.
   ▼Refer to removal procedure for Timing Belt in this manual.
7. Remove cylinder head cover LH.
   ▼Refer to removal procedure for Cylinder Head Cover LH in this manual.
8. Remove cylinder head cover RH.
   ▼Refer to removal procedure for Cylinder Head Cover RH in this manual.
9. Remove common chamber.
   ▼Refer to removal procedure for Common Chamber in this manual.
10. Remove cylinder head assembly.
    1. Loosen head bolts in reverse of tightening sequence.
    2. Remove cylinder head assembly.



014RW028

Legend

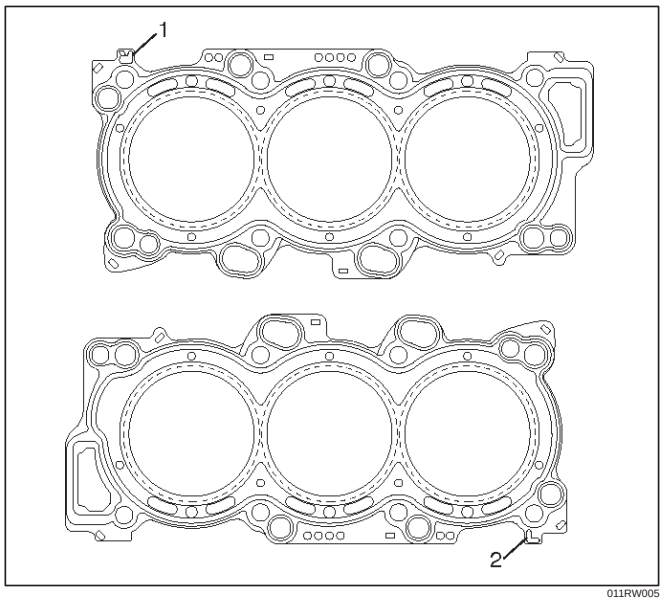
(1) Cylinder Head
(2) Cylinder Head Bolt
(3) Camshaft

Installation

1. Install cylinder head assembly to cylinder block.
   A. Put cylinder head gasket on the cylinder block.

NOTE: There is discrimination mark “R” for right bank and “L” for left bank on the cylinder head gasket as shown in the illustration.

Do not reuse cylinder head gasket.

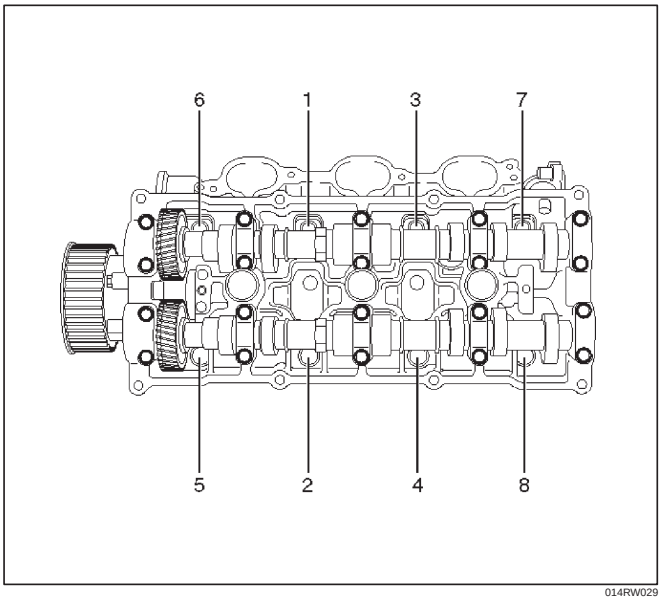


011RW005

B. Align dowel pin hole to dowel pin on the cylinder block.
C. Position cylinder head on the cylinder block.
D. Tighten two bolts temporarily by hand to prevent the cylinder head assembly from moving.
E. Using J-24239-01 cylinder head bolt wrench, tighten bolts in numerical order as shown in the illustration to the specified torque.

NOTE: Do not reuse cylinder head bolts.
Do not apply any lubricant to the cylinder head bolts.

Torque :
Temporary : 29 N·m (22 lb ft)
Final : 64 N·m (47 lb ft)



014RW029

2. Install common chamber.
   ▼Refer to installation procedure for Common Chamber in this manual.
3. Install cylinder head cover RH.
   ▼Refer to installation procedure for Cylinder Head Cover RH in this manual.
4. Install cylinder head cover LH.
   ▼Refer to installation procedure for Cylinder Head Cover LH in this manual.
5. Install timing belt.
   ▼Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   ▼Refer to installation procedure for Crankshaft Pulley in this manual.

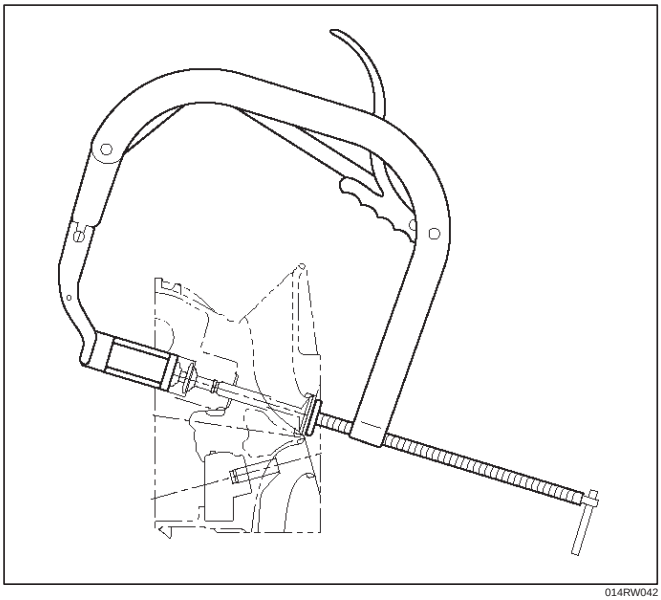
Valve Stem Oil Controller , Valve Spring and Valve Guide

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
   ▼Drain engine coolant.
3. Remove cylinder head assembly.
   ▼Refer to removal procedure for Cylinder Head in this manual.
4. Remove camshaft.
   ▼Refer to removal procedure for Camshaft in this manual.
5. Remove tappets with shim.

NOTE: Do not damage shim surface.

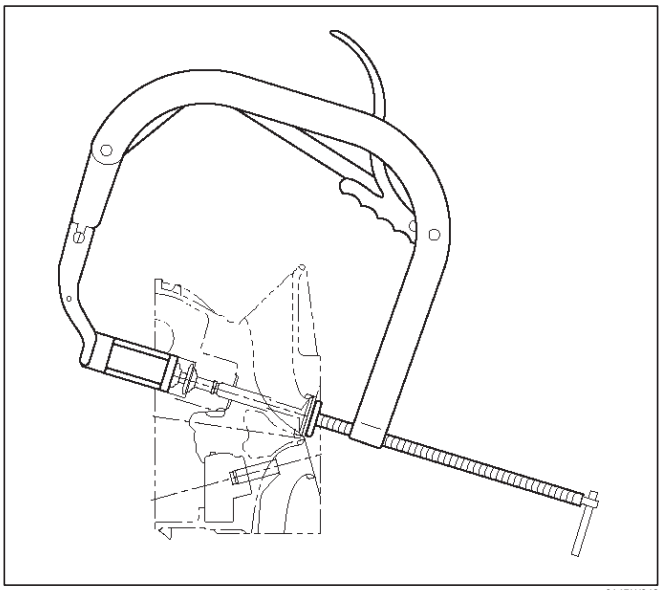
6. Remove valve springs using J-8062 valve spring compressor and J-42898 valve spring compressor adapter then remove upper valve spring seat and lower seat.


014RW042

7. Remove oil controller using J-37281 oil controller remover, remove each valve stem oil controller.
8. Remove valve guide using J-37985 valve guide replacer.

Installation

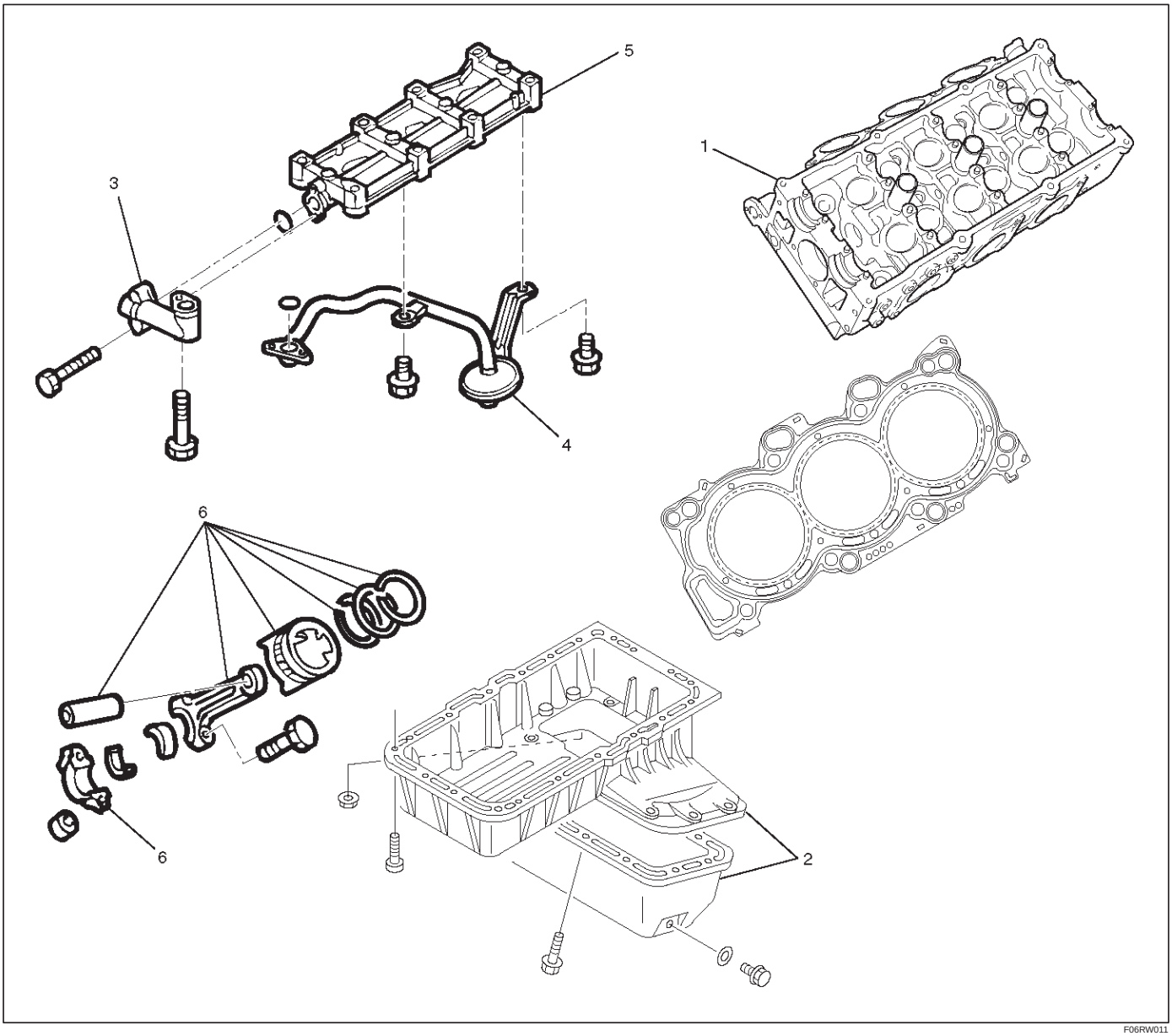
1. Install valve guide using J-42899 valve guide installer.
2. Install oil controller using J-38537 oil controller installer.
3. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using J-8062 valve spring compressor and J-42898 valve spring compressor adapter to install the split collars.


014RW042

4. Install tappet with shim.
5. Install camshaft assembly.
   ▼Refer to installation procedure for Camshaft in this manual.
6. Install cylinder head assembly.
   ▼Refer to installation procedure for Cylinder Head in this manual.
7. Fill engine oil until full level.
8. Fill engine coolant.

Piston, Piston Ring and Connecting Rod

Removal



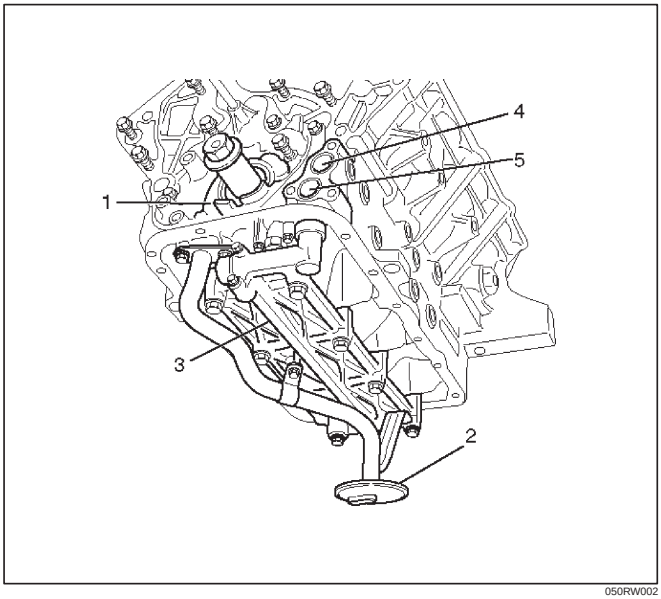
F06RW011

Legend

(1) Cylinder Head
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Gallery
(6) Piston with Connecting Rod Assembly

1. Remove cylinder head assembly.
   ▼Refer to removal procedure for Cylinder Head in this manual.
2. Remove crankcase with oil pan.
   ▼Refer to removal procedure for Oil Pan and Crankcase in this manual.

3. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.



050RW002

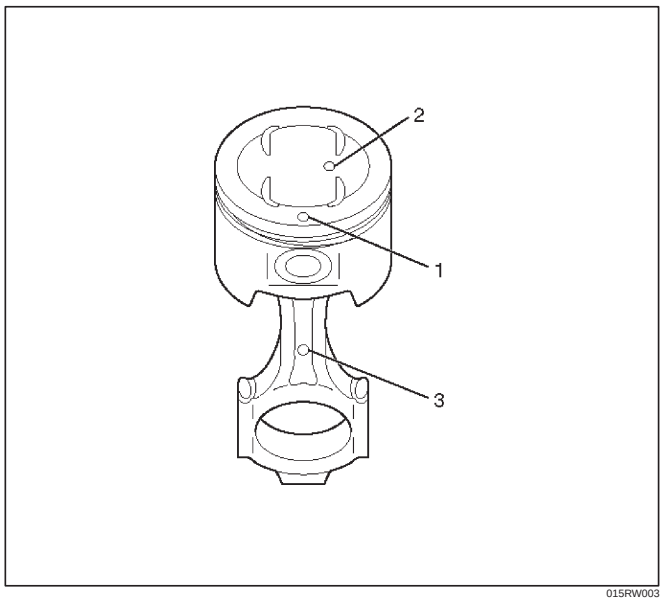
Legend
(1) Oil Pump
(2) Oil Strainer
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

4. Remove three fixing bolts, oil pipe with O-ring.
5. Remove eight fixing bolts, oil gallery.
6. Remove piston with connecting rod assembly. (before removing the bearing cap, remove carbon on the top of cylinder bore and push piston with connecting rod out from the top of cylinder bore.)

Installation

1. Install piston with connecting rod assembly.
   ▼Apply engine oil to cylinder bore, connecting rod bearing and crank pin.
   When installing the piston, its front mark must face the engine front side.
   ▼The bearing cap number must be the same as connecting rod number.
   ▼Apply engine oil to the thread and seating surface of each nut.
   ▼Tighten nuts to the specified torque.
   Torque : 54 N·m (40 lb ft)
   ▼After tightening the nuts, make sure that the crankshaft rotates smoothly.

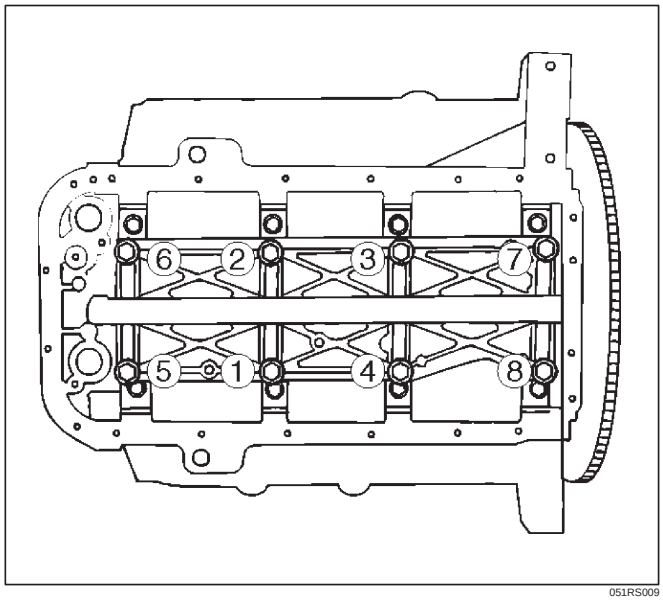
NOTE: Do not apply engine oil to the bearing back faces and connecting rod bearing fitting surfaces.



015RW003

Legend
(1) Piston Front Mark
(2) Piston Grade
(3) Connecting Rod Front Mark

2. Install oil gallery and tighten the bolts in two steps, in the order shown in illustration.
   Torque :
   1st step : 29 N·m (22 lb ft)
   2nd step : 55˚–65˚

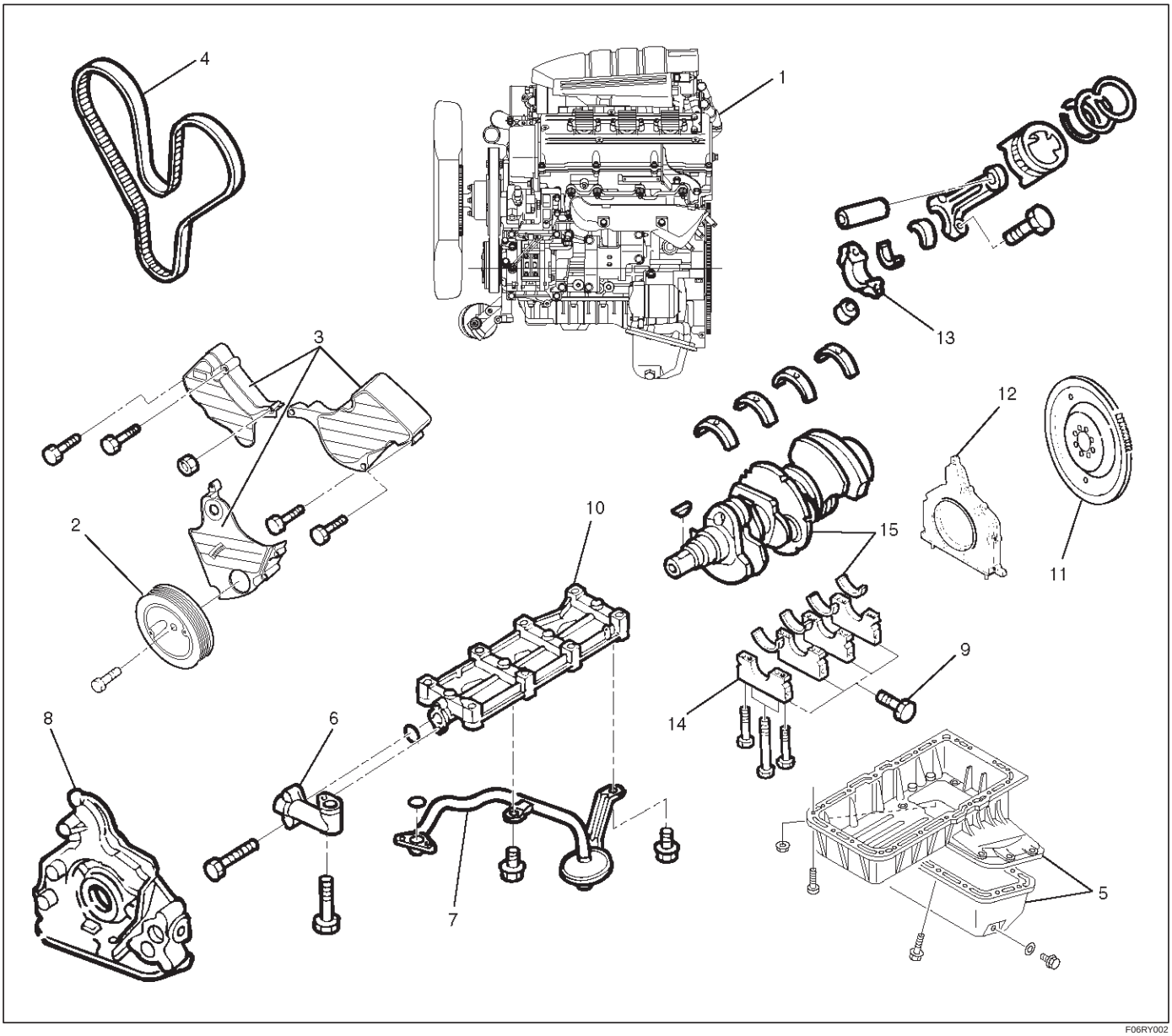


051RS009

3. Install oil pipe with O-ring.
   Torque : 10 N·m (87 lb in)
4. Install oil strainer assembly with O-ring.
   Torque : 25 N·m (18 lb ft)
5. Install crankcase with oil pan.
   ▼Refer to installation procedure for Oil Pan and Crankcase in this manual.
6. Install cylinder head assembly.
   ▼Refer to installation procedure for Cylinder Head in this manual.

Crankshaft and Main Bearings

Removal



F06RY002

Legend

(1) Engine Assembly
(2) Crankshaft Pulley
(3) Timing Belt Cover
(4) Timing Belt
(5) Crankcase with Oil Pan
(6) Oil Pipe
(7) Oil Strainer
(8) Oil Pump Assembly
(9) Cylinder Body Side Bolt
(10) Oil Gallery
(11) Flywheel
(12) Rear Oil Seal Retainer
(13) Connecting Rod Cap
(14) Crankshaft Main Bearing Cap
(15) Crankshaft and Main Bearing

1. Remove engine assembly.
   ▼Refer to removal procedure for Engine Assembly in this manual.
2. Remove timing belt.
   ▼Refer to removal procedure for Timing Belt in this manual.
3. Remove oil pan and crankcase.
   ▼Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove oil pipe with O-ring.
5. Remove oil strainer assembly with O-ring.

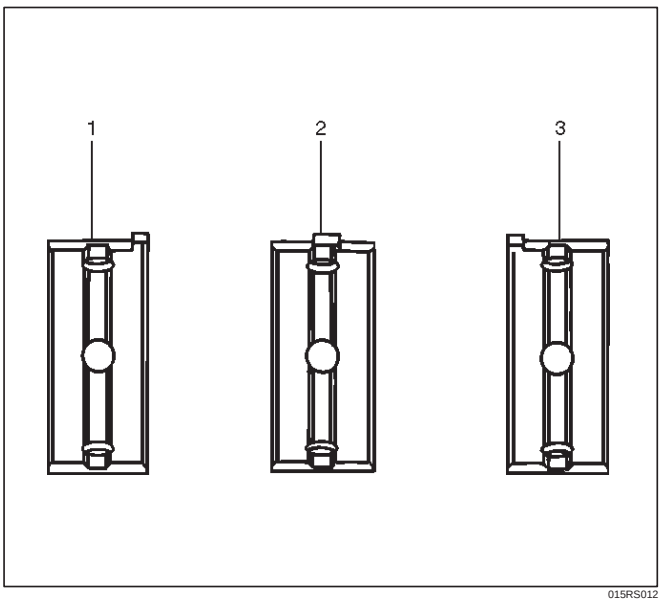
6. Remove oil pump assembly.
   ▼Refer to removal procedure for Oil Pump in this manual.
7. Remove cylinder body side bolts.
8. Remove oil gallery.
9. Remove flywheel.
10. Remove rear oil seal retainer.
    ▼Refer to removal procedure for Rear Oil Seal in this manual.
11. Remove connecting rod caps.
12. Remove crankshaft main bearing caps.
13. Remove crankshaft and main bearings.

Installation

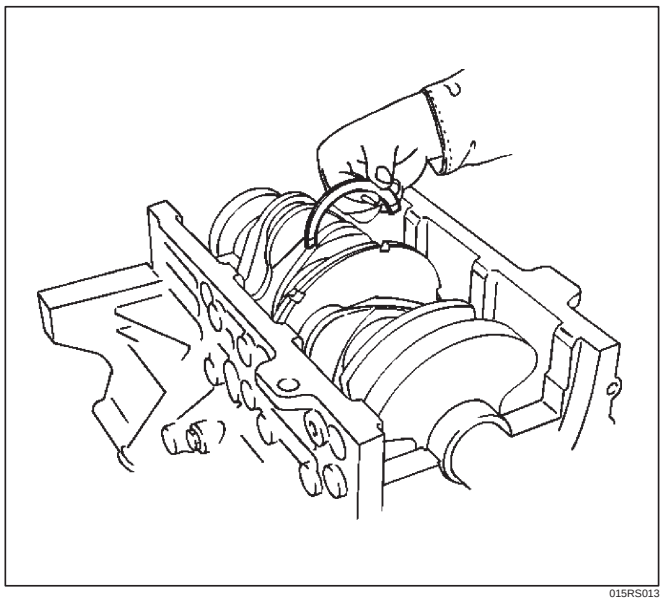
1. Install crankshaft and main bearings.
   ▼Install main bearing in the cylinder block and main bearing cap respectively.
   Apply new engine oil to upper and lower main bearings.

NOTE:

▼ Do not apply engine oil to the bearing back faces.
▼ Make sure that main bearings are in correct position.
▼ Install crankshaft with care.
▼ Apply engine oil to the thrust washer.
▼ Install thrust washer on No.3 journal.
▼ Oil grooves in thrust washer must face the crankshaft.



015RS012


015RS013

2. Install crankshaft main bearing caps.
   ▼Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.

NOTE:

▼ Do not apply engine oil to the bearing back faces.
▼ Install bearing caps, starting with cylinder block front side.
▼ Tighten main bearing fixing bolts to the specified torque.

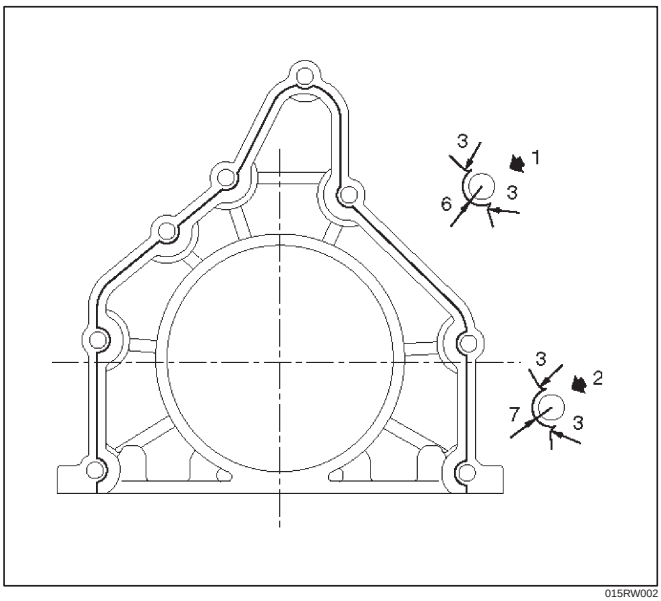
Torque : 39 N·m (29 lb ft)

▼ After tightening the bolts, make sure that the crankshaft rotates smoothly.

3. Install connecting rod caps.
   ▼The cap number must be same as connecting rod number.
   ▼Apply engine oil to the thread and seating surface of each nut.
   ▼Tighten nuts to the specified torque.

Torque : 54 N·m (40 lb ft)

   ▼After tightening the nuts, make sure that the crankshaft rotates smoothly.
4. Install rear oil seal retainer.
   ▼Remove oil on cylinder block and retainer fitting surface.
   ▼Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   ▼The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



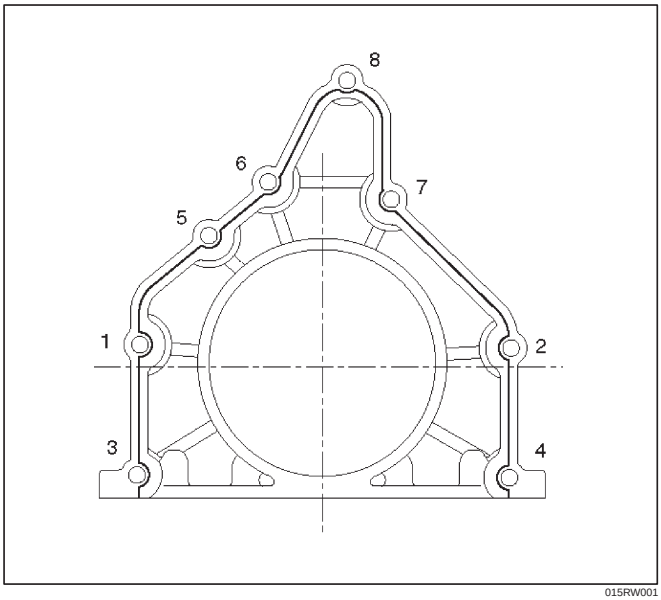
015RW002

Legend
(1) Around Bolt Holes
(2) Around Dowel Pin

▼Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.

▼Tighten retainer fixing bolts to the specified torque.

Torque : 18 N·m (13 lb ft)



015RW001

5. Install flywheel.

▼Clean tapped holes in the crankshaft.

▼Remove oil on crankshaft and flywheel fitting surface.

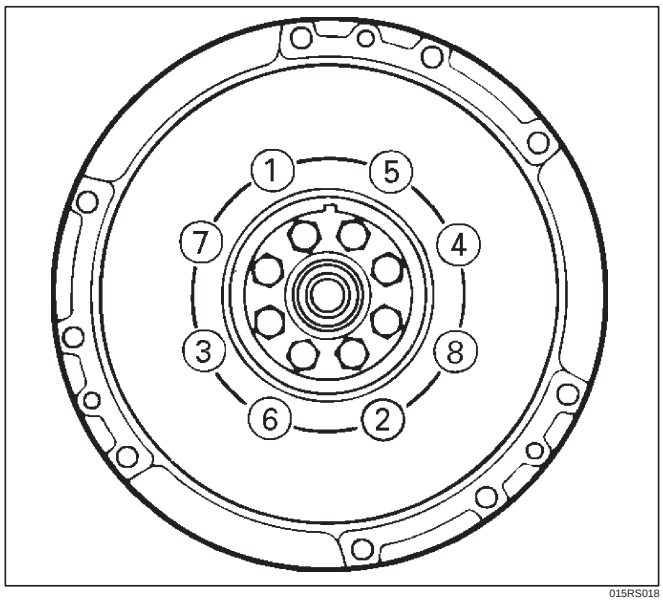
NOTE:

▼ Do not reuse the bolts.

▼ Do not apply oil or thread lock to the bolts.

▼ Tighten fixing bolts to the specified torque.

Torque : 54 N·m (40 lb ft)



015RS018

6. Install oil gallery.

▼Clean contact surface of oil gallery and main bearing cap.

Apply engine oil to oil gallery fixing bolts and tighten the bolts in two steps, in the order shown.

Torque :

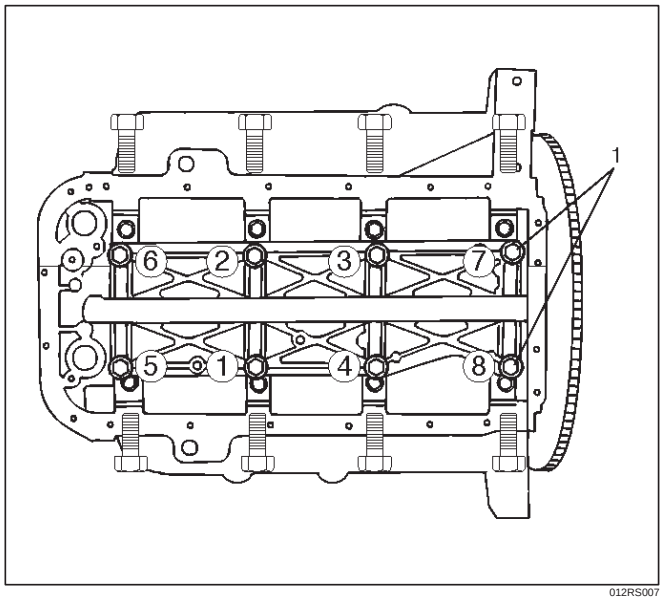
1st step : 29 N·m (22 lb ft)

2nd step : 55˚–65˚

7. Install cylinder body side bolts and tighten bolts in order to the specified torque.

Torque : 39 N·m (29 lb ft)

NOTE: Do not apply the oil to the bolts.



012RS007

8. Install oil pump assembly.

▼Remove oil on cylinder block and oil pump mounting surface.

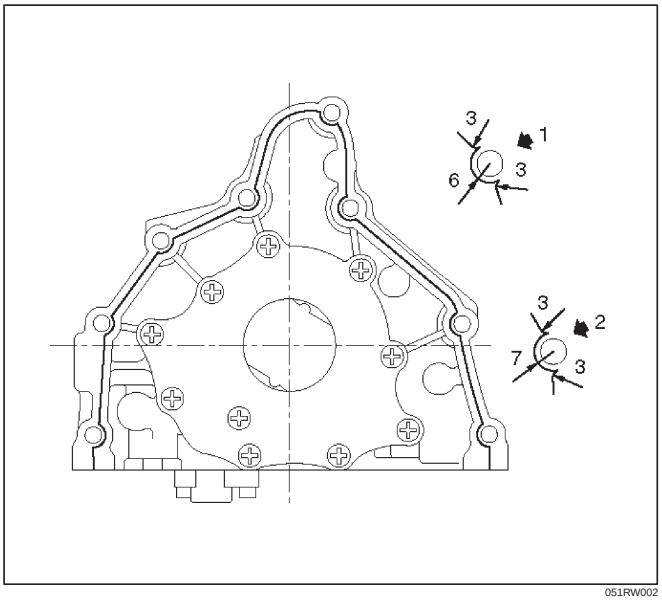
▼Apply sealant (TB1207B or equivalent) to the oil pump mounting surface.

▼The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

▼Apply engine oil to oil seal lip.

▼Install oil pump in the cylinder block and tighten fixing bolts to the specified torque.

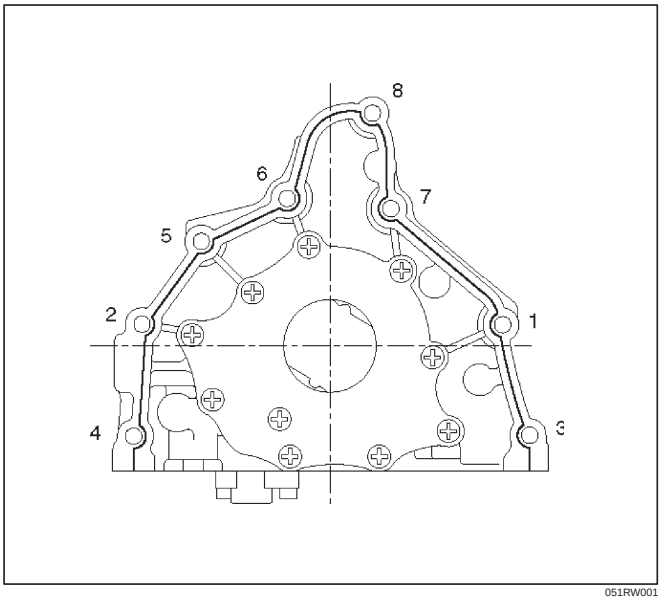
Torque : 25 N·m (18 lb ft)



051RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin



051RW001

9. Install oil strainer with O-ring, tighten to the specified torque.

Torque : 25 N·m (18 lb ft)

10. Install oil pipe with O-ring, tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)

11. Install crankcase.

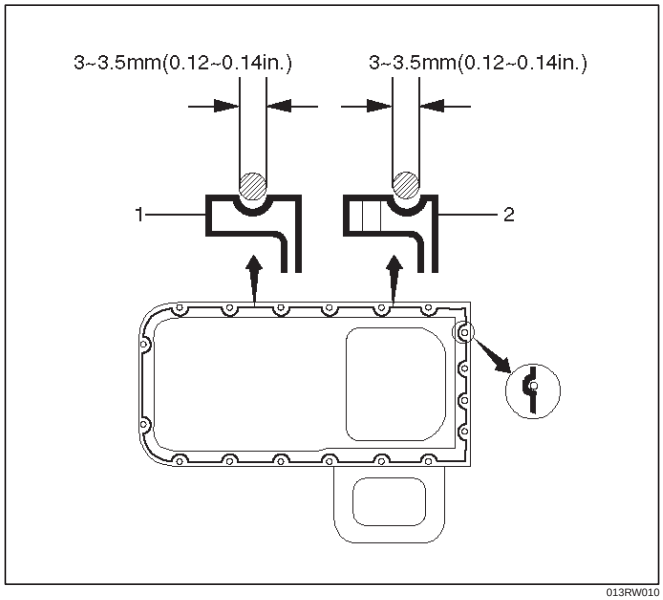
▼Remove oil on crankcase mounting surface and dry the surface.

▼Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.

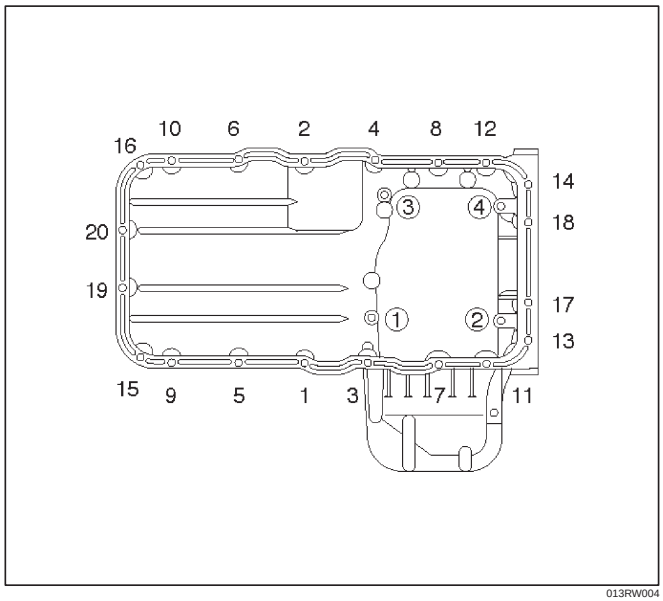
▼The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

▼Tighten fixing bolts to the specified torque.

Torque : 10 N·m (87 lb in)



013RW010



013RW004

12. Install oil pan

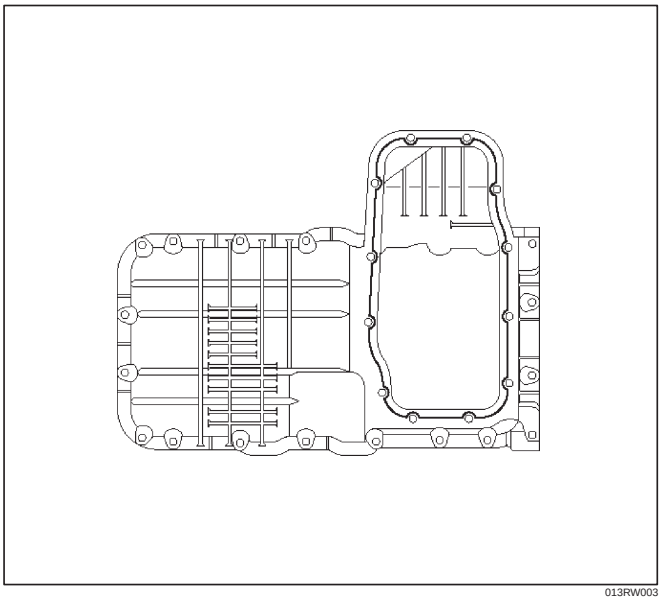
▼Remove oil on oil pan mounting surface and dry the surface.

▼Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the oil pan mounting surface. The bead must be continuous.

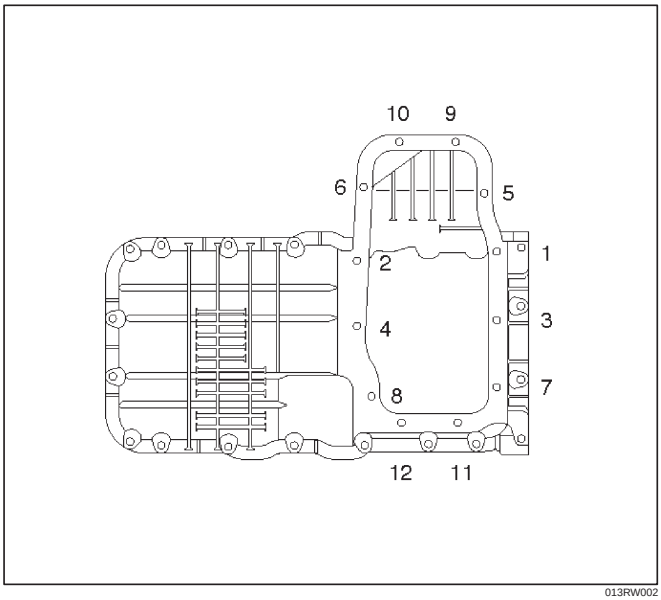
▼The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

▼Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



013RW003



013RW002

13. Install timing belt.

▼Refer to installation procedure for Timing Belt in this manual.

14. Install engine assembly.

▼Refer to installation procedure for Engine Assembly in this manual.

Rear Oil Seal

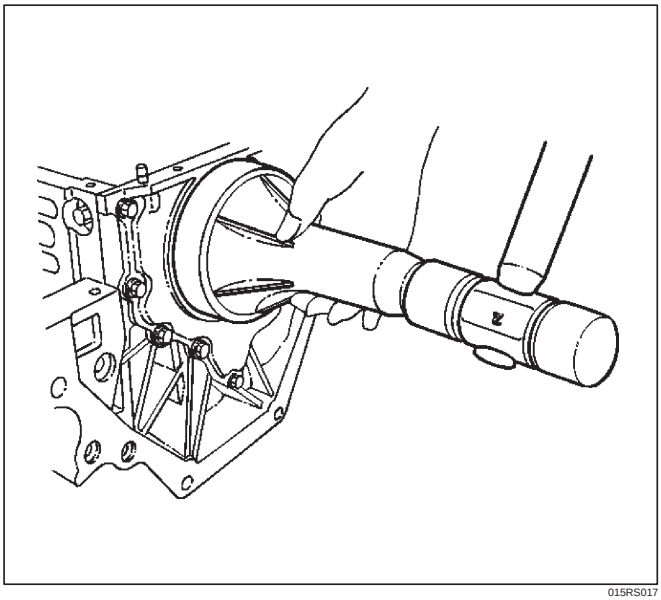
Removal

1. Remove transmission assembly.
   ▼See Transmission section in this manual.
2. Remove flywheel.
3. Remove rear oil seal using a seal remover.

NOTE: Take care not to damage the crankshaft or oil seal retainer when removing oil seal.

Installation

1. Apply engine oil to oil seal lip and install oil seal using J-39201.

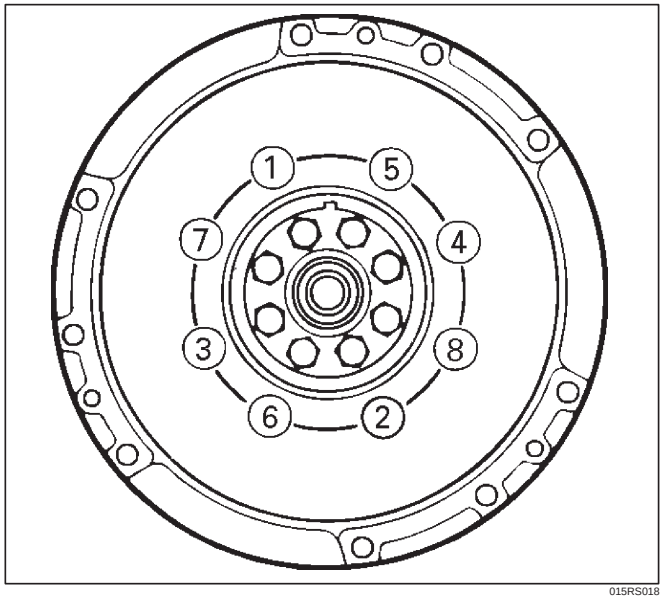


015RS017

2. Install flywheel.
   ▼Clean tapped holes in the crankshaft.
   ▼Remove oil on the crankshaft and flywheel mounting surface.
   ▼Tighten fixing bolts to the specified torque.

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

Torque : 54 N·m (40 lb ft)



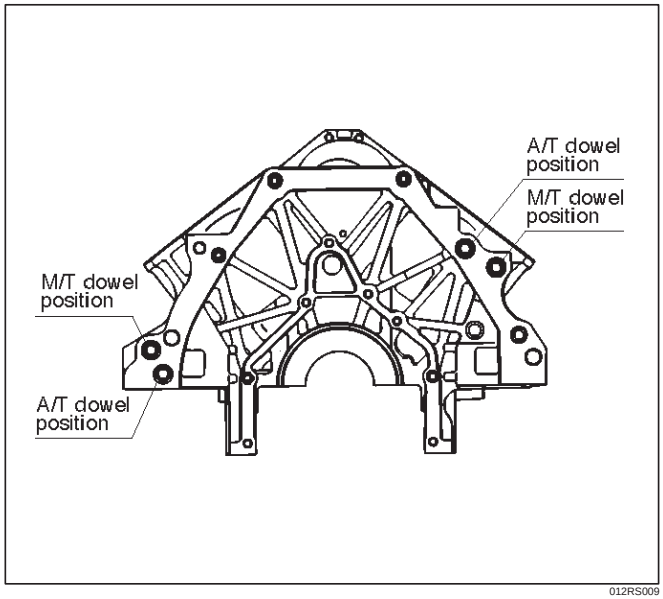
015RS018

3. Install transmission.
   ▼See Transmission section in this manual.

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

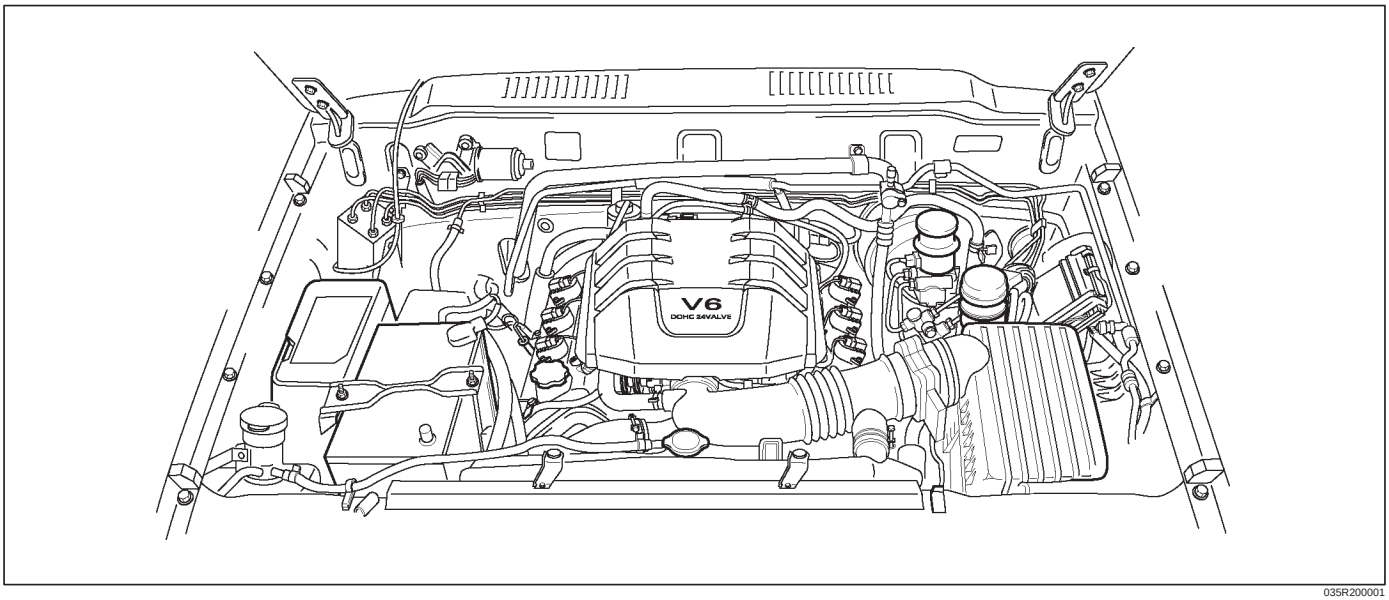
Otherwise, the transmission may be damaged.



012RS009

Engine Assembly

Removal



035R200001

1. Disconnect battery ground and positive cable.
2. Remove battery.
3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
4. Remove engine hood.
5. Drain radiator coolant.
6. Disconnect Ion sensing module harness connectors, and manifold absolute pressure sensor harness connectors from sensor on common chamber.
7. Disconnect throttle position sensor harness connectors from throttle body.
8. Disconnect air duct with air cleaner cover.
9. Remove air cleaner assembly.
10. Disconnect canister vacuum hose.
11. Disconnect vacuum booster hose.
12. Disconnect three engine harness connectors.
13. Disconnect harness connector to transmission (left front side of engine compartment), disconnect shift on the fly harness connector from front side of front axle and remove transmission harness bracket from engine left side.
14. Disconnect ground cable between engine and frame.
15. Disconnect bonding cable connector on the back of right dash panel.
16. Disconnect bonding cable terminal on the left bank.
17. Disconnect starter harness connector from starter.
18. Disconnect generator harness connector from generator.
19. Disconnect coolant reserve tank hose from radiator.
20. Remove radiator upper and lower hoses.
21. Remove upper fan shroud.
22. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
23. Move drive belt tensioner to loose side using wrench then remove drive belt.
24. Remove power steering pump fixing bolts, then power steering pump. Place the power steering pump along with piping on the body side.
25. Remove air conditioning compressor fixing bolts from bracket and place the compressor along with piping on the body side.
26. Remove four O_2 sensor harness connectors (two each bank) from exhaust front pipe.
27. Remove three exhaust pipe fixing nuts from each bank.
28. Remove two exhaust pipe fixing nuts from each exhaust pipe, then move exhaust pipe to rear side of vehicle.
29. Remove flywheel dust covers.
30. Disconnect two heater hoses from engine.
31. Disconnect fuel hoses from right side of transmission.

CAUTION: Plug fuel pipes on engine side and fuel hoses from fuel tank.

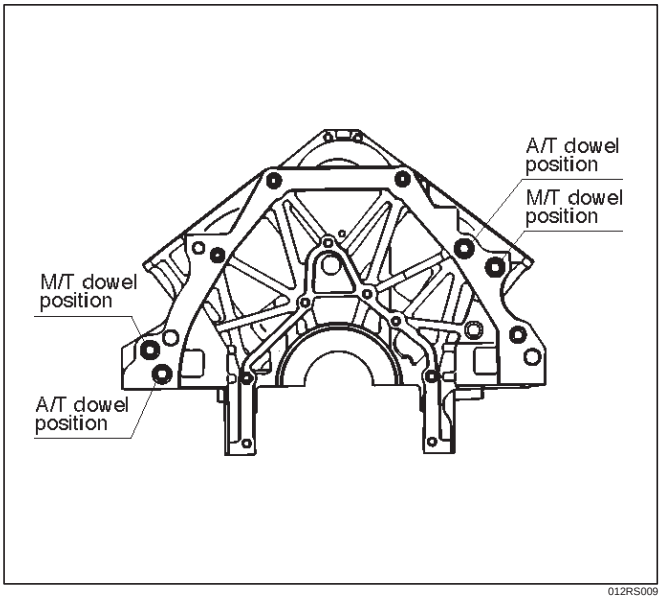
32. Remove transmission assembly. Refer to Transmission section in this manual.
33. Support the engine by engine hoist.
34. Remove two left side engine mount fixing bolts from engine mount on chassis side.
35. Remove two right side engine mount fixing bolts from engine mount on chassis side.
36. Remove engine assembly.

Installation

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

If the engine is assembled in the condition that the dowels have not been mounted in the specified positions, the transmission may be damaged.



012RS009

1. Install engine assembly. Tighten engine mount fixing bolts to frame to the specified torque.

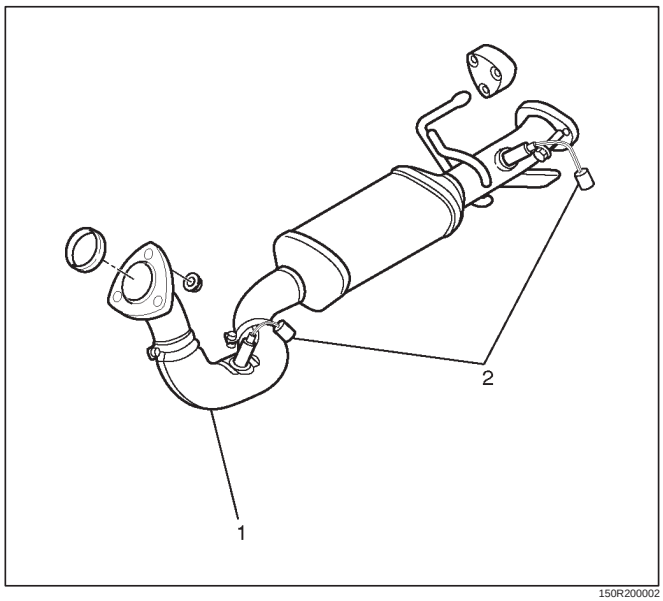
   Torque: 41 N·m (30 lb ft)

2. Reconnect fuel hose to fuel pipe on engine.
3. Install transmission assembly. Refer to Transmission section in this manual.
4. Reconnect two heater hoses to engine.
5. Install flywheel dust covers.
6. Install exhaust pipe and temporally tighten two (each bank) rear exhaust flange nuts then tighten three stud nuts (each bank) between exhaust manifold and exhaust pipe, finally tighten rear side nuts to the specified torque.

   Torque:

   Nuts: 43 N·m (32 lb ft)

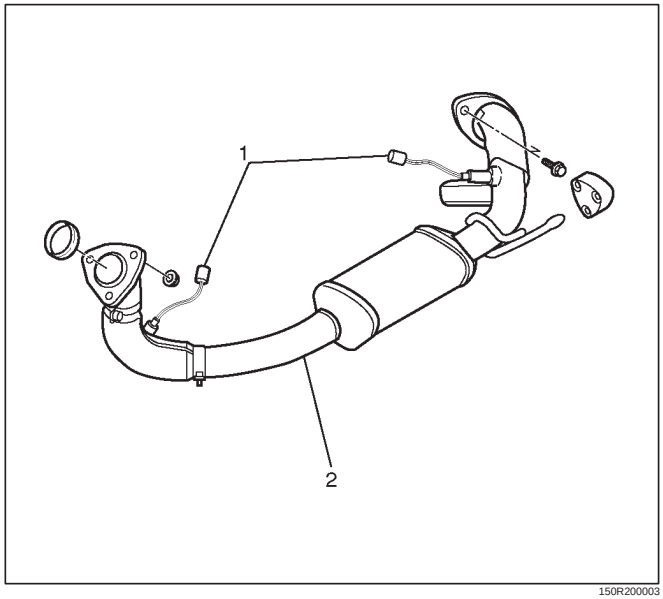
   Stud nuts: 67 N·m (49 lb ft)



150R200002

Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensor



150R200003

Legend

(1) O_2 Sensor
(2) Exhaust Front Pipe LH

7. Reconnect O_2 sensor connector.
8. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

   Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

9. Install air conditioner compressor to engine and tighten to the specified torque.

   Torque :

   M8 bolts : 22 N·m (16 lb ft)

   M10 bolts : 43 N·m (32 lb ft)

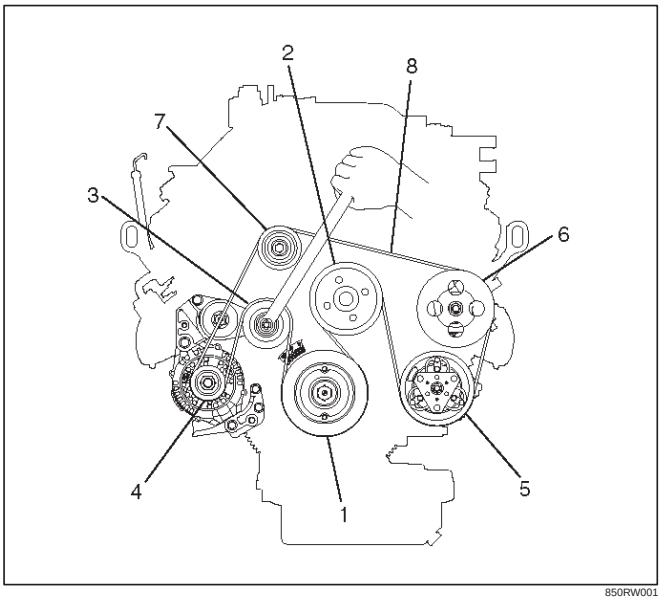
10. Install power steering pump, tighten fixing bolt to the specified torque.

    Torque :

    M8 bolts : 22N·m (16 lb ft)

    M10 bolts : 46 N·m (34 lb ft)

11. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.

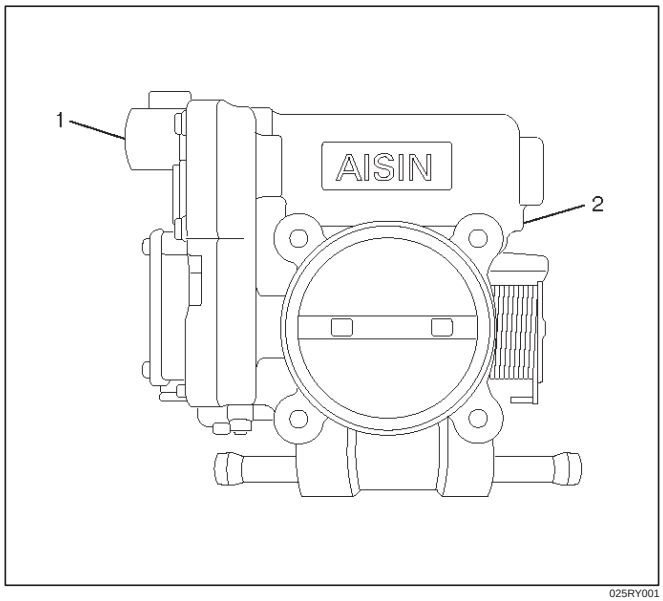


850RW001

Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

12. Install upper fan shroud.
13. Reconnect radiator upper and lower hoses.
14. Reconnect coolant reserve tank hose to radiator.
15. Reconnect generator harness connector.
16. Reconnect starter harness connector.
17. Reconnect bonding cable terminal on left bank
18. Reconnect bonding cable terminal on the back of right dash panel.
19. Reconnect ground cable between engine and chassis.
20. Reconnect harness connector to transmission and install transmission harness bracket on engine left side.
21. Reconnect three engine harness connectors.
22. Reconnect vacuum booster hose.
23. Reconnect canister vacuum hose.
24. Install air cleaner assembly.
25. Reconnect air duct.
26. Reconnect throttle position sensor harness connector.

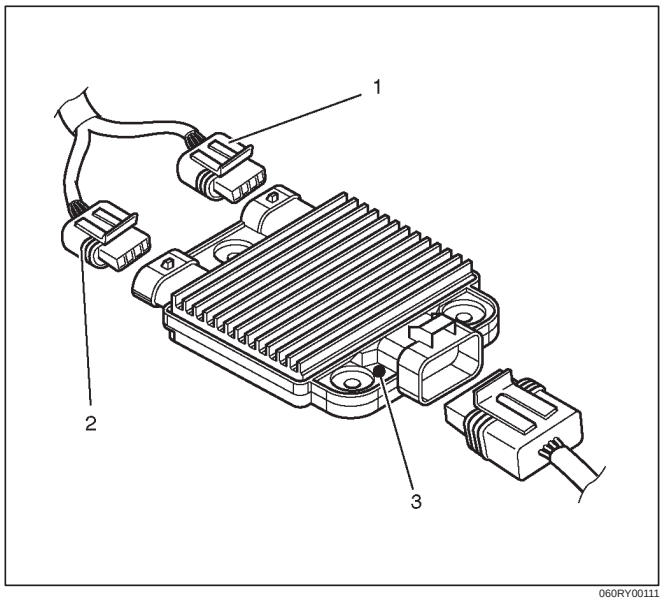


025RY001

Legend

(1) Throttle Position Sensor Connector
(2) Throttle Valve Assembly

27. Reconnect manifold absolute pressure sensor harness connectors.
28. Reconnect ion sensing module connectors as shown in the illustration.



060RY00111

Legend

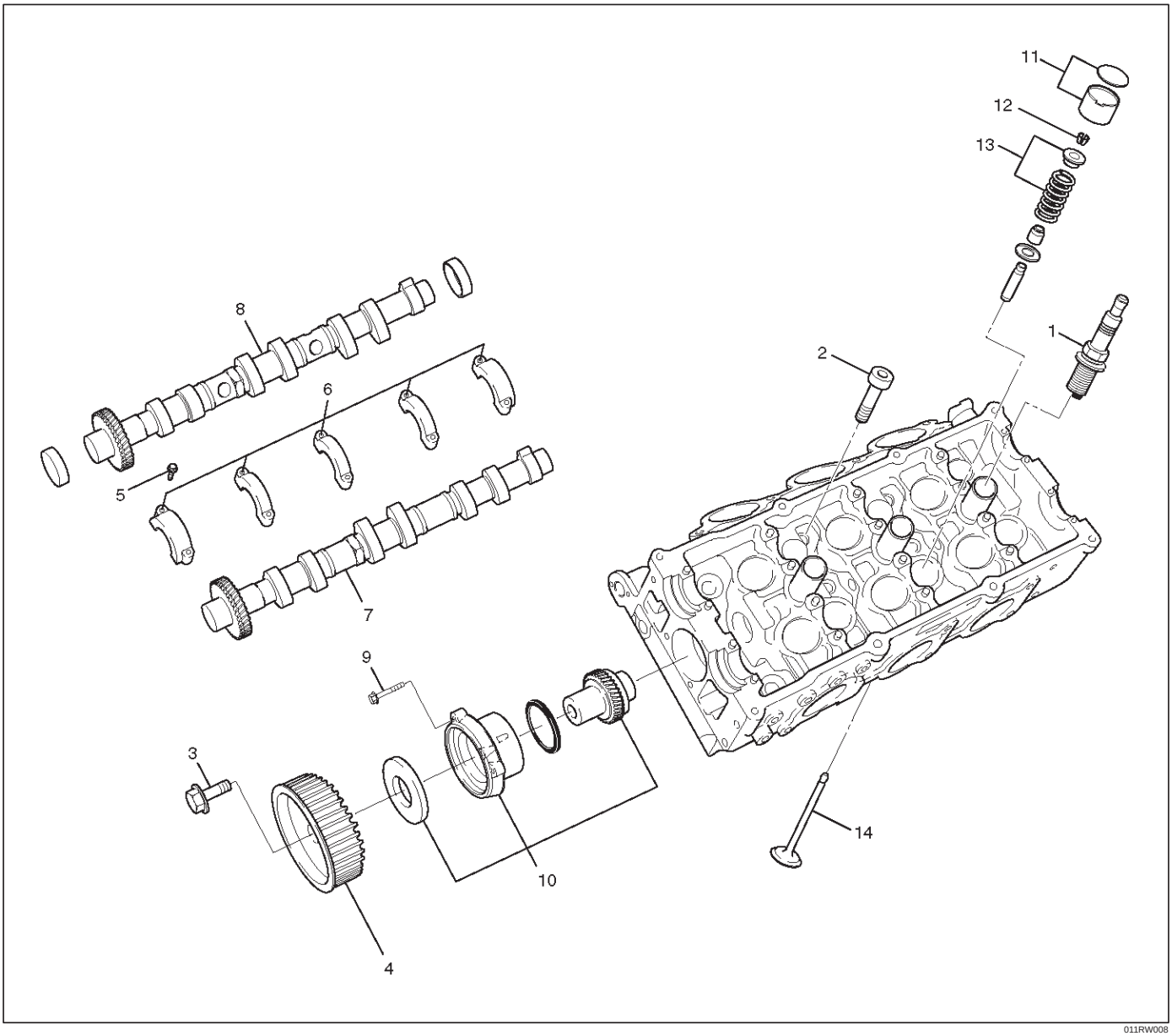
(1) Green Connector
(2) Blue Connector
(3) Identification Mark (6VE1 Engine Only)

29. Install engine hood to the original position.

    ▼Refer to installation procedure for Body section in this manual.

Cylinder Head

Cylinder Head and Associated Parts



011RW008

Legend

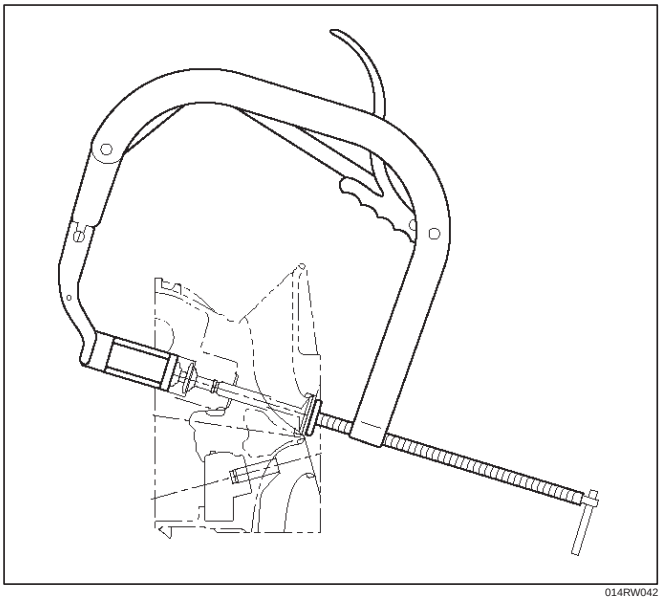
(1) Spark Plug
(2) Cylinder Head Bolt
(3) Camshaft Drive Gear Pulley Fixing Bolt
(4) Camshaft Drive Gear Pulley
(5) Camshaft Bearing Cap Fixing Bolt
(6) Camshaft Bearing Cap
(7) Camshaft Exhaust
(8) Camshaft Intake
(9) Retainer Fixing Bolt
(10) Retainer Assembly
(11) Tappet with Shim
(12) Split Collar
(13) Valve Spring and Spring Upper Seat
(14) Valve

Disassembly

NOTE:

- ▼ During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.
- ▼ Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

1. Remove camshaft drive gear pulley fixing bolt (3), then pulley (4).
2. Remove camshaft bearing cap fixing bolt (5), camshaft bearing cap (6), then camshaft exhaust (7), and intake side (8).
3. Remove tappet with shim (11).
4. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove the split collar (12), valve spring with upper seat (13) and valve (14).



014RW042

5. Remove spark plug (1).

CAUTION: Do not remove the spark plugs when the head and plugs are hot. Clean dirt and debris from spark plug recess areas before removal.

Clean

Cylinder head

Carefully remove all varnish, soot and carbon from the bare metal. Do not use surface conditioning disc on any gasket sealing surface.

Inspection and Repair

1. Inspect cylinder head gasket and mating surfaces for leaks, corrosion and blow–by. If the gasket has failed, determine the cause.
   - – Insufficient torque on head bolts
   - – Improper installation
   - – Loose or warped cylinder head
   - – Missing dowel pins
   - – Warped case surface
2. Inspect cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Inspect cylinder head deck for corrosion, sand particles in head and porosity.

CAUTION:

- ▼ **Do not attempt to weld the cylinder head. Replace it.**
- ▼ **Do not reuse cylinder head bolts.**

4. Inspect cylinder head deck, common chamber and exhaust manifold mating surfaces for flatness. These surfaces may be reconditioned by milling. If the surfaces are “out of flat” with “round” by more than specification, the surface should be ground to within specifications. Replace the head if it requires machining beyond the repairable limit.

Head surface and manifold surface

Standard: 0.05 mm (0.002 in) or less

Warpage limit: 0.2 mm (0.0079 in)

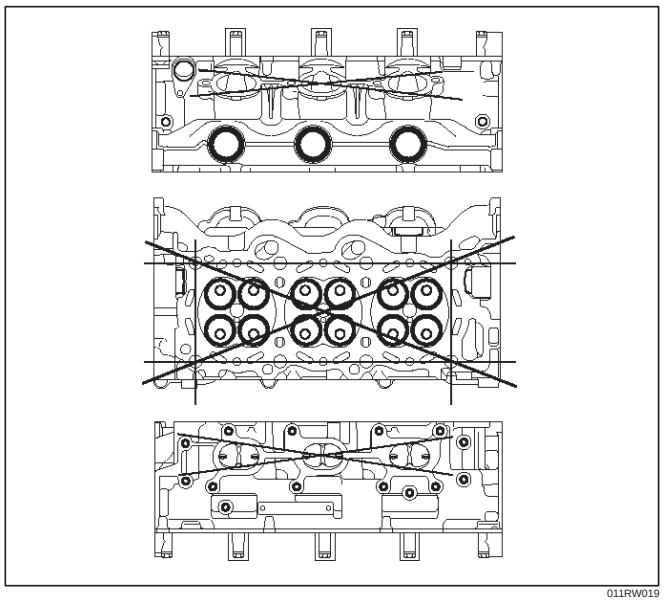
Maximum Repairable limit: 0.2 mm (0.0079 in)

Head height

Standard height : 133.2 mm (5.2441 in)

Warpage limit : 0.2 mm (0.0079 in)

Maximum Repairable limit : 133.0 mm (5.2362 in)



011RW019

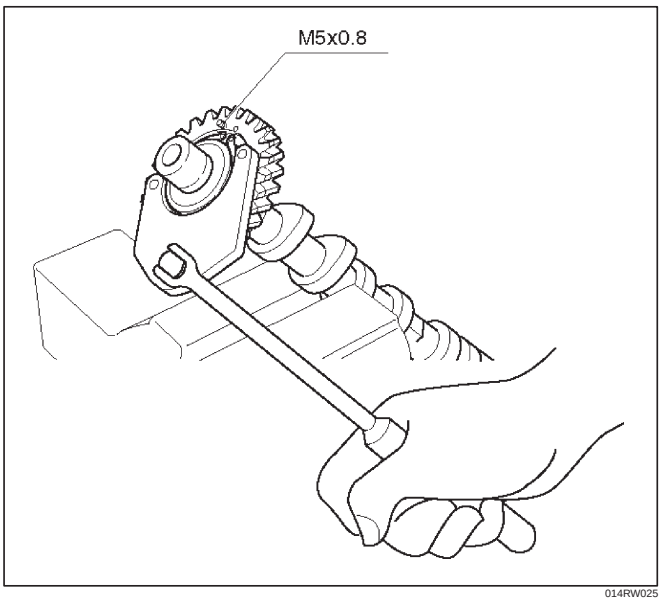
5. Water jacket sealing plugs seating surfaces.

Reassembly

1. Install Spark plug and tighten all the spark plugs to specified torque.

   Torque: 18 N·m (13 lb ft)

2. Tighten sub gear setting bolt.
   1. Use J–42686 gear spring lever to turn sub gear to right direction until the M5 bolt aligns with the hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.

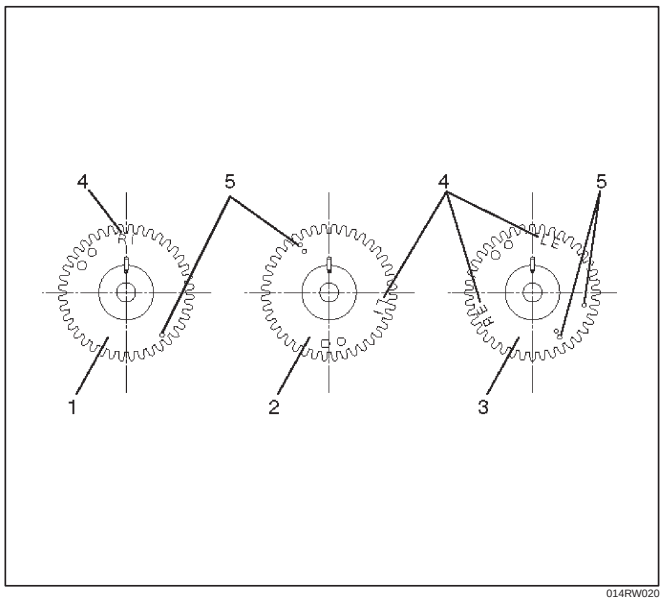


014RW025

3. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   Torque: 10 N·m (87 lb in)

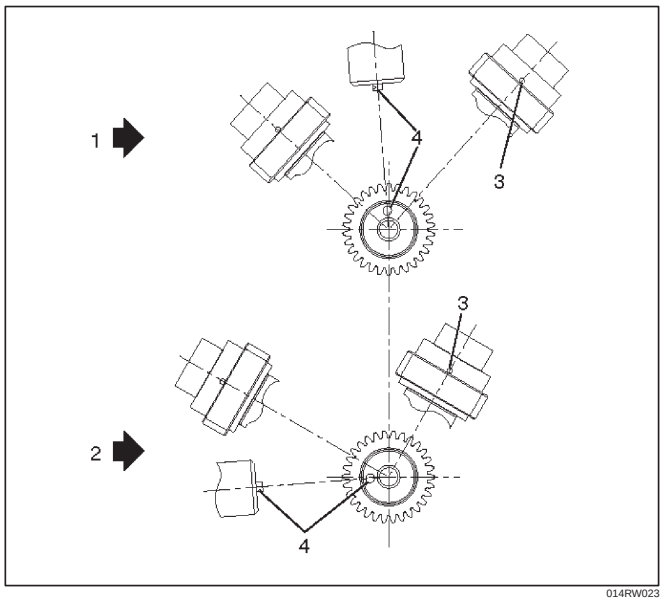
4. Install camshaft assembly and camshaft bearing cap, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

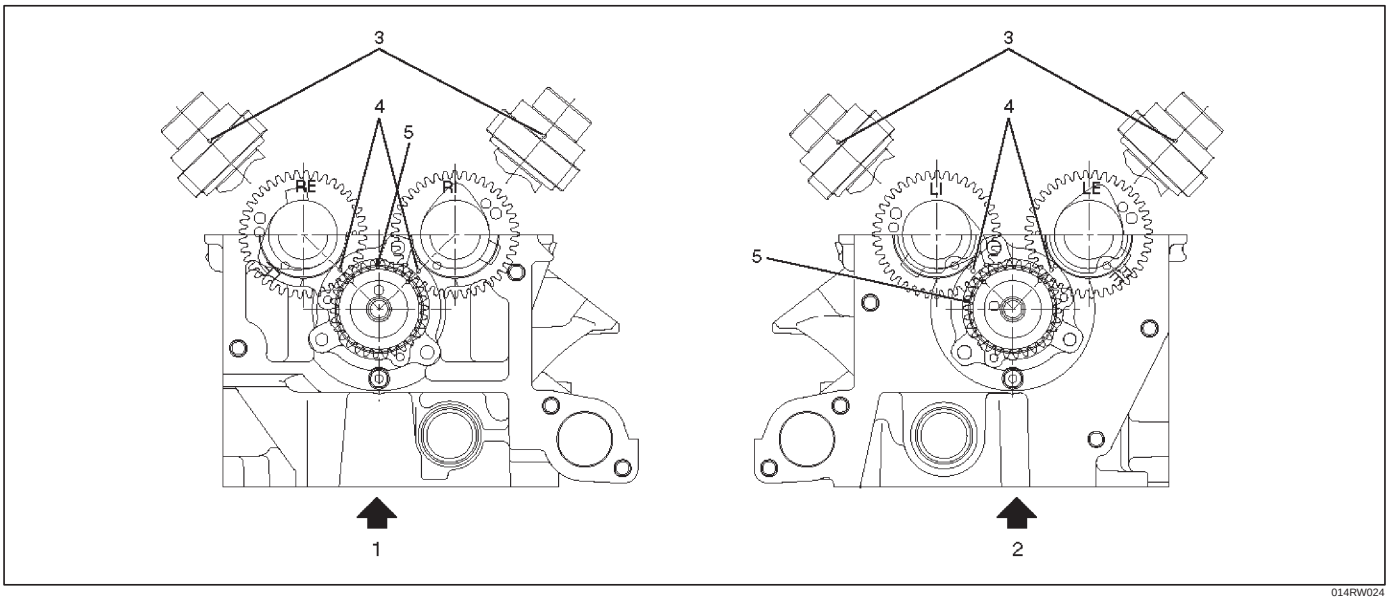
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
LI: Left Bank Intake
RI: Right Bank Intake
LE: Left Bank Exhaust
RE: Right Bank Exhaust



014RW023

Legend

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin



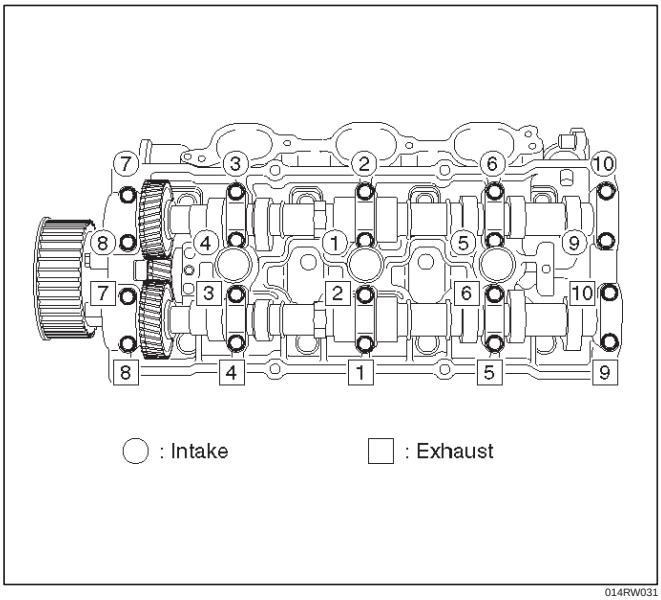
014RW024

Legend

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on each bank as shown in the illustration.

Torque: 10 N·m (87 lb in)



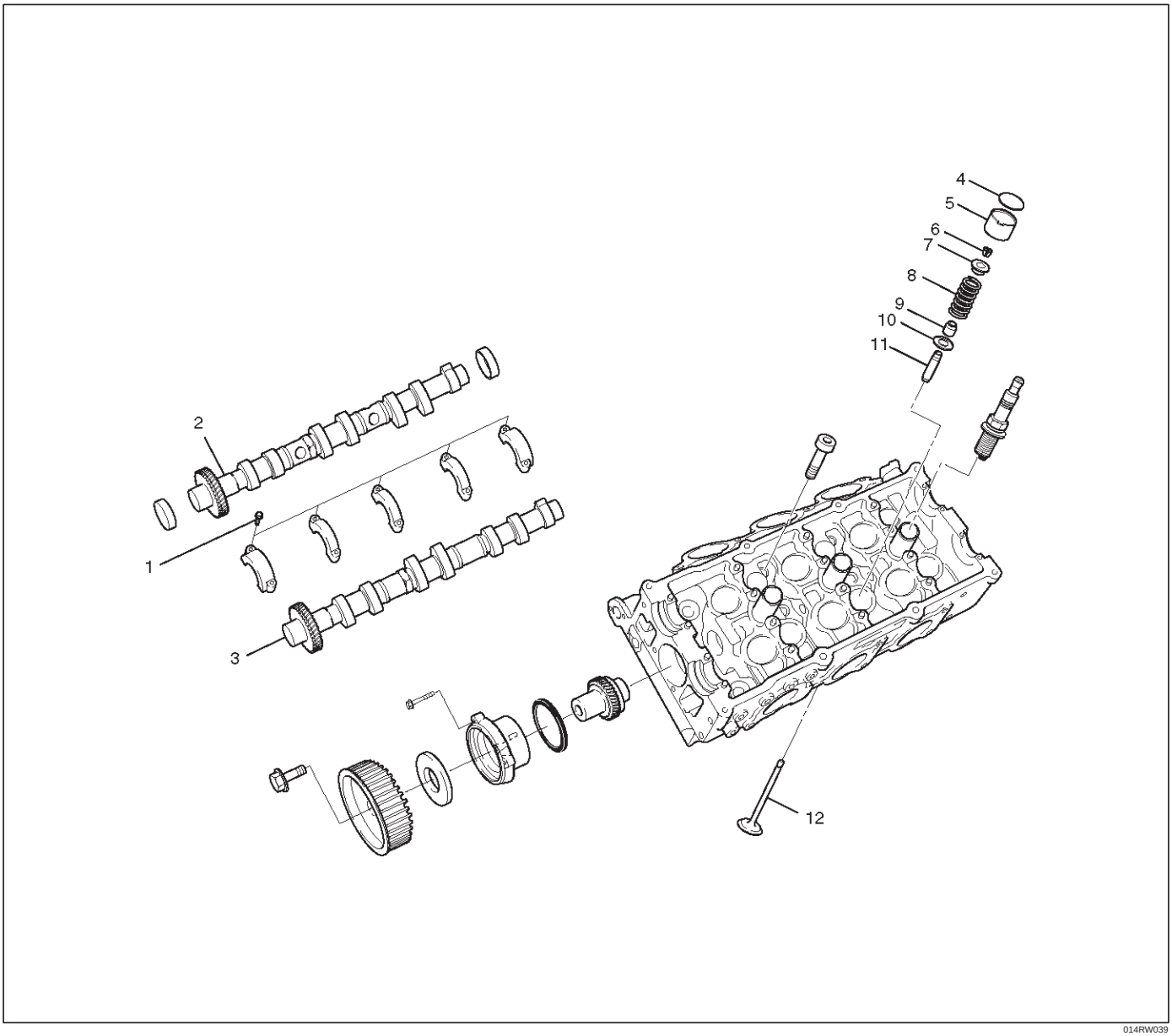
014RW031

5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

Torque: 98 N·m (72 lb ft)

Valve Spring, Oil Controller, Valve, Valve Guide

Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts



014RW039

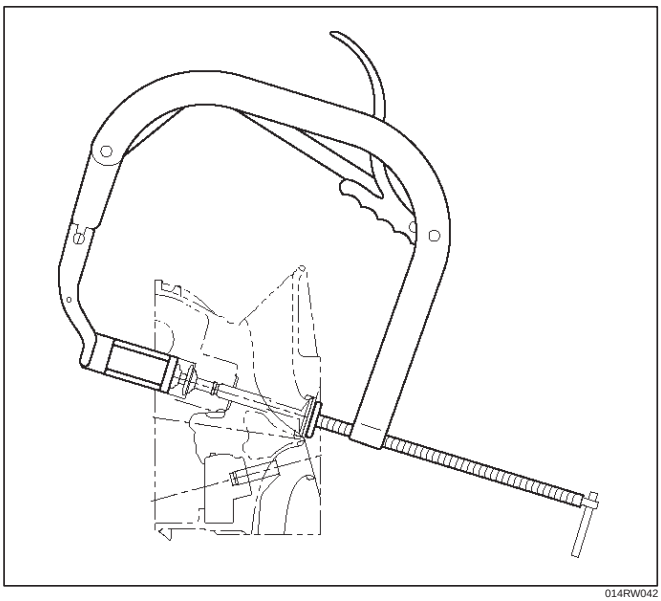
Legend

(1) Camshaft Bearing Cap Fixing Bolts
(2) Camshaft Assembly Inlet
(3) Camshaft Assembly Exhaust
(4) Shim
(5) Tappet
(6) Split Collar
(7) Spring Upper Seat
(8) Valve Spring
(9) Oil Controller
(10) Spring Lower Seat
(11) Valve Guide
(12) Valve

Disassembly

1. Remove camshaft bearing cap fixing bolts (1).
2. Remove camshaft assembly (intake).
3. Remove camshaft assembly (Exhaust side).
4. Remove shim (4) and tappet (5).

5. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove split collar.


014RW042

6. Remove valve spring.
7. Remove valve.
8. Remove oil controller and spring lower seat.
9. Remove the valve guide using the J–42899 valve guide replacer.

Inspection and Repair

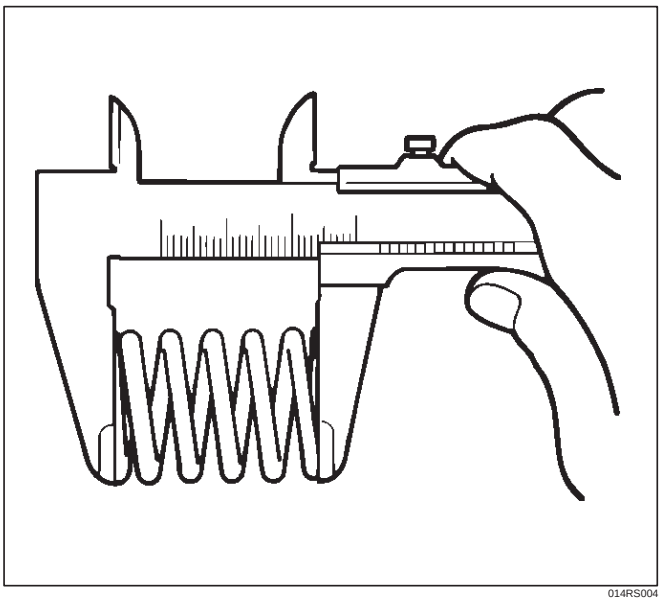
Valve Spring

CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

1. Measure the free height of the springs. The springs must be replaced if the free height is below the specified limit.

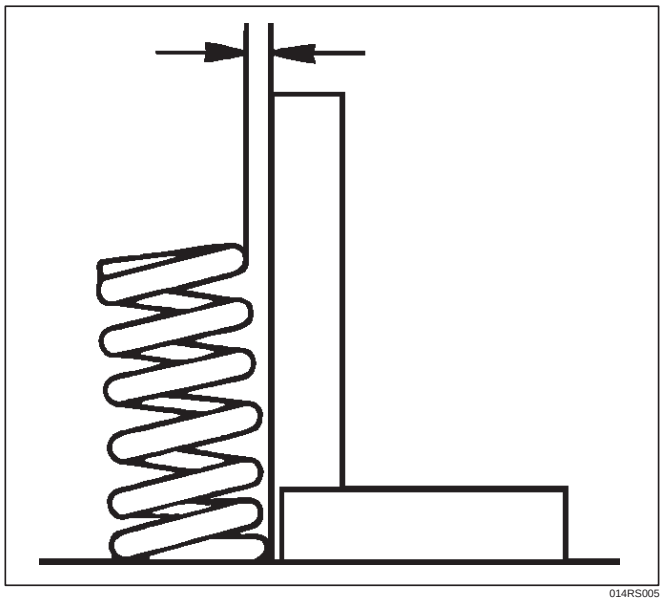
Standard : 44.6 mm (1.756 in)

Limit : 43.6 mm (1.717 in)


014RS004

2. Measure the valve spring squareness with a steel square and replace the valve springs if the measured value exceeds the specified limit.

Limit : 2 mm (0.079 in)

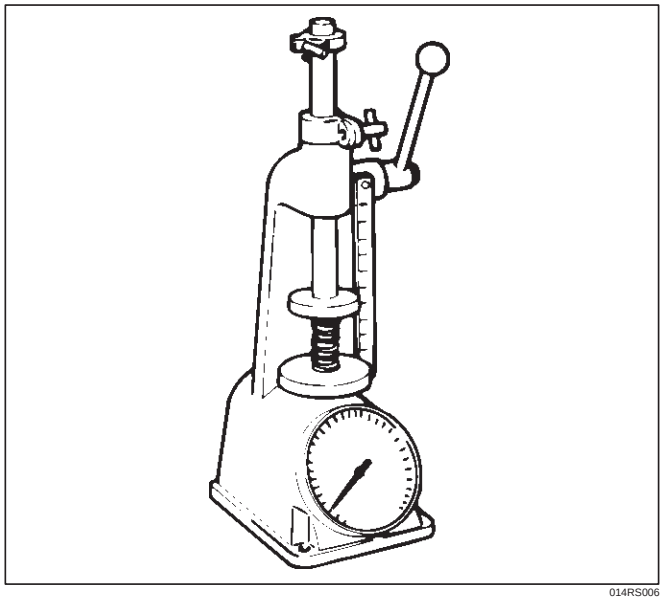

014RS005

3. Using a spring tester to compress the springs to the installed height, measure the compressed spring tension, and replace the springs if the measured tension is below the specified limit.

At installed height: 35.0 mm (1.38 in)

Standard: 196 N (44 lb)

Limit: Less than 181 N (41 lb)


014RS006

Valve Guide

CAUTION: Take care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratches or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

1. Measure the valve stem diameter with a micrometer. If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

Diameter of Valve Stem

Intake

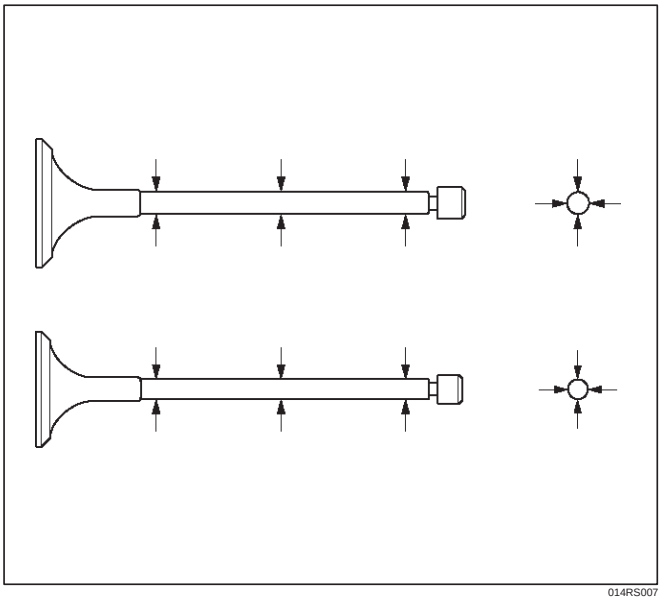
Standard : 5.977 mm–5.959 mm (0.2353 in–0.2346 in)

Limit : 5.90 mm (0.2323 in)

Exhaust

Standard : 5.952 mm–5.970 mm (0.2343 in–0.2350 in)

Limit : 5.90 mm (0.2323 in)



014RS007

2. Measure the inside diameter of the valve guide with a micrometer. Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the value exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Inside Diameter of the Vale Guide

Inlet clearance

Standard : 0.023 mm–0.056 mm (0.0009 in–0.0002 in)

Limit : 0.20 mm (0.00787 in)

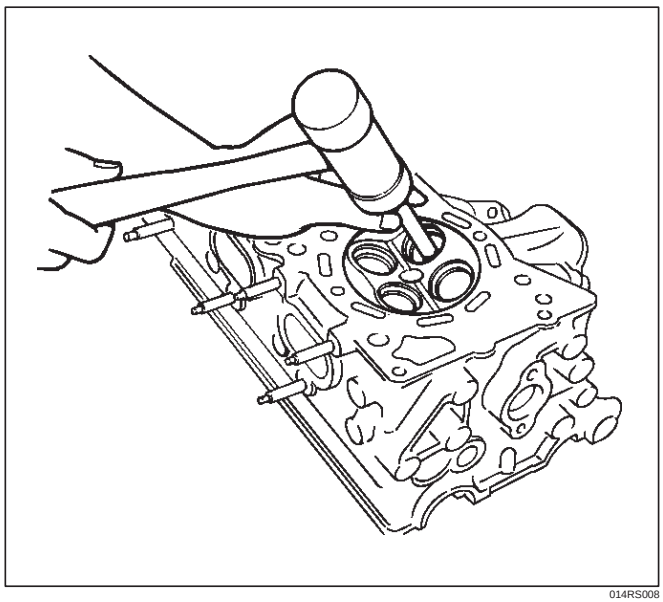
Exhaust clearance

Standard : 0.030 mm–0.063 mm (0.0012 in–0.0025 in)

Limit : 0.20 mm (0.00787 in)

Valve Guide Replacement

1. Using Valve guide replacer: J–42899, drive out the valve guide from the combustion chamber side.

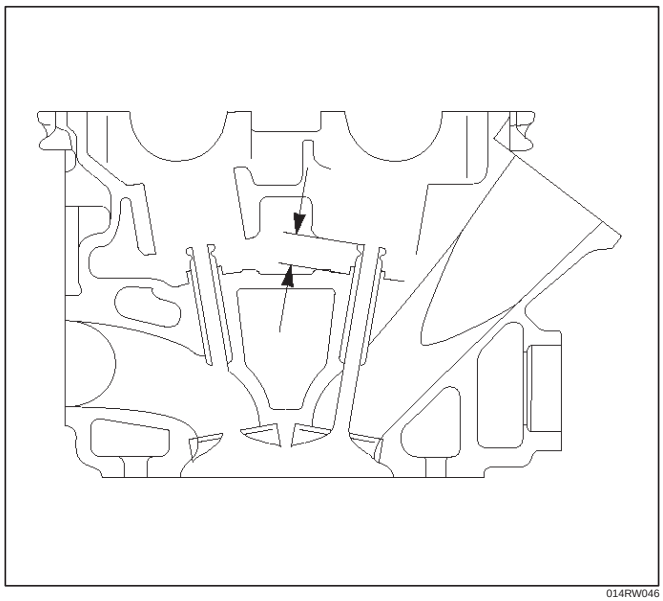


014RS008

2. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side, and check the valve guide height.

Valve guide upper end height: 13.0 mm (0.5118 in)

(Measured from the cylinder head upper face)



014RW046

3. Check the clearance. If the clearance is less than the specified value, ream the inside diameter of valve guide. Using a sharp 6 mm reamer, ream the valve guide to obtain the specified clearance.

Valve Seat

1. Measure the protrusion of the valve stem when a new valve is installed in the cylinder head. If the protrusion of the valve stem exceeds the limit, replace the valve seat insert or the cylinder head assembly.

Protrusion of valve stem

Intake

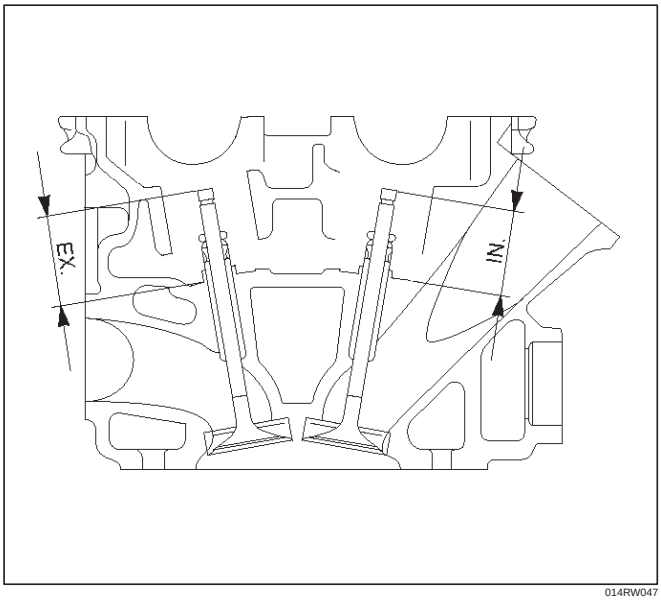
Standard: 39.32 mm (1.5480 in)

Limit: 39.47 mm (1.5539 in)

Exhaust

Standard: 39.3 mm (1.5472 in)

Limit: 39.45 mm (1.5531 in)



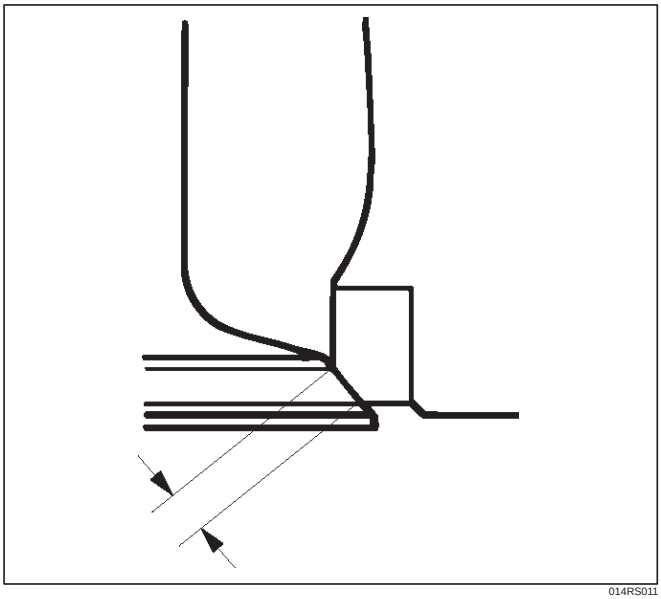
014RW047

2. Measure the valve seat contact width. Make the necessary corrections if the seat contact surface is damaged or rough or if the contact width wear exceeds the limit.

Valve seat contact width

Standard: 1.1 mm (0.0433 in)

Limit: 1.7 mm (0.0669 in)

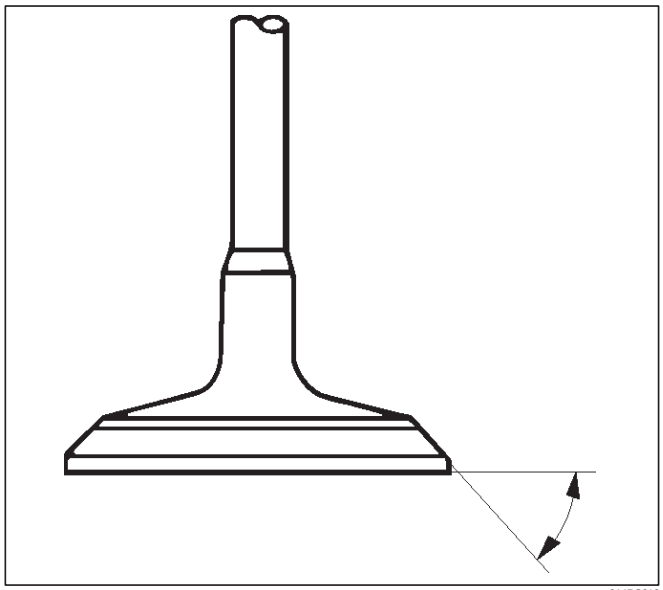


014RS011

Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Valve contact surface angle: 45˚

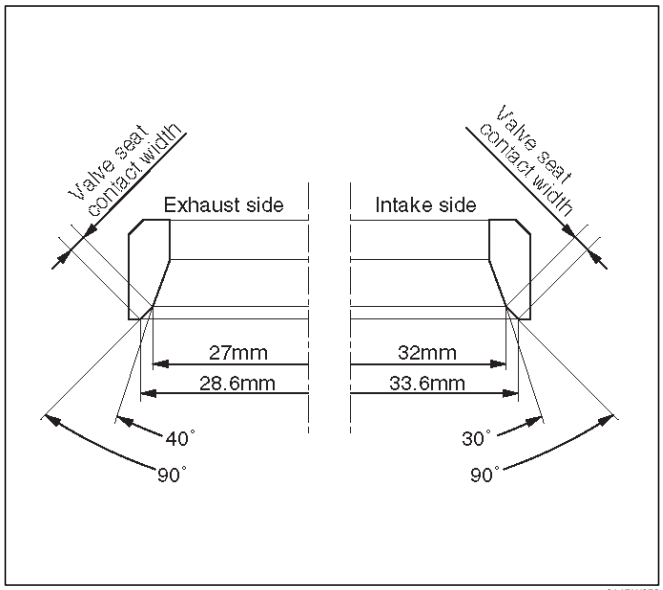


014RS012

Valve Seat Insert Correction

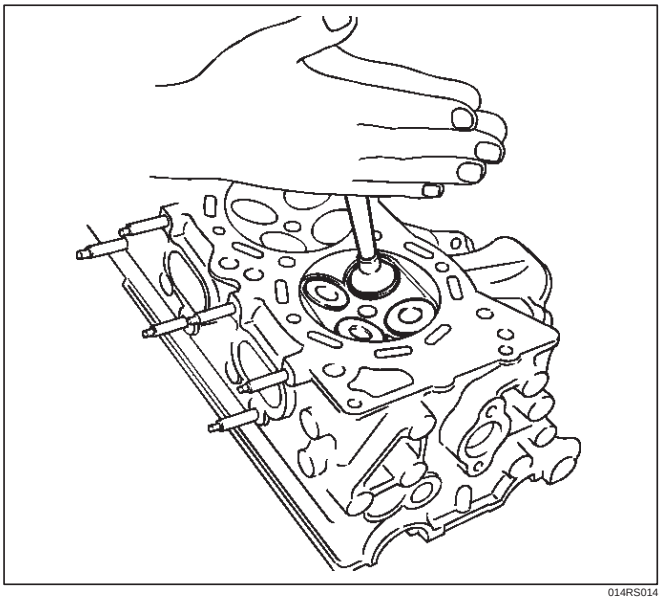
1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

Valve seat angle degree: 90˚



014RW059

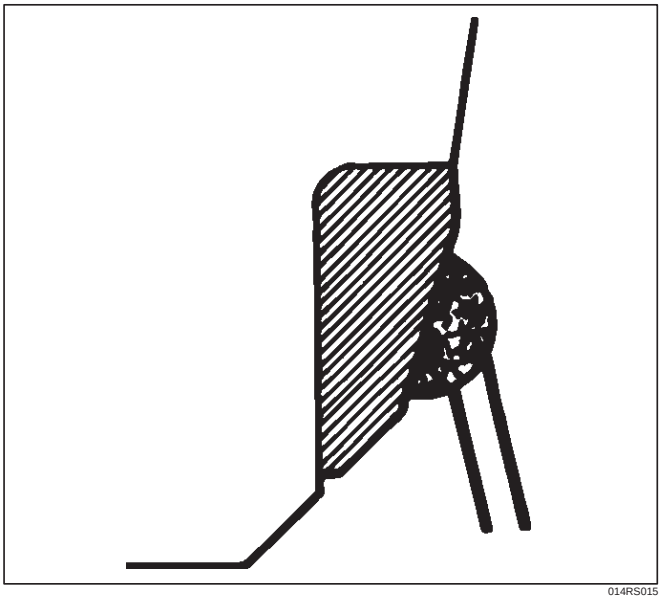
3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while lapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



014RS014

Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.



014RS015

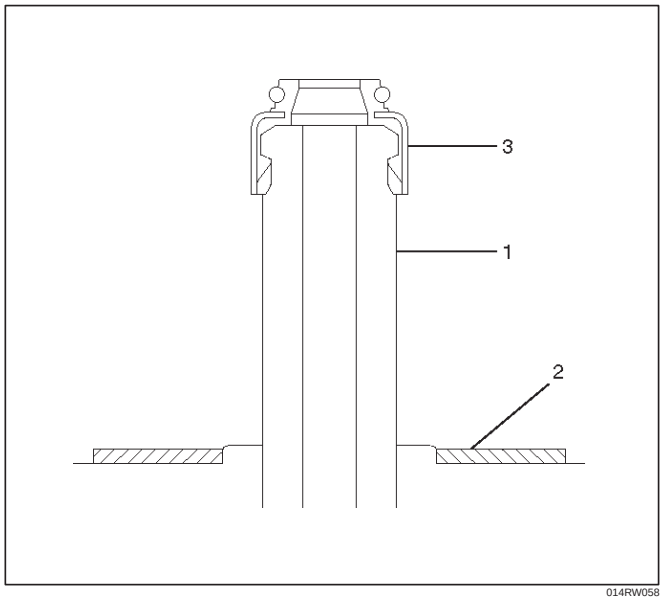
4. Carefully clean the valve seat press–fit section on the cylinder head side.
5. Heat the press–fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press–fit section into the valve seat horizontally.

Standard fitting interference: 0.14 mm–0.09 mm (0.0055 in–0.0035 in)

7. After insertion, use a seat grinder to grind finish the seating face. Carefully note the seating angle, the contact width, and the depression.
8. Lap the valve and the seat.

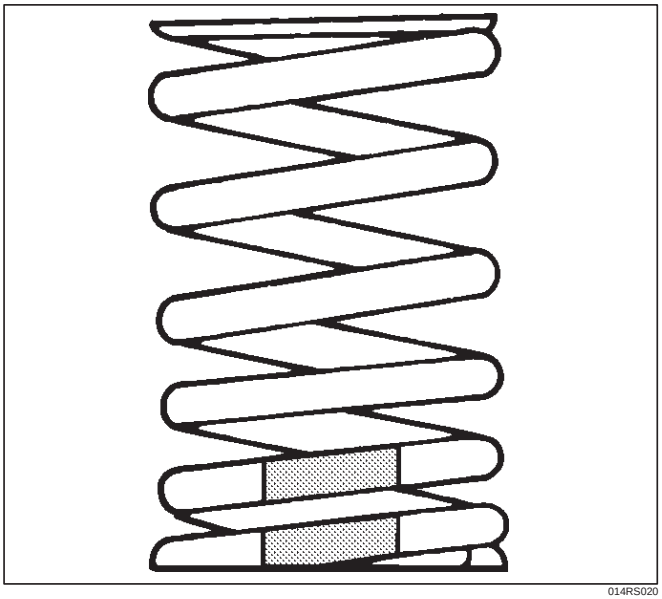
Reassembly

1. Install valve guide (1) to cylinder head. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side.
2. Install oil controller (3) and spring lower seat (2). Using oil controller replacer J–37281, drive in a new oil controller.

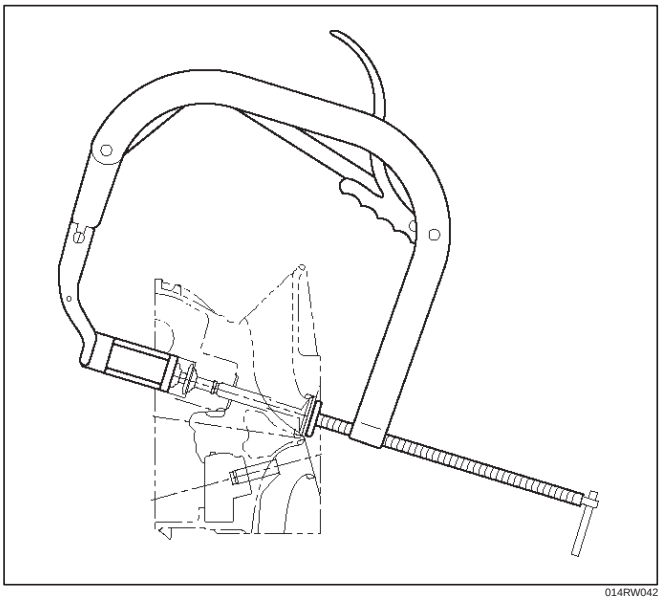


014RW058

3. Install valve to valve guide. Before installing valve guide apply engine oil to the outside of the valve stem.
4. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat. The painted area of the valve spring should be facing downward.


014RS020

5. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to install the split collars.

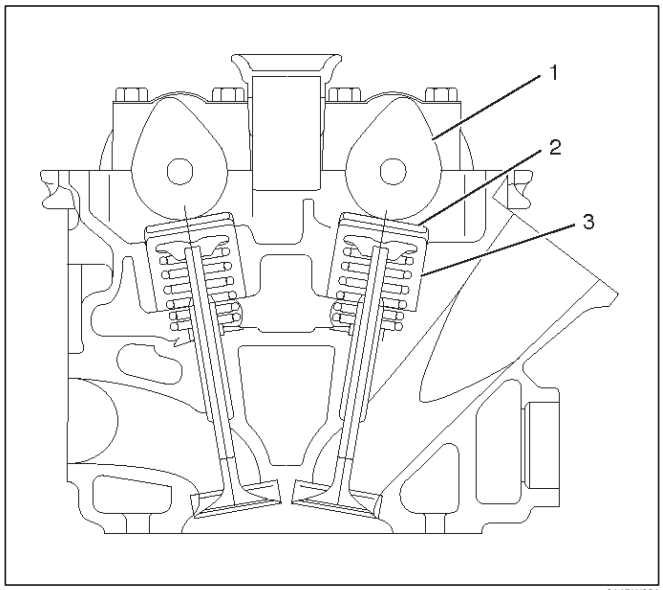

014RW042

6. Install tappet with shim.
7. Install camshaft assembly.

▼Refer to installation procedure for Camshaft in this manual.

Valve Clearance Adjustments

NOTE: To adjust valve clearance, apply engine oil to the cam as well as to the adjusting shim (2) with the cylinder head built on the cylinder block, give a few turns to the camshaft by means of timing pulley tightening bolt, and measure valve clearance when the nose of cam is just opposite of maximum cam lift (1) as shown in illustration below.



014RW081

Legend

(1) Cam
(2) Shim
(3) Tappet

Valve Clearance Standard Value (cold)

Intake: 0.23 mm–0.33 mm (0.0091 in–0.0130 in)

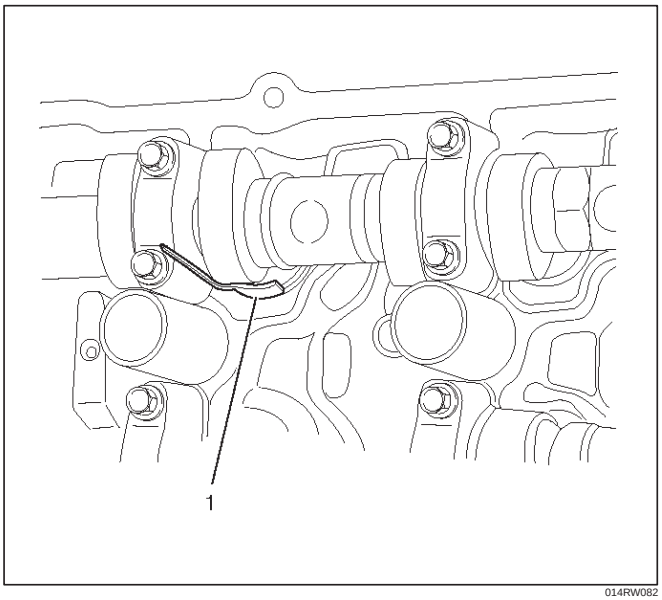
Exhaust: 0.25 mm–0.35 mm (0.0098 in–0.0138 in)

Selection of Adjusting Shim

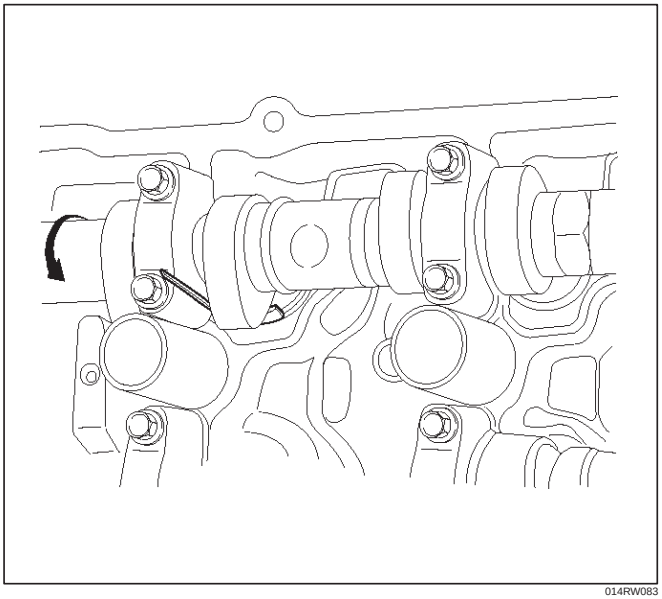
Shim to be selected = (Thickness of removed shim) + (Valve clearance measurement – Standard value)
Based on the above formula, the best suited shim should be selected from 41 types of shim (differently thick at 0.02mm (0.0008 in) intervals from 2.40mm (0.0945 in) through 3.2mm (0.1260 in) thick). Install the shim and check valve clearance.

Replacement of Shim

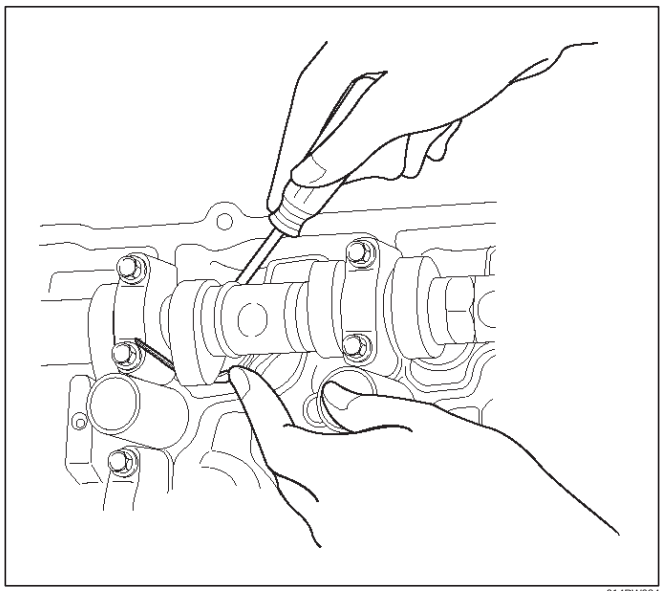
Let the cam push down the edge of tappet by using J–42689 valve clearance adjusting tool and push out the shim with a flat blade screw driver as shown in illustrations below.



014RW082



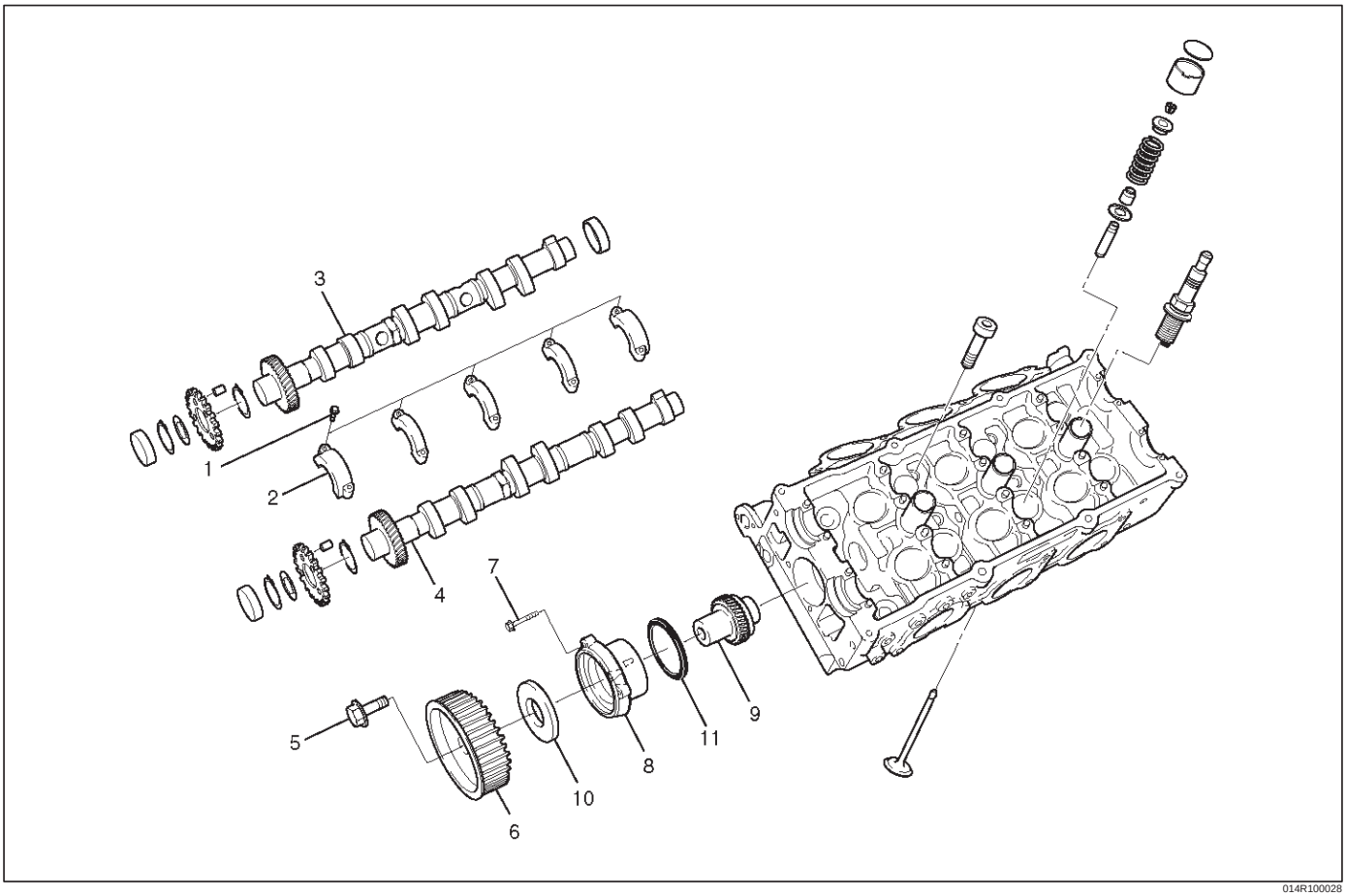
014RW083



014RW084

Camshaft

Camshaft and Associated Parts



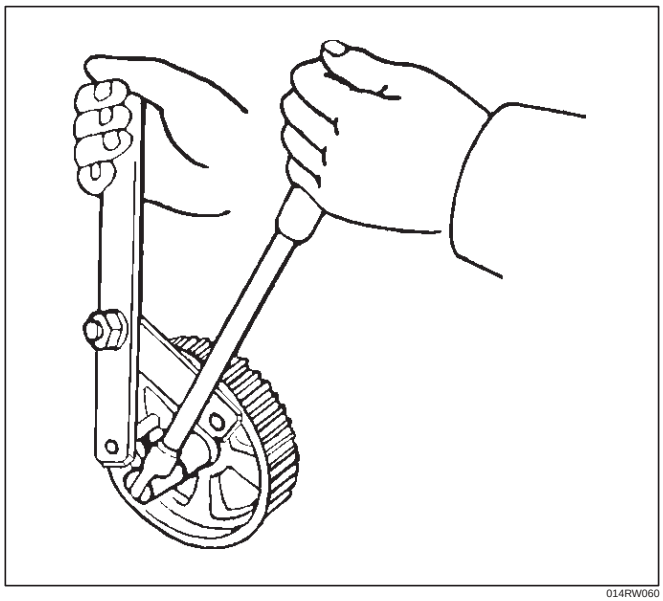
014R100028

Legend

(1) Camshaft Bracket Fixing Bolt
(2) Camshaft Bracket
(3) Camshaft Assembly Intake
(4) Camshaft Assembly Exhaust
(5) Pulley Fixing Bolt
(6) Camshaft Drive Gear Pulley
(7) Retainer Fixing Bolt
(8) Retainer
(9) Camshaft Drive Gear
(10) Oil Seal
(11) O–ring

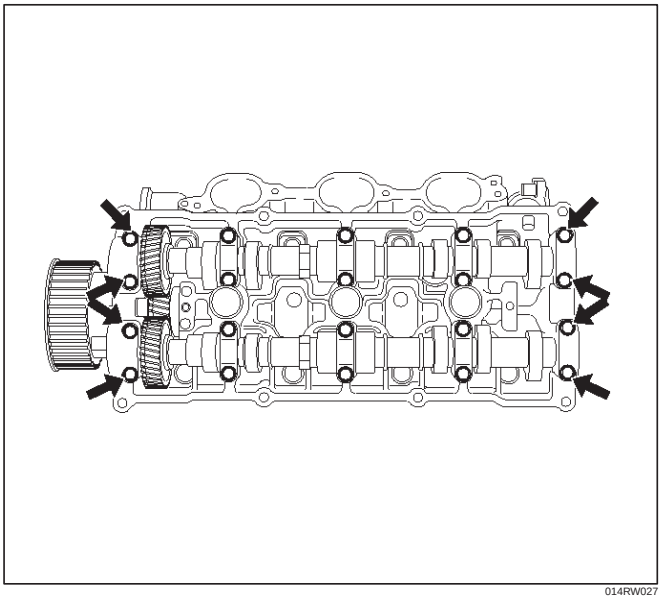
Disassembly

1. Remove fixing bolt (5) for camshaft drive gear pulley using the J–43041 universal holder.



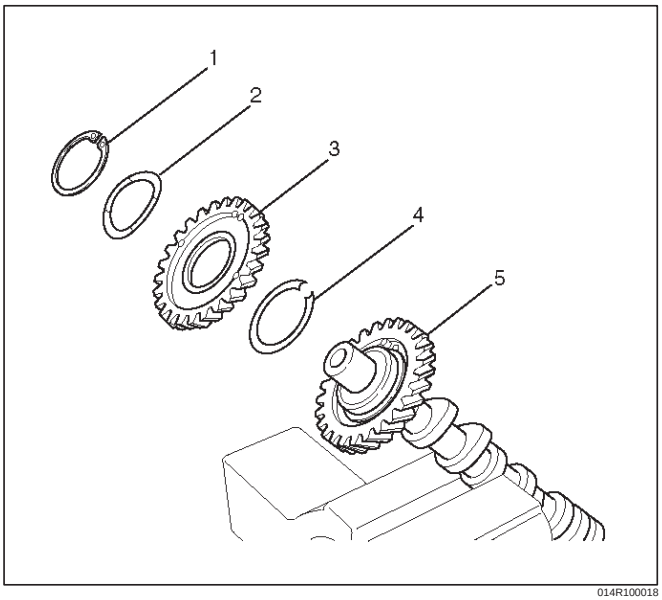
014RW060

2. Remove twenty fixing bolts from intake and exhaust camshaft bracket on one side bank, then camshaft brackets (2).



014RW027

3. Remove camshaft assembly (3), (4) with camshaft end plug.
4. Remove three fixing bolts (7) from camshaft drive gear retainer (8), then camshaft drive gear assembly.
5. Use the snap ring pliers to remove the snap ring(1).
6. Remove the wave washer(2), sub gear(3) and spring camshaft gear(4) from the camshaft assembly(5).



014R100018

Legend

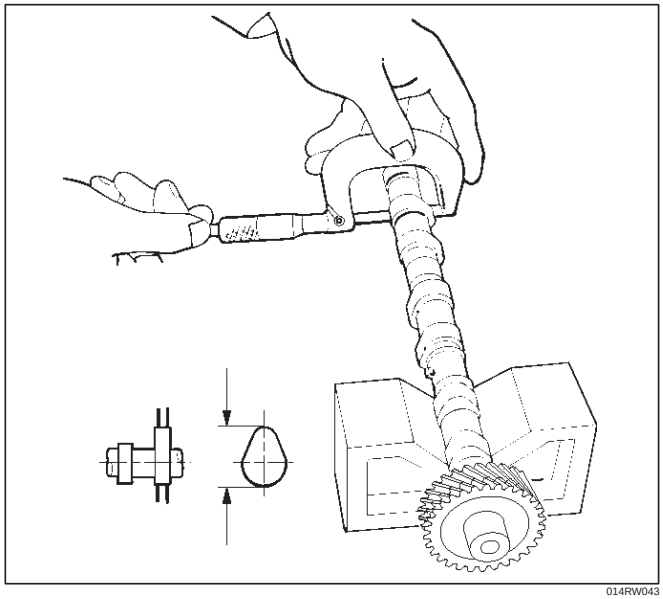
(1) Snap Ring
(2) Wave Washer
(3) Sub Gear
(4) Spring; Camshaft Gear
(5) Camshaft Assembly

Inspection and Repair

1. Use a micrometer to measure the cam lobe height and uneven wear. Replace the camshaft if either the lobe height or the uneven wear exceeds the specified limit.

Lobe height : 44.709 mm (1.7602 in)

Uneven wear : 0.05 mm (0.0020 in)



014RW043

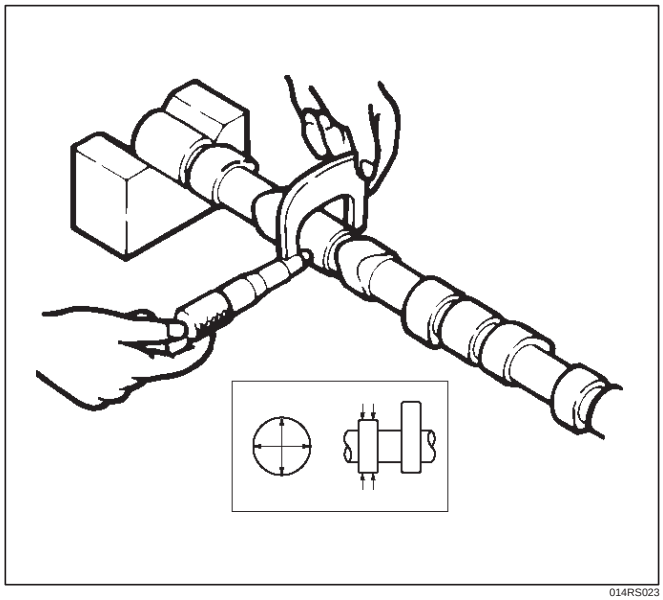
2. Use a micrometer to measure the diameter and the uneven wear of the camshaft journals.
   Replace the camshaft if the diameter or the uneven wear exceeds the specified limit.

Journal Diameter

Standard : 25.972 mm–25.993 mm (1.0225 in–1.0233 in)

Limit : 25.8 mm (1.0157 in)

Uneven wear : 0.05 mm (0.0020 in)

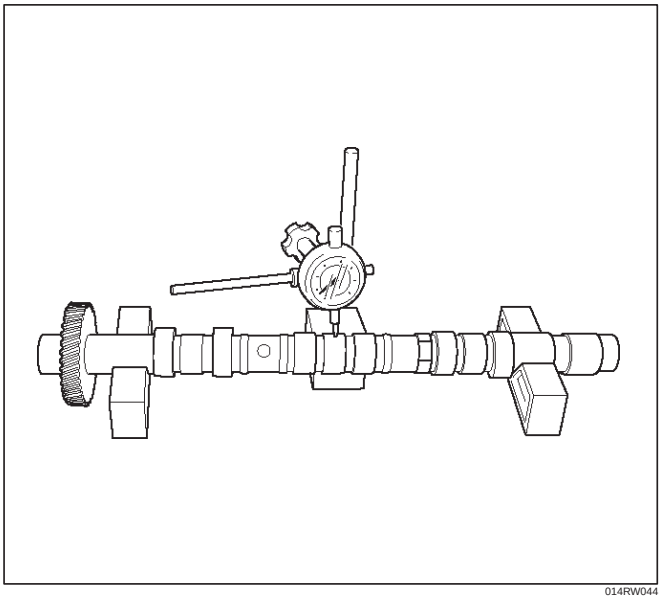


014RS023

3. Place the camshaft on V–blocks.
   Slowly rotate the camshaft and measure the runout with a dial indicator.
   Replace the camshaft if the runout exceeds the specified limit.

Runout

Limit : 0.1 mm (0.0039 in)

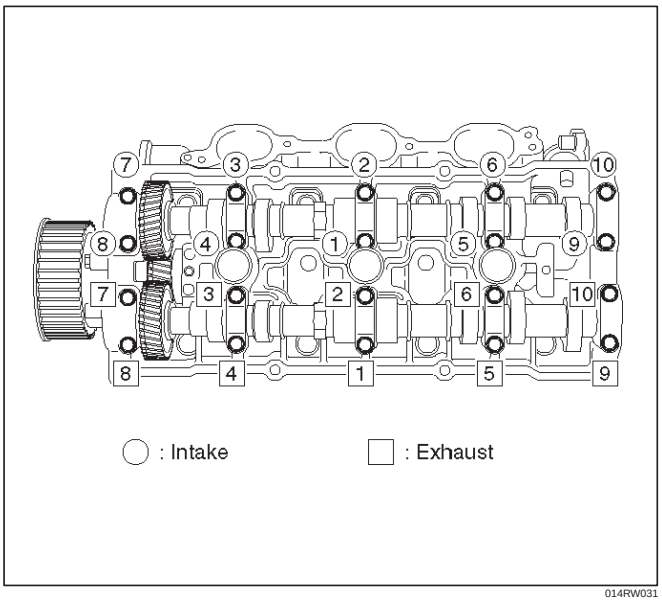


014RW044

4. Measure the camshaft journal oil clearance.
   1. Measure the camshaft bracket housing inside diameter.

NOTE: Tighten camshaft bracket (2) to specified torque before measuring the camshaft bracket inside diameter.

Torque : 10 N·m (89 lb in)



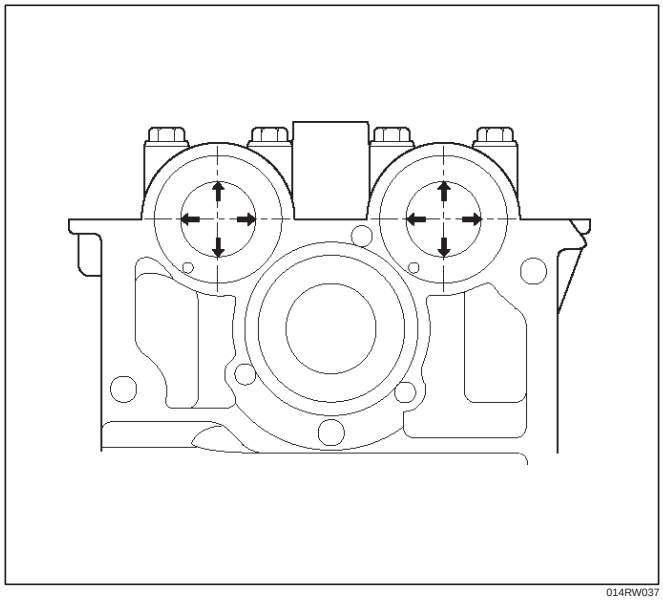
014RW031

   2. Subtract the camshaft outside diameter from the camshaft bracket housing inside diameter.

Oil Clearance

Standard : 0.027 mm–0.078 mm (0.0011 in–0.0031 in)

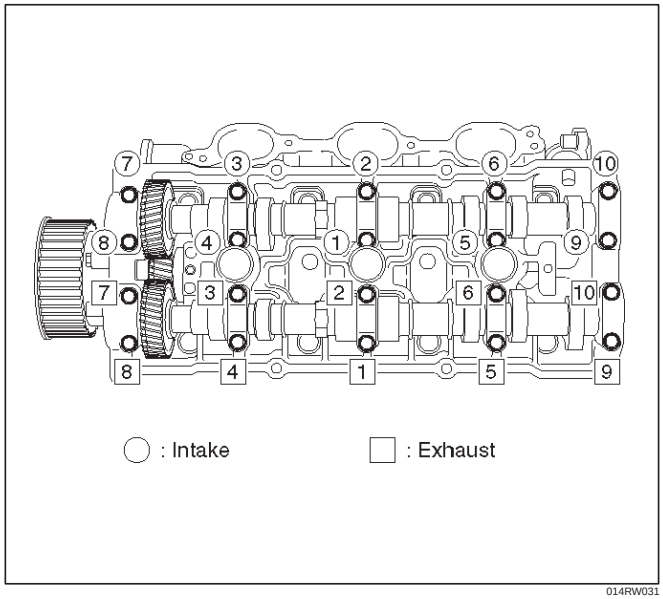
Limit : 0.11 mm (0.0043 in)



014RW037

5. Replace the cylinder head and/or camshaft if the measured oil clearance exceeds the specified limit.
   1. Carefully clean the camshaft journal, the camshaft bracket, and the cylinder head.
   2. Install camshaft assembly and camshaft brackets (2), tighten twenty bolts (1) on one side bank to the specified torque.

Torque: 10 N·m (89 lb in)



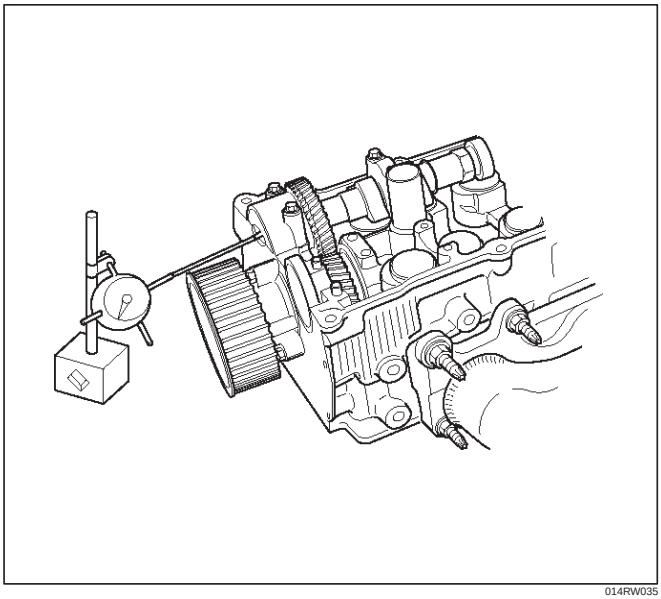
014RW031

3. Measure the camshaft thrust clearance with a dial indicator. Replace the camshaft and/or the cylinder head if the camshaft thrust clearance exceeds the specified limit.

Camshaft thrust Clearance

Standard : 0.03 mm–0.08 mm (0.0012 in.–0.0031 in.)

Limit : 0.12 mm (0.0047 mm)



014RW035

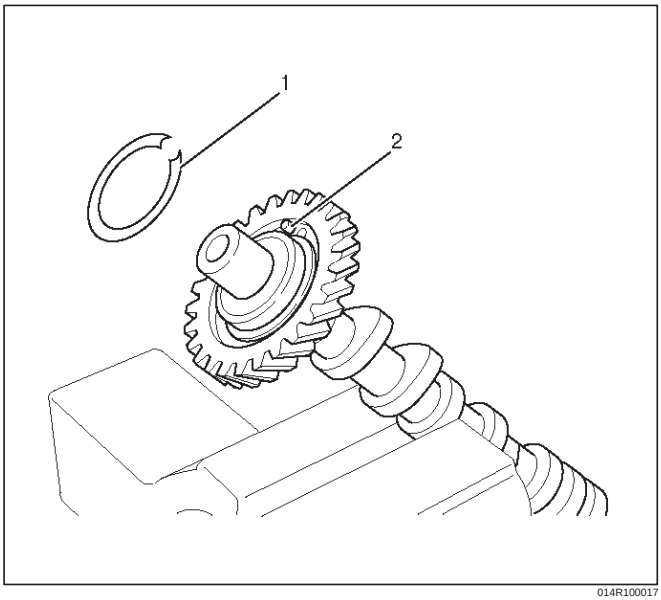
Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

   Torque: 10 N·m (89 lb in)

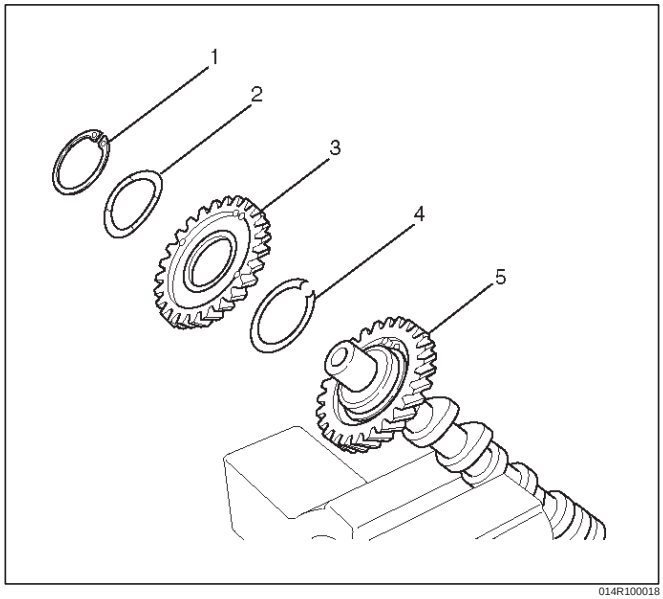
2. Install the spring ; camshaft gear(1) into the camshaft assembly.

   Ensure the clearance is between the right side of the spring; camshaft gear (1) and the dowel pin (2).



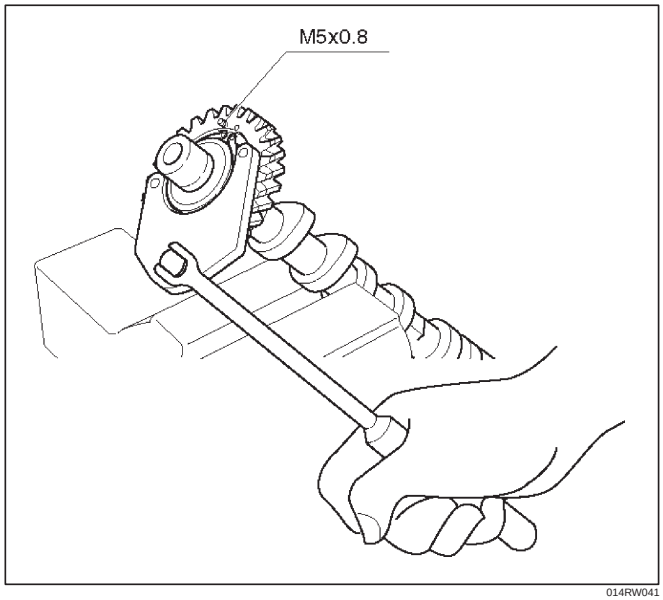
014R100017

3. Align the dowel pin on the sub gear to the clearance of the spring ; camshaft gear made in step 2 and install the sub gear (3).
4. Install the wave washer (2). Use snap ring pliers to install the snap ring (1).



014R100018

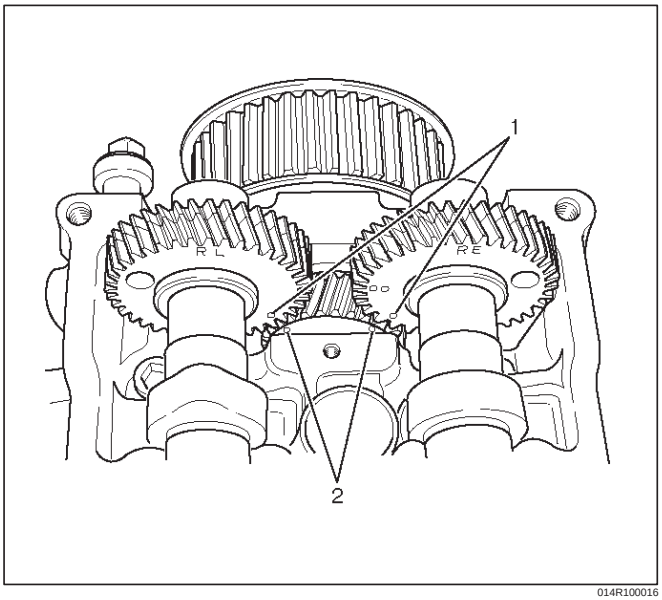
5. Tighten sub gear setting bolt.
   a. Use J–42686 gear spring lever to pre-load the sub gear. Turn the sub gear in a clockwise direction until the M5 bolt hole aligns with the hole in the camshaft driven gear.
   b. Install the M5 bolt and tighten to a suitable torque to prevent the sub gear from moving.



014RW041

6. Align the timing mark on the retainer and dowel pin of the camshaft drive gear.
7. Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.

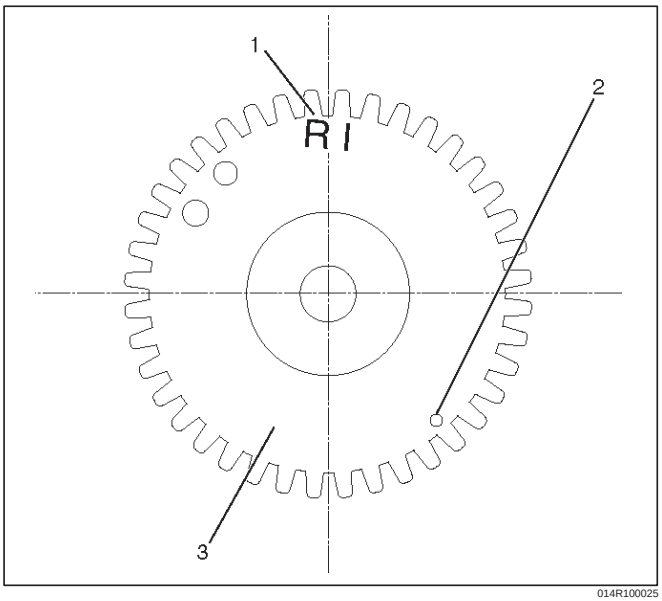
a. Apply engine oil to camshaft journal and bearing surface of camshaft bracket.
b. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014R100016

Legend

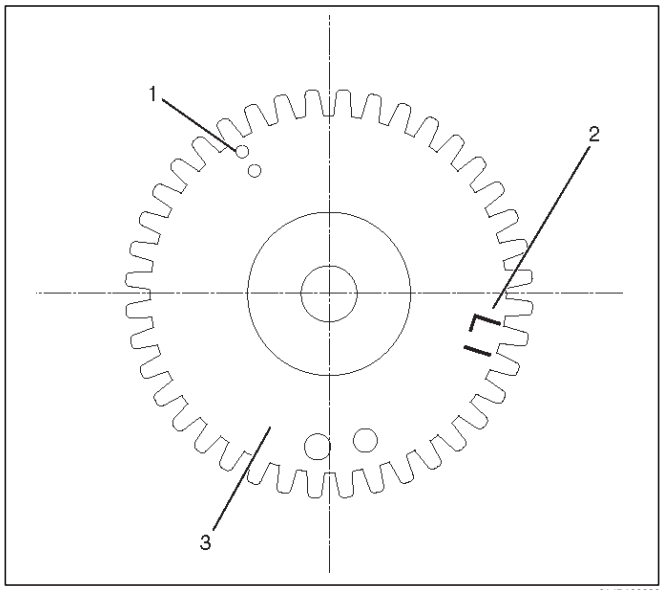
(1) Alignment Mark on the Camshaft Gear
(2) Alignment Mark on the Camshaft Drive Gear



014R100025

Legend

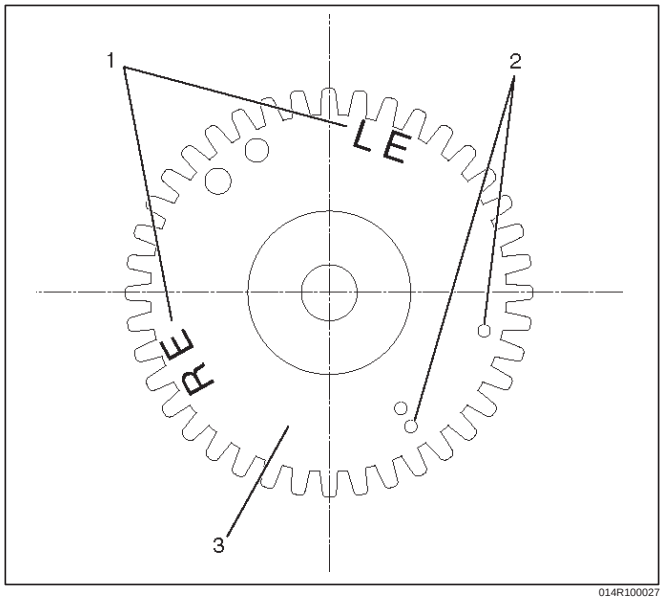
(1) Discrimination Mark for Right Bank Intake Camshaft Gear
(2) Alignment Mark for Right Bank (One Dot)
(3) Camshaft Timing Gear for Right Bank Intake



014R100026

Legend

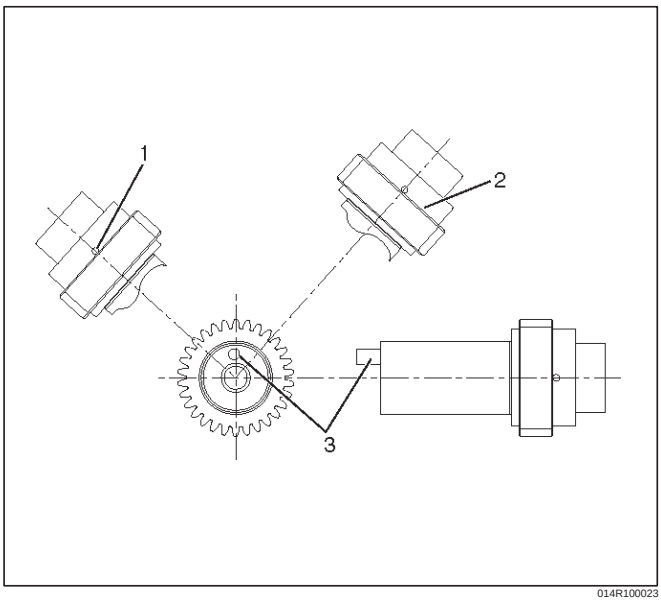
(1) Alignment Mark for Left Bank (Two Dots)
(2) Discrimination Mark for Left Bank Intake Camshaft Gear
(3) Camshaft Timing Gear for Left Bank Intake



014R100027

Legend

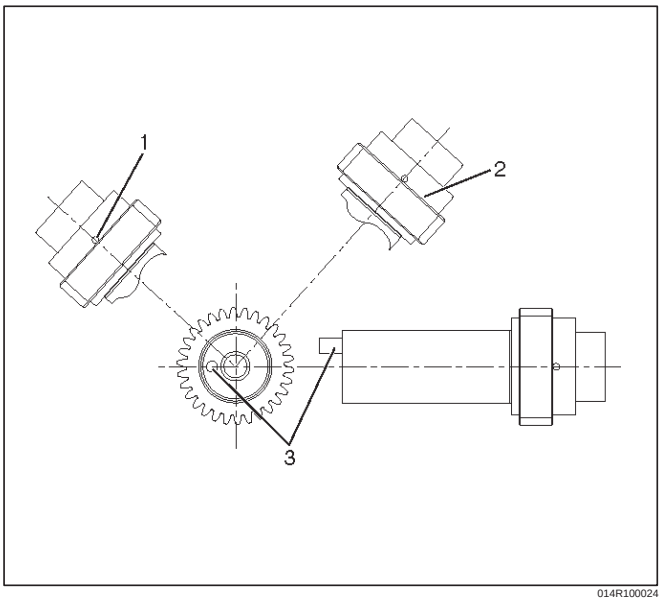
(1) Discrimination Mark
LE : Left Bank Exhaust
RE : Right Bank Exhaust
(2) Alignment Mark
One Dot for Right Bank
Two Dots for Left Bank
(3) Camshaft Timing Gear for Exhaust



014R100023

Legend

(1) Timing Mark on the Camshaft Drive Gear for Right Bank Exhaust Camshaft
(2) Timing Mark on the Camshaft Drive Gear for Right Bank Intake Camshaft
(3) Dowel Pin



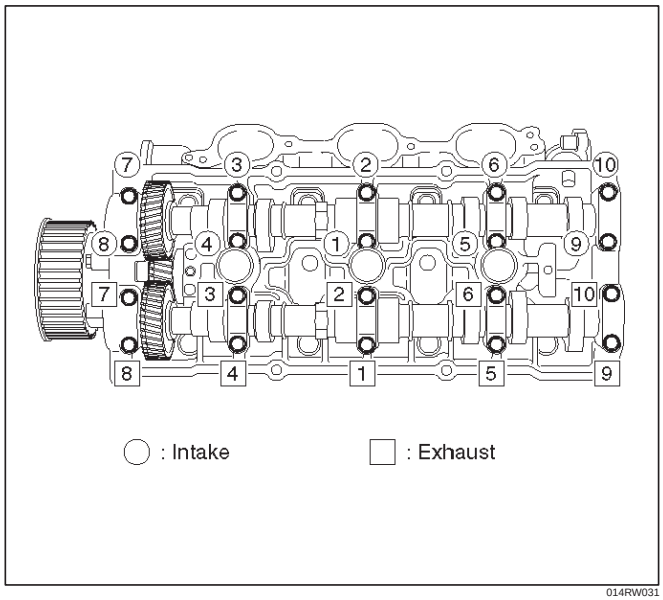
014R100024

Legend

(1) Timing Mark on the Camshaft Drive Gear for Left Bank Intake Camshaft
(2) Timing Mark on the Camshaft Drive Gear for Left Bank Exhaust Camshaft
(3) Dowel Pin

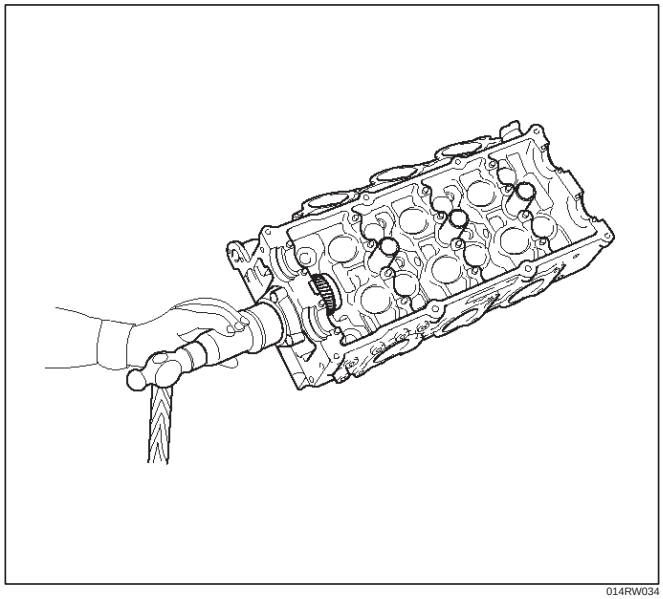
c. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (89 lb in)



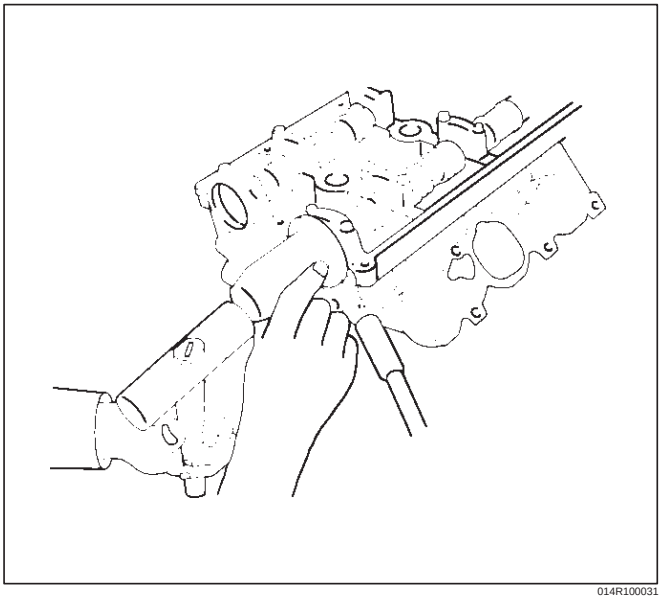
014RW031

8. If the oil seal requires replacement, use the J–42985 to install the oil seal.



014RW034

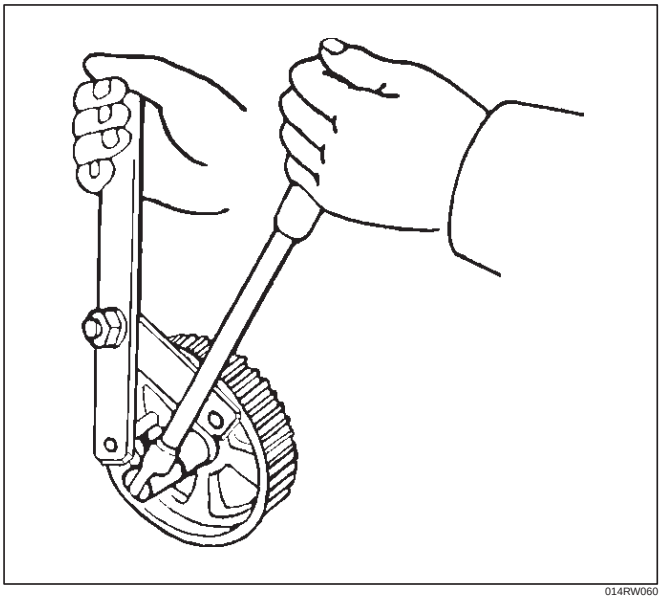
9. If the camshaft end plug requires replacement, use the J–42985 to install the camshaft end plug.



014R100031

10. Tighten bolt for camshaft drive gear pulley to the specified torque using the J–43041 universal holder.

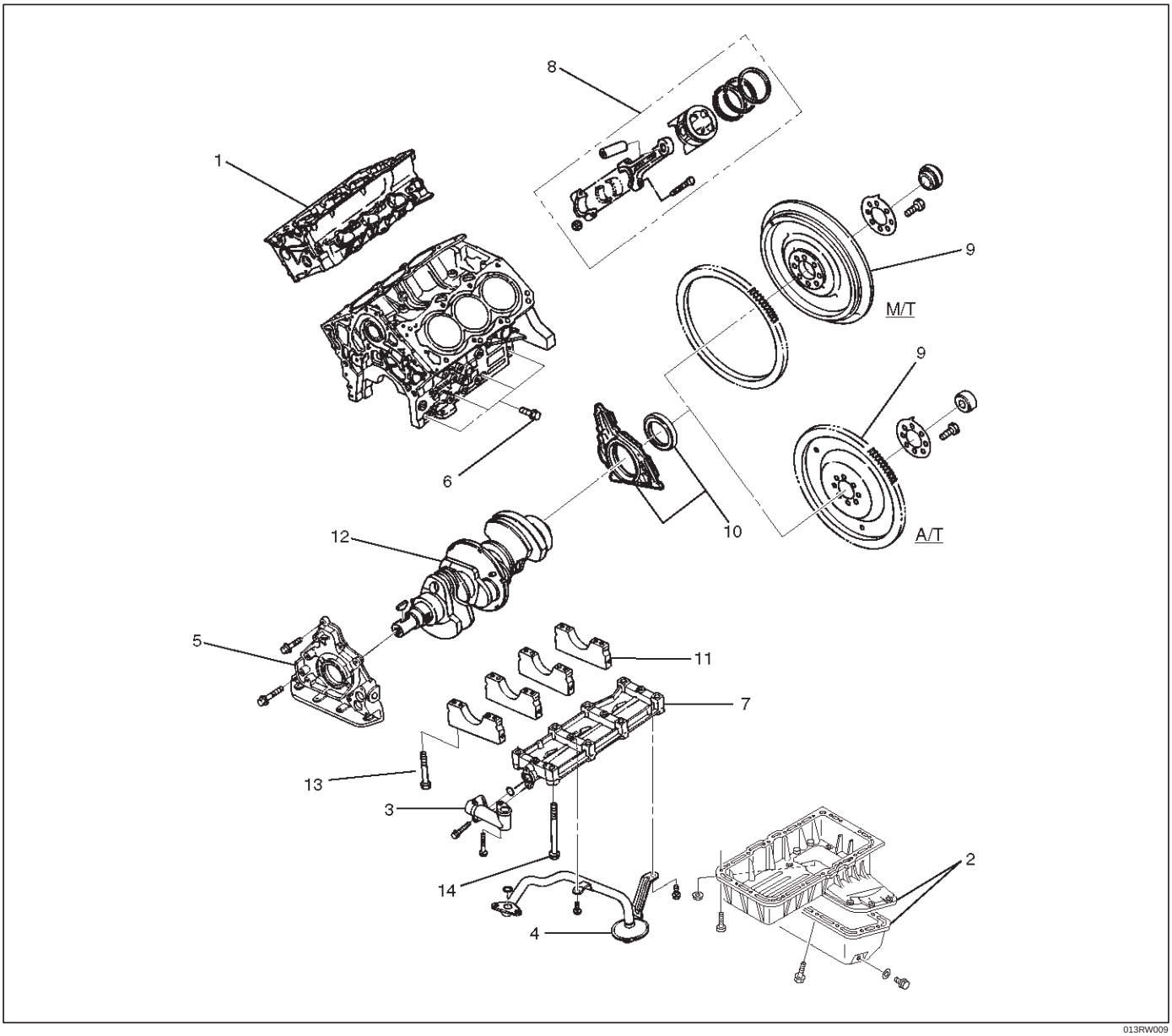
Torque: 98 N·m (72 lb ft)



014RW060

Crankshaft

Crankshaft and Associated Parts



013RW009

Legend

(1) Cylinder Head Assembly
(2) Crankcase with Oil Pan
(3) Oil Pipe and O-ring
(4) Oil Strainer and O-ring
(5) Oil Pump Assembly
(6) Cylinder Block Side Bolts
(7) Oil Gallery
(8) Piston and Connecting Rod Assembly
(9) Flywheel
(10) Rear Oil Seal Retainer and Oil Seal
(11) Main Bearing Cap
(12) Crankshaft
(13) Main Bearing Cap Fixing Bolts
(14) Oil Gallery Fixing Bolts

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head” in this manual.
2. Remove crankcase with oil pan (2). Refer to “Oil Pan and Crankcase” in this manual.

CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.

3. Remove oil pipe and O-ring (3).
4. Remove oil strainer and O-ring (4).
5. Remove oil pump assembly (5).
6. Remove crankcase side bolts (6).

7. Remove oil gallery (7).
8. Remove piston and connecting rod assembly (8). Refer to “Piston, Piston Ring and Connecting Rod” in this manual.
9. Remove flywheel (9).
10. Remove rear oil seal retainer (10).
11. Remove main bearing cap (11).
12. Remove crankshaft (12).

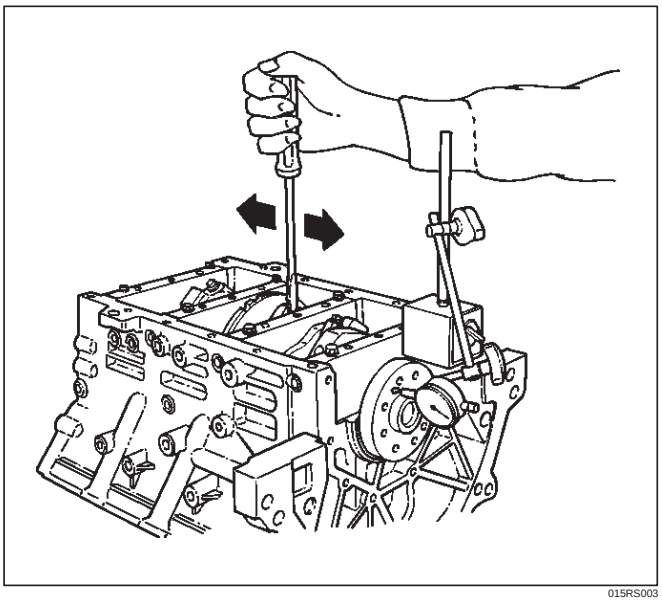
Inspection and Repair for Bearings

1. Inspect Crankshaft
   Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

   Thrust Clearance

   Standard : 0.06 mm–0.24 mm (0.0024 in–0.0094 in)

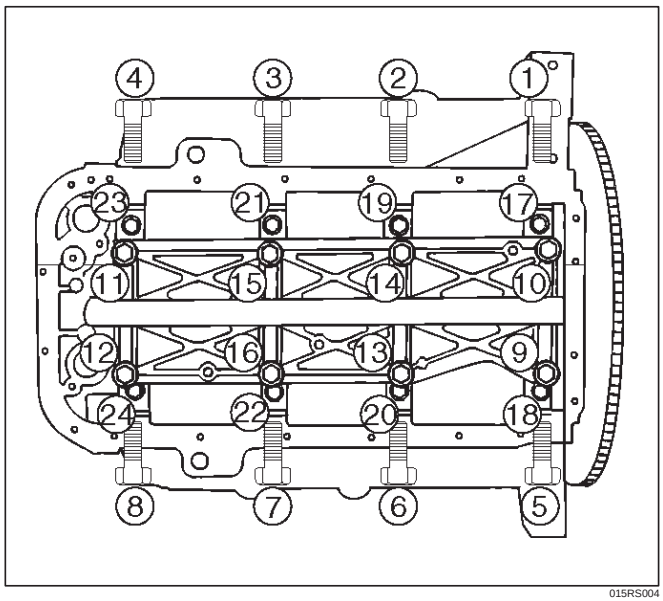
   Limit : 0.30 mm (0.0118 in)



015RS003

Main Bearing Clearance

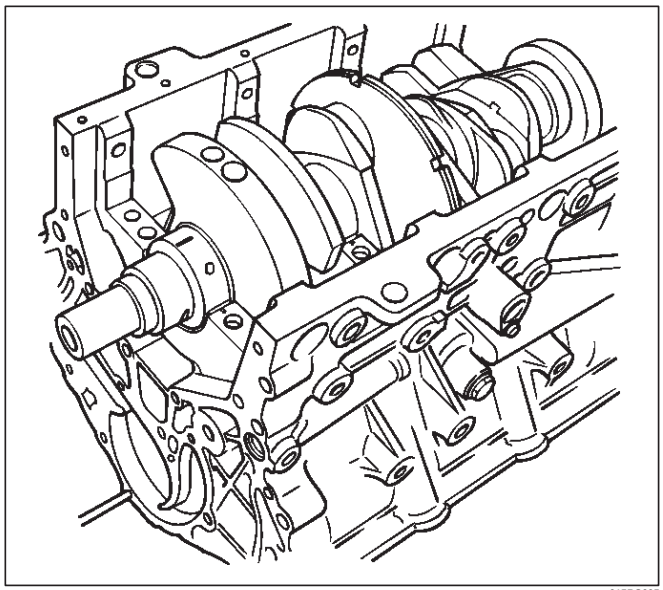
1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts in the sequence shown in the illustration.
   Arrange the removed main bearing caps in the cylinder number order.
   Remove the main bearings.



015RS004

3. Remove the crankshaft.
   Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear.
   The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions.
   Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.

NOTE: Do not set the plastigage on the oil hole.



015RS005

9. Install main bearing caps, oil gallery and crank case bolts in the order shown, and tighten each bolt to the specified torque.

NOTE: Do not apply engine oil to the crank case side bolts.

Main bearing cap bolts.

Torque: 39 N·m (29lb ft)

Oil gallery fixing bolts.

Torque:

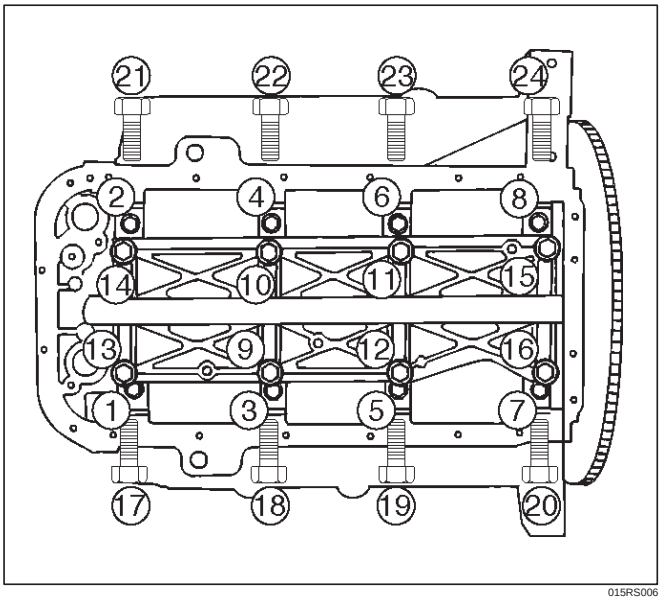
1st step: 29 N·m (22 lb ft)

2nd step 55˚~ 65˚

Crank case side bolts

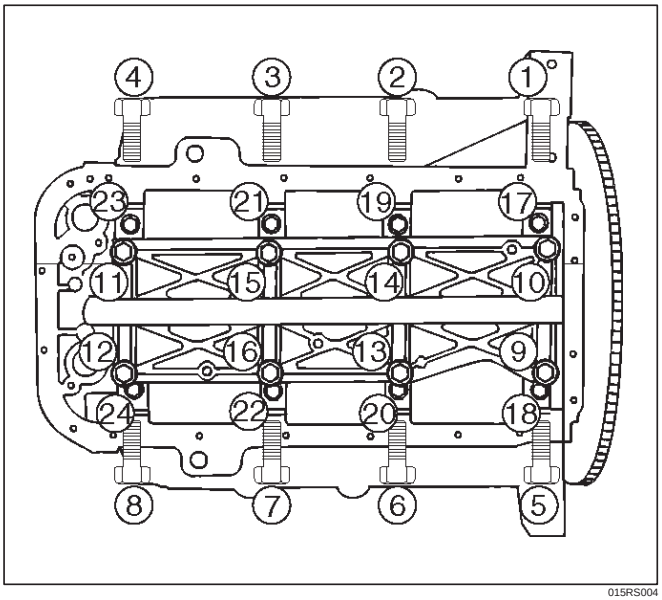
Torque : 39 N·m (29lb ft)

NOTE: Do not allow the crankshaft to rotate.



015RS006

10. Remove the main bearing caps in the sequence shown in the illustration.

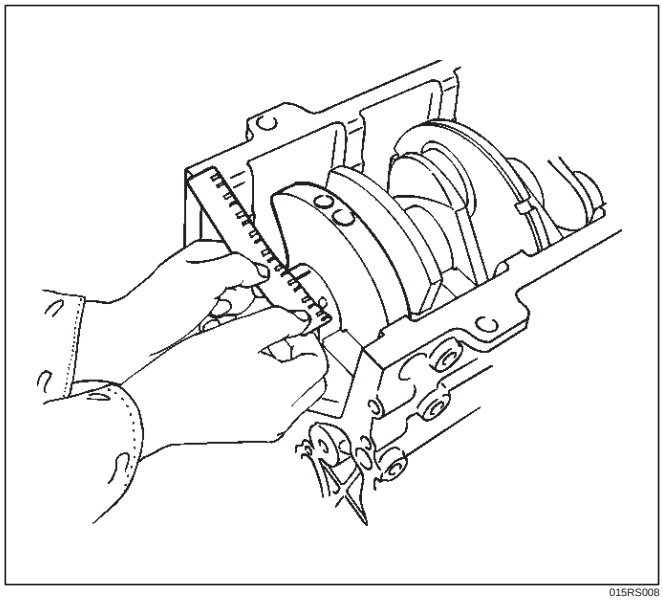


015RS004

11. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.0031 in)


015RS008

12. Clean the plastigage from the bearings and the crankshaft.

Remove the crankshaft and the bearings.

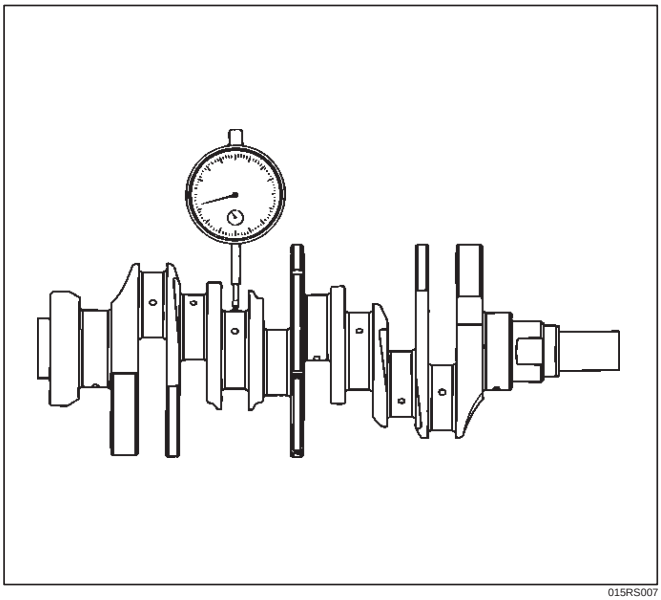
Crankshaft Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

Inspection and Repair for Crankshaft

1. Carefully set the crankshaft on the V–blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

Runout : 0.04 mm (0.0016 in)

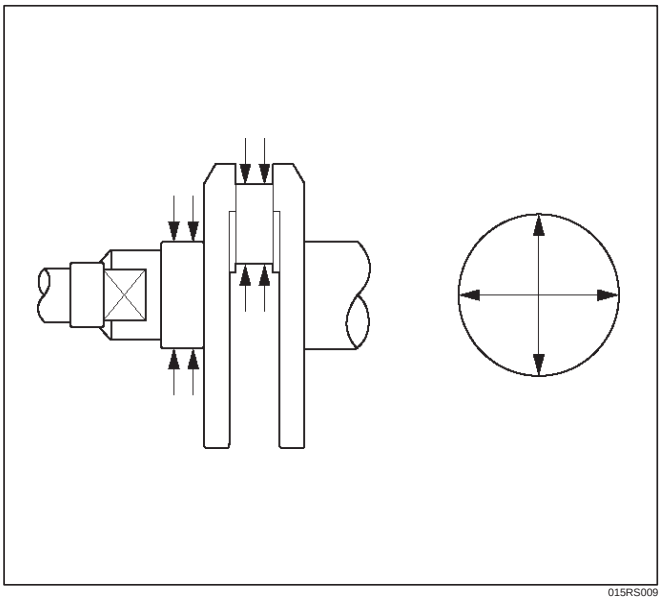

015RS007

2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

Main journal diameter : 63.918 mm–63.933 mm (2.5165 in–2.5170 in)

Crank pin diameter : 53.922 mm–53.937 mm (2.1229 in.–2.1235 in.)

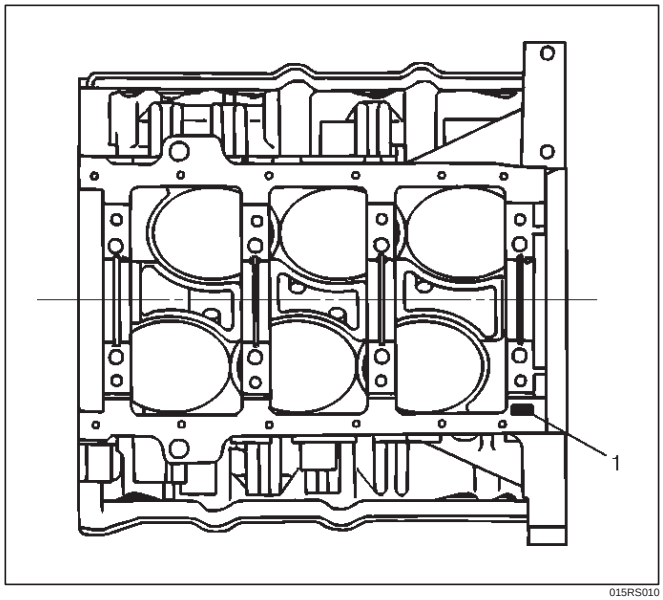
Uneven wear limit : 0.005 mm (0.0002 in)


015RS009

Crankshaft Bearing Selection

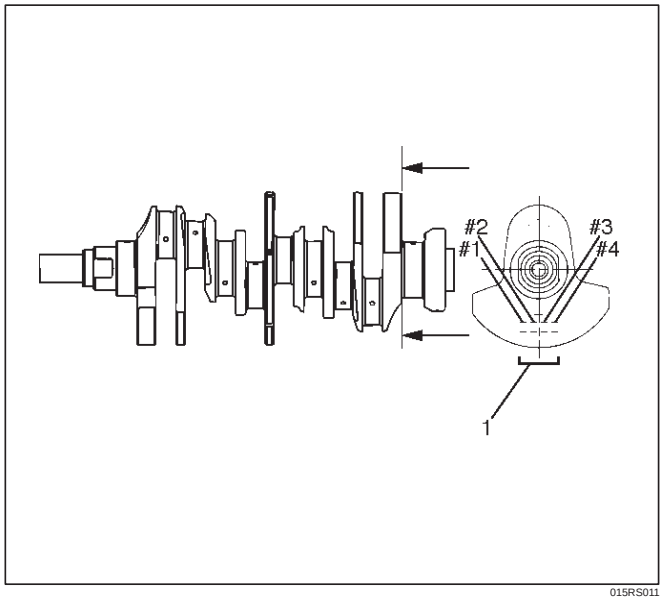
When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings, paying close attention to the cylinder block journal hole.

1. Diameter size mark (1) and the crankshaft journal.



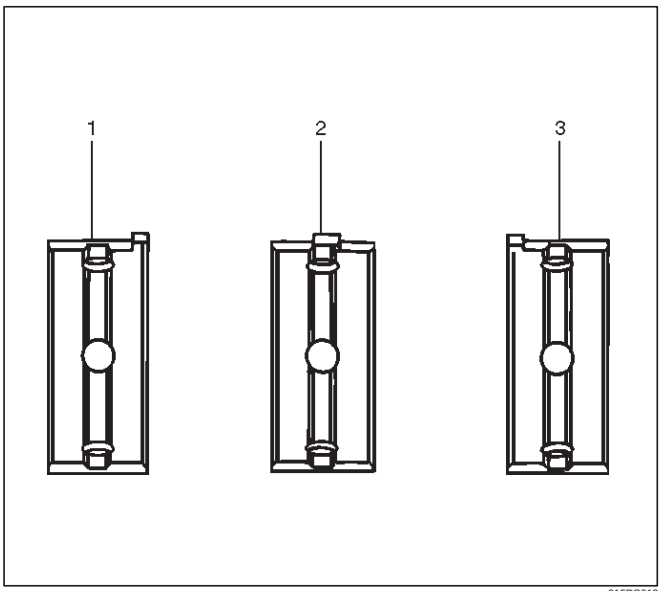
015RS010

2. Diameter size mark (1).
   The diameter size marks are stamped on the No.1 crankshaft balancer as shown in the illustration.



015RS011

NOTE: Take care to ensure the bearings are positioned correctly.



Legend

(1) Number 1 and 4 main bearing upper and lower
(2) Number 2 and 3 main bearing upper
(3) Number 2 and 3 main bearing lower

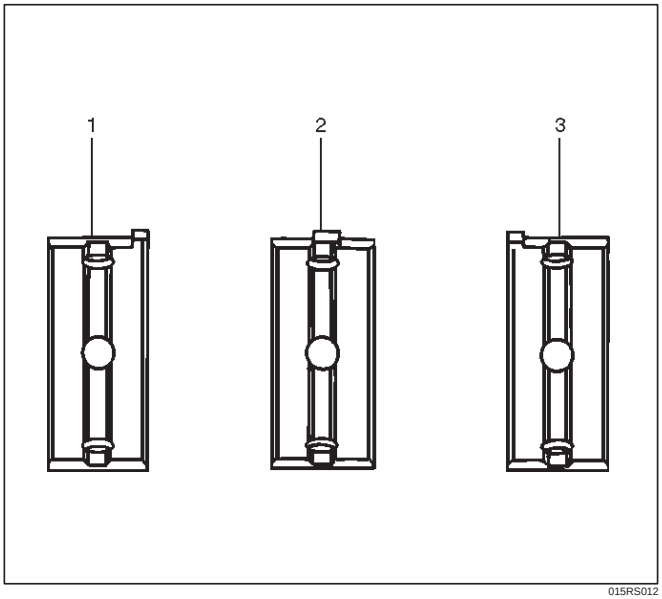
mm (in)

1 Size Mark	Main Bearing Bore Diameter	Crank Shaft Main Journal Diameter	2 Size Mark	Crank Shaft Bearing Size Mark (Upper Side)	Crank Shaft Bearing Size Mark (Lower Side)	Oil Clearance (Reference)
1	68.994-69.000 (2.7163-2.7165)	63.918-63.925 (2.5165-2.5167)	2	Blue	Blue	0.030-0.049 (0.0012-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Brown	Brown	0.028-0.047 (0.0011-0.0019)
2	68.987-68.993 (2.7160-2.7163)	63.918-63.925 (2.5165-2.5167)	2			0.029-0.048 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Green	Green	0.027-0.046 (0.0011-0.0018)
3	68.980-68.986 (2.7157-2.7160)	63.918-63.925 (2.5165-2.5167)	2			0.028-0.047 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Yellow	Yellow	0.026-0.045 (0.0010-0.0018)

Reassembly

1. Crankshaft (12)
   - ▼Install the main bearings to the cylinder block and the main bearing caps.
   - ▼Be sure that they are positioned correctly.
   - ▼Apply new engine oil to the upper and lower main bearing faces.

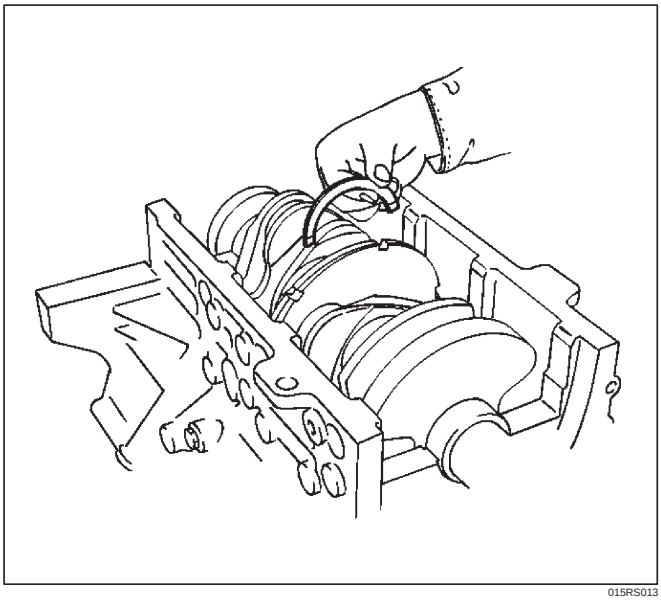
NOTE: Do not apply engine oil to the main bearing back faces.



▼Carefully mount the crankshaft.

▼Apply engine oil to the thrust washer.

▼Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.



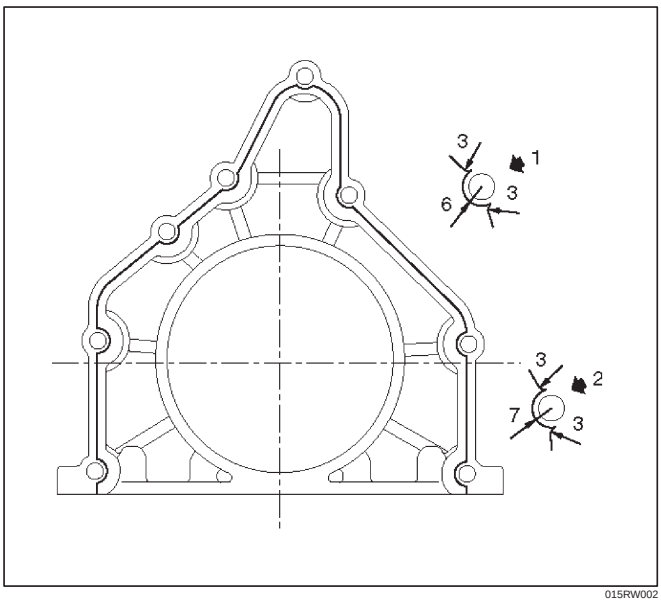
015RS013

2. Rear oil seal (10)

▼Remove the oil from the cylinder block and the retainer mounting surface.

▼Apply sealant (TB–1207B or equivalent) to the retainer mounting surface, following the pattern shown in the illustration.

The retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



015RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

▼Apply engine oil to the oil seal lip.

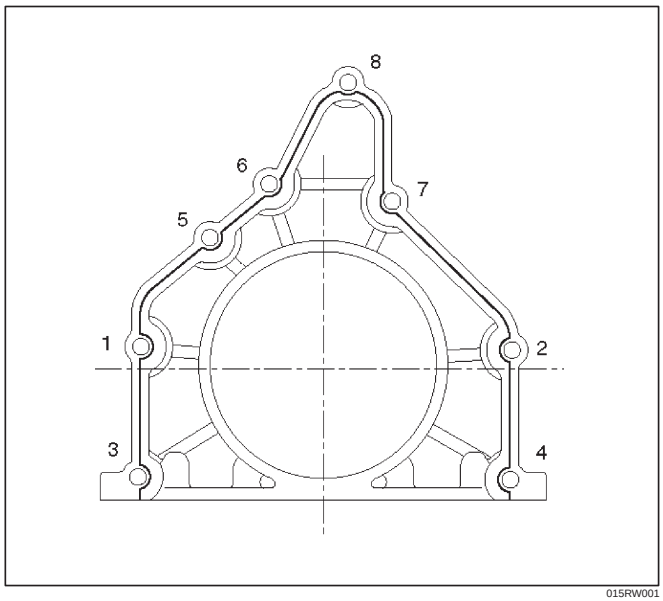
▼Align the cylinder block dowel pin holes with the rear retainer dowel pins.

▼Tighten the rear retainer fixing bolts. New bolts should be used when installing rear retainer.

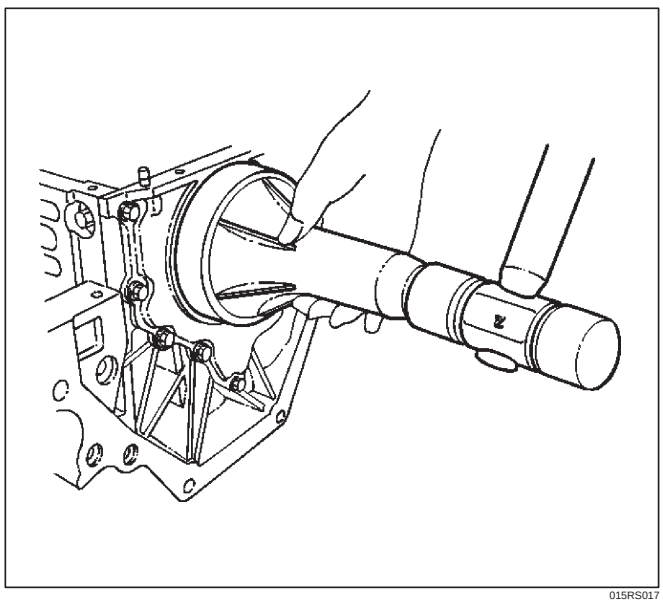
Torque: 18 N·m (13 lb ft)

NOTE: Be very careful not to disengage the oil seal garter spring during installation of the rear retainer.

If the seal was removed from retainer for replacement, apply engine oil to the oil seal lip and install the oil seal using J–39201 oil seal installer.



015RW001



015RS017

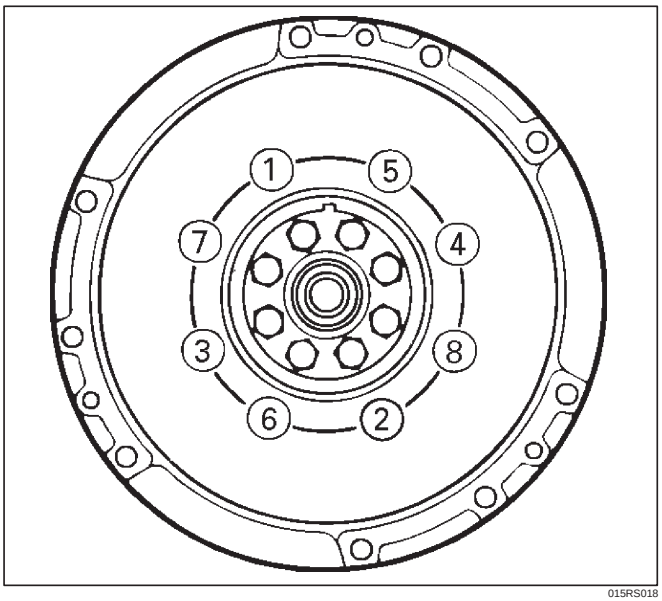
3. Flywheel (9)

1. Thoroughly clean and remove the oil from the threads of crankshaft.
2. Remove the oil from the crankshaft and flywheel mounting faces.
3. Mount the flywheel on the crankshaft and then install the washer.

4. Hold the crankshaft to prevent from rotating then install the bolts in the order shown to the specified torque.

Torque: 54 N·m (40 lb ft)

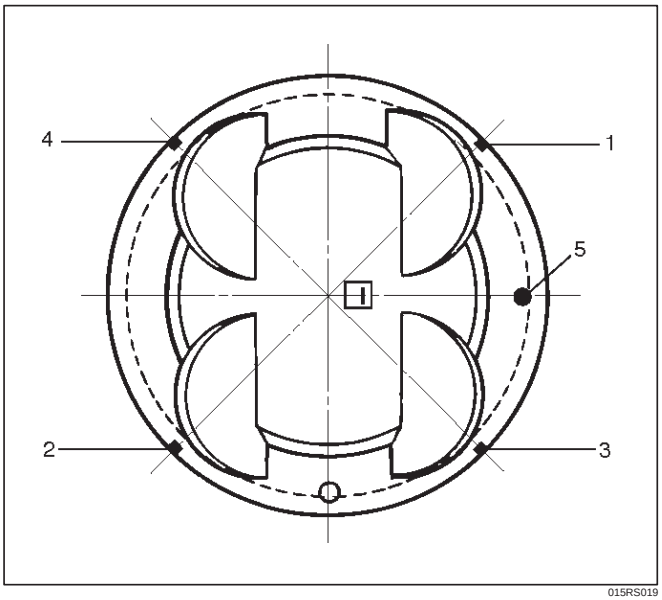
NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS018

4. Piston and connecting rod assembly (8)

▼Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.



015RS019

Legend

(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

▼Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.

▼Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.

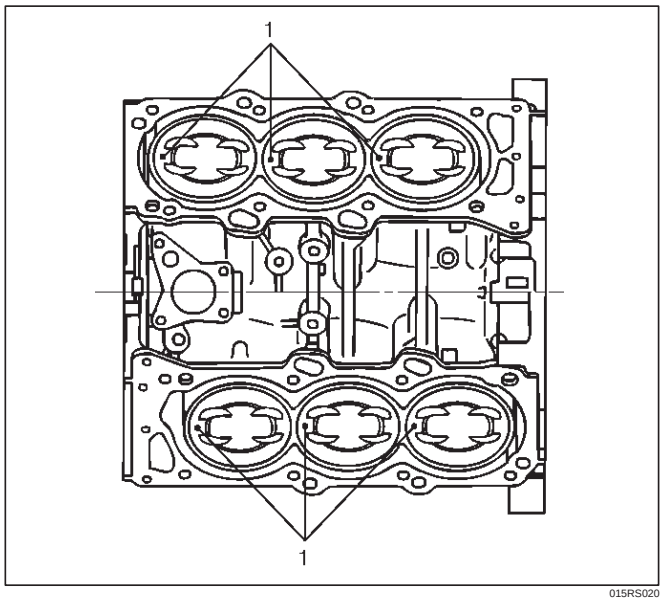
▼Apply engine oil to the threads and seating faces of the nuts.

▼Tighten the nuts.

Torque: 54 N·m (40 lb ft)

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces.

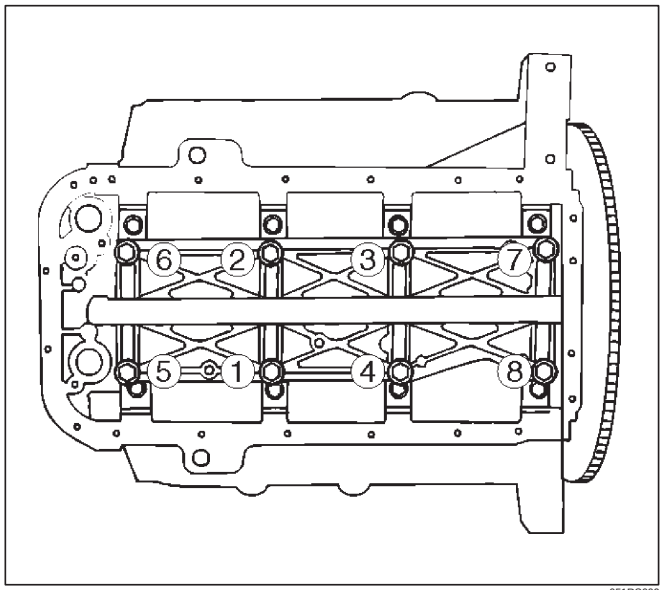


015RS020

5. Install oil gallery (7) and tighten the bolts in 2 steps, in the order shown.

1st step: 29 N·m (22 lb ft)

2nd step: 55°~ 65°



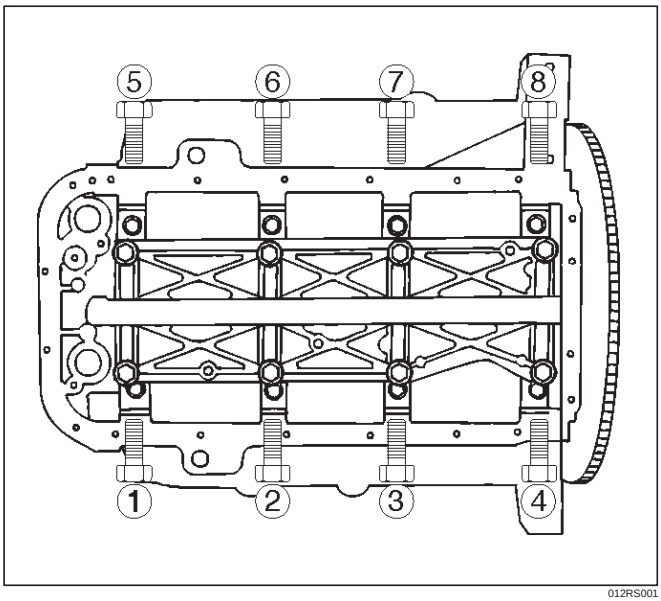
051RS009

6. Cylinder block side bolts (6)

   ▼Tighten all the bolts to the specified torque in the order shown.

NOTE: Do not apply engine oil to the crank case side bolts.

Torque: 39 N·m (29 lb ft)



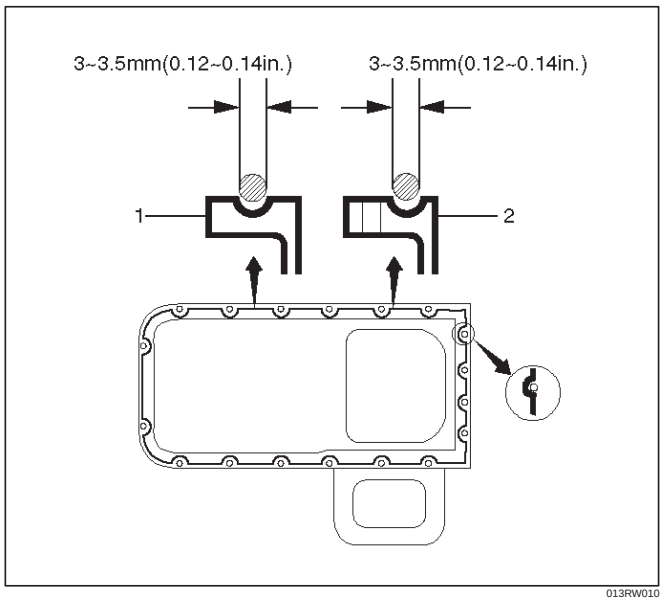
012RS001

7. Install oil pump assembly (5), refer to “Oil pump” in this manual.
8. Install oil strainer and O-ring (4).
9. Install oil pipe and O-ring (3) and tighten the bolts.

   Torque: 25 N·m (18 lb ft)

10. Install crankcase with oil pan (2).
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB—1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
    3. The crankcase assembly must be installed within 5 minutes after sealant application.
    4. Tighten the bolts and nuts to the specified torque.

    Torque : 10 N·m (87 lb in)



013RW010

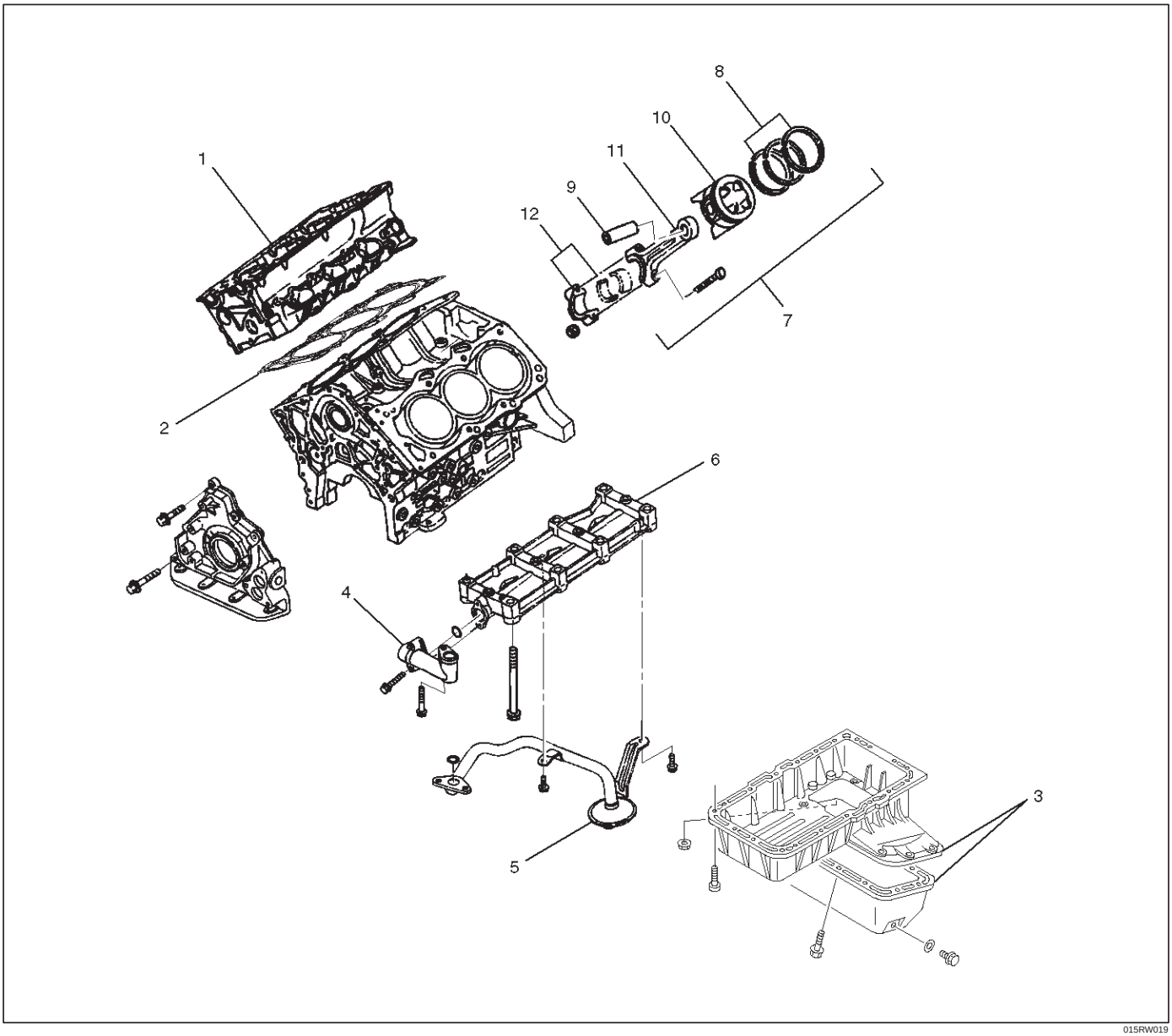
Legend

(1) Portion Between Bolt Holes
(2) Bolt Hole Portion

11. Install cylinder head assembly, refer to “Cylinder head” in this manual.

Piston and Connecting Rod

Piston, Connecting Rod and Associate Parts



015RW019

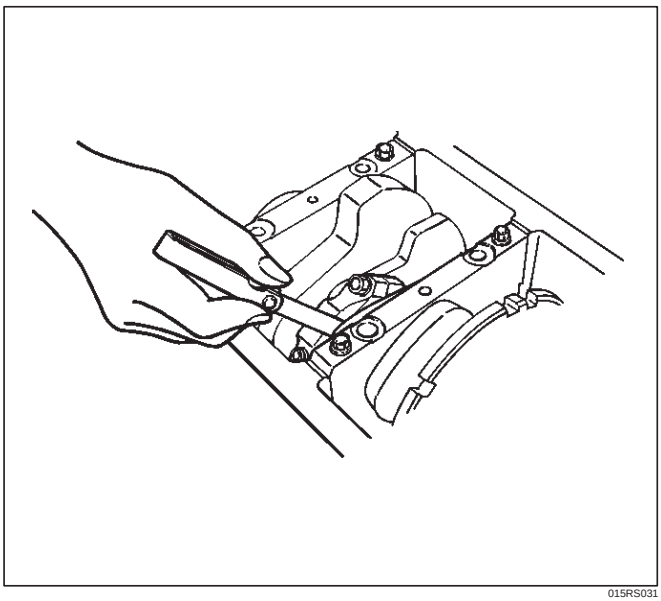
Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Gallery
(7) Piston and Connecting Rod Assembly
(8) Piston Ring
(9) Piston Pin
(10) Piston
(11) Connecting Rod
(12) Connecting Rod Cap

Disassembly

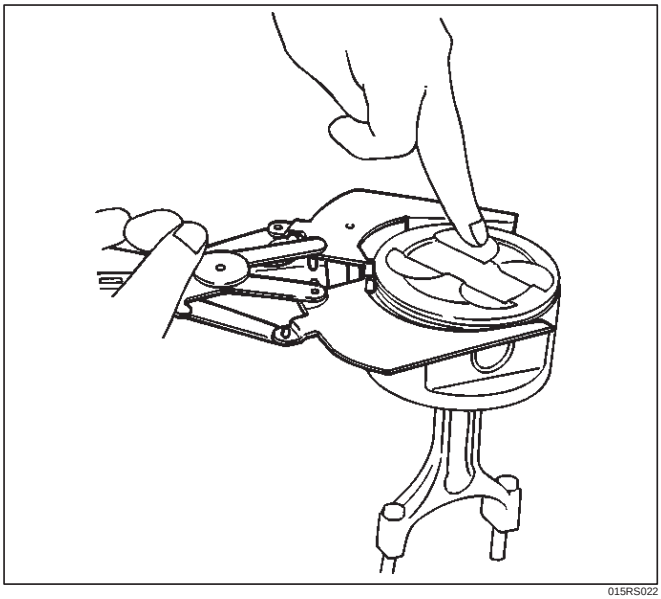
1. Remove cylinder head assembly (1). Refer to “Cylinder Head Removal” in this manual.
2. Remove cylinder head gasket (2).
3. Remove crankcase with oil pan (3). Refer to“Oil Pan and Crankcase” in this manual.
4. Remove oil pipe and O-ring (4).
5. Remove oil strainer and O-ring (5).
6. Remove oil gallery (6).
7. Remove connecting rod cap with connecting rod lower bearing (12).
8. Remove piston and connecting rod assembly (7).

NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.


015RS031

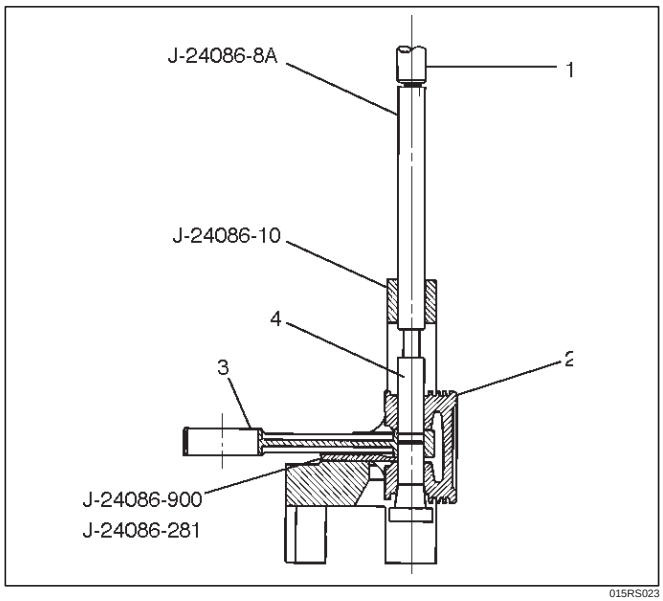
▼Remove any ridge or carbon build up from the top end of the cylinder.

9. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.


015RS022

10. Remove the piston pin (9) using J–24086–C piston pin service set and piston support with a press.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions. Heating the connecting rod will permit easy removal of the piston pin.



015RS023

Legend
(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

11. Piston (10)
12. Connecting rod (11)

Inspection and Repair

Pistons

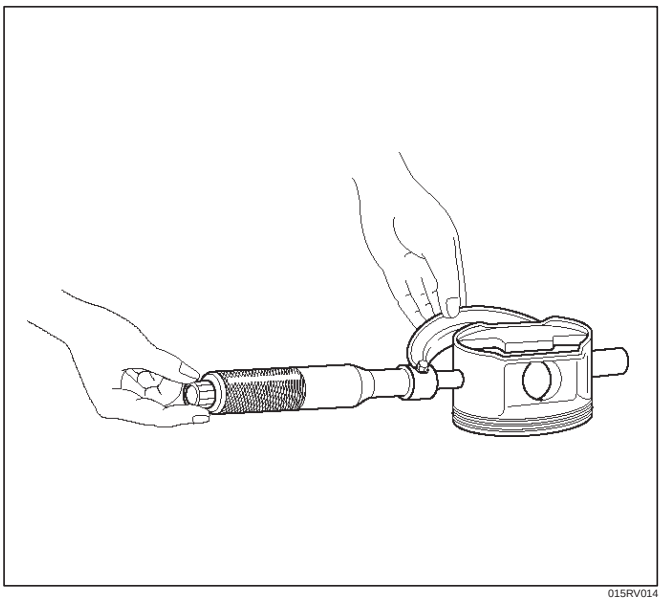
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

Piston Diameter

1. Measure the piston outside diameter with micrometer at the piston grading position and a right angle to the piston pin.
   Piston grading position (from piston head)

   Piston grading position : 43.0 mm (1.6929 in)


015RV014

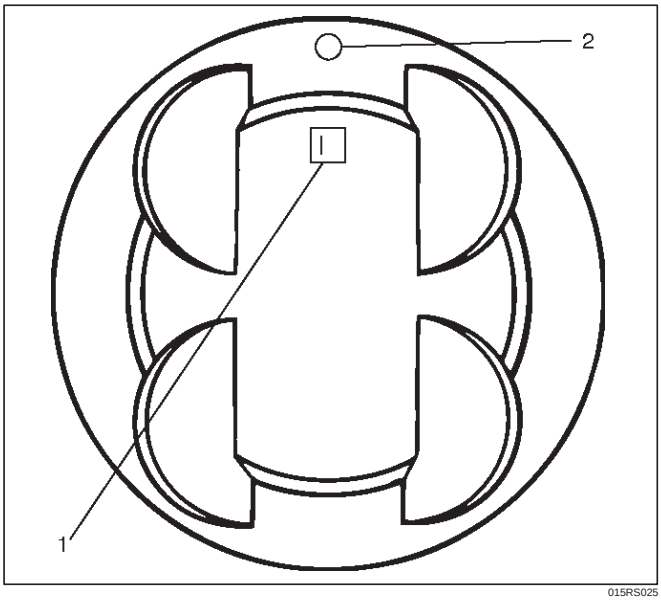
The size mark (1) for piston outside diameter is represented as shown in Figure.

Outside Diameter

Size Mark A : 93.360 mm–93.370 mm (3.6756 in–3.6760 in)

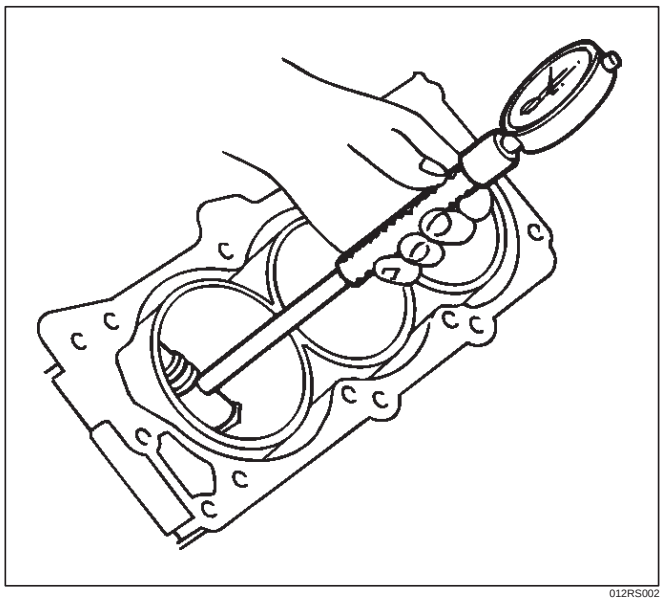
Size Mark B : 93.371 mm–93.380 mm (3.6760 in–3.6764 in)

Size Mark C : 93.381 mm–93.390 mm (3.6764 in–3.6768 in)



015RS025

Measure the cylinder bore inside diameter (refer to “Cylinder Block” in this manual).


012RS002

Piston Rings

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement

▼Insert the piston ring into the bore.

▼Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.

▼Measure the ring end gap.

Compression Ring

1st ring

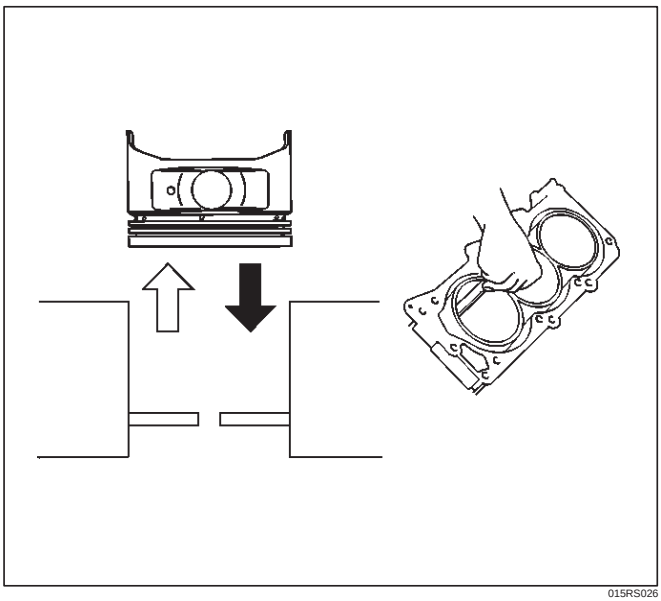
Standard:	**0.300 mm–0.400 mm (0.0118 in–0.0157 in)**
Limit:	**1.0 mm (0.0394 in)**

2nd ring

Standard:	**0.450 mm–0.600 mm (0.0177 in–0.0236 in)**
Limit:	**1.2 mm (0.0472 in)**

Oil ring

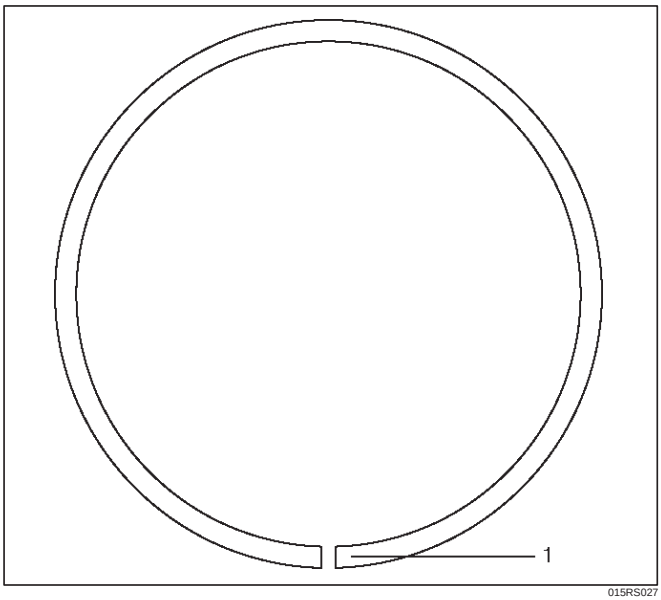
Standard:	**0.150 mm–0.450 mm (0.0059 in–0.0177 in)**
Limit:	**1.05 mm (0.0413 in)**


015RS026

▼Positioning mark (1) is painted as shown in the illustration.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring



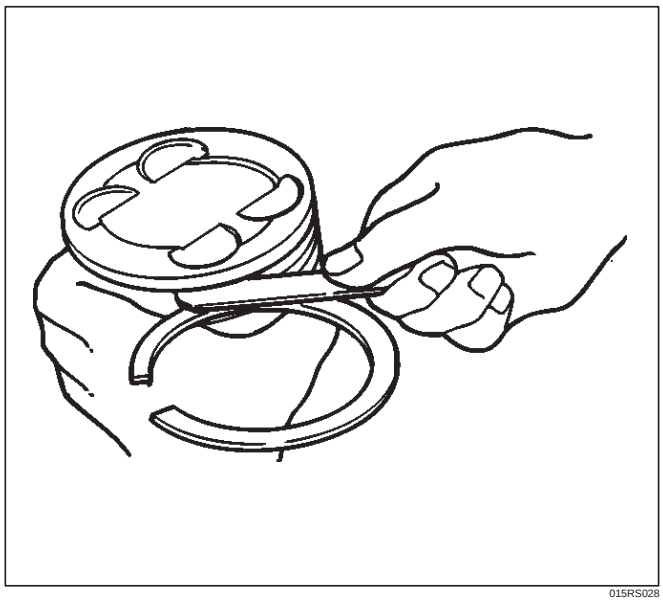
015RS027

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

Compression Ring Clearance

Standard : 0.025 mm–0.065 mm (0.0006 in.–0.0015 in)

Limit : 0.1mm (0.0059 in)

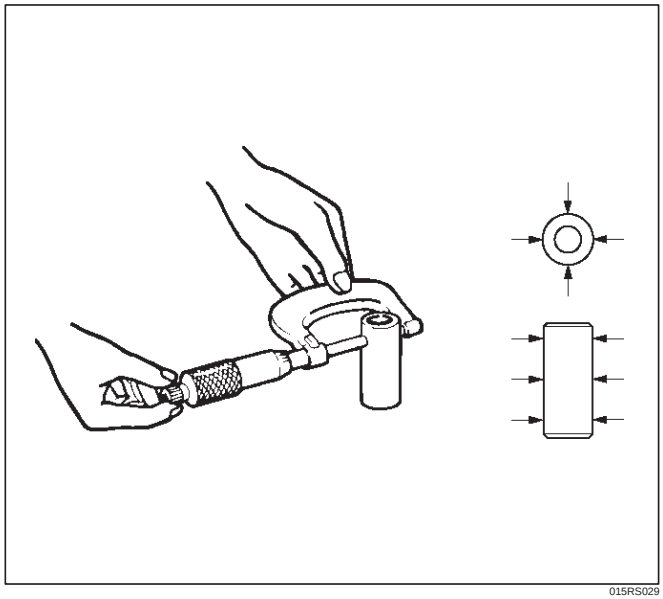

015RS028

Piston Pin

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

Standard : 0.023 mm–0.038 mm (0.0009 in–0.0015 in)


015RS029

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

Clearance

Standard : 0.010 mm–0.017 mm (0.0004 in.–0.0007 in)

Limit : 0.040 mm (0.0016 in)

Connecting Rods

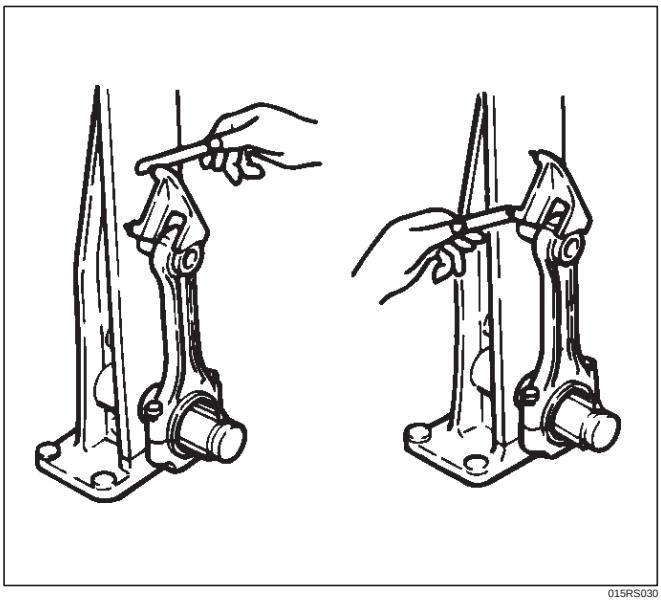
1. Check the connecting rod alignment If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

Bend per 100 mm (3.937 in)

Limit: 0.15 (0.0059)

Twist per 100 mm (3.937 in)

Limit: 0.20 (0.0078)

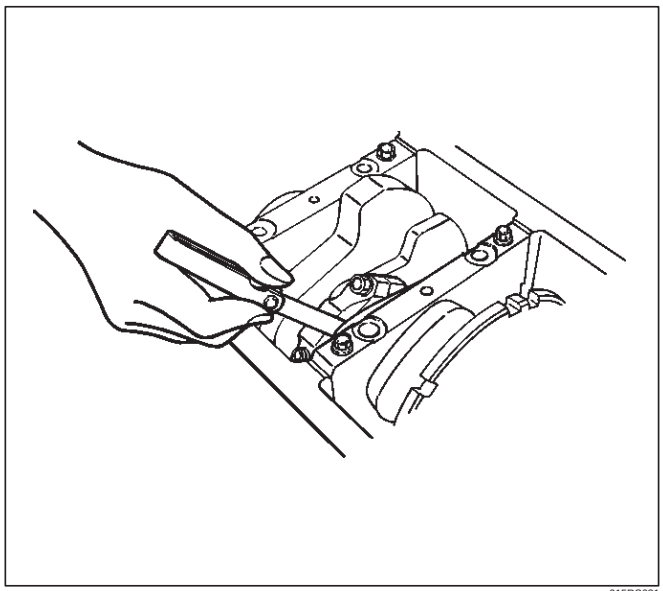


015RS030

2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the large end of the connecting rod If the clearance exceeds the specified limit, the connecting rod must be replaced.

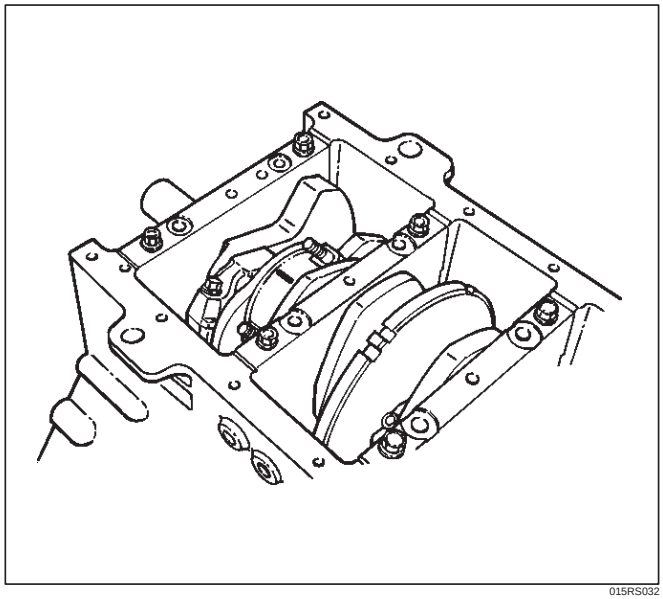
Standard : 0.16 mm–0.35 mm (0.0063 in.–0.0138 in)

Limit : 0.40 mm (0.0157 in)



015RS031

3. Measure the oil clearance between the connecting rod and the crankshaft.
   1. Remove the connecting rod cap nuts and the rod caps (12).
      Arrange the removed rod caps in the cylinder number order.
   2. Clean the rod bearings and the crankshaft pins.
   3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.



015RS032

   4. Reinstall the rod caps (12) to their original positions.
      Tighten the rod cap nuts.

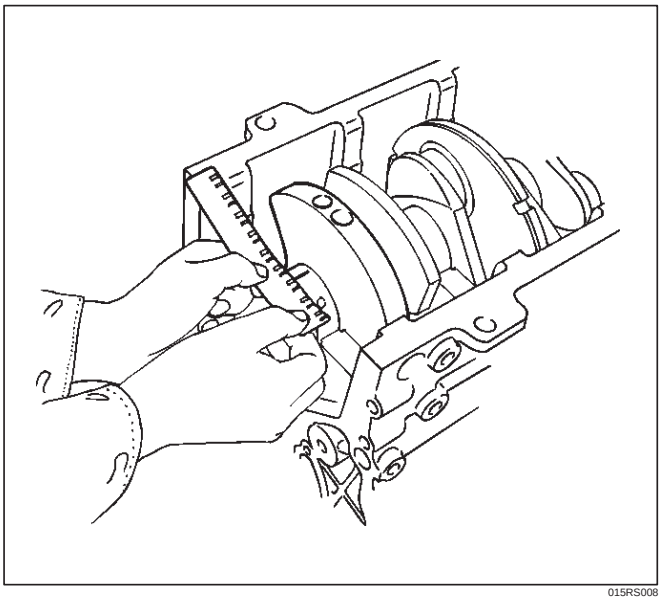
Torque: 54 N·m (40 lb ft)

NOTE: Do not allow the crankshaft to rotate.

5. Remove the rod caps.
6. Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.0031 in)

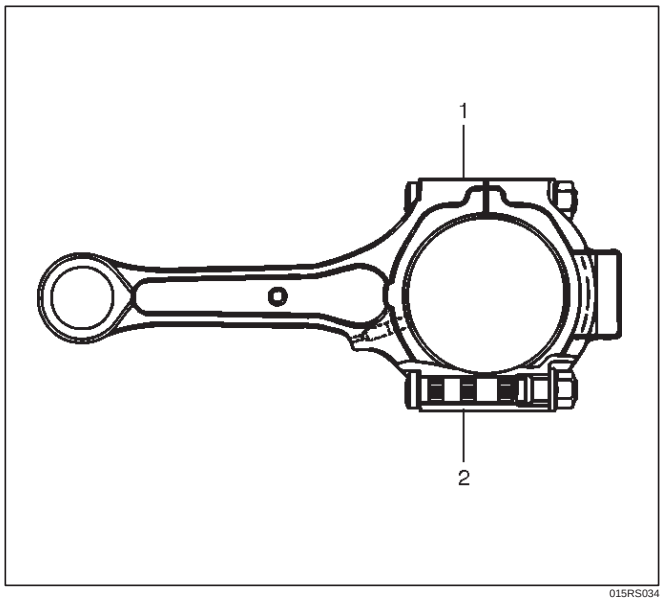

015RS008

7. Clean the plastigage from the bearings and the crankshaft pins.

Con–rod Bearing Selection

Select and install the new connecting rod bearings, paying close attention to the connecting rod big end diameter size mark (1).

NOTE: Take care not to confuse the alignment mark (2) and the size mark (1) during the installation procedure.



015RS034

mm (in)

1 Size Mark	Big end Bore Diameter	Crankshaft Pin Diameter	Connecting Rod Bearing Thickness (Reference)	Color of Size Mark	Oil Clearance (Reference)
A	56.994-57.000 (2.2439-2.2441)	53.922-53.937 (2.1229-2.1235)	1.512-1.516 (0.0595-0.0597)	Yellow	0.025-0.054 (0.0010-0.0021)
B	56.988-56.994 (2.2436-2.2439)		1.508-1.512 (0.0594-0.0595)	Green	0.027-0.056 (0.0011-0.0022)
C	56.982-56.988 (2.2434-2.2436)		1.504-1.508 (0.0592-0.0594)	Pink	0.029-0.058 (0.0011-0.0023)

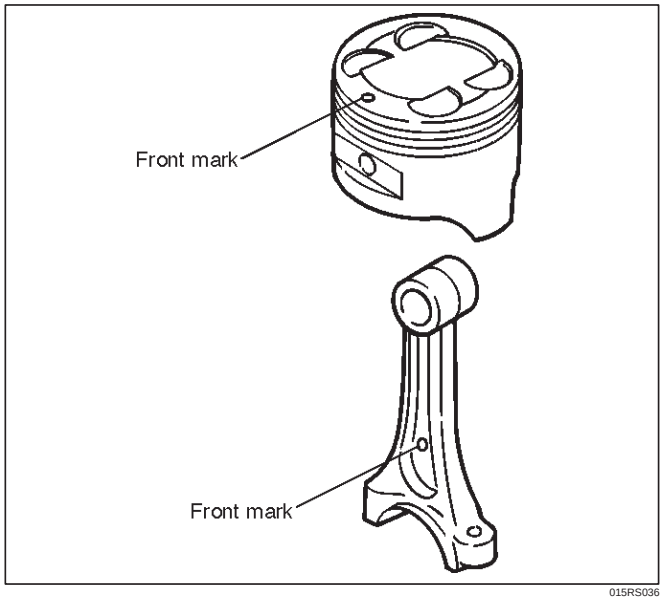
Reassembly

1. Install connecting rod
2. Install piston
3. Install piston pin

▼Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

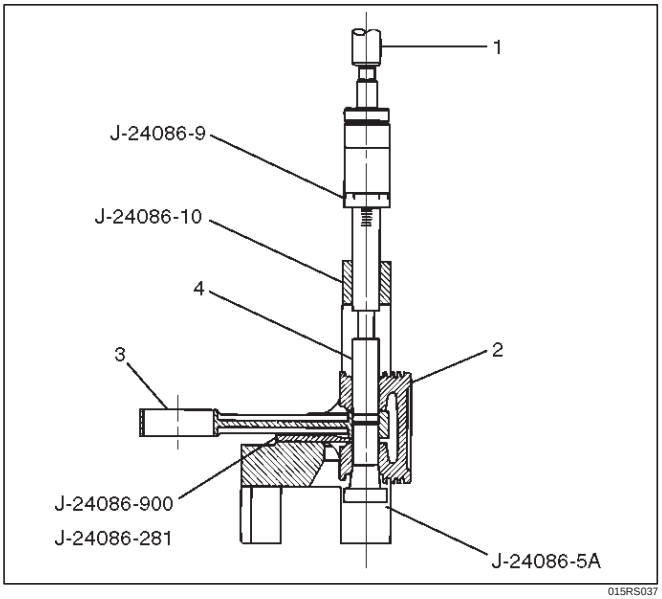
▼Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.



015RS036

▼With J–24086–C Piston pin service set and a press, press fit the piston pin.

NOTE: Heat the connecting rod small end to a suitable temperature to ensure smooth installation.



015RS037

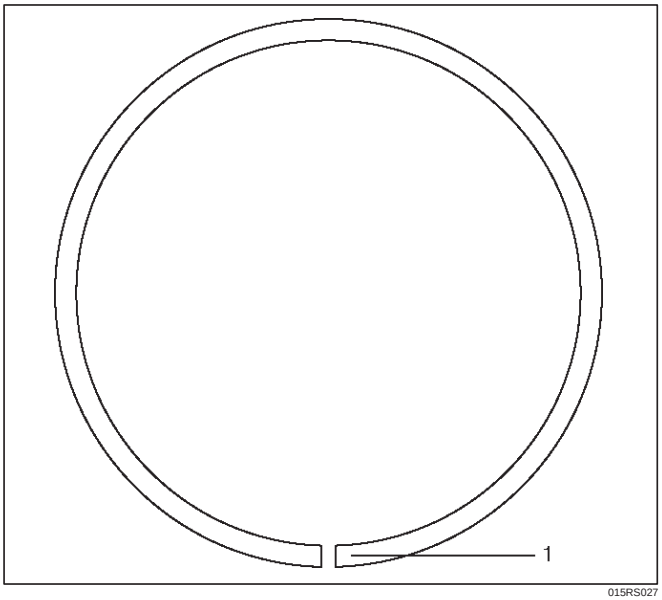
Legend

(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

4. Install piston ring with the piston ring expander.
   The compression ring must be set with the T mark (1) facing up.

   Marked T : No.1 Compression ring

   Marked T2 : No.2 Compression ring



015RS027

▼Install piston rings in the following sequence.

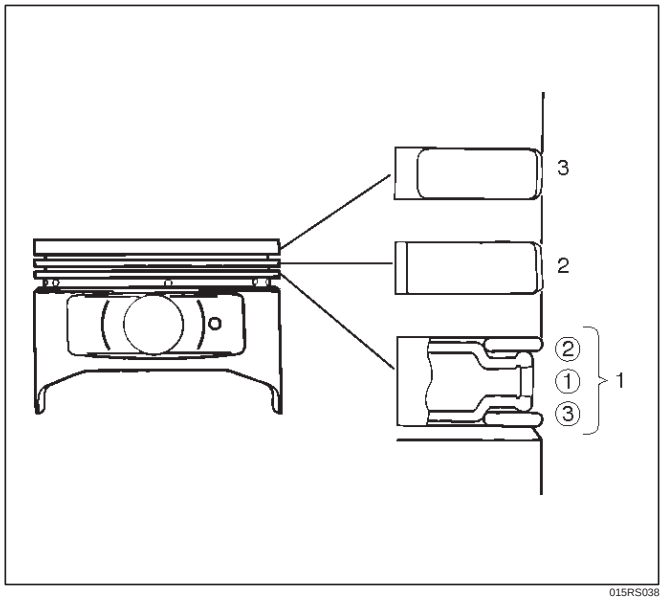
1. Oil ring
   1. Expander ring
   2. Upper side rail
   3. Lower side rail
2. 2nd compression ring
3. 1st compression ring

▼The compression rings must be set with the T or T2 mark facing up.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring

▼After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.



015RS038

5. Install piston and connecting rod assembly.

   ▼Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.

   ▼Tighten the connecting rod cap nuts

   Torque : 54 N·m (40 lb ft)

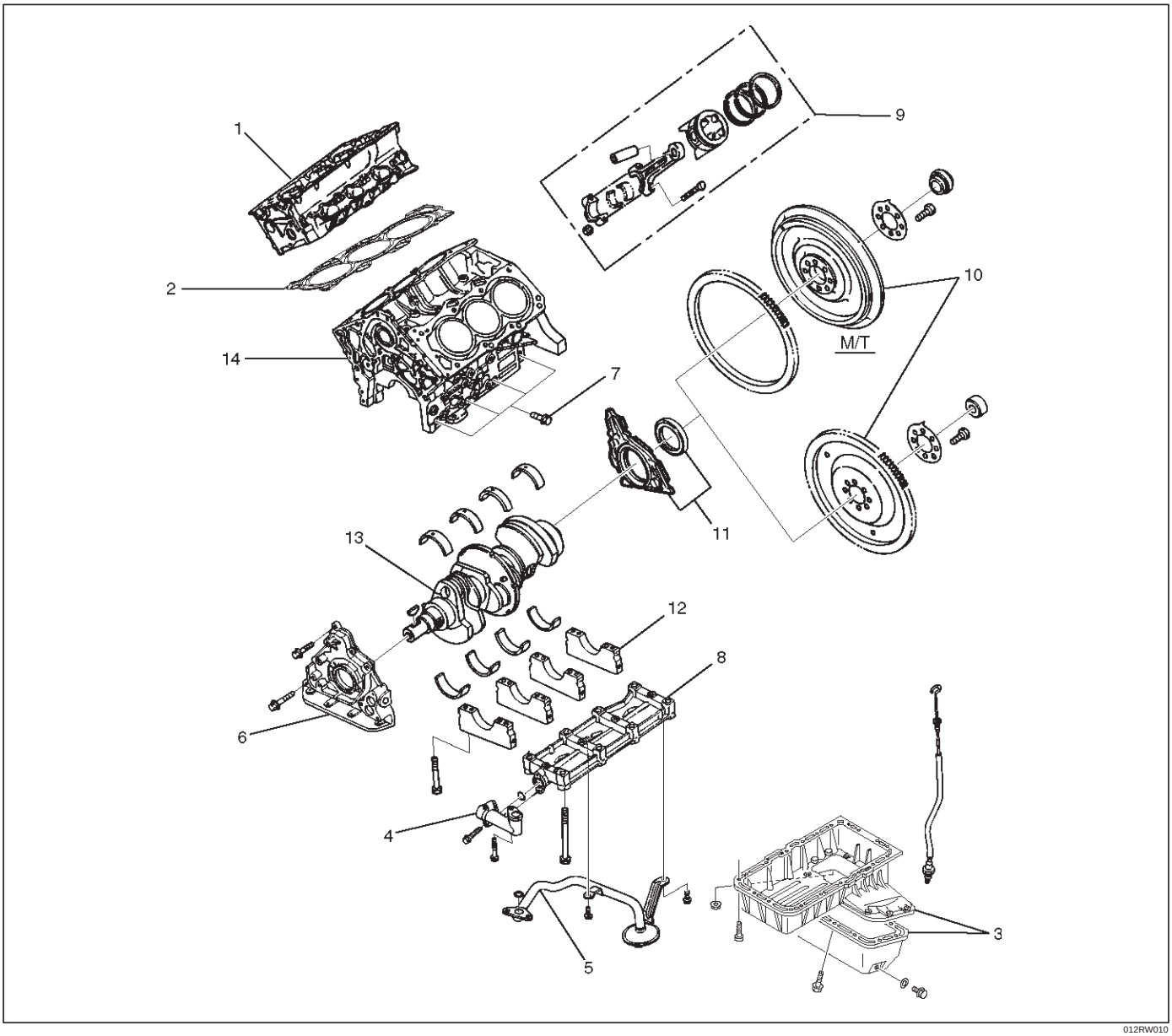
NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to “Crankshaft and main bearing” in this manual.
7. Oil strainer and O-ring.
8. Oil pipe and O-ring.
9. Install crankcase with oil pan, refer to “Oil pan and Crankcase” in this manual.
10. Install cylinder head gasket.
11. Install Cylinder head assembly.

    ▼Refer to “Cylinder head” in this manual.

Cylinder Block

Cylinder Block and Associated Parts



012RW010

Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Pump Assembly
(7) Cylinder Block Side Bolts
(8) Oil Gallery
(9) Piston and Connecting Rod Assembly
(10) Flywheel
(11) Rear Oil Seal Retainer Assembly
(12) Main Bearing Cap
(13) Crankshaft
(14) Cylinder Block

Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove crankcase with oil pan.
4. Remove oil pipe and O-ring.
5. Remove oil strainer and O-ring.
6. Remove oil pump assembly.
7. Remove crankcase side bolts.
8. Remove oil gallery.
9. Remove piston and connecting rod assembly.
10. Remove flywheel.

11. Remove rear oil seal retainer assembly.
12. Remove main bearing cap.
13. Remove crankshaft.
14. Remove cylinder block.

Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

Flatness

1. Using a straight–edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

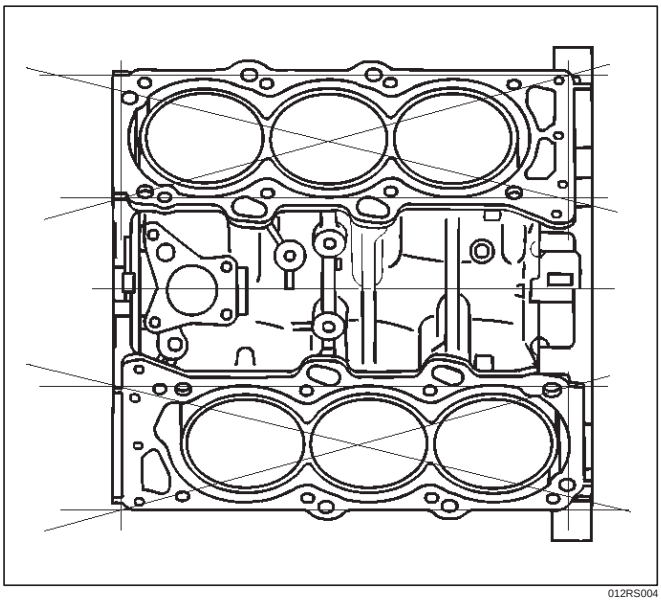
CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

Warpage

Limit : 0.15 mm (0.0059 in)

Maximum repairable limit: 0.15 mm (0.0059 in)



012RS004

Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

Cylinder Bore Inside Diameter

Limit : 93.530 mm (3.6823 in)

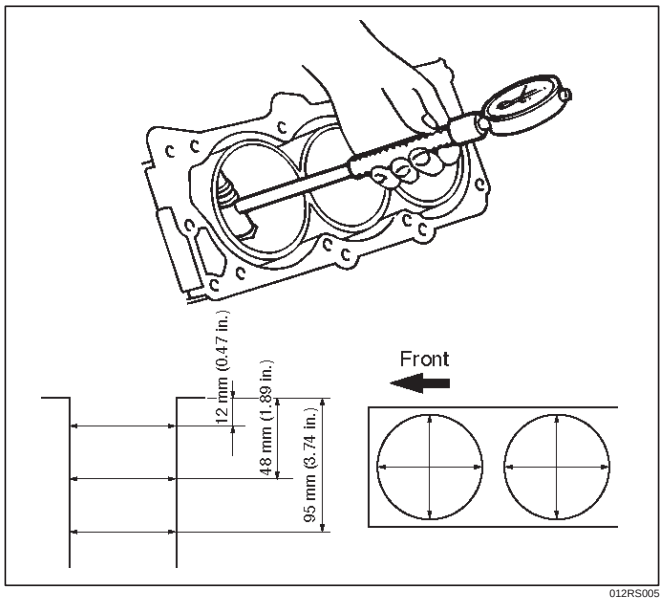
If the measurement exceed the specified limit, the cylinder block must be replaced.

Diameter

Grade A : 93.400 mm–93.410 mm (3.6772 in–3.6776 in)

Grade B : 93.411 mm–93.420 mm (3.6776 in–3.6779 in)

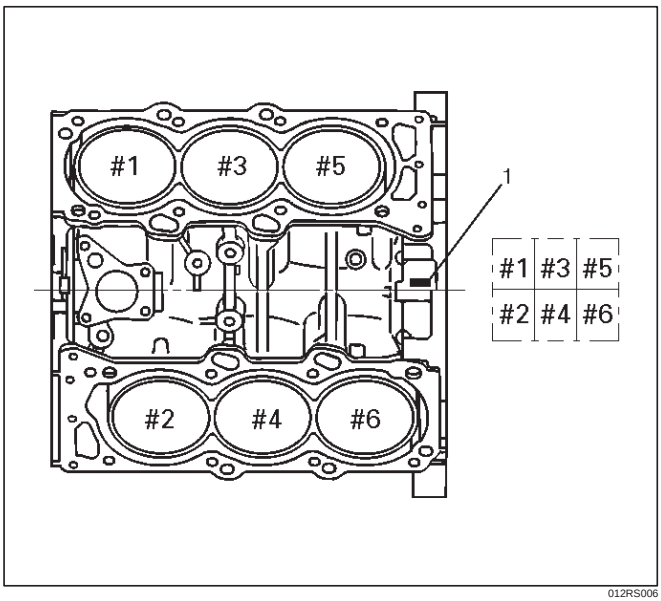
Grade C : 93.421 mm–93.430 mm (3.6780 in–3.6783 in)



012RS005

NOTE: For information on piston diameter, please refer to the section ”Inspection of the Piston and Connecting Rod Assembly” in this manual.

▼ The ”Grade” mark (1) is stamped at the position illustrated.

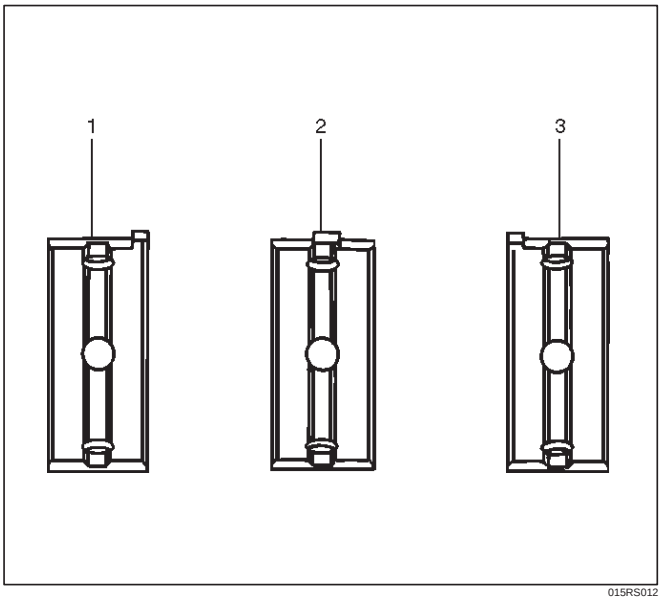


012RS006

Reassembly

1. Install cylinder block.
2. Install crankshaft.
   - ▼Install the main bearings to the cylinder block and the main bearing caps.
   - ▼Be sure that they are positioned correctly.
   - ▼Apply new engine oil to the upper and lower main bearing faces.

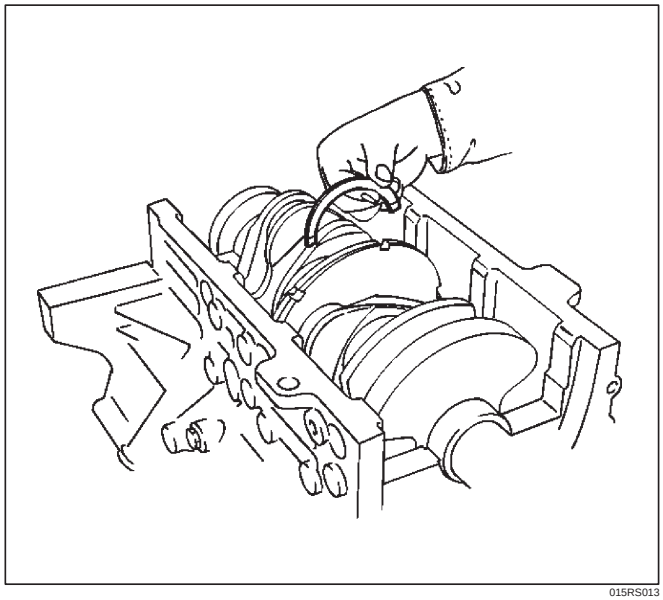
NOTE: Do not apply engine oil to the bearing back faces.



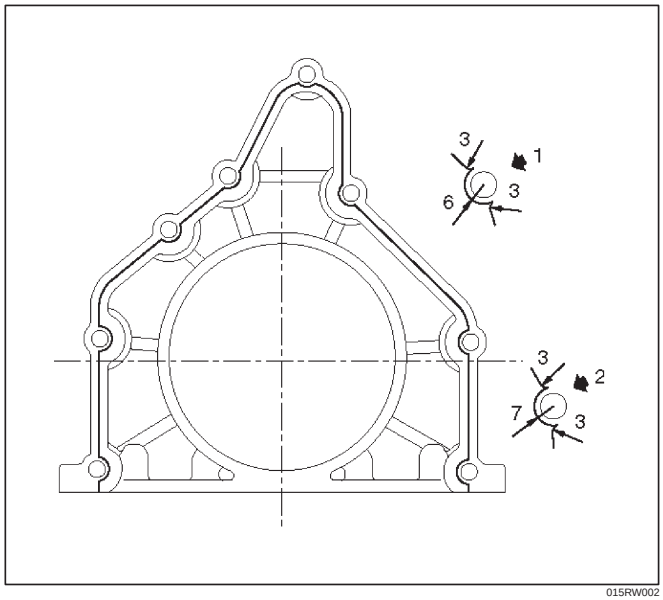
015RS012

Legend
(1) Number 1 and 4 main bearing upper and lower.
(2) Number 2 and 3 main bearing upper.
(3) Number 2 and 3 main bearing lower.

- ▼Carefully mount the crankshaft.
- ▼Apply engine oil to the thrust washer.
- ▼Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.


015RS013

3. Install rear oil seal retainer.
   - ▼Remove oil on cylinder block and retainer fitting surface.
   - ▼Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - ▼The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



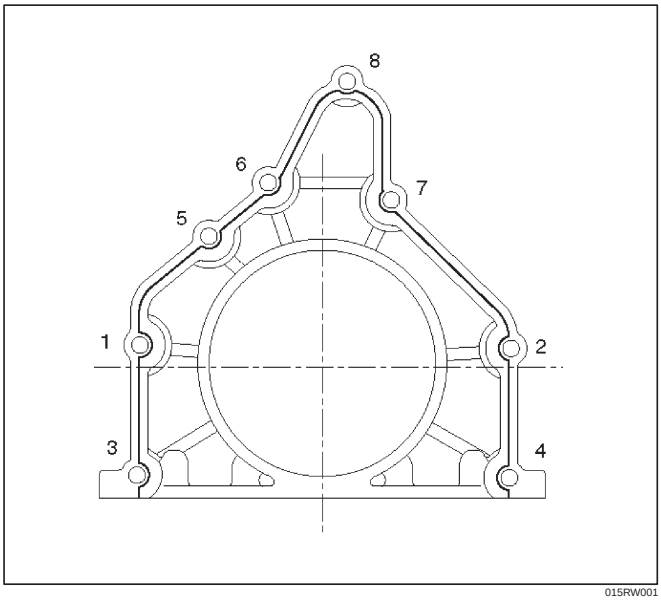
015RW002

Legend
(1) Around Bolt Holes
(2) Around Dowel Pin

▼Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.

▼Tighten retainer fixing bolts to the specified torque.

Torque: 25 N·m (18 lb ft)

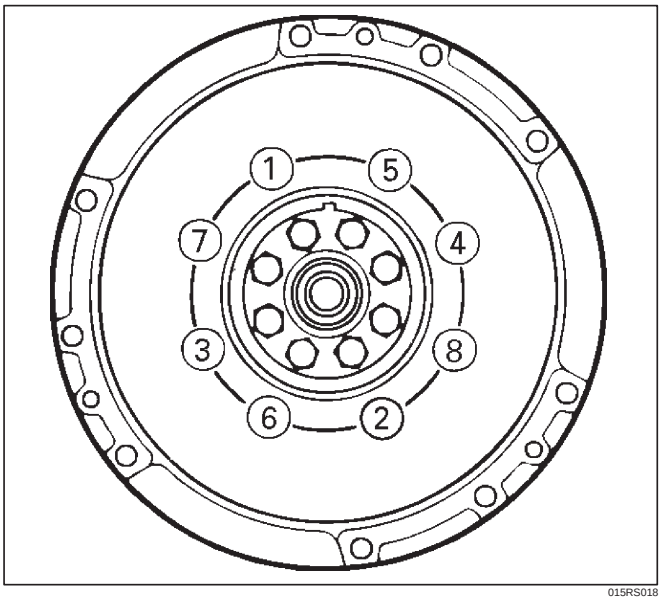


015RW001

4. Install flywheel
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Holding the crankshaft stationary, tighten the flywheel bolts in the order shown.

Torque: 54 N·m (40 lb ft)

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.



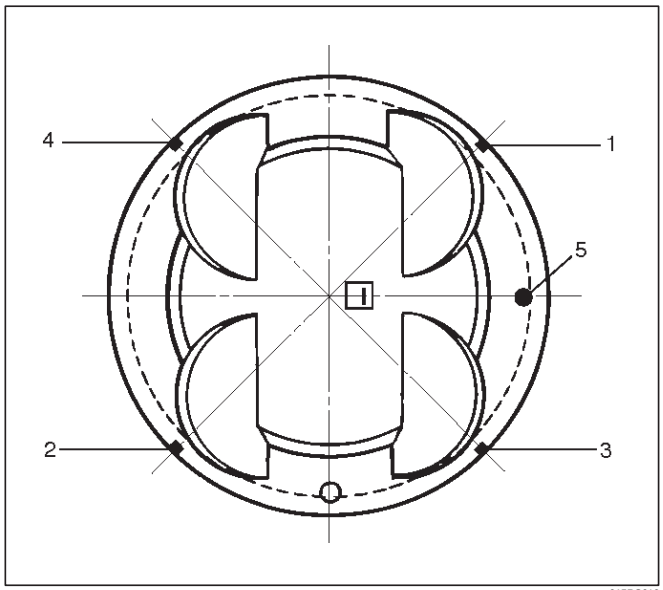
015RS018

5. Install piston and connecting rod assembly.

▼Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

▼Check to see that the piston ring end gaps are correctly positioned.



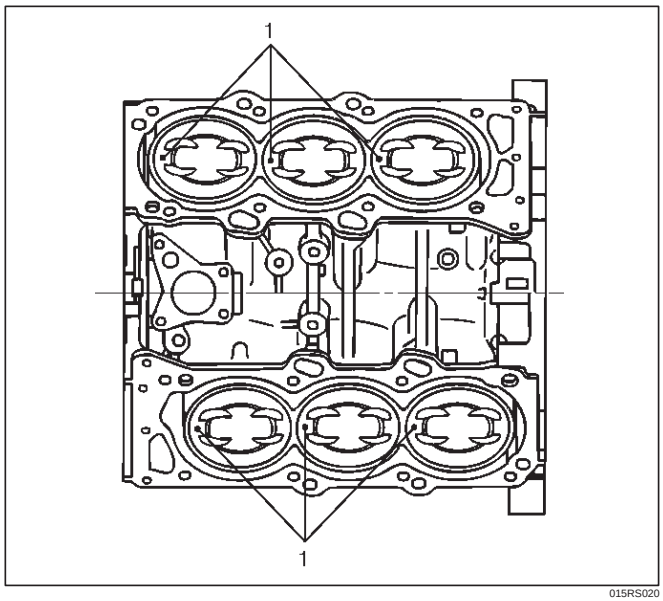
015RS019

Legend

(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

▼Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.

▼The front marks (1) must be facing the front of the engine.

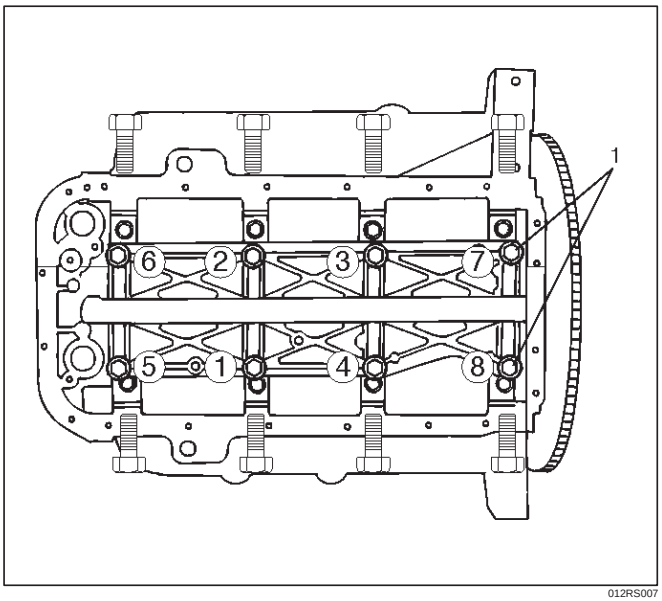


015RS020

6. Install oil gallery and tighten the bolts in 2 steps in the order shown.

1st step : 29 N·m (22 lb ft)

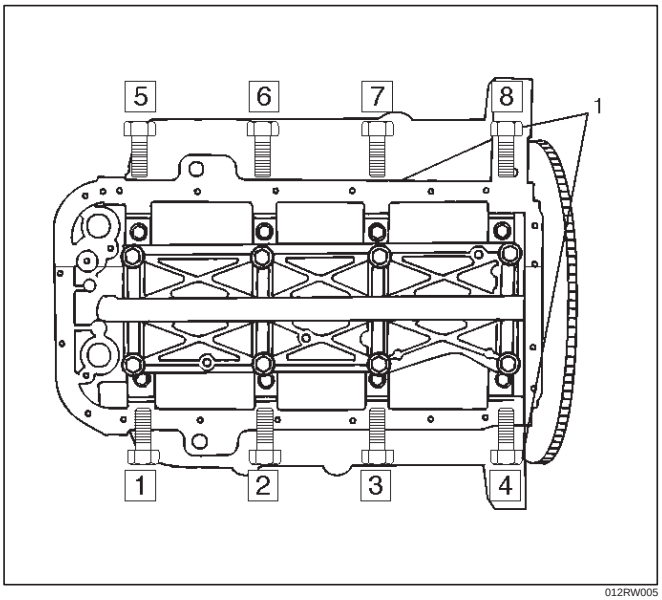
2nd step : 55˚ ~ 65˚



012RS007

7. Install cylinder block side bolts (1) and tighten crankcase bolts in sequence shown in the illustration.

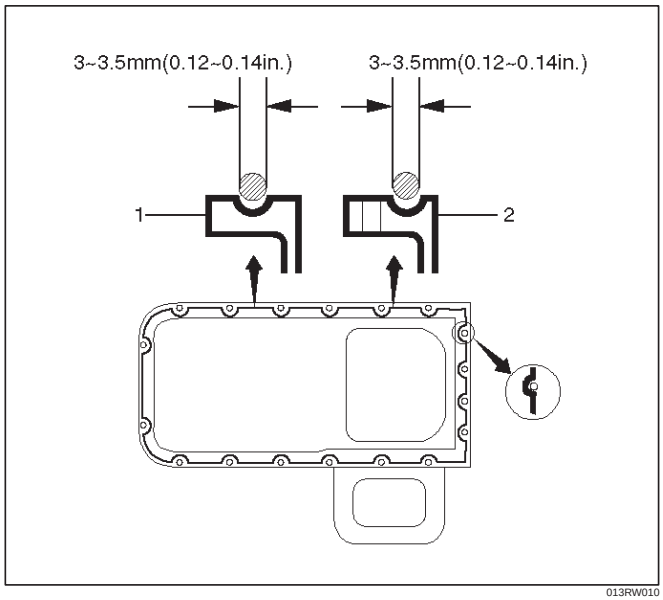
Torque : 39 N·m (29 lb ft)



012RW005

8. Install oil pump assembly. Refer to “Oil Pump” in this manual.
9. Install oil strainer and O-ring.
10. Install oil pipe and O-ring.
11. Install crankcase with oil pan.
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB– 1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
    3. The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (87 lb in)



013RW010

Legend

(1) Portion Between Both Holes
(2) Bolt Hole Portions

12. Install cylinder head gasket.
13. Install cylinder head assembly. Refer to “Cylinder Head” in this manual.

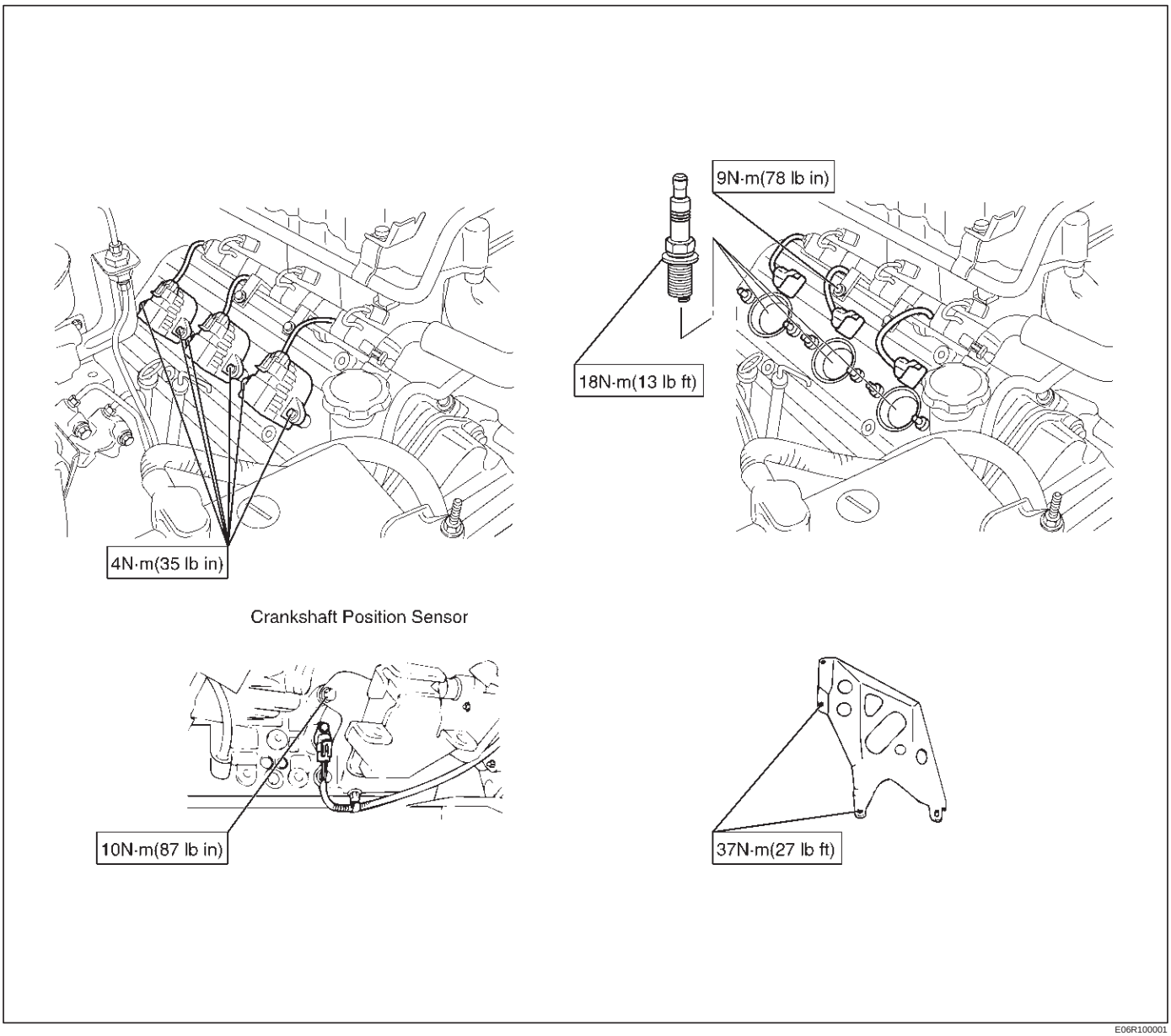
Main Data and Specification

General Specification

Item	Specifications
	6VE1
Engine type, number of cylinders and arrangement	Water cooled, four cycle V6
Form of combustion chamber	Pent-roof type
Valve mechanism	4-Cams, 4-Valves, DOHC Gear & Belt Drive
Cylinder liner type	Casted in cylinder drive
Total piston displacement	3494 cc
Cylinder bore x stroke	93.4mm x 85mm (3.677 in x 3.346 in)
Compression ratio	9.1
Compression pressure at 300rpm	1.37 MPa (14.0 Kg/cm^2)
Engine idling speed rpm	Non adjustable (750)
Valve clearance	Intake: 0.28 mm (0.11 in)
	Exhaust: 0.30mm (0.12in)
Oil capacity	5.3 liters
Ignition timing	Non adjustable (20˚ BTDC at idle rpm)
Spark plug	PK16PR11, RC10PYP4, K16PR-P11
Plug gap	1.0 mm–1.1 mm(0.0394 in – 0.0433 in)

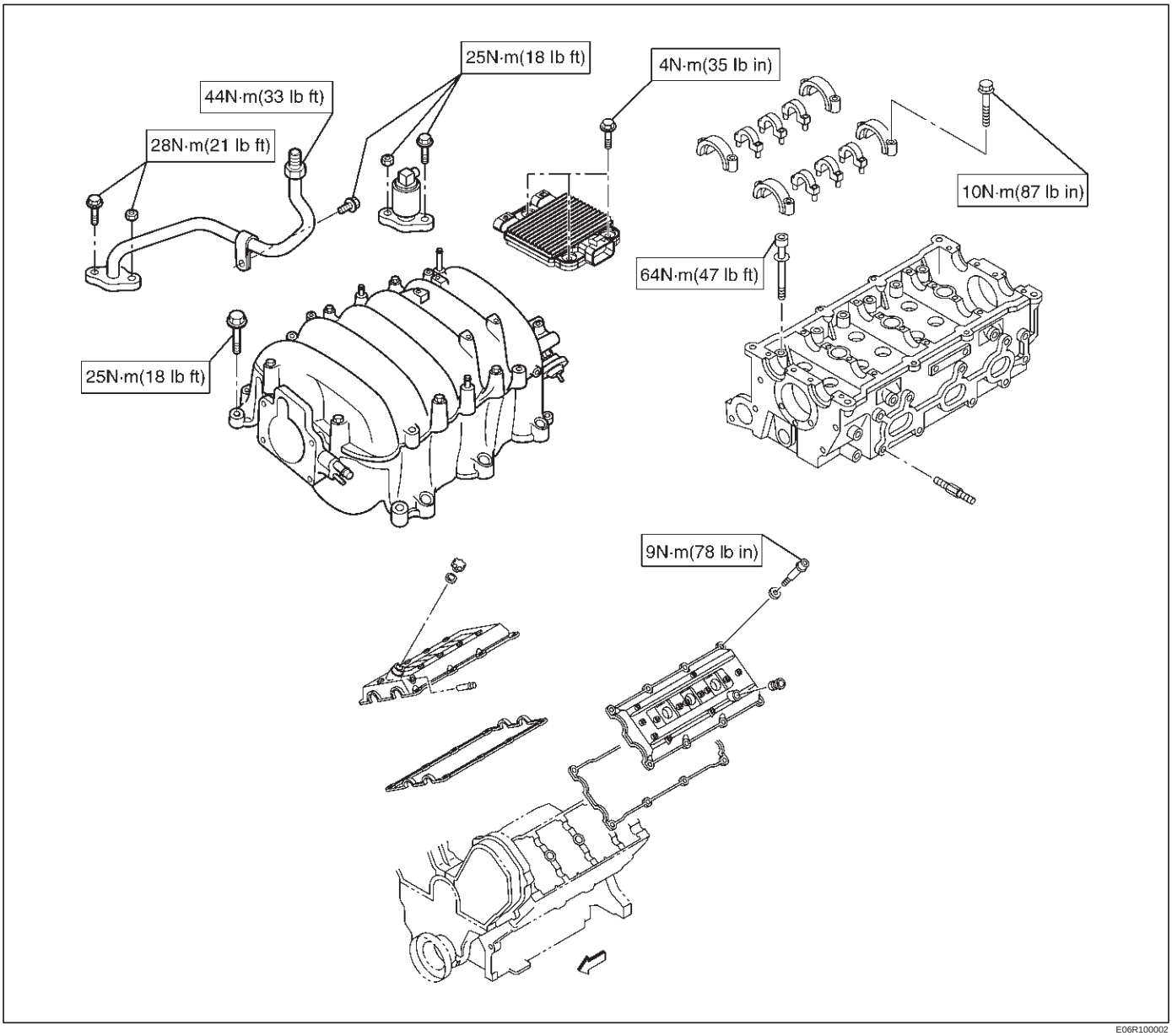
Torque Specifications

Ignition coil, Spark plug, Crankshaft position sensor and Under cover



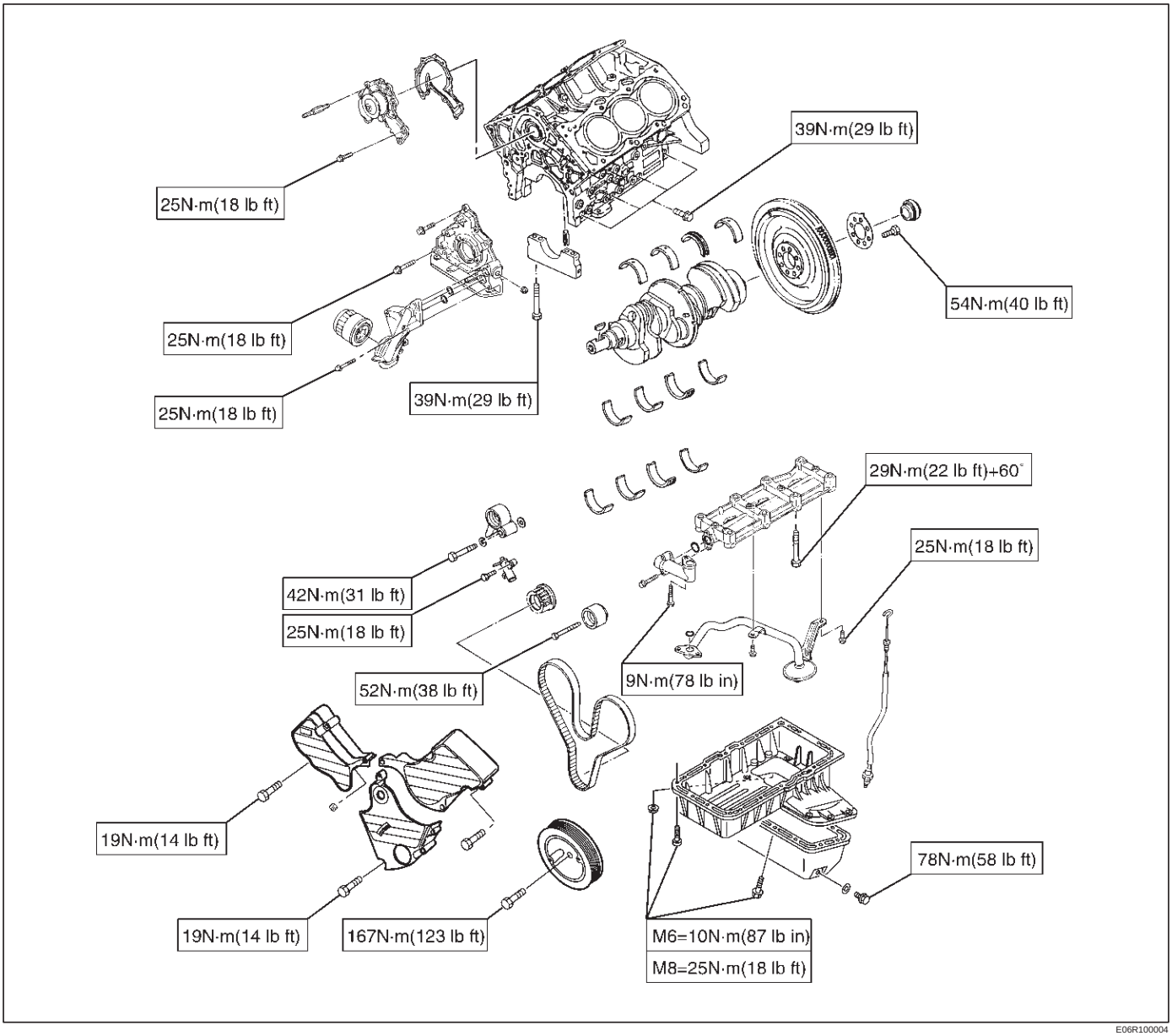
E06R100001

Cylinder head cover, Cylinder head, Camshaft bearing cap, Common chamber, EGR valve and EGR pipe, Ion sensing module



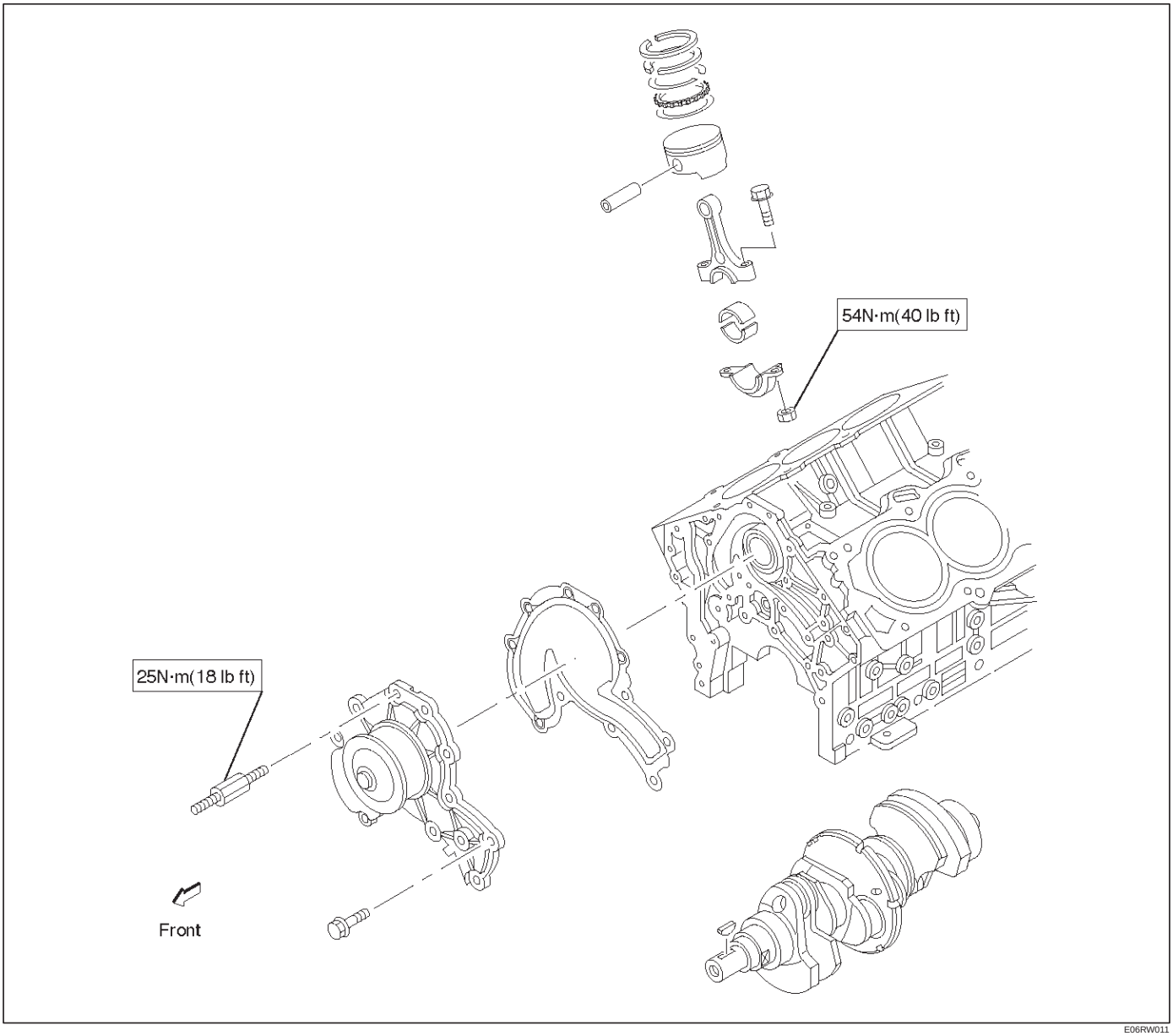
E06R100002

Crankshaft main bearing, Flywheel, Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer and water pump



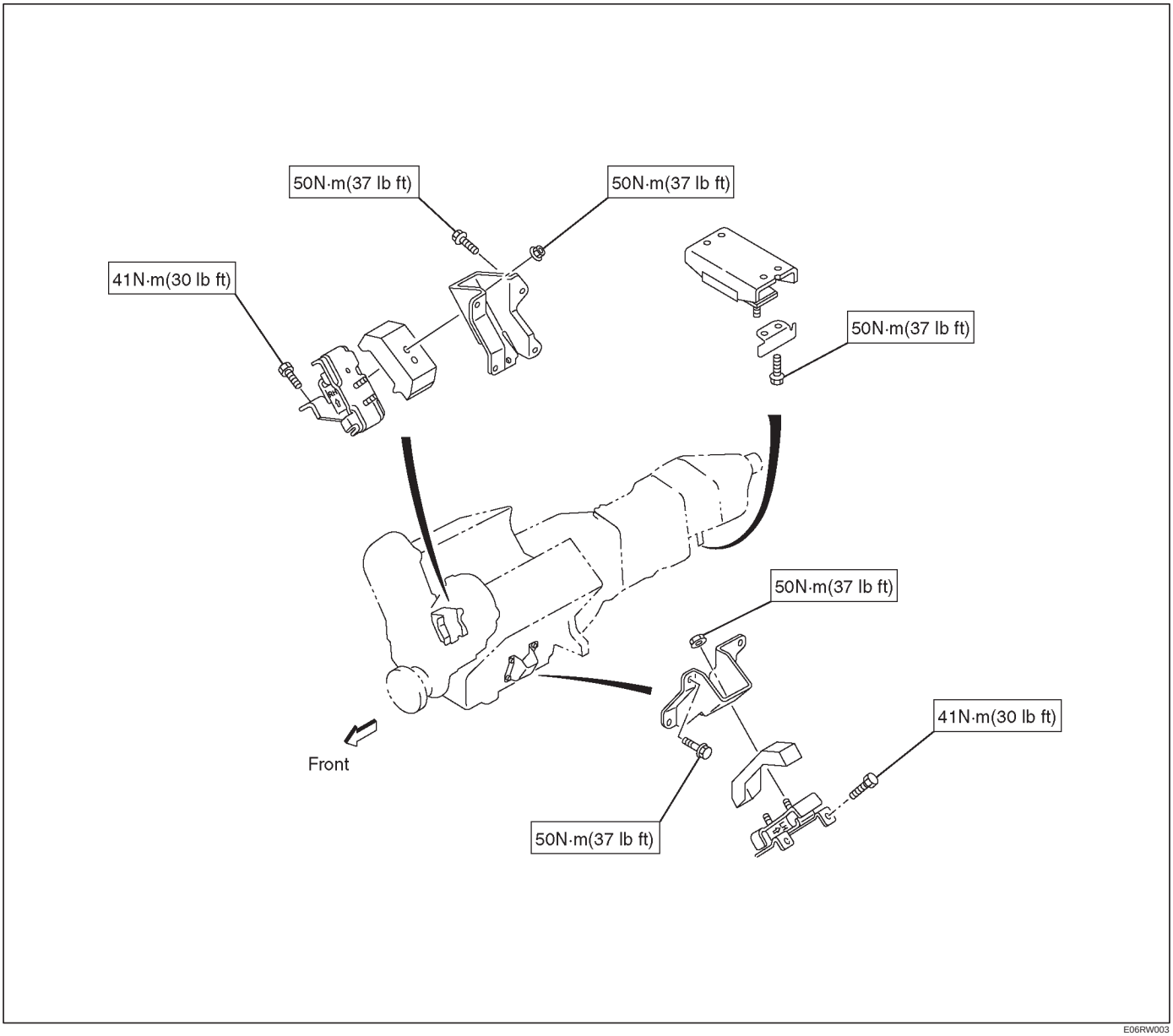
E06R100004

Connecting rod and Water pump



E06RW011

Engine mount



E06RW003

Special Tool

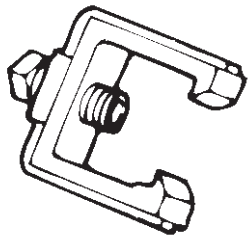
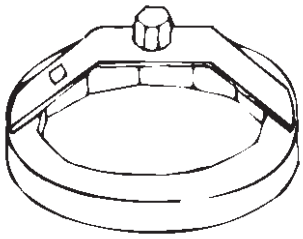
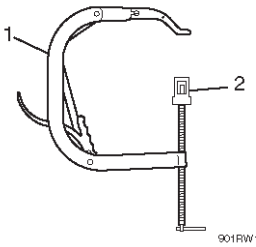
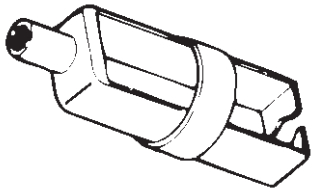
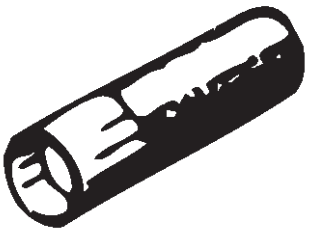
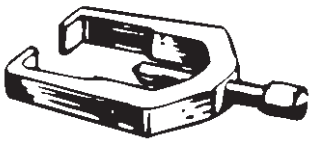
ILLUSTRATION	TOOL NO. TOOL NAME
 901RT033	**J–21687–02** Remover; tie rod end
 901RT034	**J–36390** Wrench; Oil filter
 901RW108	**J–8062** Compressor; Valve spring (1) **J–42898** Adapter; Compressor, Valve spring (2)
 901RT036	**J–37281** Remover; Oil controller
 901RT037	**J–38537** Installer; Oil controller
 901RT038	**J–29107** Universal pitman arm puller

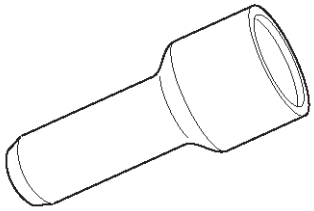
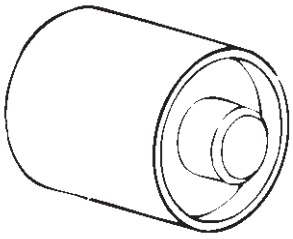
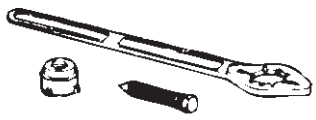
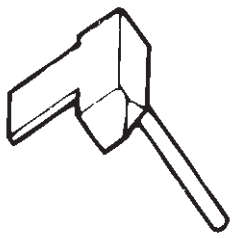
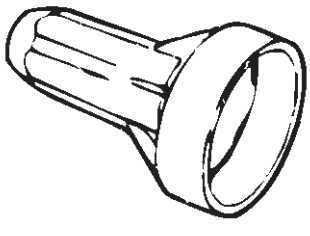
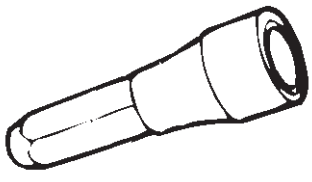
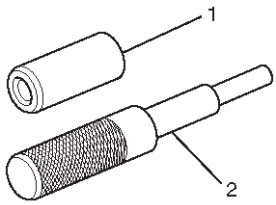
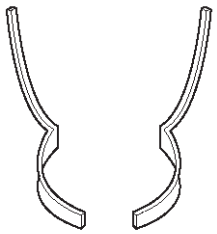
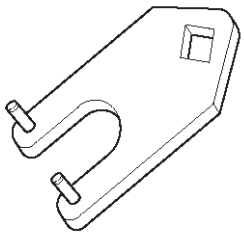
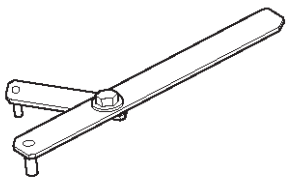
ILLUSTRATION	TOOL NO. TOOL NAME
 901RW171	**J–42985** Installer; Camshaft oil seal
 901RT040	**J–39206** Installer; Pilot bearing
 901RT041	**J–8614–01** Holder; Crankshaft
 901RT042	**J–37228** Seal cutter
 901RT043	**J–39201** Installer; Real oil seal
 901RT044	**J–39202** Installer; Oil pump oil seal

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT046	**J–24239–1** Cylinder head bolt wrench
 901RW182	**J–42899** Replacer; Valve guide (1,2) **J–42687** Installer; Valve guide (1) **J–37985–1** Remover; Valve guide (2)
 901RW109	**J–42689** Adjusting Tool; Valve clearance
 901RW110	**J–42686** Lever; Gear spring
 901RW115	**J–43041** Holder; Universal

AXIOM

ENGINE

ENGINE COOLING (6VE1 3.5L)

CONTENTS

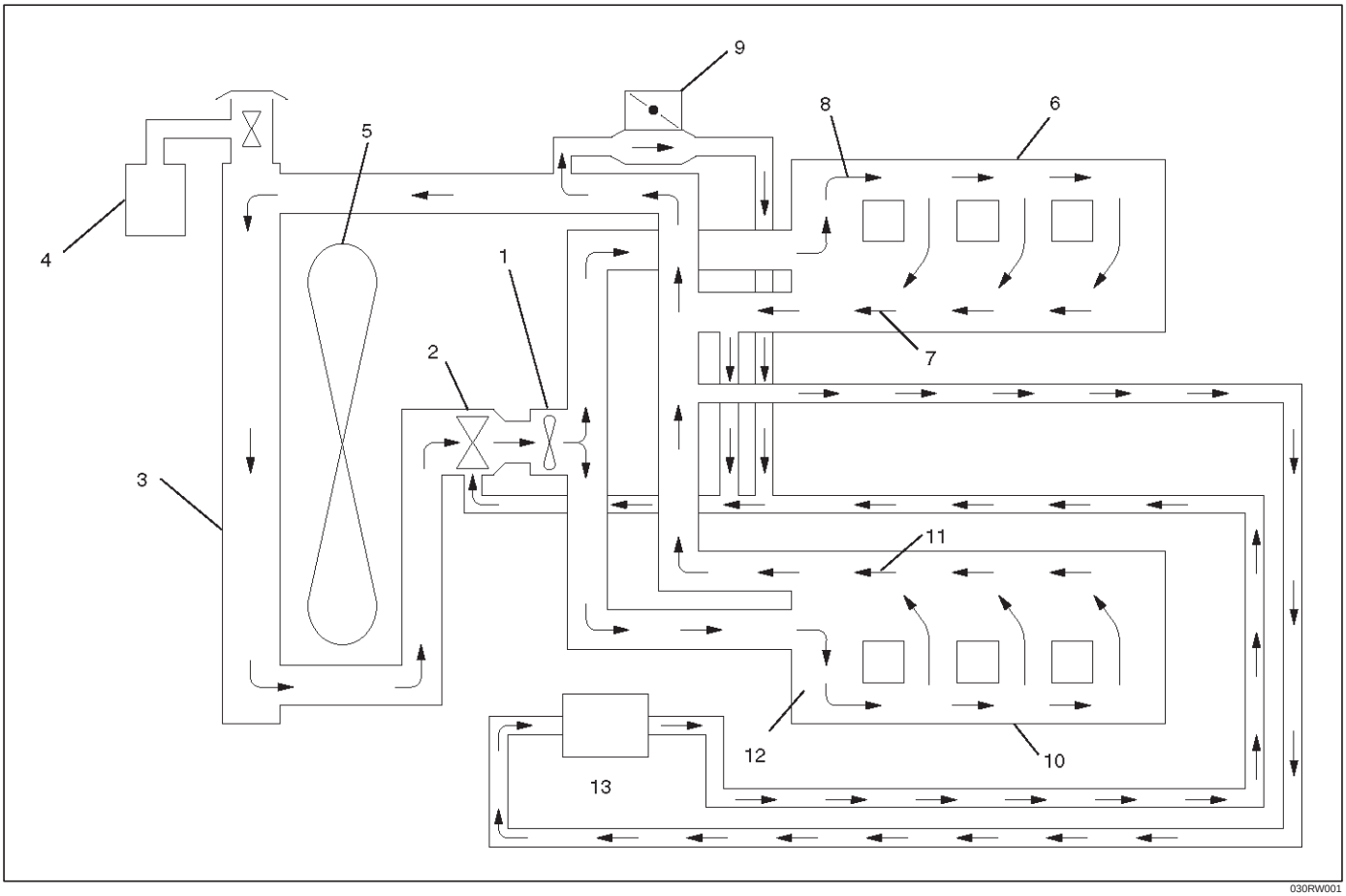
Service Precaution 6B–1
General Description 6B–2
Diagnosis 6B–4
Draining and Refilling Cooling System 6B–5
Water Pump 6B–6
Water Pump and Associated Parts 6B–6
Removal 6B–6
Inspection 6B–6
Installation 6B–6
Thermostat 6B–7
Thermostat and Associated Parts 6B–7
Removal 6B–7
Inspection 6B–7
Installation 6B–7
Radiator 6B–8
Radiator and Associated Parts 6B–8
Removal 6B–8
Inspection 6B–9
Installation 6B–10
Drive Belt and Cooling Fan 6B–11
Drive Belt and Associated Parts 6B–11
Removal 6B–11
Inspection 6B–11
Installation 6B–11
Main Data and Specifications 6B–12
Special Tool 6B–13

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



030RW001

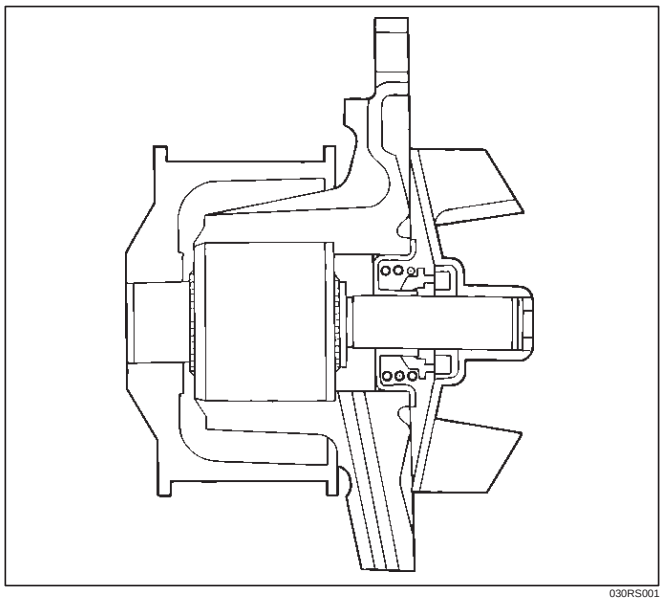
Legend

(1) Water Pump
(2) Thermostat
(3) Radiator
(4) Reserve Tank
(5) Cooling Fan
(6) Cylinder Block
(7) Cylinder Head
(8) Right Bank
(9) Throttle Body
(10) Cylinder Block
(11) Cylinder Head
(12) Left Bank
(13) Heater

The cooling system is a pressurized Engine Coolant (EC) forced circulation type which consists of a water pump, thermostat cooling fan, radiator and other components. The automatic transmission fluid is cooled by the EC in the radiator.

Water Pump

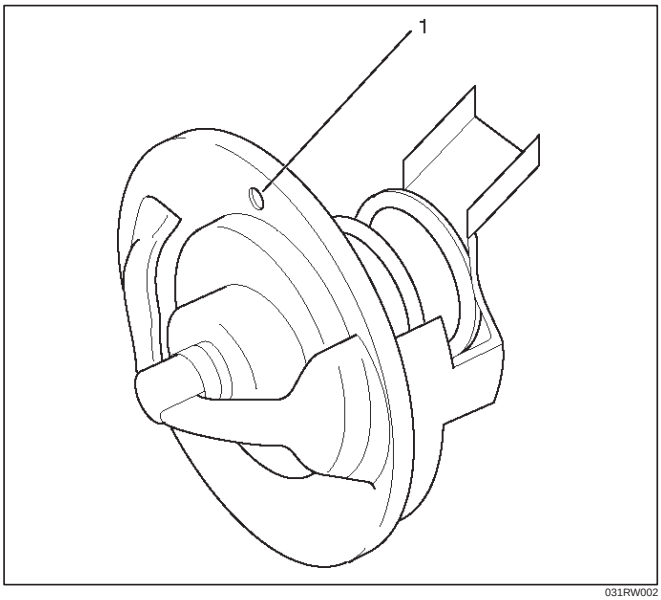
The EC pump is a centrifugal impeller type and is driven by a timing belt.



030RS001

Thermostat

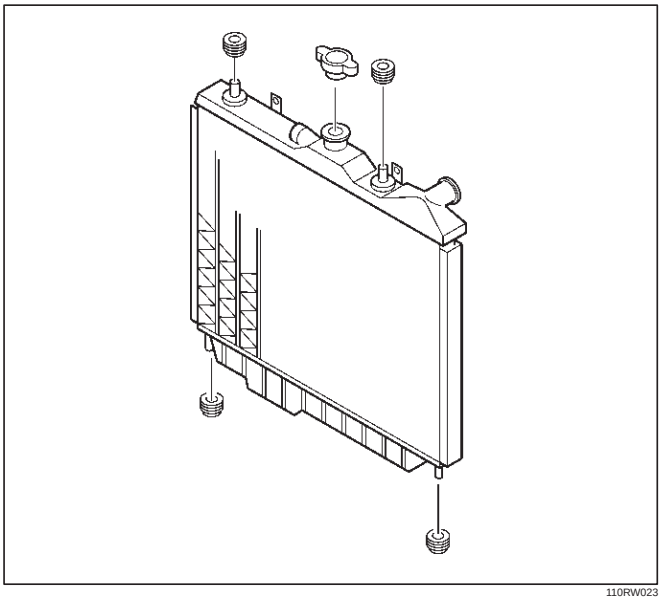
The thermostat is a wax pellet type with a air hole(1) and is installed in the thermostat housing.



031RW002

Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of the coolant, the radiator is fitted with a cap in which the valve is operated at 88.2 ~ 117.6 kPa (12.8 ~ 17.0 psi) pressure. (No oil cooler provided for M/T)



110RW023

Antifreeze Solution

▼Relation between the mixing ratio and freezing temperature of the EC varies with the ratio of anti–freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

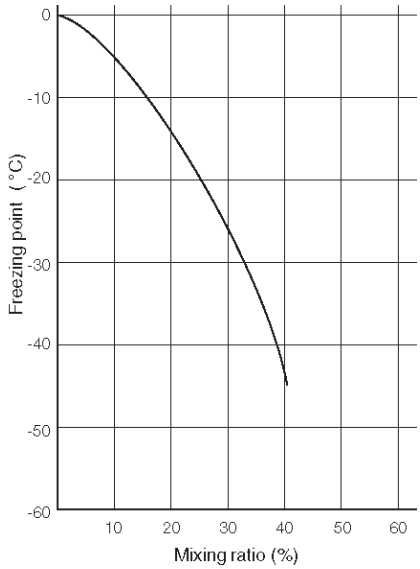
▼Calculating mixing ratio

$$\text{Mixing ratio} = \frac{\text{Anti freeze solution (Lit/gal.)}}{\text{Anti freeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

NOTE: Antifreeze solution + Water = Total cooling system capacity.

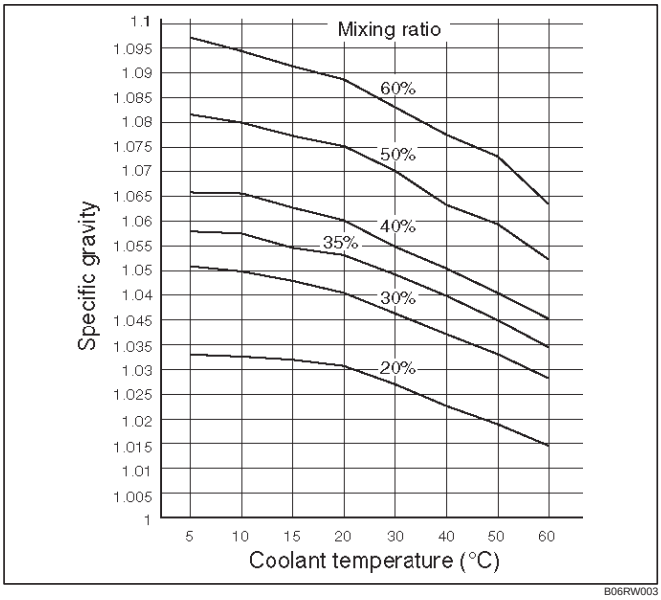
▼Total Cooling System Capacity
▼A/T 10.0Lit (2.64Us gal)



B06RW002

▼Mixing ratio

Check the specific gravity of engine coolant in the cooling system temperature ranges from 0˚C to 50˚C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.



Diagnosis

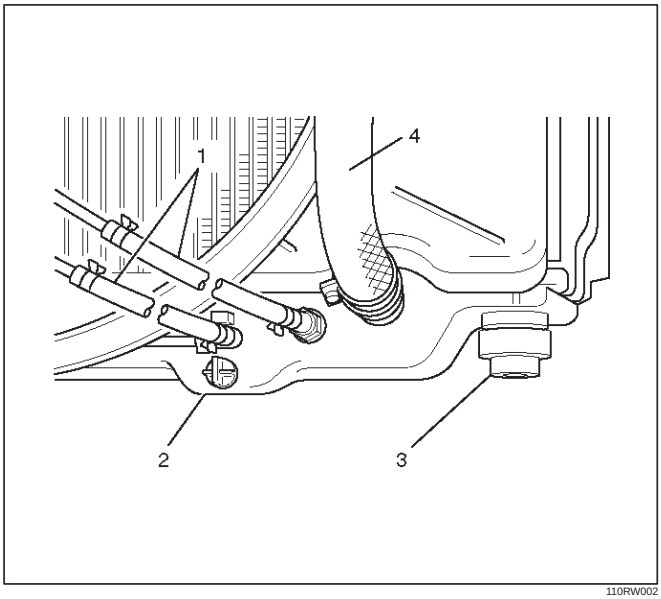
Engine Cooling Trouble

Condition	Possible cause	Correction
Engine overheating	Low Engine Coolant level	Replenish
	Incorrect fan installed	Replace
	Thermo meter unit faulty	Replace
	Faulty thermostat	Replace
	Faulty Engine Coolant temperature sensor	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Faulty Throttle Position sensor	Replace throttle valve assembly
	Open or shorted Throttle Position sensor circuit	Repair or replace
	Damaged cylinder head gasket	Replace
Engine overcooling	Faulty thermostat	Replace
Engine slow to warm–up	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the “MIN” and “MAX” lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the “MAX” line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.
Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug (2) at the bottom of the radiator.



110RW002

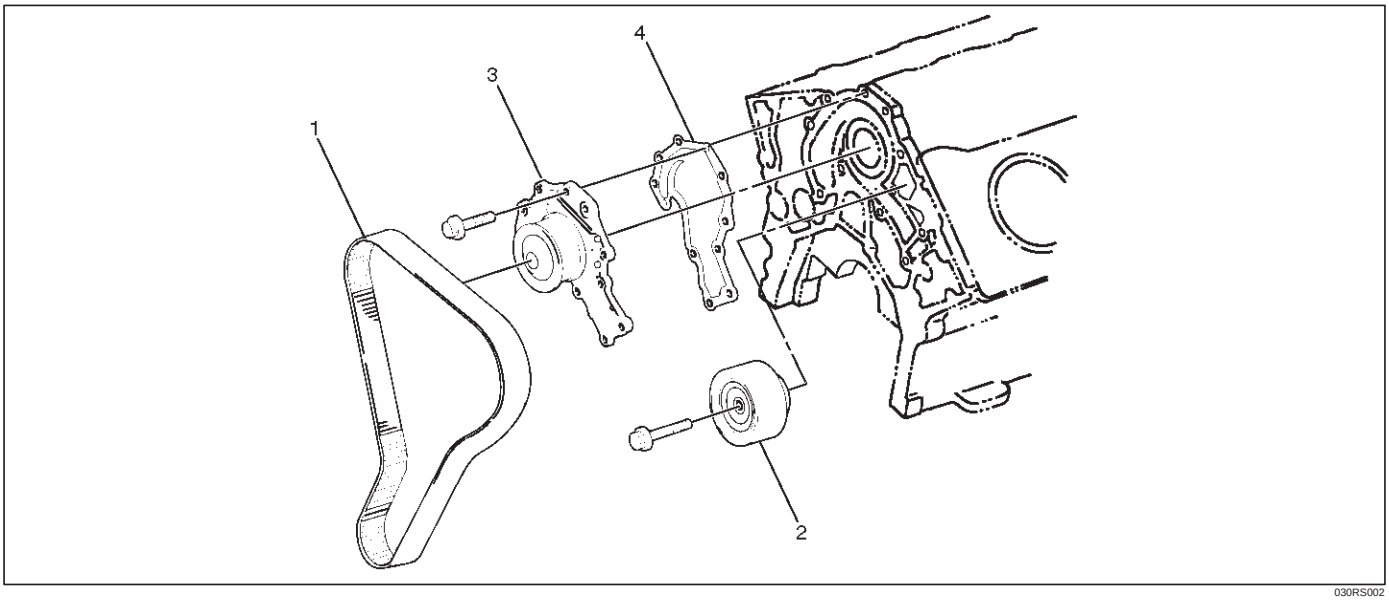
2. Remove the radiator cap.

WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.

3. Disconnect all hoses from the EC reserve tank.
   Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.
   Fill the EC reserve tank to “MAX” line when the engine is cold.
6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to “P” (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.
9. After the engine has cooled, replenish with EC up to the “MAX” line of the reserve tank.
10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).
11. If the running water sound is heard, repeat steps 8 to 10.

Water Pump

Water Pump and Associated Parts



030RS002

Legend
(1) Timing Belt
(2) Idle Pulley
(3) Water Pump Assembly
(4) Gasket

Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt. Refer to “Timing Belt” in this manual.
5. Remove Idle pulley.
6. Remove water pump assembly.
7. Remove gasket.

Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced.

- ▼Crack in the water pump body
- ▼EC leakage from the seal unit
- ▼Play or abnormal noise in the bearing
- ▼Cracks or corrosion in the impeller

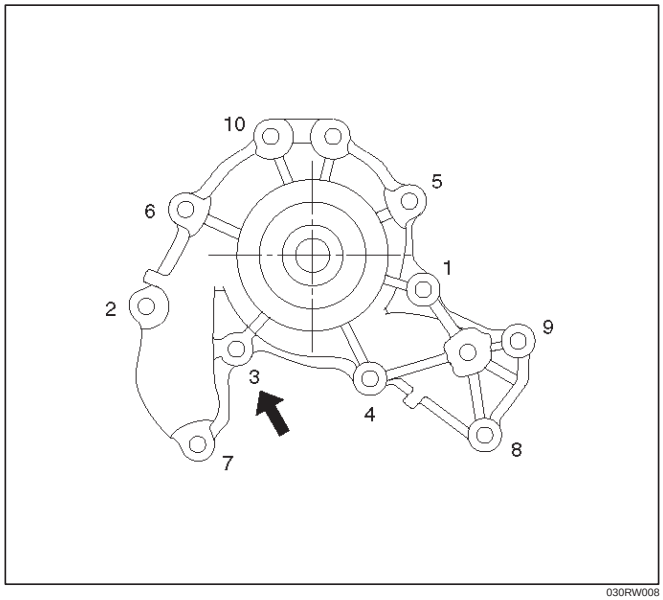
Installation

1. Install gasket, clean the mating surface of gasket before installation.
2. Install water pump assembly and tighten bolts to the specified torque.

   Torque: 25 N·m (18 lb ft)

   ▼Tightening order
   The tightening order are in the illustrate.

NOTE: To prevent the oil leakage, apply the LOCTITE 262 or an equivalent, to the arrow marked fixing bolt thread.



030RW008

3. Idle pulley

   ▼Install idle pulley and tighten bolt to the specified torque.

   Torque: 52 N·m (38 lb ft)

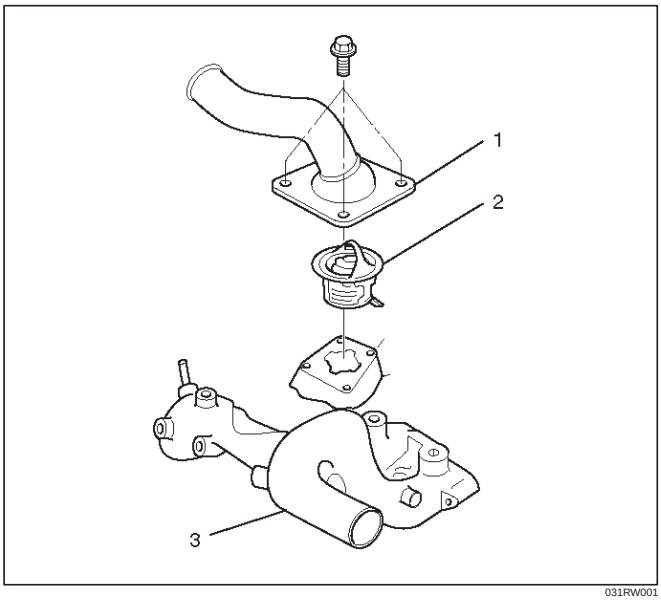
4. Timing belt

   ▼Install timing belt. Refer to timing belt installation step in “Timing Belt” in this manual.

5. Connect radiator inlet hose and replenish EC.
6. Connect battery ground cable.

Thermostat

Thermostat and Associated Parts



031RW001

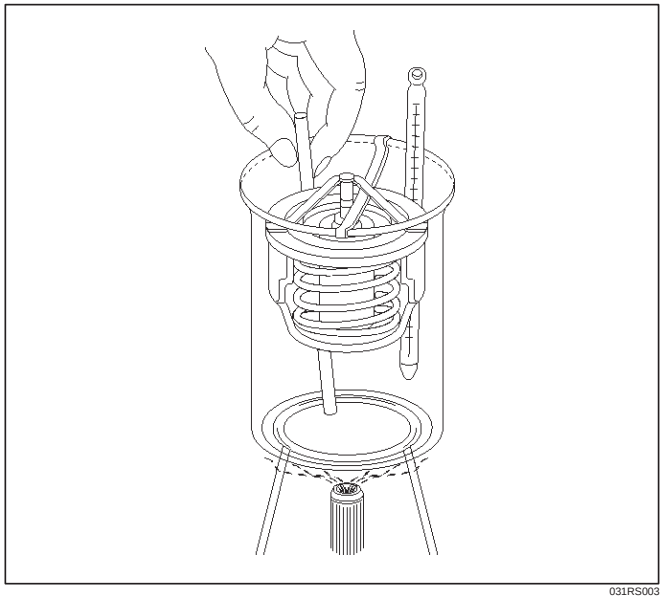
Legend
(1) Thermostat Housing
(2) Thermostat
(3) Outlet Pipe

Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.
5. Remove thermostat(2).

Inspection

Suspend the thermostat in a water–filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat.
Gradually increase the water temperature. Stir the water so that the entire water is same temperature.


031RS003

Confirm the temperature when the valve first begins to open.

Valve opening temperature 74.5C ~ 78.5˚C (166.1˚F ~ 173.3˚F)

Confirm the temperature when the valve is fully opened.

Valve full open temperature and lift More than 8.5mm (0.33 in) at 90˚C (194˚F)

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

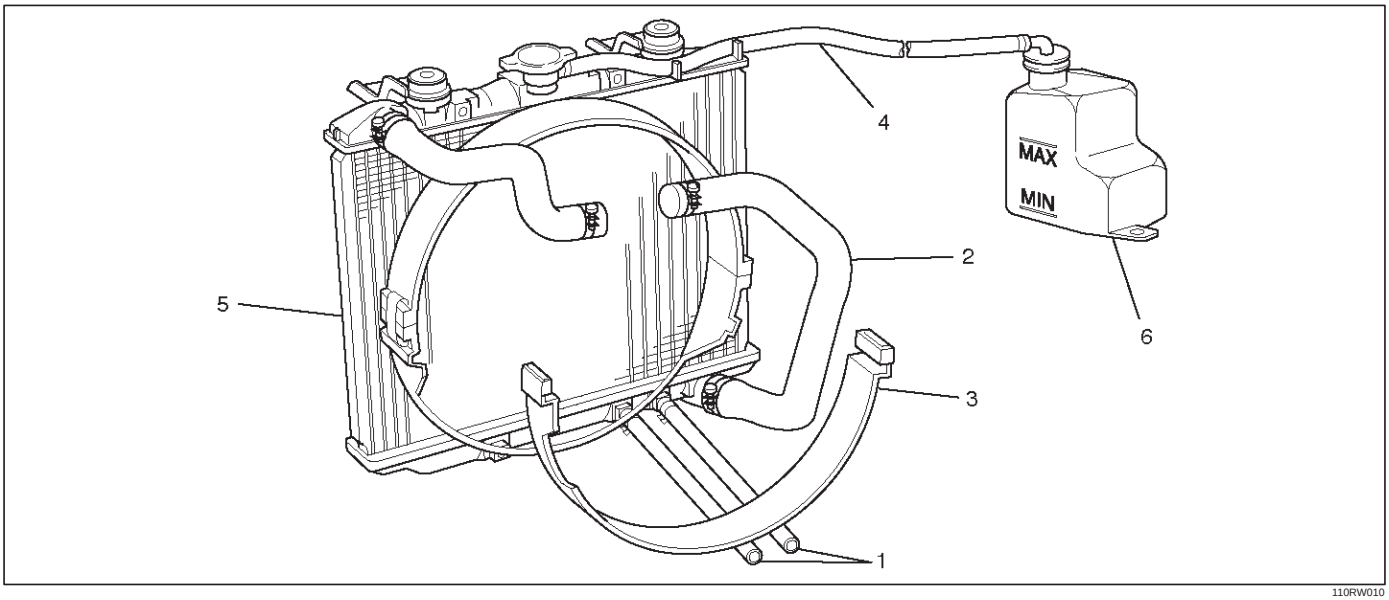
Installation

1. Install thermostat into the outlet pipe(4) making sure that the air hole is in the up position.
2. Install thermostat housing and tighten bolts to the specified torque.

   Torque: 25 N·m (18 lb ft)
3. Installation rubber hose.
4. Replenish engine coolant (EC).
5. Start engine and check for EC leakage.

Radiator

Radiator and Associated Parts



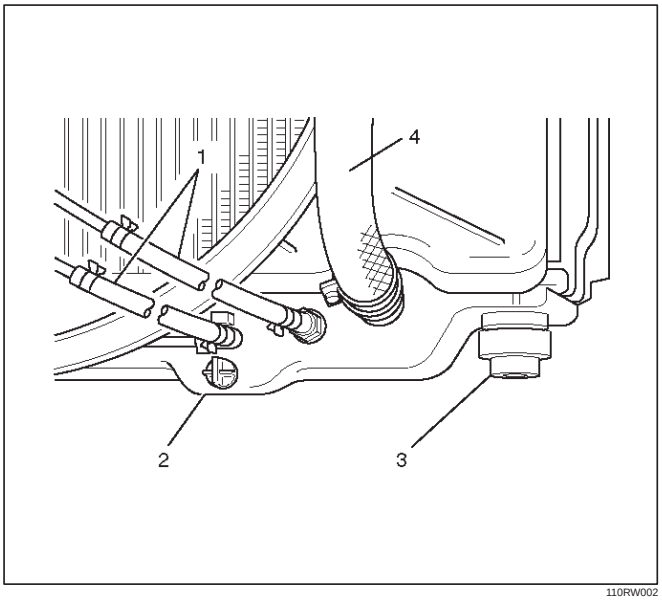
110RW010

Legend

(1) Oil Cooler Hose For Automatic Transmission
(2) Radiator Hose
(3) Fan Guide, Lower
(4) Reserve Tank Hose
(5) Radiator Assembly
(6) Reserve Tank

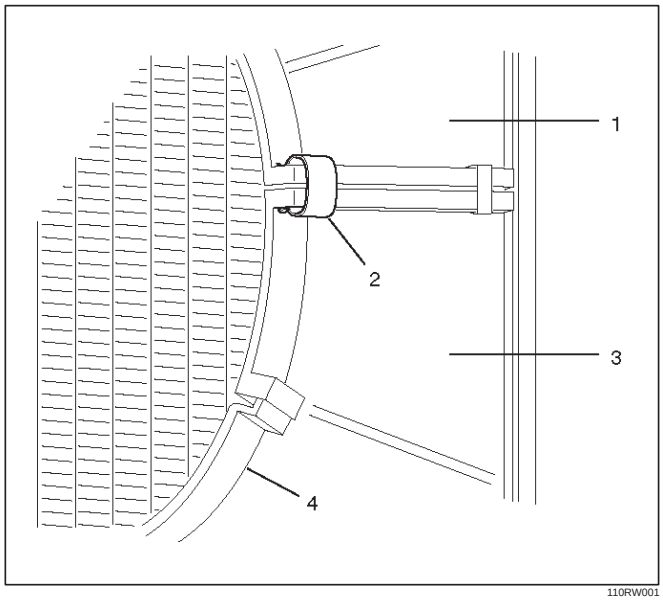
Removal

1. Disconnect battery ground cable.
2. Loosen a drain plug(2) to drain EC.
3. Disconnect oil cooler hose(1) on automatic transmission (A/T).
4. Disconnect radiator inlet hose and outlet hose from the engine.



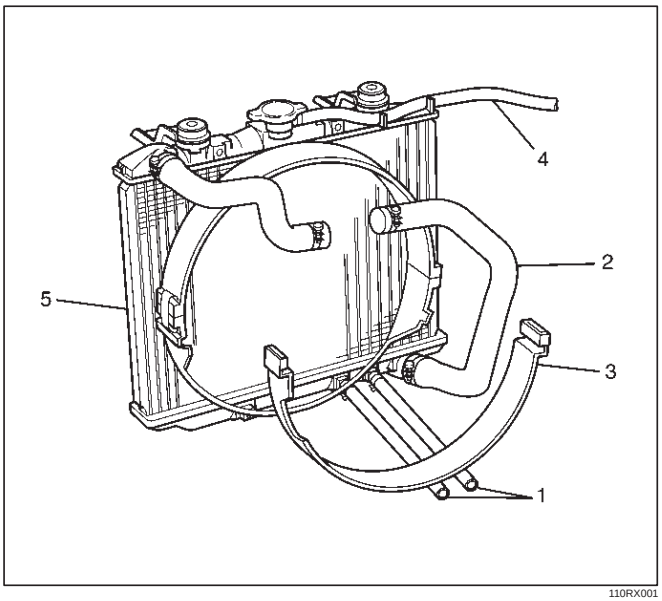
110RW002

5. Remove fan guide(1), clips(3) on both sides and the bottom lock, then remove fan guide lower(3) with fan shroud(4).



110RW001

6. Disconnect the reserve tank hose(4) from radiator.



110RX001

7. Lift up and remove the radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
8. Remove rubber cushions on both sides at the bottom.

Inspection

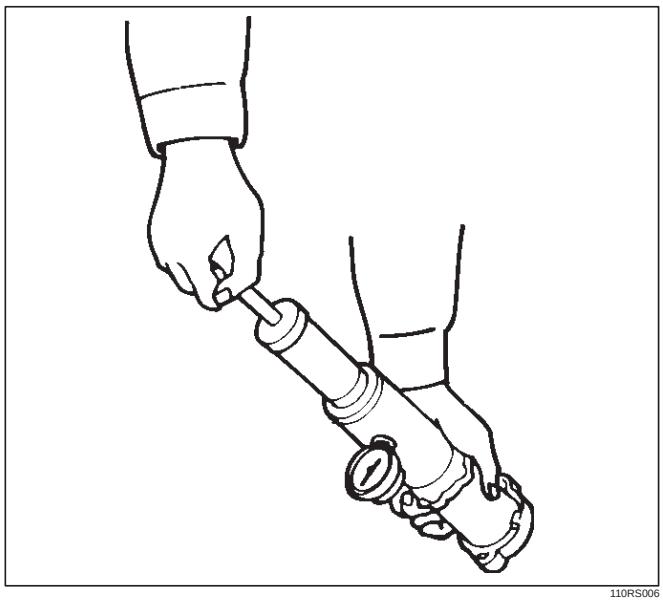
Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester.
Replace the cap if the valve opening pressure is outside the standard range.

Valve opening pressure kPa (psi) 93.3 ~ 122.7 (13.5 ~17.8)

Cap tester: J–24460–01
Adapter: J–33984–A
Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

Valve opening vacuum kPa (psi) 0 ~ 6.9 (0 ~ 1.0)


110RS006

Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

Flushing the Radiator

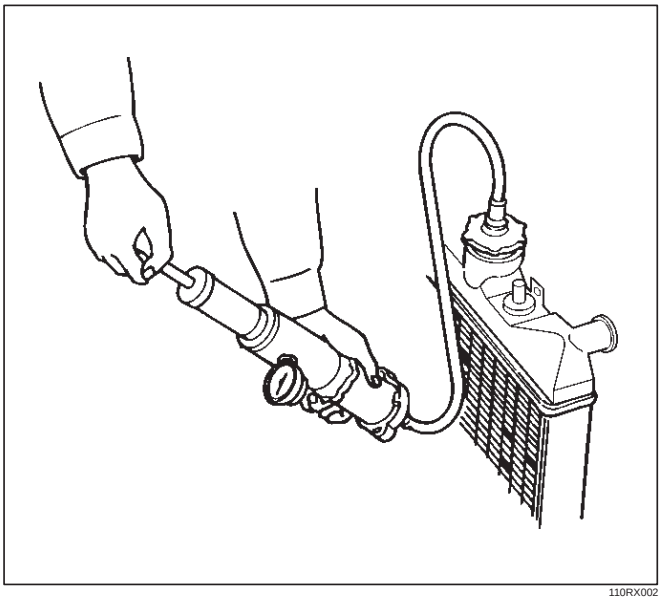
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all signs of scale and rust.

Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 150 kPa (22 psi) with a cap tester:

- ▼ Leakage from the radiator
- ▼ Leakage from the coolant pump
- ▼ Leakage from the water hoses
- ▼ Check the rubber hoses for swelling.

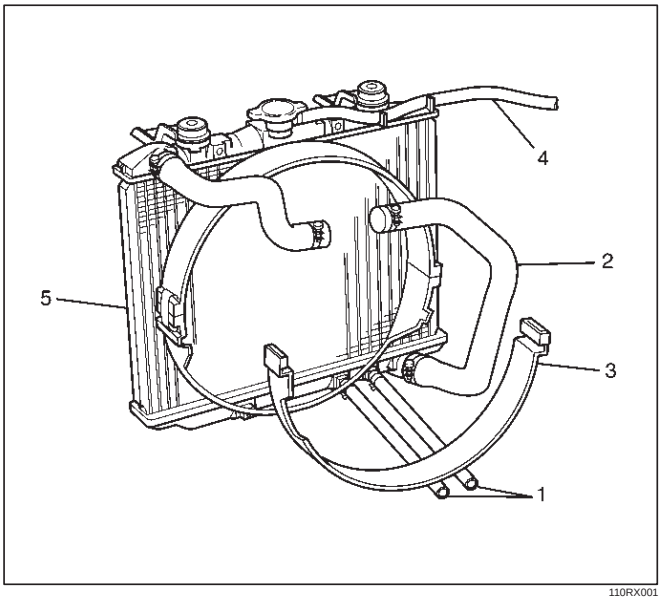
Cap tester: J–24460–01
Adapter: J–33984–A



110RX002

Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Connect reserve tank hose (4).
4. Install lower fan guide (3).
5. Connect radiator inlet hose and outlet hose to the engine.
6. Connect oil cooler hose (1) to automatic transmission.



110RX001

7. Connect battery ground cable.
8. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.

110RW012

Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.

Engine Coolant Filling Up Procedure

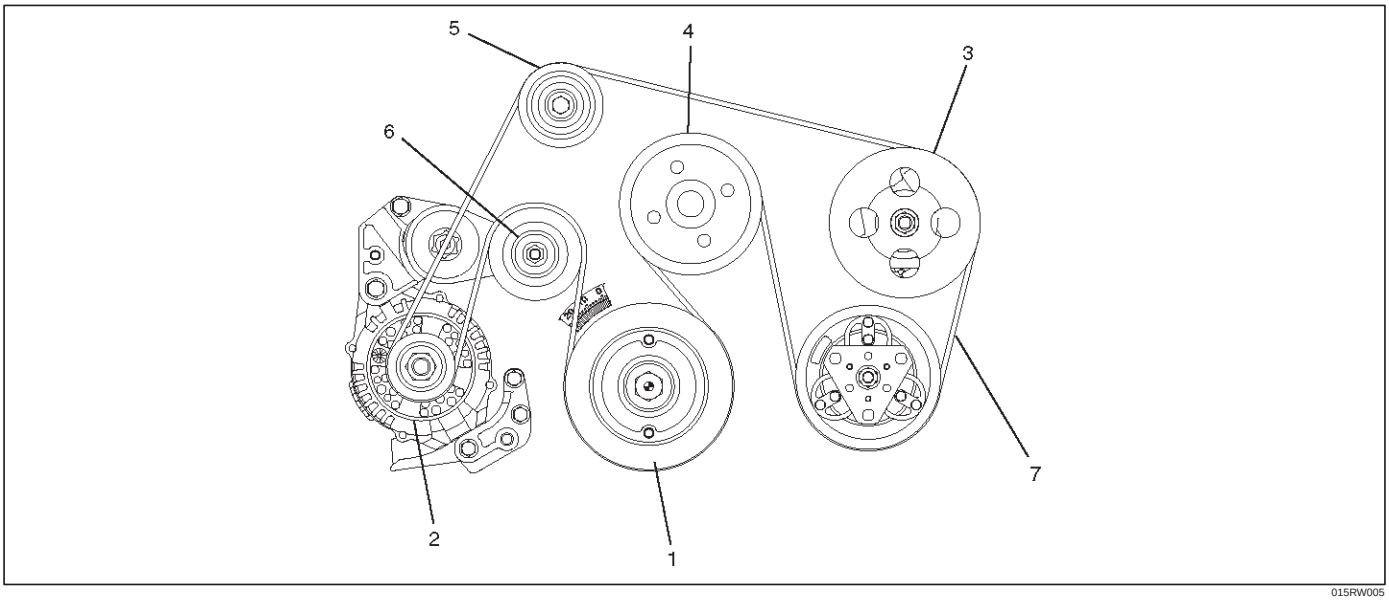
1. Make sure that the engine is cool.

WARNING: WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

2. Open radiator cap pour coolant up to filler neck.
3. Pour coolant into reservoir tank up to “MAX” line.
4. Tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.
5. After replenishing with coolant tighten radiator cap, warm up the engine at about 2000 rpm. Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
6. Check to see the thermometer, continuously idle for 5 minutes and stop the engine.
7. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the coolant system and reservoir tank hose for leakage.
8. Pour coolant into the reservoir tank up to “MAX” line.

Drive Belt and Cooling Fan

Drive Belt and Associated Parts



015RW005

Legend

(1) Crankshaft Pulley
(2) Generator
(3) Power Steering Pump
(4) Water Pump and Cooling Fan Pulley
(5) Idle Pulley
(6) Tension Pulley
(7) Drive Belt

The drive belt adjustment is not required as automatic drive belt tensioner is equipped.

Removal

Move the tension pulley drive belt loosen side, remove the drive belt.

Inspection

Check drive belt for wear or damage, and replace with a new one as necessary.

Installation

Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

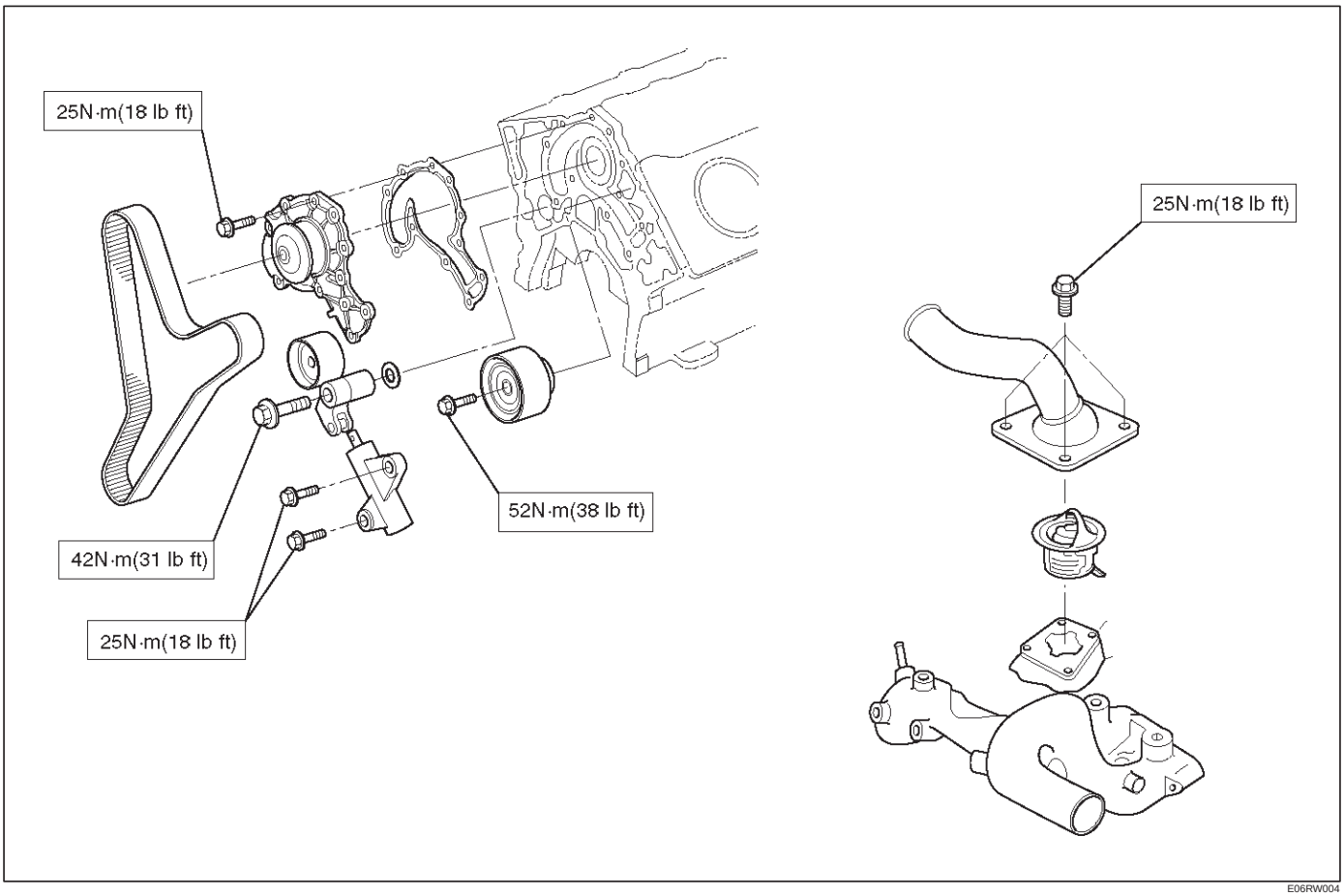
Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

Main Data and Specifications

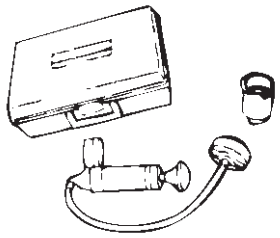
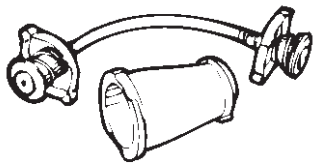
General Specifications

	A/T
Cooling system	Engine coolant forced circulation
Radiator	Tube type corrugated (2 tube in row)
Heat radiation capacity	85,500 kcal/h
Heat radiation area	14.02m^2 (150.9ft^2)
Radiator front area	0.263m^2 (2.83ft^2)
Radiator dry weight	56N (12.6lb)
Radiator cap valve opening pressure	93.3 ~ 122.7kpa (13.5 ~ 17.8psi)
Engine coolant capacity	2.4lit (0.6 US gal)
Engine coolant pump	Centrifugal impeller type
Delivery	300 (317) or more
Pump speed	5000 ± 50 rpm
Thermostat	Wax pellet type with air hole
Valve opening temperature	74.5 ~ 78.5˚C (166.1 ~ 173.3˚F)
Engine coolant total capacity	10.0lit (2.64 US gal)

Torque Specifications



Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW072	**J–24460–01** Tester; radiator cap
 901RW073	**J–33984–A** Adapter; radiator cap

AXIOM

ENGINE

ENGINE FUEL

CONTENTS

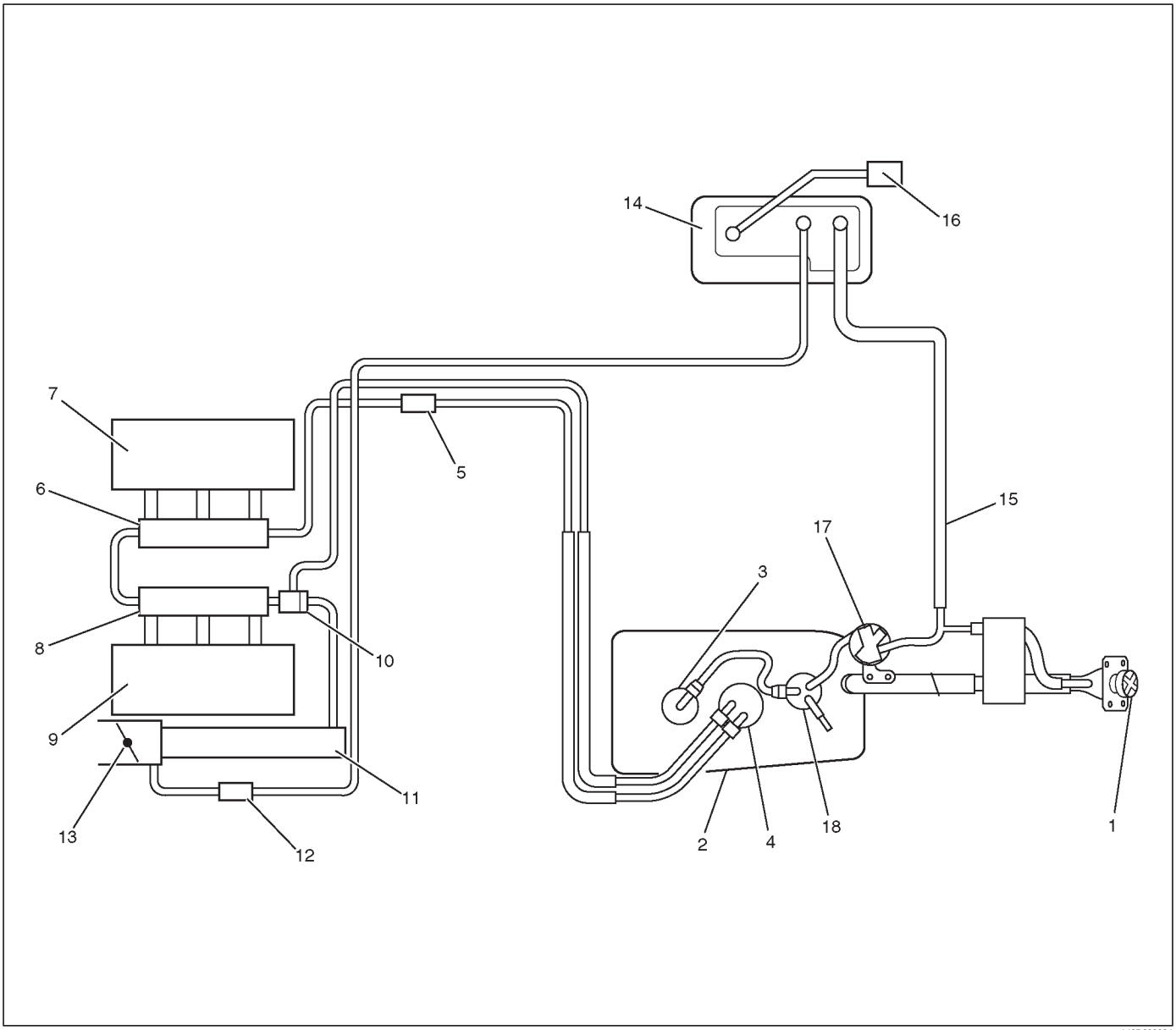
Service Precaution 6C–1
General Description 6C–2
Fuel Metering 6C–3
Fuel Filter 6C–4
Removal 6C–4
Inspection 6C–4
Installation 6C–5
Inspection 6C–5
In–Tank Fuel Filter 6C–5
Fuel Pump Flow Test 6C–5
Fuel Pump 6C–6
Fuel Pump and Associated Parts 6C–6
Removal 6C–6
Installation 6C–7
Fuel Tube / Quick – Connector Fittings 6C–8
Precautions 6C–8
Cautions During Work 6C–8
Removal 6C–8
Reuse of Quick–Connector 6C–9
Assembling Advice 6C–9
Fuel Pump Relay 6C–10
General Description 6C–10
Fuel Tank 6C–10
Fuel Tank and Associated Parts 6C–10
Removal 6C–11
Installation 6C–11
Fuel Gauge Unit 6C–12
Removal and Installation 6C–12
Fuel Filler Cap 6C–12
General Description 6C–12
Inspection 6C–12
Main Data and Specifications 6C–13
Special Tool 6C–13

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



140R200004

Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve)

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the battery ground cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect “O” rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.
Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.
The vapor pressure sensor and vent solenoid valve for vapor pressure sensor are used to detect abnormalities in the evaporative emission control system.
The PCM decides whether there is an abnormality in the evaporative emission control system based on vapor pressure sensor signal.

Fuel Metering

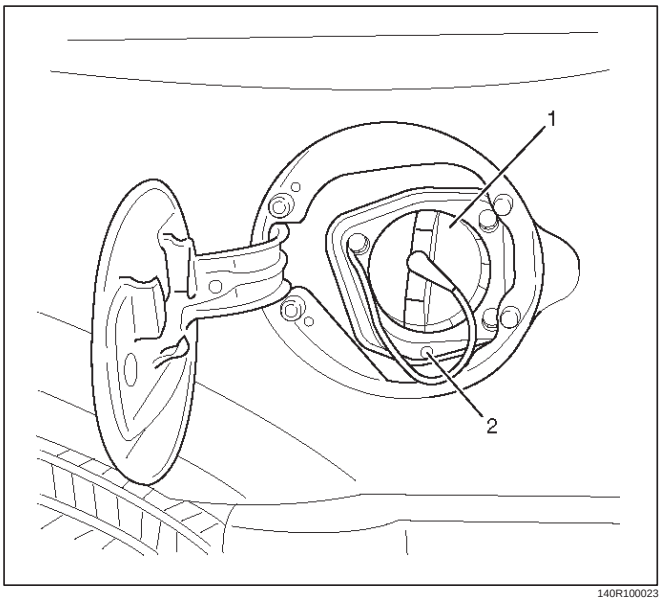
The Powertrain Control Module (PCM) is in complete control of this fuel delivery system during normal driving conditions.
The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.
The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.
This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the PCM.
With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the PCM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to affect an appropriate air/fuel ratio.
The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The PCM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.
Two interchangeable “O” rings are used on the injector that must be replaced when the injectors are removed.
The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.
Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.
The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.
See Section “Driveability and Emission” for more information and diagnosis.

Fuel Filter

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Remove Fuel filler cap(1).

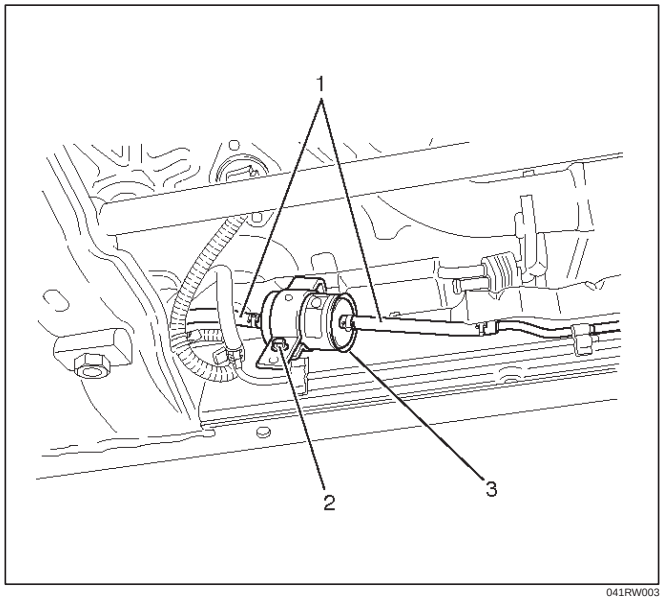


140R100023

Legend

(1) Fuel Filler Cap
(2) Receive Rubber Drain

3. Disconnect fuel hoses(1) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt(2).
   ▼Remove the fuel filter fixing bolt(2) on fuel filter holder.
5. Remove fuel filter(3).



041RW003

Legend

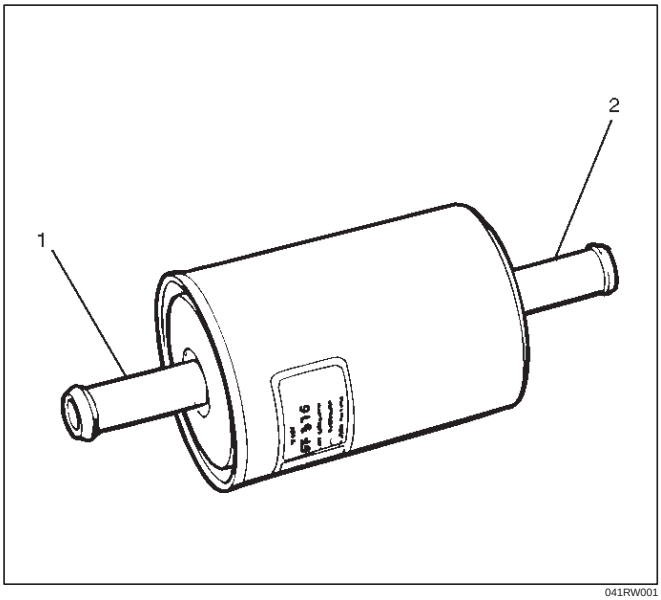
(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check clogged drain port of the receive rubber by the foreign material, repair or clear if found clog it.

Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.
3. Connect fuel hoses on engine side(1) and fuel tank side(2).



041RW001

4. Install fuel filler cap
5. Connect the battery ground cable.

Inspection

After installation, start engine and check for fuel leakage.

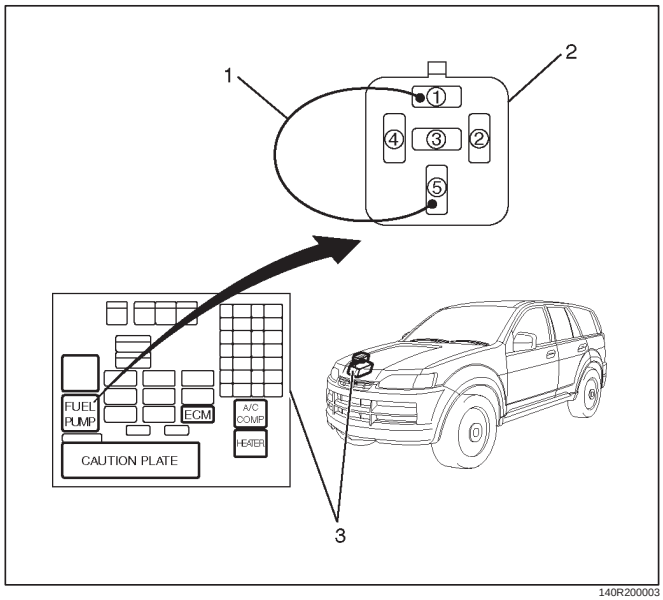
In–Tank Fuel Filter

The filter is located on the lower end of fuel pickup tube in the fuel tank. The fuel filter prevents dirt and water the fuel system not unless the filter is submerged in water. The fuel filter is maintenance free, that requires no maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stall. If this happens, the fuel tank would need to be cleaned thoroughly.

Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks.

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, inspect bent or kink fuel pipes and hoses.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.
4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.



140R200003

CAUTION: Never generate sparks when connecting a jumper wire.

Delivery Times	Delivery
15 seconds	0.38 liters minimum

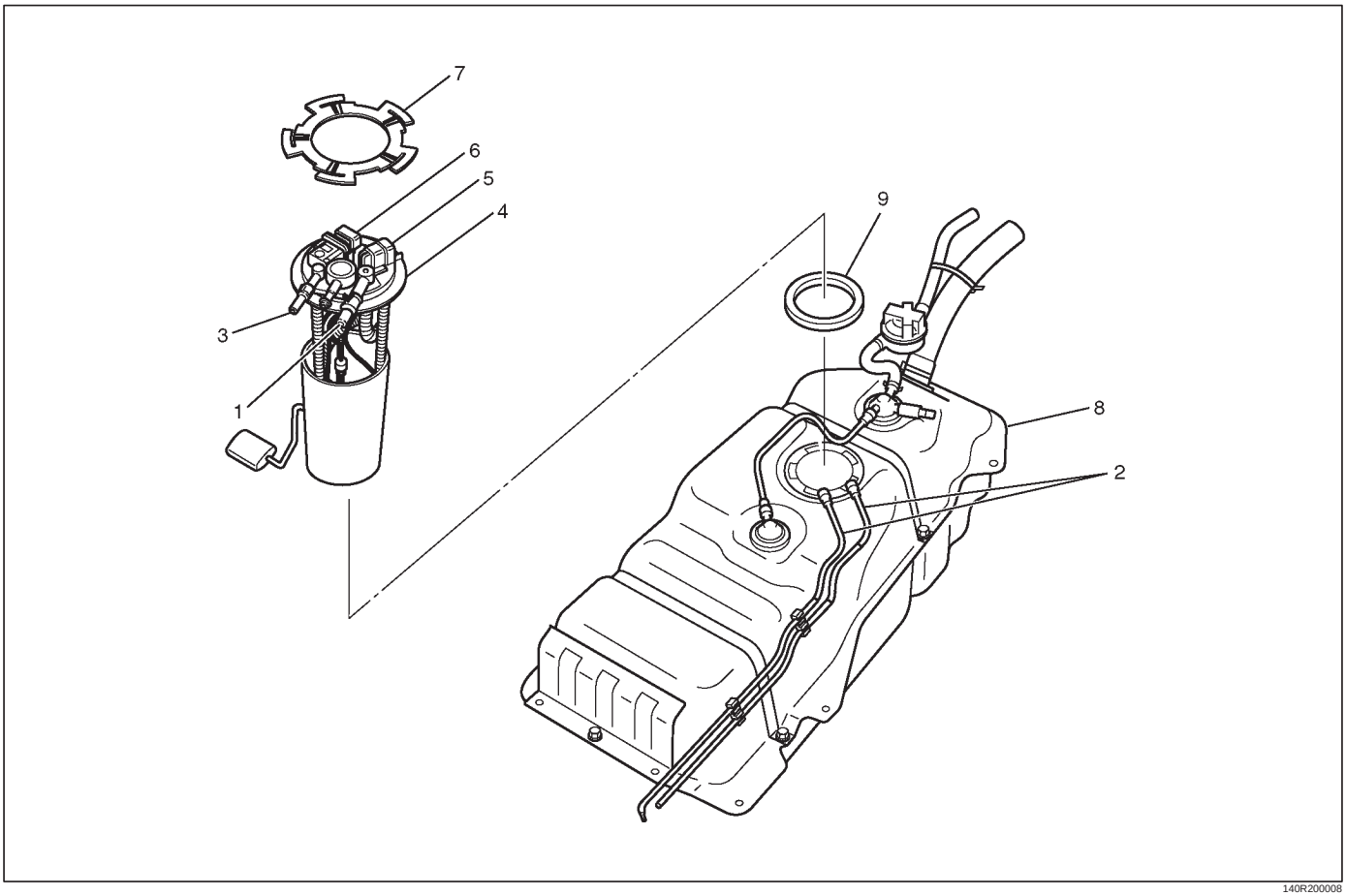
If the measure value is out of standard, conduct the pressure test.

Pressure test

For the pressure test to the fuel system, see Section 6E “Fuel Control System”.

Fuel Pump

Fuel Pump and Associated Parts



140R200008

Legend

(1) Fuel Feed Port
(2) Fuel Tube/Quick Connector
(3) Fuel Return Port
(4) Fuel Pump and Sender (FPS) Assembly
(5) Connector; Fuel Feed Pump
(6) Connector; Fuel Tank Pressure Sensor
(7) Retainer (Fuel Pump Lock)
(8) Fuel Tank Assembly
(9) Seal; Fuel Pump

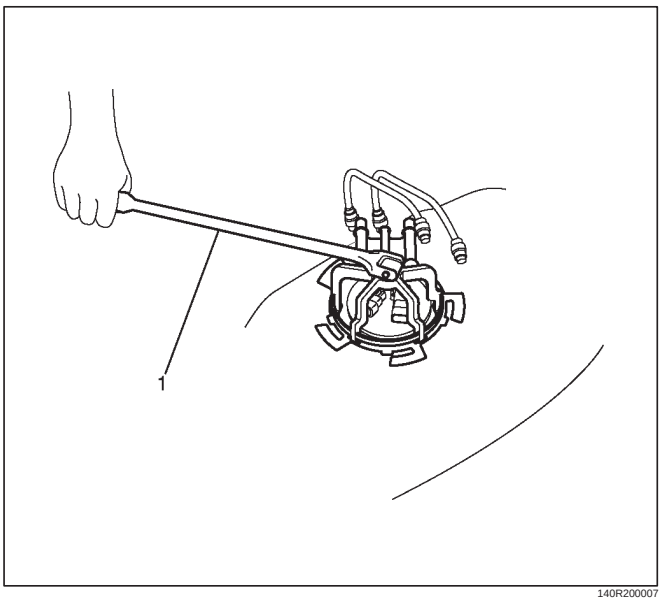
Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Remove fuel tank assembly(8). Refer to "Fuel Tank Removal" in this section.
2. Remove Fuel Tube/Quick Connector (2).

NOTE: Refer to "Fuel Tube/Quick Connector Fittings" in this section when performing any repairs.

3. Remove the retainer (7) with tool J–39765 and remove the fuel pump and sender (FPS) assembly (4).



NOTE: After removing pump assembly (4), cover fuel tank to prevent any dust entering.

Installation

1. Install FPS assembly(4) with retainer (7) and new seal; fuel pump (9) by J–39765.
2. Install Fuel Tube/Quick Connector (2).

NOTE: Refer to “Fuel Tube/Quick Connector Fittings” in this section when performing any repairs.

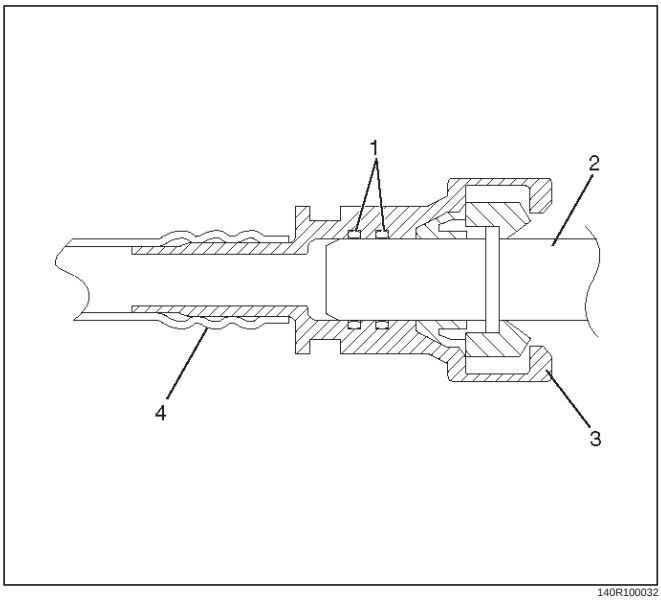
3. Install fuel tank assembly(8). Refer to “Fuel Tank Installation”.

Fuel Tube / Quick – Connector Fittings

Precautions

- ▼Do not light a match or create a flame.
- ▼Keep flames away from your work area to prevent flammable materials from catching fire.
- ▼Disconnect battery ground cable to prevent electrical shorts.
- ▼Pre-treat piping system or associated parts from thermal damage or from spattering when welding or similar heat-generating work.

Cautions During Work



140R100032

Legend

(1) O-ring
(2) Port
(3) Connector
(4) Plastic Tube

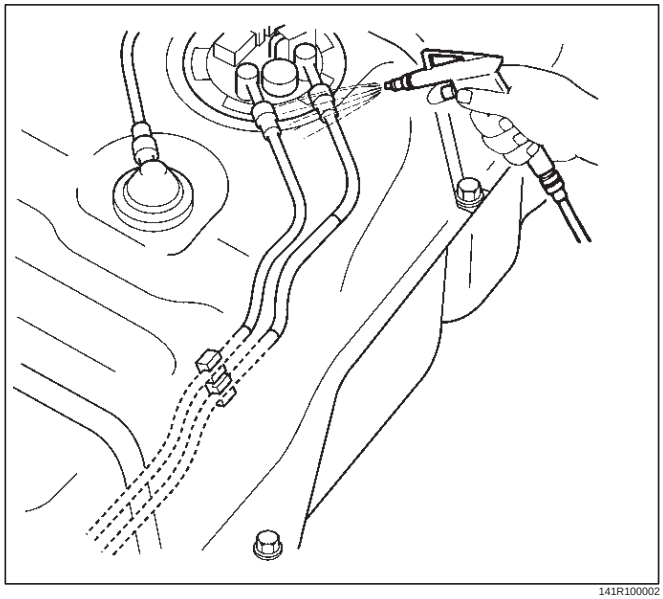
NOTE: An O-ring inside the quick connector provides the seal between the quick connector and the port. Be careful not to damage the mating surfaces and O-ring when attaching the connector. Do not allow foreign material to enter the connector or the port.

Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electrolyte.
Piping that has been splattered with battery electrolyte or battery electrolyte soaked cloth that was wiped on the piping cannot be used.

Removal

1. Open the fuel cap to relieve the fuel pressure in the tank.

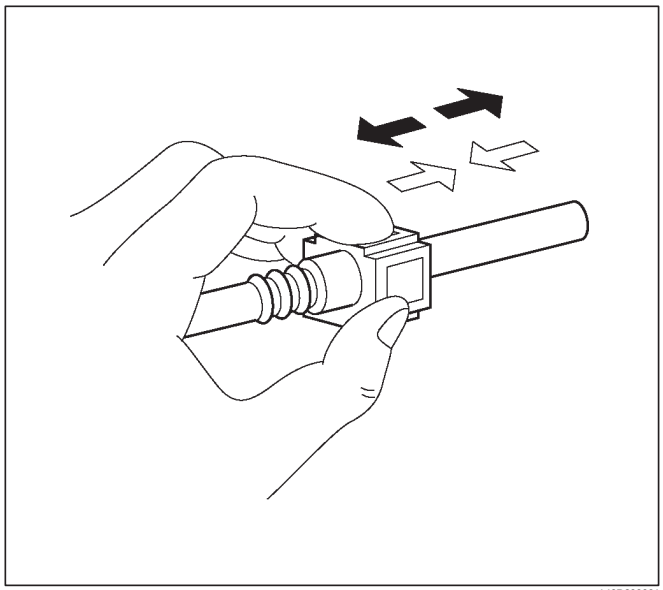
   Use compressed air to remove any dirt on the fuel quick connect fittings prior to disconnecting the fittings.



141R100002

   When disconnecting the fuel pipe, cover the area with a cloth to prevent fuel from splashing as the fuel pipe may still have some pressure in it.

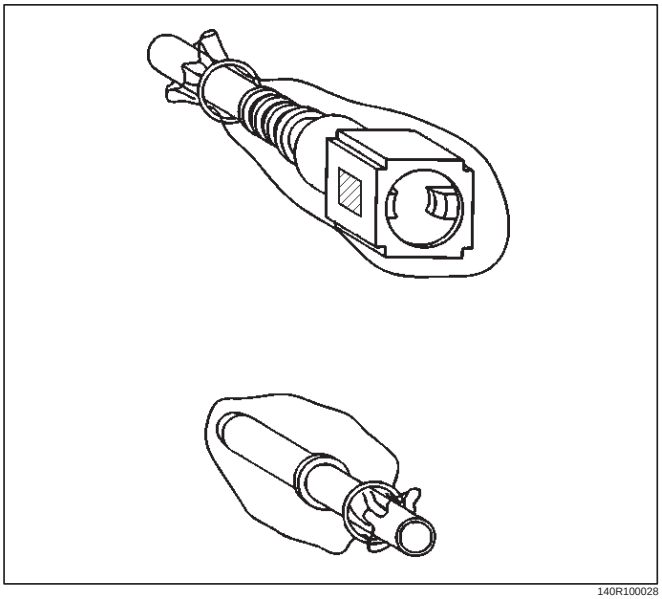
2. For removal of the quick connector, pull out the connector with the other hand while pressing the square relieve button of the connector, as illustrated.



140R200001

NOTE: Do not use tools of any kind. Only use bare hands when disconnecting the connector. Use a lubricant (light oil) and/or push and pull the connector until the pipe is disconnected.

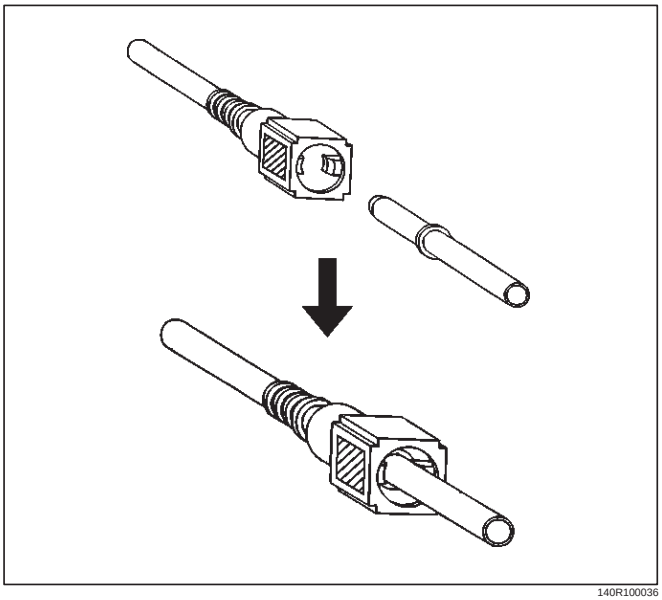
Cover the connectors that was removed with a plastic bag, to prevent dust or rain water from entering.



140R100028

Reuse of Quick–Connector

- ▼ Replace the port and connector if scratch, dent or crack is found.
- ▼ Remove any dirt build up on the port when installing the connector. Replace the connector, if there is any forms of rust, dent, scratch.
- ▼ After cleaning the port, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.



140R100036

Assembling Advice

By applying engine oil or light oil to the pipe, port makes pipe assembly easier. The pipe assembly should take place immediately after applying oil (to prevent dust from sticking to the pipe surface – which may decrease sealing ability).

Test/Inspection After Assembling

1. Reconnect the battery negative cable.
2. Turn the ignition key to the “ON” position and listen for pump start-up sound. Inspect for leaks, the fuel pressure will increase as the fuel pump is actuated.
3. Perform leak inspection (step 2) several times.
4. Start the engine and observe the engine idle speed. The presence of dirt in the fuel system may affect the fuel injection system.

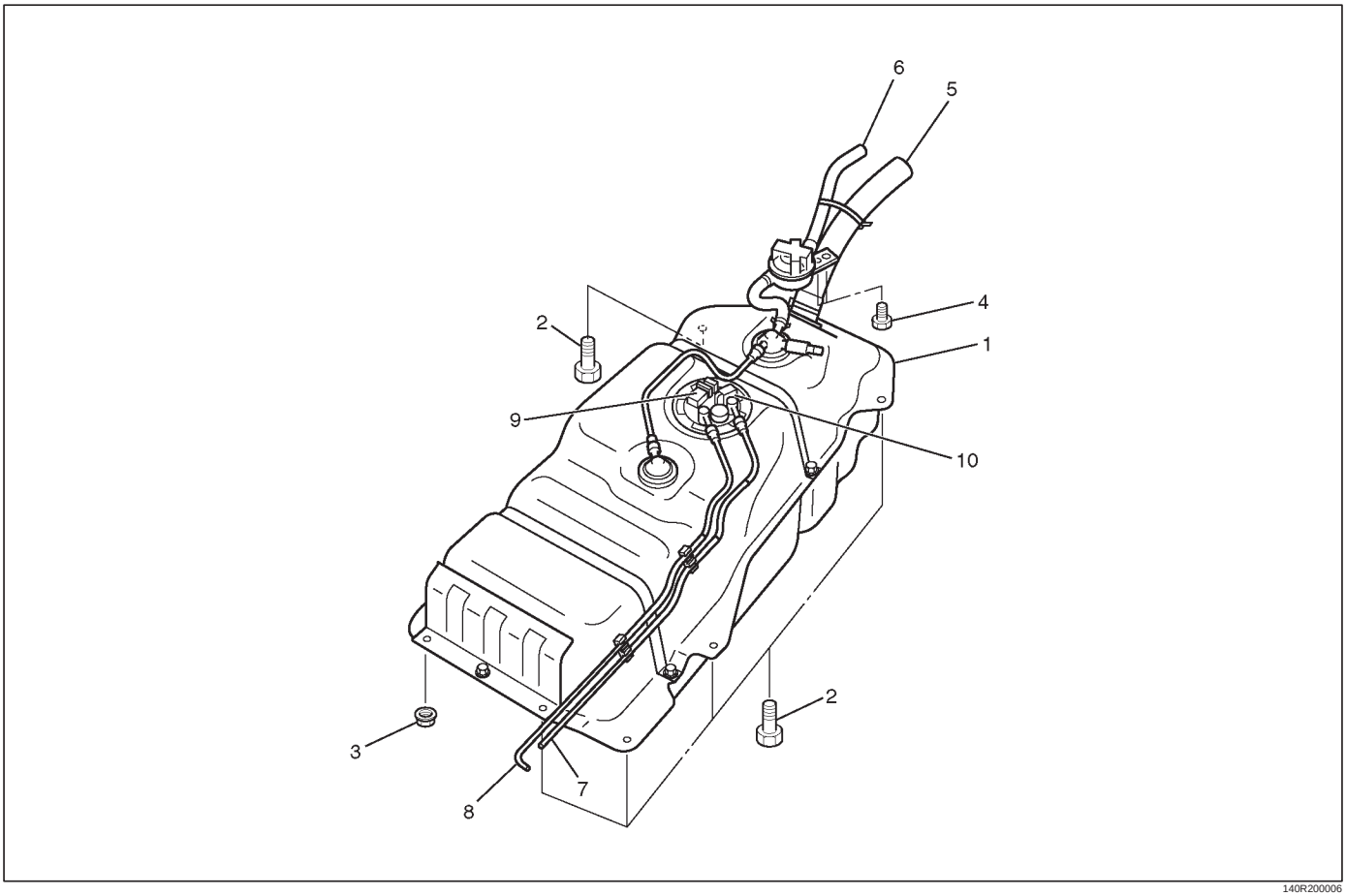
Fuel Pump Relay

General Description

In order to control the fuel pump and sender (FPS) operation, the FPS relay is provided. When the starter switch is turned to “ON” position, the FPS relay operates the FPS for 2 seconds.
When the key is turned to “START” position, the Engine Control Module receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FPS to feed fuel.

Fuel Tank

Fuel Tank and Associated Parts



140R200006

Legend

(1) Fuel Tank Assembly
(2) Fuel Tank Fixing Bolt (QTY: 5)
(3) Fuel Tank Fixing Nut (QTY: 1)
(4) Separator Fixing Bolt (QTY: 2)
(5) Fuel Filler Hose
(6) Fuel Vent Hose
(7) Fuel Feed Hose
(8) Fuel Return Hose
(9) Vapor Pressure Sensor Connector
(10) Fuel Feed Pump Connector

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Drain the fuel from the fuel tank, refer to the "Fuel Pump Flow Test" in this section.
2. Disconnect battery ground cable.
3. Loosen fuel filler cap to reduce the pressure in fuel tank.
4. Support underneath of the fuel tank assembly (1) with a lifter.
5. Disconnect fuel feed hose (7) and fuel return hose (8) near the fuel filter.

NOTE: Plug both ends of the fuel hoses to prevent fuel leakage.

6. Disconnect fuel filler hose (5) and fuel vent hose (6) at the fuel filler neck.

NOTE: Cover fuel hoses to prevent any dust entering.

7. Remove two bolts (4) and remove separator.
8. Remove the five fuel tank assembly fixing bolts (2) and one nut (3).
9. Lower the tank and disconnect the wiring connectors (9, 10).

Installation

1. Raise the fuel tank assembly (1) and connect the wiring connectors (9, 10).
2. Install fuel tank assembly along with protectors and tighten the five fixing bolts (2) and one nut (3) to the specified torque.

   Torque: 68 N·m (50 lb ft)
3. Install the separator and tighten two bolts (4).

   Torque: 10 N·m (95 lb in)
4. Connect fuel filler hose (5) and fuel vent hose and clip them firmly.
5. Connect fuel feed hose (7) and fuel return hose(8), and clip them firmly.
6. Tighten fuel filler cap until at least three clicks are heard.
7. Connect battery ground cable.

Fuel Gauge Unit

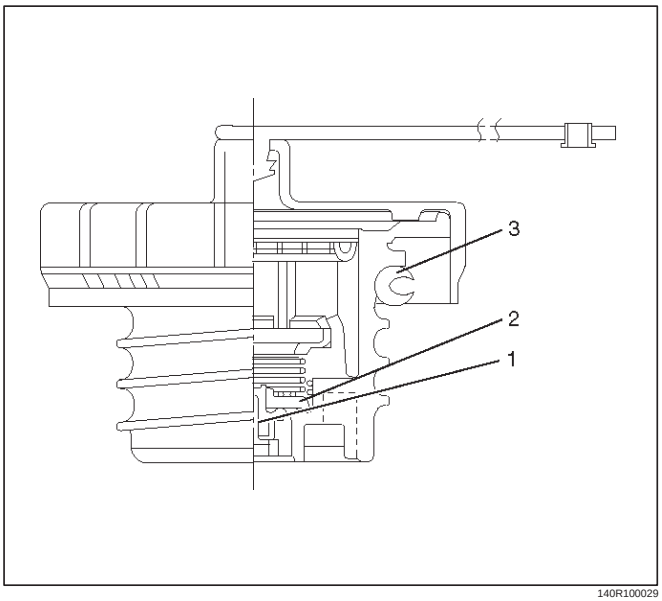
Removal and Installation

Refer to “Fuel Pump” in this section for removal and installation of the Fuel Gauge Unit, since the fuel gauge unit is linked to the fuel pump and sender assembly.

Fuel Filler Cap

General Description

A vacuum valve and pressure valve are built into the fuel filler cap which adjusts the fuel pressure in the fuel tank to prevent fuel tank damage.



140R100029

Legend

(1) Vacuum Valve
(2) Pressure Valve
(3) Seal Ring

Inspection

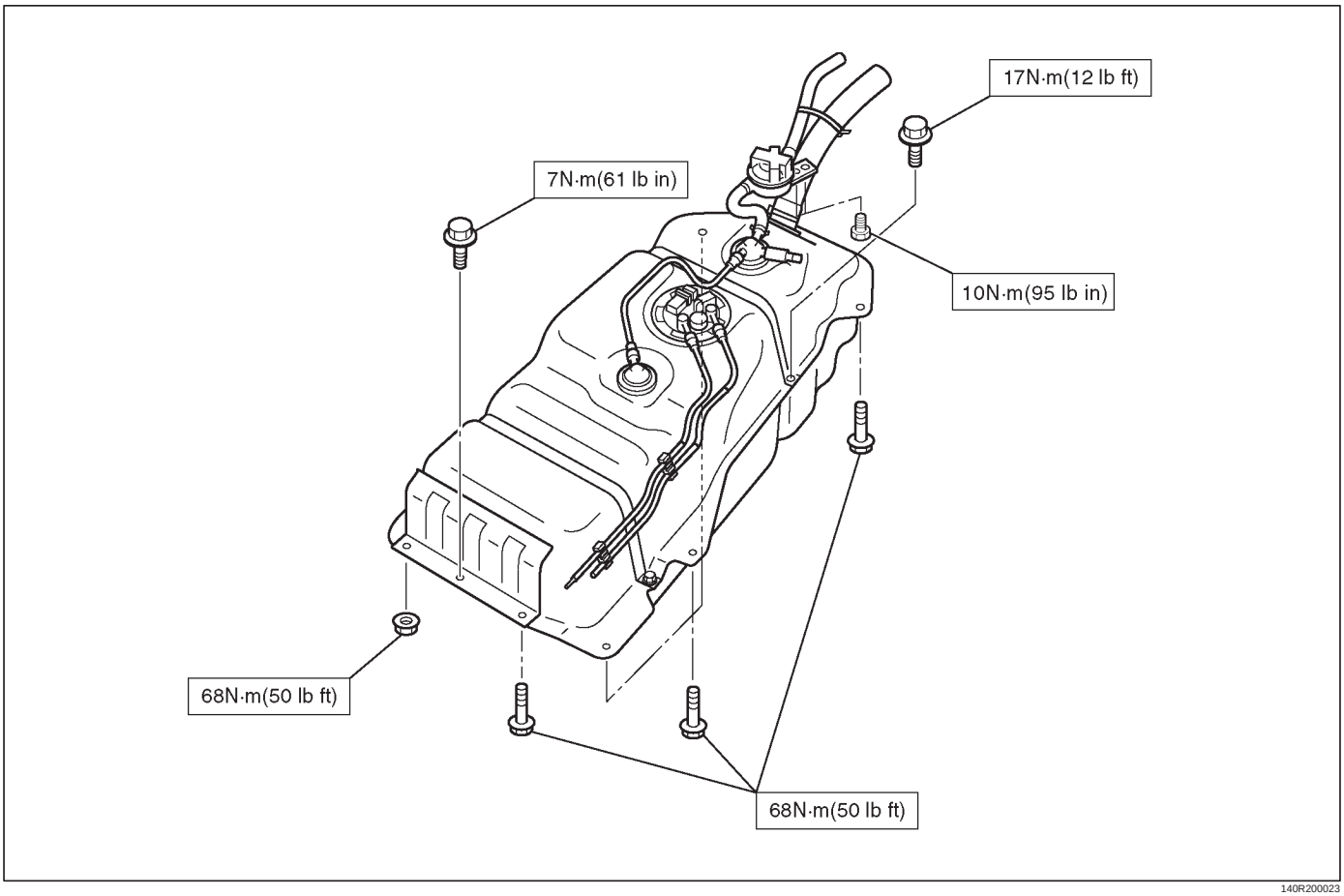
The fuel filler cap must be inspected for seal condition. The fuel filler cap must be replaced if found defective.

CAUTION:

A replacement fuel filler cap must be the same as the original. The fuel filler cap valve was designed primarily for this application and must be replaced with the same type or decreased engine performance may occur.

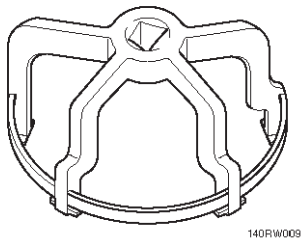
Main Data and Specifications

Torque Specification



140R200023

Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
 140RW009	**J–39765** Remover; fuel pump retainer

AXIOM

ENGINE

ENGINE ELECTRICAL (6VE1 3.5L)

CONTENTS

Service Precaution 6D1–1
Battery 6D1–2
General Description 6D1–2
Diagnosis 6D1–2
Battery Charging 6D1–3
Jump Starting 6D1–3
Battery Removal 6D1–4
Battery Installation 6D1–4
Main Data and Specifications 6D1–5

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Battery

General Description

The battery is completely sealed except for the two small vent holes (2) on the side. These vent holes (2) permit the escape of small amounts of gas generated by the battery. This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

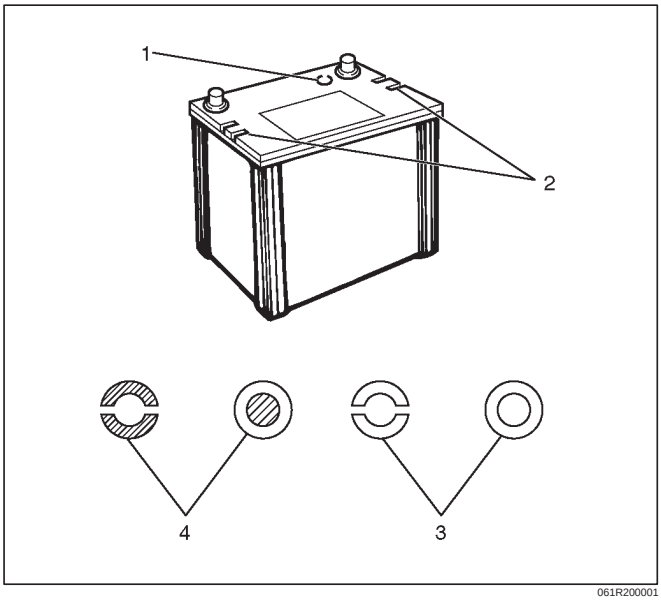
1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary.

2. Hydrometer Check

There is a built–in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.
Before trying to read the hydrometer, carefully clean the upper battery surface.
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

a. BLUE RING OR DOT VISIBLE(4) – Go to Step 3.
b. BLUE RING OR DOT NOT VISIBLE(3) – Replace the battery.



061R200001

3. Voltage Check

1. Put voltmeter test leads to battery terminals.
   a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 4 Load Test.
   b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
   Fast charge battery for 30 minutes at amperage rate no higher than specified value.
   Take voltage and amperage readings after charge.
   a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
   b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours. Then go to Step 4 Load Test.
   c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 4 Load Test.
   d. VOLTAGE BELOW 12V – Replace the Battery.

4. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
   Read voltage after 15 seconds, then remove load.
   a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.
   b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace the battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
˚F	˚C	V
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	–1	9.1
20	–7	8.9
10	–12	8.7
0	–18	8.5
The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.		

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during charging procedure.
   Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
   Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.
   Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting with an Auxiliary (Booster) Battery

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. Serous personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.
Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.
Never allow battery fluid to come in contact with your eyes or skin.
Never allow battery fluid to come in contact with fabrics or painted surfaces.
Battery fluid is a highly corrosive acid.
Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.
Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.
Always keep batteries out of reach of young children.

Jump Starting Procedure

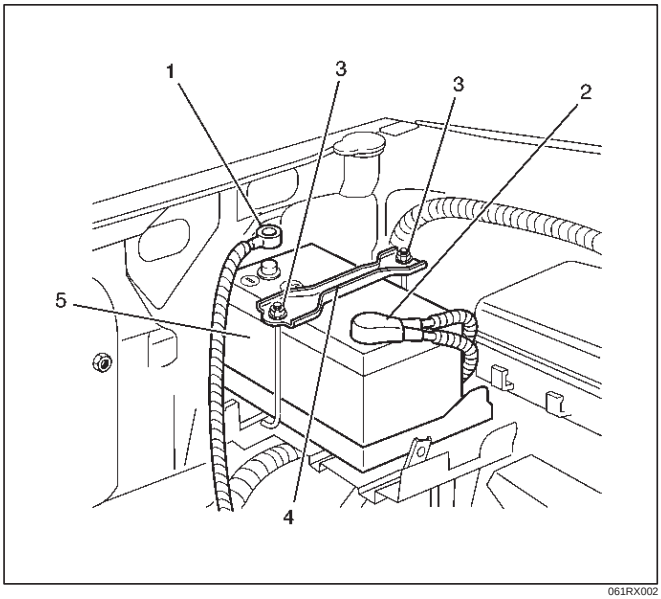
1. Set the vehicle parking brake.
   If the vehicle is equipped with an automatic transmission, place the selector level in the “PARK” position.
   If the vehicle is equipped with a manual transmission, place the shift lever in the “NEUTRAL” position.
   Turn “OFF” the ignition.
   Turn “OFF” all lights and any other accessory requiring electrical power.
2. Look at the built–in hydrometer.
   If the indication area of the built–in hydrometer is completely clear, do not try to jump start.
3. Attach the end of one jumper cable to the positive terminal of the booster battery.
   Attach the other end of the same cable to the positive terminal of the discharged battery.
   Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.
   Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.
   Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.
   The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.
   Make sure that all unnecessary electrical accessories have been turned “OFF”.
6. Start the engine of the vehicle with the dead battery.

7. To remove the jumper cables, follow the above directions in reverse order.
   Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Battery Removal



1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).

Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Install retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

Main Data and Specifications

General Specifications

Model	24R–600
Voltage (V)	12
Cold–Cranking Performance (Amp)	600
Reserve Capacity (Min)	118
Load Test (Amp)	300
BCI Group No.	24

AXIOM

ENGINE

IGNITION SYSTEM (6VE1 3.5L)

CONTENTS

Service Precaution 6D2–1
General Description 6D2–2
Diagnosis 6D2–2
Ignition Coil 6D2–3
Removal 6D2–3
Inspection and Repair 6D2–3
Installation 6D2–3
Spark Plug 6D2–5
Removal 6D2–5
Inspection and Repair 6D2–5
Installation 6D2–5
Crankshaft Position Sensor 6D2–6
Removal 6D2–6
Installation 6D2–6
Main Data and Specifications 6D2–7

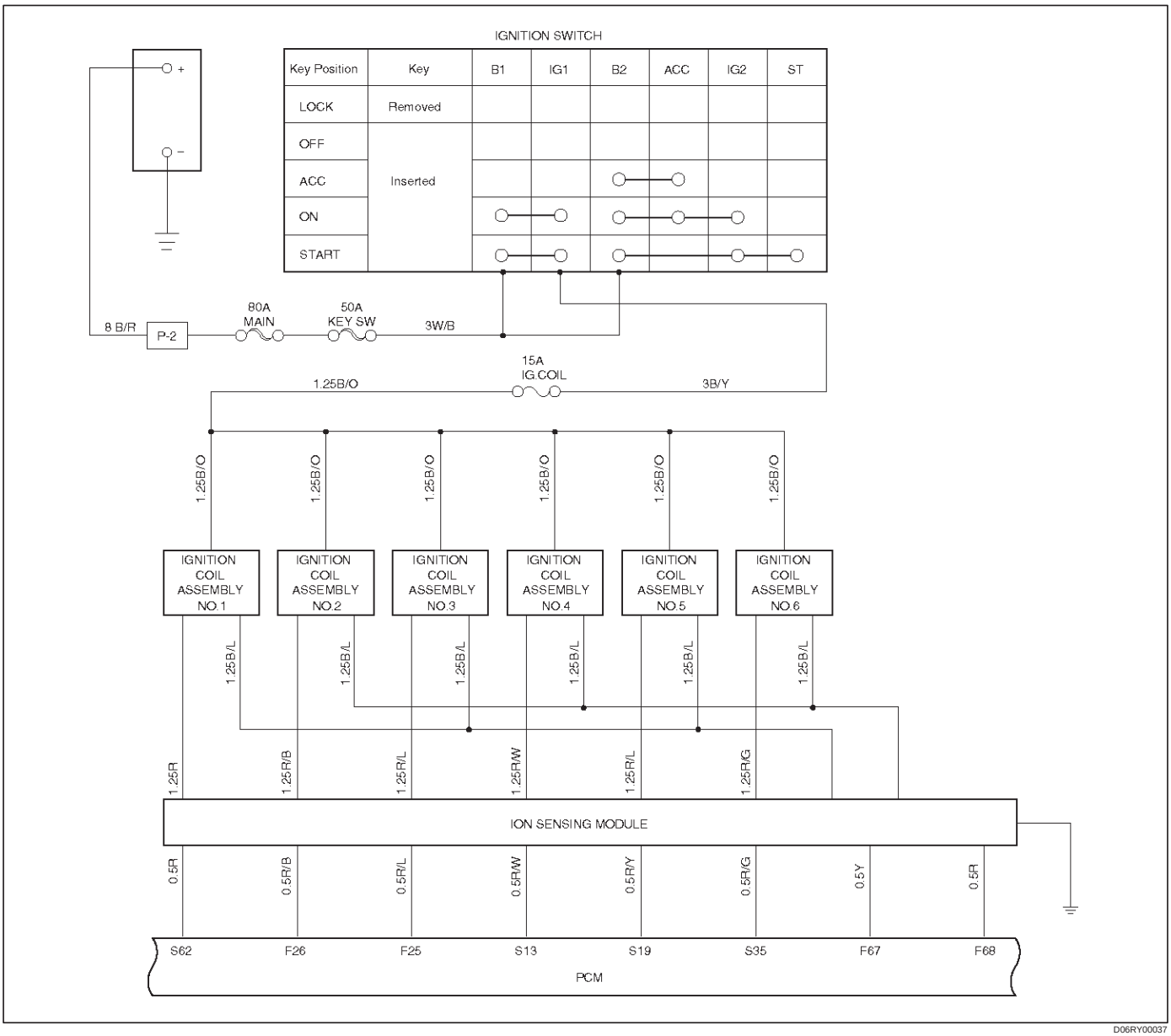
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Ignition is done by the electronic ignition (EI) that directly fires the spark plugs from ignition coils through spark plug wires without using a distributor. The firing orders are selected No.1, No.2, No.3, No.4, No.5, and No6.
Since the cylinder on exhaust stroke requires less energy to fire its ignition plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke. After additional 360˚ rotation, respective cylinder strokes are reversed.
The EI consists of six ignition coils,ignition control module, crank position sensor, powertrain control module (PCM) and other components.
The ignition coils are connected with the PCM by means of a 80 pin connector.
The ignition control module turns on/off the primary circuit of ignition coils, and also it controls the ignition timing at the engine speed below 538 rpm.
A notch in the timing disc on the crankshaft activates the crank position sensor which then sends information such as firing order and starting timing of each ignition coil to the PCM.
Further, the EI employs ignition control (IC) to control similar to a distributor system.
By receiving signals such as crank position,engine speed, water temperature and Manifold Absolute Pressure (MAP), the PCM controls the ignition timing.



D06RY00037

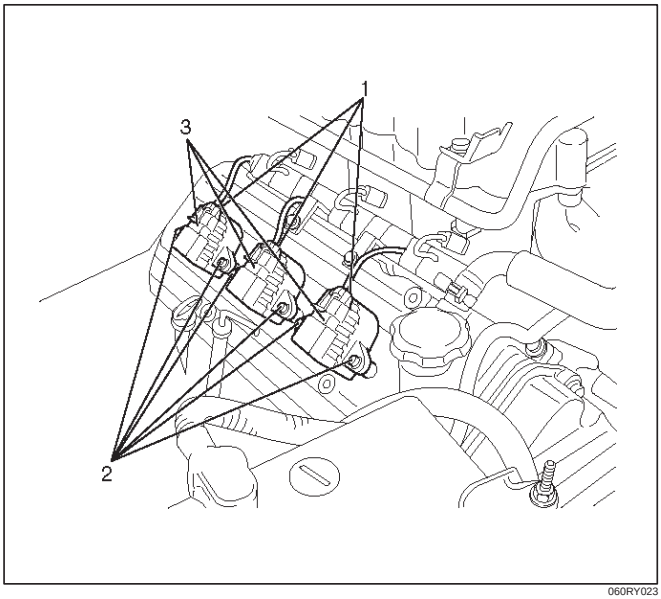
Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

Ignition Coil

Removal

1. Disconnect battery ground cable.
2. Ignition coil connector and ignition coil.
   ▼Disconnect three connector from ignition coil.
   ▼Remove harness bracket bolt on cylinder head cover.
   ▼Remove fixing bolts on ignition coil.



060RY023

Legend

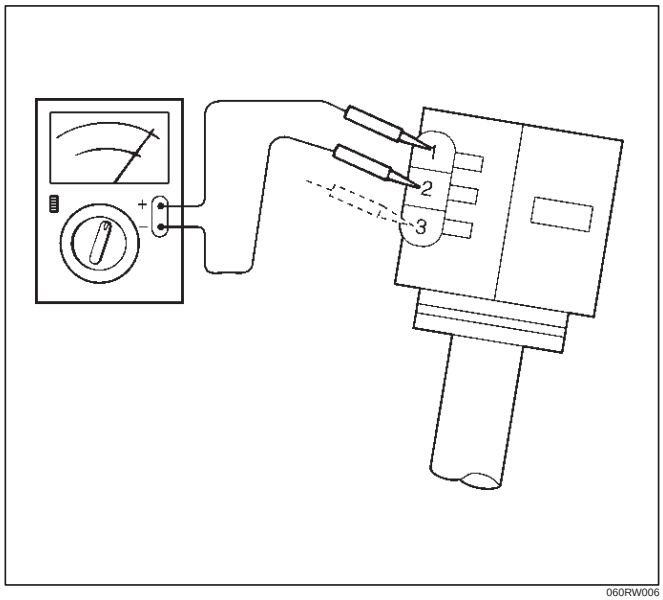
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

Inspection and Repair

Check the ignition coil assembly for insulation. Check terminals for corrosion or damage, and replace as necessary.
Measuring resistance of ignition coil assembly.

Terminal No.	Limit
1 to 2	Without 0 ohm or infinity maximum ohm.
1 to 3	Same as above
2 to 3	Same as above

Measure resistance of ignition coil assembly, and replace the ignition coil assembly if its value exceeds the standard.

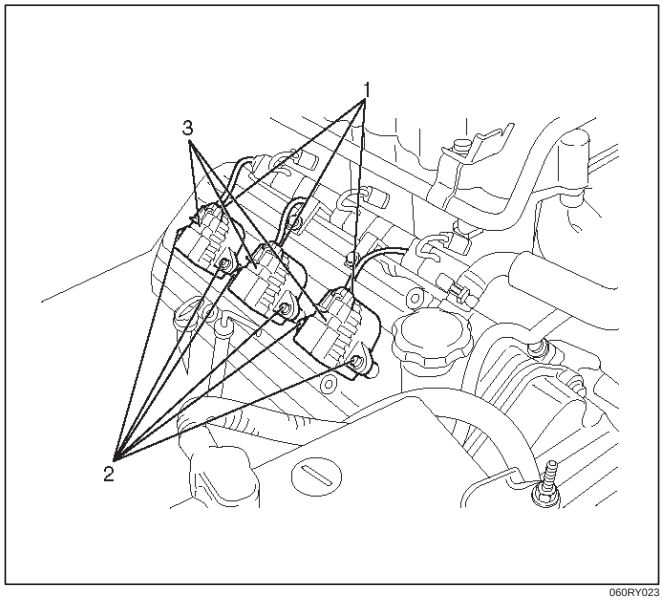


060RW006

Installation

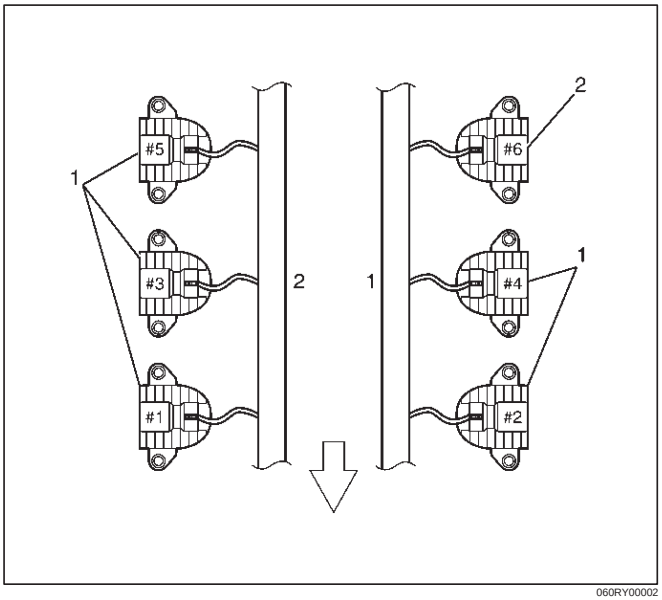
1. Install the ignition coil assembly (3).
   Connect ignition coil connector (1) and ignition coil (3), then tighten bolt (2) to the specified torque.

Torque: 4 N·m (35 lb in)



060RY023

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.



Legend

(1) Long type Ignition Coil Assemblies (#1 ~ #5)
(2) Short type Ignition Coil Assembly (#6)

2. Connect battery ground cable.

Spark Plug

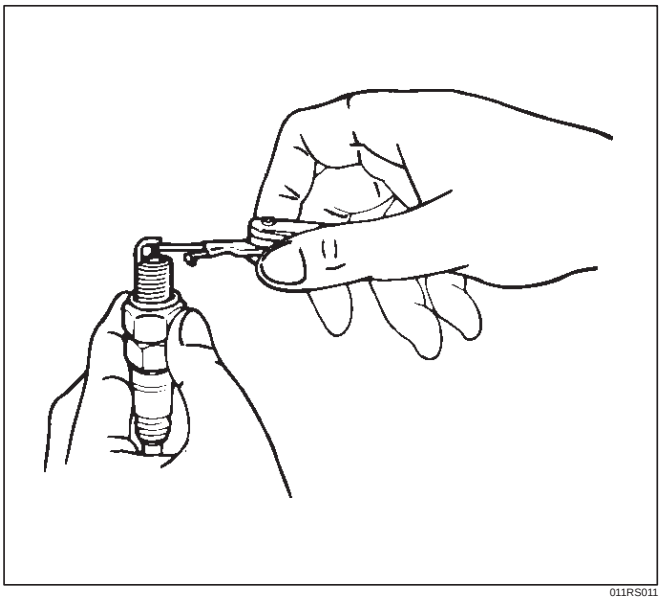
Removal

1. Remove spark plugs.

Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- ▼Check electrode and insulator for presence of cracks, and replace if any.
- ▼Check electrode for wear, and replace if necessary.
- ▼Check gasket for damage, and replace if necessary.
- ▼Measure insulation resistance with an ohmmeter, and replace if faulty.
- ▼Adjust spark plug gap to 1.0 mm – 1.1 mm (0.0394 in – 0.0433 in).



011RS011

NOTE:

- – Do not adjust the spark plugs gap without new spark plugs.
- – Do not damage to tip of spark plugs.
- – Do not cleaning the spark plugs. If require the cleaning it due to heavy dirt, it is allowed only 20 seconds to be used spark plug cleaner.

- ▼Check fuel and electrical systems if spark plug is extremely dirty.
- ▼Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- ▼Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

Possible causes:

- ▼Too rich mixture
- ▼Presence of oil in combustion chamber
- ▼Incorrectly adjusted spark plug gap

Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

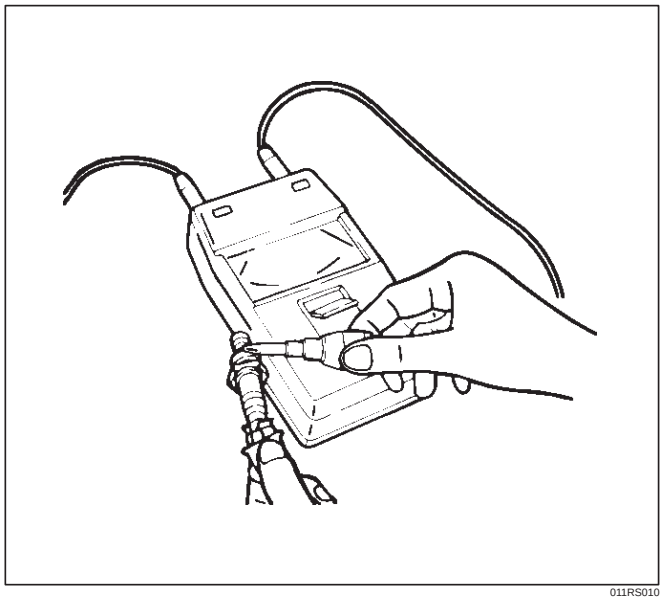
Possible causes:

- ▼Too lean mixture
- ▼Improper heat value

Measuring Insulation Resistance

- ▼Measure insulation resistance using a 500 volt megaohm meter.
- ▼Replace spark plugs if measured value is out of standard.

Insulation resistance: 50 MΩ or more



011RS010

Installation

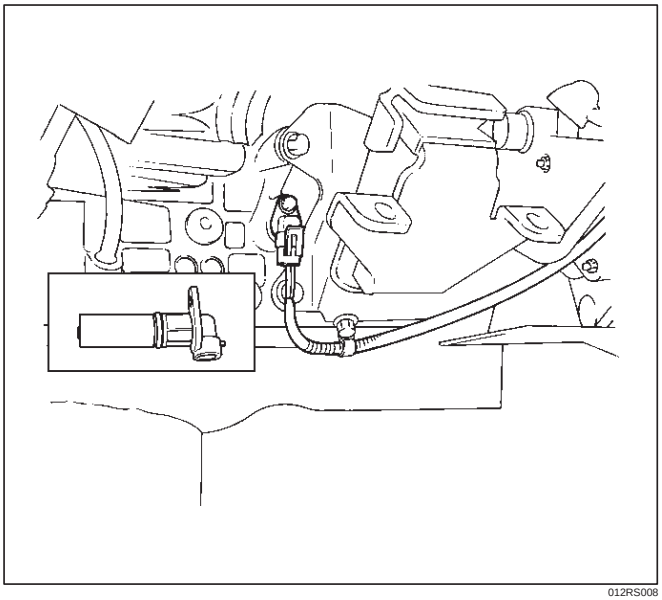
1. Spark plugs
   - ▼Tighten spark plugs to the specified torque.

   Torque: 18 N·m (13 lb ft)

Crankshaft Position Sensor

Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft position sensor.
3. Remove crankshaft position sensor from cylinder block.



012RS008

Installation

1. Install crankshaft position sensor into the cylinder block.

   Before installation,apply small amount of engine oil to the O–ring.

   Torque: 10 N·m (87 lb in)

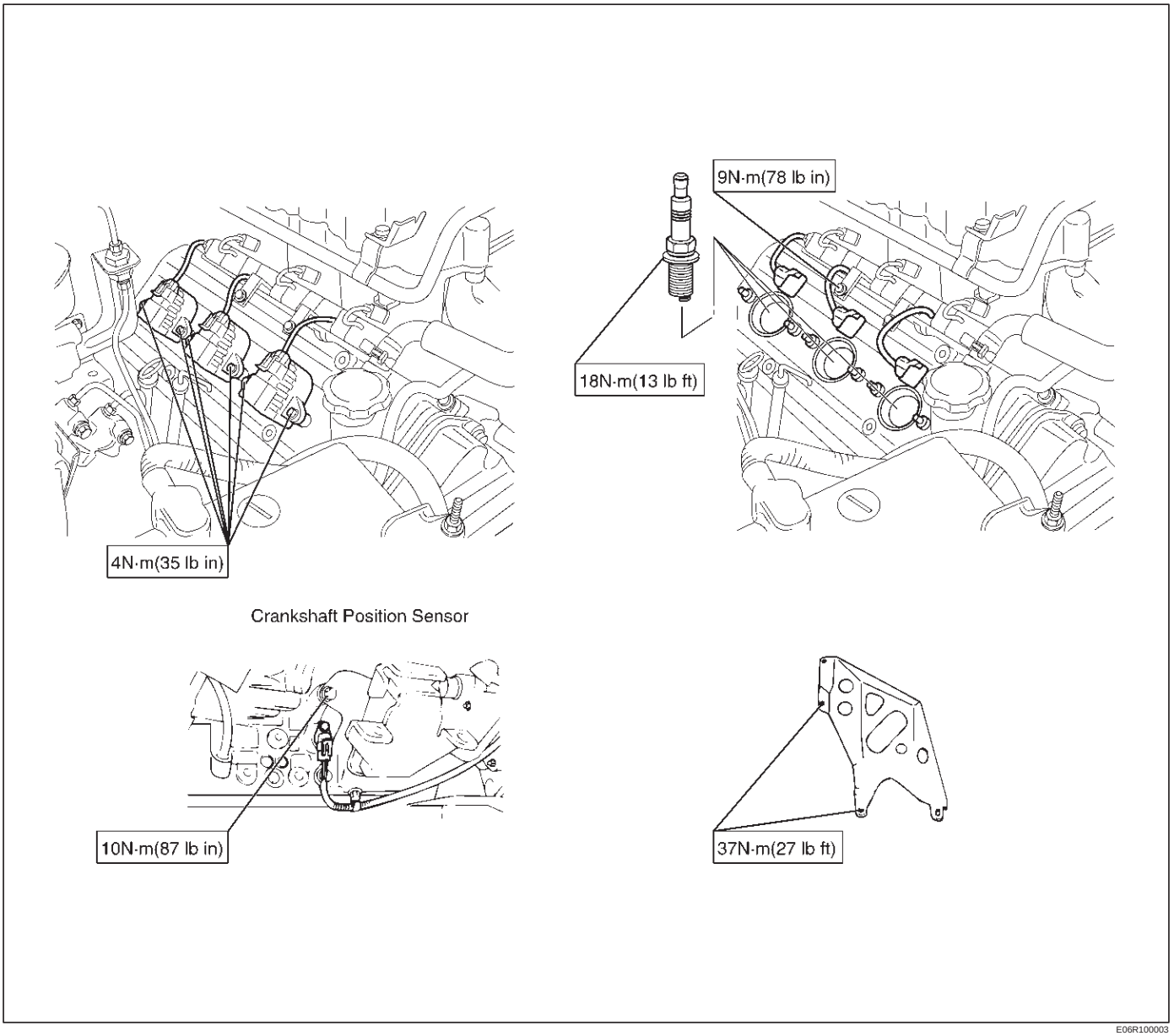
2. Reconnect wiring connector to crankshaft position sensor.

Main Data and Specifications

General Specifications

Ignition System	
Ignition Form	Electronic Ignition System (El system) with Crankshaft position Sensor
Spark Plug	
Type	K16PR–P11 RC10PYP4 PK16PR11
Plug gap	1.0 mm – 1.1 mm (0.0394 in – 0.0433 in)
Torque	18 N·m (13lb ft)

Torque Specifications



E06R100003

AXIOM

ENGINE

STARTING AND CHARGING SYSTEM (6VE1 3.5L)

CONTENTS

Service Precaution 6D3–1
Starting System 6D3–2
General Description 6D3–2
Diagnosis 6D3–4
Starter 6D3–5
Removal 6D3–5
Installation 6D3–5
Disassembled View 6D3–7
Disassembly 6D3–8
Inspection and Repair 6D3–10
Reassembly 6D3–13
Main Data and Specifications 6D3–14
Charging System 6D3–17
General Description 6D3–17
General On–Vehicle Inspection 6D3–17
Generator 6D3–18
Removal 6D3–18
Inspection 6D3–18
Installation 6D3–19
Disassembled View 6D3–19
Disassembly 6D3–20
Inspection and Repair 6D3–21
Reassembly 6D3–23
Bench Test 6D3–24
Main Data and Specifications 6D3–25

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Starting System

General Description

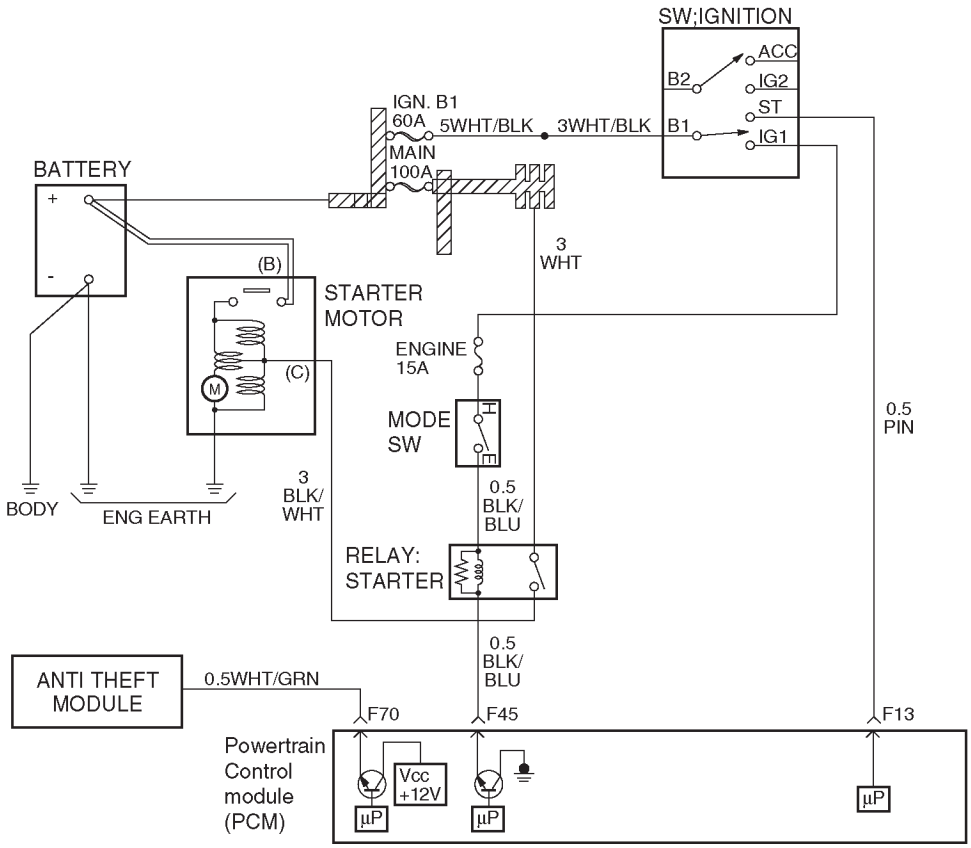
Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.


SW;IGNITION
ACC
B2
IG2
ST
B1
IG1
IGN. B1
60A
5WHT/BLK
3WHT/BLK
MAIN
100A
BATTERY
+
-
(B)
STARTER
MOTOR
(C)
M
3
WHT
ENGINE
15A
MODE
SW
H
L
0.5
PIN
BODY
ENG EARTH
3
BLK/
WHT
0.5
BLK/
BLU
RELAY:
STARTER
0.5
BLK/
BLU
ANTI THEFT
MODULE
0.5WHT/GRN
F70
F45
F13
Powertrain
Control
module
(PCM)
Vcc
+12V
µP
µP
µP

060R200062

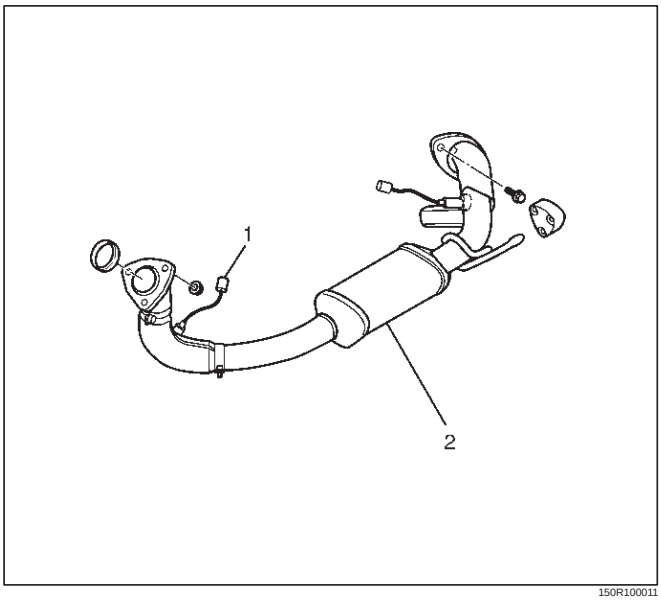
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter relay failure	Replace
	Starter failure	Repair or replace starter

Starter

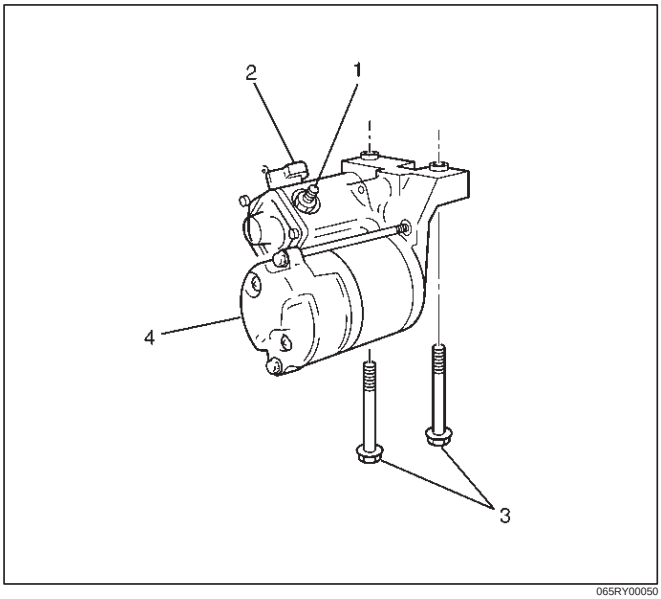
Removal

1. Battery ground cable.
2. Disconnect Heated O_2 Sensor connector (1).
3. Remove exhaust front left pipe(2).



150R100011

4. Disconnect starter wiring connector from terminals “30” (1) and “50” (2).
5. Remove starter assembly mounting bolts on inside and outside(3).
6. Remove starter assembly (4) toward the bottom of engine.



065RY00050

Legend

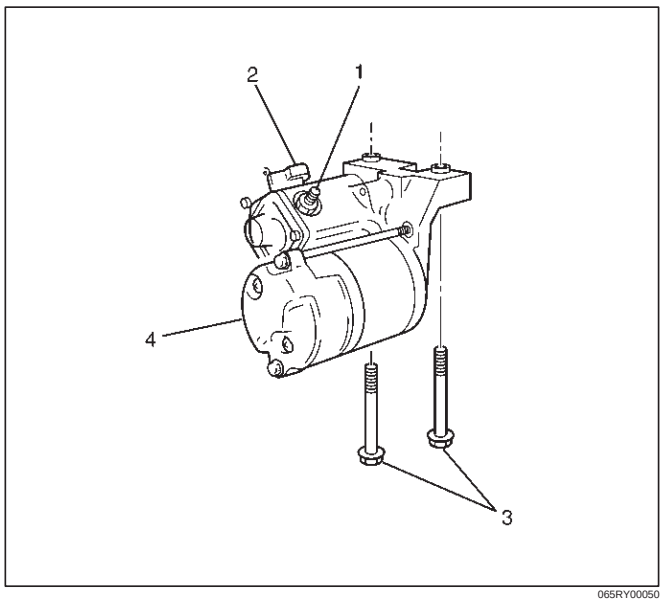
(1) Terminal “30”
(2) Terminal “50”
(3) Fixing Bolts
(4) Starter Assembly

Installation

1. Install starter assembly(4).
2. Install mounting bolts and tighten bolts to specified torque(3).

   Torque: 40 N·m (30 lb ft)
3. Reconnect the connectors to terminals “50” (2) tighten terminals “30” (1) to specified torque.

   Torque: 9 N·m (78 lb in)



065RY00050

Legend

(1) Terminal “30”
(2) Terminal “50”
(3) Fixing Bolts
(4) Starter Assembly

4. Install exhaust front left pipe (2) and tighten bolts and nuts to specified torque.

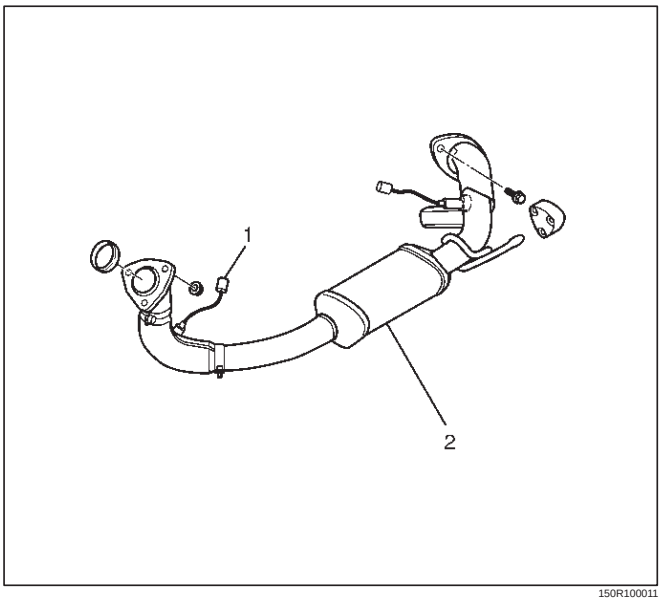
   Stud Nuts

   Torque: 67 N·m (49 lb ft)

   Bolts

   Torque: 43 N·m (32 lb ft)

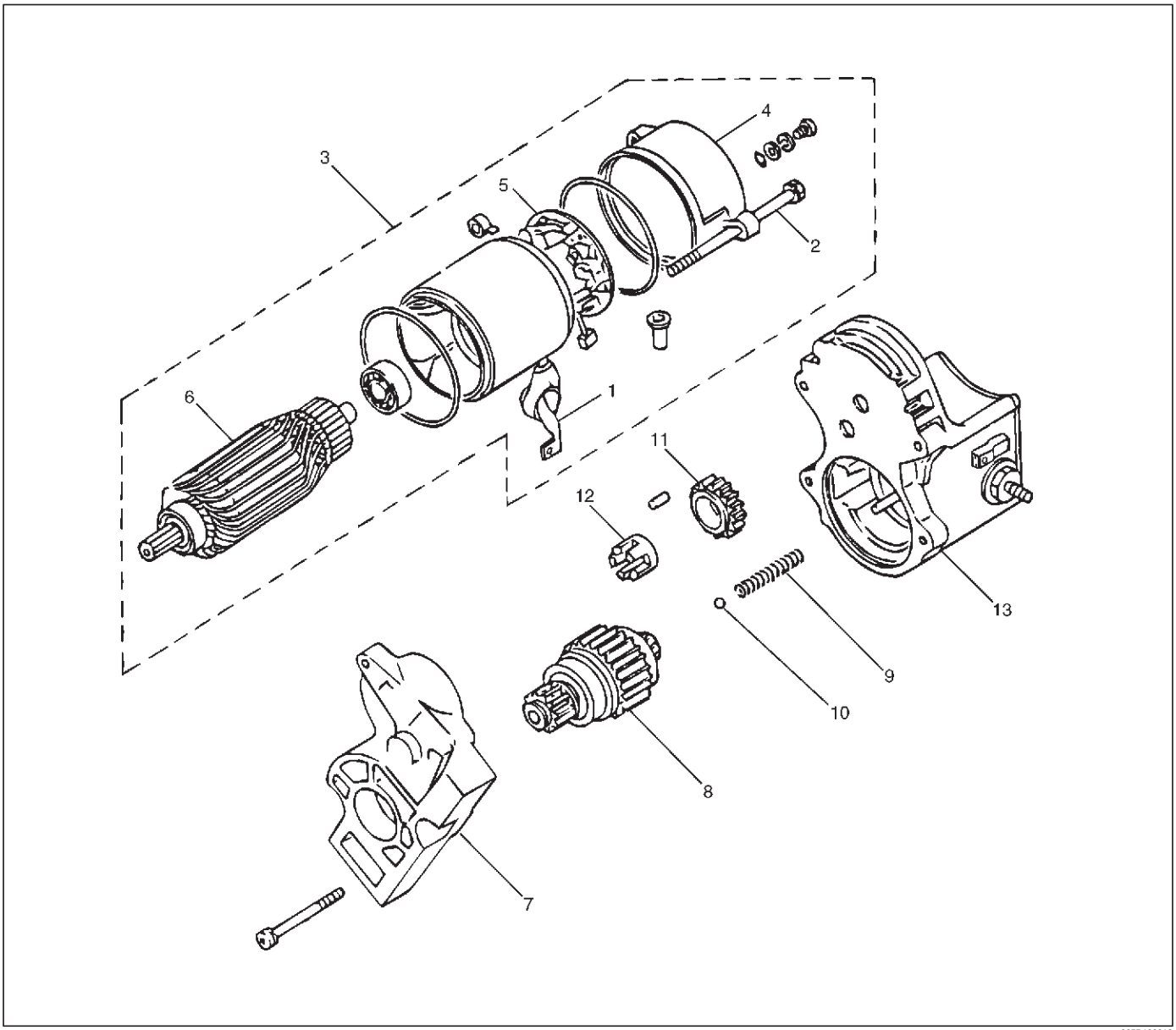
5. Connect two Heated O_2 Sensor connector (1).



150R100011

6. Reconnect the battery ground cable.

Disassembled View



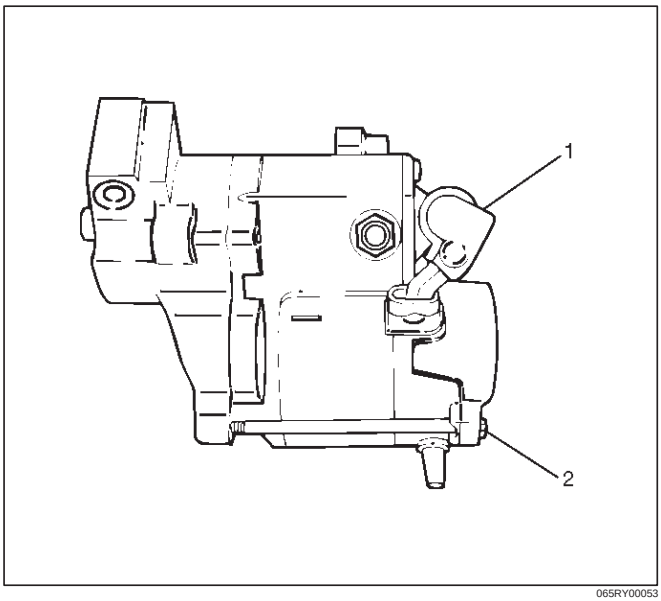
065R100012

Legend

(1) Lead Wire
(2) Through Bolt
(3) Yoke Assembly
(4) Yoke Cover
(5) Brush and Brush Holder
(6) Armature
(7) Housing
(8) Over Running Clutch
(9) Return Spring
(10) Steel Ball
(11) Idle Pinion
(12) Retainer
(13) Magnetic Switch

Disassembly

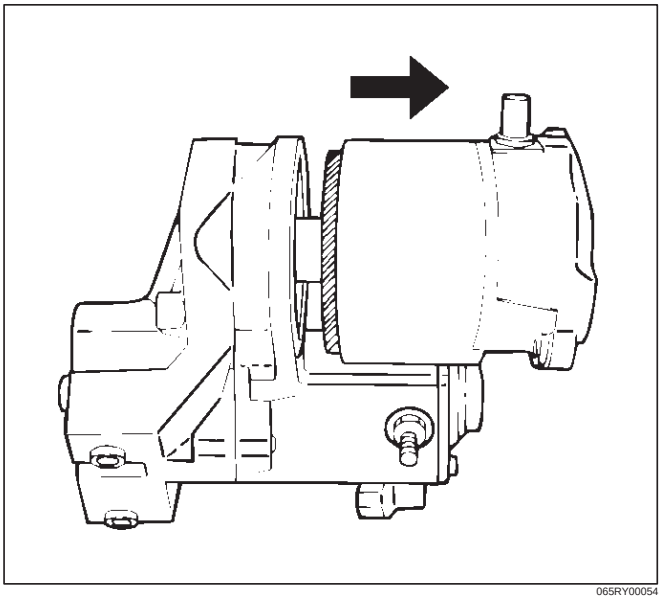
1. Remove the lead wire (1) from the magnetic switch.
2. Remove the through bolts (2).



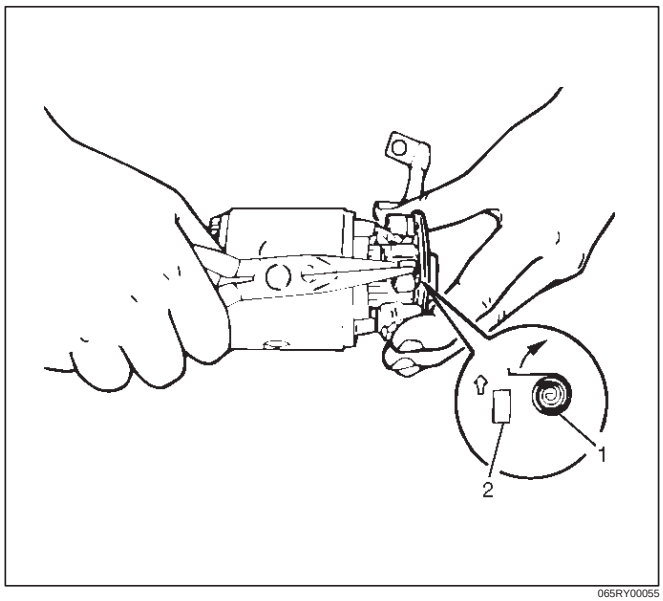
065RY00053

Legend
(1) Lead Wire
(2) Through Bolt

3. Remove the yoke from the magnetic.
4. Remove the yoke cover.
5. Use the long nose pliers to remove the brush and brush holder.



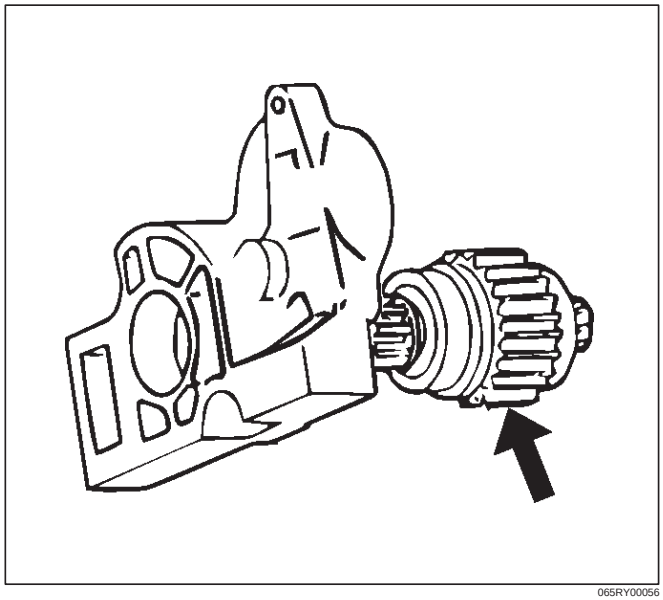
065RY00054



065RY00055

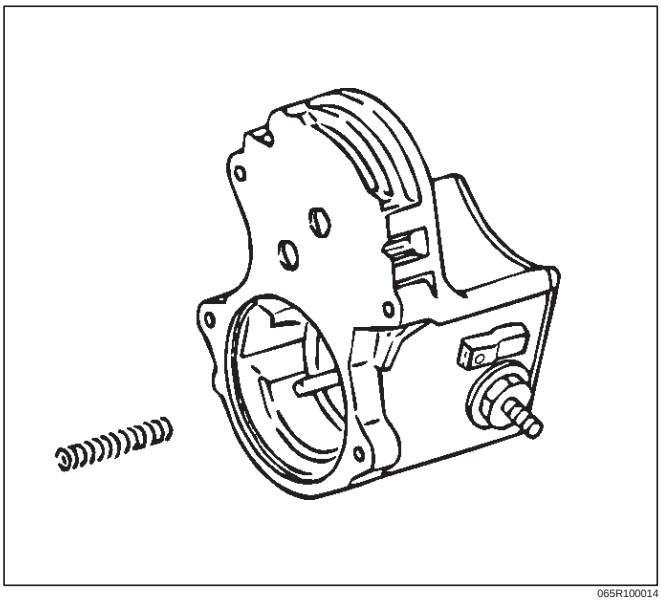
Legend
(1) Spring
(2) Brush

6. Remove the armature.
7. Remove the housing.
8. Remove the overrunning clutch from the housing.



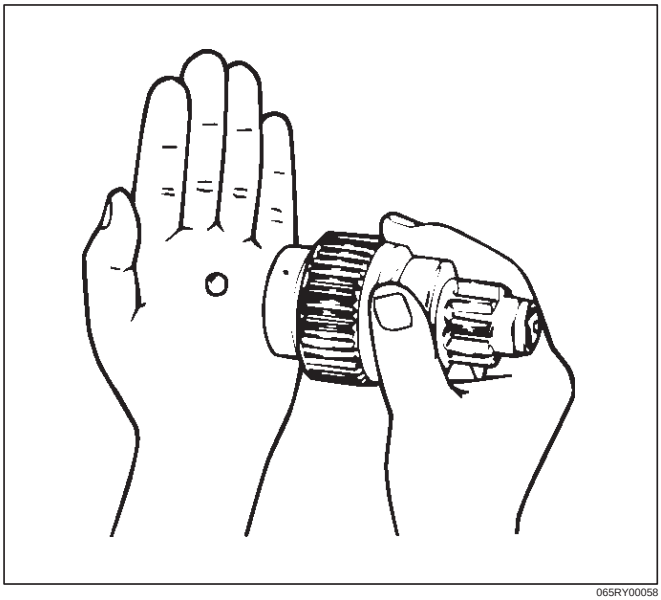
065RY00056

9. Remove the return spring from the magnetic switch.



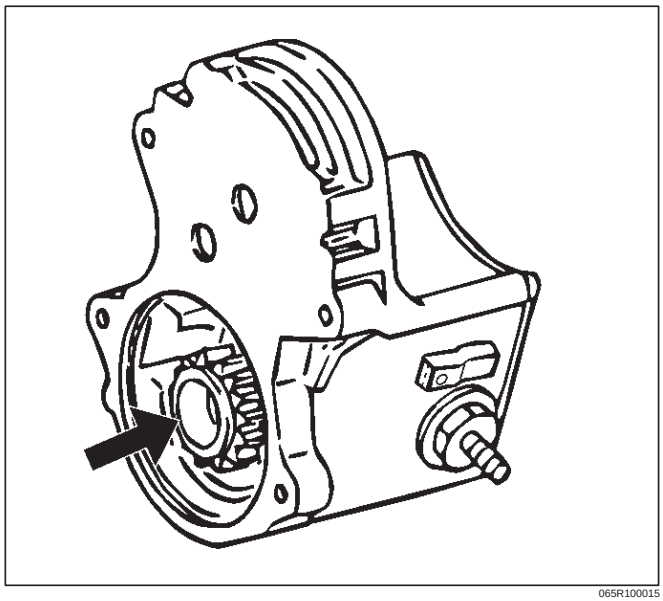
065R100014

10. Remove the steel ball from the overrunning clutch.



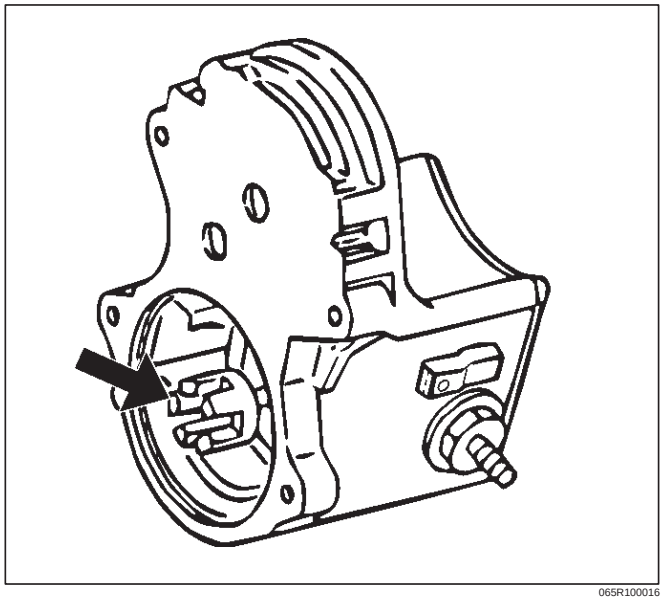
065RY00058

11. Remove the idle pinion from the magnetic switch.



065R100015

12. Remove the retainer from the magnetic switch.



065R100016

13. Remove the magnetic switch.

Inspection and Repair

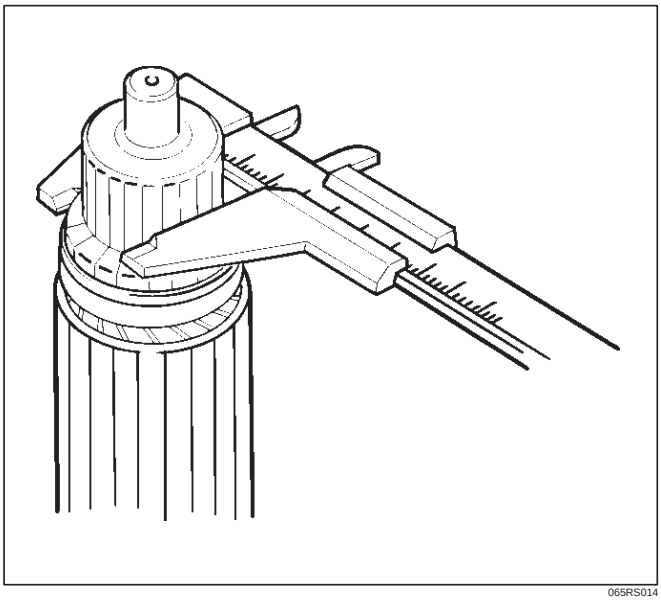
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

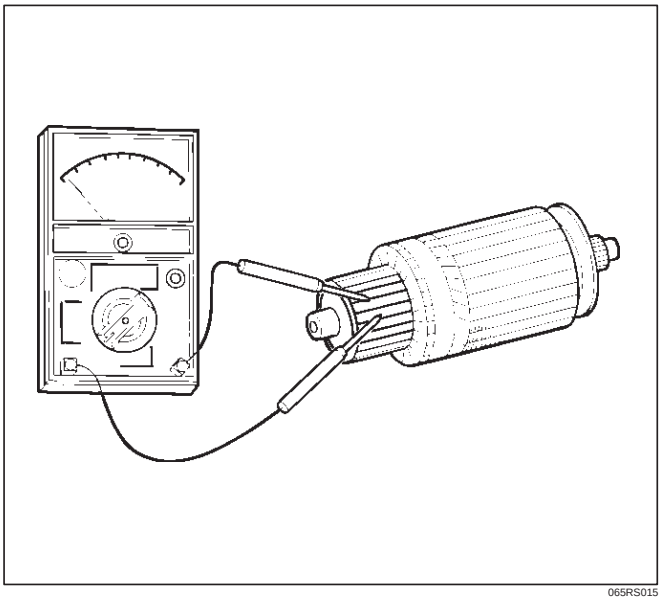
Standard: 30 mm (1.1811 in)

Limit: 29 mm (1.1417 in)



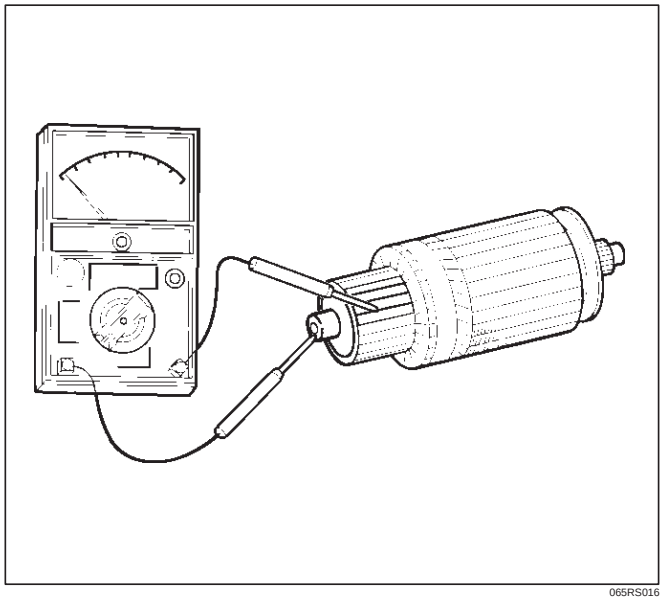
065RS014

Check for continuity between segment and segment on the commutator. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

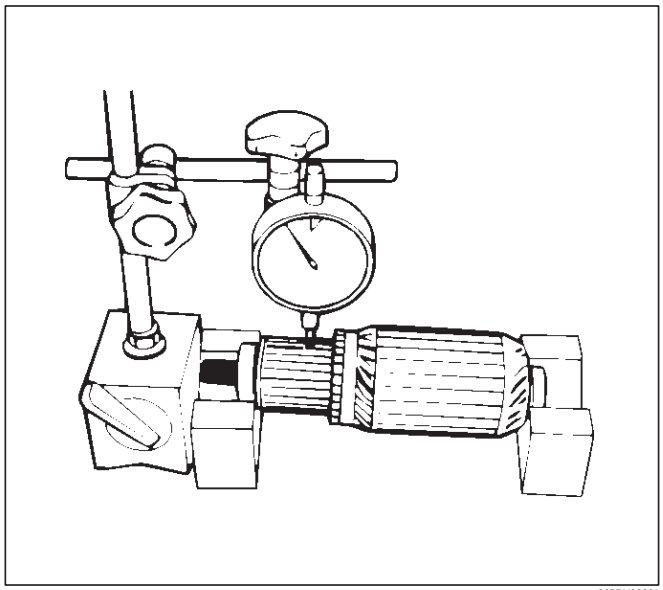
Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

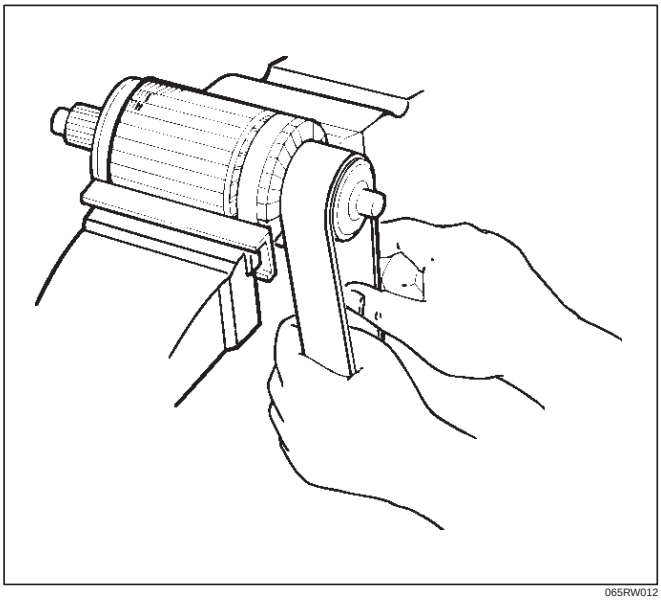
Measure runout of the commutator with a dial gauge. Repair or replace, if it exceeds the limit.

Limit: 0.4 mm (0.0157 in)



065RY00061

Polish the commutator surface with sandpaper #500 to #600 if it is rough.

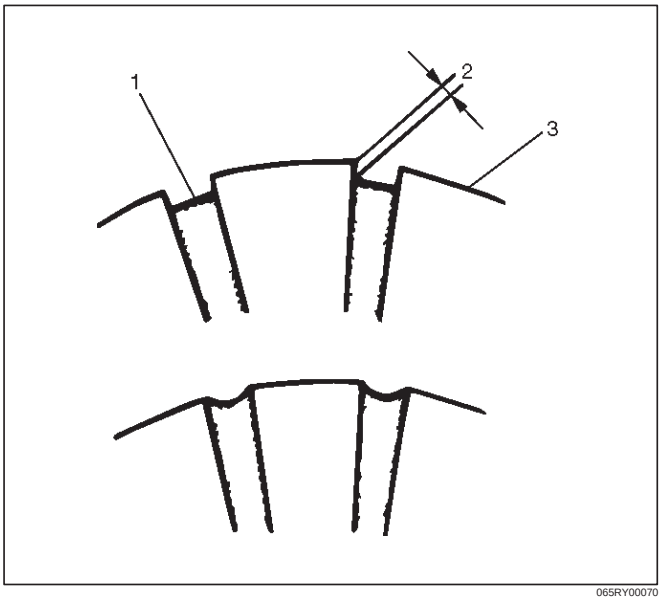


065RW012

Measure the depth of insulator in commutator. Replace, if it is below the limit.

Standard: 0.45 mm to 0.75 mm (0.0177 in to 0.0295 in)

Limit: 0.2 mm (0.008 in)



065RY00070

Legend

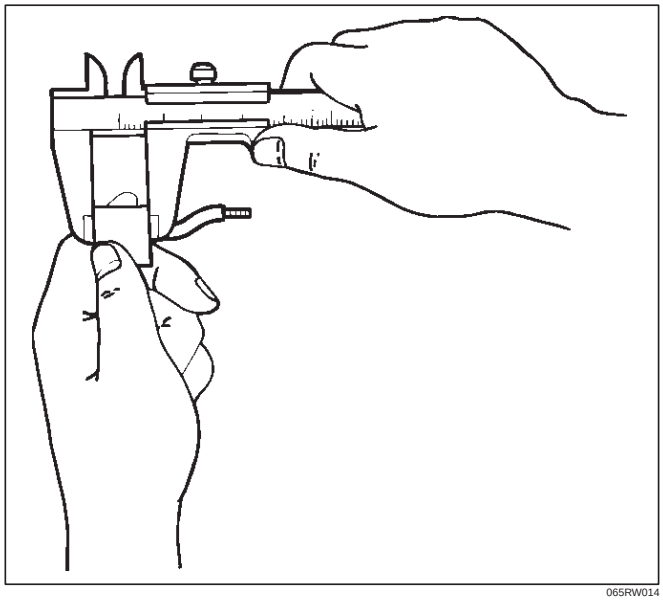
(1) Insulator
(2) Depth of Insulator
(3) Commutator Segments

Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

Standard: 15 mm (0.5906 in)

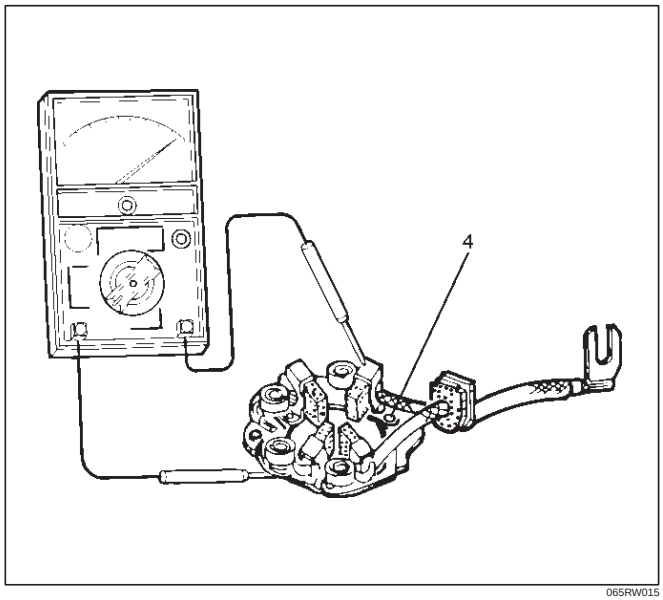
Limit: 11 mm (0.43 in)



065RW014

Brush Holder

Check for continuity between brush holder (+) (4) and base (–). Replace, if there is continuity (i.e., insulation is broken).



065RW015

Brush Spring

Use spring balancer to measure the spring setting force when remove the spring from the brush.

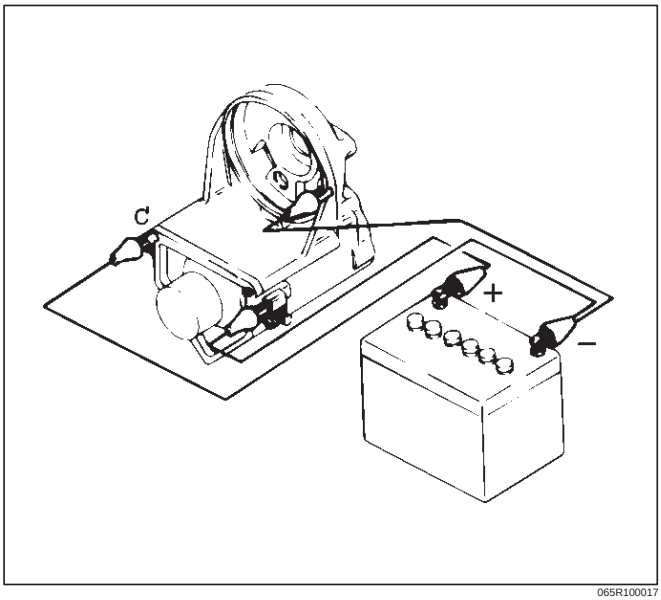
Standard: 17.65–23.54 N (38.9–51.9 lb)

Limit: 11.77 N (25.9 lb)

Magnetic Switch

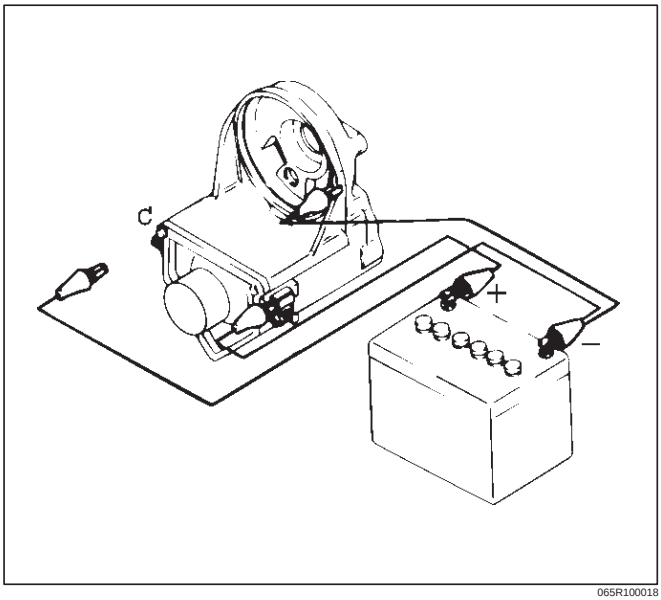
Temporarilly connect the magnetic switch between the overrunning clutch and housing.
Perform the steps described below in 3 to 5 seconds.

1. Pull in test
   Connect the ground (–) to terminal C and magnetic switch body.
   Verify that the pinion pulls out when the battery (+) pole is connected to terminal 50.



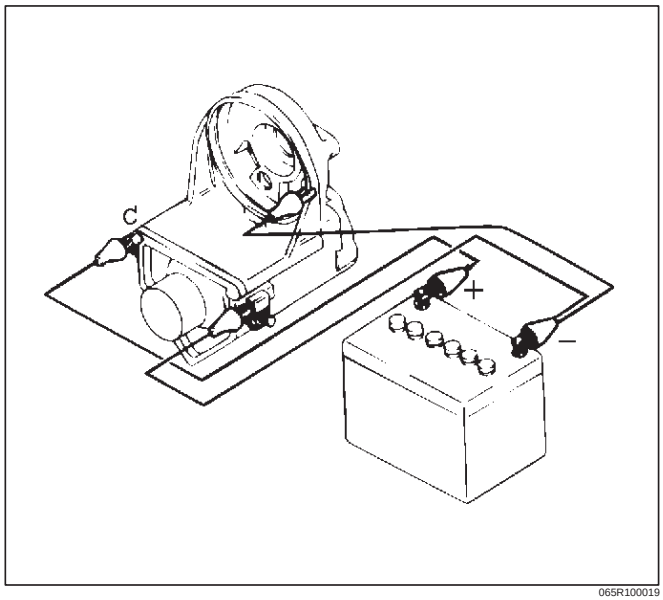
065R100017

2. Hold in test
   Observe that the pinion stays when the lead wire is disconnected from terminal C.



065R100018

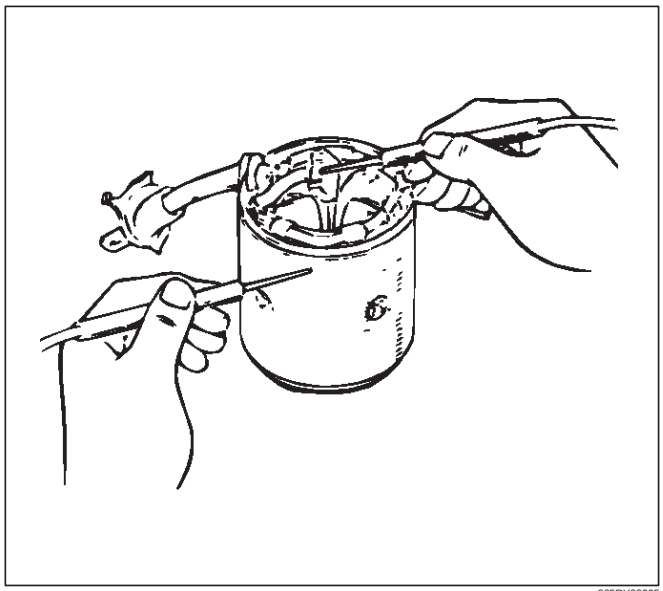
3. Return test
   Connect the ground (–) to terminal 50 and magnetic switch body.
   Verify that the pinion pulls out when the battery (+) pole is connected to terminal C and the pinion pulls away when the lead wire is disconnected from terminal 50.



065R100019

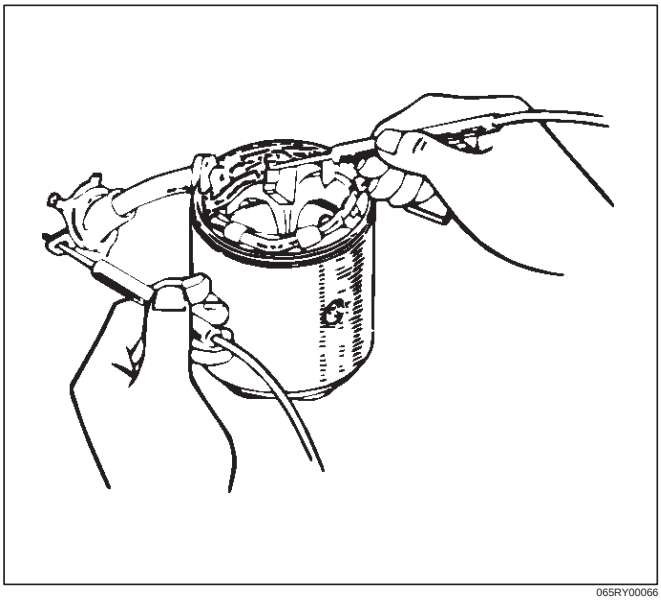
Field Coil

1. Check for continuity between the end of the field coil and yoke body.
   Replace the field coil, if there is continuity.



065RY00065

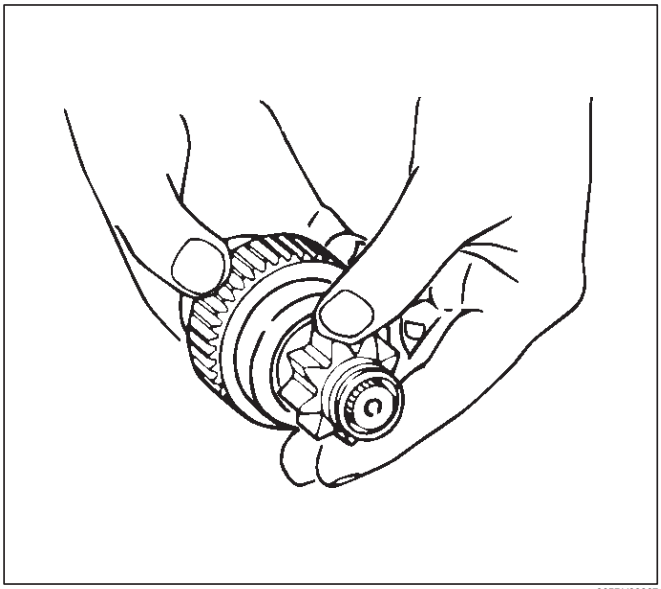
2. Check continuity between the lead wire of terminal C and brush.
   Replace the yoke assembly, if there is no continuity.



065RY00066

Overrunning Clutch

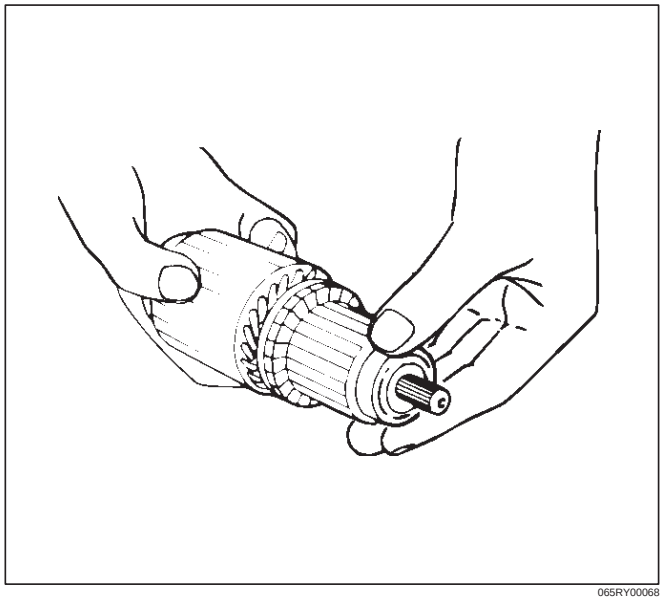
1. Visual check for excessive wear or damage.
2. Test the pinion rotation, it must rotate smoothly when rotated clockwise and it shouldn't rotate when turned counterclockwise.



065RY00067

Bearing

1. Inspect excessive wear or damage.
   Replace the bearing if an abnormal noise is heard under normal operating condition.



065RY00068

Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

Grease application places

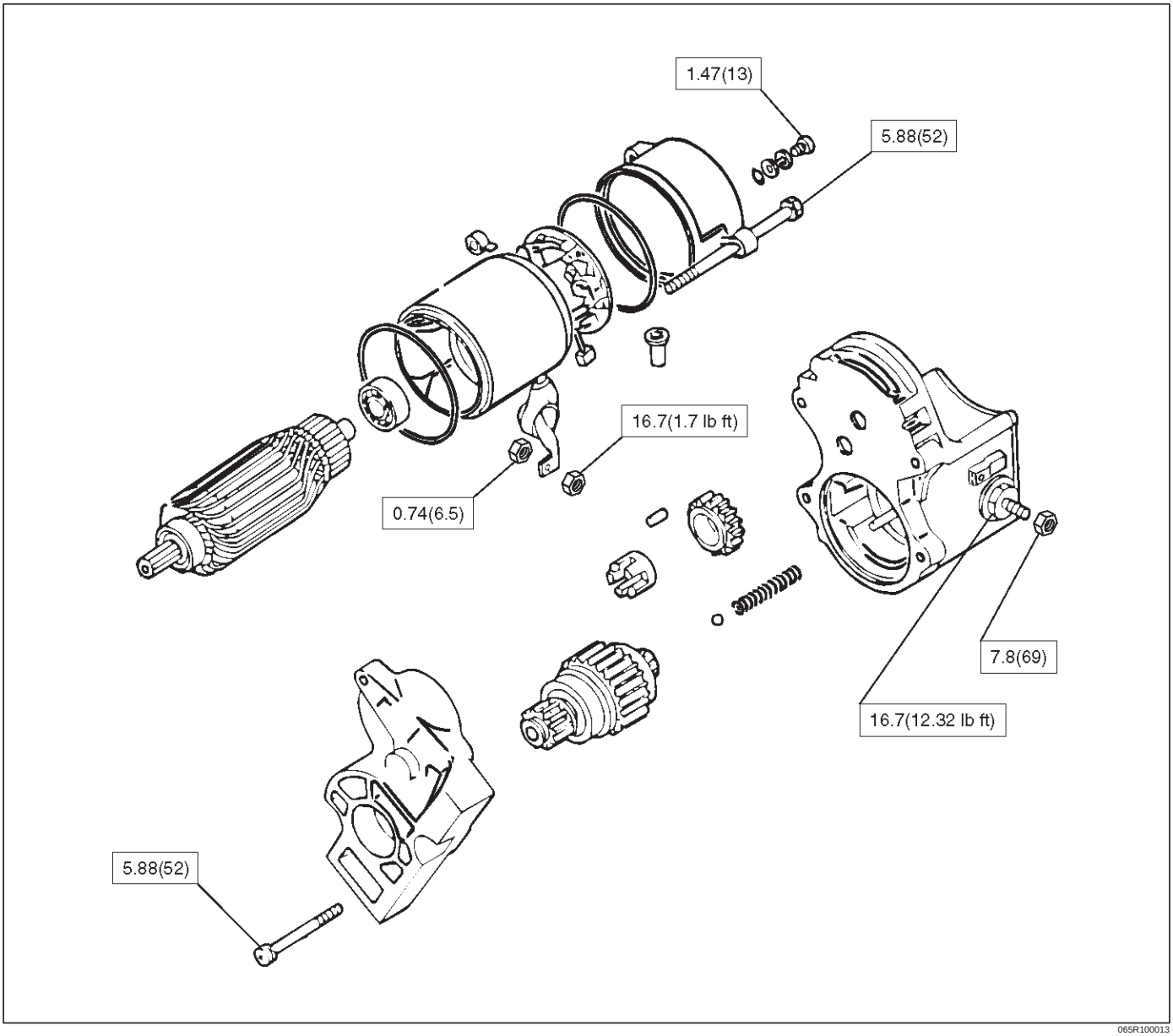
- ▼Bearing in rear cover
- ▼Gears in reduction gear
- ▼Sliding portion of pinion

Main Data and Specifications

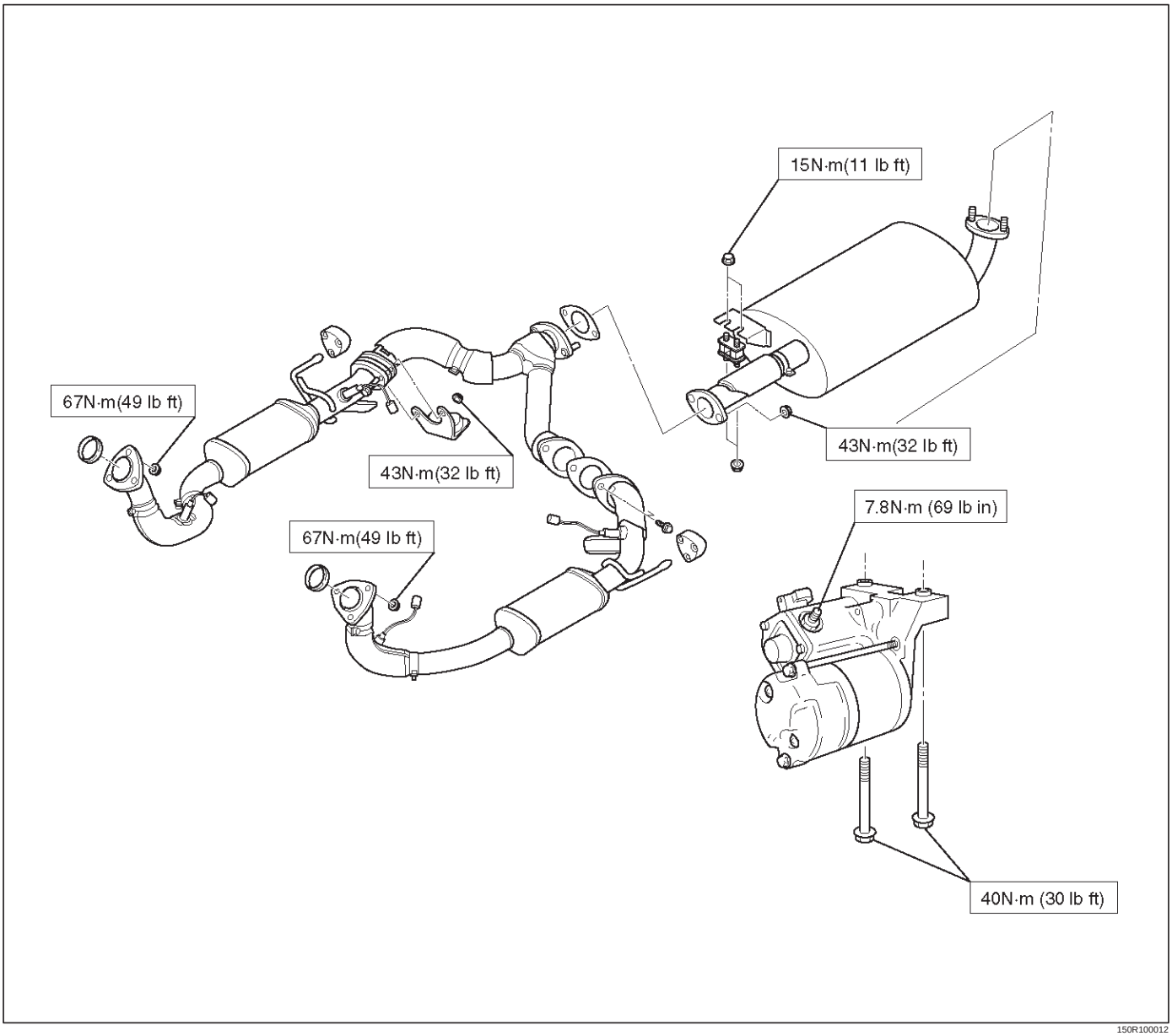
General Specifications

Model	Specification
Rating	
Voltage	12 V
Output	1.4 Kw
Time	30 sec
Number of teeth of pinion	9
Rotating direction(as viewed from pinion)	Clockwise
Weight(approx.)	37 N
No–load characteristics	
Condition: Voltage	11.5V
Current	90A or less
Speed	3000rpm or more
Load characteristics	
Condition: Voltage/Torque	8.5V/13.2 N·m (113 lb in)
Current	Maximum 350A
Speed	1000rpm or more
Locking characteristics	
Condition: Voltage	2.4V
Current	Maximum 500A
Torque	11.8N·m or more

Torque Specifications



065R100013


15N·m(11 lb ft)
67N·m(49 lb ft)
43N·m(32 lb ft)
43N·m(32 lb ft)
67N·m(49 lb ft)
7.8N·m (69 lb in)
40N·m (30 lb ft)

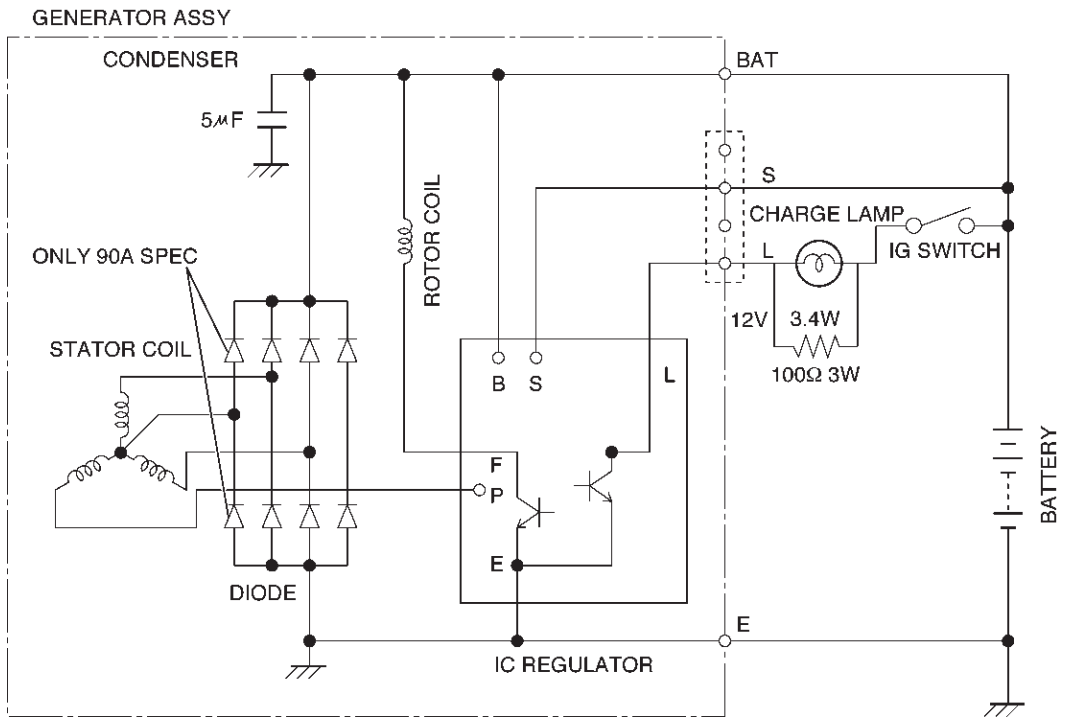
150R100012

Charging System

General Description

The IC integral regulator charging system and its main components are connected as shown in illustration.
The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.
The generator does not require particular maintenance such as voltage adjustment.

The rectifier connected to the stator coil has diodes to transform AC voltage into DC voltage.
This DC voltage is connected to the output terminal of generator.



F06RX002

General On–Vehicle Inspection

A basic wiring diagram is shown in the illustration. When operating normally, the indicator bulb will come on when the switch is turned on, and will then go out when the engine starts. If the indicator operates abnormally, or if an undercharged or overcharged battery condition occurs, the following procedure may be used to diagnose the charging system. Remember that an undercharged battery is often caused by accessories being left on overnight, or by a defective switch which allows a bulb, such as a trunk or glove box light, to stay on.

Observe the following procedure:

1. Visually check belt and wiring.
2. Go to step 5. for vehicles without charge indicator light.
3. Switch on, engine stopped, light should be on. If not, detach harness at generator, ground “L” terminal lead.
   a. Lamp lights, replace or repair generator.
   b. Lamp dose not light, locate open circuit between grounding lead and ignition switch. Bulb may be open.
4. Switch on, engine running at moderate speed. Light should be off. If not, detach wiring harness at generator.
   a. If light goes off, replace or repair generator.
   b. If light stays on, check for grounded “L” terminal wire in harness.
5. Battery undercharged or overcharged.
   a. Detach wiring harness connector from generator.
   b. With switch on, engine not running connect voltmeter from ground to “L” terminal in wiring harness, and to “IG” terminal. If used. Wiring harness may connect to either “L” or “IG” or both.
   c. Zero reading indicates open circuit between terminal and battery. Connect as required.

d. Re-connect harness connector to generator, run engine at moderate speed, with electrical accessories turned off.

e. Measure voltage across battery. If above 16.0V, replace or repair generator.

f. Connect ammeter at generator output terminal. Turn on accessories, load battery with carbon pile to obtain maximum amperes output.

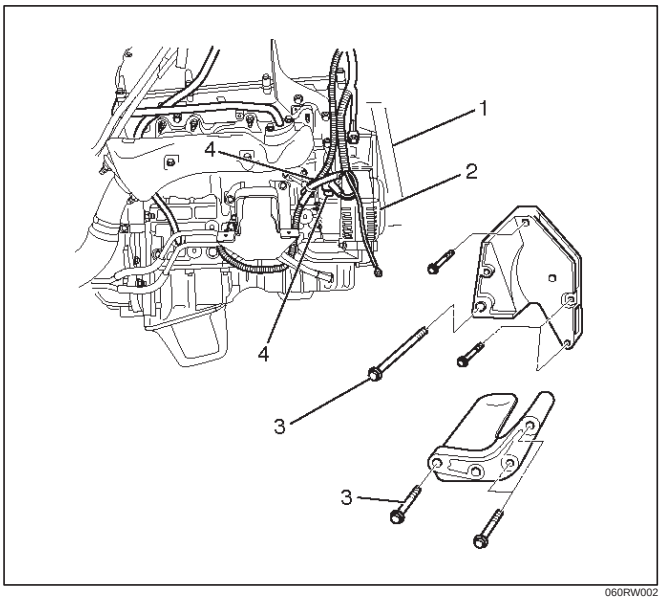
Maintain voltage at 13.0V or above.

1. If within 15 amperes of rated output, generator is OK.
2. If not within 15 amperes of rated output, replace or repair generator.

Generator

Removal

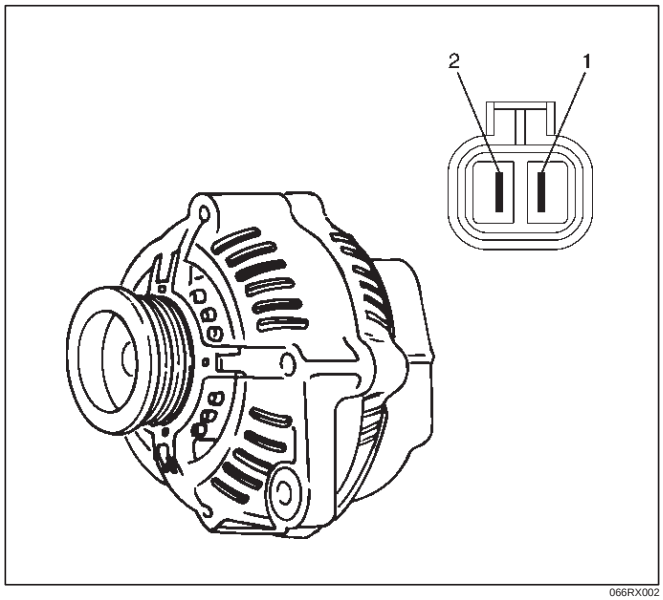
1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal “B” and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



060RW002

Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to “on” and connect a voltmeter between connector terminal L (1) and ground or between terminal S (2) and ground.



066RX002

If there is no voltage present, then perform appropriate repair.

3. Reconnect the wiring connector to the generator, run the engine at must indicate idle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., headlights). At this time the amperes must not be less than 15A and the voltage must not be less than 13V.

Installation

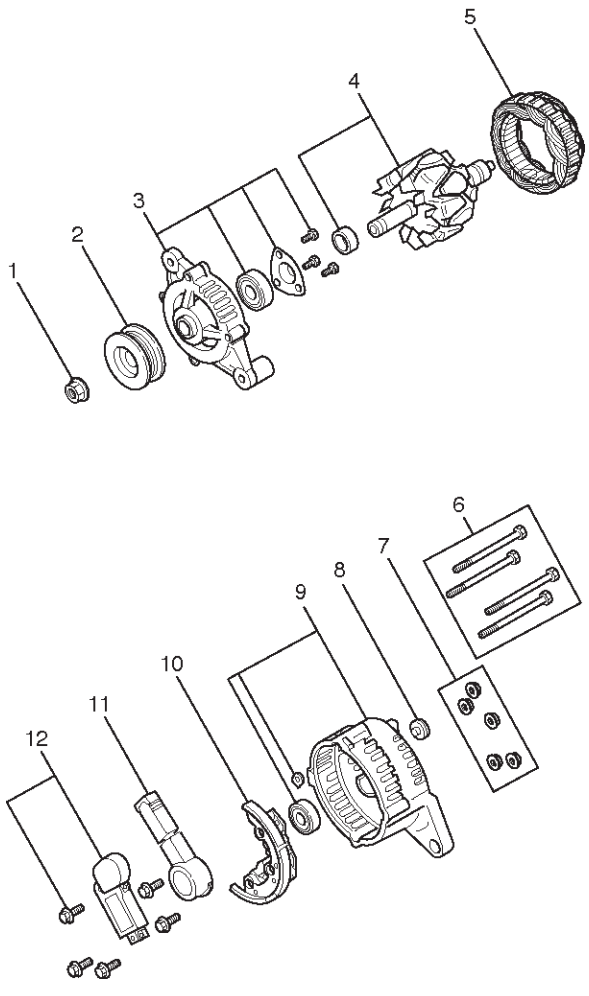
1. Install generator assembly to the position.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

   Torque:

   M10 bolt: 41 N·m (30 lb ft)

   M8 bolt: 21 N·m (15 lb ft)
3. Connect wiring harness connector and direct terminal "B".
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

Disassembled View



066RW022

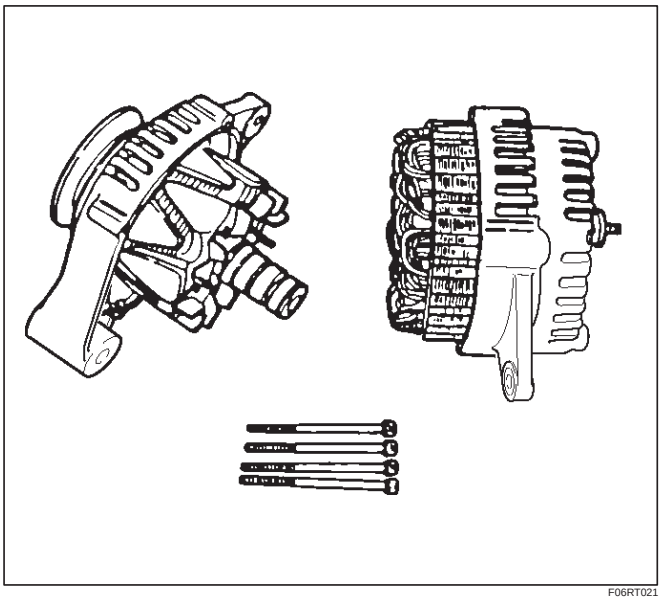
Legend

(1) Pulley Nut
(2) Pulley
(3) Front Cover Assembly
(4) Rotor Assembly
(5) Stator Assembly
(6) Through Bolt
(7) Nut
(8) Terminal Insulator
(9) Rear Cover Assembly
(10) Rectifier
(11) Brush Holder Assembly
(12) Regulator Assembly

Disassembly

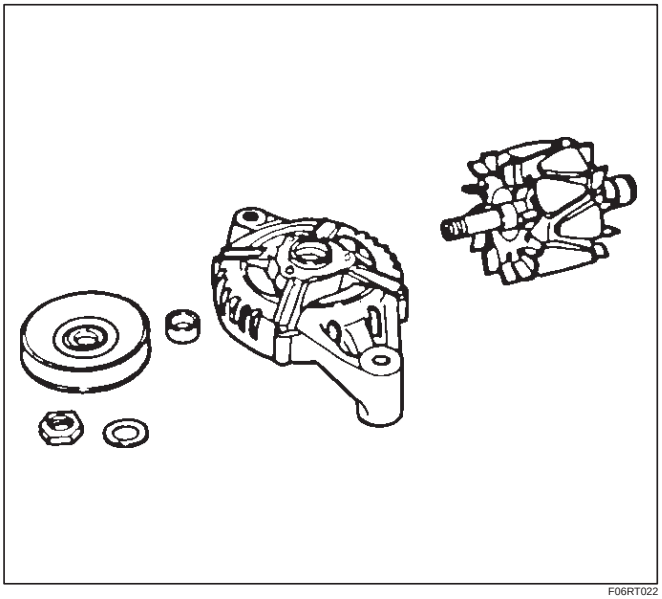
1. Remove the through bolt.
   Insert the tip of a pry bar into the gaps between the front cover and the stator core.
   Pry apart and separate the front cover, rotor, the rear cover and stator.

NOTE: Take care not to scratch or otherwise damage the stator coil with pry bar.



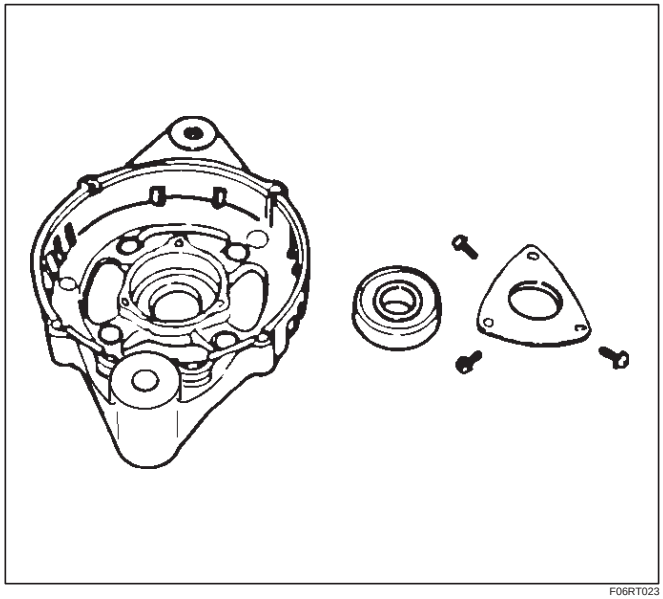
F06RT021

2. Clamp the rotor in a vise and then remove the nut and pulley.
3. Remove the rotor assembly from the front cover.



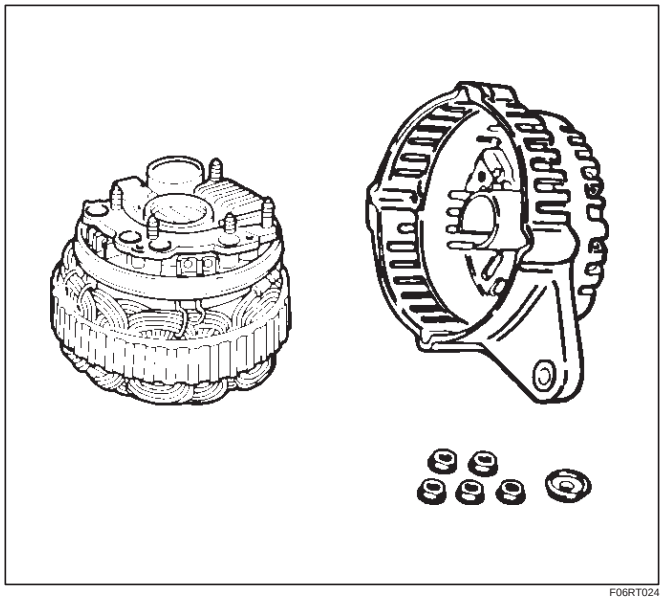
F06RT022

4. Remove the screws with bearing retainer from front cover and remove bearing.



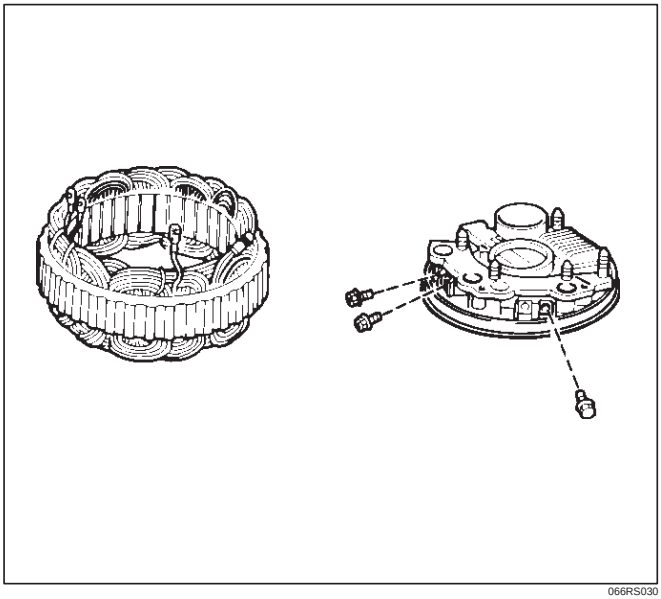
F06RT023

5. Remove the mounting nuts holding the “B” terminal, the diode, and the brush holder.
6. Separate the rear cover from the stator.



F06RT024

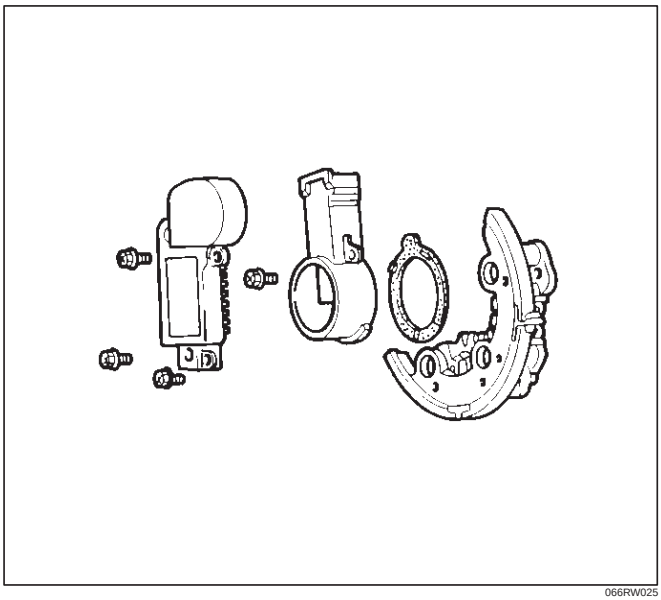
7. Remove bolts which secure stator terminal to rectifier terminal, and remove stator.



066RS030

8. Remove Bolts which secure regulator, rectifier and brush-holder, and separate these parts.

NOTE: Do not apply a shock or load to regulator, rectifier and brush holder.



066RW025

Inspection and Repair

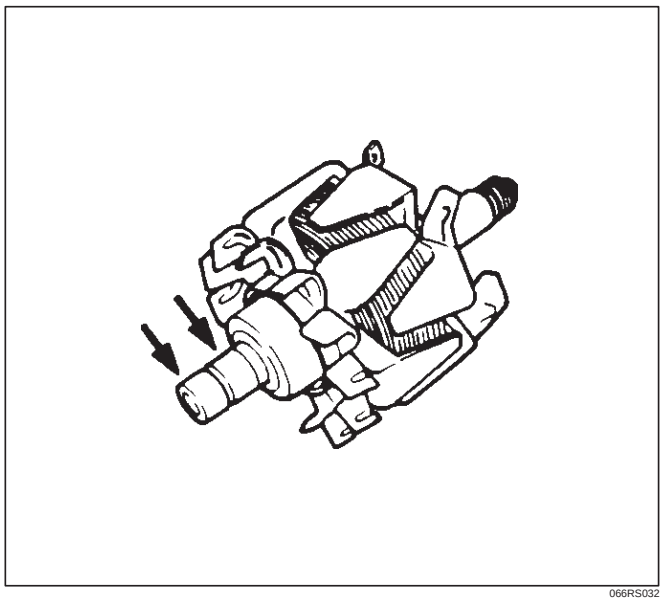
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Rotor Assembly

1. Check the face of the slip rings for contamination and roughness. If found to be scored, dress with a fine sandpaper (#500 –600). If found to be contaminated, clean with a cloth saturated with alcohol.
2. Measure the outside diameter of the slip rings.

   Standard: 27mm (1.06in)

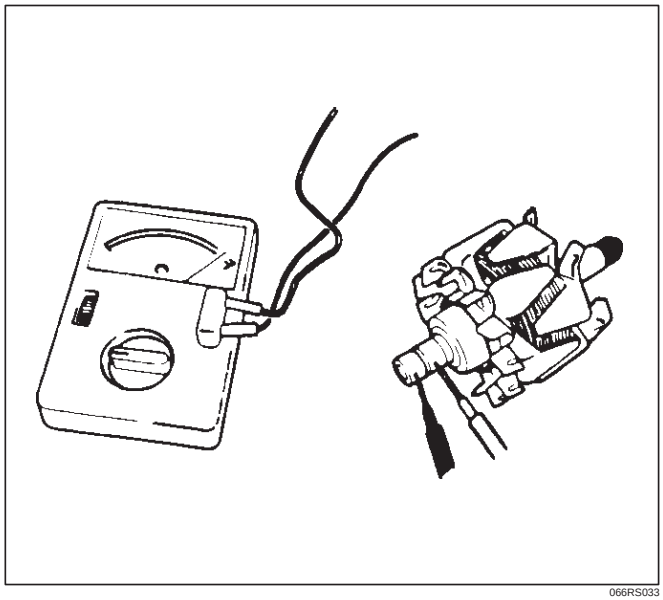
   Limit: 26mm (1.02in)



066RS032

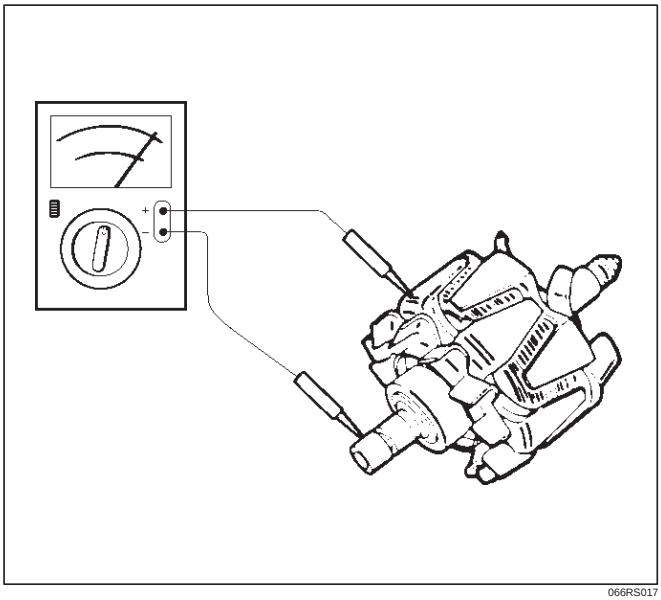
3. Check resistance between slip rings, and replace if there is no continuity.

   Standard: 3.75Ω or less



066RS033

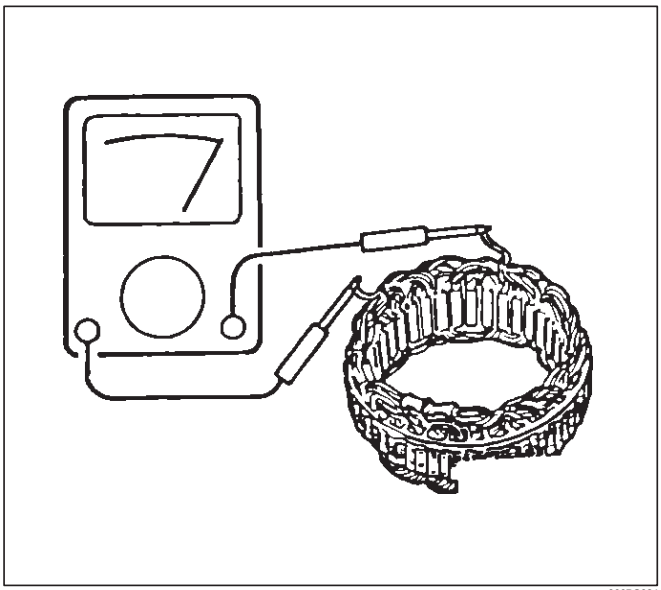
4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.



066RS017

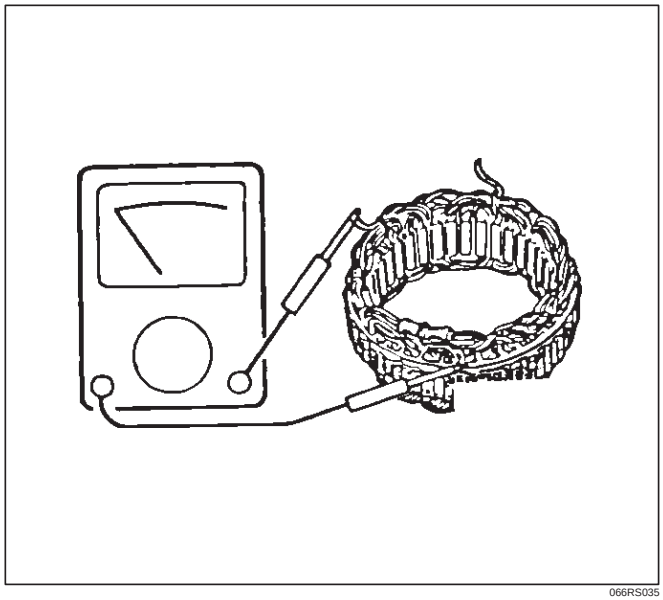
Stator Coil

1. Check for continuity across the stator coils. If no continuity exists, replace the coils.
   Resistance value at 20˚C.
   Standard: Approx. 0.07Ω



066RS034

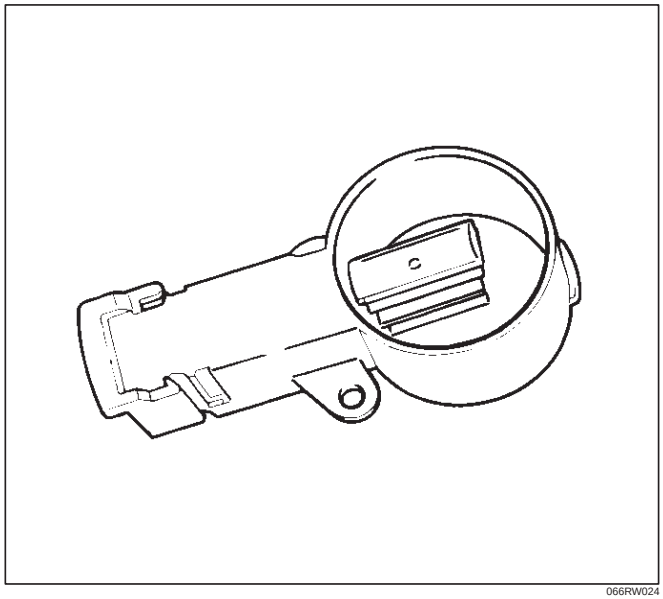
2. Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.
   Standard: More than 1MΩ



066RS035

Brush

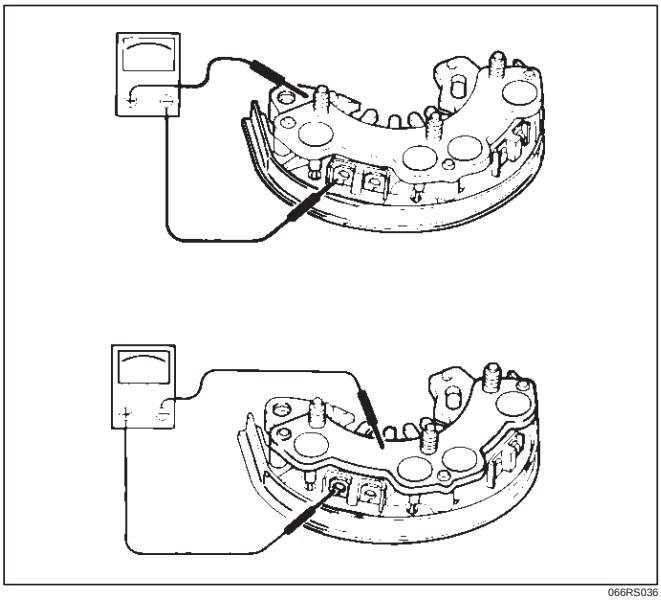
Measure the brush length.
Replace the brush if it exceeds the limit.
Standard: 18.0mm (0.709in)
Limit: 5.5mm (0.217in)



066RW024

Rectifier Assembly

1. Measure the resistance between each diode terminal and aluminum diode fin in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
2. If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.



066RS036

IC Regulator Assembly

Connect a variable resistor, two 12V batteries, a fixed resistor, and a voltmeter to the IC regulator as shown in illustration.

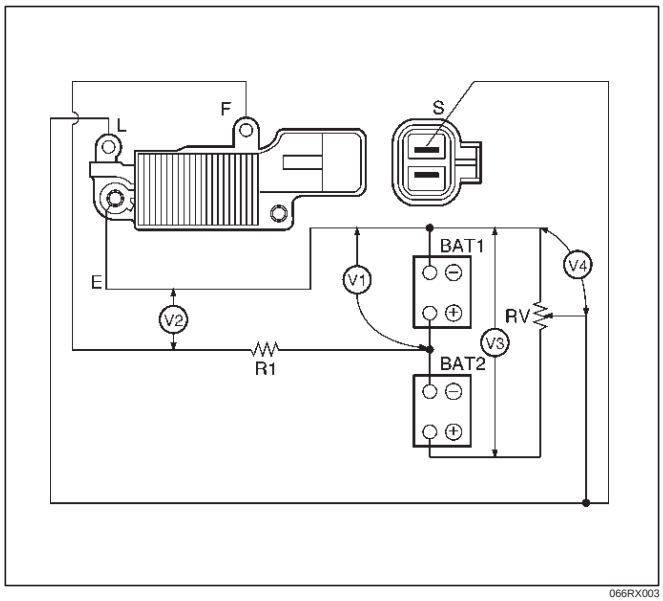
a. Measuring equipment specifications

1. Fixed resistor (R1) : 10 Ohms /3W
2. Variable resistor (Rv) : 0-300 Ohms/12W
3. Batteries (BAT1, BAT2) : 12V (2 Batteries)
4. DC voltmeter : 0-50V/0.5 steps (4 Check points)

b. Measuring procedure

1. Measure the voltage “V1” across the first battery (BAT1). If the reading is between 10 and 13 volts, the battery is normal.
2. Measure the voltage “V3” across both the batteries (BAT1, BAT2). If the reading is between 20 and 26 bolts, the batteries are normal.
3. Gradually increase the resistance of the variable resistor from zero. Measure the voltage “V2” (the voltage across the F and E terminals).

   Check to see that the voltage across “V1” changes at this time. If there is no change, the voltage regulator is faulty and must be replaced.
4. Measure the voltage at “V4” (the voltage across the variable resistor center tap and terminal E with the variable resistor resistance held constant). The measured voltage should be within the specified (14.4±0.3 volts) limits. If it is not, the regulator must be replaced.



066RX003

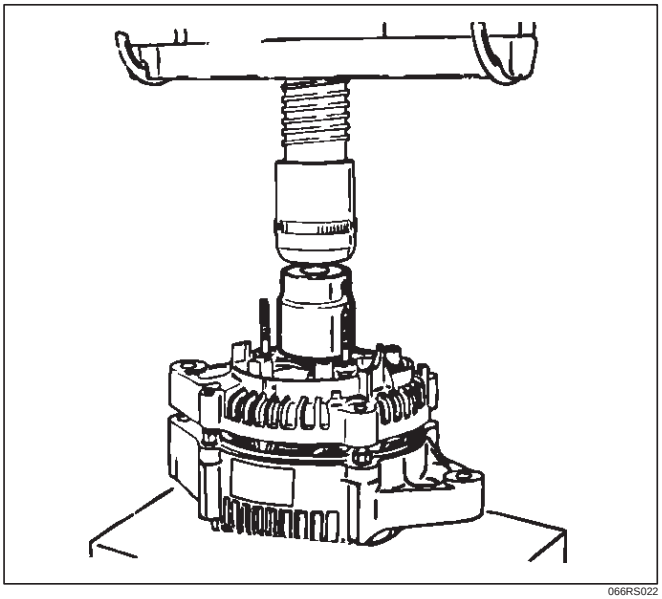
Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

NOTE:

- ▼Never make battery connections with polarities reversed, or battery will be shorted via the diodes. This will cause damage to the diodes.
- ▼Do not connect generator B terminal to ground; it is connected directly to the battery. This cable will burn if it is connected to ground.
- ▼Make sure to disconnect the positive (+) terminal of the battery when quick-charging battery . Diodes may be damaged due to abnormal pulse voltage generated by the quick charger.
- ▼When reassembling the front section to rear section, insert a stiff wire into hole in the rear face of the rear cover from the outboard side to support the brush in raised position, then insert the front section to which rotor is assembled.
- ▼Reassemble parts carefully to be sure they fit into their original position, paying attention to the insulated portions.
- ▼Wipe insulating tubes, washers and plates clean and install them in position carefully to avoid getting oil or grease on them.

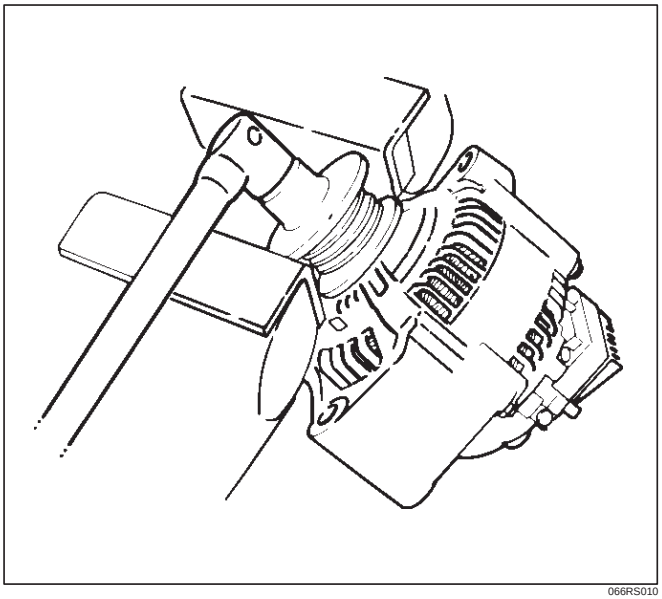
1. Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.



066RS022

2. Install pulley on the rotor.
   Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

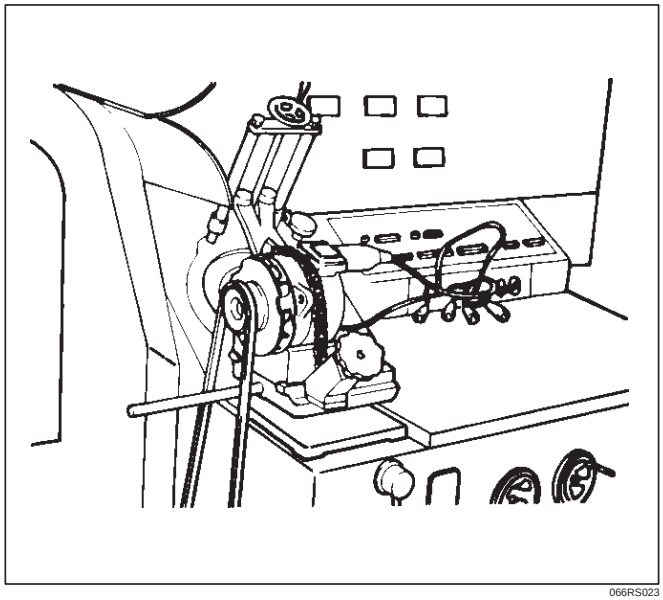
   Torque: 111 N·m (82 lb ft)



066RS010

Bench Test

Conduct a bench test of the generator.

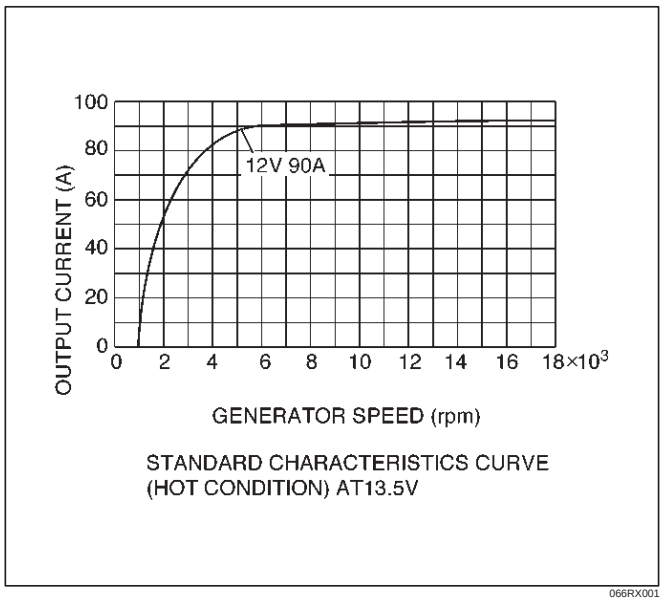


066RS023

Preparation

Remove generator from the vehicle (see “Generator removal”).

1. Secure generator to the bench test equipment and connect wires.
   Terminal “IG” for energization
   Terminal “L” for neutral (warning lamp)
   Terminal “B” for output
2. Conduct the generator characteristic test.
   Characteristics of generator are shown in illustration.
   Repair or replace the generator if its outputs are abnormal.



066RX001

Main Data and Specifications

General Specifications

Battery voltage	V	12
Rated output	A	90
Direction of rotation		
(as viewed from pulley side)		Clockwise
Rated rotation speed	rpm	5000
Maximum speed	rpm	18000

AXIOM

ENGINE

6VE1 3.5L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

Specifications 6E–6
Tightening Specifications 6E–6
Diagrams and Schematics 6E–7
PCM Wiring Diagram (1 of 7) 6E–7
PCM Wiring Diagram (2 of 7) 6E–8
PCM Wiring Diagram (3 of 7) 6E–9
PCM Wiring Diagram (4 of 7) 6E–10
PCM Wiring Diagram (5 of 7) 6E–11
PCM Wiring Diagram (6 of 7) 6E–12
PCM Wiring Diagram (7 of 7) 6E–13
PCM Pinouts 6E–14
PCM Pinout Table, 80-Way Blue Connector – Row “F1 ~ 20” 6E–14
PCM Pinout Table, 80-Way Blue Connector – Row “F20 ~ 40” 6E–15
PCM Pinout Table, 80-Way Blue Connector – Row “F41 ~ 60” 6E–16
PCM Pinout Table, 80-Way Blue Connector – Row “F61 ~ 80” 6E–17
PCM Pinout Table, 80-Way Red Connector – Row “S1 ~ 20” 6E–19
PCM Pinout Table, 80-Way Red Connector – Row “S21 ~ 40” 6E–21
PCM Pinout Table, 80-Way Red Connector – Row “S41 ~ 60” 6E–23
PCM Pinout Table, 80-Way Red Connector – Row “S61 ~ 80” 6E–25
Component Locators 6E–27
Undercarriage Component Locator 6E–29
Fuse and Relay Panel (Underhood Electrical Center) 6E–30
Sensors and Miscellaneous Component Locators 6E–31
Diagnosis 6E–33
Strategy-Based Diagnostics 6E–33
DTC Stored 6E–33
No DTC 6E–33
No Matching Symptom 6E–33
Intermittents 6E–33
No Trouble Found 6E–33
Verifying Vehicle Repair 6E–33
General Service Information 6E–33
OBD II Serviceablity Issues 6E–33
Emissions Control Information Label 6E–34
Visual / Physical Engine Compartment Inspection 6E–34
Basic Knowledge of Tools Required 6E–35
Serial Data Communications 6E–35
Class 2 Serial Data Communications 6E–35
On-Board Diagnostic (OBD II) 6E–35
On-Board Diagnostic Tests 6E–35
Comprehensive Component Monitor Diagnostic Operation 6E–35
System Status and Drive Cycle for Satisfying Federal Inspection/Maintenance (I/M 240) Regulations 6E–36
Common OBD II Terms 6E–36
The Diagnostic Executive 6E–36
DTC Types 6E–37
Decimal/Binary/Hexadecimal Conversions 6E–39
Verifying Vehicle Repair 6E–39
Reading Diagnostic Trouble Codes Using The Tech 2 Scan Tool 6E–39
Tech 2 . . . . . 6E–40
Tech 2 Features 6E–41
Getting Started 6E–41
Operating Procedure (For Example) 6E–42
DTC Modes 6E–43
DTC Information Mode 6E–43
Miscellaneous Test 6E–44
Lamps Test 6E–44
Relays Test 6E–46
EVAP Test 6E–47
Fuel System Test 6E–48
Instruments Test 6E–50
EGR Control Test 6E–52
Variable Intake Manifold Solenoid Test . . . 6E–52
Injector Balance Test 6E–54
Plotting Snapshot Graph 6E–54
Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information) 6E–55
Flow Chart for Snapshot Replay (Plotting Graph) 6E–56
Primary System-Based Diagnostic 6E–57
Primary System-Based Diagnostic 6E–57
Fuel Control Heated Oxygen Sensor 6E–57
HO2S Heater 6E–57
Catalyst Monitor Heated Oxygen Sensors and Diagnostic Operation 6E–57
Misfire Monitor Diagnostic Operation 6E–58
Misfire Monitor Diagnostic Operation 6E–58
Misfire Counters 6E–58

Fuel Trim System Monitor Diagnostic Operation 6E–59
Fuel Trim System Monitor Diagnostic Operation 6E–59
Fuel Trim Cell Diagnostic Weights 6E–59
On-Board Diagnostic (OBD II) System Check 6E–60
Circuit Description 6E–60
Diagnostic Aids 6E–60
Test Description 6E–60
A/C Clutch Control Circuit Diagnosis 6E–63
Circuit Description 6E–63
Diagnostic Aids 6E–63
A/C Clutch Diagnosis 6E–64
Electronic Ignition System Diagnosis 6E–68
EVAP Canister Purge Solenoid and EVAP Vent Solenoid Valve 6E–68
Visual Check of The Evaporative Emission Canister 6E–68
Fuel Metering System Check 6E–68
Fuel System Pressure Test 6E–68
Fuel Injector Coil Test Procedure and Fuel Injector Balance Test Procedure 6E–68
Test Description 6E–68
Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) 6E–69
Powertrain Control Module (PCM) Diagnosis 6E–73
Multiple PCM Information Sensor DTCs Set 6E–73
Circuit Description 6E–73
Diagnostic Aids 6E–73
Exhaust Gas Recirculation (EGR) Diagnosis 6E–76
Engine Tech 2 Data Definitions and Ranges 6E–76
Typical Scan Data Values 6E–78
Test Conditions 6E–78
No Malfunction Indicator Lamp (MIL) 6E–84
Circuit Description 6E–84
Diagnostic Aids 6E–84
Malfunction Indicator Lamp (MIL) “ON” Steady 6E–87
Circuit description 6E–87
Diagnostic Aids 6E–87
No Reduced Power Lamp (RPL) 6E–89
Circuit Description 6E–89
Diagnostic Aids 6E–89
Test Description 6E–89
Reduced Power Lamp (RPL) “ON” Steady . . 6E–93
Circuit Description 6E–93
Diagnostic Aids 6E–93
Test Description 6E–93
Starter Control System Check 6E–96
Circuit Description 6E–96
Diagnostic Aids 6E–96
Engine Cranks But Will Not Run 6E–100
Circuit Description 6E–102
Diagnostic Aids 6E–102
Test Description 6E–102
Fuel System Electrical Test 6E–107
Circuit Description 6E–108
Diagnostic Aids 6E–108
Test Description 6E–108
Fuel Pressure Relief Procedure 6E–108
Electric Throttle Control (ETC) System Check 6E–111
Circuit Description 6E–112
Diagnostic Aids 6E–112
Test Description 6E–112
Fuel System Diagnosis 6E–115
Circuit Description 6E–116
Test Description 6E–116
Fuel Pressure Relief Procedure 6E–117
Exhaust Gas Recirculation (EGR) System Check 6E–120
Circuit Description 6E–120
Manifold Absolute Pressure (MAP) Output Check 6E–122
Circuit Description 6E–122
Evaporative (EVAP) Emissions Canister Purge Valve Check 6E–124
Circuit Description 6E–124
Diagnostic Aids 6E–124
PCM Diagnostic Trouble Codes 6E–127
DTC P0101 MAF System Performance 6E–131
DTC P0102 MAF Sensor Circuit Low Frequency 6E–134
DTC P0103 MAF Sensor Circuit High Frequency 6E–137
DTC P0106 MAP System Performance 6E–140
DTC P0107 MAP Sensor Circuit Low Voltage 6E–143
DTC P0108 MAP Sensor Circuit High Voltage 6E–146
DTC P0112 IAT Sensor Circuit Low Voltage 6E–149
DTC P0113 IAT Sensor Circuit High Voltage 6E–152
DTC P0117 ECT Sensor Circuit Low Voltage 6E–155
DTC P0118 ECT Sensor Circuit High Voltage 6E–158
DTC P0125 ECT Excessive Time to Closed Loop Fuel Control 6E–161
DTC P0128 Thermostat Insufficient Temperature for Stable Operation 6E–164
DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1 . . . . . 6E–166
DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1 . . . . . 6E–169
DTC P0133 HO2S Slow Response Bank 1 Sensor 1 . . . . . 6E–172
DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1 . . . . . 6E–176

DTC P0135 HO2S Heater Circuit Bank 1 Sensor 1 . . . . . 6E–179
DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2 . . . . . 6E–182
DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2 . . . . . 6E–185
DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2 . . . . . 6E–188
DTC P0141 HO2S Heater Circuit Bank 1 Sensor 2 . . . . . 6E–191
DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1 . . . . . 6E–194
DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1 . . . . . 6E–197
DTC P0153 HO2S Slow Response Bank 2 Sensor 1 . . . . . 6E–200
DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1 . . . . . 6E–204
DTC P0155 HO2S Heater Circuit Open Bank 2 Sensor 1 . . . . . 6E–207
DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2 . . . . . 6E–210
DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2 . . . . . 6E–213
DTC P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2 . . . . . 6E–216
DTC P0161 HO2S Heater Circuit Bank 2 Sensor 2 . . . . . 6E–219
DTC P0171 Fuel Trim System Lean Bank 1 . 6E–222
DTC P0172 Fuel Trim System Rich Bank 1 . 6E–226
DTC P0174 Fuel Trim System Lean Bank 2 . 6E–230
DTC P0175 Fuel Trim System Rich Bank 2 . 6E–234
DTC P0201 Injector 1 Control Circuit 6E–238
DTC P0202 Injector 2 Control Circuit 6E–241
DTC P0203 Injector 3 Control Circuit 6E–244
DTC P0204 Injector 4 Control Circuit 6E–247
DTC P0205 Injector 5 Control Circuit 6E–250
DTC P0206 Injector 6 Control Circuit 6E–253
DTC P0300 Engine Misfire Detected 6E–256
DTC P0301 Cylinder Misfire Detected 6E–260
DTC P0302 Cylinder Misfire Detected 6E–262
DTC P0303 Cylinder Misfire Detected 6E–264
DTC P0304 Cylinder Misfire Detected 6E–266
DTC P0305 Cylinder Misfire Detected 6E–268
DTC P0306 Cylinder Misfire Detected 6E–270
DTC P0325 ION Sensing Module/ION Sensing Knock Intensity Circuit Fault 6E–272
DTC P0336 58X Reference Signal Circuit . . 6E–275
DTC P0337 CKP Sensor Circuit Low Frequency 6E–278
DTC P0351 Ignition 1 Control Circuit 6E–281
DTC P0352 Ignition 2 Control Circuit 6E–284
DTC P0353 Ignition 3 Control Circuit 6E–287
DTC P0354 Ignition 4 Control Circuit 6E–290
DTC P0355 Ignition 5 Control Circuit 6E–293
DTC P0356 Ignition 6 Control Circuit 6E–296
DTC P0401 EGR Flow Insufficient 6E–299
DTC P0402 EGR Pintle Crank Error 6E–302
DTC P0404 EGR Open Stuck 6E–304
DTC P0405 EGR Low Voltage 6E–306
DTC P0406 EGR High Voltage 6E–309
DTC P0420 TWC System Low Efficiency Bank 1 . . . . . 6E–312
DTC P0430 TWC System Low Efficiency Bank 2 . . . . . 6E–315
DTC P0440 EVAP System 6E–318
DTC P0442 EVAP System Small Leak Detected 6E–321
DTC P0444 EVAP Purge Control Circuit Open 6E–324
DTC P0445 EVAP Purge Control Circuit Short 6E–326
DTC P0446 EVAP Canister Vent Control Malfunction 6E–328
DTC P0447 EVAP Vent Solenoid Circuit Open 6E–331
DTC P0448 EVAP Vent solenoid Circuit Short 6E–333
DTC P0452 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) Low Voltage 6E–335
DTC P0453 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) High Voltage 6E–338
DTC P0456 EVAP Very Small Leak 6E–341
DTC P0461 Fuel Level Sensor Performance 6E–344
DTC P0462 Fuel Level Sensor Circuit–Low Voltage 6E–346
DTC P0463 Fuel Level Sensor Circuit–High Voltage 6E–349
DTC P0462 Fuel Level Sensor Noisy Signal 6E–351
DTC P0502 VSS Circuit Low Input 6E–353
DTC P0506 Idle Air Control System Low RPM 6E–356
DTC P0507 Idle Air Control System High RPM 6E–359
DTC P0562 System Voltage Low 6E–362
DTC P0563 System Voltage High 6E–364
DTC P0565 Cruise Main Switch Circuit Error 6E–366
DTC P0566 Cruise Cancel Switch Circuit Error 6E–368
DTC P0567 Cruise Resume Switch Circuit Error 6E–370
DTC P0568 Cruise Set Switch Circuit Error . 6E–372
DTC P0571 No Brake Switch Signal 6E–374
DTC P0601 PCM Memory 6E–376
DTC P0602 PCM Programming Error 6E–378
DTC P0604 PCM RAM Error 6E–380
DTC P0606 PCM Internal Performance 6E–382
DTC P1106 MAP Sensor Circuit Intermittent High Voltage 6E–384

DTC P1107 MAP Circuit Intermittent Low Voltage 6E–386
DTC P1111 IAT Sensor Circuit Intermittent High Voltage 6E–388
DTC P1112 IAT Sensor Circuit Intermittent Low Voltage 6E–391
DTC P1114 ECT Sensor Circuit Intermittent Low Voltage 6E–393
DTC P1115 ECT Sensor Circuit Intermittent High Voltage 6E–395
Diagnostic Trouble Code(DTC)P1120-TPS 1 Throttle Position Sensor (TPS1) Output Abnormal 6E–398
DTC P1125 ETC (Electric Throttle Control) Limit Performance Mode 6E–401
DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1 . . . . . 6E–404
DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1 . . . . . 6E–408
DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1 . . . . . 6E–412
DTC P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1 . . . . . 6E–416
DTC P1167 Fuel System Rich During Decel Fuel Cut Off (Bank 1) 6E–420
DTC P1169 Fuel System Rich During Decel Fuel Cut Off (Bank 2) 6E–422
DTC P1171 Fuel System Lean During Acceleration 6E–424
DTC P1220 Throttle Position Senser2 (TPS2) Circuit Fault 6E–427
DTC P1221 TPS1 – TPS2 Correlation (Circuit Performance) 6E–430
DTC P1271 APS 1– 2 Correlation Error . . . 6E–433
DTC P1272 APS 2 – 3 Correlation Error . . . 6E–436
DTC P1273 APS 1 – 3 Correlation Error 6E–439
DTC P1275 APS 1 Output Fault 6E–442
DTC P1280 APS 2 Output Fault 6E–444
DTC P1285 APS 3 Output Fault 6E–446
DTC P1290 ETC Forced Idle Mode 6E–448
DTC P1295 ETC Power Management Mode 6E–451
DTC P1299 ETC Forced Engine Shutdown Mode 6E–455
DTC P1310 ION Sensing Module Diagnosis 6E–459
DTC P1311 ION Sensing Module SEC Line 1 Circuit Fault 6E–462
DTC P1312 ION Sensing Module SEC Line 2 Circuit Fault 6E–465
DTC P1326 ION Sensing Module Combustion Quality Input Circuit Fault 6E–468
DTC P1340 ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail) 6E–471
DTC P1404 EGR Stuck Closed 6E–474
DTC P1441 EVAP System Flow During Non-Purge 6E–477
DTC P1514 TPS - MAF Correlation Error . . . 6E–480
DTC P1515 Command - Actual TPS Correlation Error 6E–484
DTC P1516 Command - Actual TPS Correlation Error 6E–487
DTC P1523 Actuator Control Return Performance 6E–490
DTC P1571 Brake Switch No Operation 6E–493
DTC P1625 PCM Unexpected Reset 6E–495
DTC P1635 Reference Voltage # 1 Circuit Fault 6E–496
DTC P1639 Reference Voltage # 2 Circuit Fault 6E–498
DTC P1640 Driver-1-Output Circuit Fault (ODM) 6E–500
DTC P1650 Quad Driver Module “A” Fault . . 6E–503
Symptom Diagnosis 6E–506
Default Matrix Table 6E–535
On Vehicle Service
Crankshaft Position (CKP) Sensor 6E–538
Engine Coolant Temperature (ECT) Sensor . 6E–538
Heated Oxygen Sensor (HO2S) 6E–539
Intake Air Temperature (IAT) Sensor 6E–542
ION Sensing Module 6E–542
Mass Air Flow (MAF) Sensor 6E–543
Manifold Absolute Pressure (MAP) Sensor . 6E–544
Malfunction Indicator Lamp (MIL) 6E–545
Reduced Power Lamp 6E–545
Powertrain Control Module (PCM) 6E–545
Service Precaution 6E–545
EEPROM 6E–547
Throttle Position (TP) Sensor 6E–547
Vehicle Speed Sensor (VSS) 6E–548
Air Cleaner/Air Filter 6E–549
Common Chamber 6E–549
Accelerator Pedal Replacement 6E–550
Accelerator Position Sensor Replacement . . 6E–551
Accelerator Position Sensor Adjustment 6E–551
Fuel Filler Cap 6E–552
Fuel Filter 6E–552
Fuel Gauge Unit 6E–553
Fuel Injectors 6E–554
Fuel Metering System 6E–555
Fuel Pump Assembly 6E–555
Fuel Pump Relay 6E–556
Fuel Rail Assembly 6E–557
Fuel Tank 6E–558
Throttle Body (TB) 6E–558
Electronic Ignition System 6E–560
Catalytic Converter 6E–561
Air Conditioning Thermo Relay 6E–561
EVAP Canister Hoses 6E–561
EVAP Canister 6E–562
EVAP Canister Vent Solenoid 6E–562

Fuel Tank Pressure
(Vapor Pressure) Sensor 6E–563
EVAP Canister Purge Solenoid (Purge Duty
Solenoid Valve) 6E–564
Fuel Tank Vent Valve
(Vent Solenoid Valve) 6E–565
Linear Exhaust Gas
Recirculation (EGR) Valve 6E–565
Positive Crankcase Ventilation (PCV) Valve . 6E–566
Wiring and Connectors 6E–566
PCM Connectors and Terminals 6E–567
Wire Harness Repair: Twisted Shielded
Cable 6E–567
Twisted Leads 6E–568
Weather-Pack Connector 6E–569
Com-Pack III 6E–570
Metri-Pack 6E–571
General Description (PCM and Sensors) . . . 6E–572
General Description (Air Induction) 6E–577
General Description (Fuel Metering) 6E–578
General Description (Electronic Ignition
System) 6E–580
A/C Clutch Diagnosis 6E–583
General Description (Evaporative (EVAP)
Emission System) 6E–583
General Description (Exhaust Gas
Recirculation (EGR) System) 6E–588
General Description (Positive Crankcase
Ventilation (PCV) System) 6E–589
Special Tools 6E–591

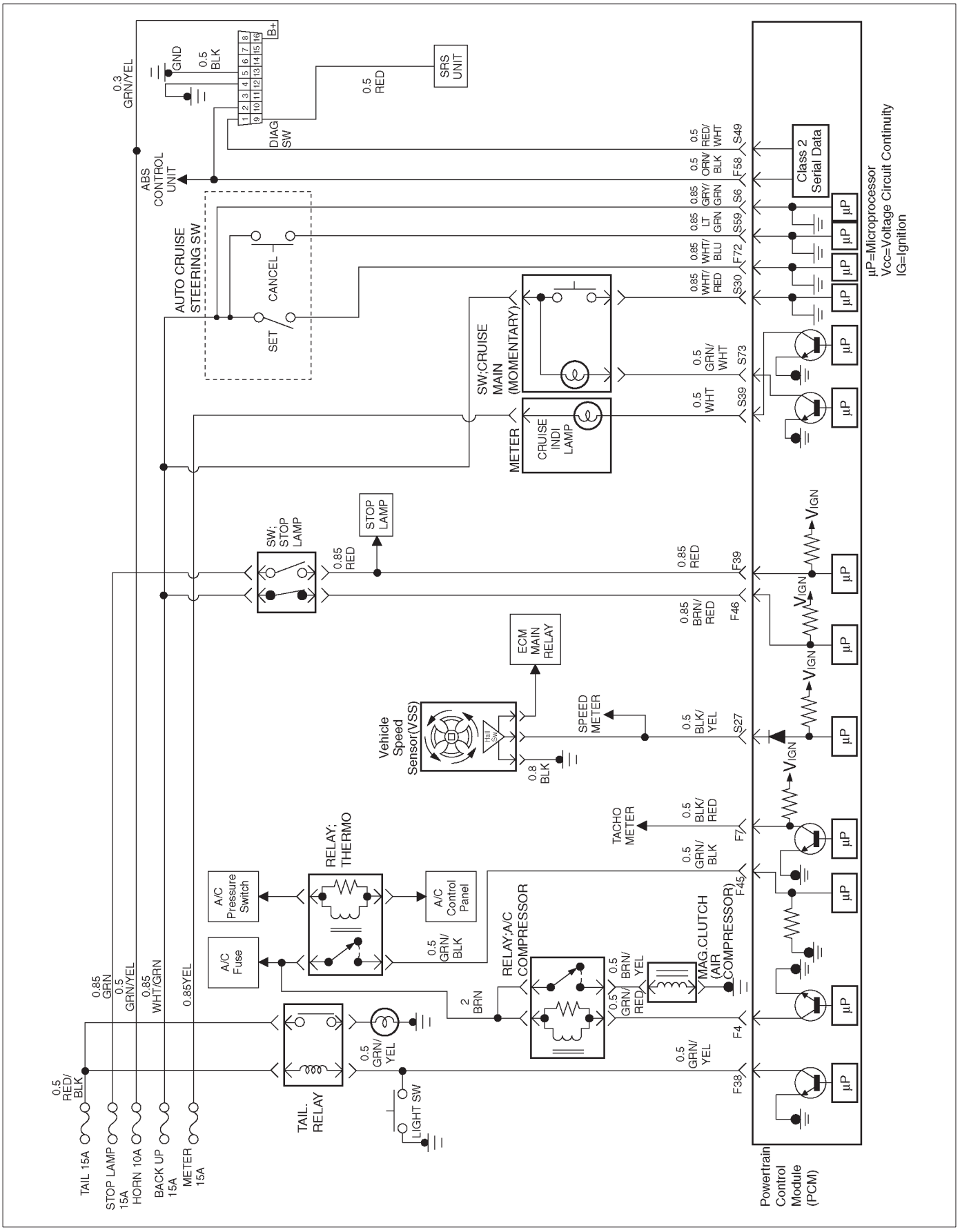
Specifications

Tightening Specifications

Application	N·m	Lb Ft.	Lb In.
EGR Bolt	25	18	—
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	3	—	26
Fuel Rail Bolts	25	18	—
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	55	40	—
Lower Intake Manifold to Engine Block Bolts	25	18	—
Lower Intake Manifold to Engine Block Nuts	25	18	—
Spark Plugs	18	13	—
Throttle Body Mounting Bolts	10	—	87
Common Chamber to Lower Intake Manifold Bolts	25	18	—
VSS Retaining Bolt	16	12	—

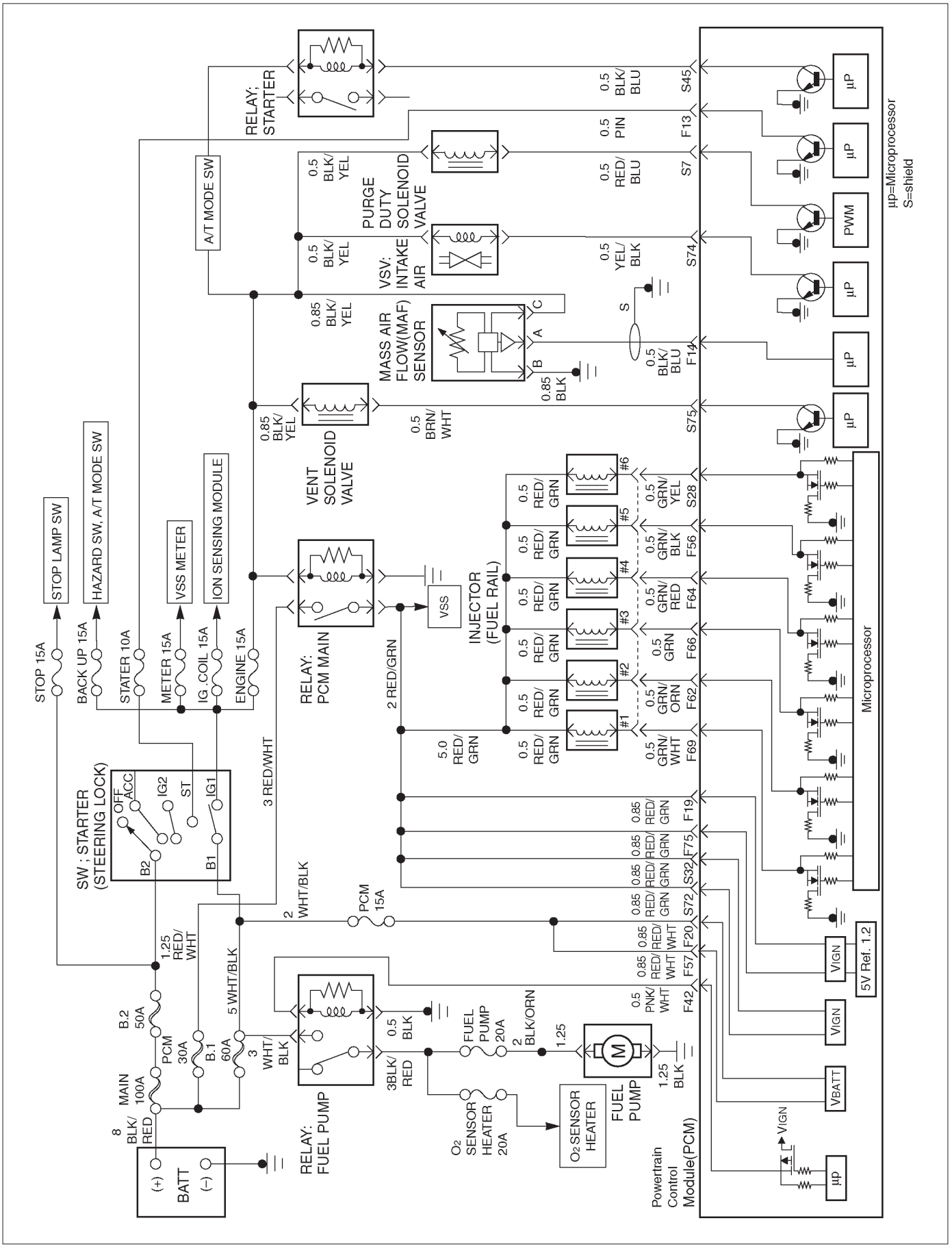
Diagrams and Schematics

PCM Wiring Diagram (1 of 7)



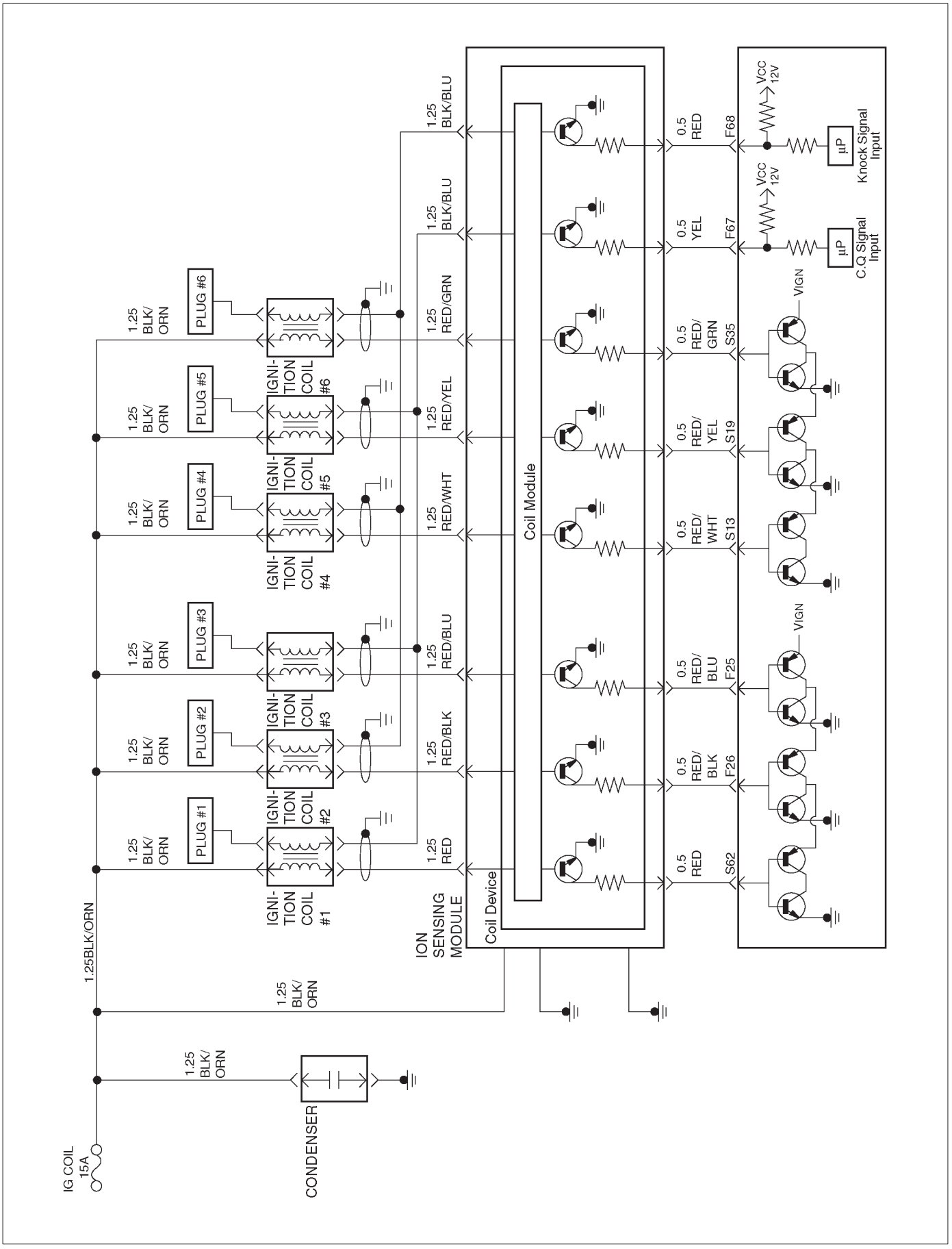
060R200082

PCM Wiring Diagram (2 of 7)



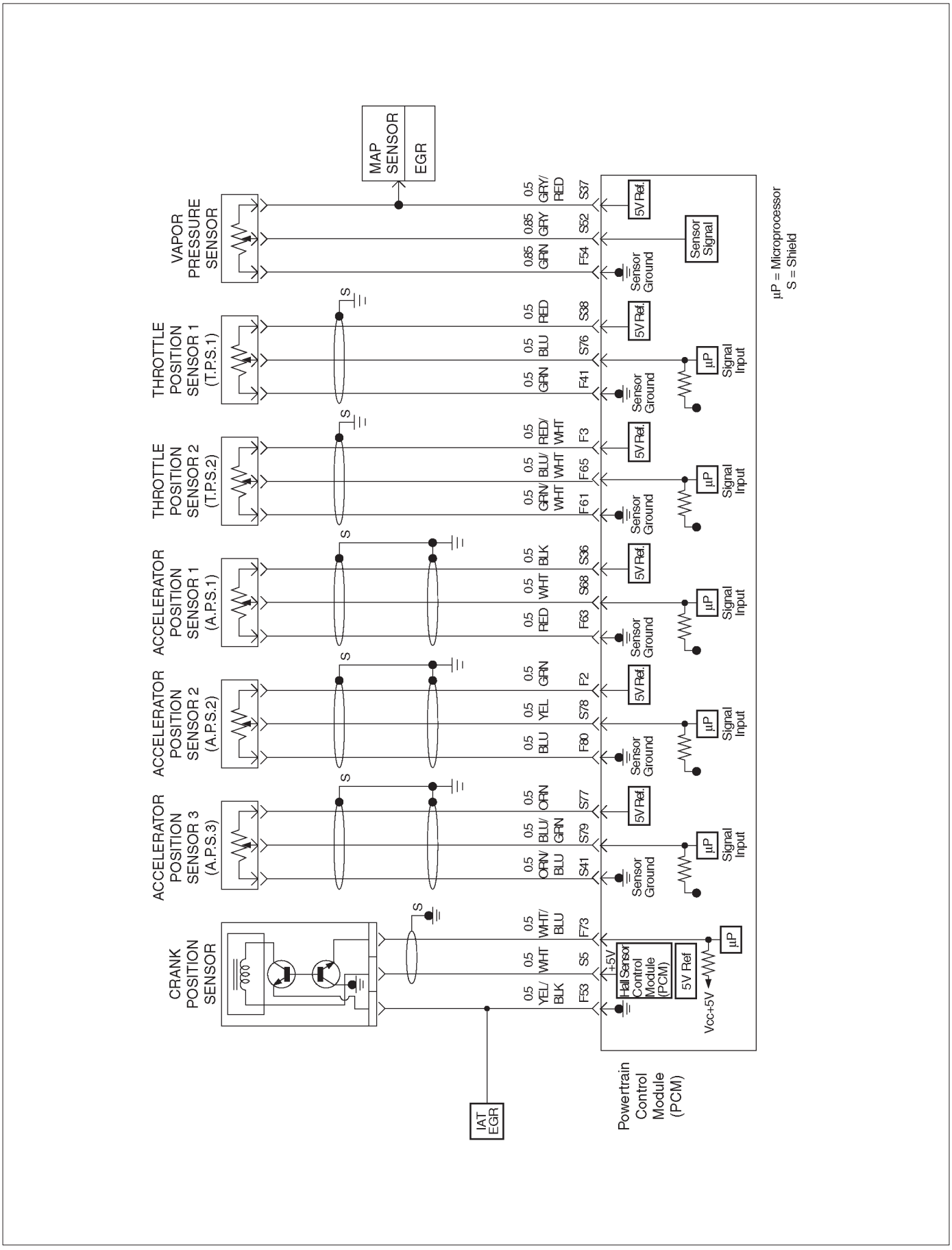
060R200083

PCM Wiring Diagram (3 of 7)



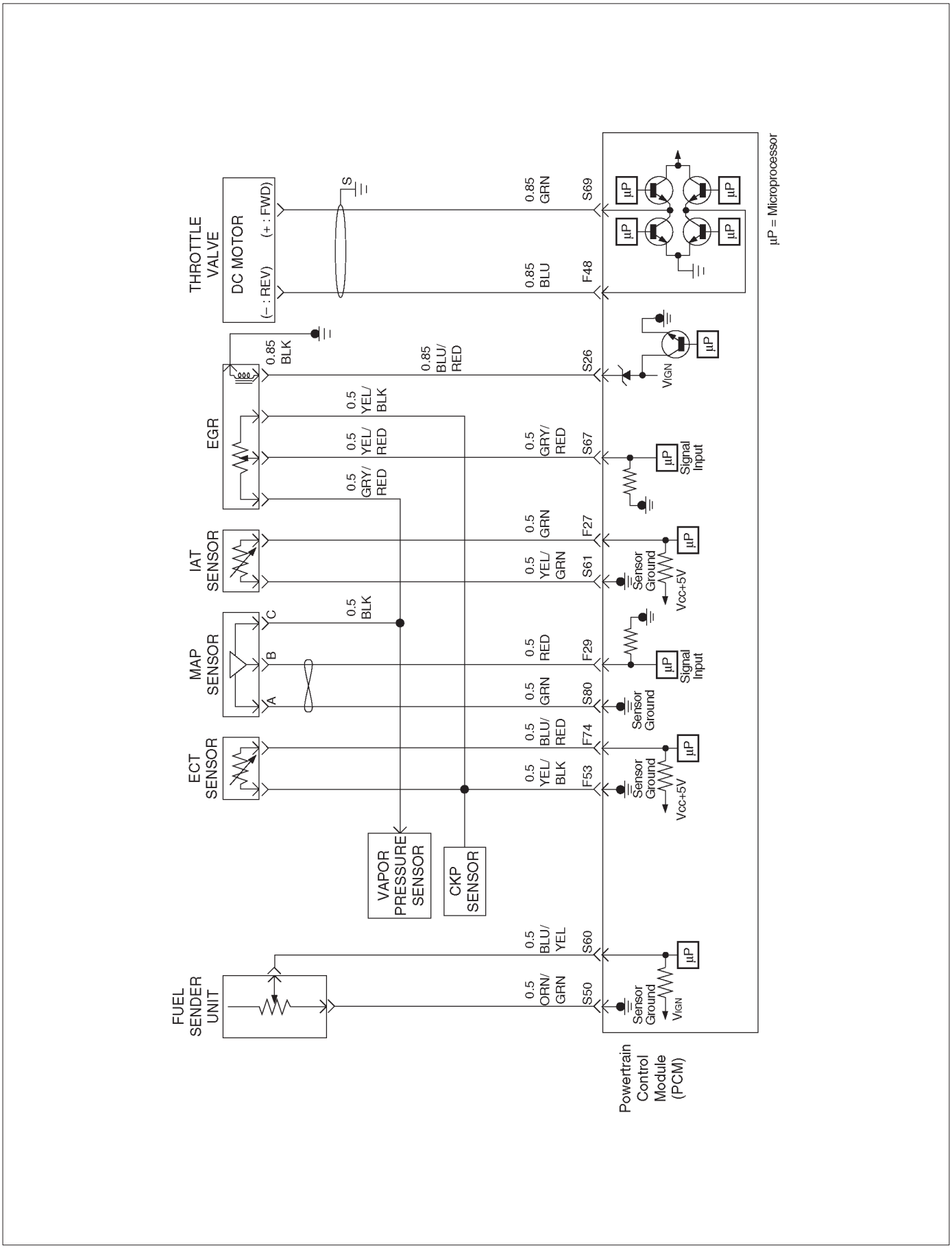
060R200043

PCM Wiring Diagram (4 of 7)



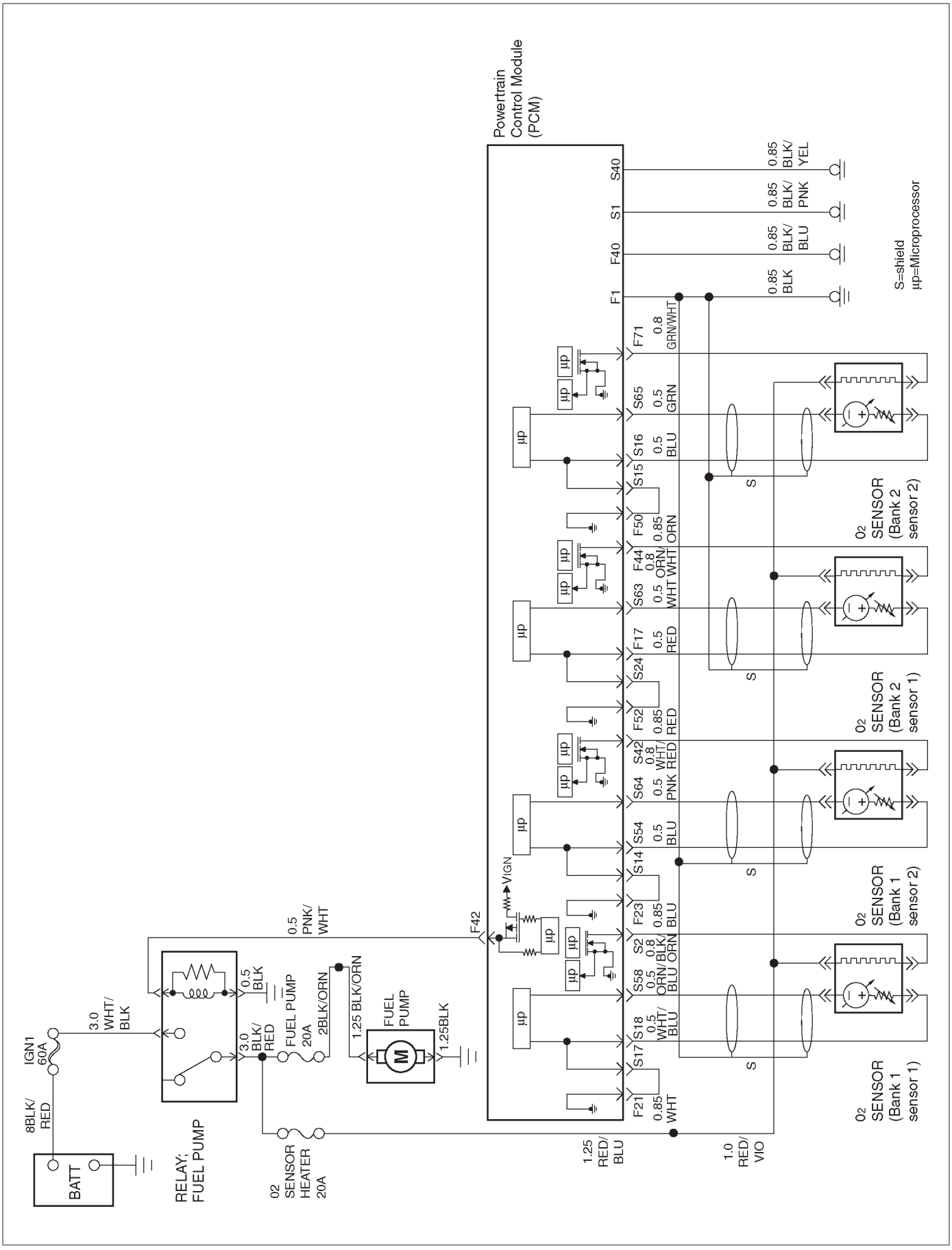
060R200065

PCM Wiring Diagram (5 of 7)



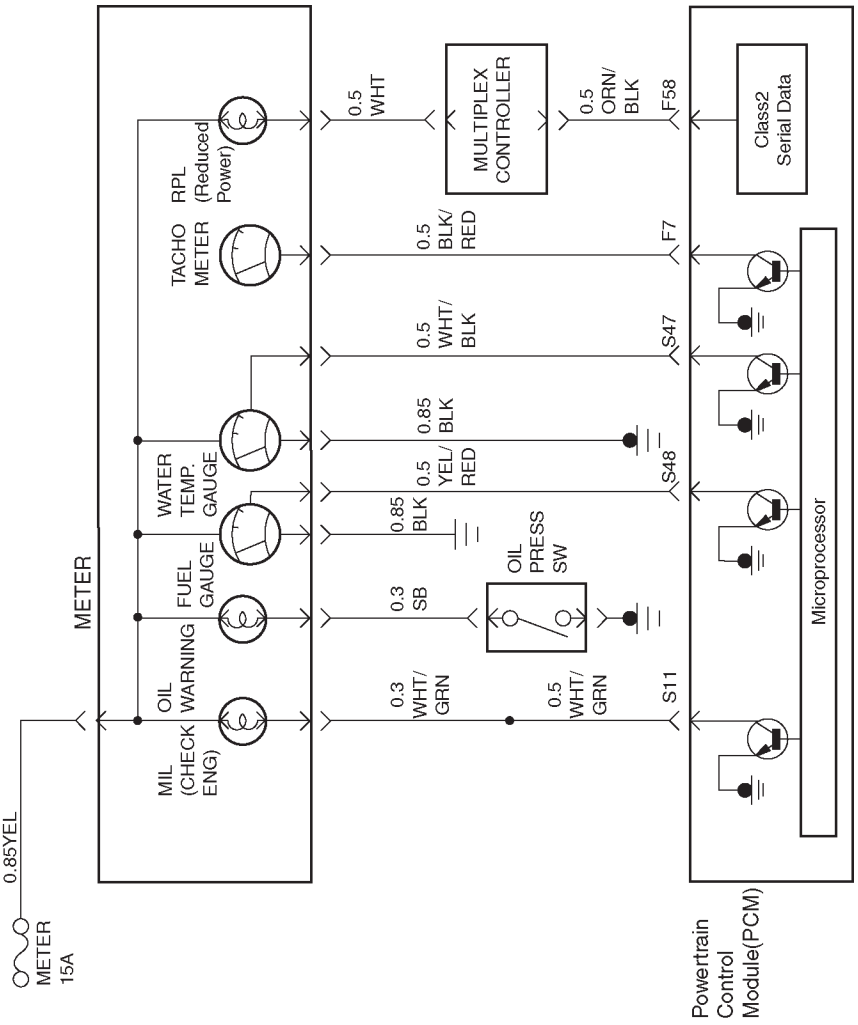
060R200041

PCM Wiring Diagram (6 of 7)



060R200046

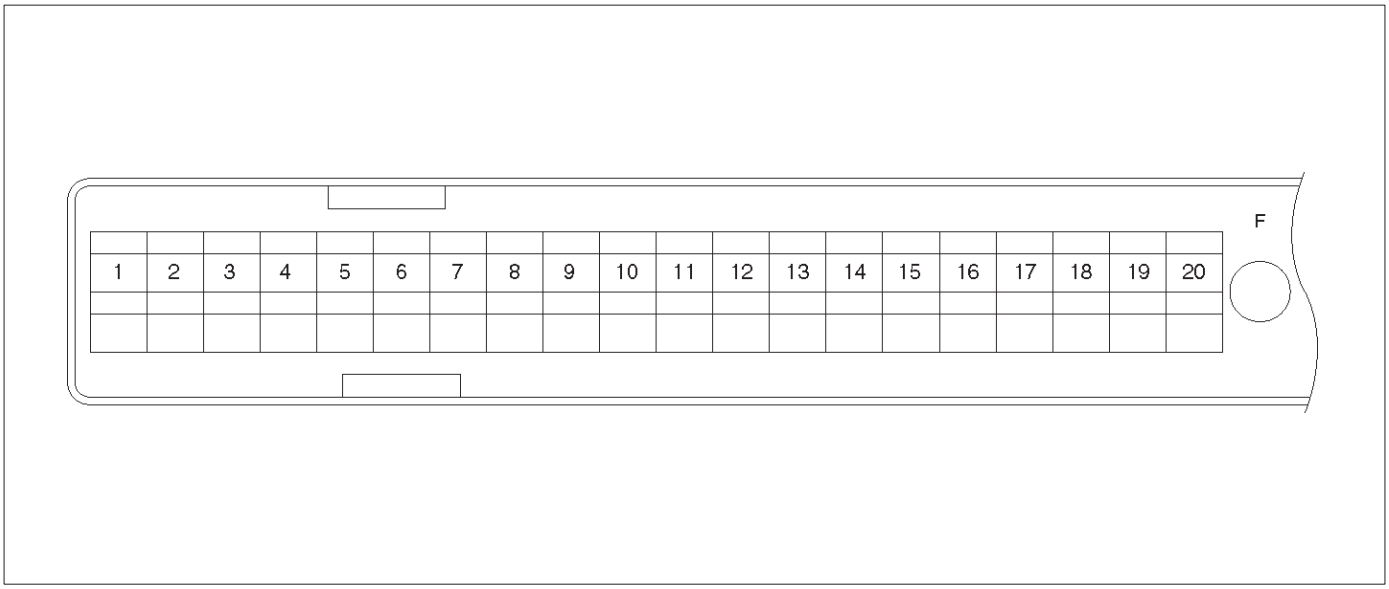
PCM Wiring Diagram (7 of 7)



060R200084

PCM Pinouts

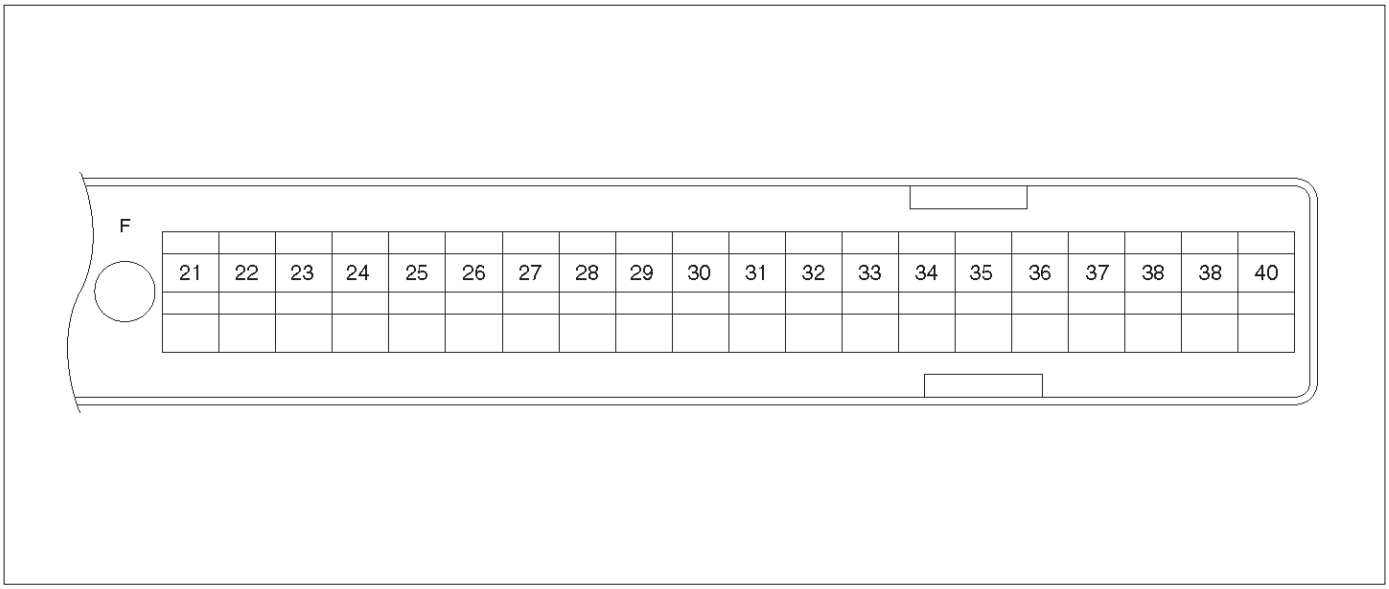
PCM Pinout Table, 80-Way Blue Connector – Row “F1 ~ 20”



060RY00045

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F1	PCM Ground	BLK	0.0V	0.0V	Chassis Electrical
F2	5Volt Reference“2” (AP Sensor 2)	GRN	5.0V	5.0V	Accelerator Position (AP) Sensor
F3	5Volt Reference“2” (TP Sensor 2)	RED/WHT	5.0V	5.0V	Throttle Position (TP) Sensor
F4	A/C Clutch	GRY/RED	B+(A/C off)	B+(A/C off)	General Description and Operation, A/C Clutch Circuit Operation
F5	Relay Shift Solenoid	GRN/RED	0.0V	0.0V	4L30E T/Mission
F6	Not Used	—	—	—	—
F7	Tachometer	BLK/RED	8.8V	10.0V (at idle)	Chassis Electrical
F8	Not Used	—	—	—	—
F9	Not Used	—	—	—	—
F10	Not Used	—	—	—	—
F11	T.O.D	RED/WHT	—	—	—
F12	Not Used	—	—	—	—
F13	Starter Feed	PNK	—	—	—
F14	Mass Air Flow(MAF)	BLK/BLU	4.9V	4.2V	General Description, Mass Air Flow Sensor
F15	Not Used	—	—	—	—
F16	Not Used	—	—	—	—
F17	Bank 1 HO2S Low	RED	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S 2
F18	Not Used	—	—	—	—
F19	Ignition Feed	RED/GRN	B+	B+	6D Section
F20	Ignition Feed	RED/WHT	B+	B+	6D Section

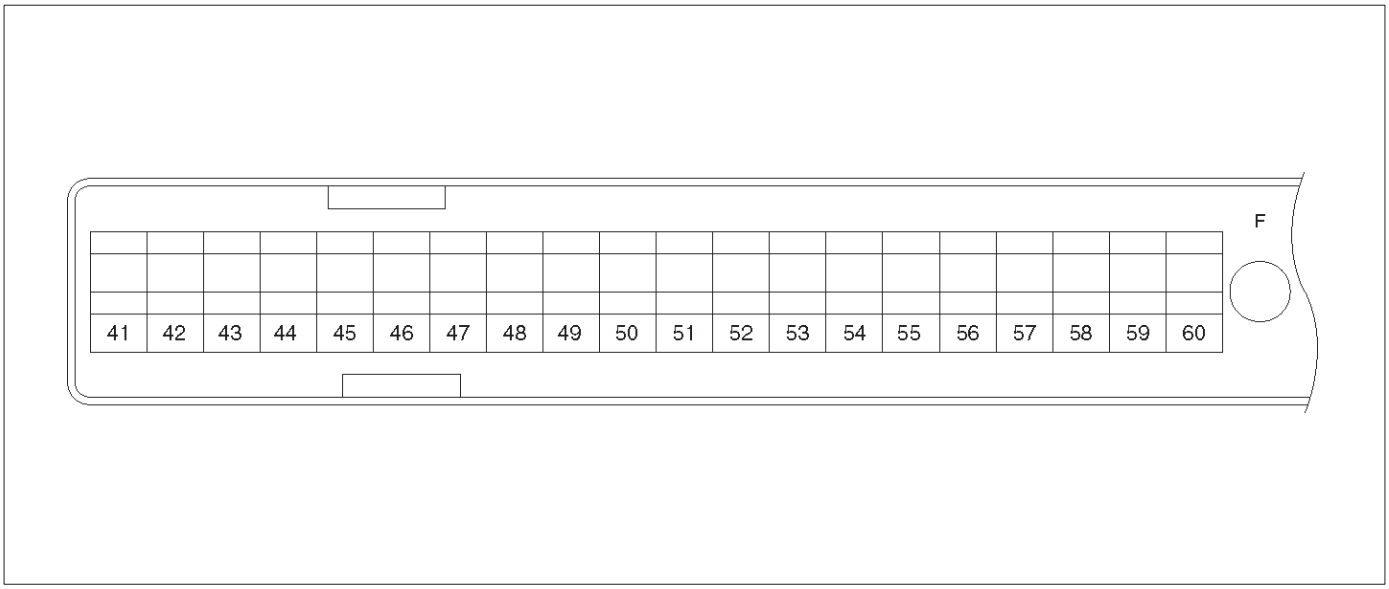
PCM Pinout Table, 80-Way Blue Connector – Row “F20 ~ 40”



060RY00156

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F21	Bank 1 HO2S 1 Ground	WHT	0.0V	0.0V	—
F22	Not Used	—	—	—	—
F23	Bank 2 HO2S 1 Ground	BLU	0.0V	0.0V	General Description
F24	Not Used	—	—	—	—
F25	ION Sensing Module	RED/BLU	1.555V	1.555V	General Description and Operation, ION Sensing Module
F26	ION Sensing Module	RED/BLK	1.555V	1.555V	General Description and Operation, ION Sensing Module
F27	Intake Air Temperature (IAT) Sensor Signal	GRN	0.5–4.9V	0.5–4.9V	General Description and Operation, IAT
F28	Not Used	—	—	—	—
F29	Manifold Absolute Pressure (MAP) Sensor Signal	RED	3.5V–4.9V (depends on altitude and barometric pressure)	0.6-1.3V	General Description and Operation, Manifold Absolute Pressure
F30	Not Used	—	—	—	—
F31	Not Used	—	—	—	—
F32	Not Used	—	—	—	—
F33	Not Used	—	—	—	—
F34	Not Used	—	—	—	—
F35	Not Used	—	—	—	—
F36	Not Used	—	—	—	—
F37	Power Steering Pressure (PSP)	GRN/YEL	B+	B+	Power Steering
F38	Illuminated Switch	GRN/YEL	B+	B+	Chassis Electrical
F39	Brake Switch	RED	0.0V	0.0V	4L30E T/Mission
F40	PCM Ground	BLK/BLU	0.0V	0.0V	Chassis Electrical

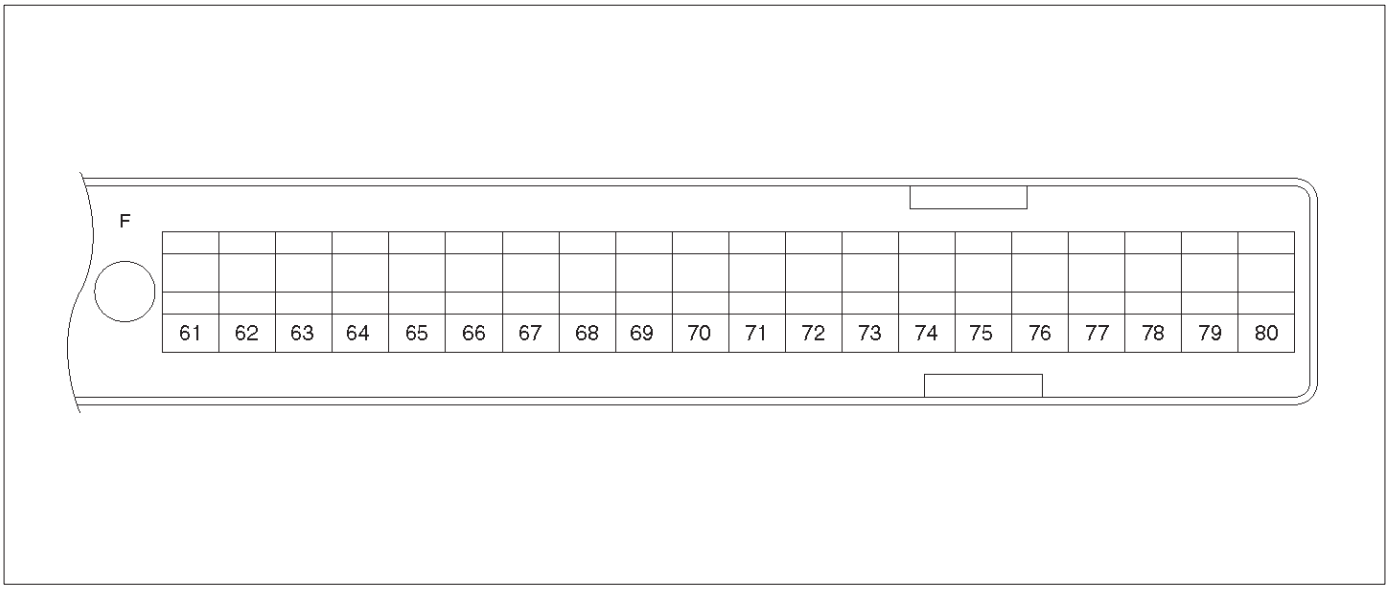
PCM Pinout Table, 80-Way Blue Connector – Row “F41 ~ 60”



060RY00046

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F41	Throttle Position(TP) 1 Sensor Ground	GRN	0.0V	0.0V	General Description and Operation, TPS
F42	Fuel Pump Relay	PNK/WHT	0.0V	B+	On Vehicle Service, Fuel Pump Relay
F43	Adaptor Case	VIO/RED	0.0V	0.0V	4L30E T/Mission
F44	Bank 1 HO2S 2 Heater Ground	ORN/WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F45	A/C Request	GRN/BLK	0.0V	0.0V	Chassis Electrical
F46	Stop Lamp Switch	BRN/RED	0.0V	0.0V	Chassis Electrical
F47	Adaptor Case	VIO/WHT	B+	B+	4L30E T/Mission
F48	Throttle Valve DC Motor(–: REV)	BLU	Duty Cycle	Duty Cycle	General Description and Operation, ETC
F49	Not Used	—	—	—	—
F50	Bank 2 HO2S 2 Ground	ORN	0.0V	0.0V	—
F51	Not Used	—	—	—	—
F52	Bank 1 HO2S 2 Ground	RED	0.0V	0.0V	—
F53	ECT Ground	YEL/BLK	0.0V	0.0V	General Description and Operation, ECT Sensor
F54	Vapor Pressure (Fuel Tank Pressure) Sensor Ground	GRN	0.0V	0.0V	General Description and Operation, VP Sensor
F55	Not Used	—	—	—	—
F56	Injector Cylinder #5	GRN/BLK	B+	B+	General Description and Operation, Fuel Injector
F57	Ignition Feed	RED/WHT	B+	B+	Chassis Electrical
F58	Class 2 Data	ORN/BLK	0.0V	0.0V	General Description
F59	Not Used	—	—	—	—
F60	Not Used	—	—	—	—

PCM Pinout Table, 80-Way Blue Connector – Row “F61 ~ 80”

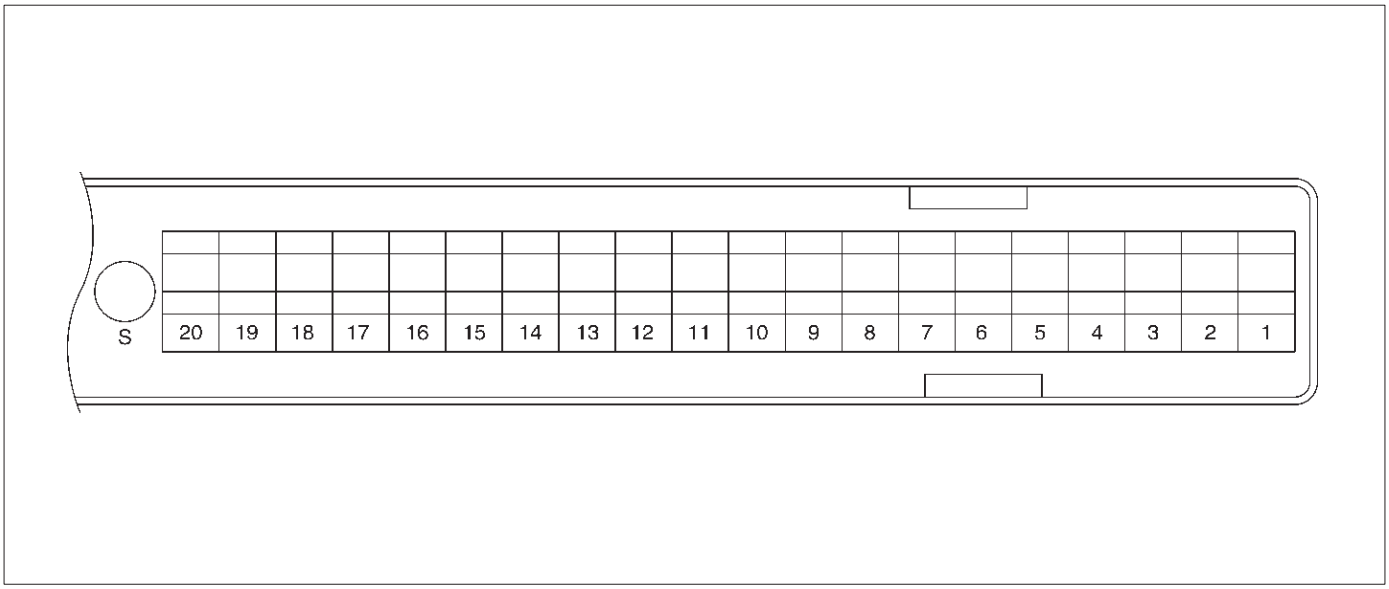


060RY00047

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F61	Throttle Position(TP) 2 Sensor Ground	GRN/WHT	0.0V	0.0V	General Description and Operation, TPS
F62	Injector Cylinder #2	GRN/ORN	B+	B+	General Description and Operation, Fuel Injector
F63	AP Sensor 1 Sensor Ground	RED	0.0V	0.0V	On-Vehicle Service
F64	Injector Cylinder #4	GRN/RED	B+	B+	General Description and Operation, Fuel Injector
F65	Throttle Position(TP) 2 Sensor Signal	BLU/WHT	0.5–0.8V	0.8–0.8V (at idle)	General Description and Operation, TPS
F66	Injector Cylinder #3	GRN	B+	B+	General Description and Operation, Fuel Injector
F67	ION Sensing Module	YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
F68	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
F69	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation, Fuel Injector
F70	ANTI Theft	WHT/GRN	—	—	—
F71	Bank 2 HO2S 2 Heater Ground	GRN/WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1
F72	Auto Cruise Switch Resume	WHT/BLU	0.0V	0.0V	Chassis Electrical
F73	Crankshaft Position Sensor	WHT/BLU	0.3V	2.2V	General Description and Operation, CKP sensor
F74	ECT Sensor	BLU/RED	0.5–4.9V	0.5–4.9V	General Description and Operation, ECT Sensor
F75	Ignition Feed	RED/GRN	B+	B+	Chassis Electrical
F76	Mode Switch	PNK/BLK	B+	B+	4L30E T/Mission
F77	Mode Switch	PNK/BLU	B+	B+	4L30E T/Mission

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F78	Mode Switch	PNK/YEL	0.0V	0.0V	4L30E T/Mission
F79	Mode Switch	PNK	0.0V	0.0V	4L30E T/Mission
F80	AP Sensor 2 Ground	BLU	0.0V	0.0V	On-Vehicle Service

PCM Pinout Table, 80-Way Red Connector – Row “S1 ~ 20”

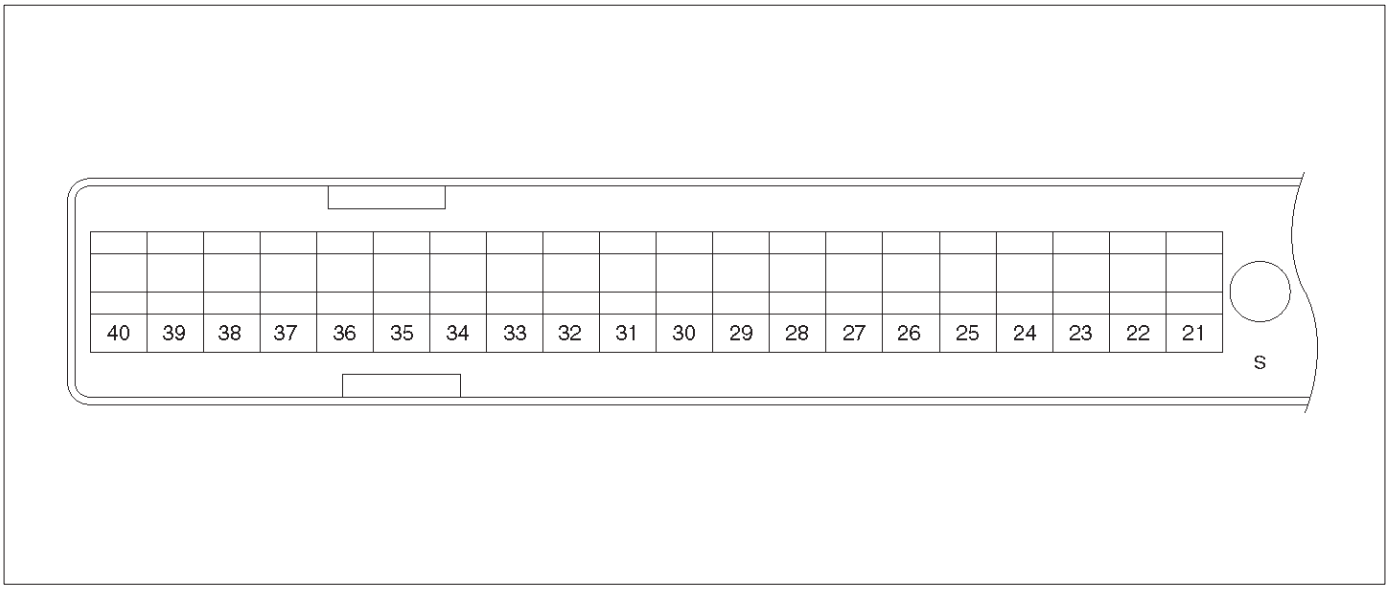


060RY00069

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S1	PCM Ground	BLK/PNK	0.0V	0.0V	Chassis Electrical
S2	Bank 1 HO2S 1 Heater Ground	BLK/ORN	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S3	Not Used	—	—	—	—
S4	Not Used	—	—	—	—
S5	5Volt Reference“2” (CKP Sensor)	WHT	5.0V	5.0V	Appropriate Sensor (CKP Sensor, AP2 Sensor)
S6	Auto Cruise Switch Cancel	GRY/GRN	0.0V	0.0V	Chassis Electrical
S7	Purge Duty Solenoid Valve	RED/BLU	B+	B+	EVAP Emission Control System
S8	M.I.D	0.5 GRN	—	—	—
S9	Not Used	—	—	—	—
S10	Shift High (Band Apply)	BRN/YEL	B+	B+	4L30E T/Mission
S11	Malfunction Indicator (Check Engine) Lamp	WHT/GRN	0.0V	B+	Chassis Electrical
S12	Not Used	—	—	—	—
S13	ION Sensing Module	RED/WHT	1.555V	1.555V	General Description and Operation, ION Sensing Module
S14	Bank 2 HO2S 1 Ground	BLU	0.0V	0.0V	—
S15	Bank 2 HO2S 2 Ground	ORN	0.0V	0.0V	—
S16	Bank 2 HO2S 2 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S17	Bank 1 HO2S 1 Ground	WHT	0.0V	0.0V	—
S18	Bank 1 HO2S 1 Low	WHT/BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S19	ION Sensing Module	RED/YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
S20	Transmission Fluid Temperature Sensor Ground	RED/WHT	0.0V	0.0V	4L30E T/Mission

PCM Pinout Table, 80-Way Red Connector – Row “S21 ~ 40”

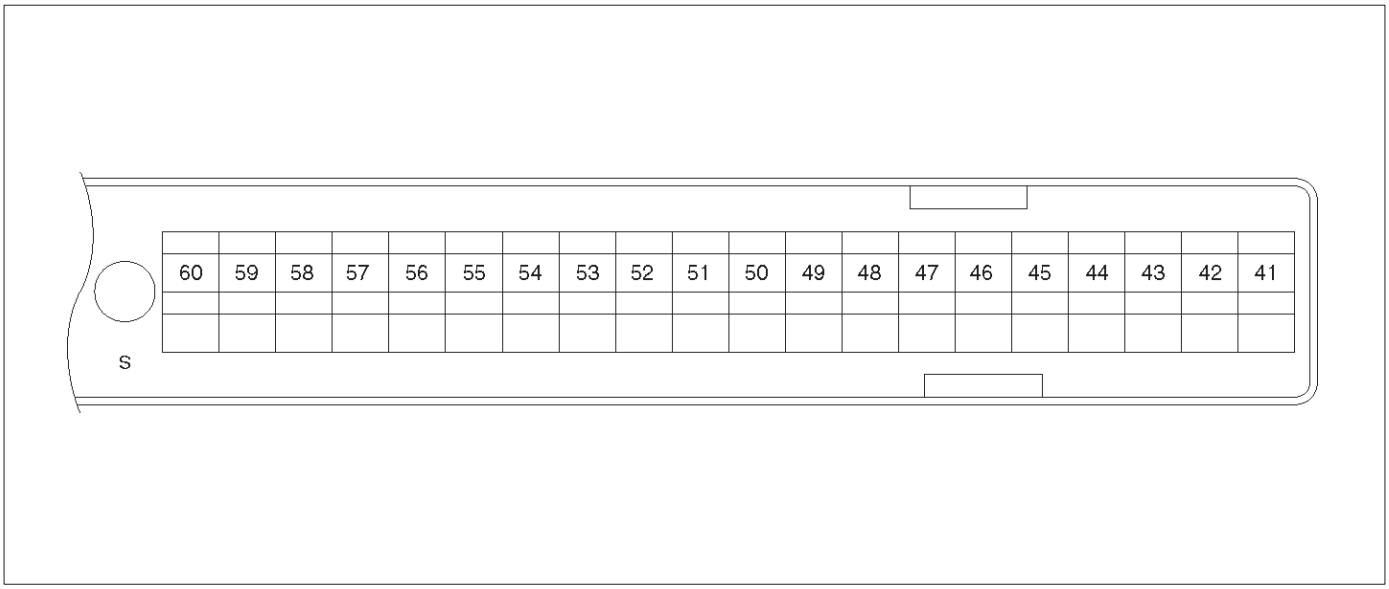


060RY00049

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S21	Audio	YEL/GRN	—	—	Chassis Electrical
S22	Transmission Output Speed Sensor	BLU/YEL	0.0V	0.0V	4L30E T/Mission
S23	PCM Ground	BLK	0.0V	0.0V	Chassis Electrical
S24	Bank 1 HO2S 2 Ground	RED	0.0V	0.0V	—
S25	Not Used	—	—	—	—
S26	EGR Control High	BLU/RED	B+	B+	General Description and Operation, EGR Control
S27	VSS Input	BLK/YEL	0.0V	0.1V (at rest)	Chassis Electrical
S28	Injector Cylinder #6	GRN/YEL	B+	B+	General Description and Operation, Fuel Injector
S29	Winter Switch	VIO/GRN	B+	B+	4L30E T/Mission
S30	Auto Cruise Main Switch	WHT/RED	0.0V	0.0V	Chassis Electrical
S31	Shift Solenoid	GRN	0.0V	0.0V	4L30E T/Mission
S32	Ignition Feed	RED/GRN	B+	B+	Chassis Electrical
S33	TCC Solenoid	BRN/WHT	0.0V	0.0V	T/Mission
S34	Not Used	—	—	—	—
S35	ION Sensing Module	RED/GRN	1.555V	1.555V	General Description and Operation, ION Sensing Module
S36	5Volt Reference (AP Sensor 1)	BLK	5.0V	5.0V	AP Sensor
S37	5Volt Reference (Vapor Pressure {Fuel Tank Pressure} Sensor/MAP Sensor/EGR Position Sensor)	GRY/RED	5.0V	5.0V	(Fuel Tank Pressure Sensor/MAP Sensor/EGR Position Sensor) Sensor
S38	5Volt Reference (TP Sensor 1)	RED	5.0V	5.0V	TP Sensor

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S39	Auto Cruise Set Lamp	WHT	0.0V	0.0V	Chassis Electrical
S40	PCM Ground	BLK/YEL	0.0V	0.0V	Chassis Electrical

PCM Pinout Table, 80-Way Red Connector – Row “S41 ~ 60”

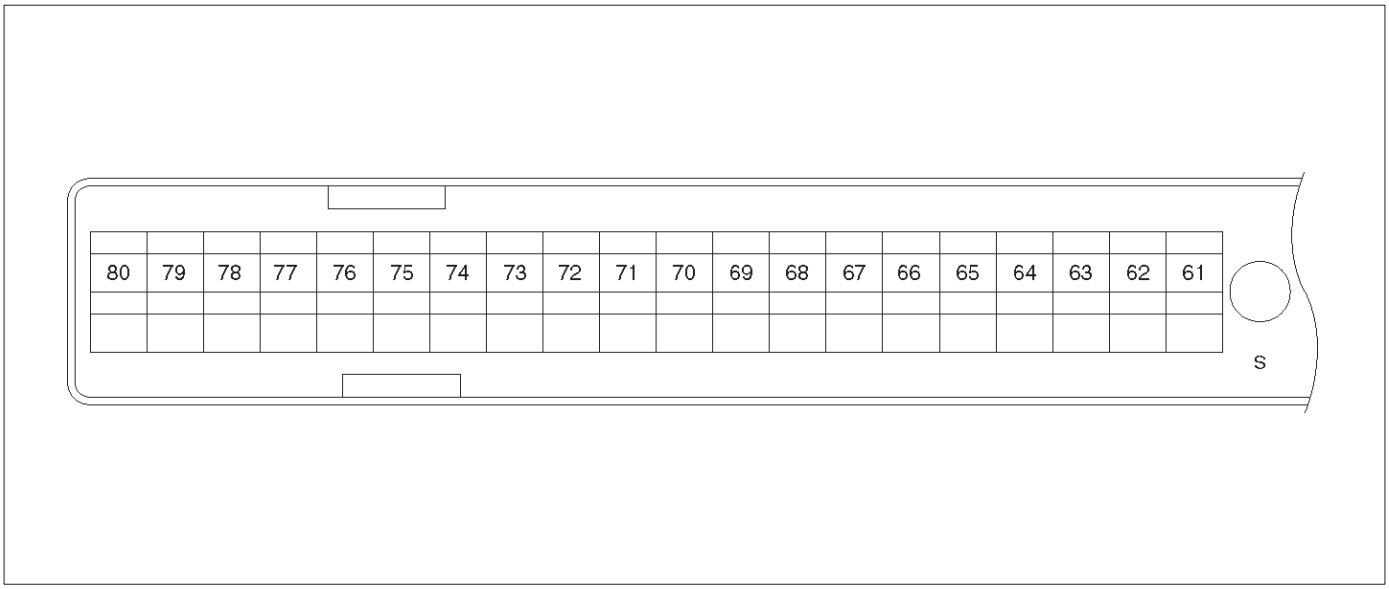


060RY00050

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S41	AP Sensor 3 Sensor Ground	ORN/BLU	0.0V	0.0V	On-Vehicle Service
S42	Bank 2 HO2S 1 Heater Ground	WHT/RED	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S43	Solenoid Power Supply	GRY/WHT	B+	B+	4L30E T/Mission
S44	Rr Def. Relay	RED/WHT	—	—	—
S45	Starter Relay	BLK/BLU	—	—	—
S46	Fuel Gauge	YEL/RED	B+	B+	Chassis Electrical
S47	Water Temp. Gauge	WHT/BLK	B+	B+	4L30E T/Mission
S48	Fuel Gauge	YEL/RED	B+	B+	General Description and Chassis Electrical
S49	DLC	RED/WHT	B+	B+	General Description
S50	Fuel Sender Unit	ORN/GRN	0.0V	0.0V	—
S51	TCC Solenoid	BRN/BLU	0.0V	0.0V	T/Mission
S52	Vapor Pressure (Fuel Tank Pressure) Sensor Signal	GRY	0.2–4.8V	0.2–4.8V	General Description and Operation, VP Sensor
S53	Power Switch	VIO/RED	B+	B+	4L30E T/Mission
S54	Bank 2 HO2S 1 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S55	Transmission Output Speed Sensor	BLU/GRN	0.0V	0.0V	4L30E T/Mission
S56	Not Used	—	—	—	—
S57	Not Used	—	—	—	—
S58	Bank 1 HO2S 1 High	ORN/BLU	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S59	Auto Cruise Set Switch	Light GRN	0.0V	0.0V	Chassis Electrical
S60	Fuel Sender Unit	BLU/YEL	0.5–4.9V	0.5–4.9V	On-Vehicle Service PCM and Sensors

PCM Pinout Table, 80-Way Red Connector – Row “S61 ~ 80”



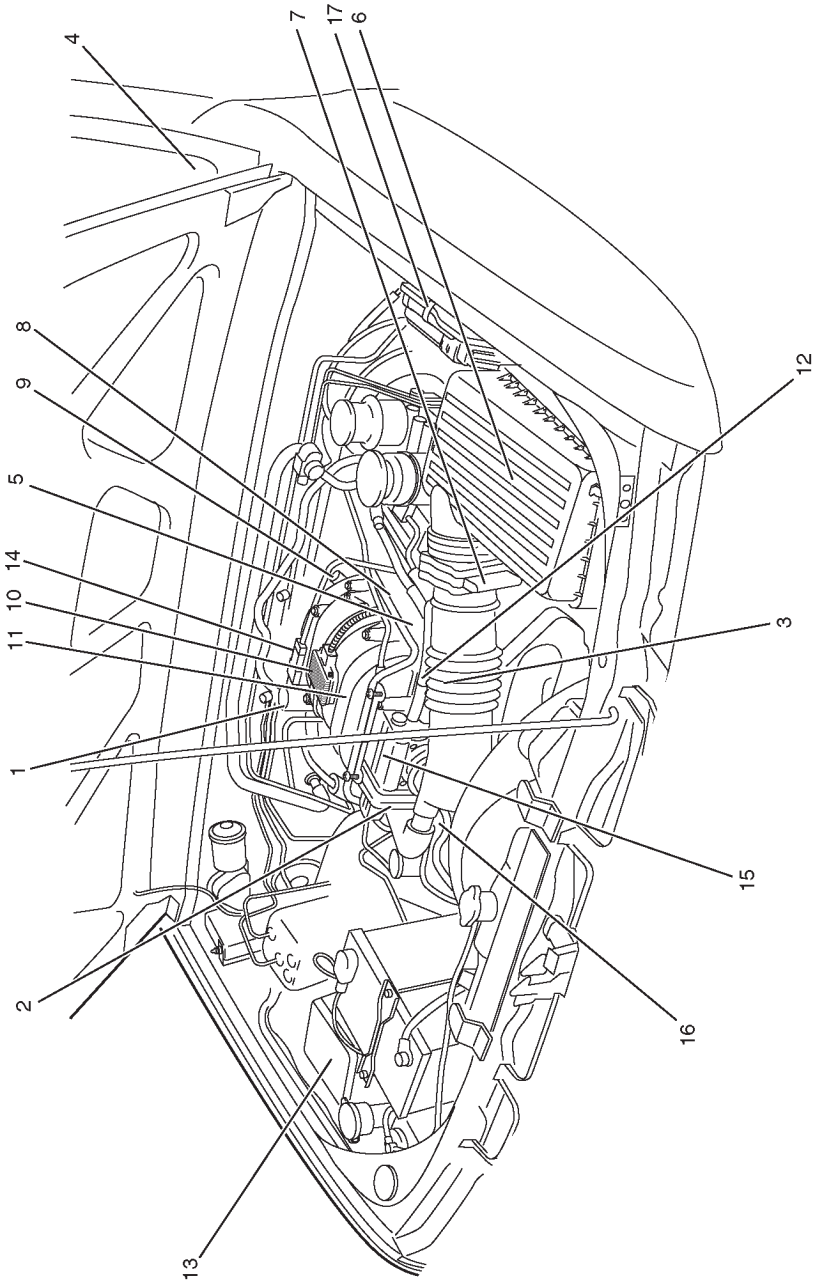
060RY00051

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S61	Intake Air Temperature (IAT) Sensor Ground	YEL/GRN	0.0V	0.0V	General Description and Operation, IAT
S62	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
S63	Bank 1 HO2S 2 High	WHT	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S64	Bank 2 HO2S 1 High	PNK	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S65	Bank 2 HO2S 2 High	GRN	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S66	Transmission Fluid Temperature Sensor	RED/BLK	0.5–4.9V (depends on temperature)	0.5–4.9V (depends on temperature)	4L30E T/Mission
S67	Exhaust Gas Recirculation (EGR) Position Signal	GRY/RED	0.6V	0.6V	General Description and Operation, EGR Control
S68	Accelerator Position (AP) Sensor 1	WHT	0.41–0.45V	0.41–0.45V	On-Vehicle Service
S69	Throttle Valve DC Motor(+: FWD)	GRN	Duty Cycle	Duty Cycle	General Description and Operation, ETC
S70	Not Used	—	—	—	—
S71	Not Used	—	—	—	—
S72	Ignition Feed	RED/GRN	B+	B+	Chassis Electrical
S73	Auto Cruise Main Lamp	GRN/WHT	B+	B+	Chassis Electrical
S74	Variable Intake Manifold	YEL/BLK	0.0V	B+ (rpm 3600 over)	General Description
S75	Canister Purge Cut Solenoid Valve	RED/WHT	6.0V Tank empty	5.7V Tank empty	General Description and Operation, EVAP
S76	Throttle Position (TP) 1 Sensor Signal	BLU	0.5–0.8V	0.5–0.8V (at idle)	General Description and Operation, TPS

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S77	5Volt Reference (AP Sensor 3)	ORN	5.0V	5.0V	AP Sensor
S78	Accelerator Position (AP) Sensor 2	YEL	0.41–0.45V	0.41–0.45V	On-Vehicle Service
S79	Accelerator Position (AP) Sensor 3	BLU/GRN	4.55–4.99V	0.41–0.45V	On-Vehicle Service
S80	Manifold Absolute Pressure (MAP) Sensor Ground	GRN	0V	0V	General Description and Operation, Manifold Absolute Pressure

Component Locators

Engine Component Locator

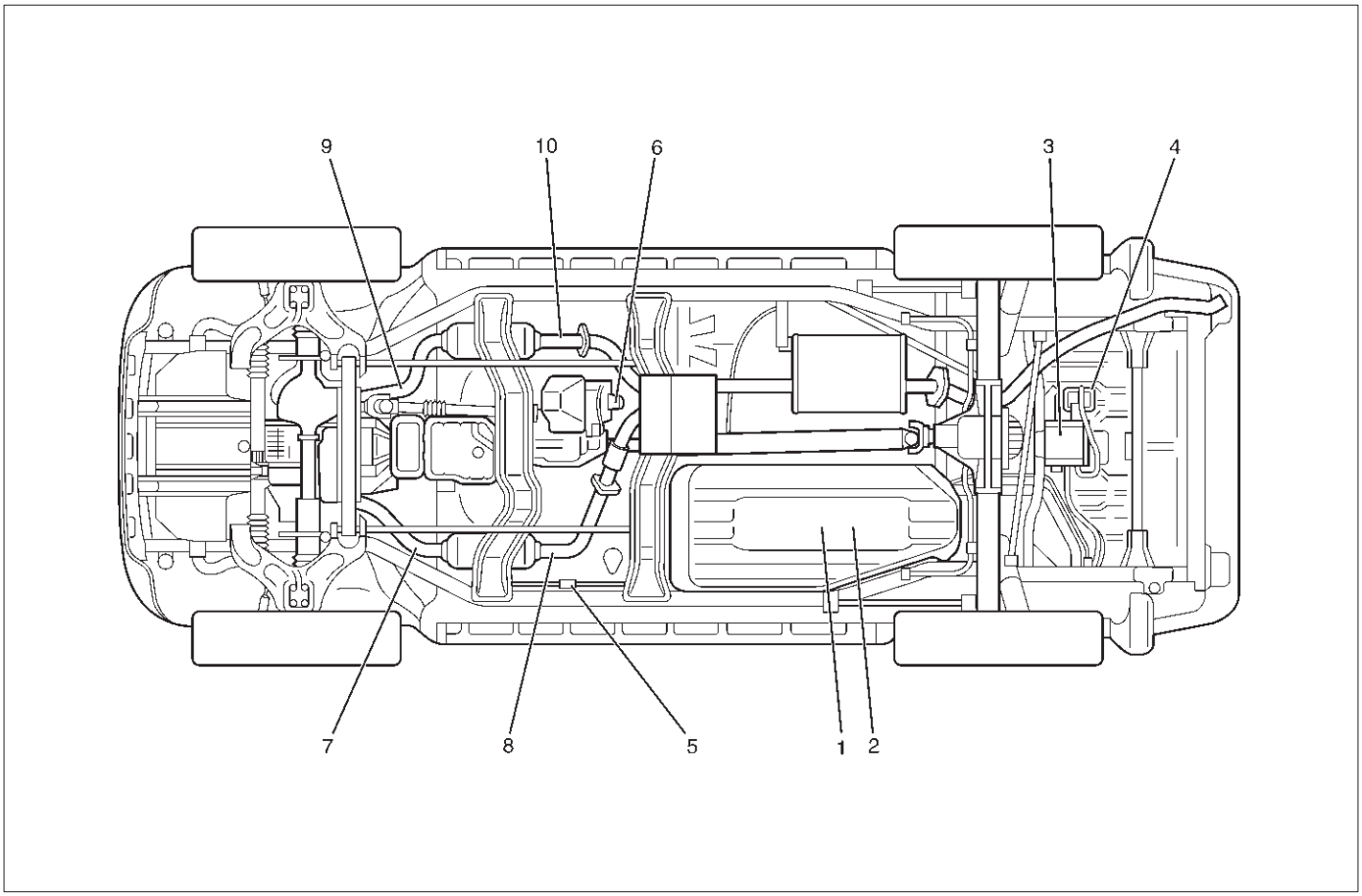


060R200040

Engine Component Locator Table

Number	Name	Location
1	Linear Exhaust Gas Recirculation (EGR) Valve	Rear right side of the engine
2	Throttle Position (TP) Sensor	On the throttle body
3	Intake Air Temperature (IAT) Sensor	On the intake air duct near the throttle body
4	Check Engine (MIL) Light	On the instrument panel beneath the tachometer
5	Positive Crankcase Ventilation (PCV) Valve	On the left of the cylinder head cover
6	Air Cleaner	Left front of the engine bay
7	Mass Air Flow (MAF) Sensor	Attached to the air filter box
8	Fuel Rail	On the Common Chamber
9	Fuel Pressure Regulator	Rear side of the engine
10	ION Sensing module	Bolted to the top of the Common Chamber
11	Common Chamber	Top of the engine
12	EVAP Duty Solenoid Valve	Bolted to the front of the coolant pipe
13	Fuse/Relay Box	Along the inside of the right fender
14	Manifold Absolute Pressure (MAP) Sensor	Bolted to the top of the Common Chamber
15	Throttle Body	Between the intake air duct and the Common Chamber
16	Engine Coolant Temperature Sensor	On the coolant crossover pipe at the front of the engine, near the throttle body
17	Power Train Control Module (PCM)	Along the inside of the left fender

Undercarriage Component Locator

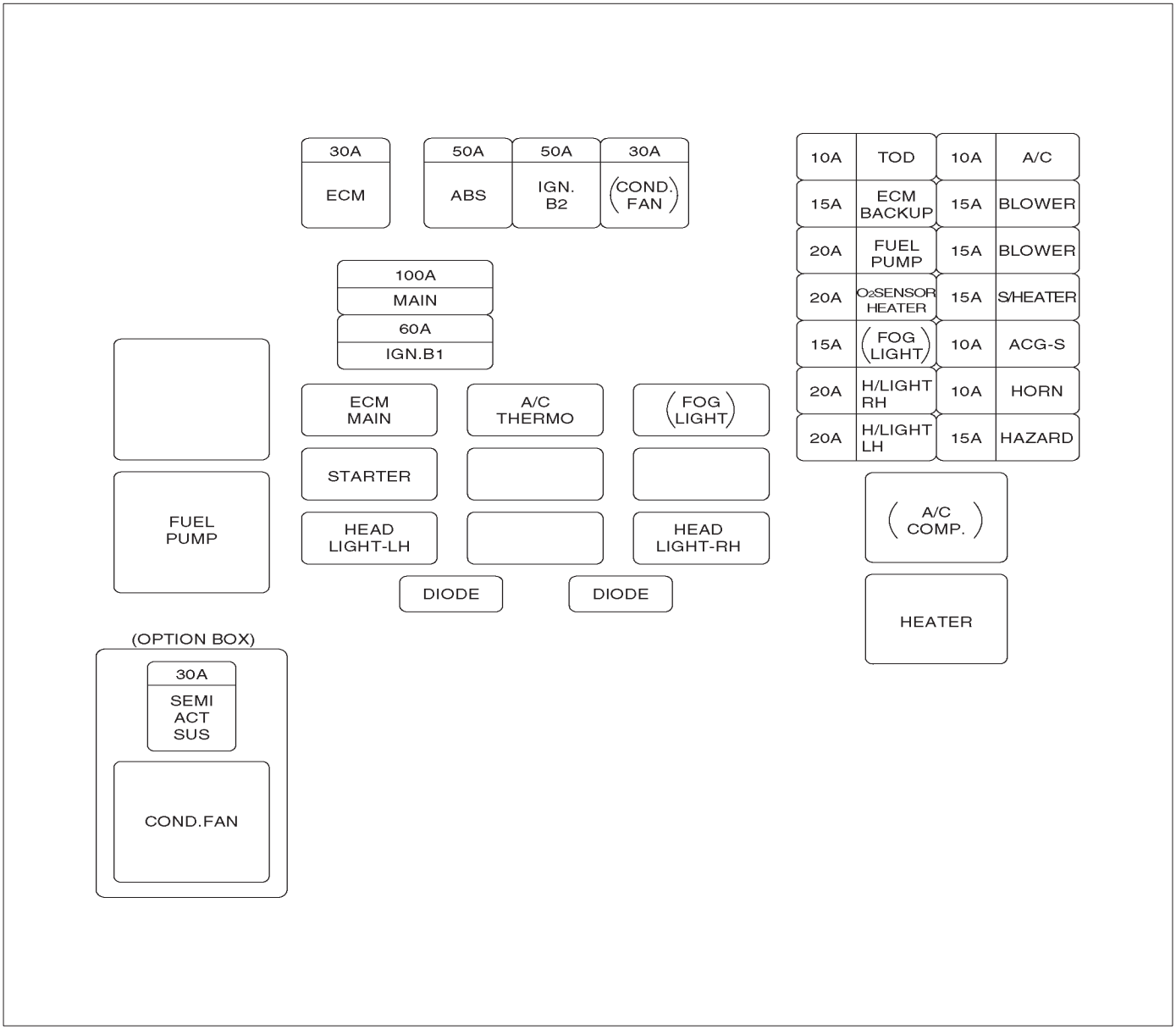


014RW142

Undercarriage Component Locator Table

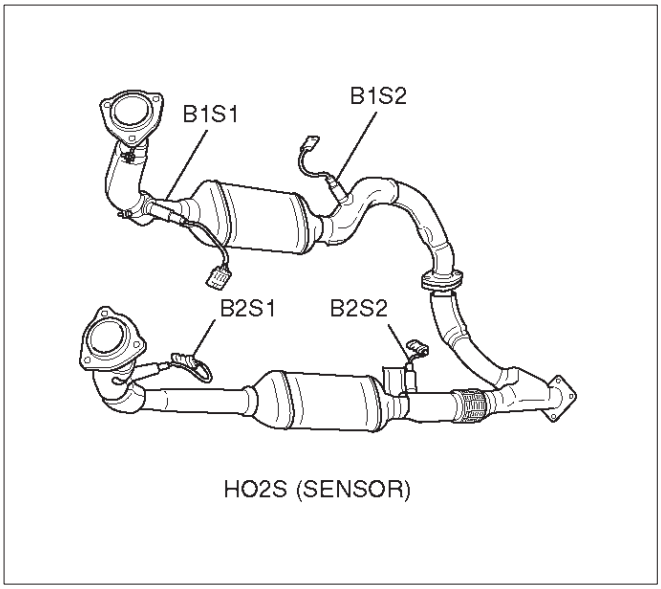
Number	Name	Location
1	Fuel Pump Assembly and Vapor Pressure (Fuel Tank Pressure) Sensor	Installed in the top of the fuel tank
2	Fuel Gauge Unit	Installed in the top of the fuel tank
3	Evaporative (EVAP) Canister	On the top of the bracket that is located behind the cross member
4	Vent Solenoid (EVAP Canister)	On the top of the bracket that is located behind the cross member
5	Fuel Filter	Located along the inside of the right frame rail, ahead of the fuel tank
6	Vehicle Speed Sensor (VSS)	Protrudes from the transmission housing, just ahead of the propeller shaft
7	Heated Oxygen Sensor (Bank 1, HO2S 1)	Threaded into the exhaust pipe behind the right-hand catalytic converter
8	Heated Oxygen Sensor (Bank 1, HO2S 2)	Threaded into the exhaust pipe ahead of the right-hand catalytic converter
9	Heated Oxygen Sensor (Bank 2, HO2S 1)	Threaded into the exhaust pipe ahead of the left-hand catalytic converter
10	Heated Oxygen Sensor (Bank 2, HO2S 2)	Threaded into the exhaust pipe behind the left-hand catalytic converter

Fuse and Relay Panel (Underhood Electrical Center)

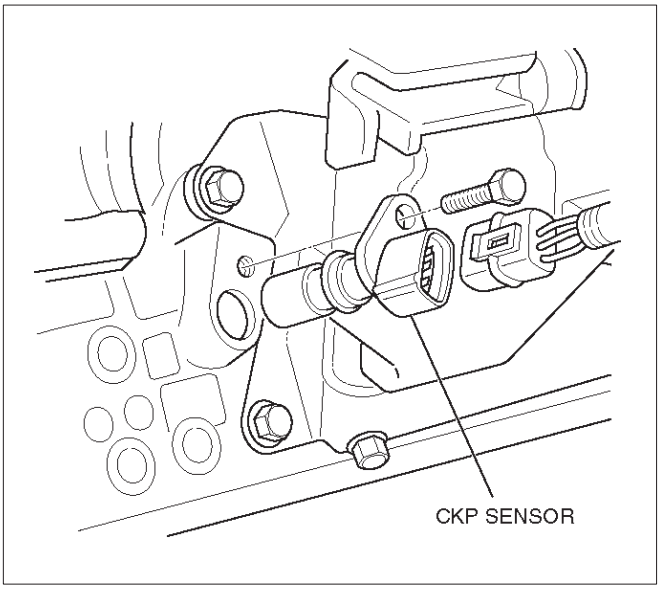


060R200085

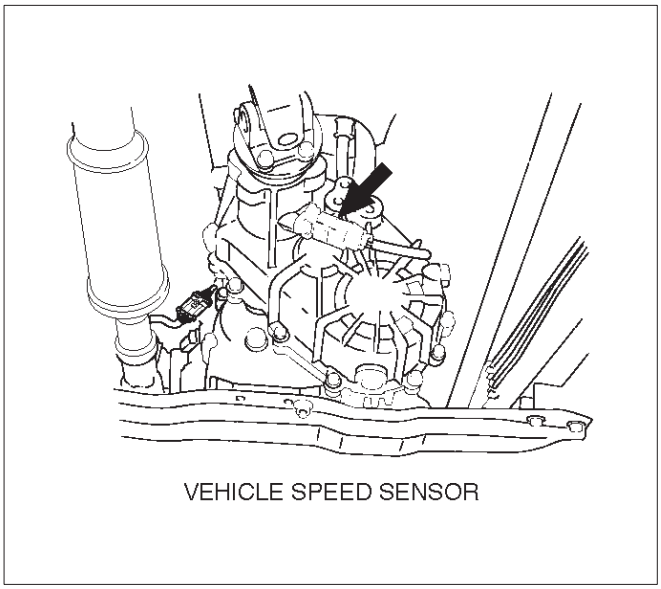
Sensors and Miscellaneous Component Locators



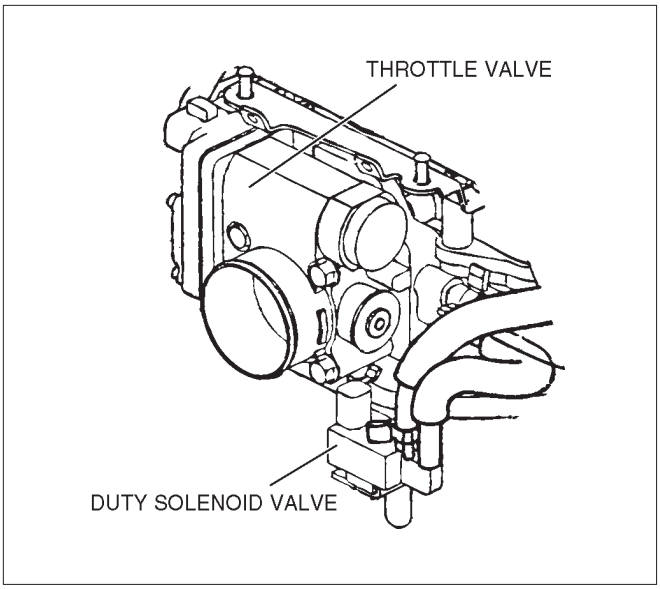
060RY00013



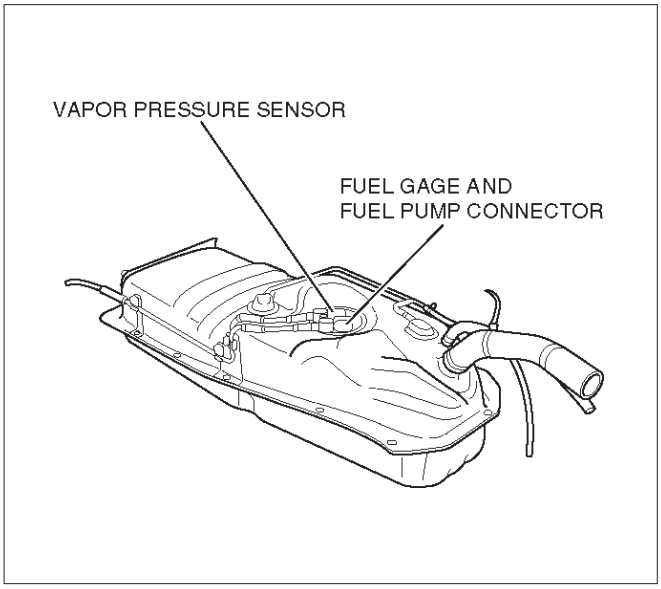
060RW111



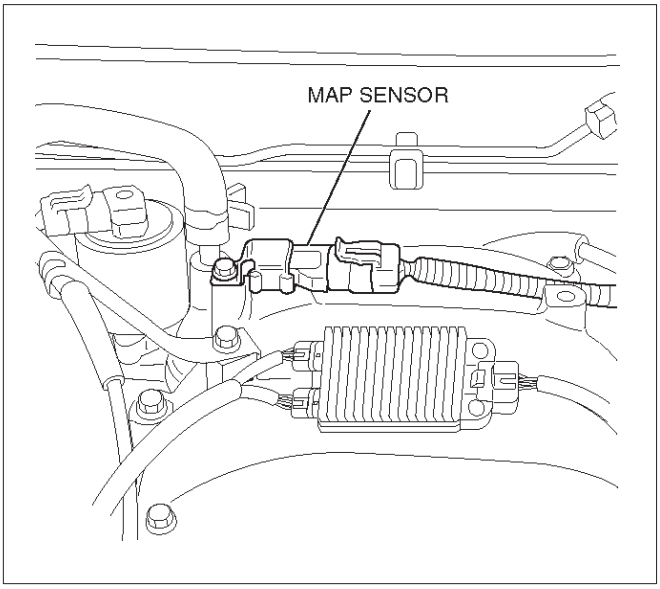
T321067



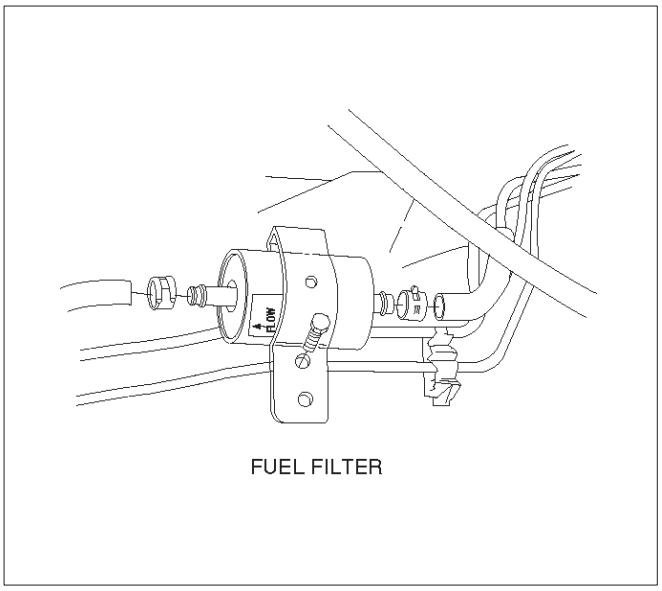
060R200080



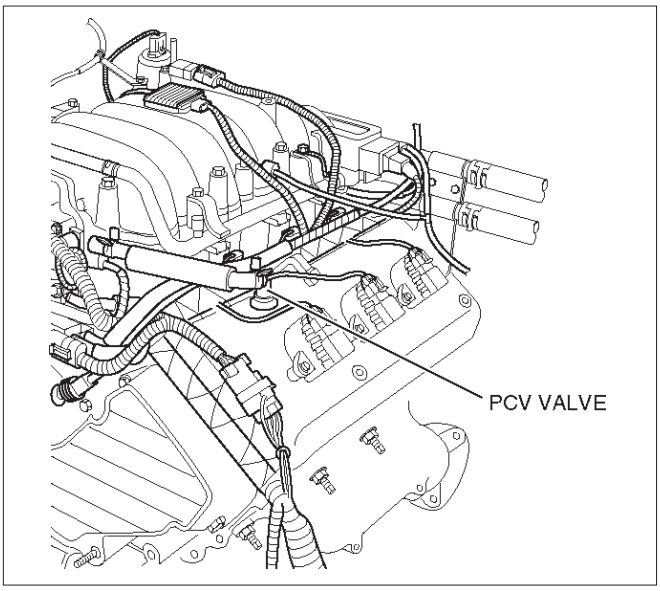
014RW126



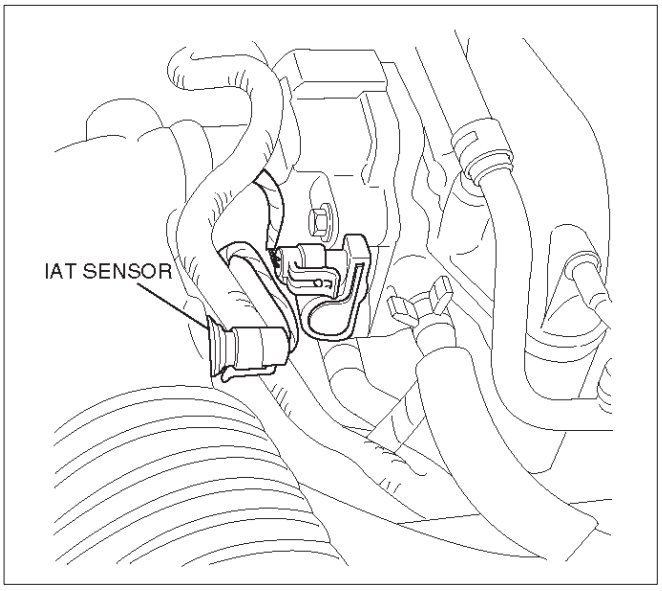
055RY00002



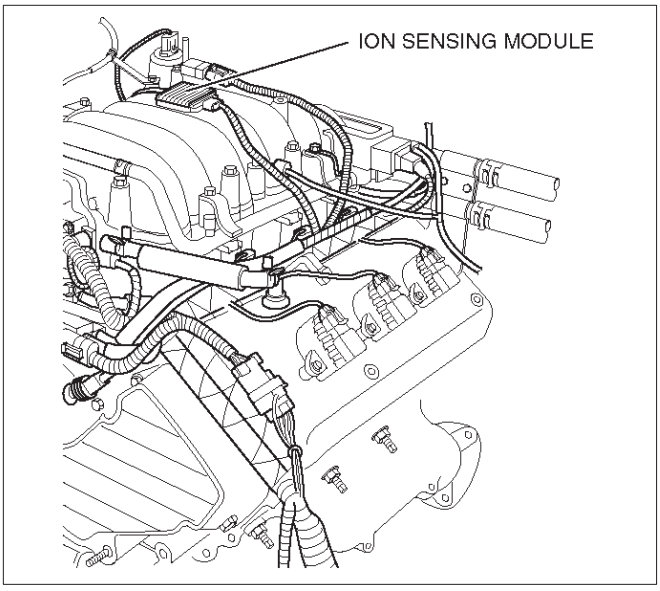
041RW004



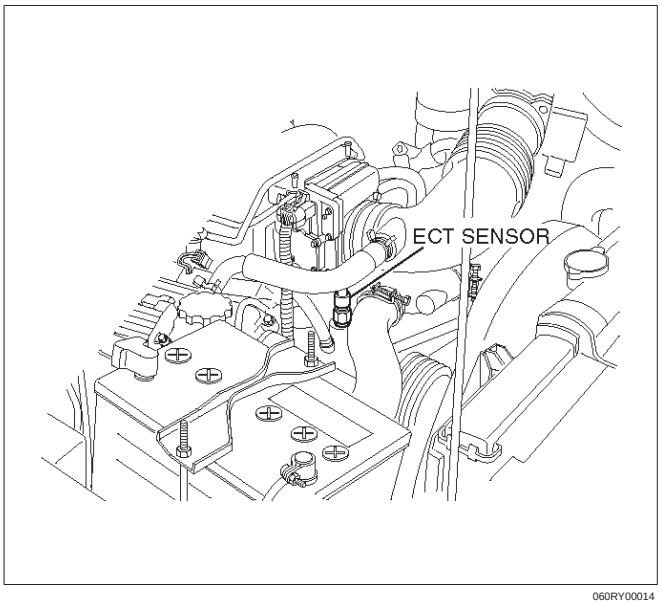
060RY00016



025RW005



060RY00023



060RY00014

Diagnosis

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   - ▼ To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - ▼ Conduct a thorough visual inspection.
   - ▼ Review the service history.
   - ▼ Detect unusual sounds or odors.
   - ▼ Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - ▼ This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - ▼ “System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint.
   When the complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in *Intermittents* section, or could be normal.
2. Repair and verify.
   After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
   - ▼ Conditions noted by the customer.
   - ▼ If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL(”Check Engine” lamp) has been requested).
2. Clear the DTC(S).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

OBD II Serviceablity Issues

With the introduction of OBD II diagnostics across the entire passenger car and light-duty truck market in 1996, illumination of the MIL (“Check Engine” lamp) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer

dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL ("Check Engine" lamp) with OBD II systems is new.

Fuel additives such as "dry gas" and "octane enhancers" may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will show up as a Misfire DTC P0300. The Reed Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reed Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic as well.

Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Many of the major fuel companies advertise that using "premium" gasoline will improve the performance of the vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel's ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non-OEM Parts

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high-performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL ("Check Engine" lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL ("Check Engine" lamp) to turn on.

Aftermarket electronics, such as transceivers, stereos, and anti-theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL ("Check Engine" lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain-soaked, it can temporarily cause engine misfire and turn on the MIL ("Check Engine" lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on-board diagnostic system will sense this as a system fault and turn on the MIL ("Check Engine" lamp) with a DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL ("Check Engine" lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL ("Check Engine" lamp) to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD II. Poor vehicle maintenance can't be classified as a "non-vehicle fault", but with the sensitivity of OBD II diagnostics, vehicle maintenance schedules must be more closely followed.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment "Vehicle Emissions Control Information Label" contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced. It can be ordered from Isuzu Dealership.

Visual / Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnections, and proper routing.
- Inspect hoses that are difficult to see behind other components.

- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Serial Data Communications

Class 2 Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the "Class 2" communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class 2 data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Scan tool manufacturers with the capability to access data from any make or model vehicle that is sold. The data displayed on other Scan tools will appear the same, with some exceptions. Some Scan tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. On this vehicle the Scan tool displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

On-Board Diagnostic (OBD II)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage. Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable. Output components to be monitored include, but are not limited to, the following circuits:

- Control module controlled EVAP Canister Purge Valve
- Electronic Transmission controls
- A/C relays
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70˚C (160˚F) *and* rise at least 22˚C (40˚F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Frame Data* in this section for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

System Status and Drive Cycle for Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on-board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on-board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required".

The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E under the heading "Conditions for Setting the DTC". Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAF/MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- TCC enabled
- A/C on

Trip

Technically, a trip is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is idle; some diagnostics function with the TCC disabled. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enabling criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as the following:

- Commanding the MIL ("Check Engine" lamp) on and off
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non-emission related Service Lamp
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns on the MIL when emission-related faults occur. It can also turn off the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) ("Check Engine" lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("Check Engine" lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned on when the PCM detects a DTC that will impact vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three-Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain on steady.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after *three(3) consecutive* trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned off, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm-up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur within 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL ("Check Engine" lamp) is on the instrument panel and has the following function:

- It informs the driver that a fault affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come "ON" with the key "ON" and the engine not running. When the engine is started, the MIL will turn "OFF."
- When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On-Board Diagnostic (OBD ll) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - "Armed" after one (1) trip with a fail
  - "Disarmed" after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non-Emissions related
  - Requests illumination of the Service
  - Stores a History DTC on the *first trip* with a fail

- *Does not* store a Freeze Frame
- Stores Fail Record when test fails
- Updates the Fail Record each time the diagnostic test fails

- Type D
  - Non-Emissions related
  - Not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to "flash" at a rate of once per second during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned off, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non-consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate
- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- AP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

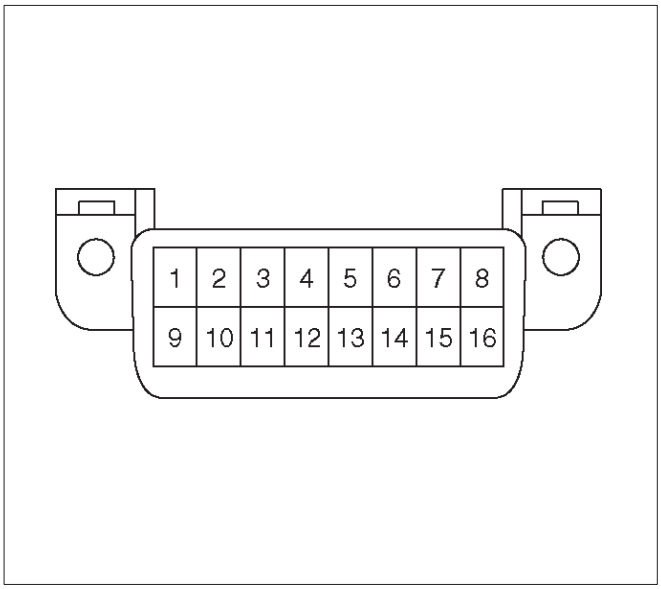
In the case of an "intermittent" fault, the MIL ("Check Engine" lamp) may illuminate and then (after three trips) go "OFF". However, the corresponding diagnostic trouble code will be stored in memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the "Diagnostic Aids" associated with the diagnostic trouble code. A physical inspection of the applicable sub-system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel behind a small square cover. The DLC is used to connect to the Tech 2 Scan Tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.



TS24064

Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan Tool manufacturers with software information to display vehicle operating parameters. All Scan Tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD ll systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using The Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan Tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the “warm-up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan Tool “clear DTCs” or “clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

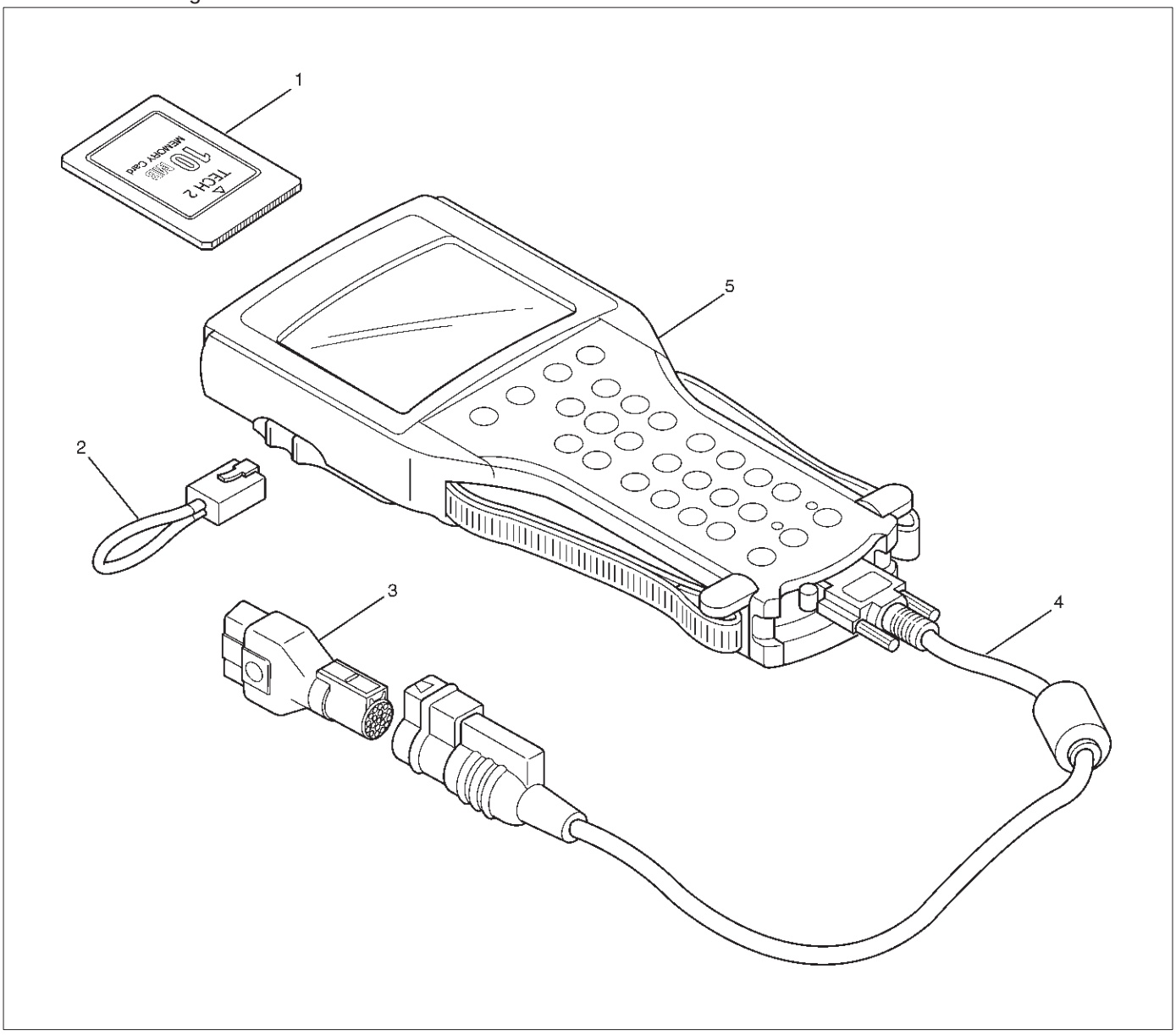
When a Scan Tool is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be “OFF” when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors, etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 Scan Tool. Please refer to the Tech 2 user guide.



901RW180

Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

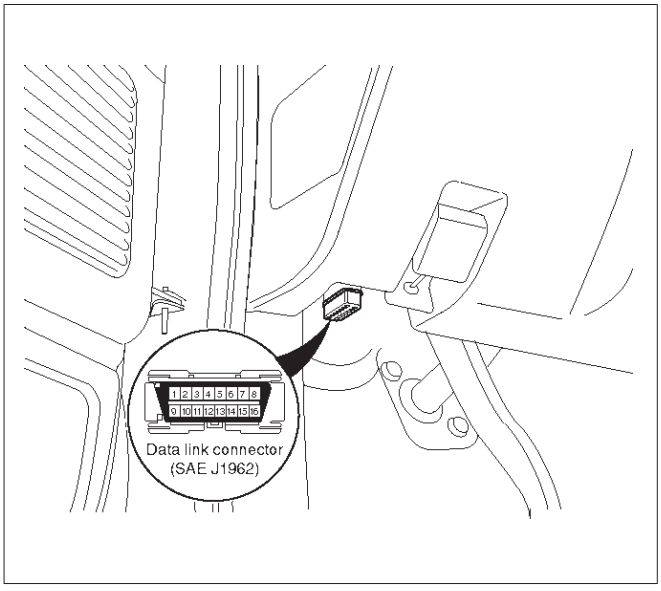
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volts.
2. After connecting and/or installing the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

▼ Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. Insert the Isuzu system PCMCIA card (1) into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



826RW002

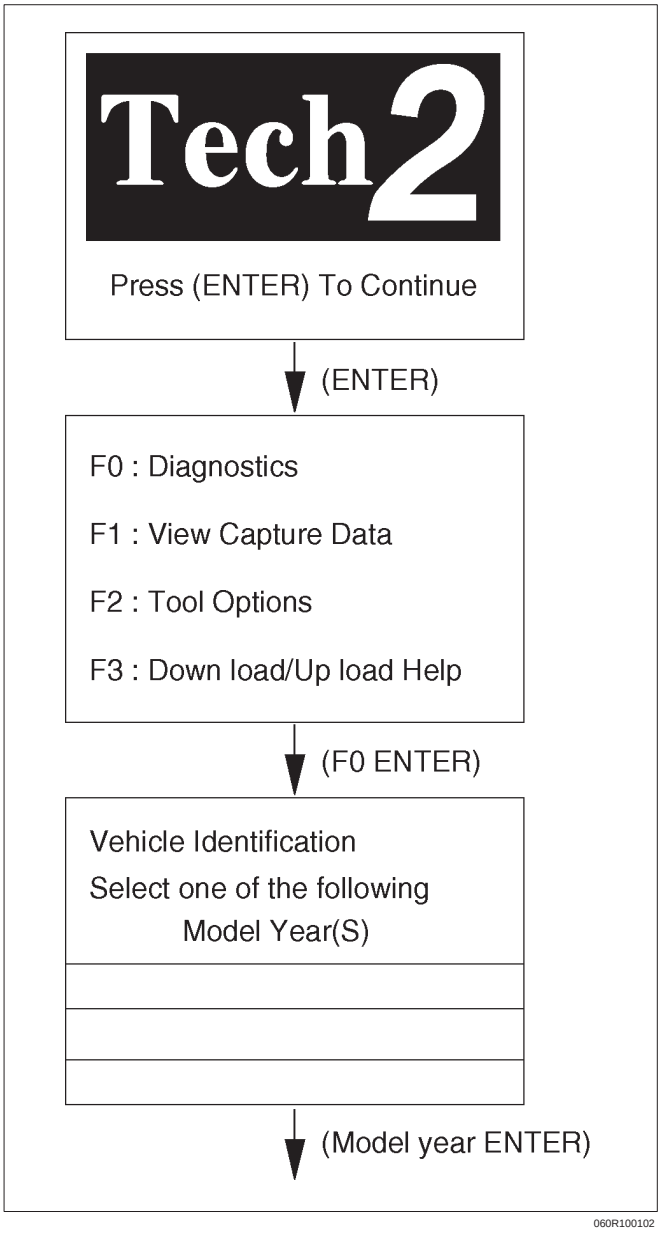
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and verify the Tech 2 power up display.

060RW009

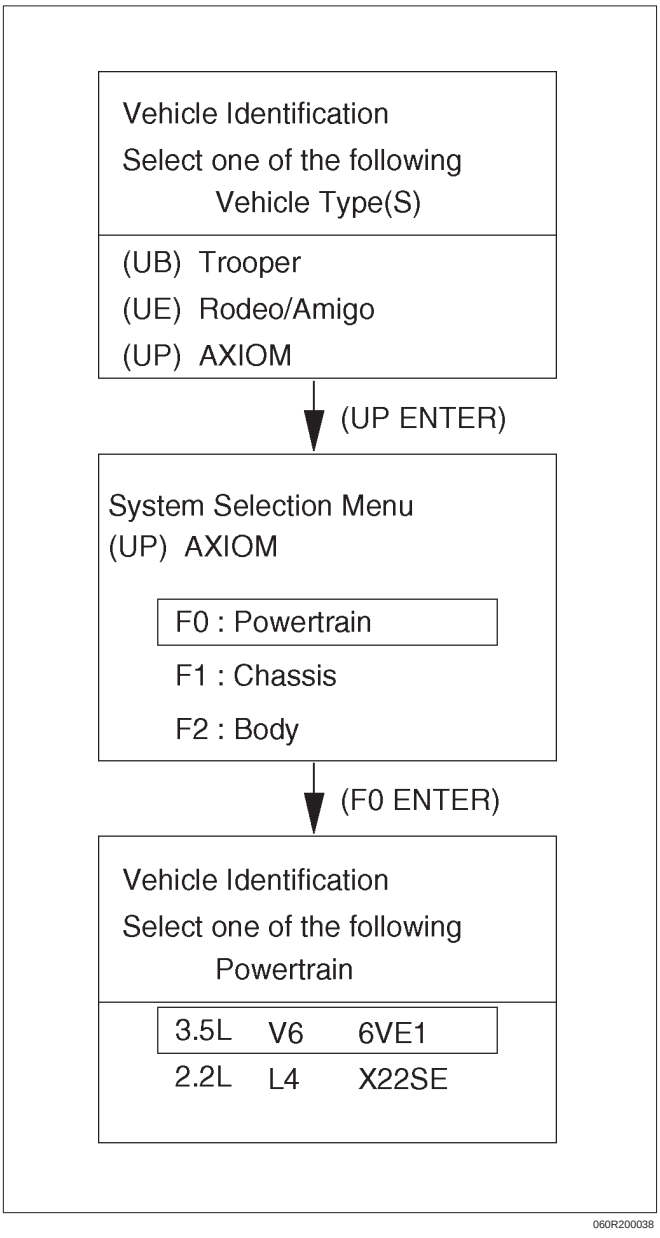
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

Operating Procedure (For Example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



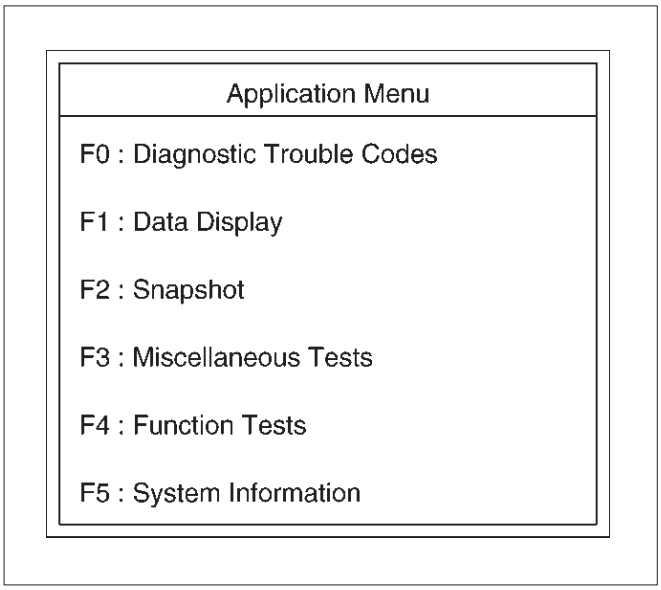
060R100102



060R200038

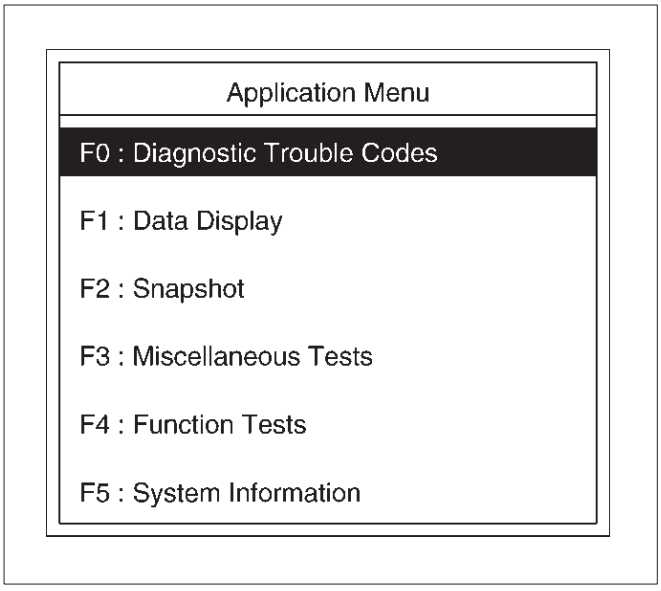
Menu

▼ The following table shows which functions are used for the available equipment versions.



060R100018

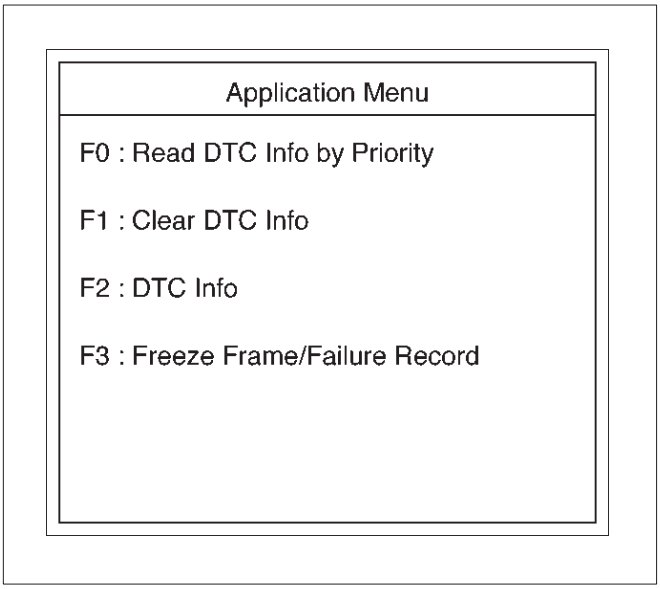
DTC Modes



060R100077

On OBD II vehicles there are options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

1. Read DTC Info by Priority
2. Freeze Frame
3. Fail Records (not all applications)
4. DTC Info
5. Clear Info



060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information.

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

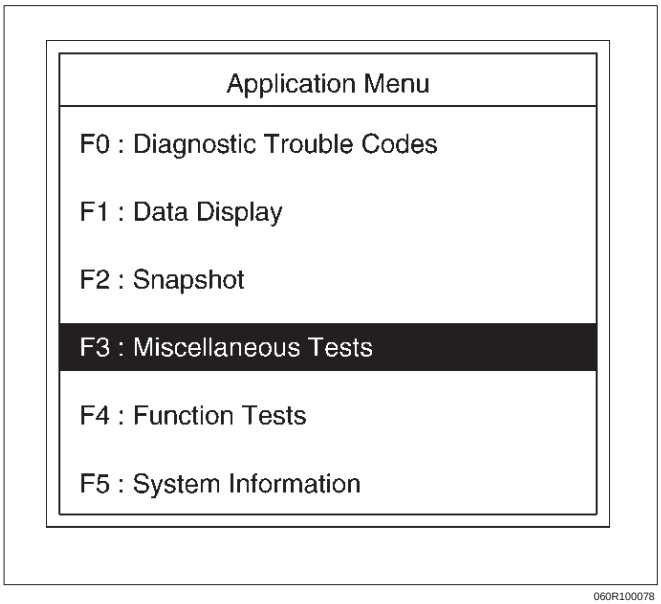
This test consists of eight menus-Lights, Relays, EVAP, Fuel System, Instruments, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.
In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.
To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. Down load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

Lamps Test

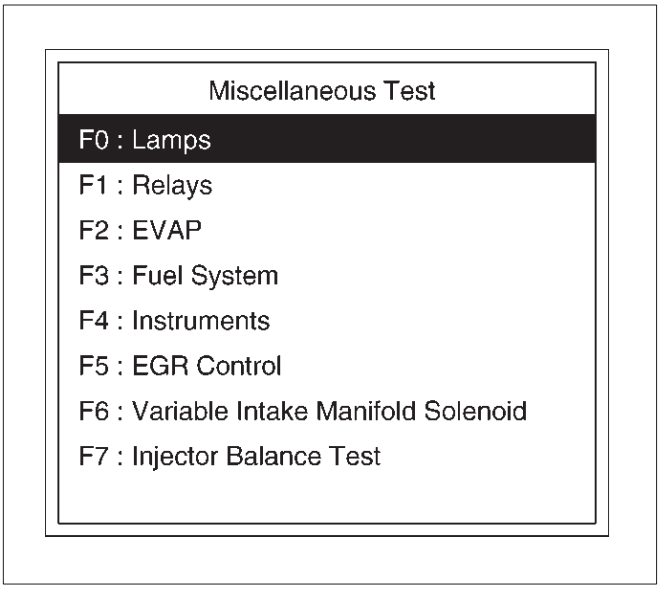
This test is conducted check MIL, Up Shift Lamp, Low Fuel Lamp, Reduced Power Lamp and Cruise Control Lamp for its working.
Tech2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



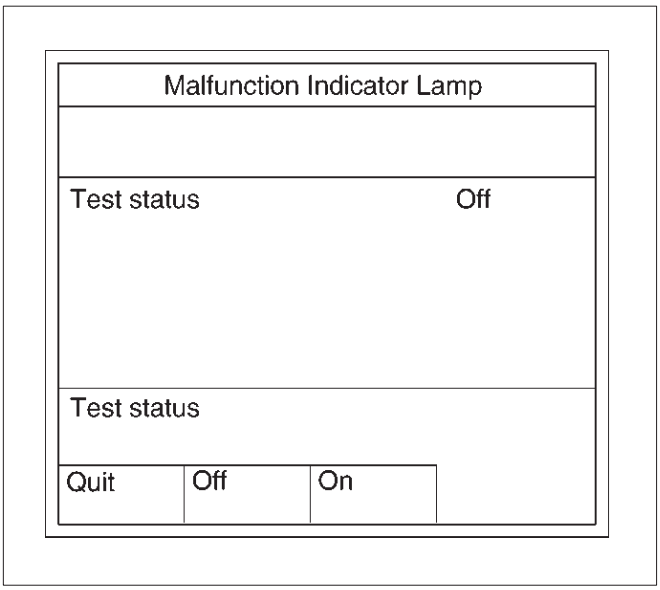
060R100078

4. Select F0:Lamps Test in the Miscellaneous Test.



060RY00080

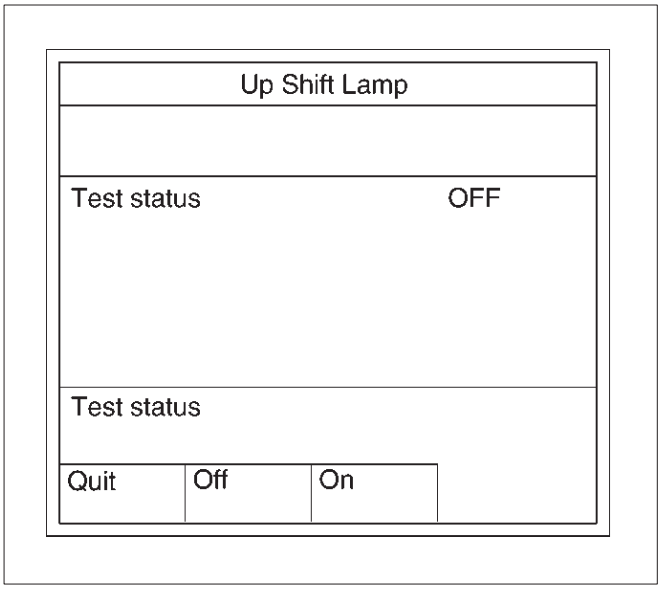
5. Select F0:Malfunction Indicator Lamp.



060RY00091

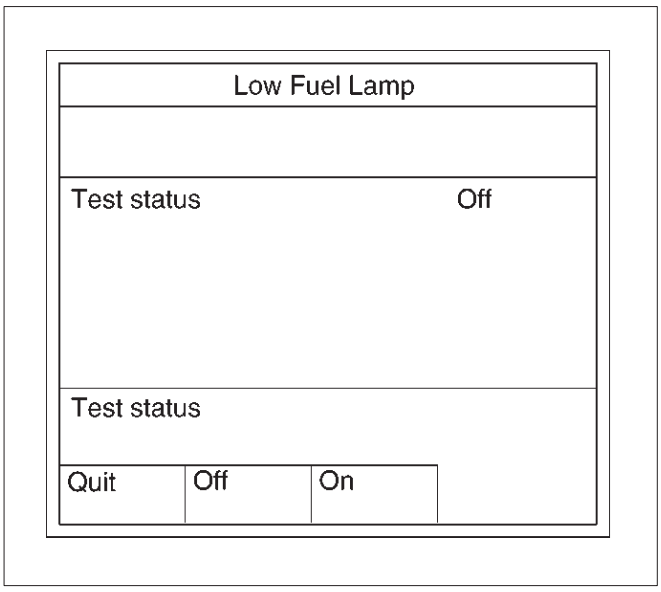
6. Push”On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.

9. Select F2: Up Shift Lamp



060RY00076

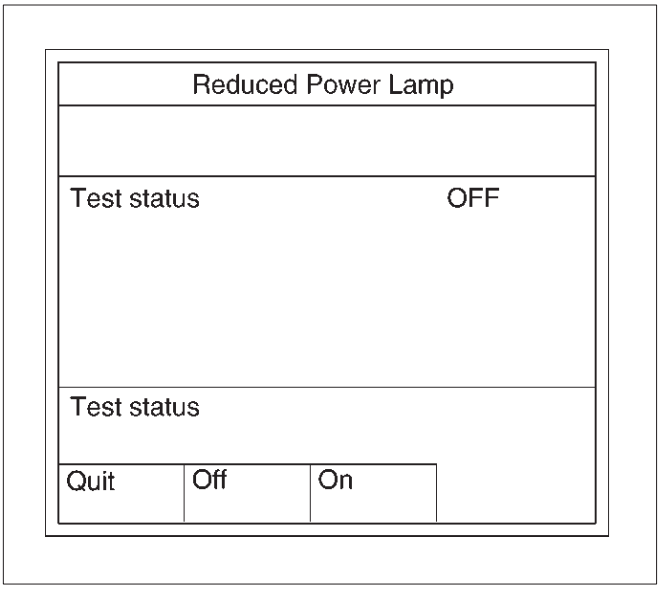
10. Push “On” soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operating correctly.
13. Select F2:Low Fuel Lamp



060RY00092

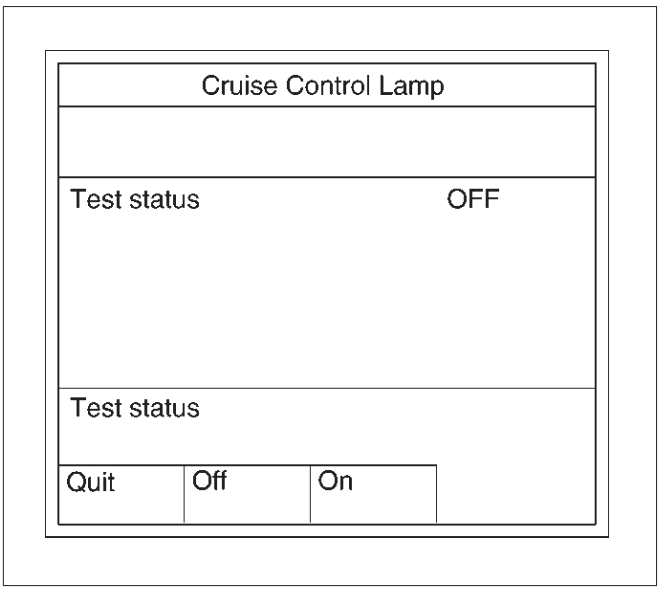
14. Push “On” soft key.
15. Make sure Lamp illuminates.
16. If Lamp illuminates, the Lamp is operating correctly.

17. Select F3:Reduced Power Lamp



060RY00077

18. Push “On” soft key.
19. Make sure Lamp illuminates.
20. If Lamp illuminates, the Lamp is operating correctly.
21. Select F5:Cruise Control Lamp



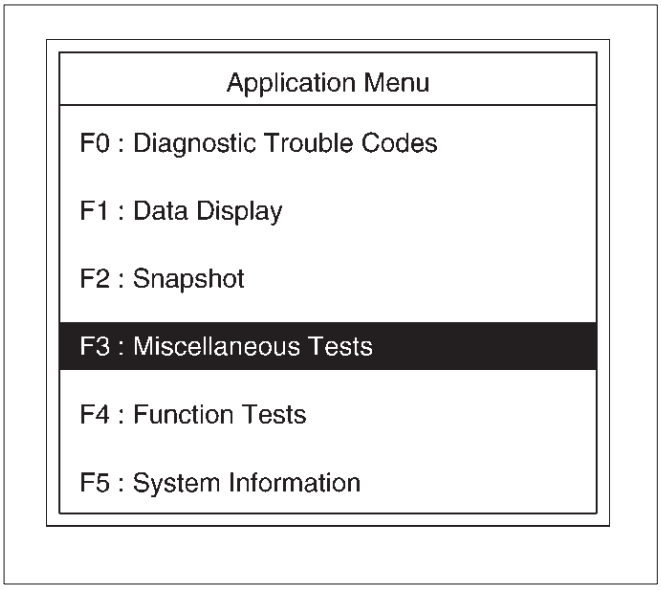
060RY00078

22. Push “On” soft key.
23. Make sure Lamp illuminates.
24. If Lamp illuminates, the Lamp is operating correctly.

Relays Test

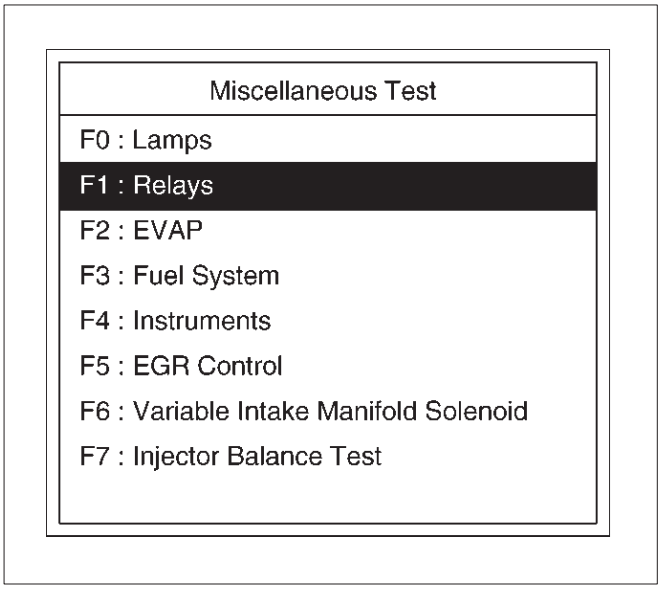
This test is conducted to check Fuel Pump Relay and A/C Clutch for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



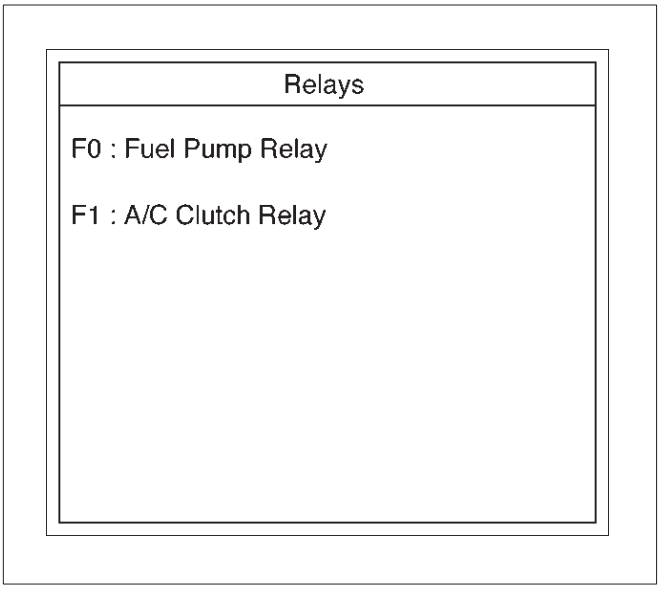
060R100078

4. Select F1:Relay Test in the Miscellaneous Test.



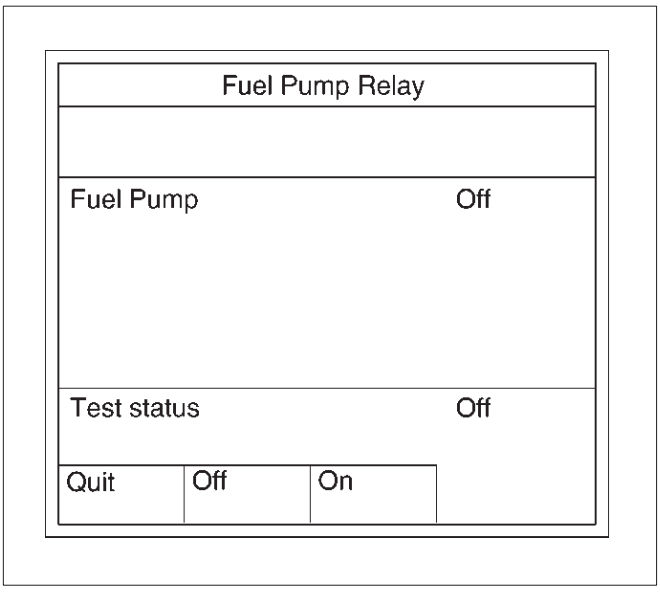
060RY00081

5. Select F0:Fuel Pump Relay.



060RX021

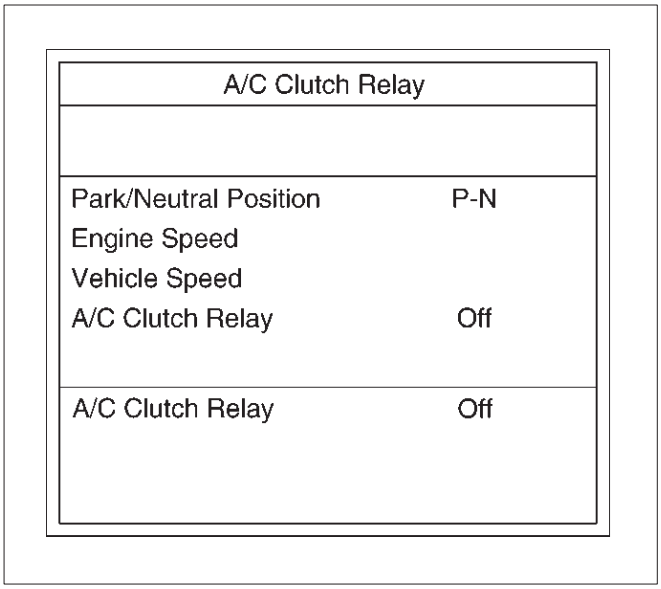
6. Push “On” soft key.



060RY00093

7. Control Fuel Pump Relay and check data list.
8. If the data list changes, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. Run the Engine at idle.

11. Turn on Air Conditioning.



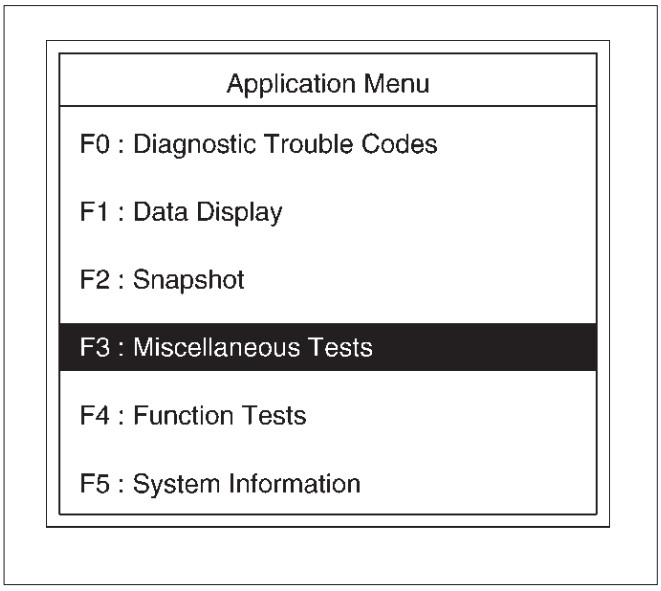
060RY00094

12. Turn “On” and “Off” A/C Switch.
13. Contol A/C Clutch Relay and check data list.
14. If the data list changes, the Fuel Pump Relay is normal.

EVAP Test

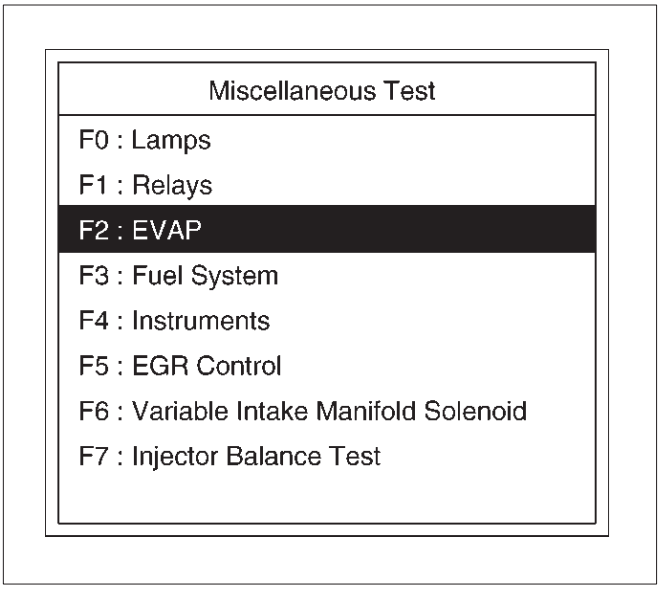
This test is conducted to check EVAP system for its power operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



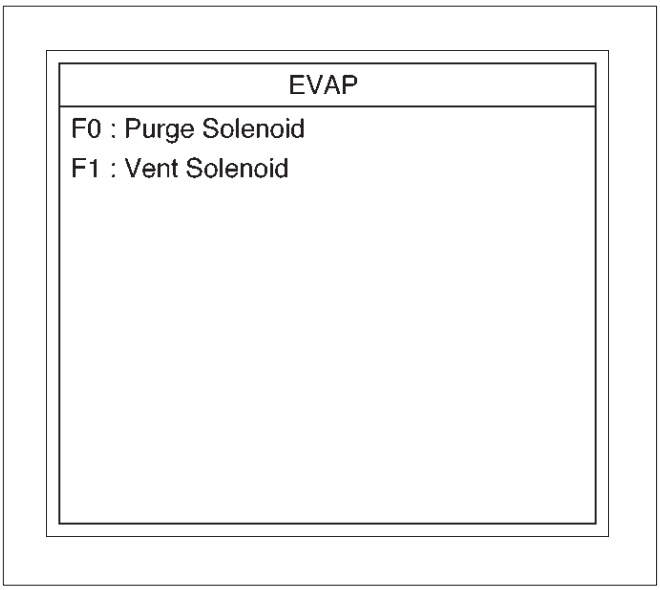
060R100078

4. Select F2: EVAP Test in the Miscellaneous Test.



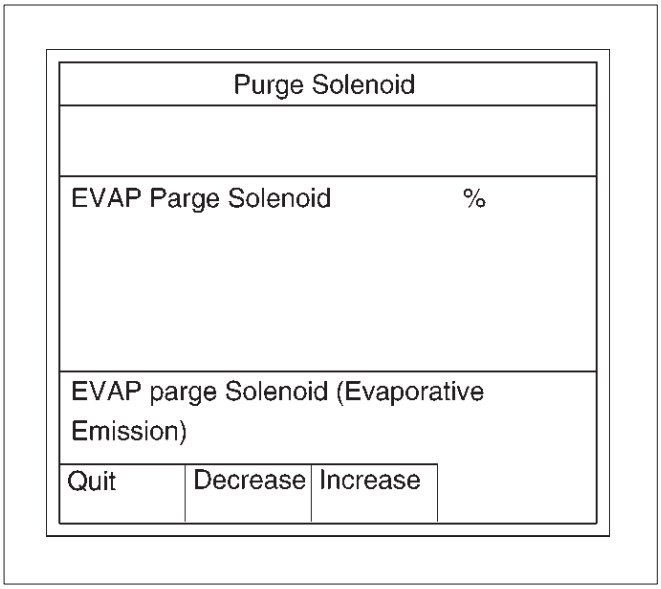
060RY00082

5. Select F0: Purge Solenoid.



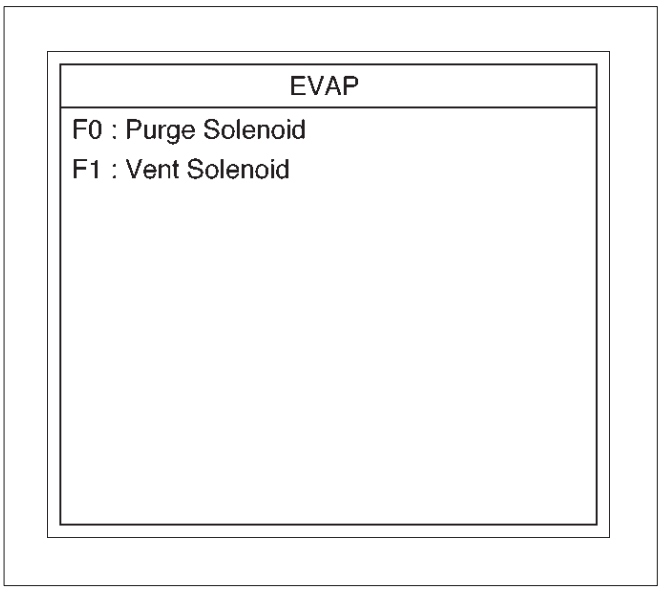
060RX025

6. Push “Decrease” or “Increase” soft key.



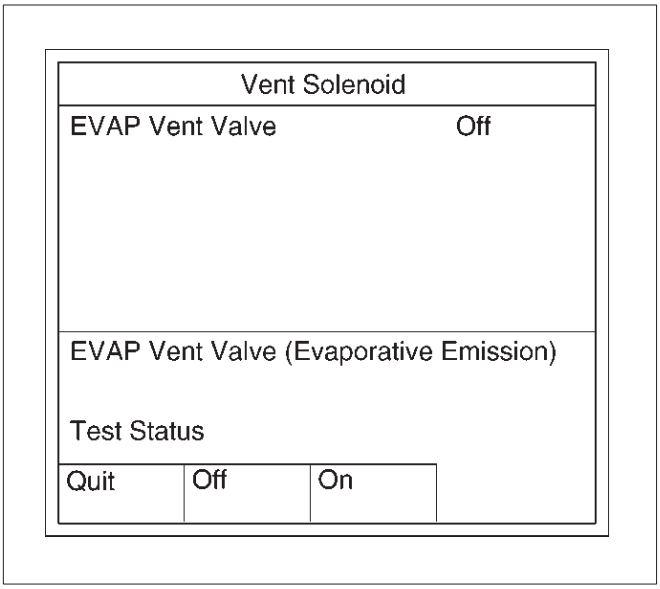
060RY00095

7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the Purge Solenoid is normal.
9. Turn engine off, turn ignition SW “On”.
10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” soft key.



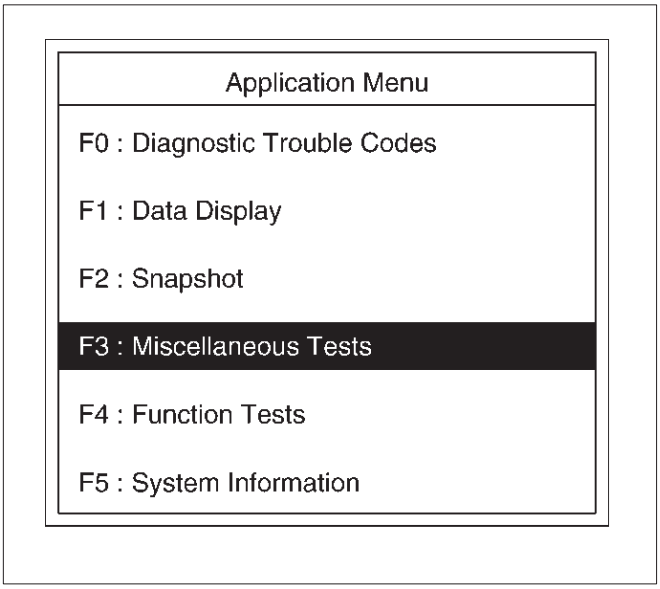
060RY00096

12. Control EVAP Vent Solenoid and check data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Fuel System Test

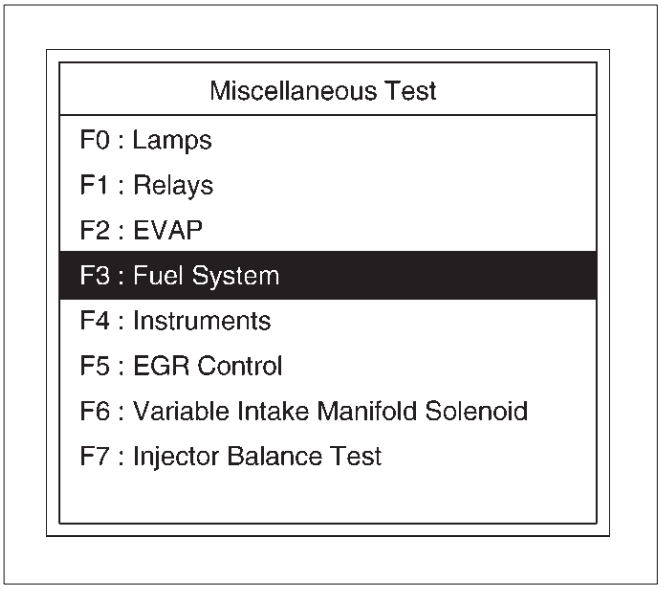
This test is conducted check Fuel system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



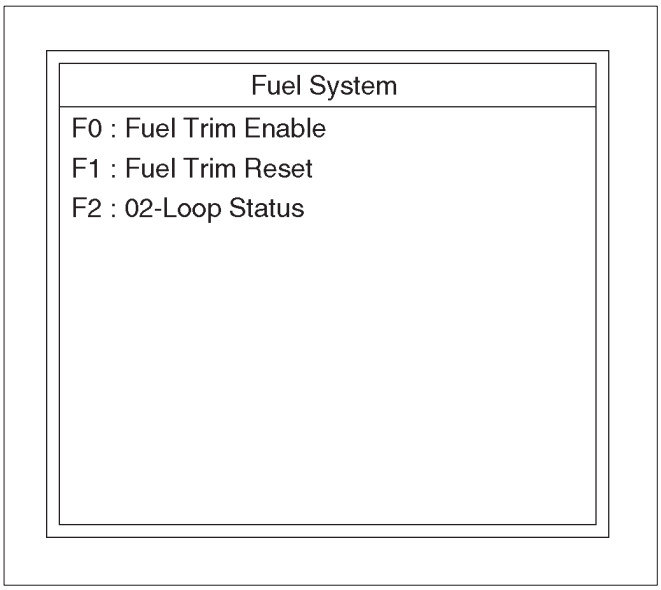
060R100078

4. Select F3: Fuel System in the Miscellaneous Menu.



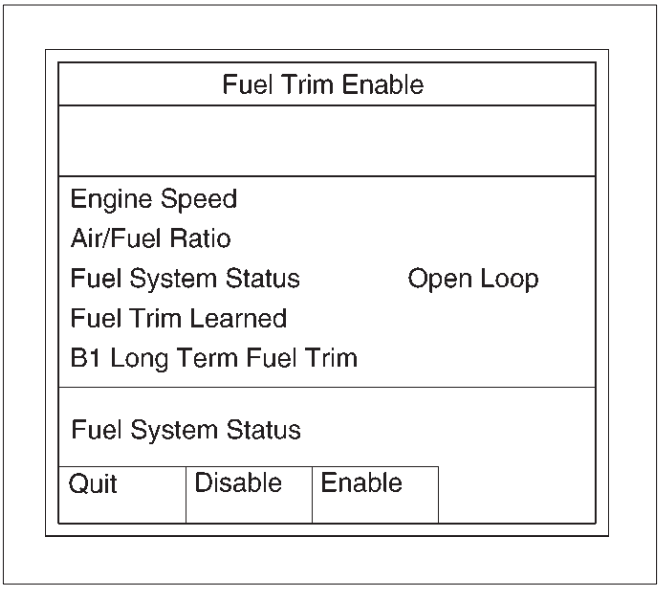
060RY00083

5. Select F0: Fuel Trim Enable.



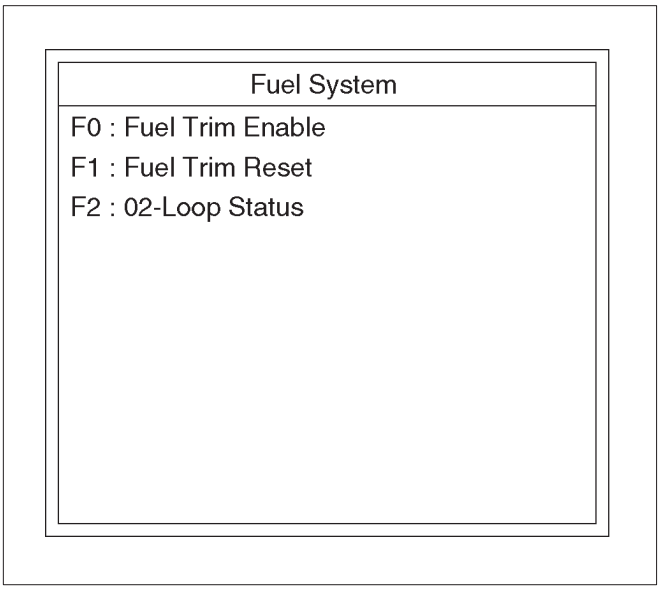
060R200071

6. Push “Disable” or “Enable” soft key.



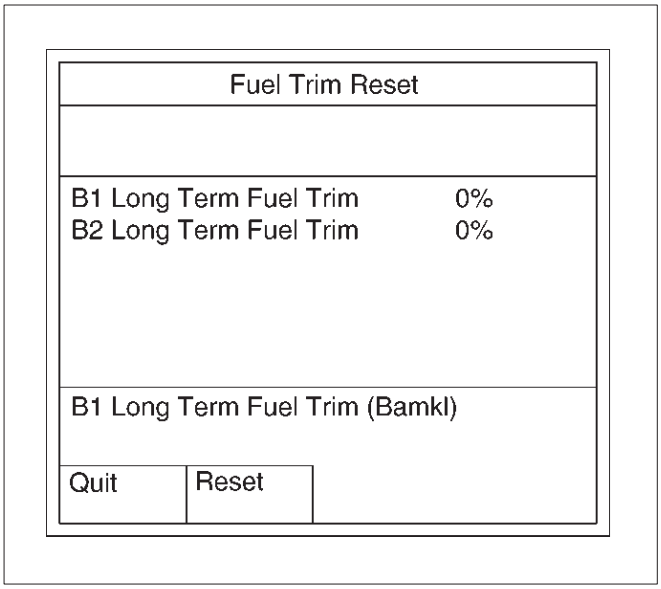
060RY00097

7. Control Fuel Trim and check data list.
8. If data list changes, the Fuel Trim is normal.
9. Select F1: Fuel Trim Reset.



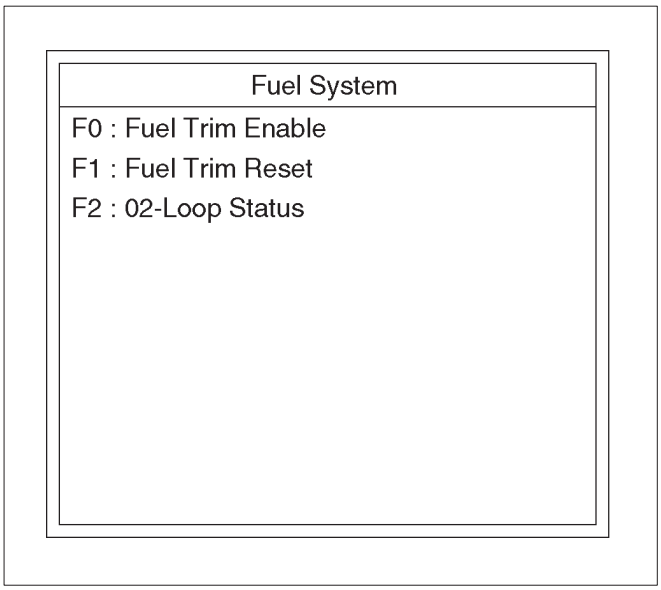
060R200071

10. Push “Reset” soft key.



060RY00098

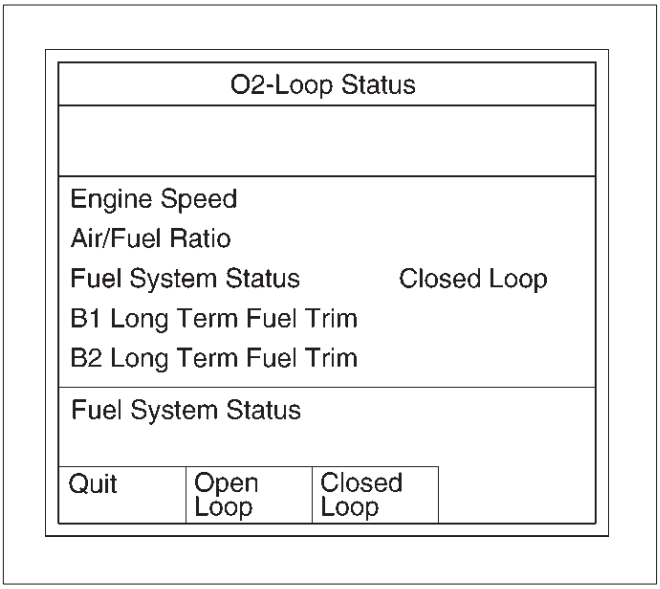
11. Select F2: O2-Loop status.



060R200071

12. This test is check the “Closed Loop Status” performance.

13. Push “Open Loop” or “Closed Loop” soft key.



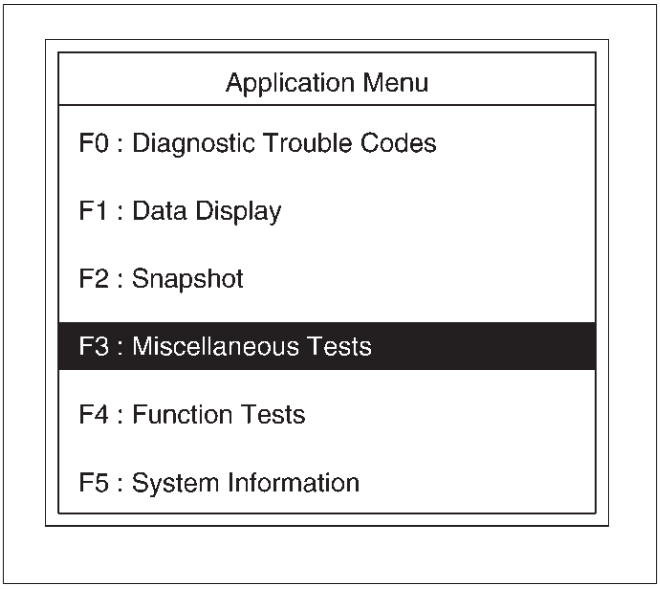
060RY00099

14. Control O2-Loop and check data list.
15. If data list changes, the O2-Loop is normal.

Instruments Test

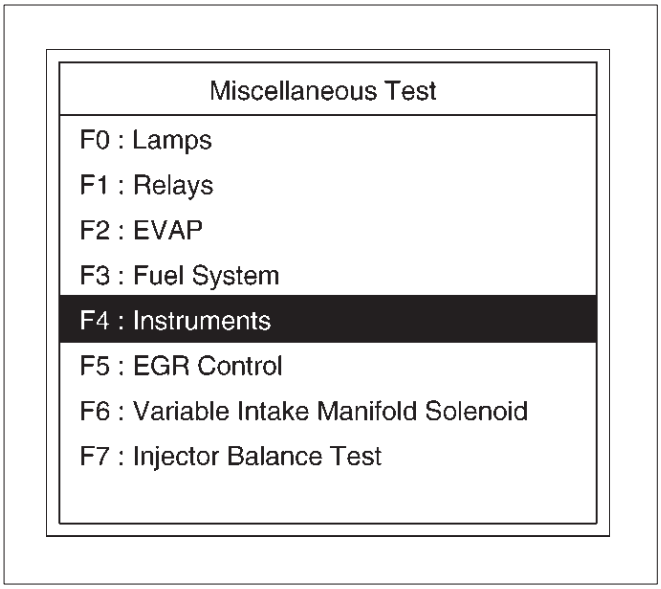
This test is conducted check Instruments for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



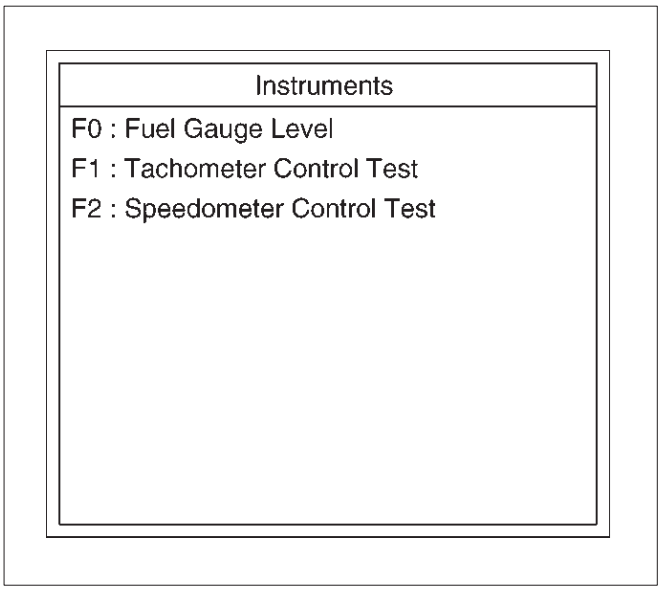
060R100078

4. Select F4: Instruments in the Miscellaneous Menu.



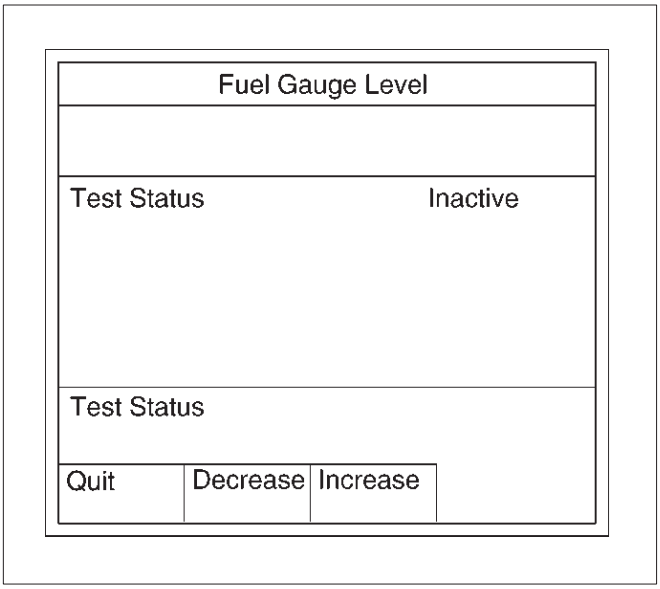
060RY00106

5. Select F0: Fuel Gauge level.



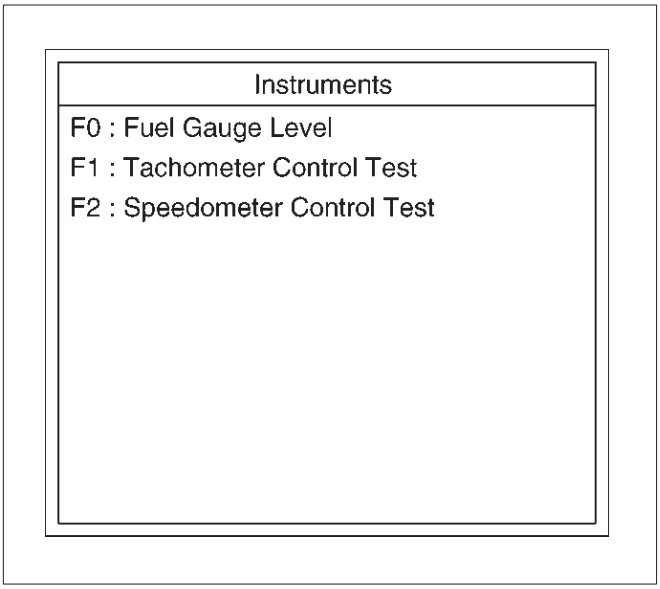
060RY00107

6. Push “Decrease” or “Increase” soft key.



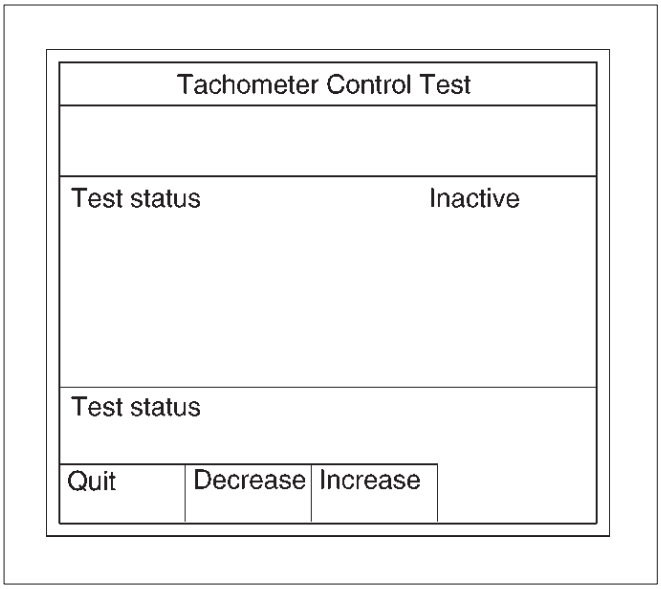
060RY00100

7. Control Fuel Level and check data list.
8. If data list and Fuel gauge meter changes, Fuel Gauge level is normal.
9. Select F1: Tachometer Control Test.



060RY00107

10. Push “Inactive” or “active” soft key.



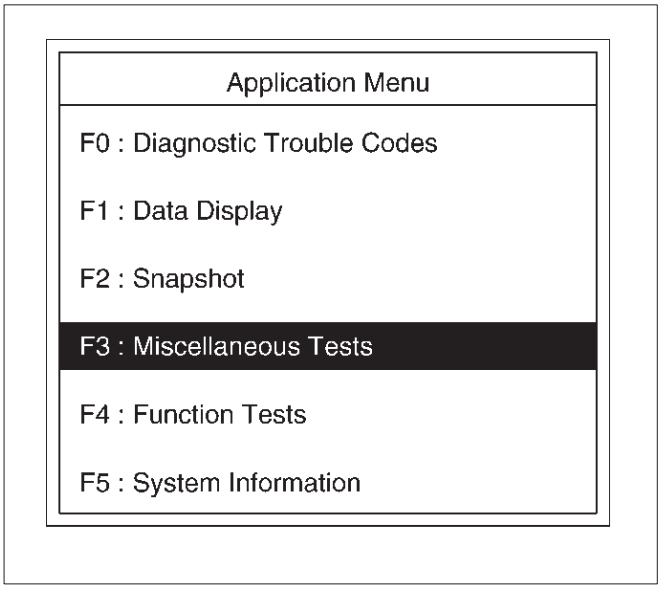
060RY00101

11. Control tachometer and data list.
12. If data list and meter changes, the tachometer control is normal.

EGR Control Test

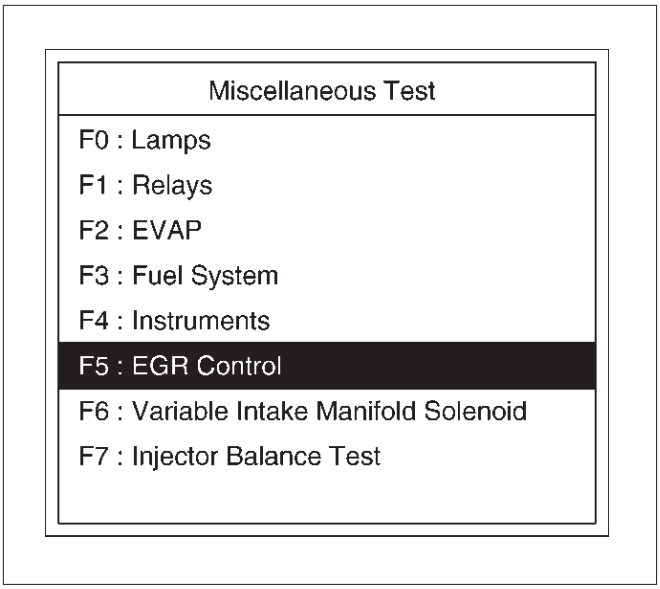
This test is conducted check EGR valve for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



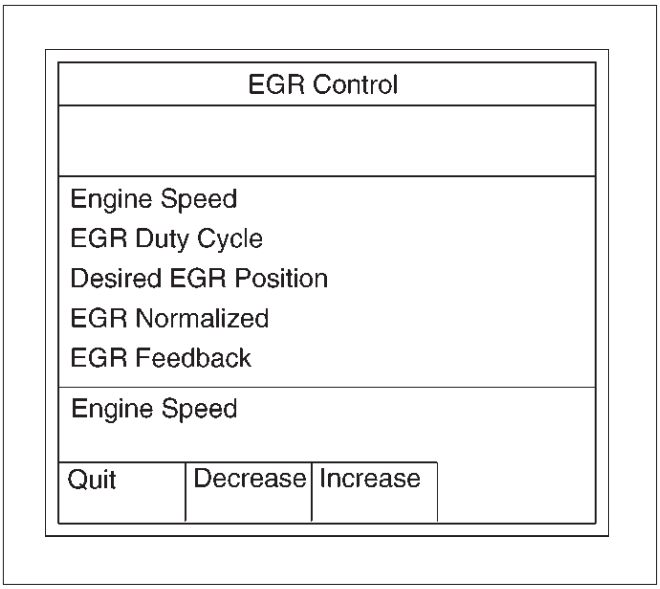
060R100078

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RY00084

5. Control EGR Valve and check data list.



060RY00103

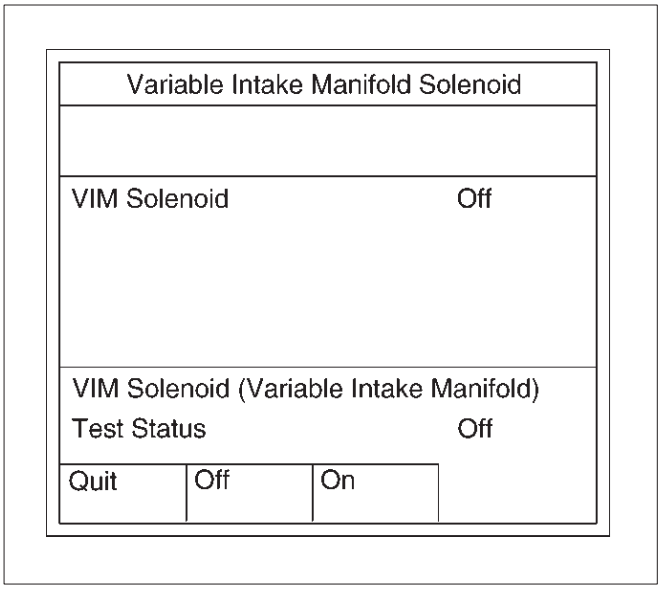
6. If data list changes, the EGR Control is normal.

Variable Intake Manifold Solenoid Test

This test is conducted check VIM Solenoid for proper operation.
Tech 2 must be used for this test.
Test Procedure:

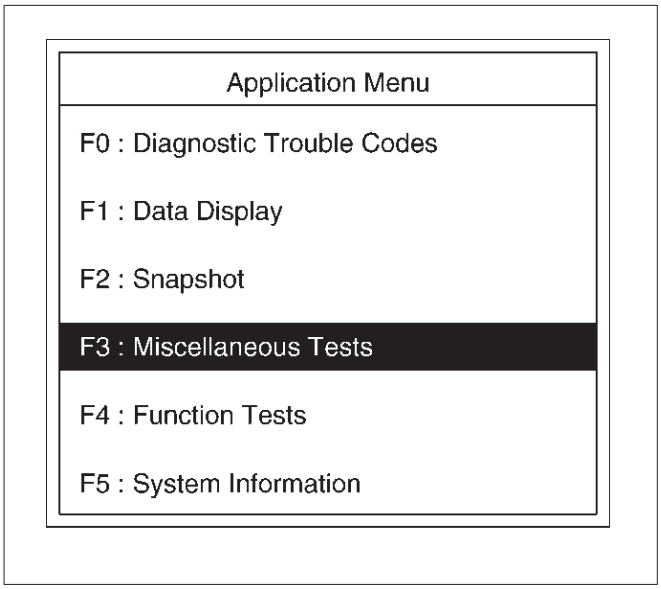
1. Connect Tech 2 to the vehicle DLC.

2. Ignition SW is “On”.



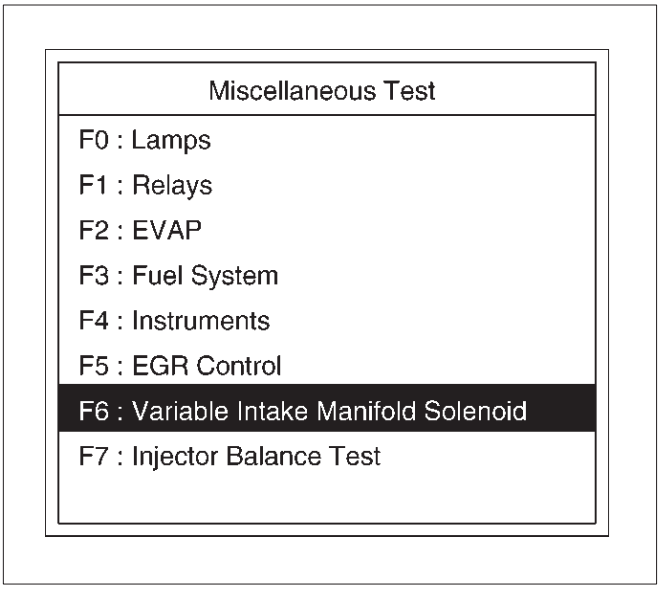
060RY00104

3. Select F3: Miscellaneous Test in the Application Menu.



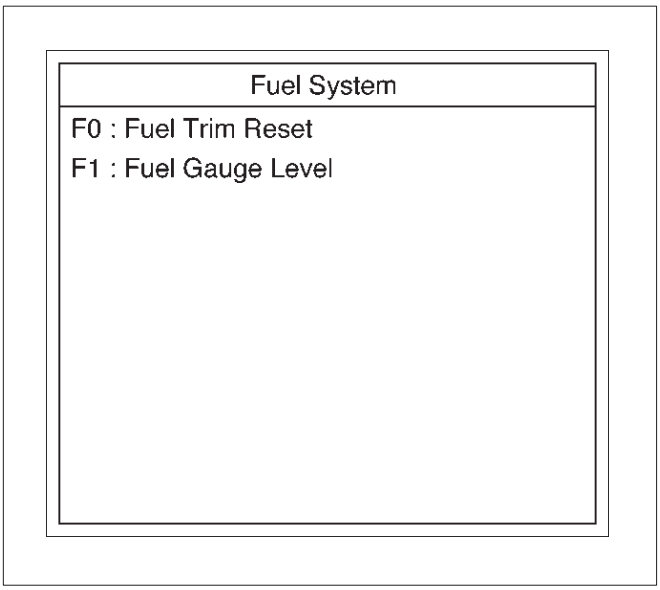
060R100078

4. Select F6: Variable Intake Manifold Solenoid Test.



060RY00085

5. Push “On” or “Off” soft key.



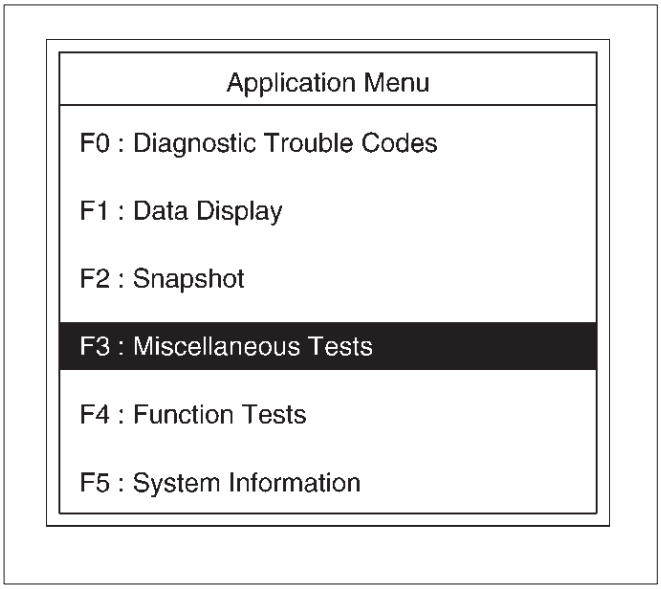
060RX028

6. Control VIM Solenoid check data list.
7. If data list changes, the VIM Solenoid is normal.

Injector Balance Test

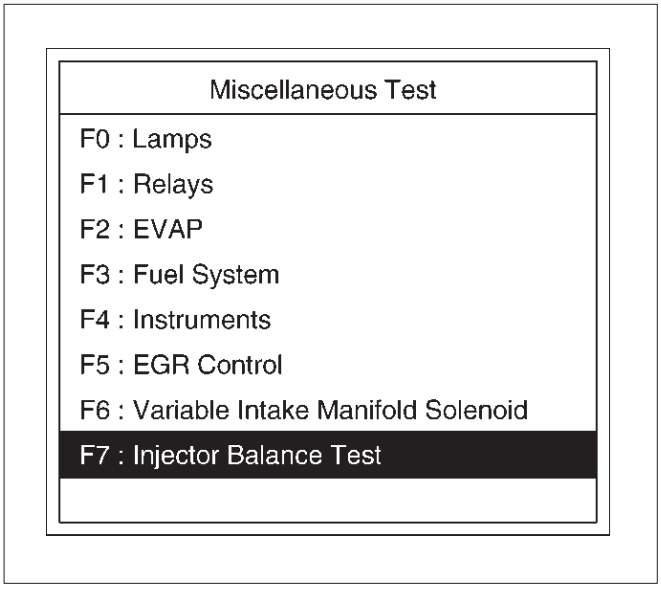
This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



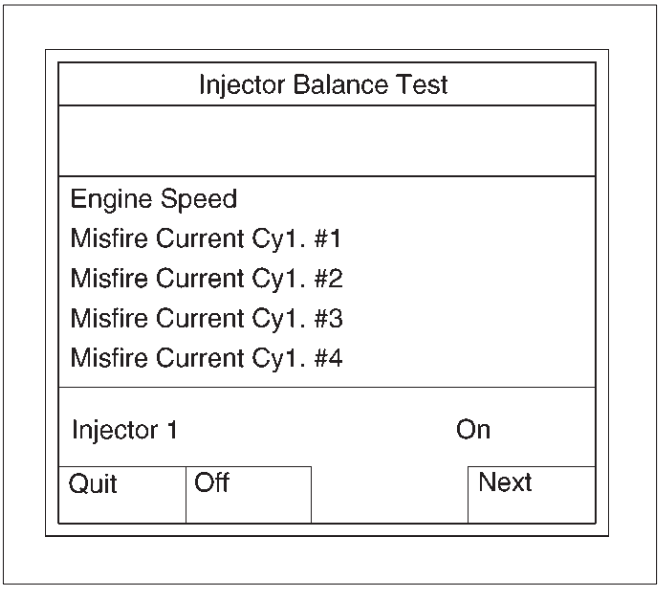
060R100078

4. Select F7: Injector Balance Test in the Miscellaneous Test.



060RY00086

5. Select injector number and push “injector off” soft key.

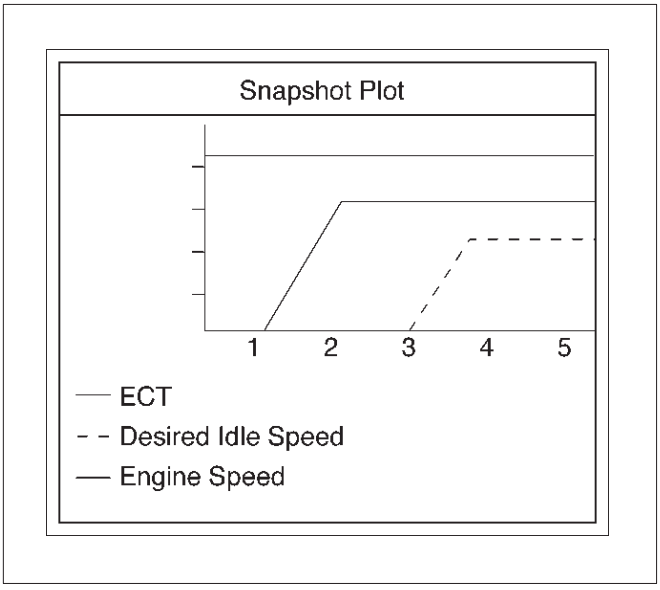


060RY00105

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

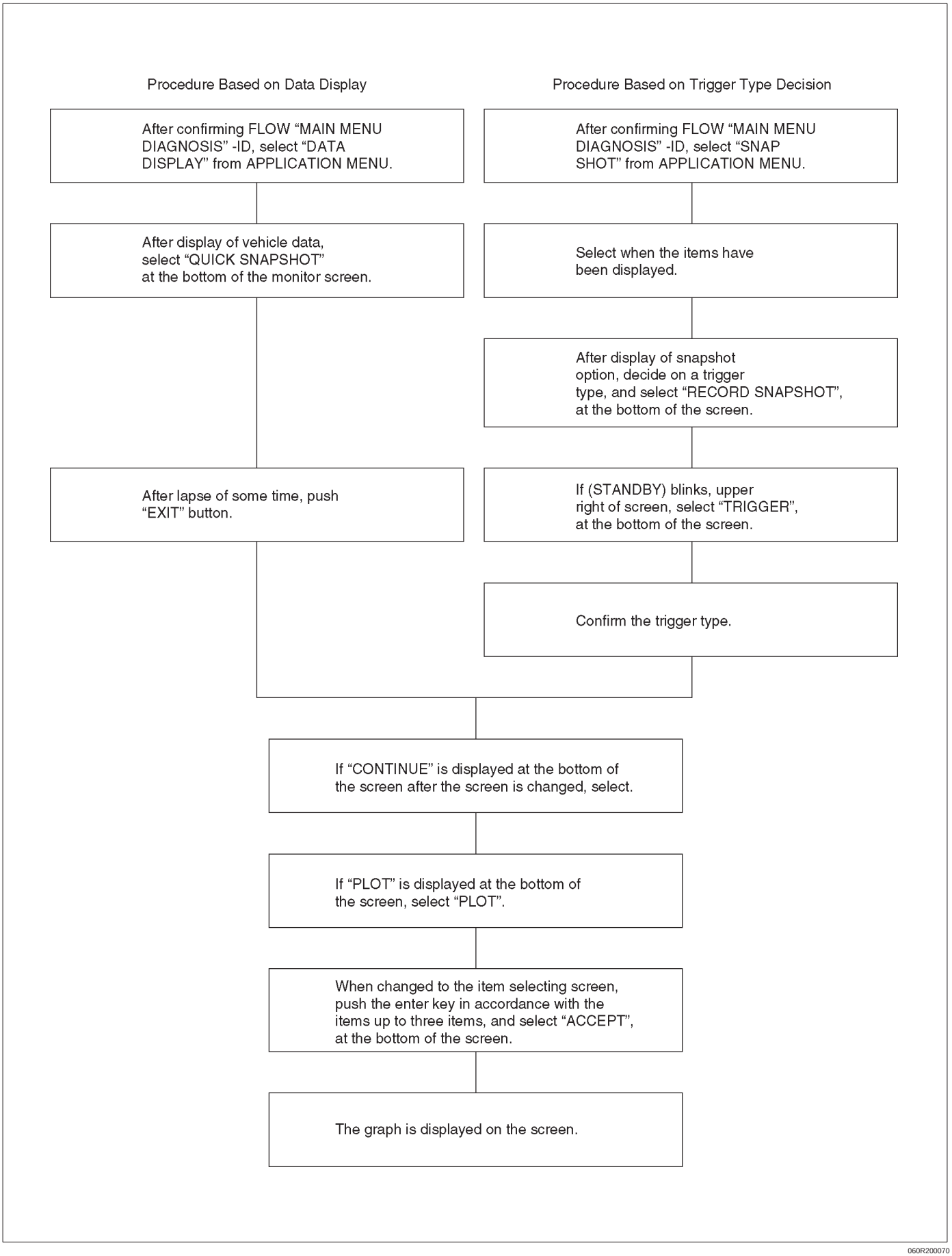
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



060RX037

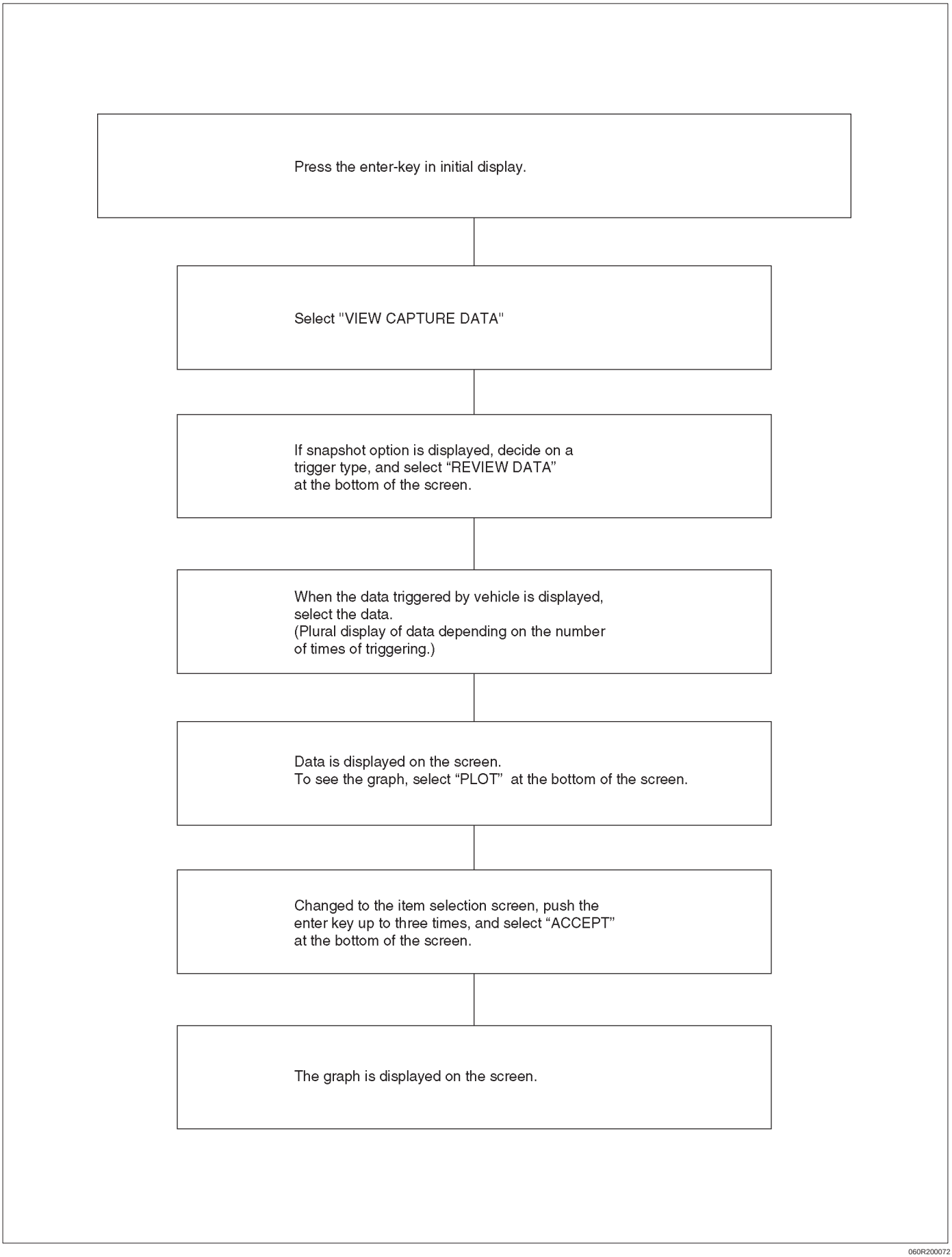
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



060R200070

Flow Chart for Snapshot Replay (Plotting Graph)



060R200072

Primary System-Based Diagnostic

Primary System-Based Diagnostic

There are primary system-based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensors (Bank 1 HO2S 2 and Bank 2 HO2S 2) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to *On-Vehicle Service, Heated Oxygen Sensors* in this section.

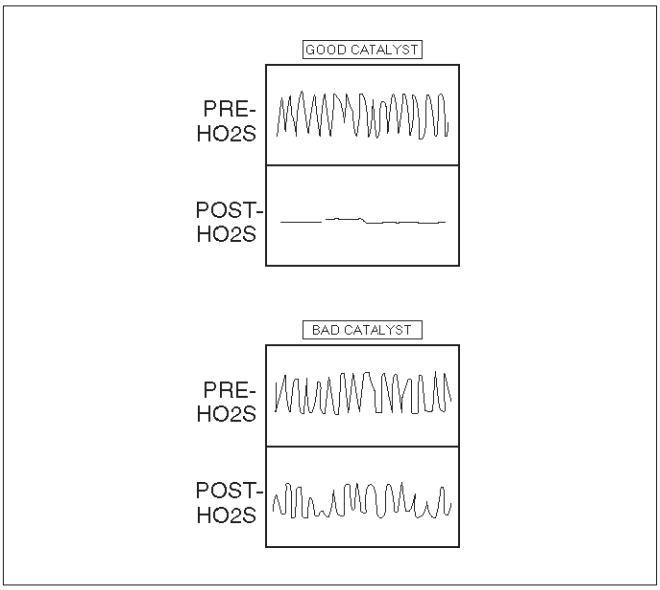
Fuel Control Heated Oxygen Sensor

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in closed loop to adjust fuel injector pulse width. While in closed loop, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors (Bank 1 HO2S 1 and Bank2 HO2S 1) to become active. Oxygen sensor heaters are required by catalyst monitor and sensor (Bank 1 HO2S 2 and Bank 2 HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors and Diagnostic Operation



TS24067

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre-catalyst and post-catalyst heated oxygen sensors. The pre-catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The post-catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre-catalyst signal will be far more active than that produced by the post-catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in closed loop, the PCM will adjust the fuel delivery slightly to compensate.

- For the 3.5L w/automatic transmission, the pre-catalyst sensors are designated Bank 1 HO2S 1 and Bank 2 HO2S 1. The post-catalyst sensors are Bank 1 HO2S 2 and Bank 2 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three-Way Catalyst Oxygen Storage Capacity

The Three-Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre-catalyst HO2S and post-catalyst HO2S oxygen sensors. When the TWC is operating properly, the post-catalyst oxygen sensor will have significantly less activity than the pre-catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre-catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post-catalyst oxygen sensor approaches that of the pre-catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on-board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The seconds stage then looks at the inputs for the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

Misfire Monitor Diagnostic Operation

Misfire Monitor Diagnostic Operation

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

The misfire ratio is calculated once every 100 engine cycles. For example, on a 6-cylinder engine, 600 ignition plug sparks occur every 100 cycles and if a misfire occurs 12 times during that time, the misfire is $12/600 \times 100 = 2$ %.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These "misfire counters" are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1-6) indicate the number of firing events out of the last 100 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist #1-6) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 100 cylinder firing events. A misfire counter is maintained for each cylinder. If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring. Misfires are counted from more than one cylinder. Cylinder #1 has the majority of counted misfires. In this case, the Misfire Counters would identify cylinder #1 as the misfiring cylinder. The misfires in the other counters were just background noise caused by the erratic misfire rotation of the crankshaft. If the number of accumulated misfires is sufficient for the diagnostic to identify a true misfire, the diagnostic will set DTC P0300 – Misfire Detected.

Use diagnostic equipment to monitor misfire counter data on OBD II-compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counter indicate cylinders

numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.
Misfire counter information is located in the “Eng”. menu, “Misfire Data” sub-menu of the data list.
The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Low fuel
- Fuel-fouled spark plugs
- Basic engine fault

Fuel Trim System Monitor Diagnostic Operation

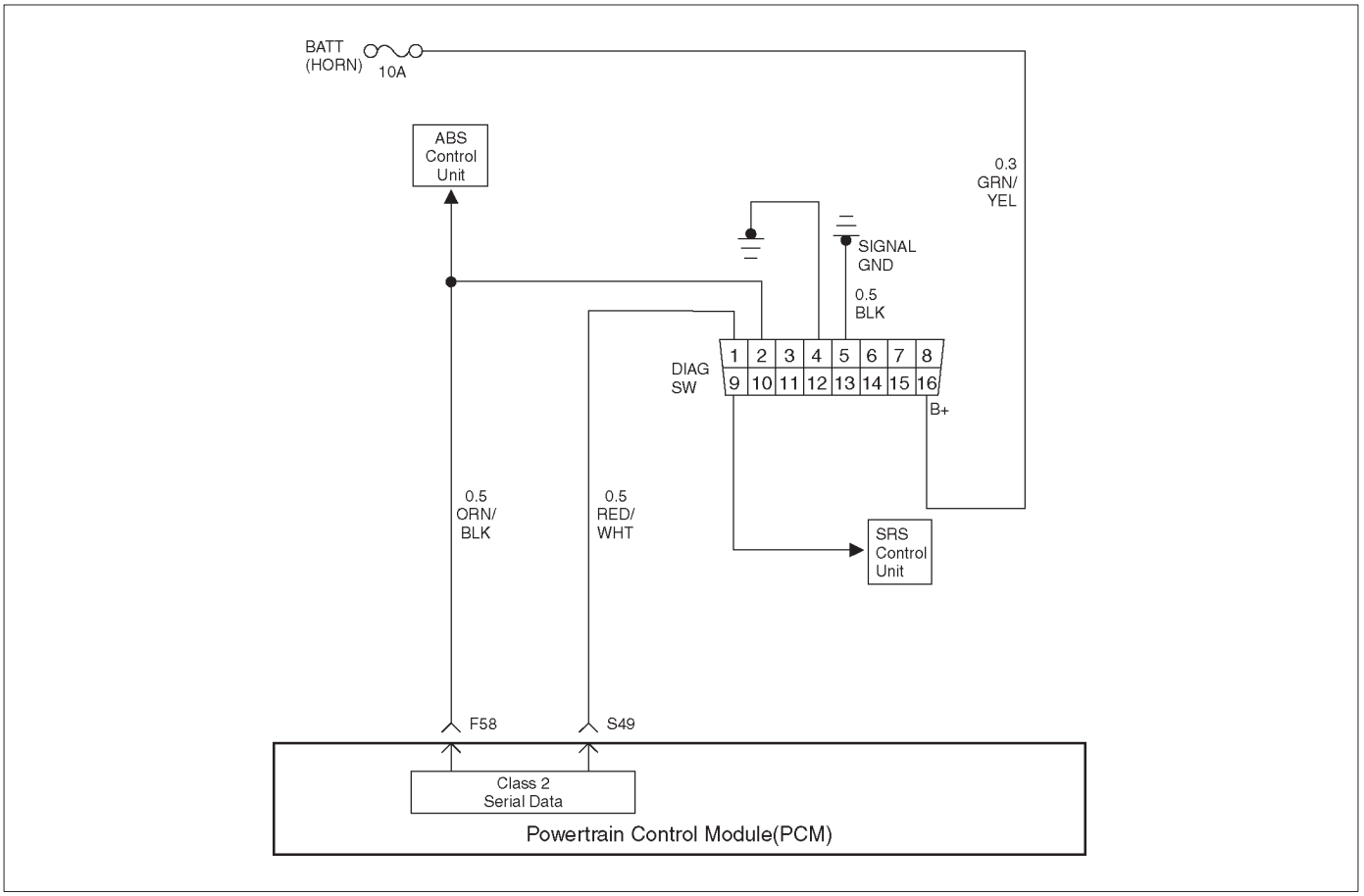
Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.
A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

On-Board Diagnostic (OBD II) System Check



060R200048

Circuit Description

The on-board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on-board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1.The MIL (“Check Engine lamp”) should be “ON” steady with the ignition “ON ” and the engine “OFF”. If not, the “No MIL” chart should be used to isolate the malfunction.

2.The RPL (“Reduced Power lamp”) should be “ON” steady with the ignition “ON ”and the engine “OFF”. If not, the “No RPL”chart should be used to isolate the malfunction.

3.Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.

4.This test ensures that the PCM is capable of controlling the MIL (“Check Engine lamp”) and the MIL (“Check Engine lamp”) driver circuit is not shorted to ground.

5.This test ensures that the PCM is capable of controlling the RPL (“Reduced Power lamp”) and the RPL (“Reduced Power lamp”) driver circuit is not shorted to ground.

7.Check the DTCs (System ,Volts Supply circuit).

8.Check the DTCs (PCM{Software} detect Errors).

11.If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

14.A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

15.This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors* of this section.

10. If the starter motor will not start, the starter control system chart should be used to diagnose the condition.

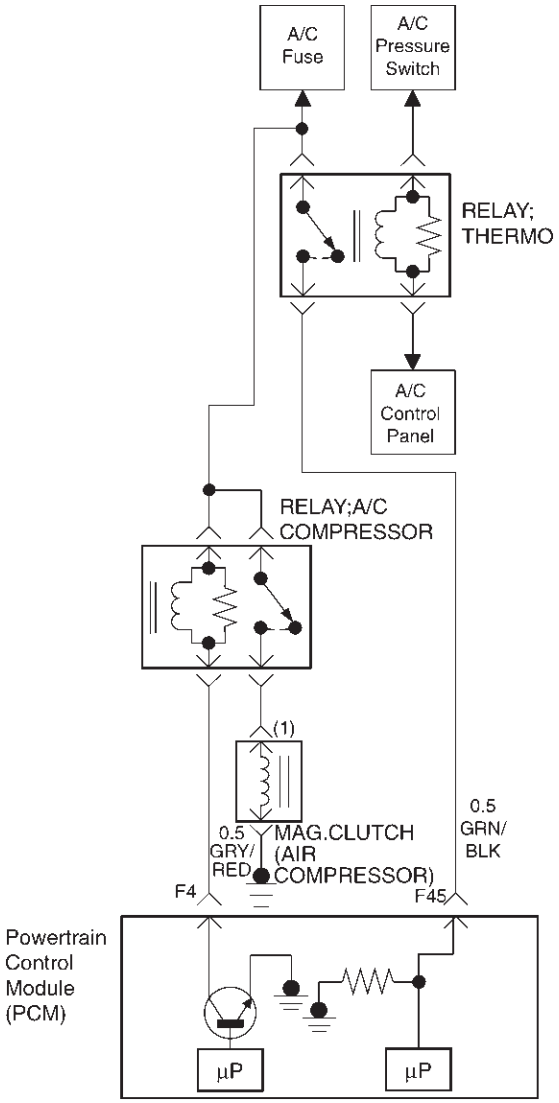
On-Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition “ON”, engine “OFF”. 2. Observe the malfunction indicator lamp (MIL or “Check Engine lamp”). Is the MIL (“Check Engine lamp”)“ON”?	—	Go to *Step 2*	Go to *No MIL(“Check Engine lamp”)*
2	1. Ignition “ON”, engine “OFF”. 2. Observe the “Reduced Power lamp”. Is the RPL (“Reduced Power lamp”) “ON”?	—	Go to *Step 3*	Go to *No RPL(“Reduced Power lamp”)*
3	1. Ignition “OFF”. 2. Install Tech 2. 3. Ignition “ON”. 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 4*	Go to *Step 12*
4	1. Using the Tech 2 output tests function, select MIL (“Check Engine lamp”) control and command the MIL (“Check Engine Lamp”) “OFF”. 2. Observe the MIL (“Check Engine lamp”). Did the MIL (“Check Engine lamp”) turn “OFF”?	—	Go to *Step 5*	Go to *MIL(“Check Engine lamp”) On Steady*
5	1. Using the Tech 2 output tests function, select MIL (“Check Engine lamp”) control and command the RPL (“Reduced Power lamp”) “OFF”. 2. Observe the RPL (“Reduced Power lamp”). Did the MIL (“Reduced Power lamp”) turn “OFF”?	—	Go to *Step 6*	Go to *RPL(“Reduced Power lamp”) On Steady*
6	Select “Display DTCs” with the Tech 2. Are any DTCs stored?	—	Go to *Step 7*	Go to *Step 11*
7	Stored DTCs. P0562, P0563, P0601, P0602, P0604, P0606, P1625, P1635, P1639, P1640, P1650 Are the applicable DTCs stored?	—	Go to *applicable DTC table*	Go to *Step 8*
8	Stored DTCs. P1514, P1515, P1516, P1523, P1125, P1290, P1295, P1299 Are the applicable DTCs stored?	—	Go to *applicable DTC table*	Go to *Step 9*
9	Stored DTCs. 1. P0425, P0106, P0107, P1107, P0401, P1404, P0405, P1120, P1221, P1515, P1516, P1275, P1635, P1271, P1273, P1285, P1272 2. P0336, P0337, P1220, P1515, P1221, P1516, P1280, P1639, P1271, P1272 Are the applicable DTCs stored?	—	Go to *“Multiple PCM Information sensor DTCs Set”*	Go to *Step 10*
10	Attempt to crank the starter motor Did the starter motor crank?	—	Go to *Step 10*	Go to *Starter control system*
11	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 6*	Go to *Cranks But Will Not Run*

On-Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
12	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *Symptom*	Refer to *indicated Component System Checks*
13	1. Ignition "OFF", disconnect the PCM. 2. Ignition "ON", engine "OFF". 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. 4. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 14*
14	1. Attempt to reprogram the PCM. Refer to *Powertrain Control Module (PCM) in On-Vehicle Service.* 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 15*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *Step 2*	—

A/C Clutch Control Circuit Diagnosis



060R100063

Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerant charge, a 12-volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily canceled during system operation by the electronic thermostat in the evaporator case. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125 ˚C (257 ˚F).
- The intake air temperature (IAT) is less than 5˚C (41˚F).
- The power steering pressure switch signals a high pressure condition.

Diagnostic Aids

To diagnose an the intermittent fault, check for following conditions:

- Poor connection at the PCM–Inspect connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to OK, observe the A/C clutch while moving connectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent fault.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commanded the A/C clutch "ON". The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

Test Description

IMPORTANT: Do not engage the A/C compressor clutch with the engine running if an A/C mode is not selected at the A/C control switch.

The numbers below refer to the step numbers on the Diagnostic Chart:

3. This a test determine is the problem is with the refrigerant system. If the switch is open, A/C pressure gauges will be used to determine if the pressure switch is faulty or if the system is partially discharged or empty.
4. Although the normal complaint will be the A/C clutch failing to engage, it is possible for a short circuit to cause the clutch to run when A/C has not been selected. This step is a test for that condition.
7. There is an extremely low probability that both relays will fail at the same time, so the substitution process is one way to check the A/C Thermostat relay. Use a known good relay to do a substitution check.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs stored?	—	Go to the other DTC chart(s) first	Go to *Step 3*
3	1. Disconnect the electrical connector at the pressure switch located on the receiver/drier. 2. Use an ohmmeter to check continuity across the pressure switch. Is the pressure switch open?	—	Go to Air *Conditioning* to diagnose the cause of the open pressure switch	Go to *Step 4*
4	**IMPORTANT:** Before continuing with the diagnosis, the following conditions must be met: ▼ The intake air temperature must be greater than 15˚C. (60˚F). ▼ The engine coolant temperature must be less than 119˚C (246˚F). 1. A/C "OFF". 2. Start the engine and idle for 1 minute. 3. Observe the A/C compressor. Is the A/C compressor clutch engaged even though A/C has not been requested?	—	Go to *Step 37*	Go to *Step 5*
5	1. Idle the engine. 2. A/C "ON". 3. Blower "ON". 4. Observe the A/C compressor. Is the A/C compressor magnetic clutch engaged?	—	Refer to *Diagnostic Aids*	Go to *Step 6*
6	1. Engine idling. 2. A/C "ON". 3. Blower "ON". 4. Observe the "A/C Request" display on the Tech 2. (Refer to the Miscellaneous test) Does the tool "A/C Request" display indicate "Yes"?	—	Go to *Step 26*	Go to *Step 7*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
7	Temporarily substitute the A/C compressor relay in place of the A/C thermostat relay, then repeat Step 5. Did the "A/C Request" display indicate "Yes"?	—	Go to *Step 8*	Go to *Step 9*
8	Replace the original A/C thermostat relay. Is the action complete?	—	Verify repair	—
9	Does the blower operate?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the blower. Is the action complete?	—	Verify repair	—
11	Check for a faulty 10A A/C fuse in the underdash fuse panel. Was the 10A fuse OK?	—	Go to *Step 13*	Go to *Step 12*
12	Check for short circuit and make repairs if necessary. Replace the 10A A/C fuse. Is the action complete?	—	Verify repair	—
13	1. Remove the glove box to gain access to the A/C thermostat. 2. Disconnect the thermostat connector. 3. Attach a fused jumper between ground and the thermostat wire. 4. A/C "ON". 5. Blower "ON". Dose A/C request indicate "YES" on the Tech 2?	—	Go to *Step 14*	Go to *Step 17*
14	1. Ignition "ON". 2. Use a DVM to check voltage at the electronic A/C thermostat. Was voltage equal to the specified value?	B+	Go to *Step 17*	Go to *Step 15*
15	Check for open wire between the thermostat and the A/C switch. Was the wire open?	—	Go to *Step 16*	Go to *Step 17*
16	Repair the open wire between the thermostat and the A/C switch. Is the action complete?	—	Verify repair	—
17	Check for an open circuit between A/C thermostat relay and PCM A/C request terminal (F45). Was there an open circuit?	—	Go to *Step 18*	Go to *Step 19*
18	Repair the open circuit between the PCM and A/C thermostat relay. Is the action complete?	—	Verify repair	—
19	1. Ignition "ON". 2. Use a DVM to check voltage at the A/C pressure switch. Was voltage equal to the specified value?	B+	Go to *Step 21*	Go to *Step 20*
20	Repair the open circuit between the 10A A/C fuse and the pressure switch. Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Use an ohmmeter to check continuity between the pressure switch and the A/C thermostat relay. Was the circuit open?	—	Go to *Step 22*	Go to *Step 23*
22	Repair the open circuit between the pressure switch and the A/C thermostat relay. Is the action complete?	—	Verify repair	—
23	Check for damaged pin or terminal at F45 of the PCM. Was a damaged pin or terminal found?	—	Go to *Step 24*	Go to *Step 25*
24	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
25	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
26	1. Remove the A/C compressor relay. 2. Ignition "ON". 3. Use a DVM to check voltage at both of the wires at the A/C compressor relay socket. Is the voltage equal to the specified value?	B+	Go to *Step 28*	Go to *Step 27*
27	Repair the faulty wire between the A/C fuse and the A/C compressor relay . Is the action complete?	—	Verify repair	—
28	1. A/C compressor relay removed. 2. Engine idling. 3. A/C "ON". 4. Blower "ON". 5. Use a DVM to measure voltage between the wire at the A/C compressor relay socket and battery±. Did the DVM indicate the specified value?	B+	Go to *Step 32*	Go to *Step 29*
29	Check for an open wire between PCM terminal F4 and the A/C compressor relay. Was the wire open?	—	Go to *Step 30*	Go to *Step 31*
30	Repair the open wire between the PCM and the A/C compressor relay. Is the action complete?	—	Verify repair	—
31	Check for a damaged pin or terminal at F4 of the PCM. Was a damaged pin or a terminal found?	—	Go to *Step 24*	Go to *Step 25*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
32	1. A/C compressor relay removed. 2. Connect a fused jumper at the A/C compressor relay socket with either wire. 3. Engine idling. 4. A/C "ON". 5. Blower "ON". Did the compressor magnetic clutch engage?	—	Go to *Step 33*	Go to *Step 34*
33	Repair the A/C compressor relay. Is the action complete?	—	Verify repair	—
34	Check for an open circuit between the A/C compressor relay and the A/C clutch. Was an open circuit found?	—	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the compressor Clutch and the A/C compressor relay. Is the action complete?	—	Verify repair	—
36	Service the compressor clutch or replace the compressor due to a faulty internal overheat switch. Is the action complete?	—	Verify repair	—
37	1. Remove the A/C compressor relay. 2. Idle the engine. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 38*	Go to *Step 39*
38	Repair the short to voltage between the A/C clutch and A/C compressor relay. Is the action complete?	—	Verify repair	—
39	1. Reinstall the A/C compressor relay. 2. Remove the A/C thermostat relay. 3. Engine idling. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 40*	Go to *Step 42*
40	Use a DVM to check for a short to ground between the A/C compressor relay and F4 of the PCM. Was a short detected?	—	Go to *Step 41*	Go to *Step 25*
41	Repair the short to ground between the PCM and A/C compressor relay. Is the action complete?	—	Verify repair	—
42	Repair the short to ground between the A/C thermostat relay and the electronic thermostat. Is the action complete?	—	Verify repair	—

Electronic Ignition System Diagnosis

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is in the ignition system or the fuel system. If DTC P0300 through P0306, P0341, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.
If a misfire is being experienced with no DTC set, refer to the *Symptoms* section for diagnosis.

EVAP Canister Purge Solenoid and EVAP Vent Solenoid Valve

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. Refer to the DTC charts for further information.

Visual Check of The Evaporative Emission Canister

- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

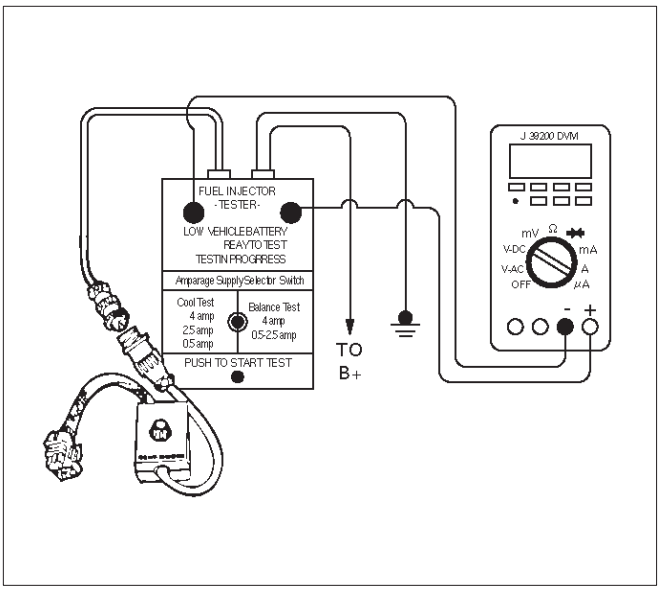
Fuel Metering System Check

Some failures of the fuel metering system will result in an "Engine Cranks But Will Not Run" symptom. If this condition exists, refer to the *Cranks But Will Not Run* chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.
Refer to *Fuel System Electrical Test* for the fuel system wiring schematic.
If there is a fuel delivery problem, refer to *Fuel System Diagnosis*, which diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is "ON", the fuel trim may be as low as –38%. If the fuel trim values are greater than +23%, refer to *DTC P0131, DTC P0151, DTC P0171, and DTC 1171* for items which can cause a lean HO2S signal.

Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to *Fuel Systems Diagnosis.*

Fuel Injector Coil Test Procedure and Fuel Injector Balance Test Procedure



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730-1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch "OFF", open the valve on the fuel pressure gauge.

3. Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance (Ohms)	Voltage Specification at 10˚C-35˚C (50˚F-95˚F)
11.8 – 12.6	5.7 – 6.6

- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.

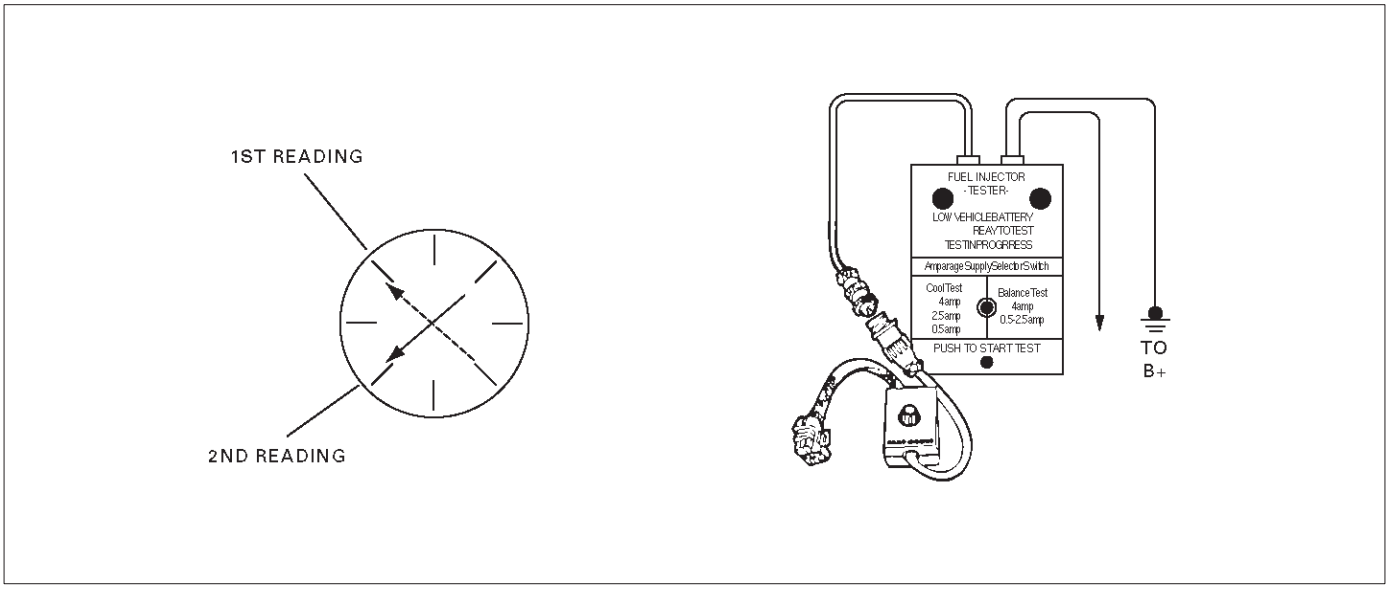
▼An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volts

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool-down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to “Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)



R262001

CYLINDER	1	2	3	4	5	6
1st Reading (1)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
2nd Reading (2)	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)	131 kPa (19 psi)	130 kPa (19 psi)
Amount of Drop (1st Reading–2nd Reading)	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)	165 kPa (24 psi)	166 kPa (24 psi)
Av.drop = 166 kPa/24 psi ± 10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)	OK	OK

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Turn the engine “OFF”. NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to *Test Description Number 2.* 3. Connect the J 39021-5V Fuel Injector Tester to B+ and ground, and to the J 39021-90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located on the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the “Coil Test” 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10˚C (50˚F) to 35˚C (95˚F)	Go to *Step 3*	Go to *Step 5*
3	1. Set injector switch box injector #1. 2. Press the “Push to Start Test” button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7-6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Go to *Step 7*	—

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set injector switch box injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted Value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730-1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296-376 kPa (43-55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump "OFF". Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Connect the J 39021-5V Fuel Injector Tester and J 39021-90 Injector Switch Box the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the Tech 2 turn the fuel pump "ON" then "OFF" in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the "Push to Start Test" button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 10*	Go to *OBD System Check*
10	Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 9. NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding. Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 11*	Go to *Symptoms*
11	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Verify repair	—

Powertrain Control Module (PCM) Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition “OFF” and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all component and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned “ON” and “OFF” by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

Multiple PCM Information Sensor DTCs Set

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions.

The PCM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors.

The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The engine coolant temperature (ECT) sensor
- The intake air temperature (IAT) sensor
- The transmission fluid temperature (TFT) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

1

- The exhaust gas recirculating (EGR) pintle position sensor
- The manifold absolute pressure (MAP) sensor
- The throttle position (TP) sensor 1
- The acceleration position (AP) sensor 1
- The acceleration position (AP) sensor 3
- The Vapor Pressure Sensor

2

- The Crank position (CKP) sensor
- The throttle position (TP) sensor 2
- The acceleration position (AP) sensor 2

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

IMPORTANT: Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

IMPORTANT: If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

A short to ground in the 5–volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0453
- P0106, P0107, P1107
- P0401, P1404, P0405
- P1120, P1515, P1221, P1516, P1635

- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damage terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor fs displayed value on the Tech 2 with the ignition “ON” and the engine “OFF” while you move the connectors and the wiring harnesses related to the following sensors:
  - Vapor Pressure (Fuel Tank Pressure) Sensor
  - MAP Sensor
  - EGR
  - TPS1/TPS2
  - APS1/APS2/APS3
  - CKP

Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition “OFF”, disconnect the PCM. 2. Turn the ignition “ON”, check the 5 volt reference 1 and 2 circuit for the following conditions: ▼ A poor connection at the PCM. ▼ An open between the PCM connector and the splice. ▼ A short to ground. ▼ A short to voltage. Is there an open or short?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: ▼ A poor connection at the PCM or the affected sensors. ▼ An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Following below the DTCs stored: P1635, P1639	—	Go to *applicable DTC table*	Go to *Step 7*
7	Measure the resistance below the items: ▼ Between EGR sensor supply circuit and Vapor Pressure Sensor supply circuit. ▼ Between MAP sensor supply circuit and Vapor Pressure Sensor supply circuit. ▼ Between Vapor Pressure Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Is the resistance near the specified value?	—	Go to *Step 9*	Go to *Step 8*

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
8	Locate and repair the open circuit in the MAP or EGR or Vapor Pressure sensor supply circuit. Is the action complete?	—	Verify repair	—
9	1. Disconnect the MAP, Vapor pressure sensor and EGR connector. 2. Ignition "ON". 3. Measure the resistance of the blow areas: ▼ MAP sensor GND circuit. ▼ EGR GND circuit. ▼ Vapor pressure sensor GND circuit. Does the voltage resistance near the specified value?	—	Go to *Step 11*	Go to *Step 10*
10	Locate and repair the short circuit in the MAP or EGR or Vapor Pressure sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
11	Measure the resistance of the blow areas: ▼ Between CKP Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Does the voltage resistance near the specified value?	—	Go to *Step 13*	Go to *Step 12*
12	Locate and repair the open circuit in the CKP or CMP sensor supply circuit. Is the action complete?	—	Verify repair	—
13	1. Disconnect the CKP sensor connector. 2. Ignition "ON". 3. Measure the voltage of the blow areas: ▼ CKP sensor GND circuit and shield circuit. Does the voltage resistance near the specified value?	—	Go to *Step 15*	Go to *Step 14*
14	Locate and repair the short circuit in the CKP sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
15	Are more of the following items for DTCs stored? EGR, Vapor Pressure Sensor, MAP, CKP, TPS, APS	—	Go to *applicable DTC table*	Go to *Step 16*
16	Replace the PCM. The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Exhaust Gas Recirculation (EGR) Diagnosis

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401. Pintle position error diagnosis is covered by DTC P0402, P0404, P1404, P0405, P0406. If EGR diagnostic trouble codes P0401 and/or P0402, P0404, P1404, P0405, P0406 are encountered, refer to the DTC charts.

Engine Tech 2 Data Definitions and Ranges

A/C CLUTCH – Tech 2 Displays ON or OFF –
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostic.

A/C REQUEST — Tech 2 Displays YES or NO —
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO — Tech 2 Range 0.0-25.5 —
Air/fuel ratio indicates the PCM commanded value. In closed loop, the air/fuel ratio should normally be displayed around “14.2-14.7”. A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

AP1 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “13%” at idle and “85-89%” at wide open throttle.

AP2 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “11-15%” at wide open throttle.

AP3 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “32-36%” at wide open throttle.

BAROMETRIC PRESSURE — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around “61-104” depending on altitude and barometric pressure.

CHECK TRANS LAMP — AUTO TRANSMISSION —
Indicates the need to check for a DTC with the Tech 2 when the lamp is flashing 0.2 seconds ON and 0.2 seconds OFF.

DESIRED EGR POS. — Tech 2 Range 0%-100% —
Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE — Tech 2 Range 0-3187 RPM —
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT — (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE — Tech 2 Range 0%-100% —
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK — Tech 2 Range 0.00-5.00 Volts —
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

ENGINE LOAD — Tech 2 Range 0%-100% —
Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME — Tech 2 Range 00:00:00-99:99:99 Hrs:Min:Sec —
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED — Range 0-9999 RPM —
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

EVAP PURGE PWM — Tech 2 Range 0%-100% —
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. “0%” displayed indicates no purge; “100%” displayed indicates full purge.

FUEL PUMP — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the fuel pump relay driver circuit.

HO2S BANK 1, SEN. 1 — Tech 2 Range 0-1132 mV —
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 1, SEN. 2 — Tech 2 Range 0-1000mV —
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will give a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0420 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK2, SEN. 1 —Tech 2 Range 0-1132 mV—
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 2, SEN. 2—Tech 2 Range 0-1000 mV—
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will have a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0430 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK 1, SEN. 1—Tech 2 Displays NOT READY or READY—
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S BANK 2, SEN. 1 — Tech 2 Displays NOT READY or READY —
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1/BANK 1, SEN 2/BANK 2 SEN. 1/BANK 2 SEN. 2 — Tech 2 Range 00:00:00-99:99:99 HRS:MIN:SEC —
Indicates warm-up time for each HO2S. The HO2S warm-up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that tool much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm-up will the display “00:00:00”.

IAT (INTAKE AIR TEMPERATURE) — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 — Tech 2 Range 0-25.5 Volts —
This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1/INJ. PULSE BANK 2 — Tech 2 Range 0-1000 msec. —
Indicates the amount of time the PCM is commanding each injector “ON” during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

LONG TERM FUEL TRIM BANK 1/BANK 2 —
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Fuel System STATUS — Tech 2 Displays OPEN or CLOSED —
“CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In “OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAF — Tech 2 Range 0.0-512 gm/s —
MAF (mass air flow) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAP
— Tech 2 Range 10-105 kPa (0.00-4.97 Volts) —
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the malfunction indicator lamp.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-255 Counts —
The misfire current counters increase at a rate according to the number of the possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-65535 Counts —
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

MISFIRE FAILURES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

MISFIRE PASSES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

POWER ENRICHMENT — Tech 2 Displays ACTIVE or INACTIVE —
"ACTIVE" displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in power enrichment mode, the PCM will increase the amount of fuel delivered by entering open loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

SPARK — Tech 2 Range –64˚ to 64˚ —
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START-UP ECT — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

START-UP IAT — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

TOTAL MISFIRE CURRENT COUNT — Tech 2 Range 0-255 —
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

TP — Tech 2 Range 0%-100% —
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display "3-5%" at idle and "100%" at wide open throttle.

CATALYST PROTECTION MODE — Tech 2 Displays YES or NO —
"YES" displayed indicates that the PCM has detected conditions appropriate to operate in TWC protection mode. The PCM will decrease the air/fuel ratio to a value that depends on mass air flow (higher mass air flow = lower air/fuel ratio).

UPSHIFT LAMP (MANUAL TRANSMISSION)
VEHICLE SPEED — Tech 2 Range 0-255 km/h (0-155 mph) —
The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER — Tech 2 Displays Cylinder Number —
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessories off, brake not applied and air conditioning off.

3.5L V-6 Engine (Automatic and Manual Transmission)

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
A/C Clutch Relay	Engine	On/Off	Off	Off	General Description and Operation, A/C Clutch Circuit Operation
A/C Request	Engine	Yes/No	No	No	General Description and Operation, A/C Request Signal
Air/Fuel Ratio	Engine	Ratio: _ to 1	14.7	14.7	General Description and Operation, Fuel System Metering Purpose
APP Sensor1	Engine	Percent	11–13	35–40	General Description and Operation
APP Sensor2	Engine	Percent	87–88	60–65	General Description and Operation
APP Sensor3	Engine	Percent	87–88	50–57	General Description and Operation
Barometric Pressure	Engine	kPa	61-104 (depends on altitude and barometric pressure)	61-104 (depends on altitude and barometric pressure)	General Description and Operation
Brake Light Switch	Engine	Open 0V/Closed 12V	Open 0V	Open 0V	Refer to Section 5
Check Trans Lamp (**Auto Trans**)	Engine	On/Off	Off	Off	4L30-E Automatic Transmission Diagnosis
Cruise Main Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Set Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Cancel Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Resume Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Decel Fuel Cutoff	Engine	Active/Inactive	Inactive	Inactive	General Description and Operation, Deceleration Mode
Desired EGR Position	Engine	Percent	0%	0%	General Description and Operation, EGR Pintle Position Sensor
Desired Idle Speed	Engine	RPM	750	800	General Description and Operation
ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	80-100˚C (176-212˚F)	80-100˚C (176-212˚F)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
EGR Closed Pintle Position	Engine	Steps	20-40	20-40	General Description and Operation, EGR Pintle Position Sensor

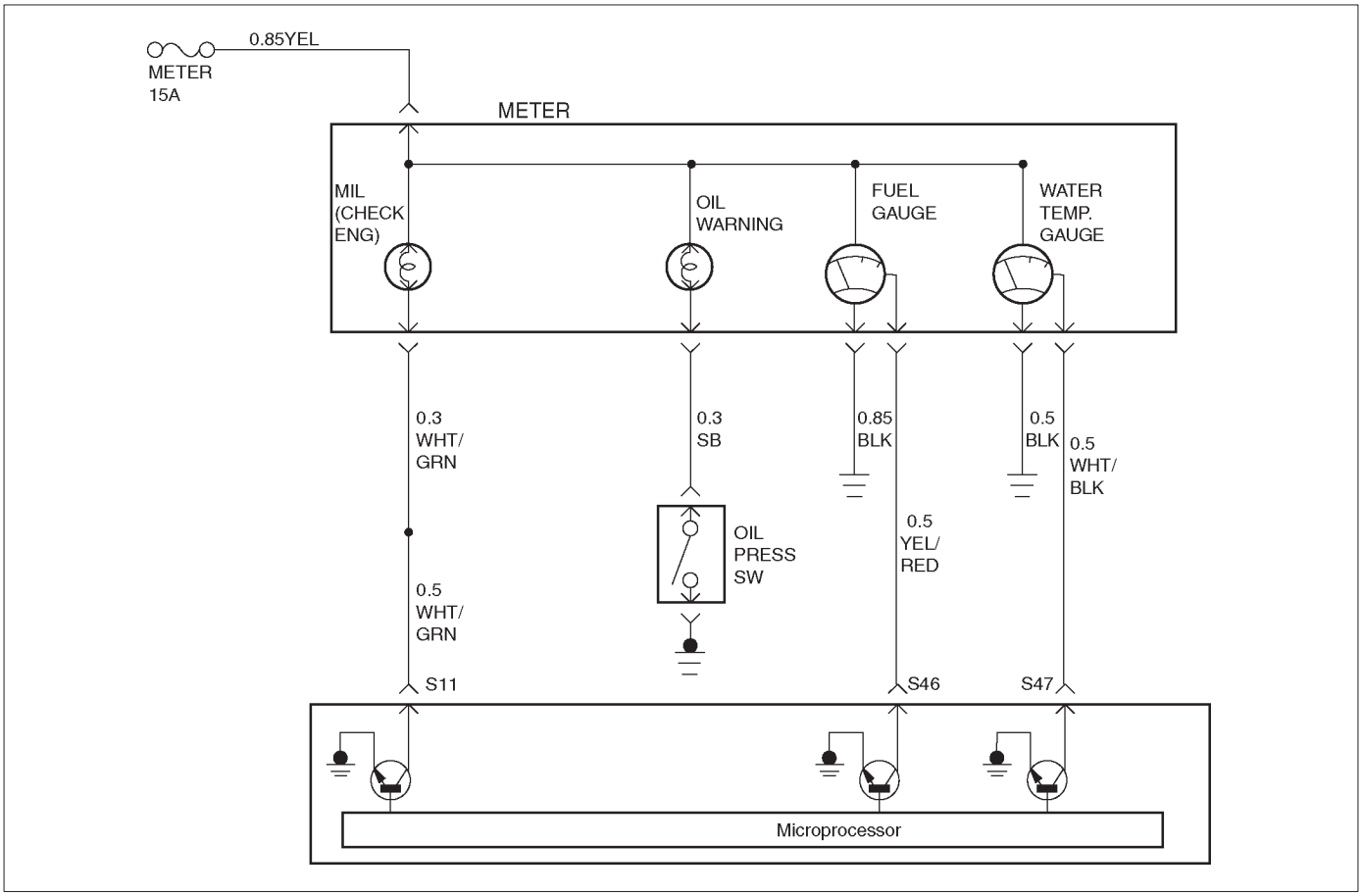
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
EGR Duty Cycle	Engine	Percent	0%	0%	General Description and Operation, Linear EGR Operation and Results of Incorrect Operation
EGR Feedback	Engine	Volts	0.45-0.80	0.45-0.80	—
EGR Normalized	Engine	Percent	0%	0%	—
Engine Load	Engine	Percent	2.0% - 5.5%	8.0% - 16.0%	General Description and Operation, Mass Air Flow (MAF) Sensor
Time From Start	Engine	Sec	Varies. Resets at each engine start.	Varies. Resets at each engine start.	—
Engine Speed	Engine	RPM	Within –50 to +100 of “Desired Idle”	Actual engine speed	—
EVAP Purge Solenoid	Engine	Percent	0%	0%	Diagnosis, EVAP Emission Canister Purge Valve Check
EVAP Vent Valve	Engine	On/Off	Off	Off	Diagnosis, EVAP Canister Purge Solenoid and EVAP Vacuum Switch and Visual Check; DTCs: P1441, P1442
Fuel System Status	Engine	Open Loop/Closed Loop	Closed Loop	Closed Loop	General Description
Fuel Level	Engine	Percent	—	—	Engine Fuel
Fuel Level Sensor	Engine	Volts	—	—	Engine Fuel
Fuel Tank (Vapor) Pressure Sensor	Engine	Volts	1.02 – 1.86	1.02 – 2.57	General Description and Operation
		in. H2O	—	—	
Fuel Pump	Engine	On/Off	On	On	Engine Fuel
HO2S Bank 1 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950, always changing quickly	General Description and Operation, Fuel control HO2S
HO2S Bank 1 Sen.2 (millivolts) (**Auto Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.2 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.3 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Manual Trans)

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
HO2S Bank 2 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Control HO2S
HO2S Bank 2 Sen.2 (millivolts) (**Auto trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S; DTC: P0135
HO2S Bank 2 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Auto Trans)
IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	0-100˚C, depends on underhood temperature	0-80˚C, depends on underhood temperature	General Description and Operation, Intake Air Temperature (IAT) Sensor
Illumination Switch	Engine	Closed 0V/Open 12V	Closed 0V	Closed 0V	Refer to Section 8
Ignition Voltage	Engine	Volts	12.8-14.1	12.8-14.1	General Description and Operation, Electronic Ignition System
Inj. Pulse Bank 1	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Inj. Pulse Bank 2	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Knock Present	Engine	No/Yes	No	No	General Description and ION Sensing Module
Knock Signal	Engine	Percent	1~4	1~4	General Description and ION Sensing Module
Knock Sensor Retard	Engine	˚CA	0	0	General Description and ION Sensing Module
Knock Counter	Engine	Counts	—	—	General Description
Long Term FT Bank 1 (Long Term Fuel Trim)	Misfire	Counts and Percentage	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171, P0172

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Long Term FT Bank 2 (Long Term Fuel Trim)	Misfire	Counts and Percentage	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171
MAF (Mass Air Flow)	Engine	Grams per second	2.85-6.65	9.5-16.5	General Description and Operation, MAF; DTCs: P101, P0102, P0103
MAP kPa (Manifold Absolute Pressure)	Engine	Kilopascals	23-40	19-32	General Description and Operation, Manifold Absolute Pressure (MAP) Sensor; DTCs: P0106, P0107, P0108
		Volts	0.65-1.32	0.46-1.10	
MIL	Engine	On/Off	Off	Off	On-Board Diagnostic System Check
Misfire Cur. Cyl #1	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #2	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #3	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #4	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #5	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #6	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Hist. Cyl #1	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #2	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #3	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #4	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #5	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #6	Misfire	Counts	0	0	DTC P0300
Misfire Failures Since First Fail	Misfire	Counts	0	0	DTC P0300
Misfire Passes Since First Fail	Misfire	Counts	0	0	DTC P0300
PNP (Park/Neutral Position)	Engine	P-N / R-D-3-2-L	P-N	P-N	4L30-E Automatic Transmission Diagnosis
Power Enrichment	Engine	NO/YES	NO	NO	General Description and Operation, Acceleration Mode
PSP Switch (Power Steering Pressure)	Engine	Normal/Hi	Normal Pressure	Normal Pressure	Refer to 2A Section

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Spark (Advance)	Engine	Degrees Before Top Dead Center	15-22	34-44	General Description and Operation, Electronic Ignition System
Start-Up ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	Depends on engine coolant temperature at time of start-up	Depends on engine coolant temperature at time of start-up	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
Start-Up IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	Depends on intake air temperature at time of start-up	Depends on intake air temperature at time of start-up	General Description and Operation, Intake Air Temperature (IAT) Sensor
TCC Cruise Brake Switch	Engine	Active/Inactive	Active	Active	Refer to Section 10
Total Misfire Current Count	Misfire	Counts	0-5	0-5	DTC P0300
TP Sensor 1 (Throttle Position Sensor 1)	Engine	Percentage	8–12	28–36	General Description and Operation, Throttle Position (TP) Sensor
TP Sensor 2 (Throttle Position Sensor 2)	Engine	Percentage	8–12	28–36	General Description and Operation, Throttle Position (TP) Sensor
Throttle at Idle	Engine	No/Yes	Yes	No	General Description and Operation, Throttle Position (TP) Sensor
Upshift Lamp (manual trans)	Engine	On/Off	Off	Off	Manual Transmission
Vehicle Speed	Engine	MPH / km/h	0	0	4L30-E Automatic Transmission Diagnosis
Weak Cylinder	Misfire	Cylinder #	—	—	DTC P0300

No Malfunction Indicator Lamp (MIL)



060R200049

Circuit Description

The “Check Engine” lamp (MIL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL “ON” by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A “No MIL” condition accompanied by a no-start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to *PCM Terminal End View* for terminal locations of the PCM ground circuits.

12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as “good” simply by honking the horn. Replace the horn relay after completing this step.

17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures Powertrain Control Module (PCM) and Sensors.*

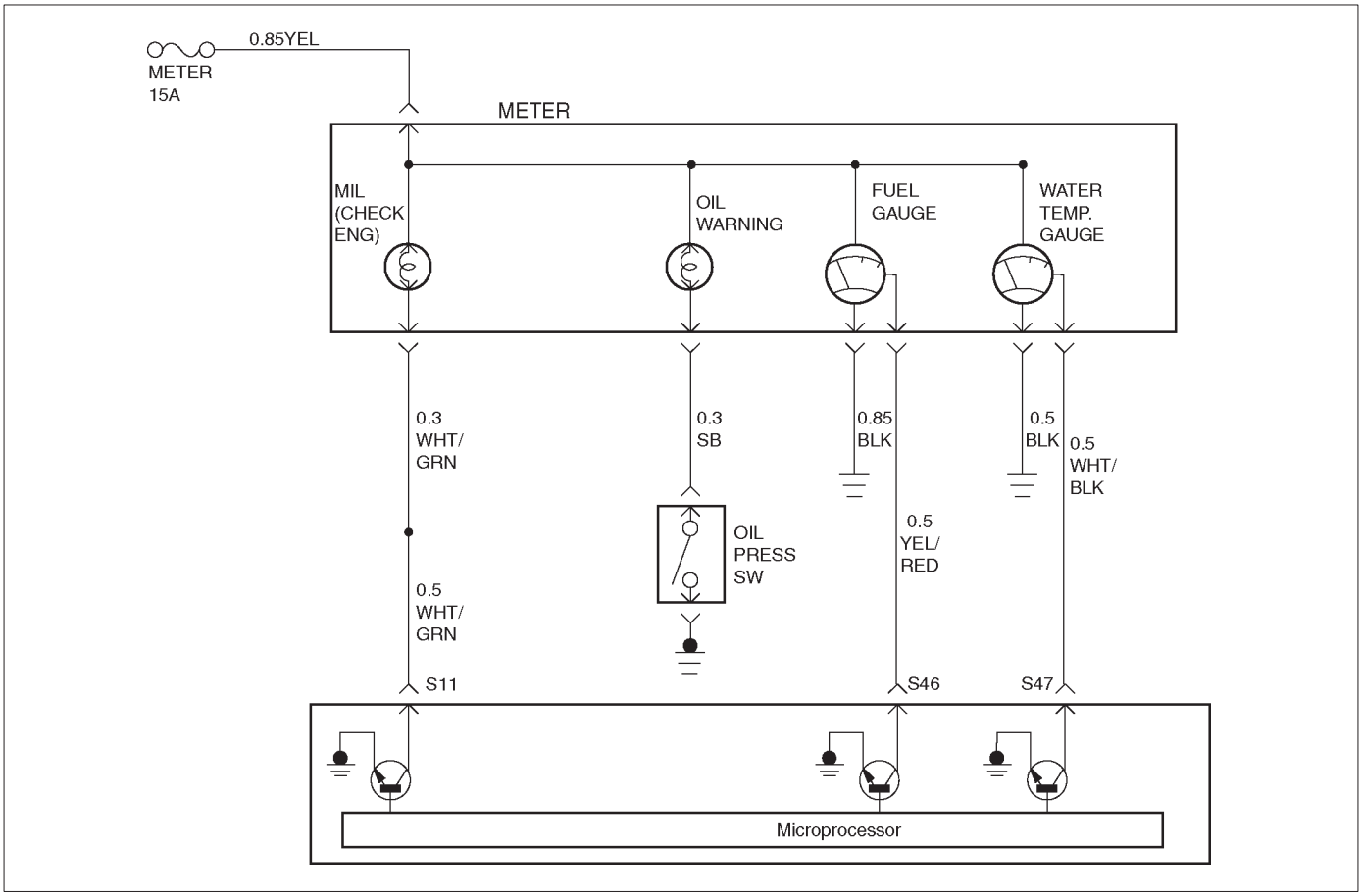
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 6*
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to *Step 4*	Go to *Step 16*
4	Ignition “ON”, probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 5*	Go to *Step 13*
5	1. Ignition “OFF”. 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition “ON”. Is the MIL “ON”?	—	Go to *Step 10*	Go to *Step 11*
6	Check the PCM ignition feed and battery feed fuses (15 A engine fuse and 15 A PCM fuse). Are both fuses OK?	—	Go to *Step 7*	Go to *Step 15*
7	1. Ignition “OFF”. 2. Disconnect the PCM. 3. Ignition “ON”. 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 8*	Go to *Step 12*
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 9*	Go to *Step 14*
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to *Step 17*
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to *Step 18*
12	Substitute a known “good” relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to *Step 13*
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *PCM* in *ON-Vehicle Service* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to *Instrument Panel* in *Electrical Diagnosis*

Malfunction Indicator Lamp (MIL) “ON” Steady



060R200049

Circuit description

The malfunction indicator lamp (MIL) should always be illuminated and steady with ignition “ON” and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL “ON” by grounding the MIL driver circuit. The MIL should not remain “ON” with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- ▼ Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

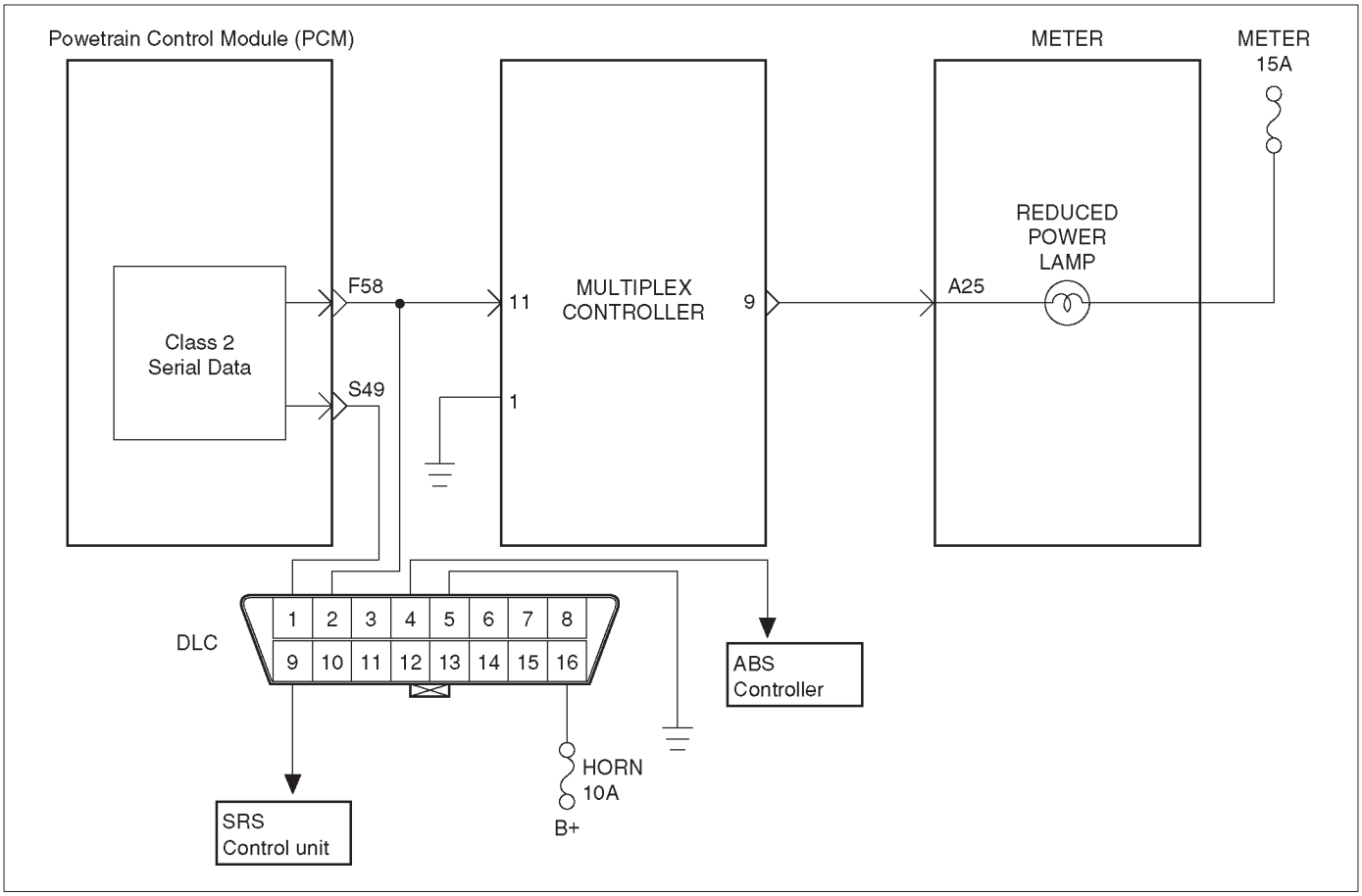
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain “ON” when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensors.*

Malfunction Indicator Lamp (MIL) “ON” Steady

Step	Action	Value(s)	Yes	No
1	Was the “On-Board diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”, disconnect PCM. 2. Ignition “ON”, observe the MIL (Service Engine Soon lamp). Is the MIL “ON”?	—	Go to *Step 3*	Go to *Step 5*
3	1. Ignition “OFF”, disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to *OBD System Check*	Go to *Step 4*
4	Replace the instrument panel cluster. Is the action complete?	—	Go to *OBD System Check*	—
5	1. Ignition “OFF”, reconnect the PCM. 2. Ignition “ON”, reprogram the EEPROM. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL “OFF”. (Refer to the Miscellaneous test) Did the MIL turn “OFF”?	—	Go to *OBD System Check*	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

No Reduced Power Lamp (RPL)



060R200073

Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orders the RPL “ON” signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL “ON” signal that turn RPL “ON” by grounding the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM and Multiplex Control Unit harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A “No RPL” condition accompanied by a no–start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the Multiplex Control Unit ground terminals to ensure that a good ground is present. Refer to Multiplex Control Unit Terminal End View for terminal locations of the Unit Terminal End View for terminal locations of the Multiplex Control Unit ground circuits.

12. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to PCM Terminal End View for terminal locations of the PCM ground circuits.

21. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as “good” simply by honking the horn. Replace the horn relay after completing this step.

24. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

No Reduced Power Lamp (RPL)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” Performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 11*
3	Check the following fuses: MAIN(100A), B+1(60A), B+2(50A), METER(15A), ECM(15A) , ENGINE(15A) Was a problem found?	—	Go to *Step 14*	Go to *Step 4*
4	1. Ignition ”OFF”. 2. Disconnect the cluster meter connector. 3. Ignition “ON”, Probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 5*	Go to *Step 15*
5	1. Ignition “OFF”. 2. Disconnect the Multiplex Control Unit. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 16*	Go to *Step 6*
6	1. Reconnect the cluster meter connector. 2. Disconnect the Multiplex Control Unit. 3. Jumper the RPL driver circuit at the Multiplex Control Unit connector to ground. 4. Ignition “ON”. Is the RPL “ON”?	—	Go to *Step 7*	Go to *Instrument Panel in Electrical Diagnosis*
7	1. Ignition “OFF”. 2. Probe the ignition feed circuit at the Multiplex Control Unit connector with a test light to ground. 3. Ignition “ON”. Is the test light “ON”?	—	Go to *Step 8*	Go to *Step 17*
8	1. Ignition “OFF”. 2. Disconnect the PCM. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 18*	Go to *Step 9*
9	Check the Multiplex Control Unit ground connection and circuit. Was a problem found?	—	Go to *Step 19*	Go to *Step 10*
10	Check for damaged terminals at the Multiplex Control Unit. Was a problem found?	—	Go to *Step 20*	Go to *Step 11*
11	1. Ignition “ON”. 2. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 12*	Go to *Step 21*

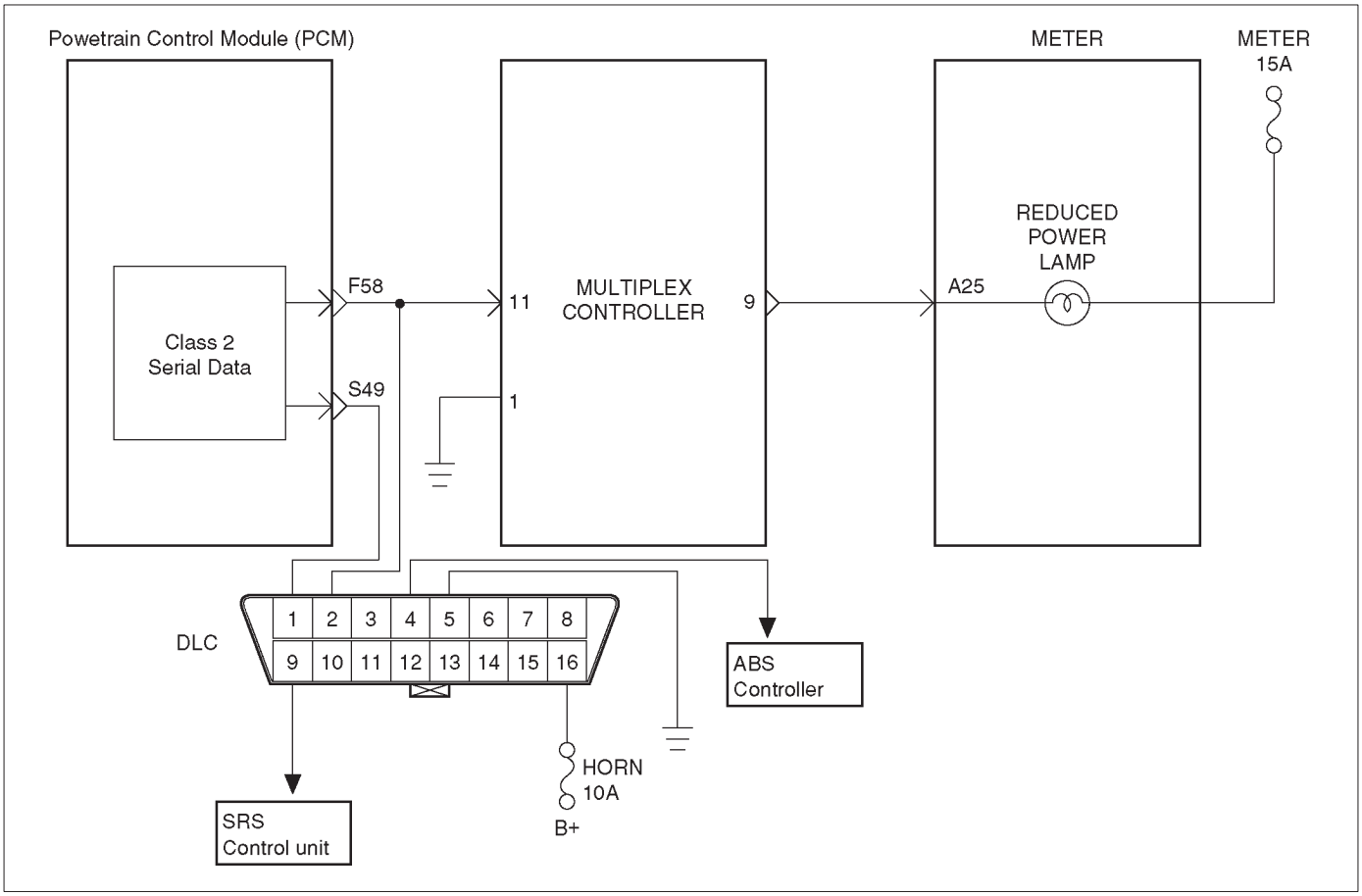
No Reduced Power Lamp (RPL) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "OFF". 2. Check for a faulty PCM ground connection and Circuit. Was a problem found?	—	Go to *Step 23*	Go to *Step 13*
13	Check for damaged terminals at the PCM. Was a problem found?	—	Go to *Step 24*	Go to *Step 25*
14	Replace the fuse. Is the action complete?	—	Verify repair	—
15	Locate and repair the cluster meter battery feed open circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the circuit between cluster meter and Multiplex Control Unit open circuit. Is the action complete?	—	Verify repair	—
17	Locate and repair the circuit Multiplex Control Unit battery feed open circuit. Is the action complete?	—	Verify repair	—
18	Locate and repair the between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Verify repair	—
19	Locate and repair the ground connection for Multiplex Control Unit circuit. Is the action complete?	—	Verify repair	—
20	Reconnect the Multiplex Control Unit. circuit. Is the action complete?	—	Verify repair	—
21	Substitute a known "good" relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to *Step 22*
22	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
23	Locate and repair the ground connection for PCM circuit. Is the action complete?	—	Verify repair	—
24	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

No Reduced Power Lamp (RPL) (Cont'd)

Step	Action	Value(s)	Yes	No
25	1. Ignition "OFF". 2. Reconnect all connectors. 3. Install the Tech 2. 4. Ignition "ON". 5. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL "ON". (Refer to the Miscellaneous test) Did the RPL turn "ON"?	—	Verify repair	Go to *Step 26*
26	1. Ignition "OFF". 2. Disconnect the PCM. 3. Check the circuit (DLC line) between PCM and DLC. Was a problem found?	—	Go to *Step 27*	Go to *Step 24*
27	Locate and repair the circuit the between PCM and DLC. Is the action complete?	—	Go to *Step 25*	—

Reduced Power Lamp (RPL) “ON” Steady



Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orders the RPL “ON” signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL “ON” signal that turn RPL “ON” by grounding the RPL driver circuit.

The RPL should not remain “ON” with the engine running and no DTC(s) set. A steady RPL with the engine running and no DTC(s) suggests a short to ground in the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the RPL does not remain “ON” when the Multiplex Control Unit is disconnected, the RPL driver wiring is not faulty.
3. If the RPL driver circuit is OK, the instrument panel cluster is faulty.
10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

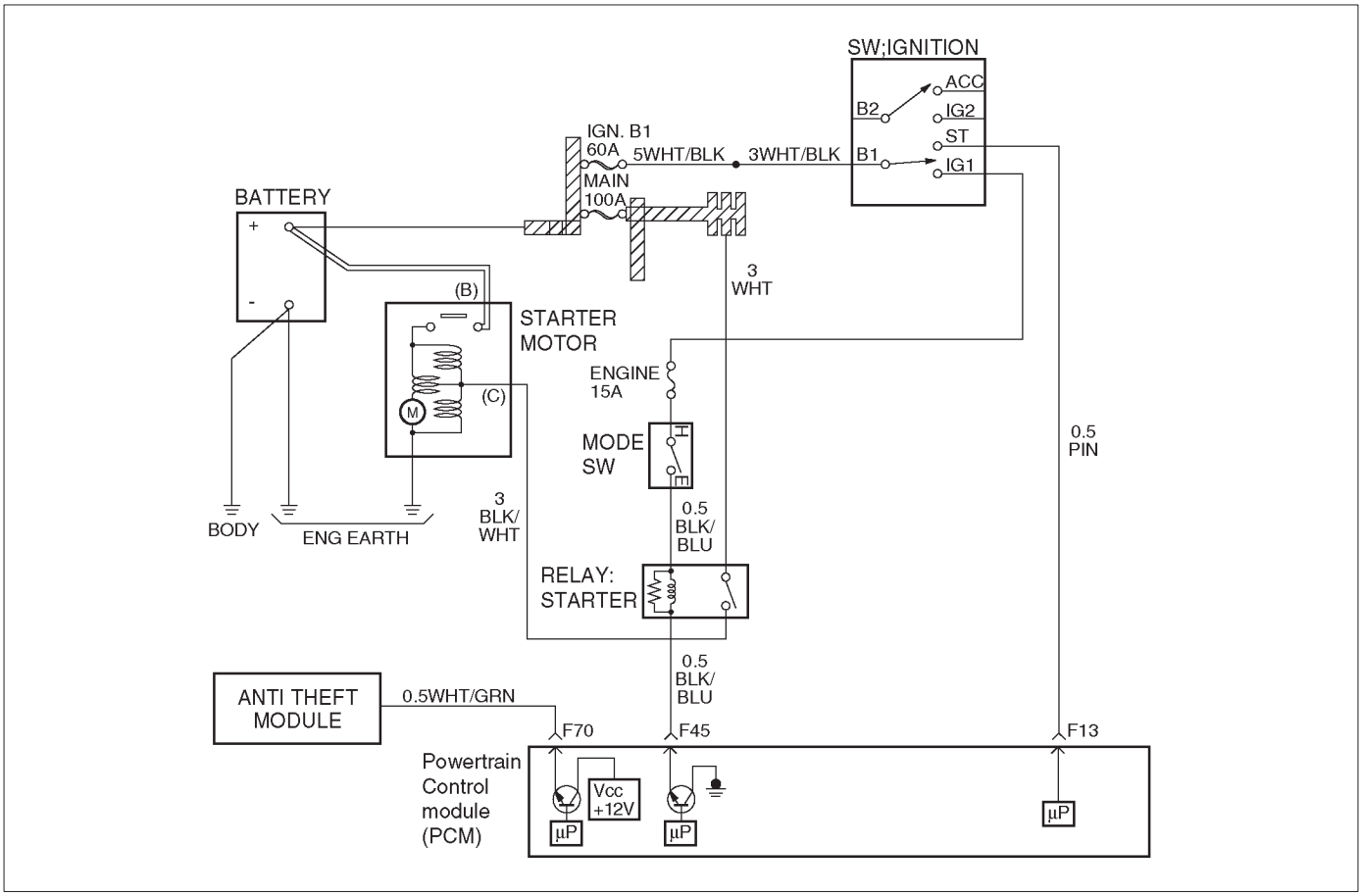
Reduced Power Lamp (RPL) “ON” Steady

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”, disconnect Multiplex Control Unit. 2. Ignition “ON”, observe the RPL (Reduced Power Lamp). Is the RPL “ON”?	—	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “OFF”, disconnect the instrument panel cluster. 2. Check the RPL driver circuit between the Multiplex Control Unit and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the RPL driver circuit shorted to ground?	—	Verify repair	Go to *Step 4*
4	1. Replace the Multiplex Control Unit. 2. Install the Tech 2 3. Ignition “ON”. 4. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL “OFF”. (Refer to the Miscellaneous test) Did the MIL turn “OFF”?	—	Verify repair	Go to *Step 5*
5	1. Ignition “OFF”. 2. Disconnect the PCM. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 6*	Go to *Step 7*
6	Locate and repair the circuit between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Go to *Step 7*	—
7	1. Install the Tech 2 2. Ignition “ON”. 3. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL “OFF”. (Refer to the Miscellaneous test) Did the MIL turn “OFF”?	—	Go to *Verify repair*	Go to *Step 8*
8	1. Ignition ”OFF”. 2. Disconnect the PCM. 3. Check the circuit (DLC line) between PCM and DLC. Was a problem found?	—	Go to *Step 9*	Go to *Step 10*

Reduced Power Lamp (RPL) “ON” Steady (Cont’d)

Step	Action	Value(s)	Yes	No
9	Locate and repair the circuit between PCM and DLC. Is the action complete?	—	Go to *Step 2*	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Starter Control System Check



060R200062

Circuit Description

Starter control system is controlled by the Power Train Control Module (PCM). The PCM monitors starter switch signal (“START”position) and MODE switch (park or neutral) signal. PCM is operated by the ignition switch. Ignition feed voltage is supplied to the MODE switch and starter relay through the engine fuse. PCM turns the starter relay “ON” by grounding the starter relay driver circuit.

The starter motor is operated until 30 seconds based on starter relay signal.

Diagnostic Aids

An intermittent may be caused by the following:

- ▼ Poor connections.
- ▼ Mis routed harness.
- ▼ Rubbed through wire insulation.
- ▼ Broken wire inside the insulation.

Test Description

2.If Anti-theft system is “ON”, PCM does not operate starter control system.

19.Refer to *6D section.*

21.Refer to *6D section.*

24.This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced,the new PCM must be programmed.

Refer to *PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.*

Starter Control System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Anti-theft System” normally? Refer to *Owner’s Manual.*	—	Go to *Step 3*	Go to *Step 7*

Starter Control System Check (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Gear position is "park or neutral". 2. Do not depress the accelerator pedal. 3. Turn the key to "START" position. 4. Release the key switch to the to "ON" position. Does the engine crank?	—	Go to *Step 27*	Go to *Step 4*
4	1. Install the Tech 2. 2. Select "Display DTCs" with the Tech 2. Are any DTCs stored?	—	Go to *Step 5*	Go to *Step 6*
5	Review and record for Tech 2 Failure Records data and DTCs. Were any DTCs information stored?	—	Go to *DTCs Chart*	—
6	1. Gear position is "park or neutral". 2. Do not depress the accelerator pedal. 3. Turn the key to "START" position. Is the engine cranking?	—	Go to *Step 27*	Go to *Step 7*
7	Check the anti–theft module circuit. Check the circuit between PCM and anti–theft module. Is the problem found?	—	Go to *Step 8*	Go to *Step 9*
8	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
9	1. Probe the anti-theft module circuit to GND. 2. Turn the key to "START" position. Is the engine cranking?	—	Go to *Step 10*	Go to *Step 11*
10	Check the anti-theft system. Refer to *section 8H anti-theft.*	—	Verify repair	—
11	Check the starter relay, starter fuse and engine fuse. Is the problem found?		Go to *Step 12*	Go to *Step 13*
12	Replace the starter relay, starter fuse and engine fuse. Is the action complete?	—	Verify repair	—
13	Check the starter circuit. 1. Ignition is "OFF". 2. Remove the starter relay. 3. Check the circuit between starter relay and starter motor. Is the problem found?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
15	Check the starter circuit. 1. Remove the main fuse (100A). 2. Check the circuit between main fuse and starter motor. 3. Check the circuit between GND and starter motor. Is the problem found?	—	Go to *Step 16*	Go to *Step 17*

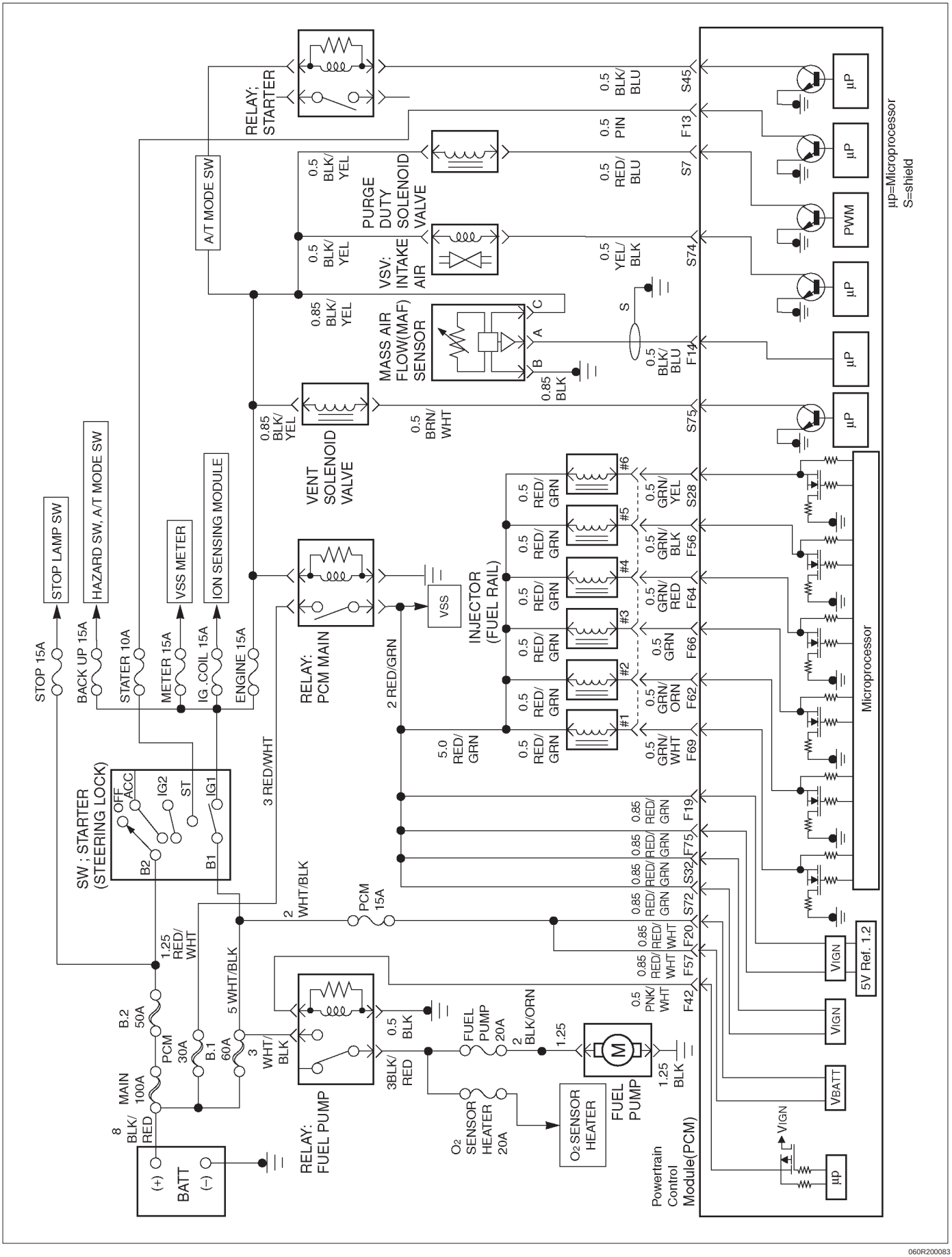
Starter Control System Check (Cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
17	Check the starter signal circuit. 1. Remove the starter fuse (10A). 2. Disconnect the PCM. 3. Check the circuit between Powertrain Control module (PCM) and starter fuse. Is the problem found?	—	Go to *Step 18*	Go to *Step 19*
18	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
19	Check the "park or neutral" signal circuit. 1. Remove the starter relay. 2. Disconnect the PCM. 3. Check the circuit between PCM and starter relay. Is the problem found?	—	Go to *Step 20*	Go to *Step 21*
20	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
21	Check the "park or neutral" signal circuit. 1. Remove the starter relay. 2. Disconnect the MODE switch. 3. Remove the engine (15A) fuse and back up (15A) fuse. 4. Check the circuit between MODE switch and starter relay. 5. Check the circuit between MODE switch and engine fuse. 6. Check the circuit between MODE switch and PCM. 7. Check the circuit between MODE switch and back up fuse. Is the problem found?	—	Go to *Step 22*	Go to *Step 23*
22	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
23	Check the MODE switch. Refer to *4L30E Automatic transmission.* Is the problem found?		Go to *Step 24*	Go to *Step 25*
24	Replace the MODE switch. Is the action complete?	—	Verify repair	—
25	Check the starter motor. Refer to *Section 6D Engine Electrical.* Is the problem found?		Go to *Step 26*	Go to *Step 28*
26	Replace the starter motor. Is the action complete?	—	Verify repair	—

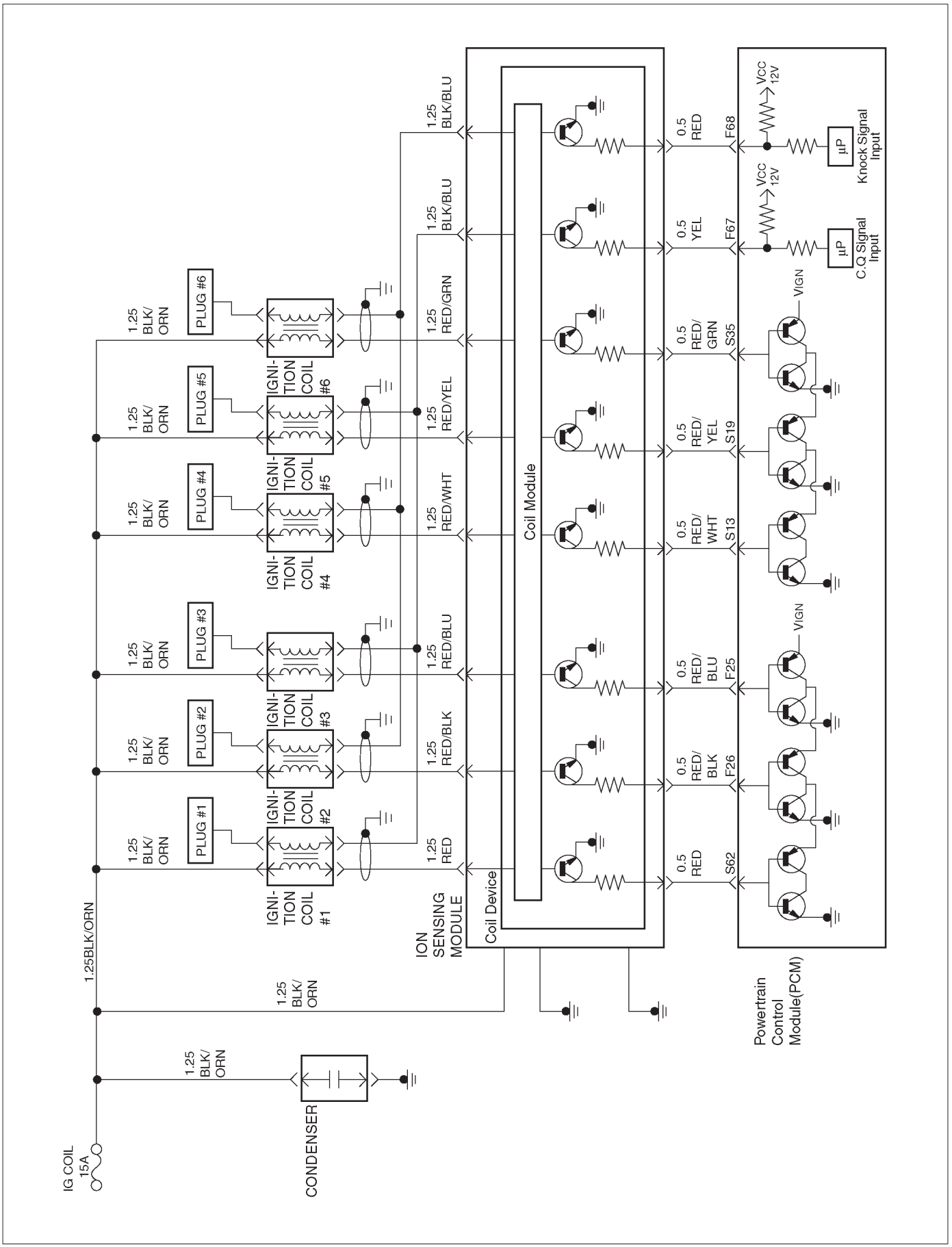
Starter Control System Check (Cont'd)

Step	Action	Value(s)	Yes	No
27	Check the engine start times. Is the engine start time less than specified value?	10 sec.	System OK	Go to *the Engine Cranks But Will Not Run Chart*
28	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power ControlModule and Sensors* for procedures.And also refer to latest Service Bulletin.Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run



060R200083


IG COIL
15A
1.25BLK/ORN
1.25
BLK/
ORN
CONDENSER
IGNI-
TION
COIL
#1
IGNI-
TION
COIL
#2
IGNI-
TION
COIL
#3
IGNI-
TION
COIL
#4
IGNI-
TION
COIL
#5
IGNI-
TION
COIL
#6
PLUG #1
PLUG #2
PLUG #3
PLUG #4
PLUG #5
PLUG #6
1.25
RED
1.25
RED/BLK
1.25
RED/BLU
1.25
RED/WHT
1.25
RED/YEL
1.25
RED/GRN
1.25
BLK/BLU
ION
SENSING
MODULE
Coil Device
Coil Module
0.5
RED
S62
0.5
RED/
BLK
F26
0.5
RED/
BLU
F25
0.5
RED/
WHT
S13
0.5
RED/
YEL
S19
0.5
RED/
GRN
S35
0.5
YEL
F67
0.5
RED
F68
VIGN
VIGN
VCC
12V
VCC
12V
µP
µP
Knock Signal
Input
C.Q Signal
Input
Powertrain
Control
Module(PCM)

060R200075

Circuit Description

The electronic Ignition system uses a coil -at-plug method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver outside the Ignition Current Sense System (ICSS), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICSS opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left "OFF" during the next six 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting been received by the PCM. The ION sensor signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start - up, the PCM will begin sequential fuel delivery with a 1 -in-6 chance that fuel delivery is correct. The engine will run without a ION sensor signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed - through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness-Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty engine coolant temperature sensor-Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10 ° C of intake air temperature. If not, replace the ECT sensor.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

5. An obvious cause of low fuel pressure would be an empty fuel tank.
6. The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
7. A blinking test light verifies that the PCM is monitoring the 58X crankshaft reference signal and is capable of activating the injectors. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 300 – 306 should be set.
19. By using a spark tester, each ignition coil's ability to produce 25,000 volts is verified.
25. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 301 – 306 should be set. All six injector driver circuits can be checked at one time without removing the intake manifold if a J 39021 – 95 test light is available. This is the alternative procedure:
    - With the ignition "OFF", disconnect the gray connector located at the rear of the air filter, attached to a bracket on the purge canister.
    - Connect test light J 39021 – 95 to the connector. Do any of the light constantly illuminate or fail to blink when the engine is cranked? If so, repair the short or open circuit, or replace the PCM if indicated.

This procedure only tests the driver circuit as far as the test connection, so step 31 is added to test the circuit all the way to the injector.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the ignition coil fuse, the engine fuse, and the PCM fuse. Was a fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF", install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. (Use a shop cloth to absorb any fuel leakage while making the connection.) 2. Ignition "ON", observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady?	285 - 375 kPa (43 – 55 psi)	Go to *Step 6*	Go to *Step 5*
5	Is any fuel pressure indicated?	—	Go to *Fuel System Electrical Test*	Go to *Fuel System Diagnosis*
6	Install the switch box J 39021–2 at the injector test connector and activate an injector. Did the fuel pressure drop when the injector was activated?	—	Go to *Step 7*	Go to *Step 18*
7	Install an injector test light at the #2 cylinder injector harness connector. Does the light blink when the engine is cranked?	—	Go to *Step 8*	Go to *Step 24*
8	1. Ignition " OFF". 2. Disconnect the 11-pin connector at the ION sensing module. 3. With a test light to B + , probe each of the 6 exposed ION sensing module pins, one at a time, while the engine is cranked. (Use the gray narrow Metri - Pak © flexible female connector from the J - 35616 kit to make the pin accessible.) Does the light flash at each pin when the engine is cranked?	—	Go to *Step 12*	Go to *Step 9*
9	1. Remove the 4-pin connector at the ION sensing module. 2. Ignition " ON". 3. Use a test light at the harness connector to verify that the module is being supplied with B + and ground. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the open ignition feed circuit or ground circuit to the ION sensing module. Is the action complete?	—	Verify repair	—
11	Repair the ION sensing module. Is the action complete?	—	Verify repair	—
12	1. Reconnect the ION sensing module 11-pin connector. 2. Remove the electrical connector from each coil. 3. With a test light to B+, probe each of the coil connectors at the wire which runs to the ION sensing module. Does the light flash at each coil connector when the engine is cranked?	—	Go to *Step 14*	Go to *Step 13*
13	Check for an open circuit between the coil and ION sensing module. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Ignition "ON". 2. While the coil connectors are disconnected, touch each coil connector's ignition feed terminal with a grounded test light (the ignition feed wire is YEL tracer). Did the test light illuminate?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the open ignition feed circuit. Is the action complete?	—	Verify repair	—
16	While the coil connectors are disconnected, touch each connector's secondary ground terminal with a test light to B +. (The ground wires are black.) Did the test light illuminate at each coil connector?	—	Go to *Step 18*	Go to *Step 17*
17	Repair the open secondary ground circuit. Is the action complete?	—	Verify repair	—
18	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to *Step 19*
19	1. Remove any ignition coil and install a spark tester at the spark plug end of the coil. 2. Observe the tester while the engine is cranking. Was a crisp, blue spark observed? Only one or two sparks followed by no result is considered the same as "No Spark".	—	Go to *Step 21*	Go to *Step 20*
20	Replace the ignition coil, and return to Step 19 to test the remaining coils. Is the action complete?	—	Verify repair	—
21	Repeat Step 19 for each coil. Remove only one coil at a time, and reinstall each coil on its spark plug after testing, but do not refasten coils with screws at this time. After all coils have passed the spark test, does the engine start?	—	Refasten all coils with their screws	Go to *Step 22*
22	1. Remove the spark plugs from all cylinders. 2. Visually inspect the spark plug electrodes. 3. Replace any spark plugs with loose or missing electrodes or cracked insulators. Did your inspection reveal any spark plugs exhibiting excessive fouling?	—	Correct the fouling condition	Go to *Step 23*

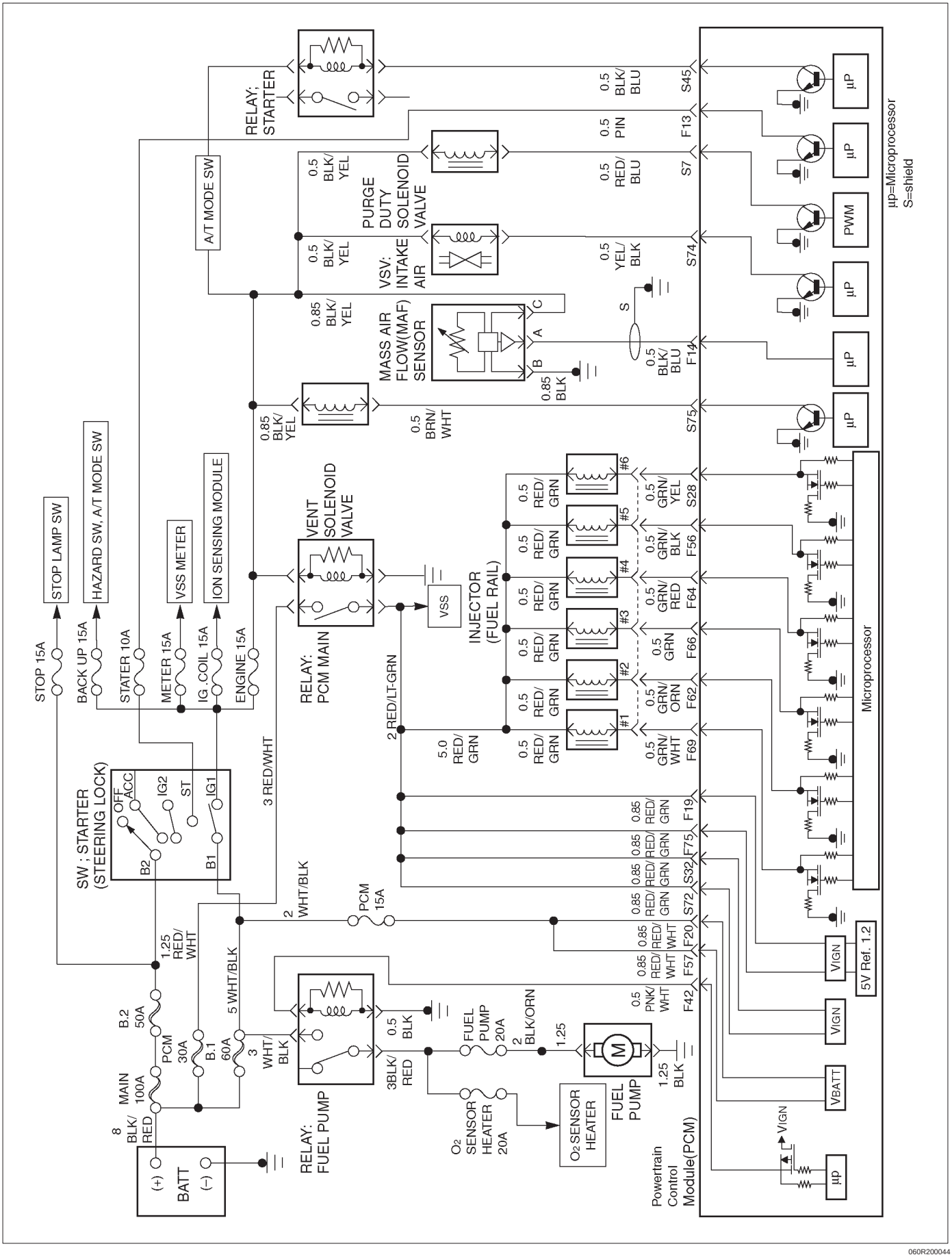
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
23	Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: ▼ Faulty or incorrect camshaft drive belts ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ Incorrect valve timing ▼ Leaking head gasket Is the action complete?	—	Verify repair	Go to *Step 25*
24	Observe the "Engine Speed" data display on the Tech 2 while cranking the engine. Is the engine RPM indicated?	—	Go to *Step 25*	Go to *Step 34*
25	1. Disconnect the 7-pin gray connector at the rear of the air filter beneath the point where the air duct attaches to the MAF sensor. 2. Ignition "ON". 3. Using a test light connected to ground, probe the ignition terminal at the PCM (female) side of the 7-pin connector. Is the test light "ON"?	—	Go to *Step 26*	Go to *Step 32*
26	1. At the PCM (female) side of the connector, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector. 2. Ignition "ON". 3. Observe the test light, and repeat the test for each injector driver circuit. Did the test light stay on when checking any of the 6 injector driver circuits?	—	Go to *Step 27*	Go to *Step 29*
27	1. Ignition "OFF", disconnect the PCM. 2. Ignition "ON", observe the test light. Is the test light "ON"?	—	Go to *Step 28*	Go to *Step 33*
28	Locate and repair the short to ground in the injector driver circuit. Is the action complete?	—	Verify repair	—
29	1. Using the same test location as in step 26, connect a test light between the ignition terminal and one of the driver circuits. 2. Crank the engine and observe the test light. 3. Repeat for each injector driver circuit. Did the light blink during the test for each circuit?	—	Go to *Step 31*	Go to *Step 30*
30	Check for an open injector driver circuit. Was a problem found?	—	Verify repair	Go to *Step 33*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
31	1. At the injector (male) side of the gray connector mentioned in step 25, connect an ohmmeter between the ignition pin and one of the driver circuit pins. 2. Check for continuity in the circuit. 3. Repeat for each injector circuit. The readings should be approximately equal to the specified value for injector resistance. Was a problem found?	12.5 Ω	Verify repair	Go to *Step 8*
32	Repair the ignition feed circuit. Is the action complete?	—	Verify repair	—
33	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
34	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition "ON". 3. With a test light to ground, probe the harness ignition feed terminal. Did the light illuminate?	—	Go to *Step 36*	Go to *Step 35*
35	Check the ignition feed wire between the sensor and the PCM for a short to ground or open circuit. Is the action complete?	—	Verify repair	—
36	1. Ignition "ON". 2. At the CKP harness connector, connect a test light between the ignition and ground terminals. Did the light illuminate?	—	Go to *Step 38*	Go to *Step 37*
37	Check the sensor ground circuit for an open or short to voltage. Is the action complete?	—	Verify repair	—
38	Check the signal circuit between the sensor and the PCM for a short to ground, short to voltage, or an open. Was a problem found?	—	Verify repair	Go to *Step 39*
39	Replace the CKP position sensor. Is the action complete?	—	Verify repair	Go to *Step 33*

Fuel System Electrical Test



060R200044

Circuit Description

When the ignition switch is first turned “ON”, the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain “ON” as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned “ON” or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition “ON”, the fuel pump can be turned “ON” by using a command by the Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- ▼ Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the “Fuel System Pressure Test” chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- ▼ **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- ▼ **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover .
3. Reinstall the fuel pump relay.

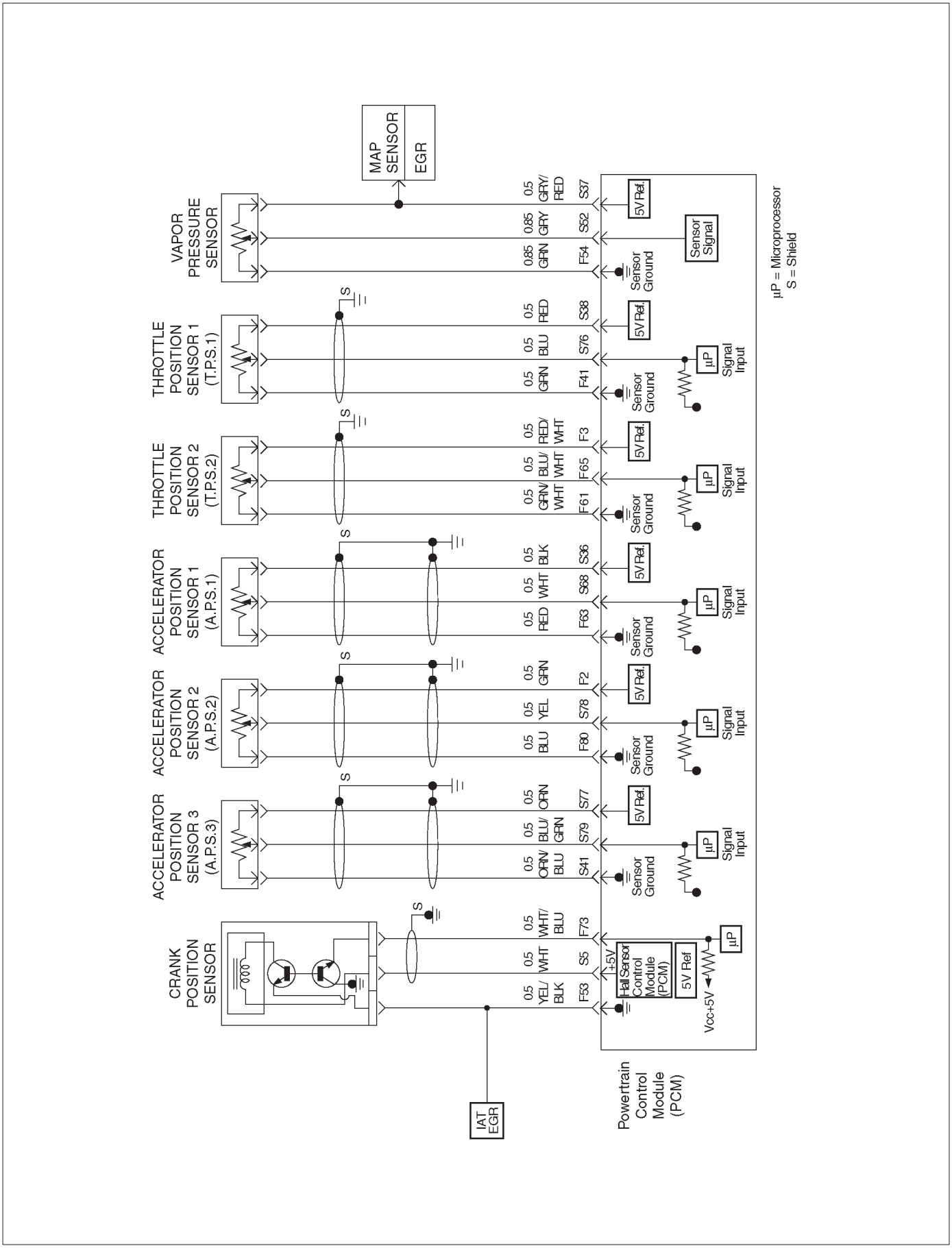
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Read the “Caution” above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Ignition ON, Engine is Off. 4. Use a Tech 2 to command the fuel pump “ON”. (Refer to the Miscellaneous Test.) Is there an immediate pressure build-up which indicates the pump is running?	—	Go to *Step 3*	Go to *Step 4*
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump “ON” with the Tech 2. Did the pump turn “OFF” after 2 seconds?	—	Test completed	Go to *Step 12*
4	1. Ignition “OFF”. 2. Remove the fuel pump relay. 3. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull-in coil. 2. Ignition “ON”. Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 12*	Go to *Step 7*
7	1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull-in coil to the PCM. 2. Ignition “ON”. Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 8*	Go to *Step 9*
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump "ON" with a Tech 2. Did the light illuminate for 2 seconds?	—	Go to *Step 15*	Go to *Step 13*
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump "ON" with the Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded "ON"?	—	Go to *Step 17*	Go to *Step 14*
14	1. Re-connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	—	Verify repair	—
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump "ON" with a Tech 2. Did the test light illuminate for 2 seconds?	—	Go to *Step 18*	Go to *Step 16*
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	—	Verify repair	—
17	1. Re-connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	—	Verify repair	—
18	Replace the fuel pump. Is the action complete?	—	Verify repair	—

Electric Throttle Control (ETC) System Check



060R200065

Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in PWM (%) to adjust the throttle valve into a passage in the throttle body to allow air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The accelerator position (AP1) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal angle will vary about 13% at idle position to about 87% at wide open throttle(WOT).

  APS signal is used to determine which DC motor will adjust throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow movement of throttle position.

Diagnostic Aids

- An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.
- Accelerator pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the accelerator pedal arm and on the accelerator pedal.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.
3. Visually/physically inspect for the following accelerator pedal conditions.
5. Check the following circuits for throttle valve and DC motor. Check the following TP sensor resistance and DC motor.
7. Check the following circuits for accelerator pedal. Check the following AP sensor resistance.
10. Following DTC: Software detect Error for ETC system.
11. Following DTC: Software detect Error for ETC system.

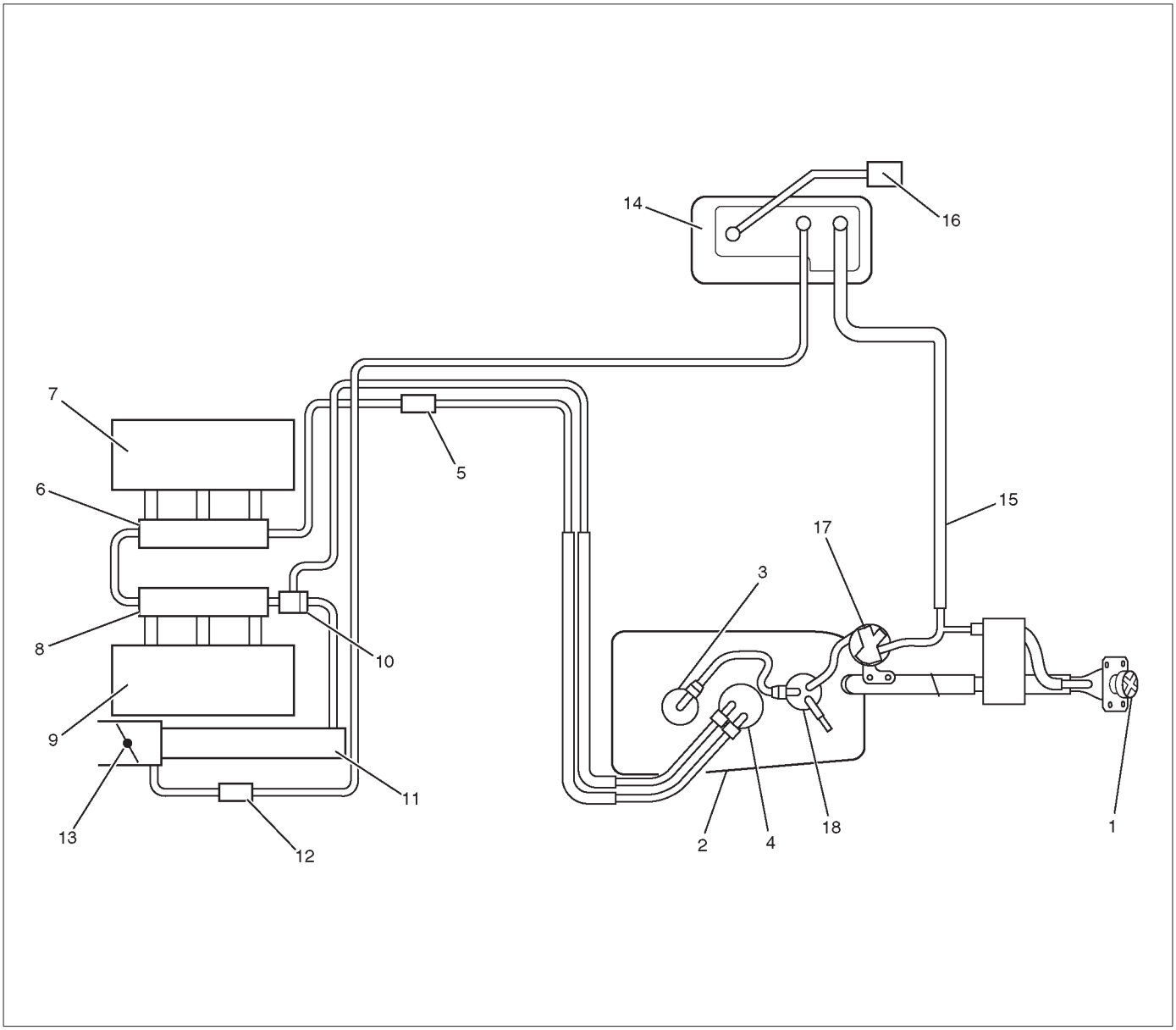
Electric Throttle Control (ETC) System Check

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ▼ Throttle body tampering. ▼ Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ▼ Throttle body with lever: When check for objects to send round the throttle spring lever that lever is smooth movement by less than 9 l·bm{1.0 N·m}, and spring lever has not excessive play. ▼ Throttle function: Check for the throttle function. When ignition switch "ON" that throttle lever is smooth operated by step on the accelerator pedal. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 3*
3	Visually/physically inspect for the following conditions: ▼ Accelerator pedal tampering. ▼ Accelerator pedal : Check for objects blocking the spring or pedal arm. ▼ Accelerator pedal : For check for objects to move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the accelerator position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Throttle position sensor 1 circuit. ▼ Throttle position sensor 2 circuit. ▼ Throttle DC motor circuit. ▼ Throttle position sensor resistance. ▼ Throttle DC motor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 1–7kΩ SIG–GND change resistance 0.3–100Ω	Verify repair	Go to *Step 6*

Electric Throttle Control (ETC) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Install the Tech 2 2. Ignition "ON" but not engine run. 3. Chech the valve for APS and TPS. Was the problem found?	Idle AP1 = 11–13% AP2 = 87–88% AP3 = 87–88% TP1 = 1–6% TP2 = 1–6% WOT AP1 = 85–89% AP2 = 11–15% AP3 = 32–36% TP1 = 98–100% TP2 = 98–100%	Go to *Step 10*	Go to *Step 7*
7	Replace the throttle valve. Is the action complete?	—	Go to *Step 8*	—
8	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Accelerator position sensor 1 circuit. ▼ Accelerator position sensor 2 circuit. ▼ Accelerator position sensor 3 circuit. ▼ Accelerator position sensor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 4–6kΩ SIG–GND change resistance	Verify repair	Go to *Step 9*
9	Replace the accelerator position sensor. Is the action complete?	—	Go to *Step 10*	–
10	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC chart*	Go to *Step 11*
11	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC chart*	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Fuel System Diagnosis



140R200004

Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Purge Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve)

Circuit Description

When the ignition switch is turned "ON", the powertrain control module (PCM) will turn "ON" the in-tank fuel pump. The in-tank fuel pump will remain "ON" as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in-tank fuel pump "OFF" 2 seconds after the ignition switch is turned "ON" or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir. The in-tank fuel pump supplies fuel through an in-line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch "ON" and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.

3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - ▼ The fuel pump check valve.
   - ▼ The fuel pump flex line.
   - ▼ The valve or valve seat within the fuel pressure regulator.
   - ▼ The fuel injector(s).

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the "Fuel Cut-Off Mode".

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine "OFF".

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
   - ▼ Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to *Fuel Rail Assembly* in *On-Vehicle Service.*
   - ▼ Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- ▼ **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- ▼ **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.

21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging , and misfiring.

22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump "ON" with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- ▼ **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- ▼ **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition “OFF”. 2. Turn the air conditioning system “OFF”. 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition “ON”. NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump “ON”. (Refer to the Miscellaneous Test.) 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 3*	Go to *Step 17*
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 4*	Go to *Step 12*
4	1. When the vehicle is at normal operation temperature, turn the ignition “ON” to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21-105 kPa (3-15 psi)	Go to *Step 5*	Go to *Step 9*
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to *Step 6*	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: ▼ The in-pipe fuel filter. ▼ The fuel feed line. Was a restriction found?	—	Verify repair	Go to *Step 7*
7	Remove the fuel tank and visually and physically inspect the following items: ▼ The fuel pump strainer for a restriction. ▼ The fuel line for a leak. ▼ Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to *Step 8*

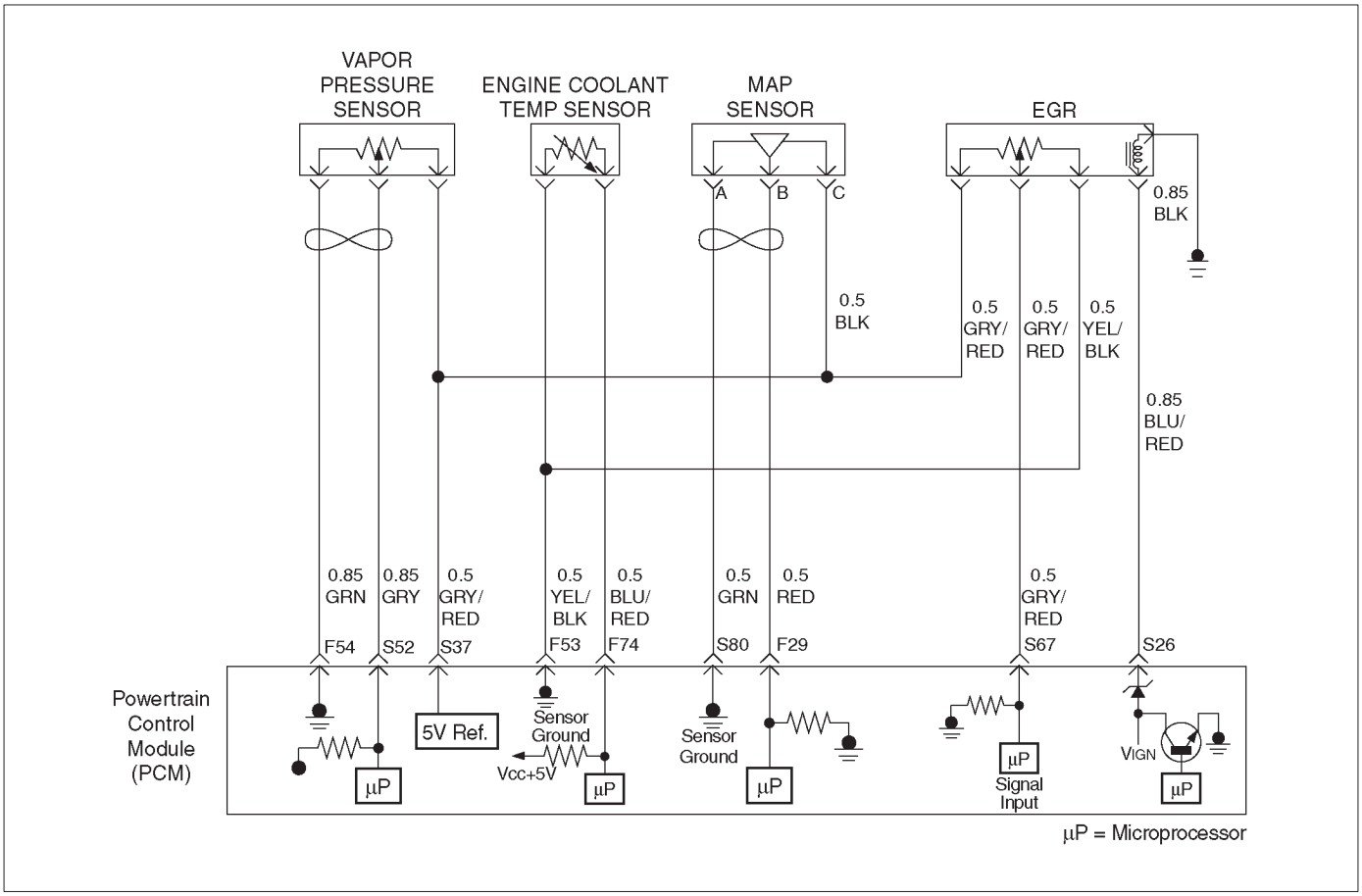
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21-105 kPa (3-15 psi)	Go to *Step 10*	Go to *Step 11*
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with the Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 13*	Go to *Step 15*
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Remove the fuel tank and inspect for leaky hose or in-tank fuel line. Was a problem found?	—	Verify repair	Go to *Step 8*
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers, which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with the Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 11*	Go to *Step 16*
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to *Step 18*	Go to *Step 21*

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
18	1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief.* 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with the Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 19*	Go to *Step 20*
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to *Step 11*
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to *Step 22*	Go to *Step 23*
22	1. Command the fuel pump "ON" with the Tech 2. 2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed. **CAUTION: Do not let the fuel pressure exceed the second specified value.** Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?	376 kPa (55 psi) 414 kPa (60 psi)	Go to *Step 11*	Go to *Step 7*
23	1. Command the fuel pump "ON" with the Tech 2. 2. Remove the fuel filler cap and listen for the sound of the fuel pump running. 3. Turn the pump off. Was the fuel pump running?	—	Go to *Step 7*	Go to *Fuel System Electrical Test Chart*

Exhaust Gas Recirculation (EGR) System Check



060R200050

Circuit Description

A properly operation exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio. Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

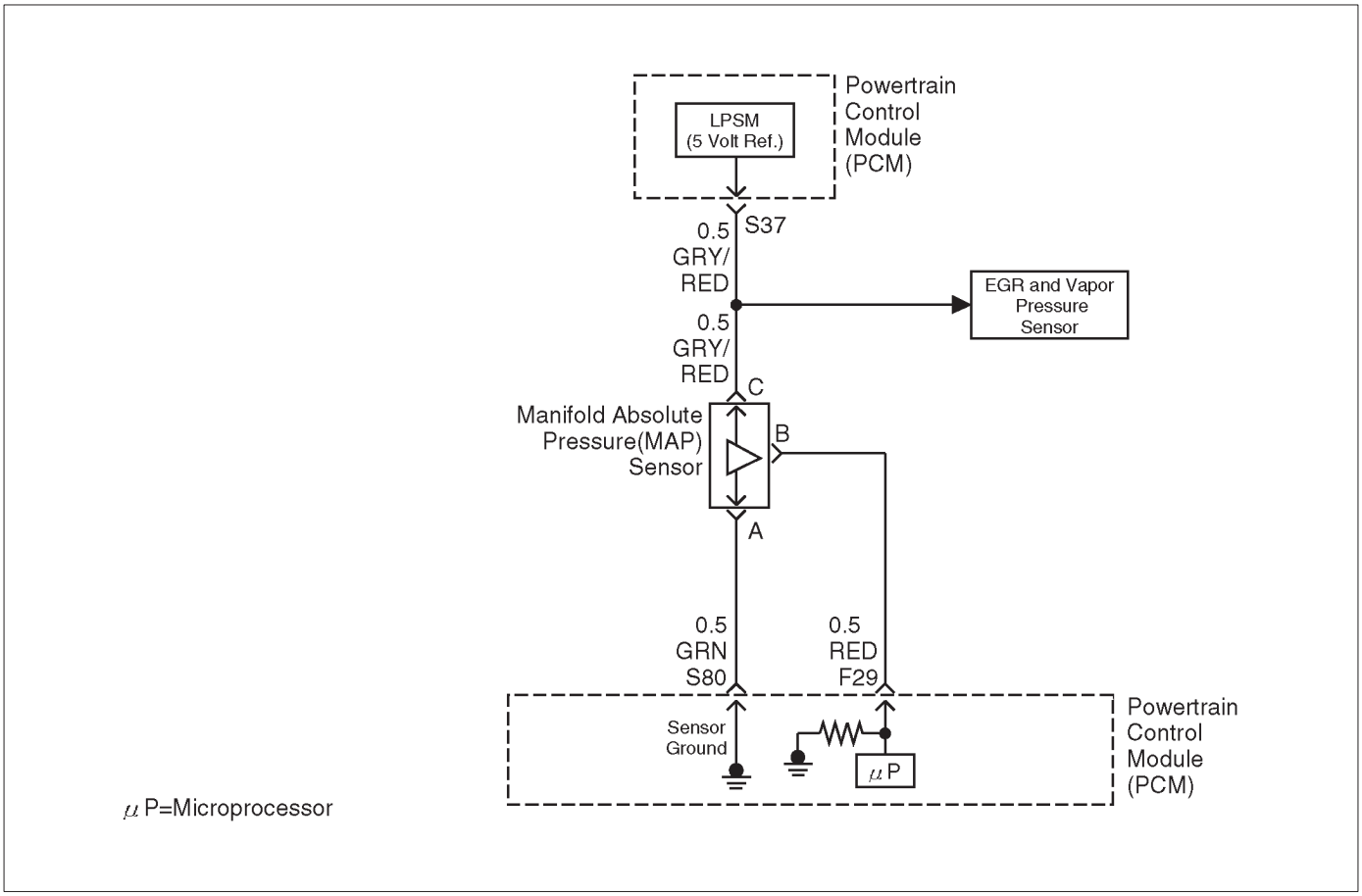
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause a rough idle. Also, an EGR mounted incorrectly (rotated 180˚) could cause rough idle. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to *Manifold Absolute Pressure Output Check.*

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve Loose?	—	Go to *Step 2*	Go to *Step 3*
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm. 3. Using a Tech 2, command EGR “50% ON”. (Refer to the Miscellaneous Test.) Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to *Step 4*
4	1. Engine “OFF”. 2. Ignition “ON”. 3. Using a test light to ground, check the EGR harness between the EGR valve and the ignition feed. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to *Step 7*	Go to *Step 8*
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to *Step 8*
8	1. Ground the EGR valve metal case to battery (–). 2. Using a Tech 2, command EGR “ON” and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to *Step 9*	Go to *DTC P1406 chart*
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to *Step 10*	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

Manifold Absolute Pressure (MAP) Output Check



060R200051

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5-volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1-2 volts at idle. Higher pressure (high voltage) output voltage will be about 4-4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to used the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Applying 34 kPa (10 inch Hg) vacuum to the MAP sensor should cause the voltage to be 1.5-2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction, Be sure that no other vacuum devices are connected to the MAP hose.

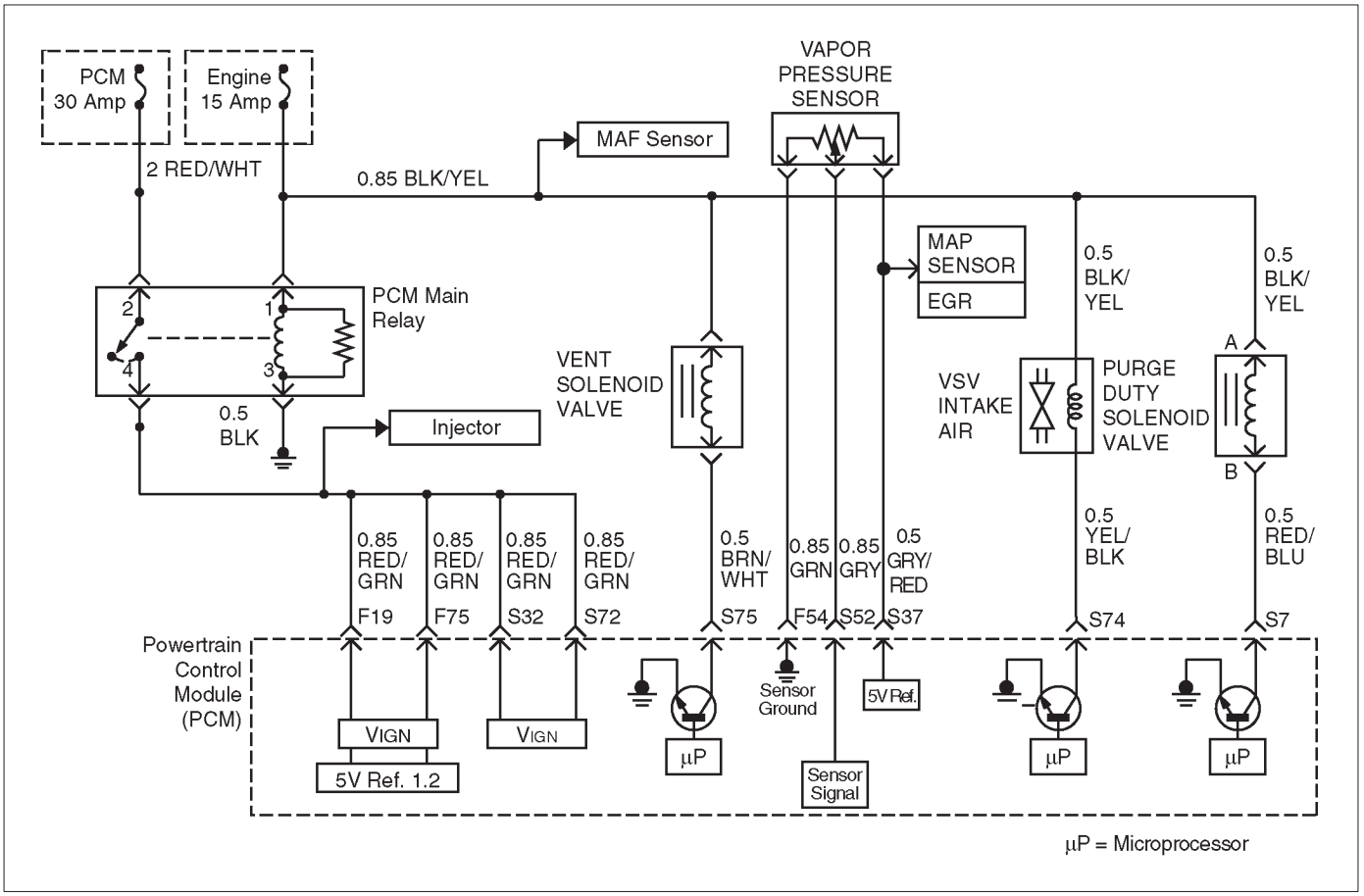
IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition “OFF” and leave it “OFF” for 15 seconds. 2. Ignition “ON”. Don’t crank engine. 3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1-4. Is the voltage reading the same +/–0.40 volt?	—	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 in.Hg) of vacuum and note the voltage change. Is the voltage change 1.5-2.1 volts less than Step 1?	—	Go to *Step 3*	Go to *Step 4*
3	Check the sensor cover for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the hose blockage. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to *Step 6*	Go to *Step 7*
6	Refer to *On-Vehicle Service, MAP Sensor.* Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check



060RY00398

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is turned “ON” and “OFF” several times a second. The duty cycle (pulse width or “ON” time) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- ▼ The engine run time after start is more than 60 seconds.
- ▼ The engine coolant temperature is above 30˚C (86˚F).
- ▼ The fuel control system is operating in the closed-loop mode.

Diagnostic Aids

- ▼ Make a visual check of vacuum hoses.
- ▼ Check the throttle body for cracks.
- ▼ Check the malfunction indicator lamp for a possible mechanical problem.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

1. Check to see if the solenoid is open or closed. The solenoid is normally de-energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge “ON”).

Evaporative (EVAP) Emissions Canister Purge Valve Check

Step	Action	Value(s)	Yes	No
1	1. Ignition “OFF”. 2. Ignition “ON”, engine “OFF”. 3. At the throttle body, disconnect the hose that goes to the purge solenoid. 4. Using a hand vacuum pump with an attached vacuum gauge J 23738-A, apply vacuum (10 in. Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 3*	Go to *Step 2*
2	1. Disconnect the solenoid electrical connector. 2. As in Step 1, apply vacuum (10 in. Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 4*	Go to *Step 7*
3	1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Apply vacuum to the purge solenoid with the hand vacuum pump. 5. Start the engine, run at 2500 RPM. 6. Using the Tech 2, select Powertrain, 3.5–V6 6VE1, F3: Misc. Tests, F2: EVAP Purge, F0: EVAP Purge. (Refer to the Misellaneous Test.) 7. Turn the purge solenoid “ON”. Did the vacuum drop when the purge was turned on?	—	Go to *Step 8*	Go to *Step 9*
4	Check for a short to ground in the S7 Pin wire. Is there a short?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the short to ground. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service*in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
7	Replace the faulty purge solenoid. Refer to *On-Vehicle Service, EVAP Canister Purge Solenoid.* Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition "OFF". 2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing. 3. Start the engine. 4. Stabilize the engine speed at about 2500 RPM. 5. Momentarily snap the throttle open and let it return to idle. Is there approximately 10 in. Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid?	—	No problem found in the EVAP emission canister purge valve check	Refer to *Diagnostic Aids*
9	1. Disconnect the solenoid electrical connector. 2. Connect a test lamp between the harness terminals. Does the test lamp light?	—	Go to *Step 7*	Go to *Step 10*
10	Probe terminal A and terminal B with a test lamp to ground. Does the test lamp light on both terminals?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to voltage in the S7 Pin wire. Is the action complete?	—	Verify repair	—
12	Does one of the terminals light the test lamp?	—	Go to *Step 13*	Go to *Step 14*
13	Check for an open in the S7 Pin wire between the purge solenoid and the PCM. Was there an open circuit?	—	Go to *Step 15*	Go to *Step 6*
14	Repair the open in the BLK/YEL wire. Is the action complete?	—	Verify repair	—
15	Repair the open in the S7 Pin wire. Is the action complete?	—	Verify repair	—

PCM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

PCM Diagnostic Trouble Codes

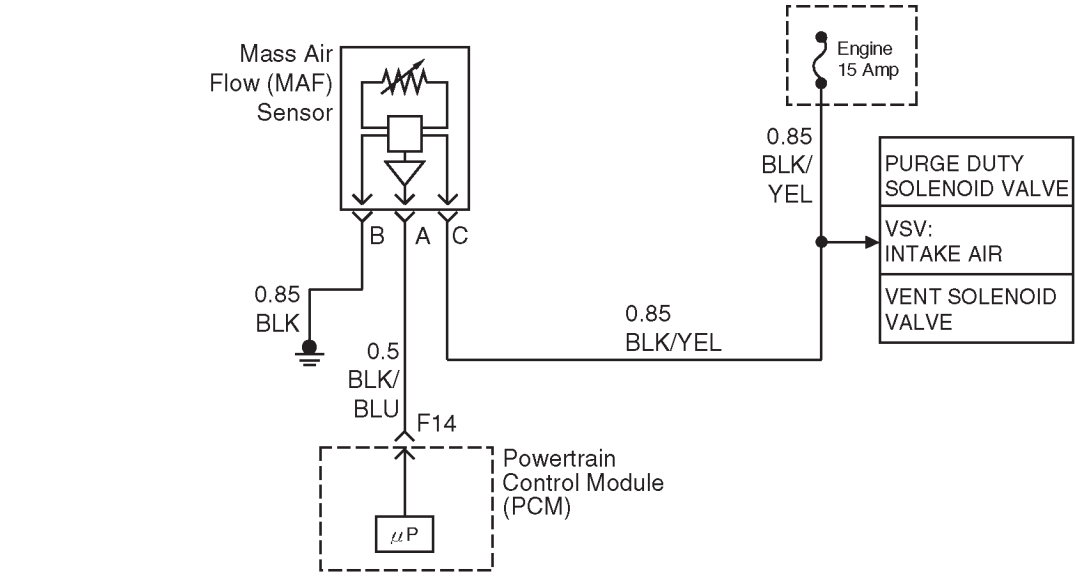
DTC	Description	Type	Illuminate MIL (Check Engine Lamp)	Illuminate RPL (Reduced Power Lamp)
P0101	MAF System Performance	B	Yes	No
P0102	MAF Sensor Circuit Low Frequency	B	Yes	No
P0103	MAF Sensor Circuit High Frequency	B	Yes	No
P0106	MAP Rationality/Performance	B	Yes	No
P0107	MAP Circuit Low Input Voltage	B	Yes	No
P0108	MAP Circuit High Input Voltage	B	Yes	No
P0112	IAT Circuit Low Input Voltage	B	Yes	No
P0113	IAT Circuit High Input Voltage	B	Yes	No
P0117	ECT Circuit Low Input Voltage	B	Yes	No
P0118	ECT Circuit High Input Voltage	B	Yes	No
P0125	ECT Insufficient for Closed Loop Fuel Control	B	Yes	No
P0128	ECT Below Thermostat Regulating Temperature	B	Yes	No
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	B	Yes	No
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	B	Yes	No
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	B	Yes	No
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	B	Yes	No
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	B	Yes	No
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	B	Yes	No
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	B	Yes	No
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	B	Yes	No
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	B	Yes	No
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	B	Yes	No
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	B	Yes	No
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	B	Yes	No
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	B	Yes	No
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	B	Yes	No
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	B	Yes	No
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	B	Yes	No
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	B	Yes	No
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	B	Yes	No
P0171	O2 Sensor – System too Lean (Bank 1)	B	Yes	No
P0172	O2 Sensor – System too Rich (Bank 1)	B	Yes	No
P0174	O2 Sensor – System too Lean (Bank 2)	B	Yes	No
P0175	O2 Sensor – System too Rich (Bank 2)	B	Yes	No

DTC	Description	Type	Illuminate MIL (Check Engine Lamp)	Illuminate RPL (Reduced Power Lamp)
P0201	Injector 1 Control Circuit	A	Yes	No
P0202	Injector 2 Control Circuit	A	Yes	No
P0203	Injector 3 Control Circuit	A	Yes	No
P0204	Injector 4 Control Circuit	A	Yes	No
P0205	Injector 5 Control Circuit	A	Yes	No
P0206	Injector 6 Control Circuit	A	Yes	No
P0300	Engine Misfire Detected	B	Yes	No
P0301	Engine Misfire Detected Cylinder #1	B	Yes	No
P0302	Engine Misfire Detected Cylinder #2	B	Yes	No
P0303	Engine Misfire Detected Cylinder #3	B	Yes	No
P0304	Engine Misfire Detected Cylinder #4	B	Yes	No
P0305	Engine Misfire Detected Cylinder #5	B	Yes	No
P0306	Engine Misfire Detected Cylinder #6	B	Yes	No
P0325	ION Sensing Module	B	Yes	No
P0336	CKP Sensor Circuit Range/Performance (58X)	B	Yes	No
P0337	CKP Sensor Circuit No signal (58X)	B	Yes	No
P0351	Ignition 1 Control Circuit	A	Yes	No
P0352	Ignition 2 Control Circuit	A	Yes	No
P0353	Ignition 3 Control Circuit	A	Yes	No
P0354	Ignition 4 Control Circuit	A	Yes	No
P0355	Ignition 5 Control Circuit	A	Yes	No
P0356	Ignition 6 Control Circuit	A	Yes	No
P0401	EGR Flow Insufficient	B	Yes	No
P0402	EGR Flow Excessive	B	Yes	No
P0404	EGR Range/Performance (Open Valve)	B	Yes	No
P0405	EGR Sensor Circuit Low Voltage	B	Yes	No
P0406	EGR Sensor Circuit High Voltage	B	Yes	No
P0420	Catalyst System Low Efficiency (Bank 1)	A	Yes	No
P0430	Catalyst System Low Efficiency (Bank 2)	A	Yes	No
P0440	EVAP Control System	B	Yes	No
P0442	EVAP Control System Small Leak Detected	B	Yes	No
P0444	EVAP Purge Control Circuit Open	D	No	No
P0445	EVAP Purge Control Circuit Short	D	No	No
P0446	EVAP Canister Vent Control Malfunction	B	Yes	No
P0447	EVAP Vent Solenoid Circuit Open	D	No	No
P0448	EVAP Vent Solenoid Circuit Short	D	No	No
P0452	EVAP Control System Tank Pressure Sensor Low Input	B	Yes	No
P0453	EVAP Control System Tank Pressure Sensor High Input	B	Yes	No
P0456	EVAP Control System Very Small Leak Detected	B	Yes	No
P0461	Fuel Level Sensor Circuit Range/Performance	D	No	No

DTC	Description	Type	Illuminate MIL (Check Engine Lamp)	Illuminate RPL (Reduced Power Lamp)
P0462	Fuel Level Sensor Circuit Low Input Voltage	B	Yes	No
P0463	Fuel Level Sensor Circuit High Input Voltage	B	Yes	No
P0464	Fuel Level Sensor Noisy Signal	D	No	No
P0502	No VSS Signal	B	Yes	No
P0506	Idle Speed Control RPM too Low	B	Yes	No
P0507	Idle Speed Control RPM too High	B	Yes	No
P0562	System Voltage is Low	D	No	No
P0563	System Voltage is High	B	Yes	No
P0565	Cruise Main Switch Circuit Error	D	No	No
P0566	Cruise Cancel Switch Circuit Error	D	No	No
P0567	Cruise Resume Switch Circuit Error	D	No	No
P0568	Cruise Set Switch Circuit Error	D	No	No
P0601	PCM/ECM Memory Checksum	A	Yes	No
P0602	PCM/ECM Programming error	D	No	No
P0604	PCM/ECM RAM error	D	No	No
P0606	PCM/ECM Internal Performance	D	No	No
P1106	MAP Circuit Intermittent High Voltage)	D	No	No
P1107	MAP Circuit Intermittent Low Input Voltage	D	No	No
P1111	IAT Circuit Intermittent High Voltage	D	No	No
P1112	IAT Circuit Intermittent Low Input Voltage	D	No	No
P1114	ECT Circuit Intermittent Low Voltage	D	No	No
P1115	ECT Circuit Intermittent High Voltage	D	No	No
P1120	TPS1 Circuit	B	Yes	No
P1125	ETC Limit Performance Mode	A	Yes	Yes
P1133	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 1 Sensor 1)	B	Yes	No
P1134	O2 Sensor – Transition Switch Time ratio (Bank 1 Sensor 1)	B	Yes	No
P1153	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 2 Sensor 1)	B	Yes	No
P1154	O2 Sensor – Transition Switch Time ratio (Bank 2 Sensor 1)	B	Yes	No
P1167	Fuel supply System RICH During Decel Fuel Cut Off (Bank 1)	D	No	No
P1169	Fuel supply System RICH During Decel Fuel Cut Off (Bank 2)	D	No	No
P1171	Fuel supply System Lean During Power Enrichment	D	No	No
P1220	TPS2 Circuit	B	Yes	No
P1221	TPS1–TPS2 Correlation (Circuit Performance)	D	No	No
P1271	APS1–APS2 Correlation (Circuit Performance)	D	No	No
P1272	APS2–APS3 Correlation (Circuit Performance)	D	No	No
P1273	APS1–APS3 Correlation (Circuit Performance)	D	No	No
P1275	APS1 Circuit	B	Yes	No
P1280	APS2 Circuit	B	Yes	No
P1285	APS3 Circuit	B	Yes	No

DTC	Description	Type	Illuminate MIL (Check Engine Lamp)	Illuminate RPL (Reduced Power Lamp)
P1290	ETC Forced Idle Mode	A	Yes	Yes
P1295	ETC Power Management Mode	A	Yes	Yes
P1299	ETC Forced Engine Shutdown in Mode	A	Yes	Yes
P1310	ION Sensing Module Diagnostic	A	Yes	No
P1311	ION Sensing Module SEC 1 Line Circuit Fault	A	Yes	No
P1312	ION Sensing Module SEC 2 Line Circuit Fault	A	Yes	No
P1326	ION Sensing Module Combustion Quality circuit	A	Yes	No
P1340	ION Sensing Module – Cylinder Synchronization	B	Yes	No
P1404	EGR Range/Performance (Closed Valve)	B	Yes	No
P1441	EVAP Control System Continuous Open Purge Flow	B	Yes	No
P1514	TPS–MAF Correlation	A	Yes	No
P1515	Command–Acrual TPS Correlation	A	Yes	No
P1516	Command–Acrual TPS Correlation Error	A	Yes	No
P1523	Throttle Actuator Control Return Performance	D	No	No
P1625	PCM/ECM System Reset	D	No	No
P1635	Reference Voltage #1 Circuit	D	No	No
P1639	Reference Voltage #2 Circuit	D	No	No
P1640	ODM Output circuit Fault	D	No	No
P1650	QDM Output Circuit Fault	D	No	No

Diagnostic Trouble Code (DTC) P0101 MAF System Performance



060R200052

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity or air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on throttle position and engine RPM.

Conditions for setting the DTC

- The engine is running.
- No TP sensor and MAP sensor DTCs are set.
- No MAF frequency DTCs are set.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0101 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0101 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.
- The duct work at the MAF sensor for leaks.
- An engine vacuum leak.
- The PCV system for vacuum leaks.
- An incorrect PCV valve.
- The engine oil dip stick not fully seated.
- The engine oil fill cap loose or missing.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness- Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow (MAF) display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide–open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3–6 g/s at idle to 100 g/s or greater at the time of the 1–2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault.

If DTC P0101 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P001 Diagnostic Chart may isolate the cause of the fault.

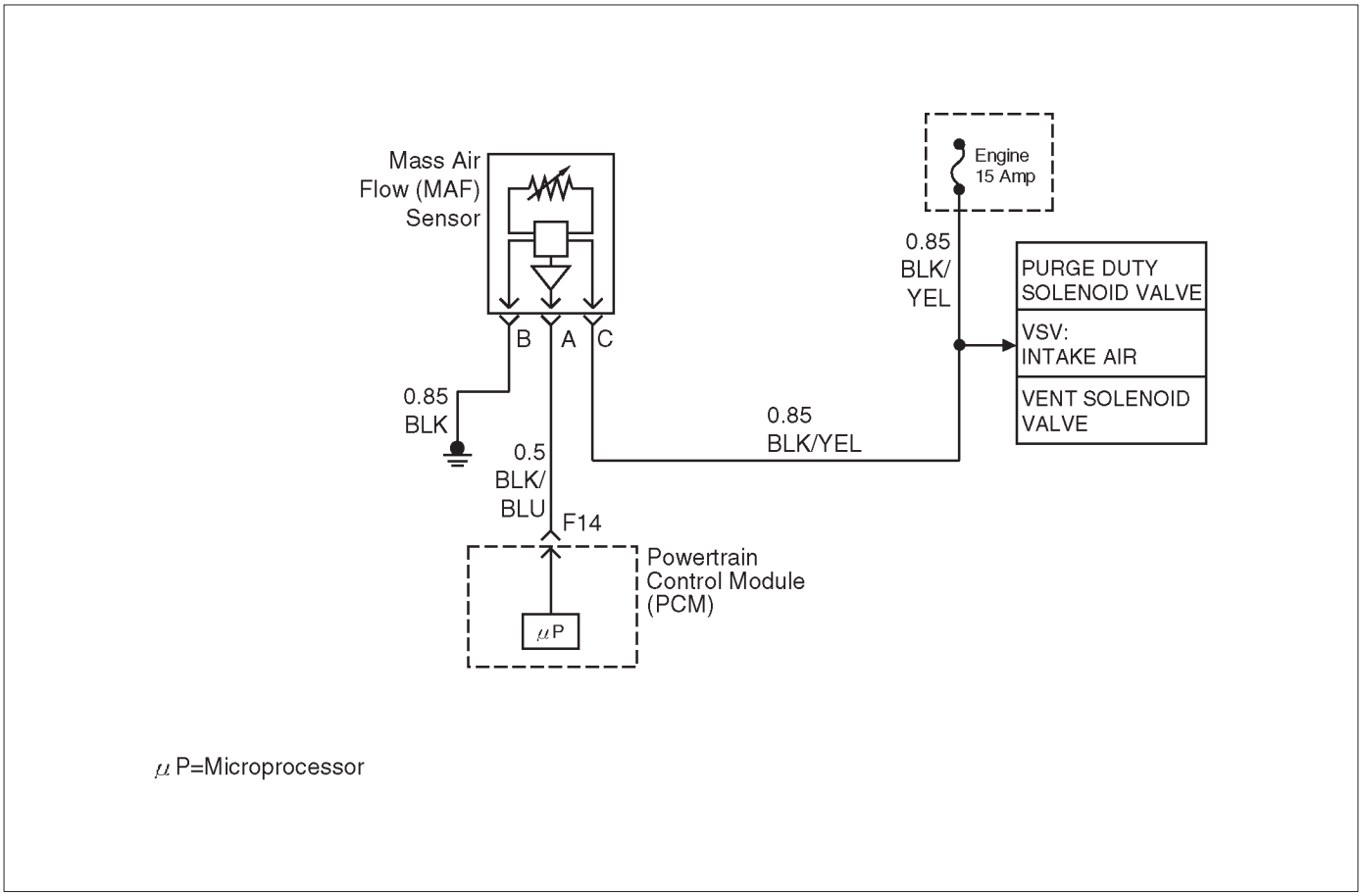
DTC P0101 – MAF System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”. 2. Disconnect the Mass Air Flow (MAF) Sensor harness connector from the MAF Sensor. 3. Place an unpowered test lamp between the 12 volt signal circuit and the ground circuit, both at the MAF Sensor connector. 4. Ignition “ON”, Engine“OFF”. Did the test lamp illuminate?	—	Go to *Step 6*	Go to *Step 3*
3	1. Ignition “ON”, Engine “OFF”. 2. Using a Digital Voltmeter (DVM), check the 12 volt signal circuit for the correct voltage. Did the DVM indicate a value within the following range?	11.5 to 12.5 Volt	Go to *Step 5*	Go to *Step 4*
4	1. Ignition “OFF”. 2. Check the 12 volt signal circuit for the following conditions: ▼ An open circuit ▼ A short to ground Was the problem found?	—	Verify repair	—
5	Check the MAF ground circuit for the following conditions: ▼ An open circuit ▼ A short to voltage Was a problem found?	—	Verify repair	—
6	1. Ignition “OFF”. 2. Check the MAF Sensor signal circuit between the PCM and the MAF Sensor for the following conditions: ▼ An open circuit ▼ A short to ground ▼ A short to battery voltage Was a problem found?	—	Verify repair	Go to *Step 7*

DTC P0101 – MAF System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Connect the MAF Sensor wiring harness connector to the MAF Sensor. 2. Connect the Tech 2 to the vehicle. 3. Place the Transmission in Park/Neutral, and fully apply the Parking Brake. 4. Start the engine. 5. Select the Mass Air Flow (MAF) parameter on the Tech 2. With the engine idling, does the Tech 2 display the following value(s)?	4 to 7 g/s	Go to *Step 8*	Go to *Step 9*
8	Observe the Tech 2 value while increasing the engine RPM to its upper limit. Does the Tech 2 display the following value(s)?	25 to 40 g/s	Go to *Step 10*	Go to *Step 9*
9	Replace the MAF Sensor. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The PCM must be reprogrammed. Refer to PCM reprogramming. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0102 MAF Sensor Circuit Low Frequency



060R200052

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is below 1.6g/s for a total of 50-percent of the last 1000 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0102 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0102 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Misrouted harness – Inspect the MAF sensor harness to ensure that it is not routed too close to high voltage wires.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or filter element – A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from

about 3-6 g/second at idle to 100 g/second or greater at the time of the 1-2 shift. If not, check for a restriction.

If DTC P0102 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.
4. A voltage reading of less than 4 or over 5 volts at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
5. This verifies that ignition feed voltage and a good ground are available at the MAF sensor.

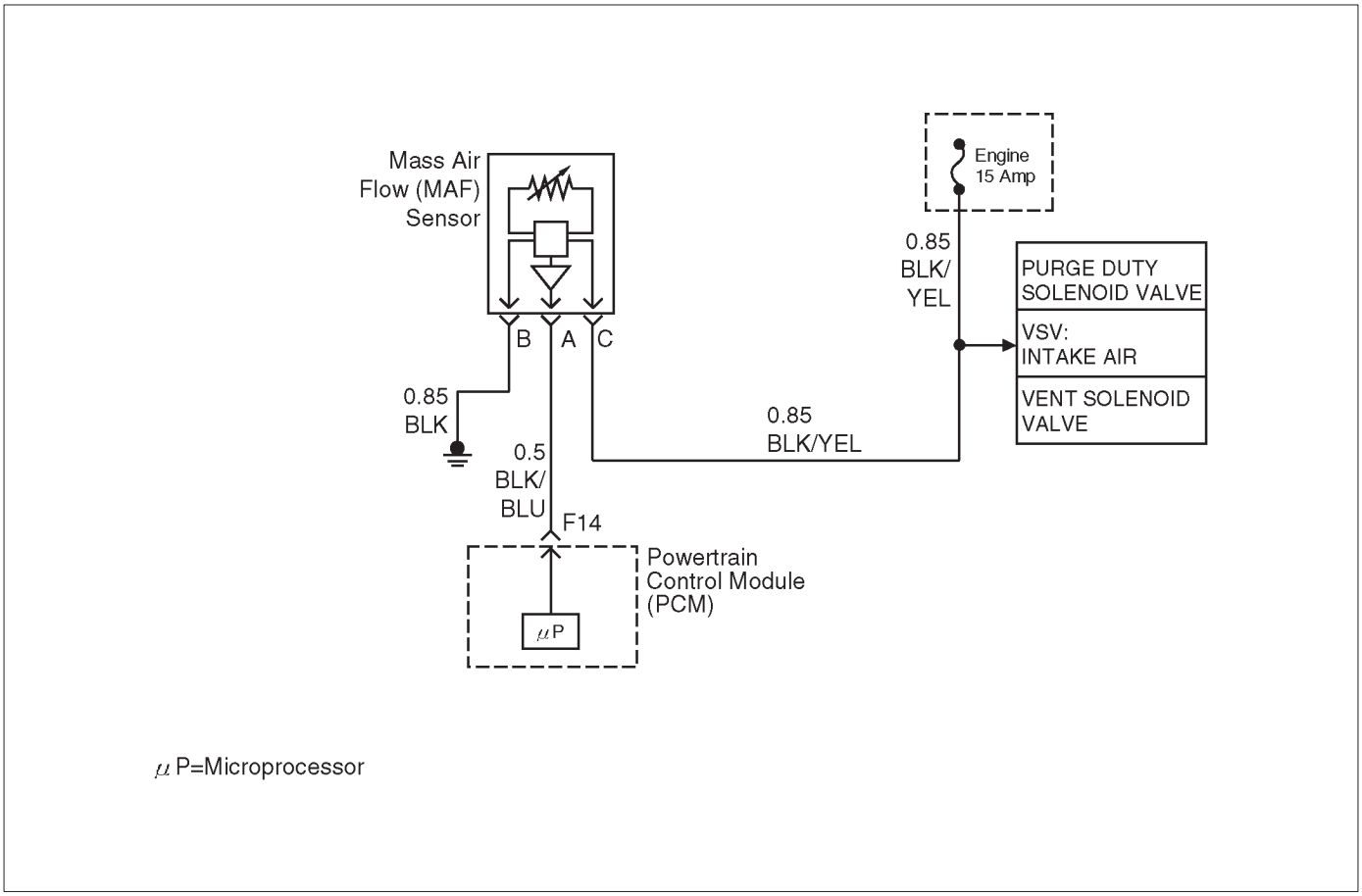
DTC P0102 – MAF Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is the “MAF Frequency” below the specified value?	1.6 g/s	Go to *Step 3*	Go to *Step 5*
3	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0102. Does the Tech 2 indicate DTC P0102 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF”. 2. Disconnect the MAF sensor connector. 3. Ignition “ON”, engine “OFF”. 4. Using a DVM, measure voltage between the MAF sensor signal circuit and battery ground. Is the voltage near the specified value?	11.5–12 V	Go to *Step 5*	Go to *Step 8*
5	Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector. Is the test light “ON”?	—	Go to *Step 7*	Go to *Step 6*
6	Connect a test light between the MAF sensor ignition feed circuit and battery ground. Is the test light “ON”?	—	Go to *Step 11*	Go to *Step 7*
7	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, replace the faulty terminal(s). Was a poor connection found?	—	Verify repair	Go to *Step 12*
8	1. Ignition “OFF”. 2. Disconnect the MAF sensor. 3. Disconnect the PCM connector for the MAF signal circuit. 4. Ignition “ON”, engine “OFF”. 5. With the DVM, measure the voltage between the MAF signal terminal at the PCM and battery ground. Is the voltage under the specified value?	0 V	Go to *Step 9*	Go to *Step 10*

DTC P0102 – MAF Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition "OFF". 2. Disconnect the PCM connector. 3. Ignition "ON". 4. Check the MAF sensor signal circuit for a short to 5 volts. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF". 2. Disconnect the PCM connector. 3. Ignition "ON". 4. Check the MAF sensor signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF ground circuit. Is the action complete?	—	Verify repair	Go to *Step 13*
11	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
12	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
13	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0103 MAF Sensor Circuit High Frequency



060R200052

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is above 40g/s for a total of 50 percent of the last 200 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0103 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0103 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

If DTC P0103 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.

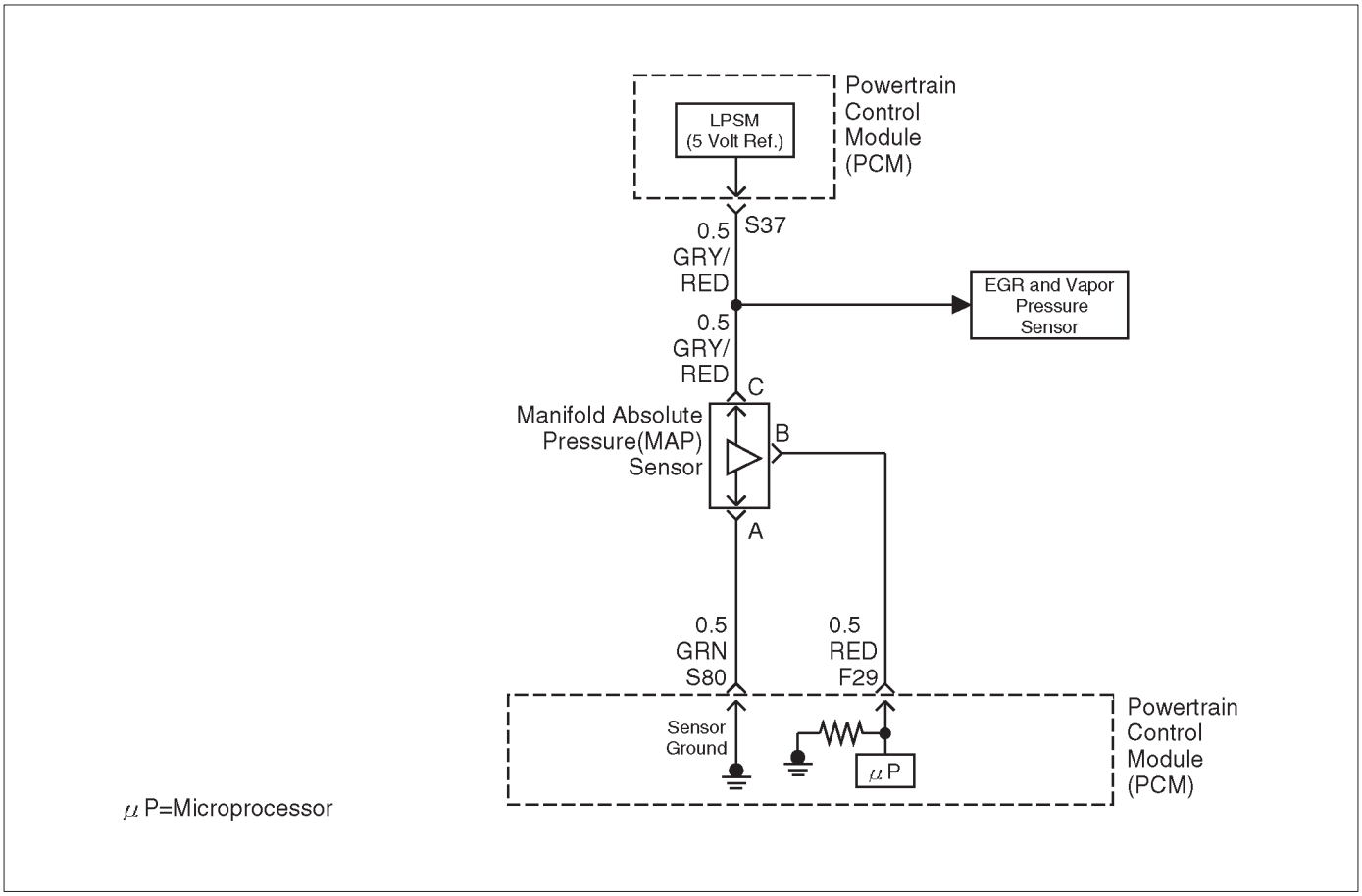
4. A frequency reading with the MAF sensor connector disconnected indicates an electromagnetic interference (EMI) related fault.

8. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensors*.

DTC P0103 – MAF Sensor Circuit High Frequency

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0103. Does the Tech 2 indicate DTC P0103 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is “MAF Frequency” above the specified value?	40g/s	Go to *Step 4*	Go to *Step 7*
4	1. Ignition “OFF”. 2. Disconnect the MAF sensor connector. 3. Ignition “ON”, engine idling. 4. Using a Tech 2, monitor “MAF Frequency”. Does the Tech 2 indicate a “MAF Frequency” at the specified value?	0g/s	Go to *Step 5*	Go to *Step 6*
5	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 8*
6	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. With the engine idling, monitor “MAF Frequency” display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate “MAF Frequency” above the specified value?	40g/s	Go to *Step 5*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0106 MAP System Performance



060R200051

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts at wide-open throttle (low vacuum) at sea level.

The MAP sensor is used to determine manifold pressure changes while the linear exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401), engine vacuum level for some other diagnostics, and barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine speed is steady, changing less then 100 RPM.
- Engine speed is between 1000 rpm and 4000 rpm.
- Throttle position is steady, throttle angle changes less than 1%.
- EGR flow rate is steady, changing less than 4%.
- No change in brake switch, A/C clutch, TCC or power steering pressure switch status.
- Above conditions are met for longer than 1 second.
- Actual MAP value varies more than 10 kPa.
- The MAP value must vary for a total of 10 seconds over a 20-second period of time that the samples were monitored.
- The failure must occur for 2 consecutive trips.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1107 Diagnostic Chart may isolate the cause of the fault.

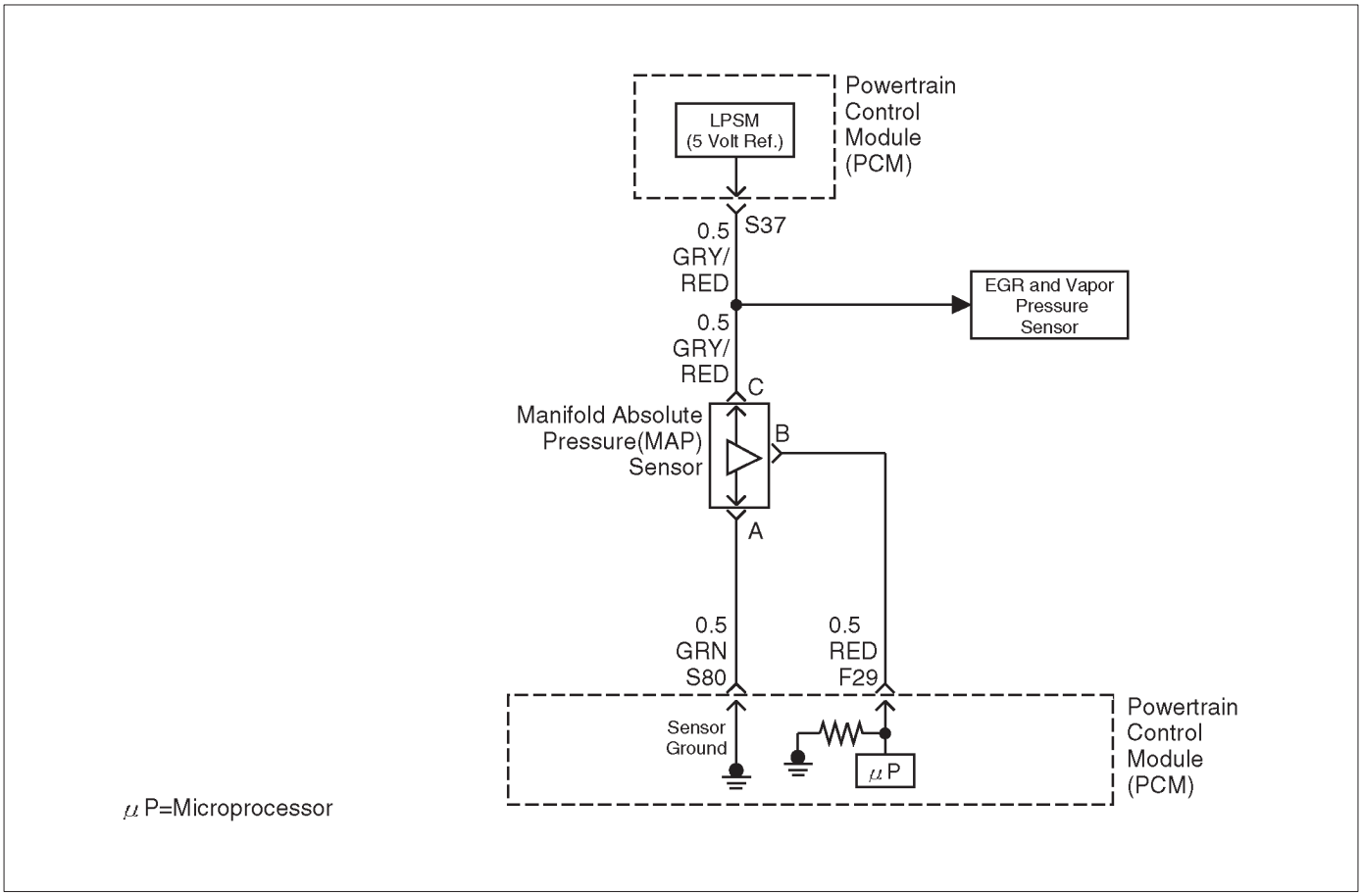
DTC P0106 – MAP System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0106. Does the Tech 2 indicate DTC P0106 failed?	—	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions: ▼ Vacuum hoses disconnected, damaged, or incorrectly routed ▼ Intake manifold vacuum leaks ▼ Vacuum leaks at throttle body ▼ Vacuum leaks at EGR valve flange and pipes ▼ Crankcase ventilation valve faulty, missing or incorrectly installed. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*
4	1. Disconnect the MAP sensor electrical connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	11 kPa	Go to *Step 5*	Go to *Step 13*
5	1. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	105 kPa	Go to *Step 6*	Go to *Step 9*
6	1. Jumper the 5 volt reference circuit and the MAP signal circuit together at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	104 kPa	Go to *Step 7*	Go to *Step 8*
7	1. Ignition “OFF”. 2. Disconnect the PCM and check the sensor ground circuit for high resistance, an open between the PCM and the MAP sensor, or for a poor connection at the PCM. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

DTC P0106 – MAP System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check the 5 volt reference circuit for high resistance, an open between the PCM and the MAP sensor, or a poor connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
9	1. Ignition "OFF". 2. Disconnect the PCM, and check the MAP sensor signal circuit for high resistance, an open, a short to ground, or a short to the sensor ground circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the MAP sensor signal circuit for a poor connection at the PCM. 2. If a problem is found, repair as necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
11	1. Check for a poor connection at the MAP sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	1. Ignition "OFF", disconnected the PCM. 2. Ignition "ON", check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0107 MAP Sensor Circuit Low Voltage



060R200051

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure at or below 11 kPa for a total of approximately 10 seconds over a 16-second period.
- Ignition voltage more than 11 volts.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0107 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check for intermittent codes.
- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit .
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

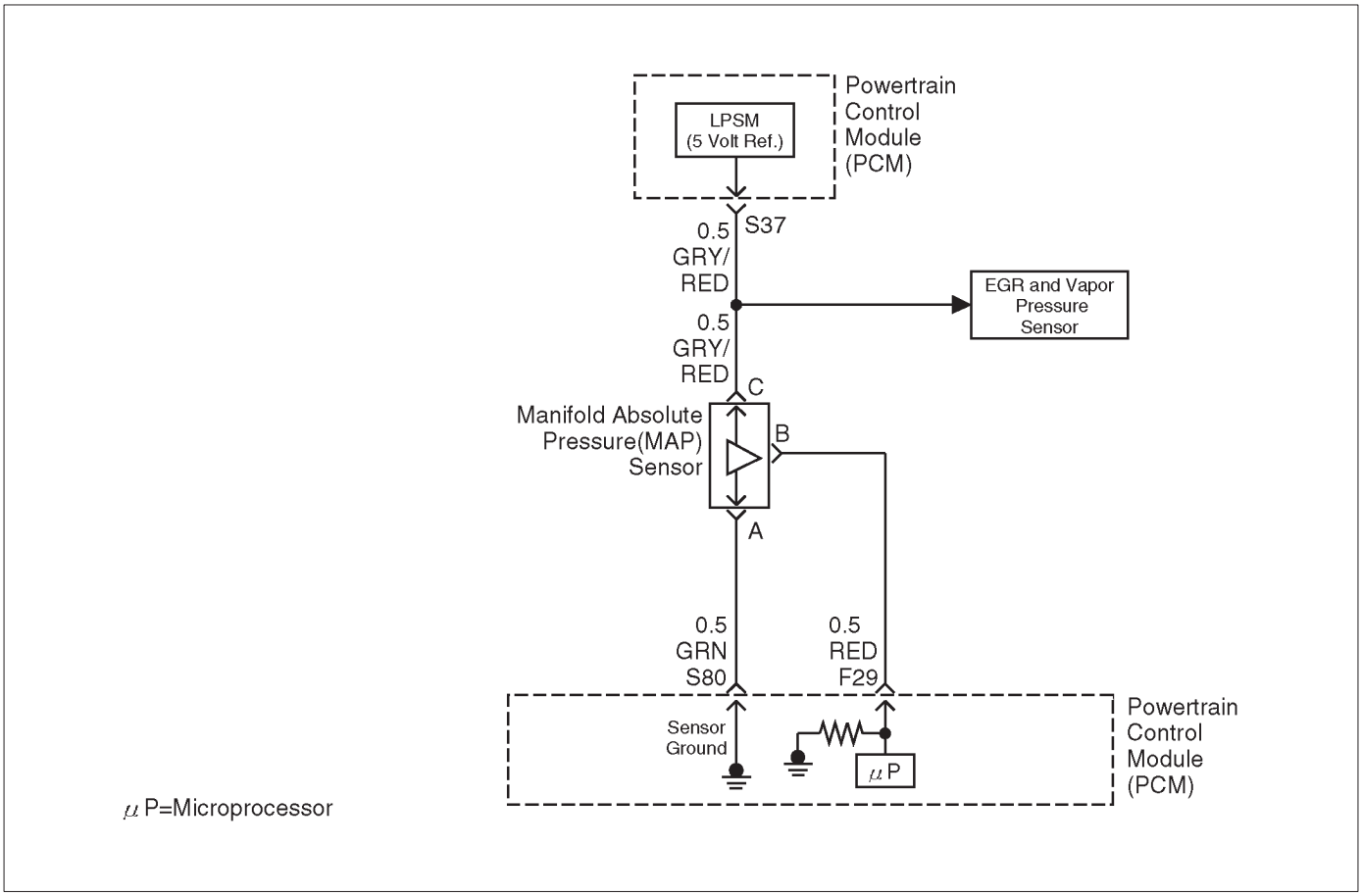
DTC P0107 – MAP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0 V 11 kPa at sea level	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0107. Does the Tech 2 indicate DTC P0107 failed?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition "ON". 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V 104 kPa	Go to *Step 10*	Go to *Step 5*
5	1. Disconnect the jumper. 2. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value.	5 V 104 kPa	Go to *Step 6*	Go to *Step 8*
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*

DTC P0107 – MAP Sensor Circuit Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF". 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to *Step 9*
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0108 MAP Sensor Circuit High Voltage



060R200051

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running for more than 10 seconds.
- Throttle position is below 3% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 10 seconds over a 16-second period.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0108 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0108 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor (Vapor Pressure Sensor). If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1108 Diagnostic Chart may isolate the cause of the fault.

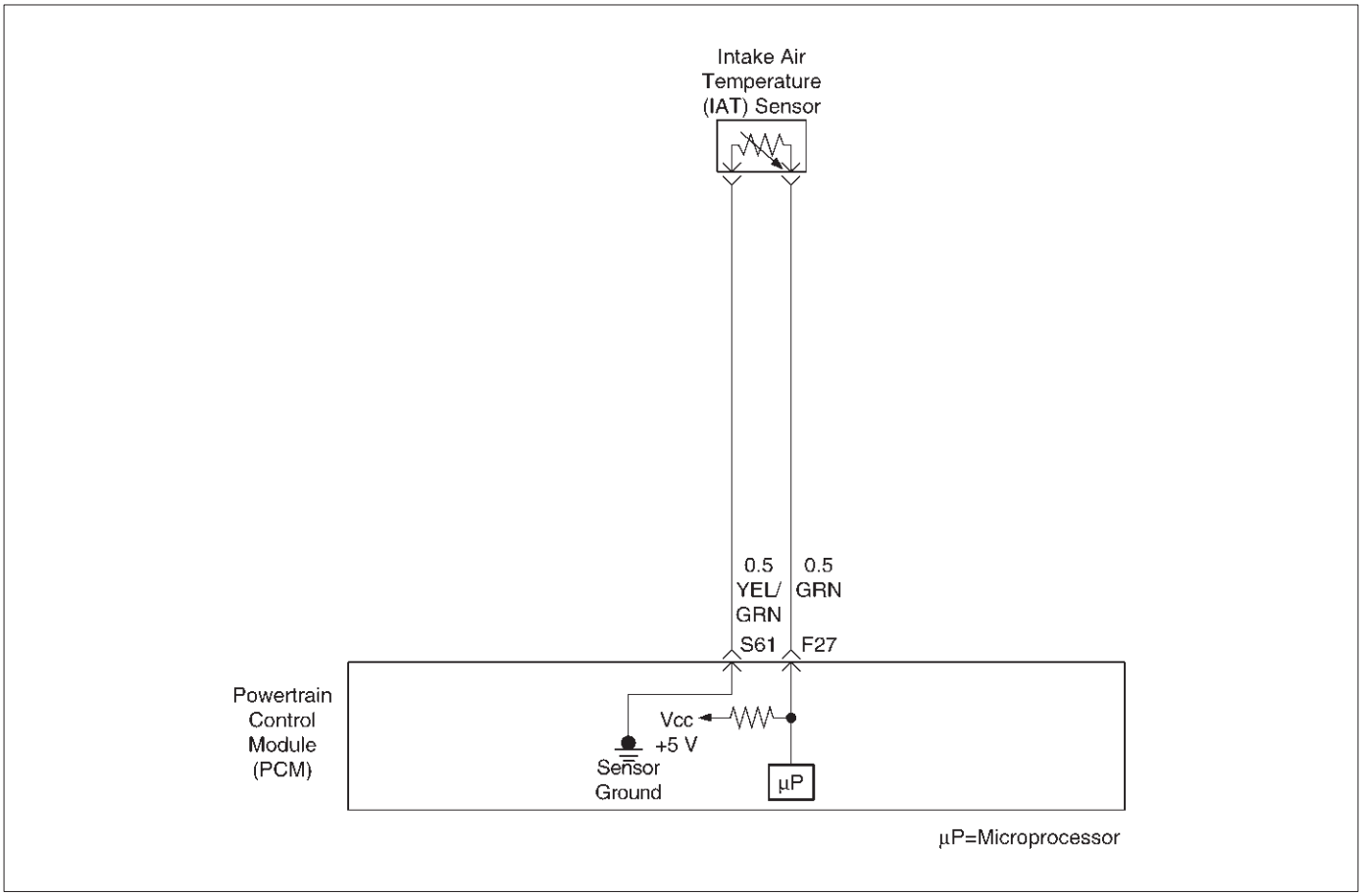
DTC P0108 – MAP Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to *Symptoms* section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	90 kPa	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0108. Does the Tech 2 indicate DTC P0108 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect the MAP sensor electrical connector. 3. Ignition "ON". 4. Note the MAP sensor voltage displayed on the Tech 2. (If no, start with diagnostic chart for other sensors in the circuit and see if 5V returns.) Is the MAP sensor voltage at the specified value?	11 kPa 0.0 V	Go to *Step 5*	Go to *Step 6*
5	Probe the sensor ground circuit with a test light to B+. Is the test light "ON"?	—	Go to *Step 7*	Go to *Step 9*
6	1. Check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 2. If the MAP sensor signal circuit is shorted, repair circuit as necessary. Was the MAP sensor signal circuit shorted?	—	Verify repair	Go to *Step 11*
7	1. Check for a poor sensor ground terminal connection at the MAP sensor electrical connector. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 8*
8	Check for a plugged or leaking vacuum supply to the MAP sensor. Is the vacuum supply plugged or leaking?	—	Verify repair	Go to *Step 12*
9	1. Check for a poor sensor ground terminal connection at the PCM. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 10*

DTC P0108 – MAP Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the continuity of the MAP sensor ground circuit. 2. If the MAP sensor ground circuit measures over 5 ohms, repair open or poor connection. Was a condition found and corrected?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0112 IAT Sensor Circuit Low Voltage



D06RY00147

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. DTC P0112 will set when the PCM detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 15 seconds.
- Vehicle speed is greater than 30 mph (48 km/h) .
- IAT signal voltage indicates and intake air temperature greater than 148˚C (298˚F) (about 5 volts) for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-bout terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

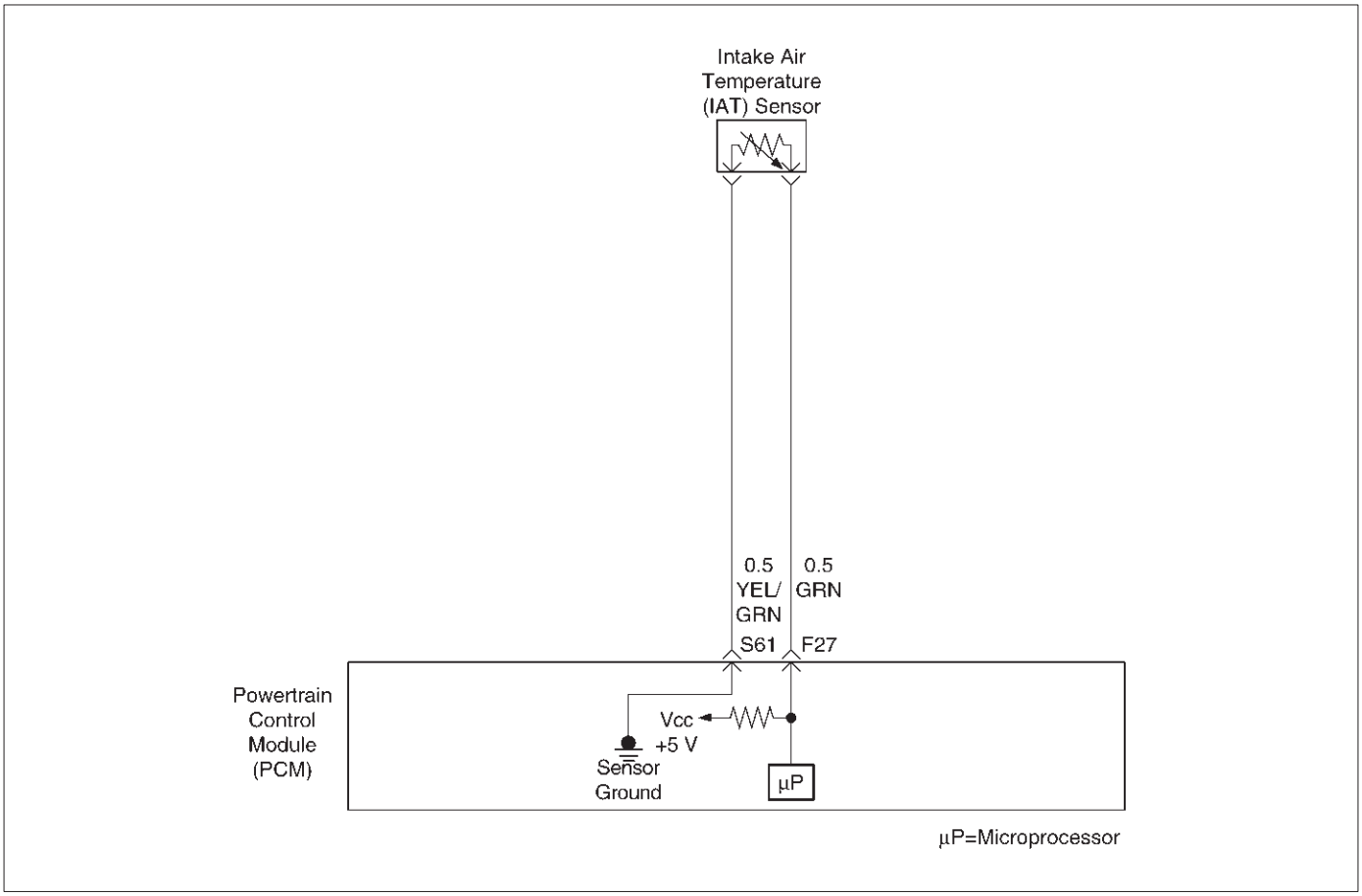
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0112–IAT Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148˚C (283˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON”, engine “OFF”. Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the “DTC” info for DTC P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF”. 2. Disconnect the IAT sensor electrical connector. 3. Ignition “ON”. 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	–38˚C (–36˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition “OFF”. 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0113 IAT Sensor Circuit High Voltage



D06RY00147

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 30 seconds.
- Vehicle speed is less than 20 mph (32 km/h).
- ECT signal temperature is above 60˚C (140˚F).
- Mass air flow is less then 20 g/second.
- IAT signal voltage indicates an intake air temperature less than –39˚C (–38˚F) for total of 12.5 seconds over a 25-second period.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0113 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0113 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The IAT sensor shares a ground with the EGR position sensor and the TP sensor. Check the ground if these DTC’s are set.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

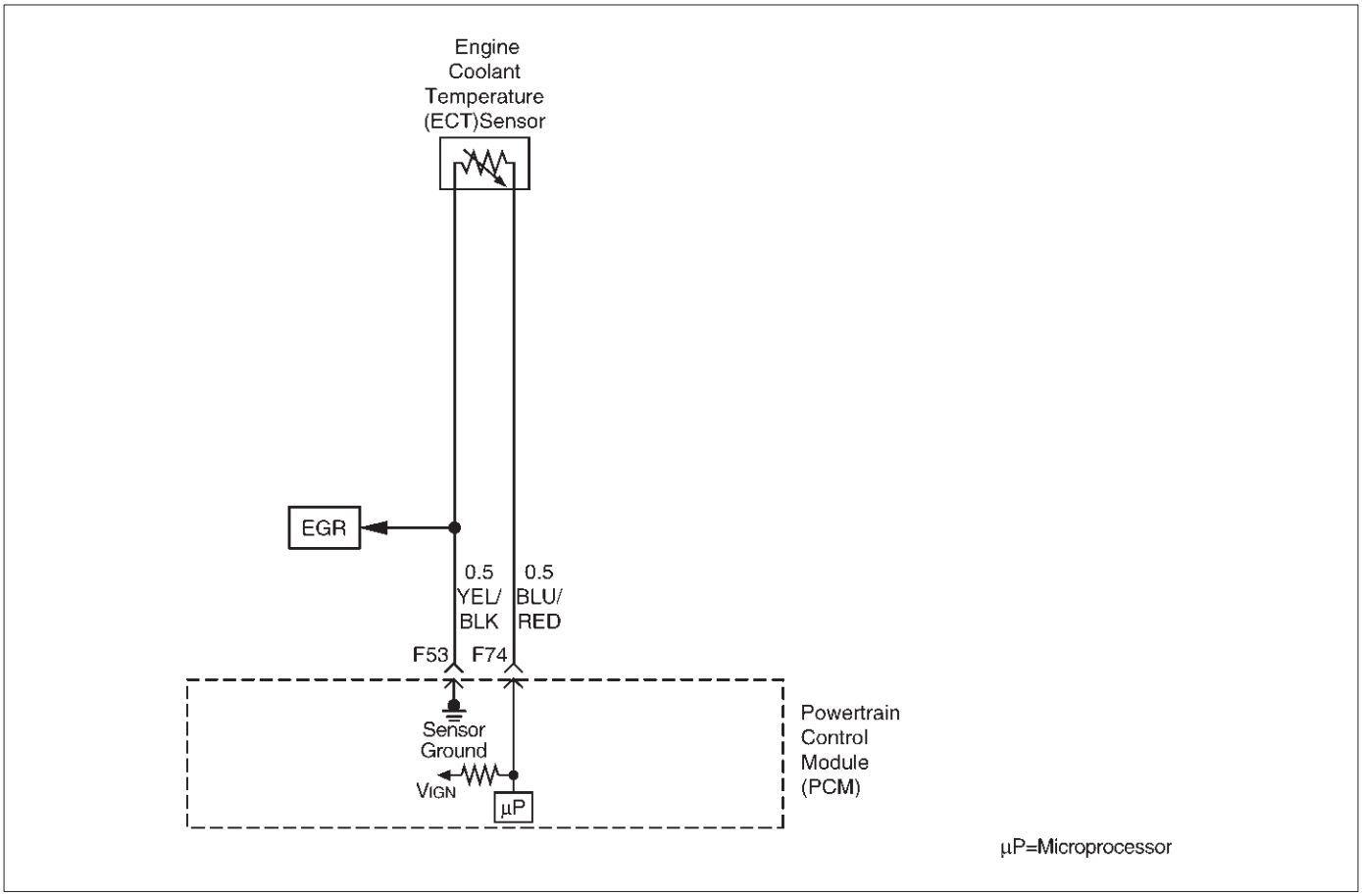
DTC P0113 –IAT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Ignition "ON", engine "OFF". Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" below the specified value?	–38˚C (–36˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0113. Does the Tech 2 indicate DTC P0113 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition "ON". 5. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140˚C (284˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140˚C (284˚F)	Go to *Step 7*	Go to *Step 8*

DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*
7	1. Ignition "OFF". 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF". 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0117 ECT Sensor Circuit Low Voltage



Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than 120 seconds.
- The ECT sensor signal indicates an engine coolant temperature greater than 150˚C (302˚F) (about 0.10 V) for a total of 50 seconds over a 100–second period.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0117 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0117 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1114 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

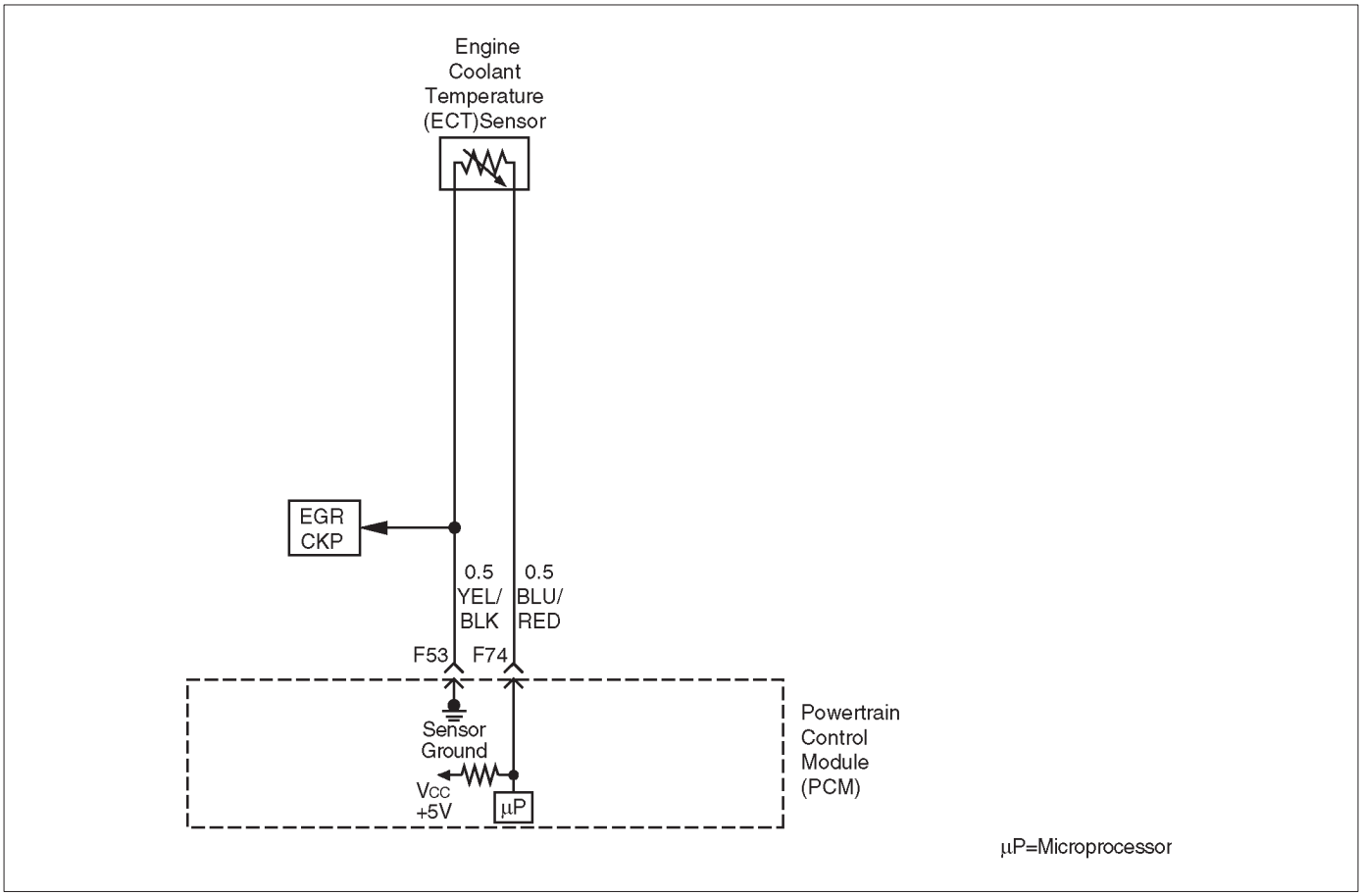
Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0117 – ECT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139˚C (282˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” at the specified value?	–39˚C (–38˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition “OFF”. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted. repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0118 ECT Sensor Circuit High Voltage



060R200053

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than 90 seconds.
- The ECT sensor signal indicates an engine coolant temperature of –39˚C (–38˚F) or less (about 5 volts) for a total of 50 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0118 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0118 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

The ECT shares a ground with the Transmission Fluid Temperature sensor, the Fuel Tank Pressure sensor, and the MAP sensor.

Check the ground if these DTCs are also set.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently,

performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

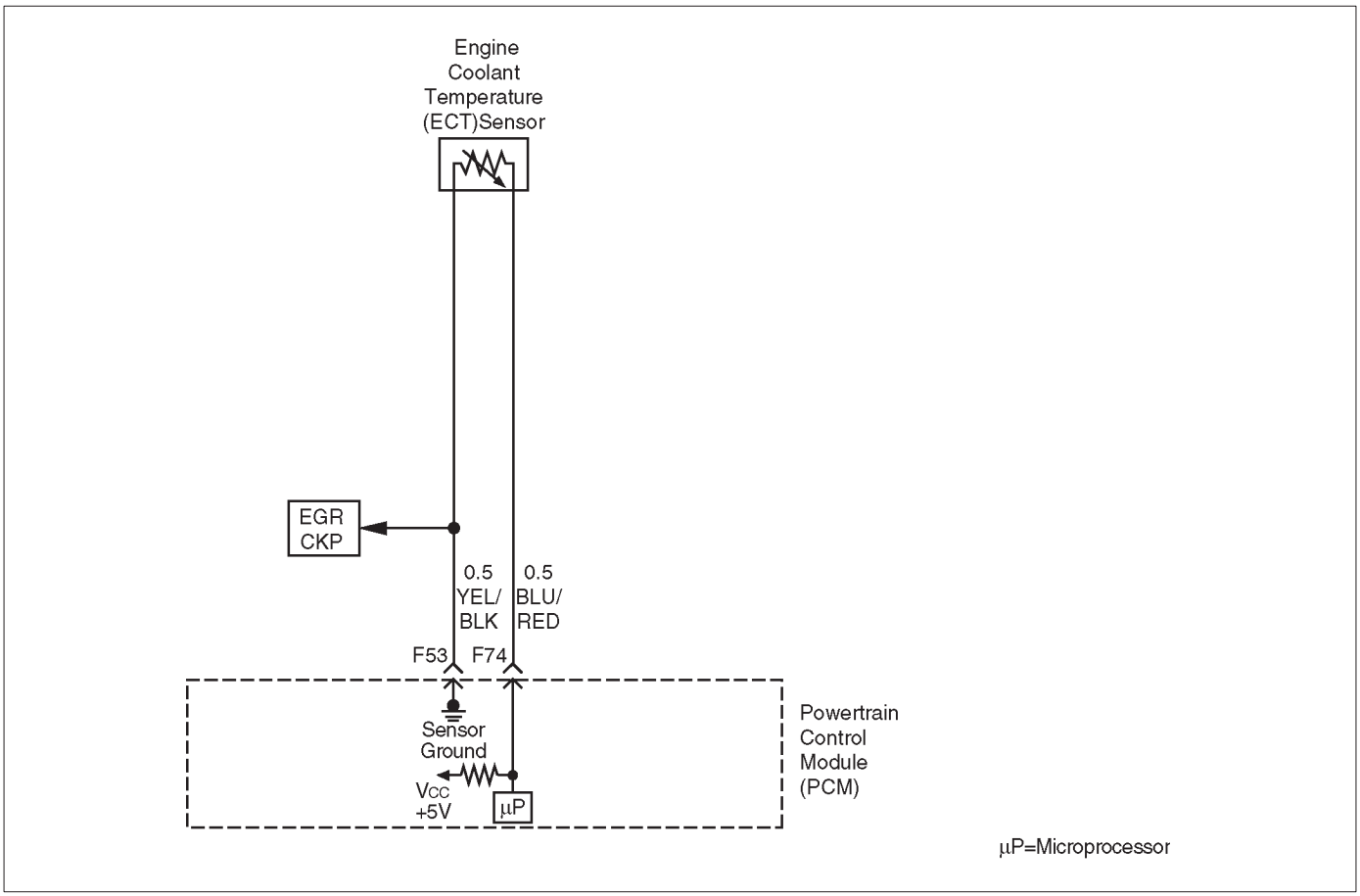
DTC P0118 – ECT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	–39˚C (–38˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0118. Does the Tech 2 indicate DTC P0118 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 7*	Go to *Step 8*
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*

DTC P0118 – ECT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF". 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF". 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0125 ECT Excessive Time to Closed Loop Fuel Control



060R200053

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in “open loop”, ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors. The PCM will begin using the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals for controlling fuel delivery under “closed loop” conditions when the following conditions have been met:

- The HO2S output signals are varying, indicating that the sensors are hot enough to operate properly.
- The engine coolant temperature sensor indicates coolant temperature above 50˚C (122˚F).
- Time since start-up is at least 16 seconds for a warm engine or 23 seconds for a cold engine.

Conditions for Setting the DTC

- No active IAT, MAF or ECT DTC(s) are present.
- Engine is running.
- Vehicle speed is greater than 5 mph (8 km/h) .
- Intake air temperature is greater than –10˚C (14˚F) 0˚C (32˚F).
- Start–up engine coolant temperature is between –10˚C (–14˚F) and 28˚C (82˚F).
- For a warm engine (intake air temperature is greater than 10˚C/50˚F), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 2 minutes of start-up. For a cold engine (intake air temperature between (–7˚C and 10˚C), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 10 minutes of start-up.
- The above condition fails 20 consecutive times.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0125 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0125 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage wince the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are close, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

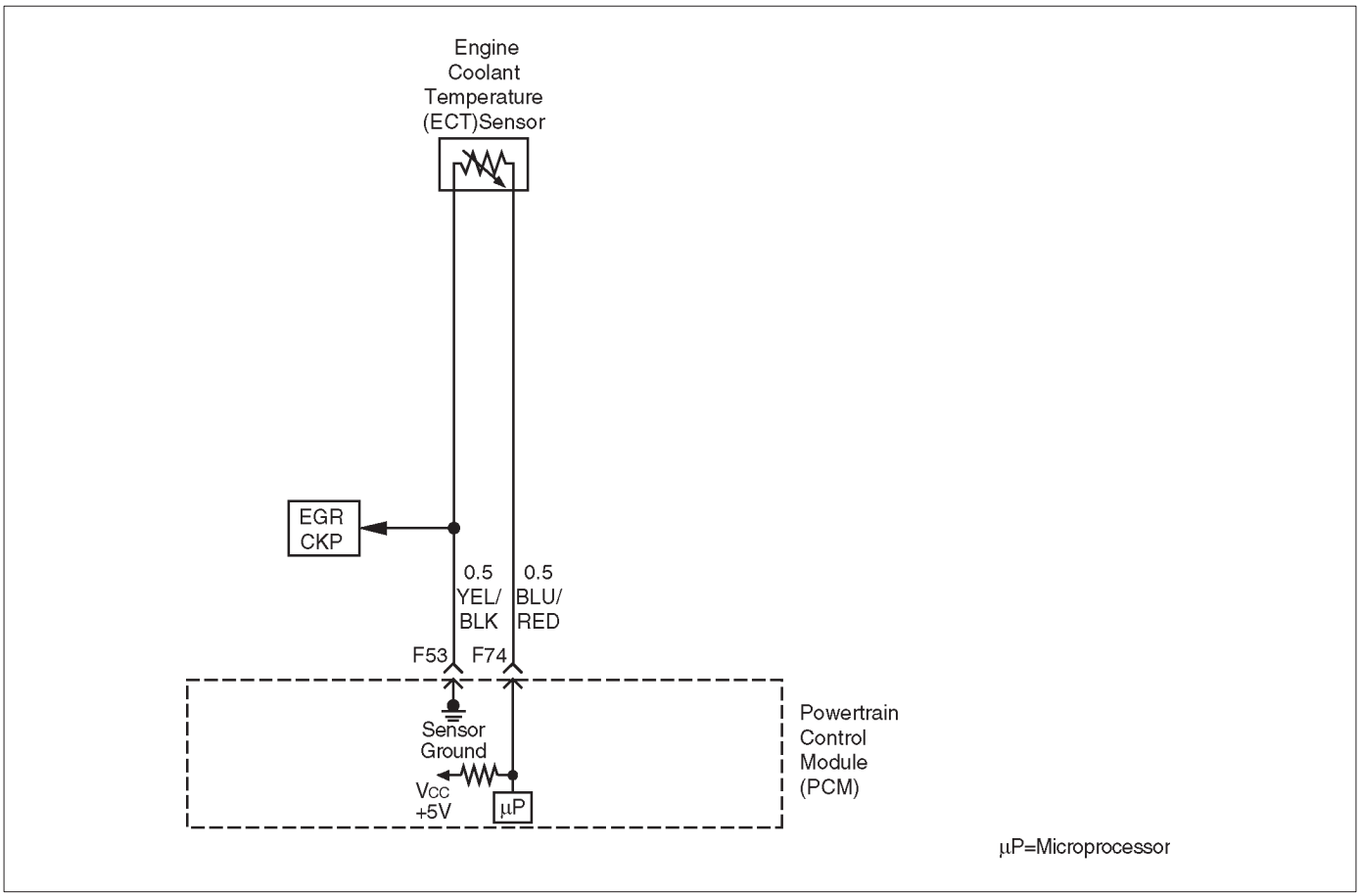
DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any ECT sensor DTCs set?	—	Go to applicable ECT sensor DTC chart	Go to *Step 3*
3	1. Allow the engine to cool completely. 2. Check the cooling system coolant level (refer to *Cooling and Radiator*). Is the coolant level OK?	—	Go to *Step 4*	Go to *Step 9*
4	1. Start the engine. 2. With the engine idling, monitor “ENG COOL TEMP” display on the Tech 2. Does “ENG COOL TEMP” increase to above the specified value within 2 minutes?	21˚C (70˚F)	Refer to *Diagnostic Aids*	Go to *Step 5*
5	Check for proper operation of the thermostat (refer to *Cooling and Radiator*). Is the thermostat operating correctly?	—	Go to *Step 6*	Go to *Step 9*

DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control (Cont'd)

Step	Action	Value(s)	Yes	No
6	Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.) Is the Tech 2 engine coolant temperature indication close to the measured temperature?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition "OFF". 2. Disconnect the PCM. 3. Using a DVM, measure the resistance of the ECT at the PCM connector. 4. Compare the DVM reading with the chart in "Test Description". Is the chart value approximately equal to the thermometer reading?	—	Go to *Step 12*	Go to *Step 8*
8	Check for high resistance in wiring related to the ECT sensor. Also, check for poor connections at the ECT sensor and the PCM. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
9	Refer to *Cooling and Radiator* for cooling system diagnosis and repair condition as necessary. Is the action complete?	—	Verify repair	—
10	Replace the faulty terminal(s) or repair faulty wiring as necessary. Is the action complete?	—	Verify repair	—
11	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0128 Thermostat Insufficient Temperature for Stable Operation



060R200053

Circuit Description

▼The engine coolant temperature (ECT) sensor thermistor mounted on a coolant crossover pipe at the front of the engine.

This code determines if system has insufficient coolant temperatures for stable operation.

Conditions for setting the DTC

▼Engine running.

▼No IAT, ECT and MAF DTCs set.

▼No VSS DTC set.

Warm case(Ambient temperature is between 50˚F and 128˚F.):

▼Time for coolant to reach stabilized closed loop value is less than 239 sec.

Cold case(Ambient temperature is between 20˚F and 50˚F.):

▼Time for coolant to reach stabilized thermostat regulation temperature is more than 263 sec.

Action Taken When the DTC Sets

▼The PCM will ON the MIL after second trip with detected fault.

▼The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼A history DTC P0128 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼DTC P0128 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼Poor connections.

▼Misrouted harness.

▼Rubbed through wire insulation.

▼Broken wire inside the insulation.

Check for the following conditions:

▼Poor connection at PCM–Inspect harness connectors for backed out terminals,improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼Damaged harness–Inspect the wiring harness for damage.

If the harness appears to be OK, observe the ECT display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

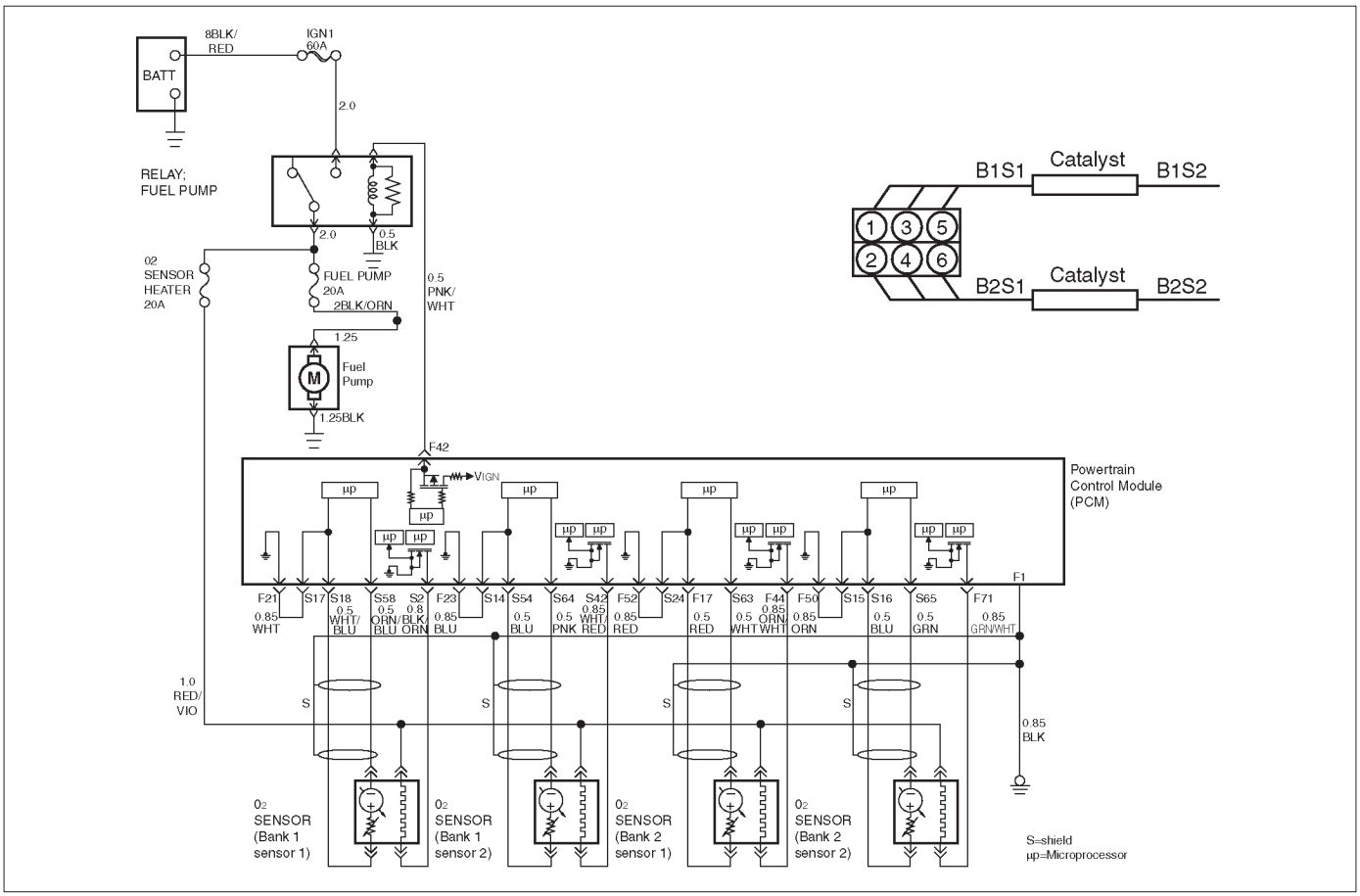
If DTC P0128 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0128 Diagnostic Chart may isolate the cause of the fault.

Diagnostic Trouble Code (DTC)
P0128 Thermostat Insufficient Temperature for stable operation

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Visually/physically check air duct and water pipe for splits, kinks, and proper connections and routing. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Remove and check the Thermostat for stable operation. Refer to *6B section.* 2. Replace the thermostat if necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0128. Does the Tech 2 indicate DTC P0128 failed this ignition?	—	Go to *Step 5*	Refer to *Diagnostic Aids*
5	1. Ignition “ON”, engine “OFF”. 2. Oberve the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139˚C (282˚F)	Verify repair	Go to *Step 6*
6	1. Ignition “OFF”. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted, repair it as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic* Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0131 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Vehicle is operating in “closed loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0131 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0131 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, If fuel pressure is too low, a DTC P0131 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform “Injector Balance Test”.
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.

- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to step numbers on the diagnostic chart.

3. DTC P0131 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

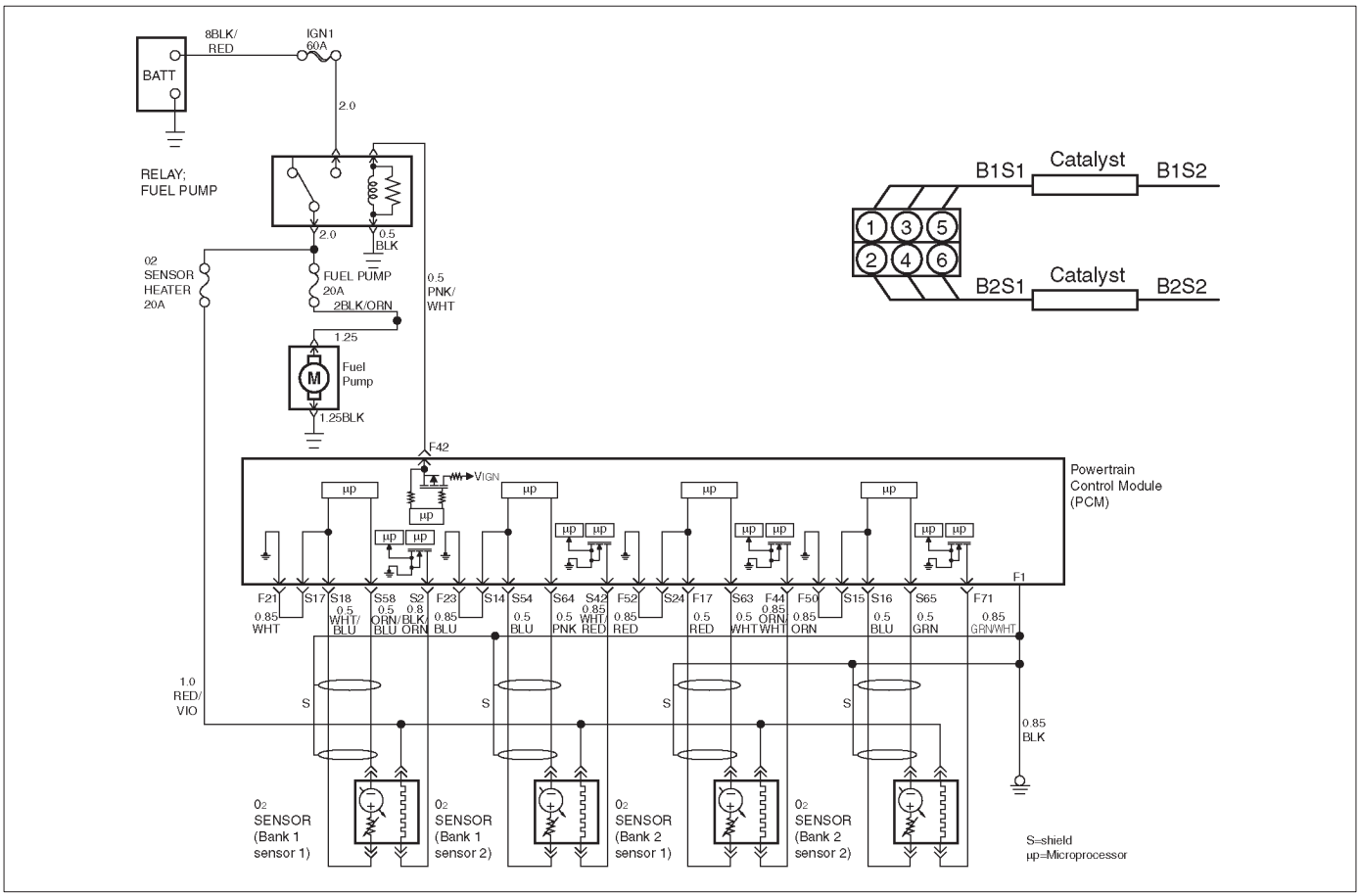
DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at normal operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0131 until the DTC P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition "OFF". 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Turn the ignition "OFF", HO2S 1 and PCM disconnected. 2. Check for short circuit between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—

DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF". 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition "ON". Does the Tech 2 indicate Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0132 HO2S Circuit High Voltage Bank 1 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0132 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F)
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during "deceleration fuel cutoff mode" operation for 3 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0132 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0132 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0132 may be set. Refer to *Fuel System Diagnosis*.
- Perform "Injector Balance Test" – Refer to *Fuel System Diagnosis*.

- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to *Evaporative (EVAP) Emission Control System*.
- MAF sensor –The system can go rich if MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see it the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine acceleration.
- Shorted Heated Oxygen Sensor (HO2S) –If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit or Faulty HO2S–A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle by monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal conditions.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0132 failing during "deceleration fuel cutoff mode" operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

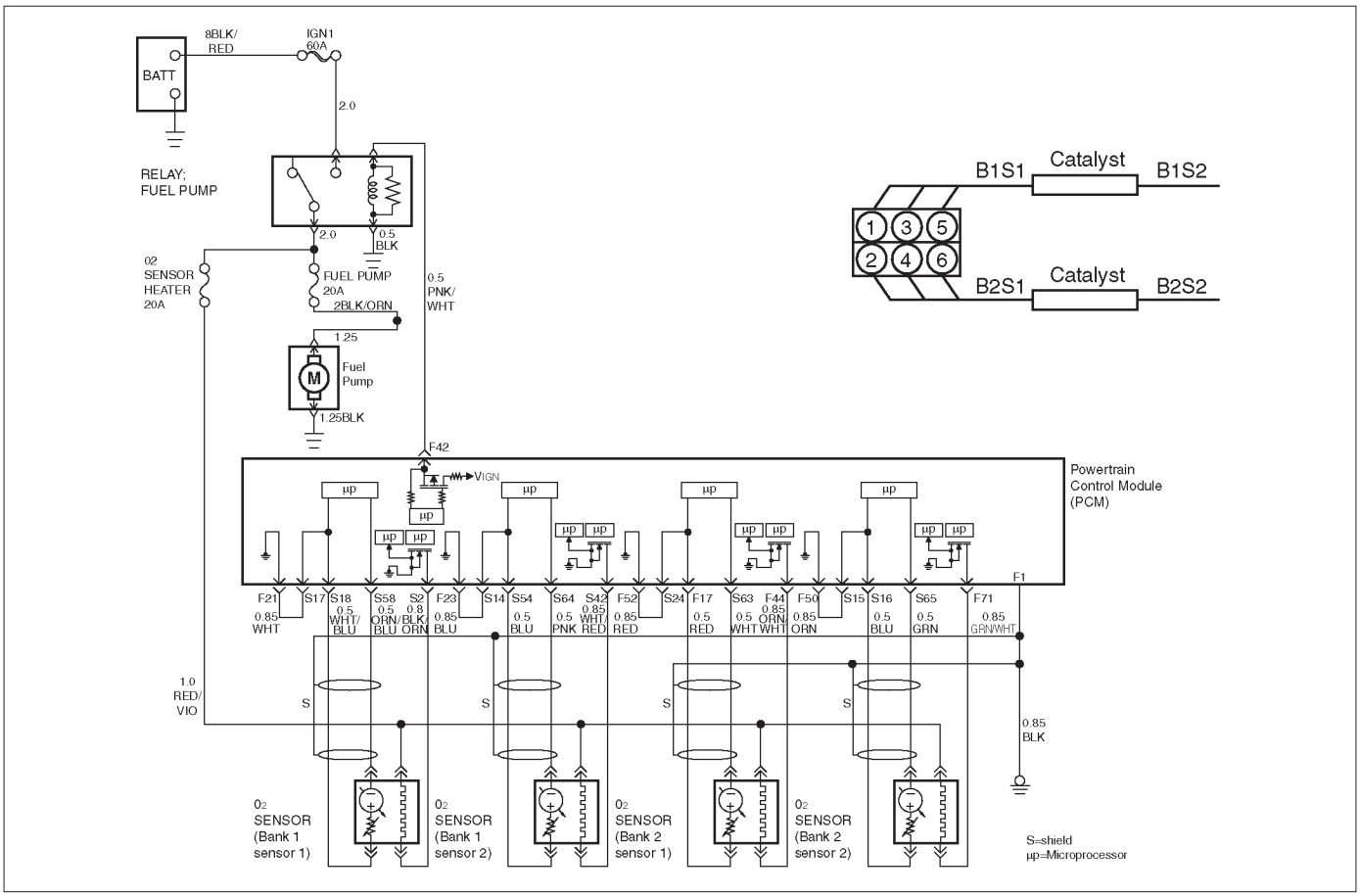
DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0132 until the DTC P0132 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0132 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect Bank 1 HO2S 1. 3. Ignition "ON". 4. At HO2S Bank 1 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*

DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON", engine"OFF". 2. At Bank 1 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0133 HO2S Slow Response Bank 1 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0133 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 60˚C (140˚F).
- Engine is operating in “closed loop”.
- Engine has been running for at least 90 seconds.
- Engine speed is between 1500 RPM and 3000 RPM.
- Canister purge duty cycle is greater than 2%.
- Mass air flow is between 18 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after “closed loop” has been enabled, Bank1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0133 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

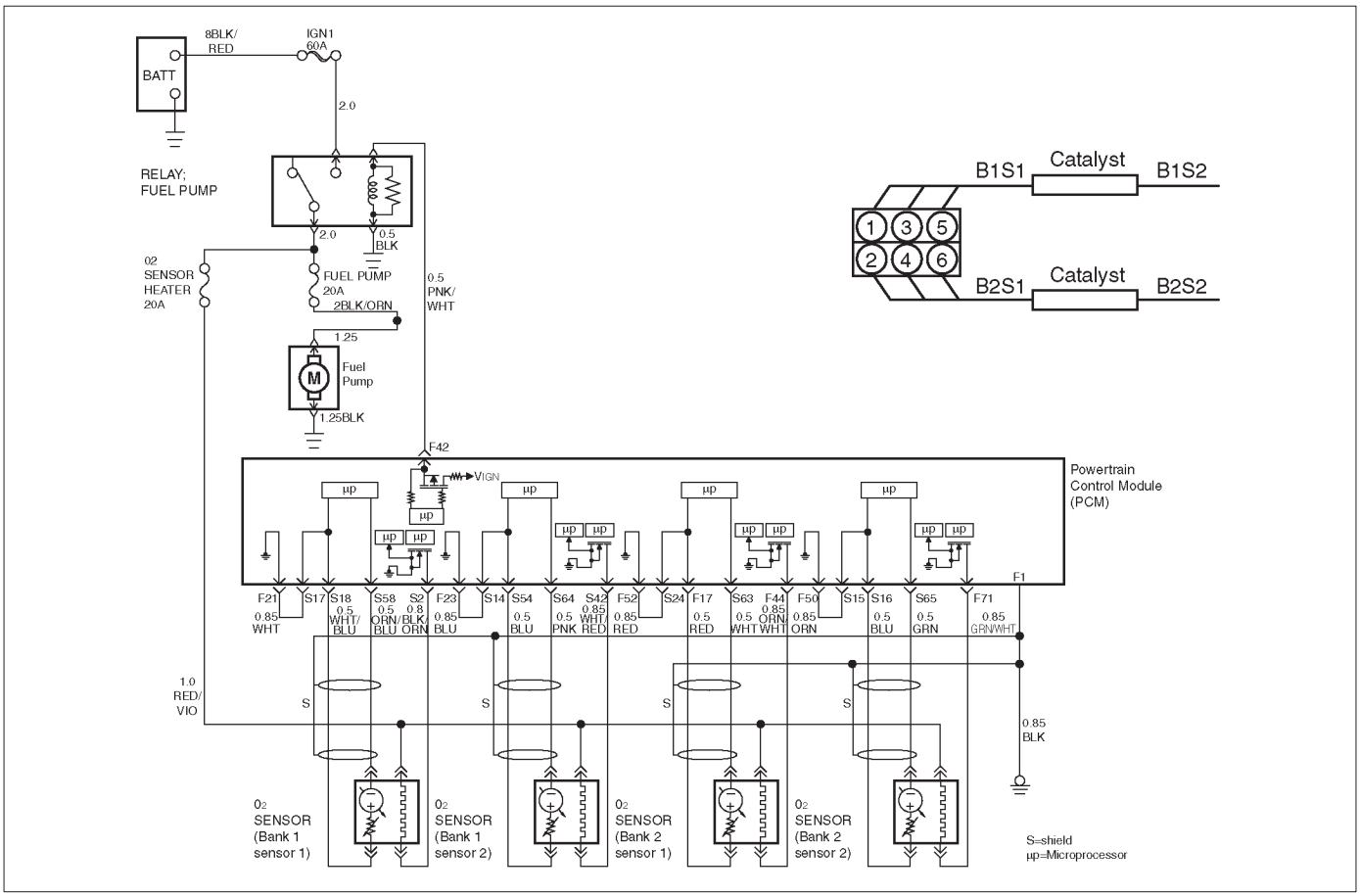
DTC P0133 – HO2S Slow Response Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set (expect P0153, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at normal operating temperature. 3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” included in Diagnostic Support. 4. Using a Tech 2, monitor “DTC” info for DTC P0133 until the DTC P0133 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U–bolt nuts at the leaking joints. Is the action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is the action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 2*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is the action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is the action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications to replace the manifold if necessary. Is the action complete?	—	Go to *Step 2*	—

DTC P0133 – HO2S Slow Response Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	Visually/physically inspect the following items: ▼ Ensure that the Bank 1 HO2S 1 is securely installed. ▼ Check for corrosion on terminals. ▼ Check terminal tension (at Bank 1 HO2S 1 and at the PCM). ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON". 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination. ▼ Use of improper RTV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1



060R200054

Circuit Description

- The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0134 will be set, indicating an open sensor signal or sensor low circuit.
- Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active.
- Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- The engine has been running for over 5 seconds.
- Engine coolant temperature (ETC) is above 60˚C (140˚F).
- Oxygen sensor heater has been determined to be functioning properly.
- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Take When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition "ON", engine "OFF", after a cool down period, the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the Ignition "ON", monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0134 test passes while the Failure Records conditions are being duplicated, an intermittent conditions is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

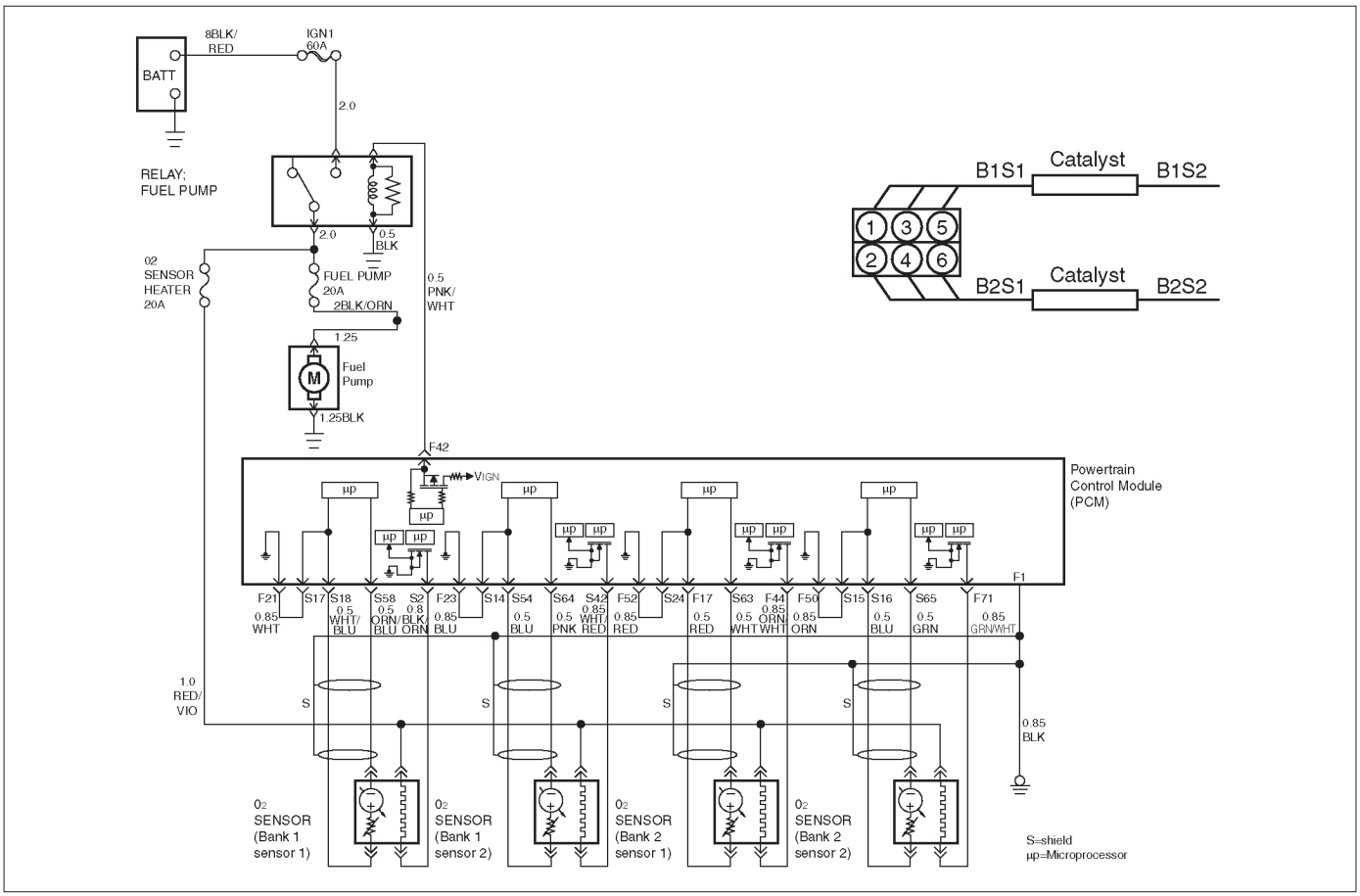
DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0134 until the DTC P0134 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0134 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*

DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON", engine "OFF". 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0135 HO2S Heater Circuit Bank 1 Sensor 1



060R200054

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a DTC P0135 will set. The time it should take the HO2S to reach operating temperature is based on the accumulated amount of air that has passed through the MAF sensor and into the engine (more accumulated air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- The engine has been running for over 120 seconds.
- Heater signal is below 0.1A.
- Bank 1 HO2S 1 voltage does not change more than 150 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 150 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulate air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0135 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0135 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- ▼ Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- ▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks or an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

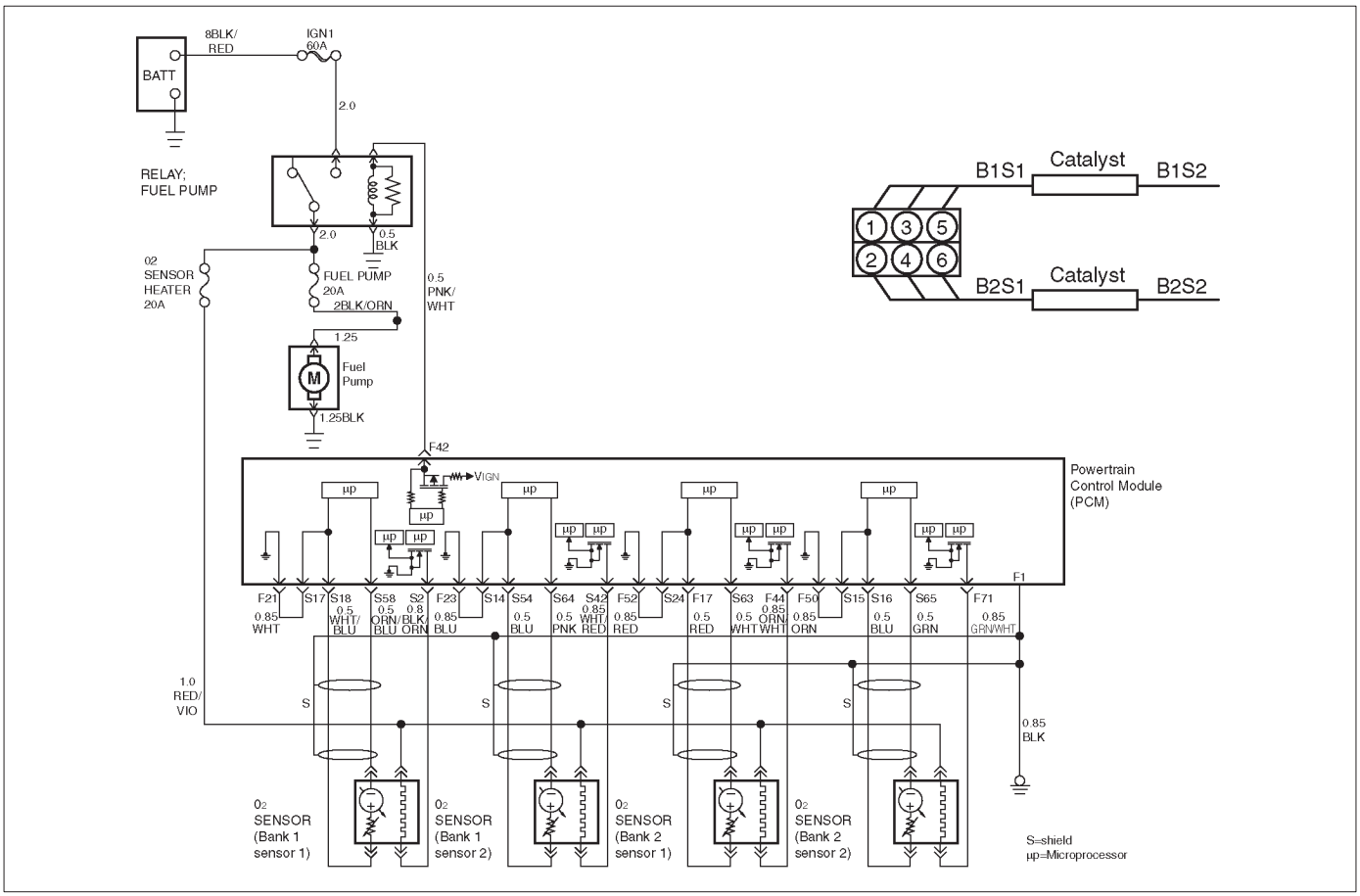
DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating ,allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF”. 4. Install a Tech 2. 5. Ignition “ON”, engine “OFF”. 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 1 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF”. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 1 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail. Is the HO2S heater resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace the Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2



060R200054

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm impedance digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0137 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains below 400 mV during power enrichment mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0137 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0137 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0137 to set. The system will go lean if pressure is too low. The PCM can

compensate for some decrease. However, if fuel pressure is too low, a DTC P0137 may be set. Refer to *Fuel System Diagnosis*.

- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0137 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

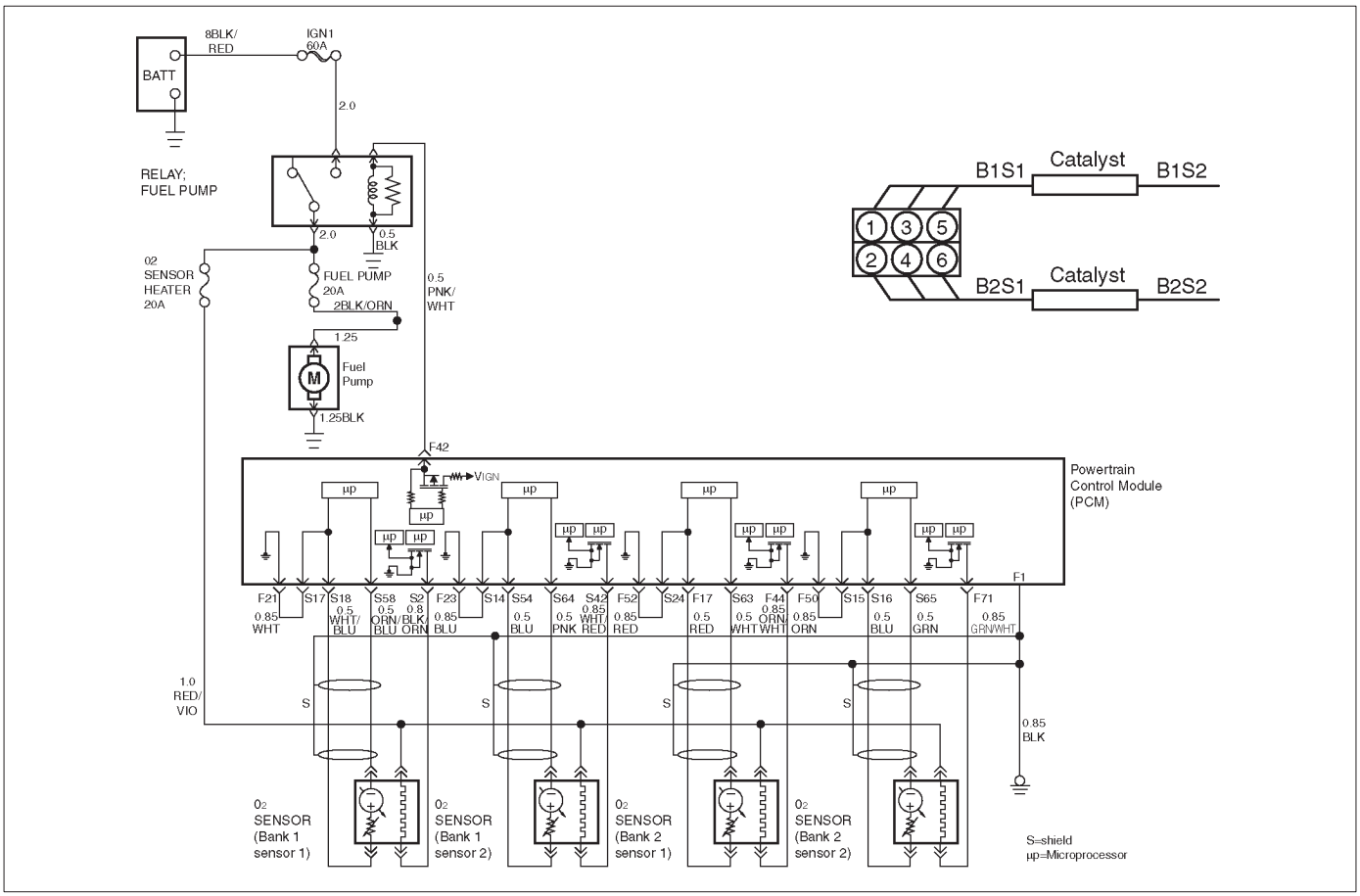
DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0137 until the DTC P0137 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0137 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition "OFF". 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 1 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "OFF". 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF". 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON". Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0138 HO2S Circuit High Voltage Bank 1 Sensor 2



060R200054

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 voltage remains excessively high for an extended period of time, DTC P0138 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop”.
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cut–off mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0138 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0138 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0138 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform “Injector Balance Test”.
- Leaking injector – Refer to *Fuel System Diagnosis*.

- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S – A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0138 being set during deceleration fuel mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

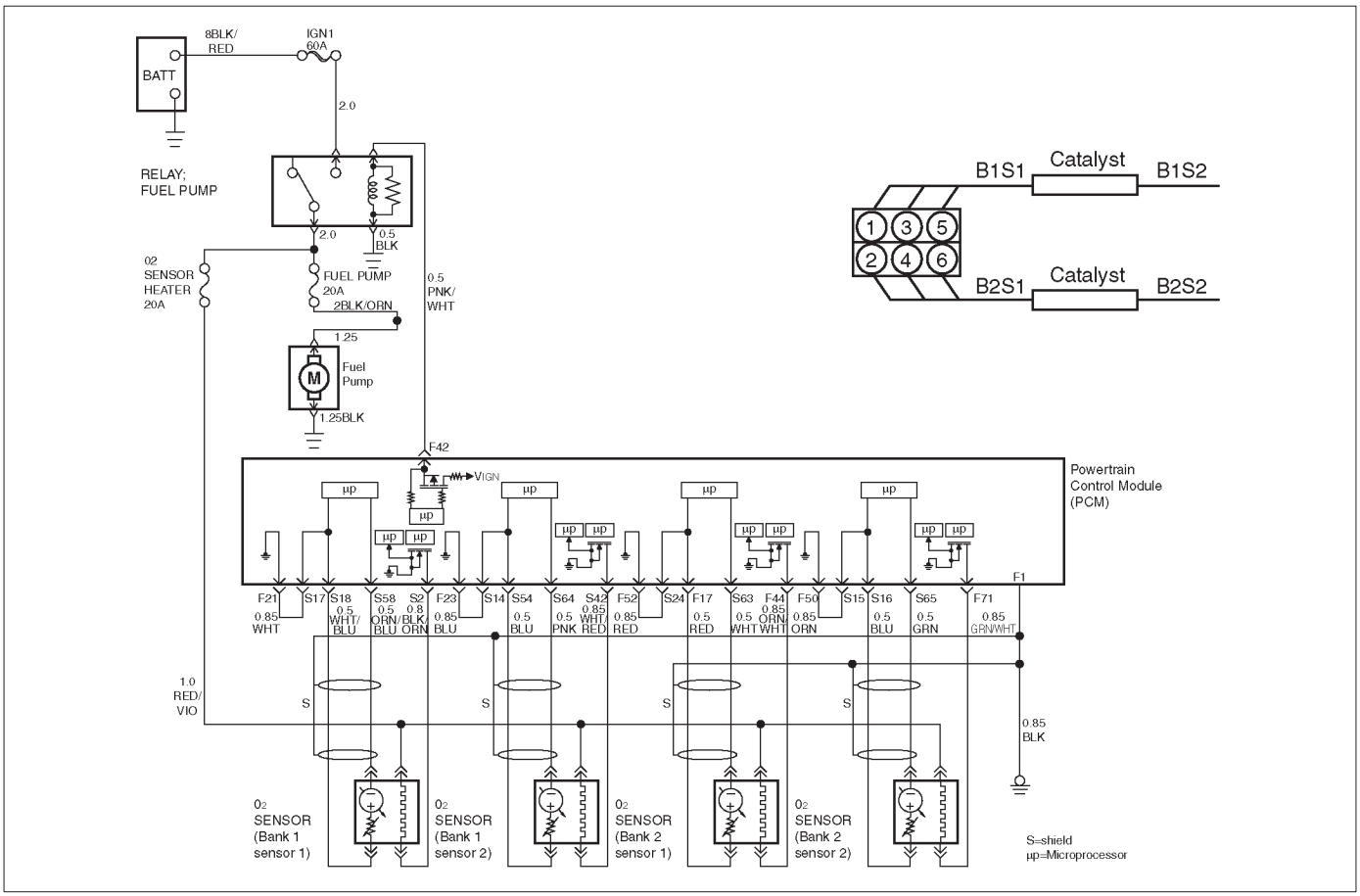
DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0138 until the DTC P0138 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0138 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect Bank 1 HO2S 1. 3. Ignition "ON". 4. At the HO2S Bank 1 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages above the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*

DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Repair short to voltage in the signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON", engine"OFF". 2. At Bank 1 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 2 PCM–side connector. 2. With the HO2S 2 connector disconnected, monitor BANK 1 HO2S 2 voltage. Is the Bank 1 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2



060R200054

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0140 will be set. Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F).
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is operating in "closed loop"
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Cleaning the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0140 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0140 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness– Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit–With the ignition“ON”, engine “OFF”, the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test–With the ignition “ON”, monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number (s) below refer to the step number (s) on the Diagnostic Chart.

3. If the DTC P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

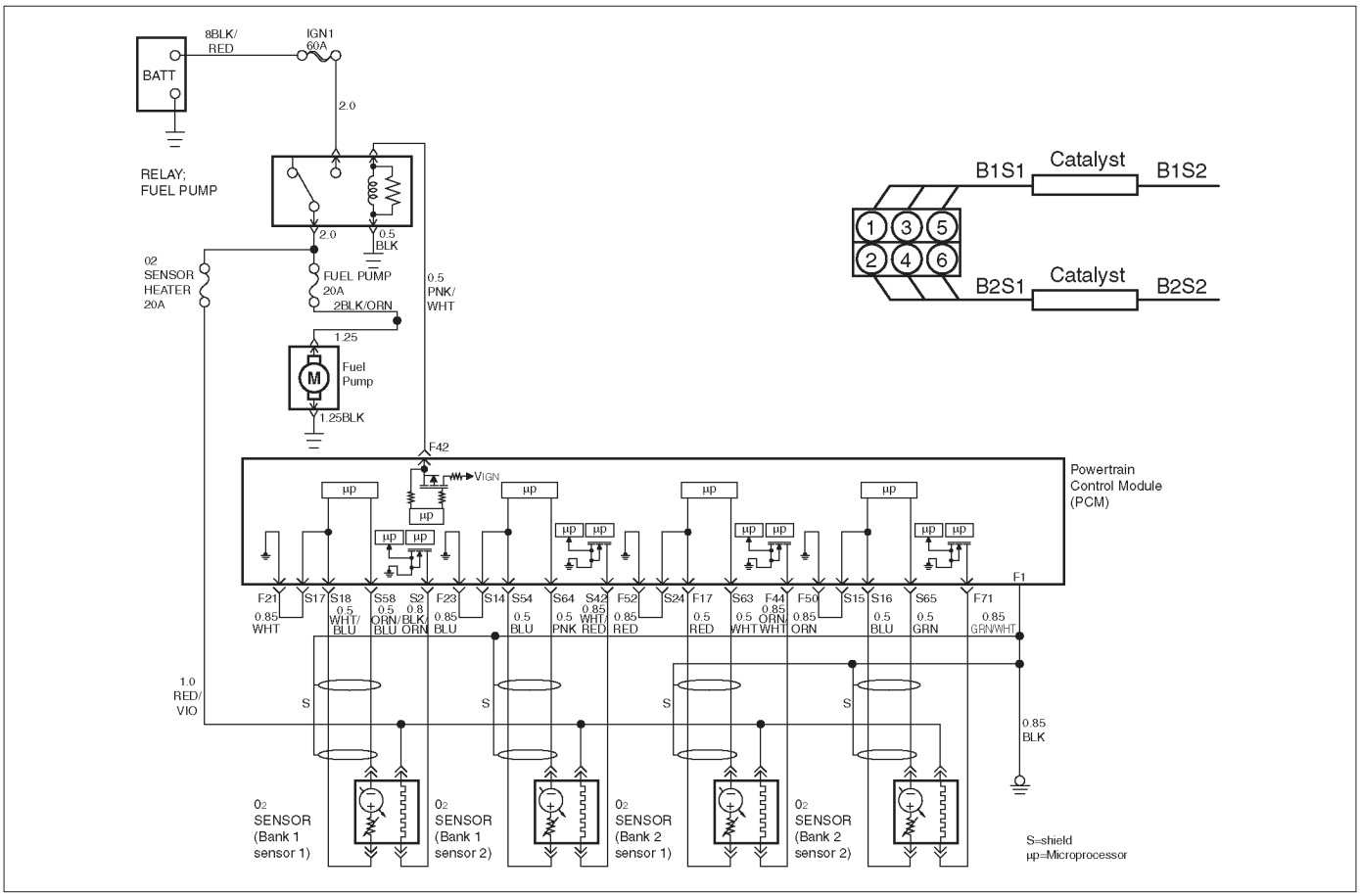
DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0140 until the DTC P0140 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0140 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF”. 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*

DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON", engine"OFF". 2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0141 HO2S Heater Circuit Bank 1 Sensor 2



060R200054

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a DTC P0141 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total airflow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0141 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0141 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

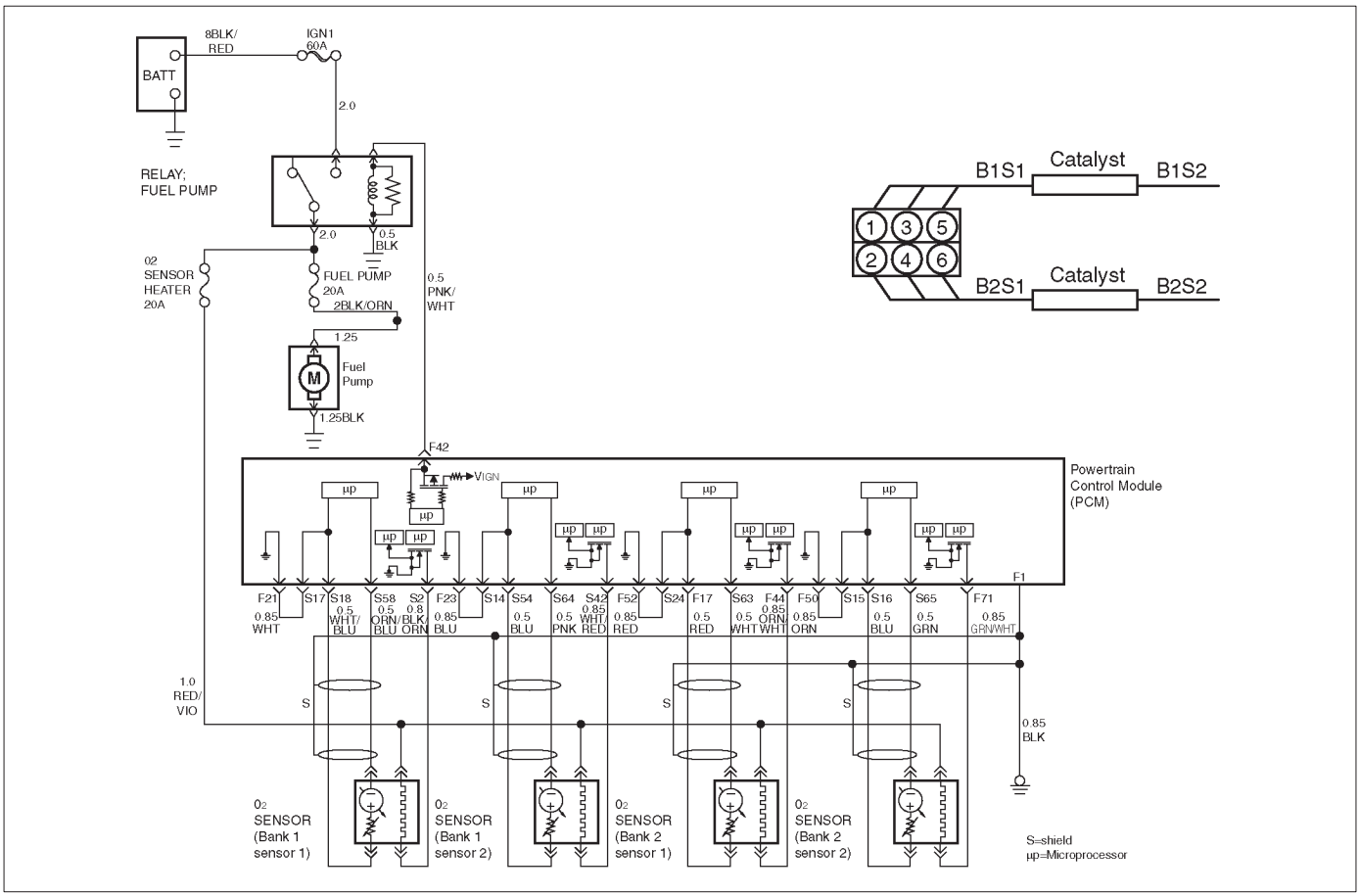
DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF”. 4. Install a Tech 2. 5. Ignition “ON”, engine “OFF”. 6. Monitor the Bank 1 HO2S 2 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for Bank 1 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF”. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 2 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit. 3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0151 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in “closed loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 2 HO2S 1 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0151 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0151 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0151 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform “Injector Balance Test”.
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.

- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor –The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0151 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0151 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicate.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

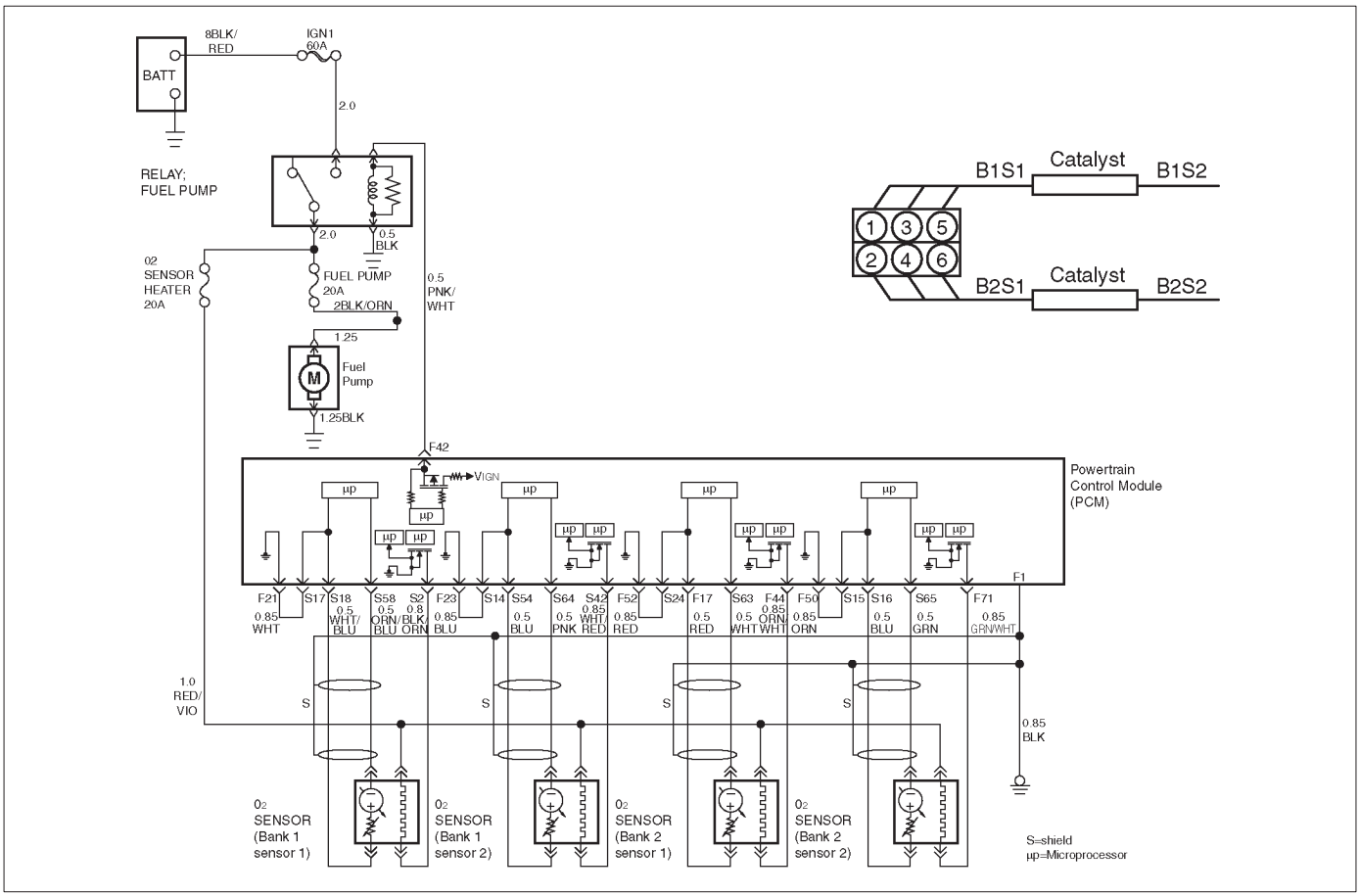
DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0151 until the DTC P0151 test runs. 4. Note test result. Does the Tech 2 indicate DTC P0151 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition “OFF”. 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 1 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 1 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 2 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition “OFF”. 2. Leave the PCM and HO2S 1 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—

DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF". 2. Reconnect the PCM, leave HO2S disconnected. 3. Ignition "ON". Does the Tech 2 indicate Bank 2 HO2S 1 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0152 HO2S Circuit High Voltage Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing the injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0152 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in “closed loop”.
- The engine coolant temperature is above 60˚C (140˚F).
- Bank 2 HO2S 1 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period.

OR

- Bank 2 HO2S 1 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will “ON” the MIL after second trip with detected fault
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0152 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0152 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0152 may be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform “Injector Balance Test”.
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) system – Check the canister for fuel saturation. If the canister is full of fuel,

check EVAP control system components and hoses. Refer to *Evaporative Emission (EVAP) Control System*.

- MAF sensor – The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if rich condition is corrected. If so, replace MAF sensor.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S)– If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can cause a high HO2S voltage to be indicated. This condition is indicated by powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S– A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage switch between the rich and lean thresholds can also cause the condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0152 failing during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0152 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

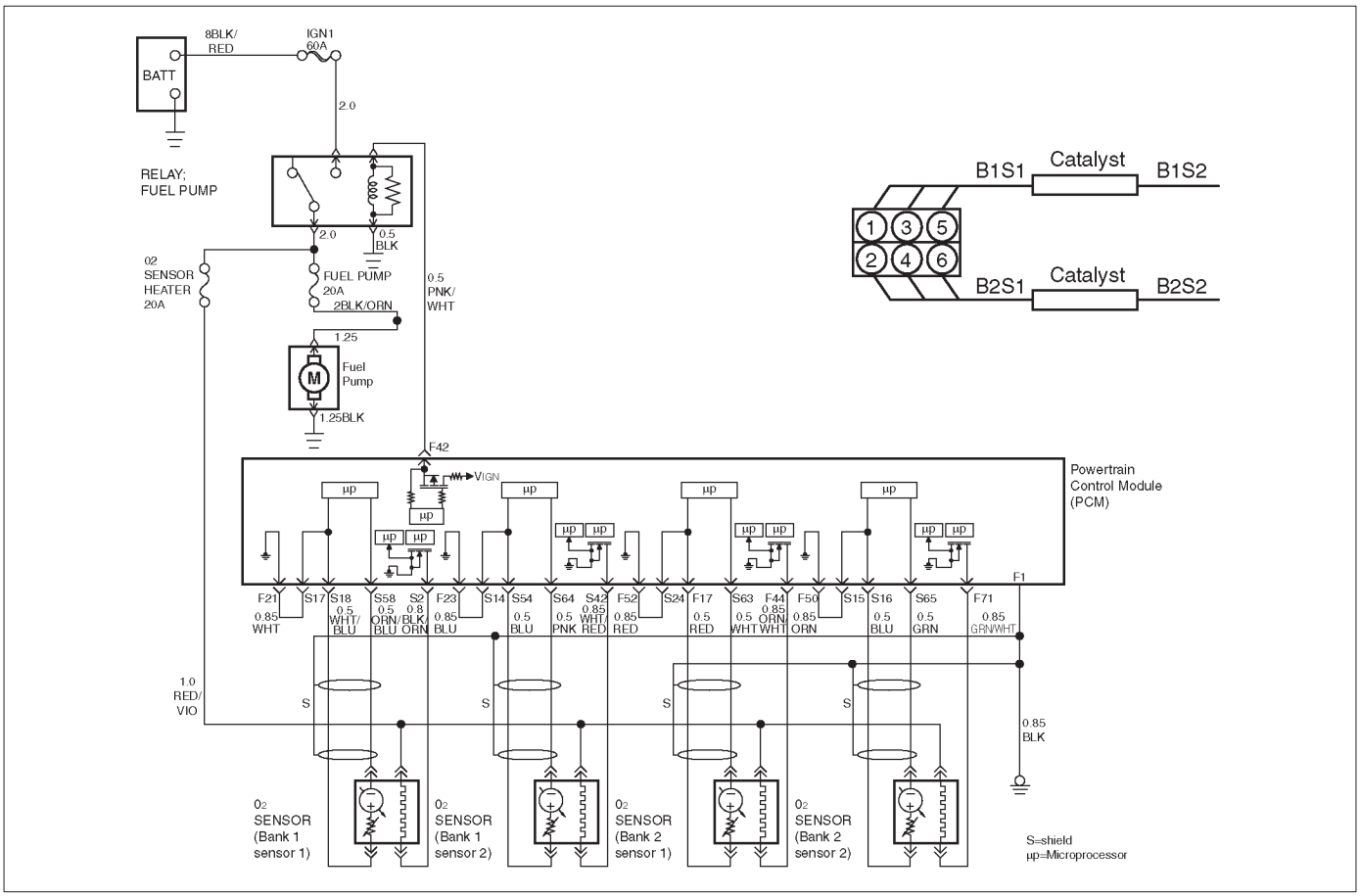
DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Engine is at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-off mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0152 until the DTC P0152 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0152 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect Bank 2 HO2S 1. 3. Ignition "ON". 4. At HO2S Bank 2 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*

DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON", engine"OFF". 2. At Bank 2 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is Bank 2 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0153 HO2S Slow Response Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0153 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 60˚C (140˚F).
- The engine is operating in "closed loop".
- Engine has been running for over 60 seconds.
- Canister purge duty cycle is above 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 18 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank 2 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or the rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0153 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

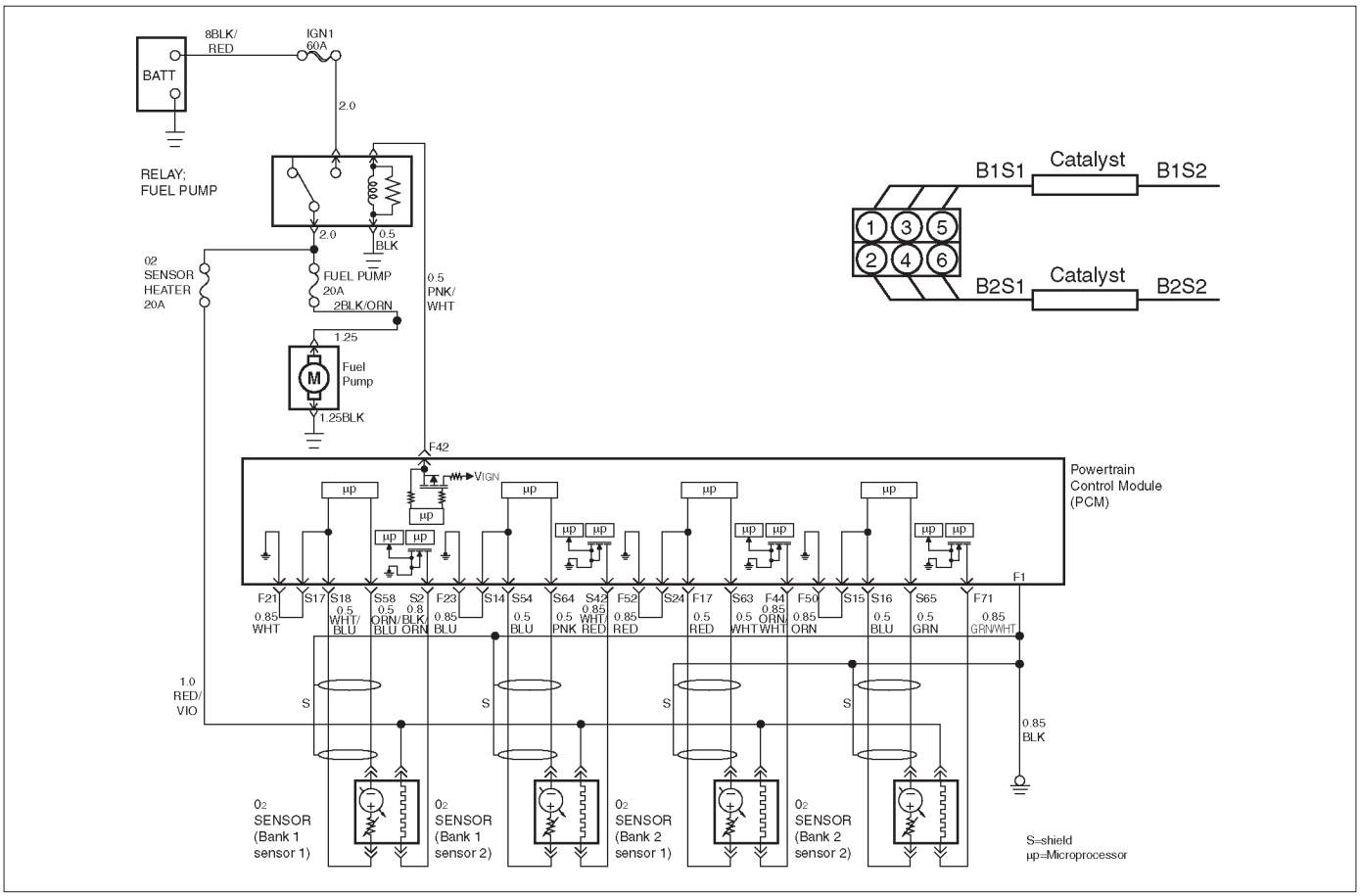
DTC P0153 – HO2S Slow Response Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set, (except P0133, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor "DTC" info for DTC P0153 until the DTC P0153 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0153 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 test failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joint. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damage or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—

DTC P0153 – HO2S Slow Response Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Visually/physically inspect the following items: ▼ Ensure that the Bank 2 HO2S 1 is securely installed. ▼ Check for corrosion on terminals. ▼ Check terminal tension (at Bank 2 HO2S 1 and at the PCM). ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON". 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination. ▼ Use of improper RV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0154 will be set, indicating an open sensor signal or sensor low circuit.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F).
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Bank 2 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0154 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals,

improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire-connection, and damaged harness.

▼ Faulty HO2S heater or heater circuit – With the ignition "ON", engine "OFF", the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.

▼ Intermittent test – With the ignition "ON", monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0154 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

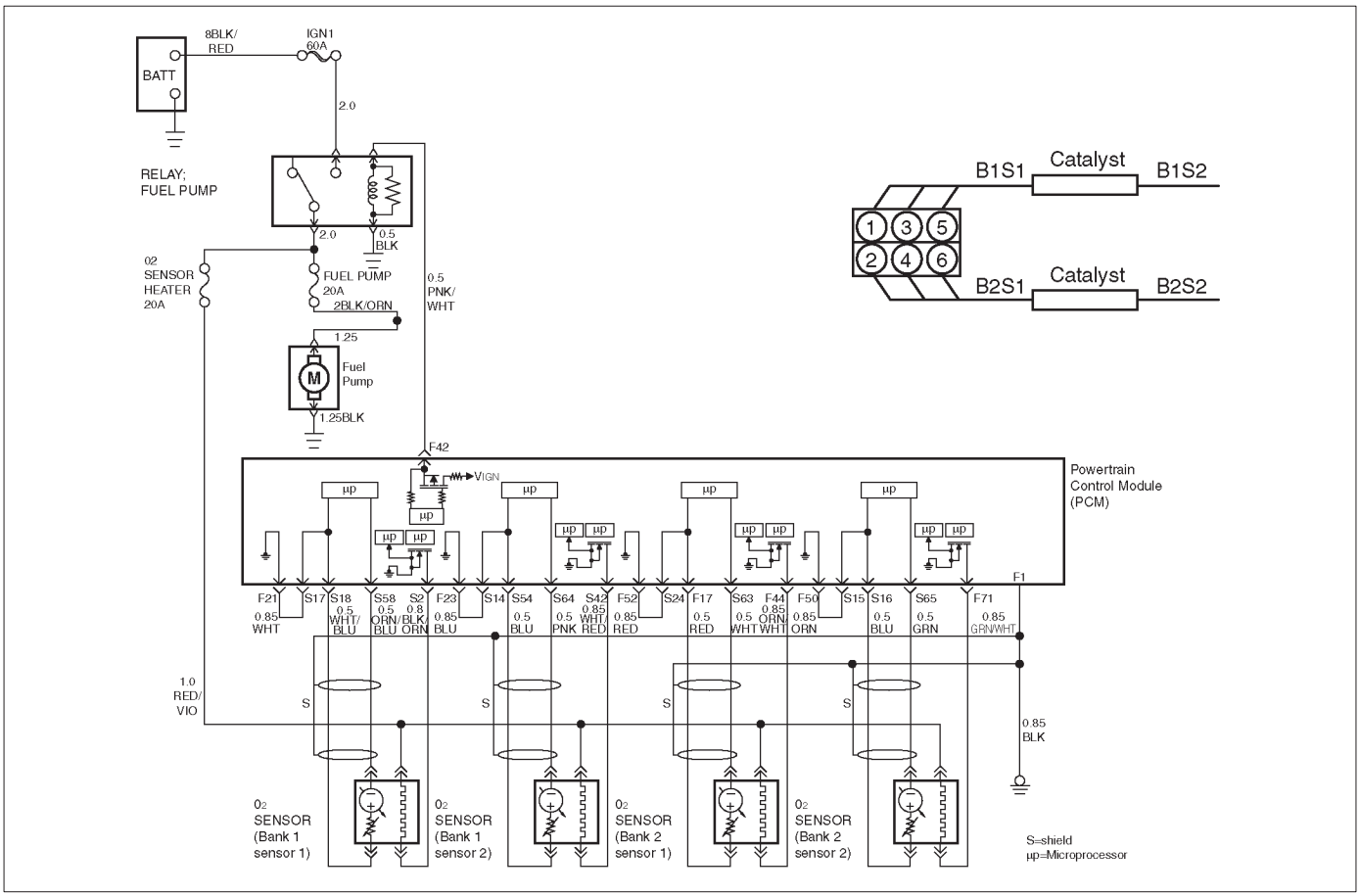
DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0154 until the DTC P0154 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0154 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 7*

DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 high circuit. 3. If the Bank 2 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON", engine "OFF". 2. Disconnect Bank 2 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0155
HO2S Heater Circuit Open Bank 2 Sensor 1



060R200054

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 1 to become active, a DTC P0155 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the mass air flow (MAF) sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Heater signal is below 0.1A.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0155 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0155 can be cleared by using the Tech 2 “Clear info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- ▼ Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- ▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

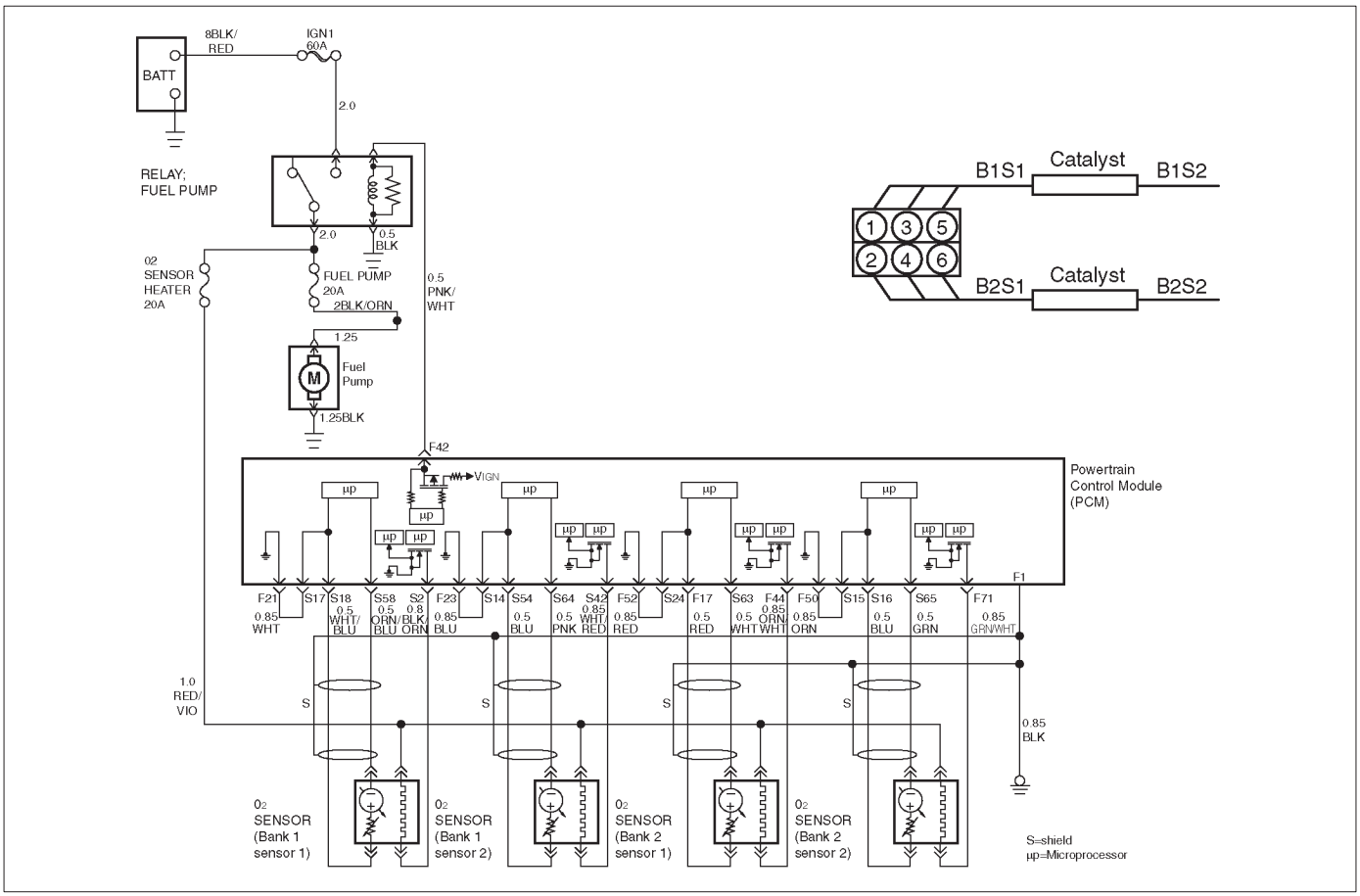
DTC P0155 – HO2S Heater Circuit Open Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition "OFF". 4. Install a Tech 2. 5. Ignition "ON", engine "OFF". 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified value?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition "OFF". 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 1 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 1 heater ground or Bank 2 HO2S 1 low), probe the ignition feed circuit at the Bank 2 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between Bank 2 HO2S 1 ignition feed and Bank 2 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0155 – HO2S Heater Circuit Open Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 1 ignition feed and the Bank 2 HO2S 1 heater ground at the Bank 2 HO2S 1 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 1 ignition feed circuit to Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 1 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 2 HO2S 1 signal or low circuit terminal connection at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 1 signal circuit and the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 signal circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 1 signal circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair short to ground in Bank 2 HO2S 1 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2



060R200054

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0157 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- Engine coolant temperature is above 60˚C (140˚F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8
- Bank 2 HO2S 2 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 2 HO2S 2 signal voltage remains below 400 mV during "power enrichment" mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0157 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0157 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0157 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0157 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0157 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of above conditions are present, replace the affected HO2S 2.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0157 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0157 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

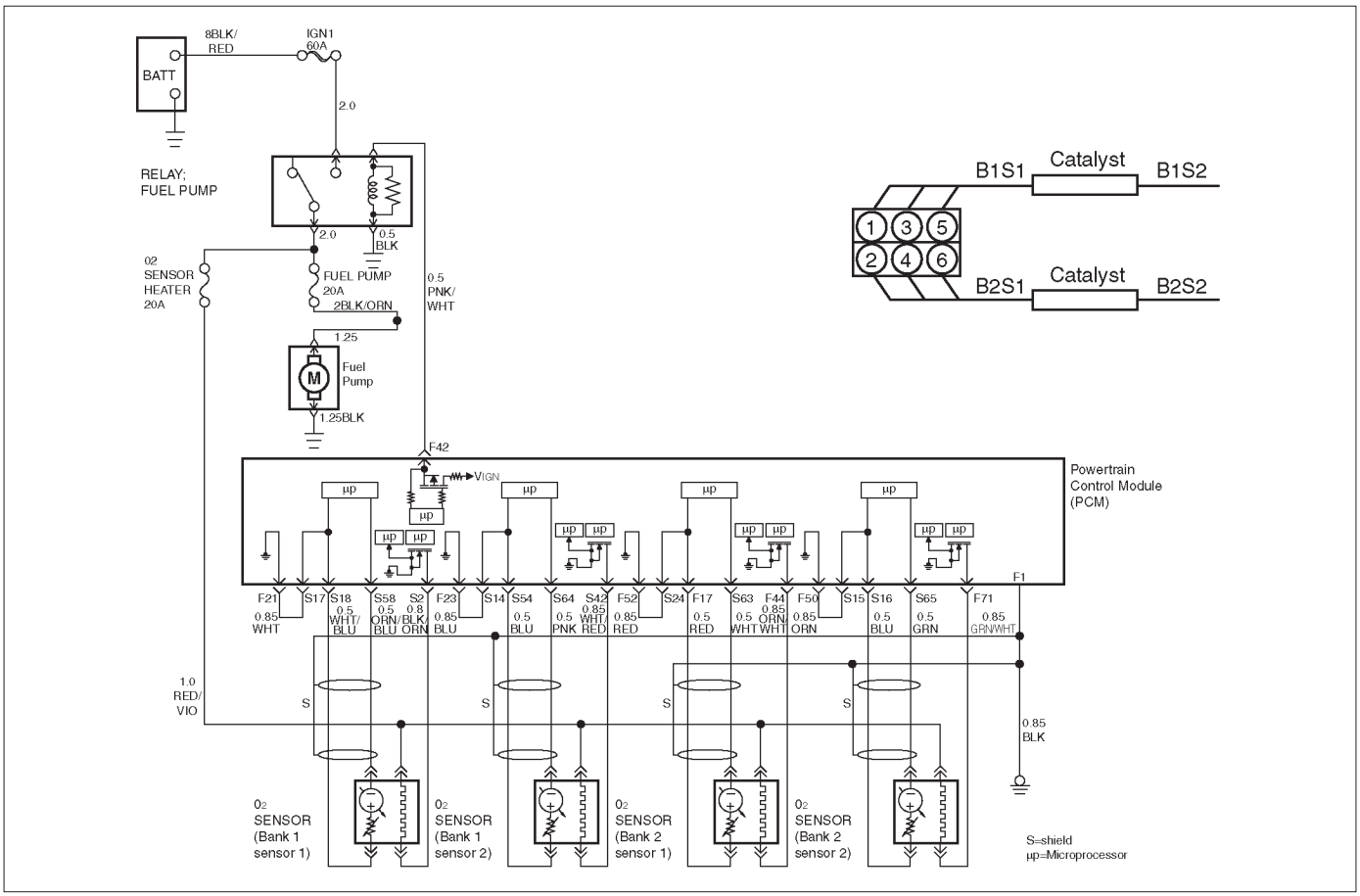
DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0157 until the DTC P0157 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0157 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition "OFF". 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—

DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "OFF". 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF". 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON". Does the Tech 2 indicate Bank 2 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0158 HO2S Circuit High Voltage Bank 2 Sensor 2



060R200054

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively high for an extended period of time, DTC P0158 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop".
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Bank 2 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period.

OR

- Bank 2 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0158 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0158 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0158 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test".
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if a rich condition is corrected. If so, replace the MAF sensor.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S signal or low circuit, or faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel cutoff mode operation. An HO2S which is faulty and does not allow full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.
- If none of above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0158 being set during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0158 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

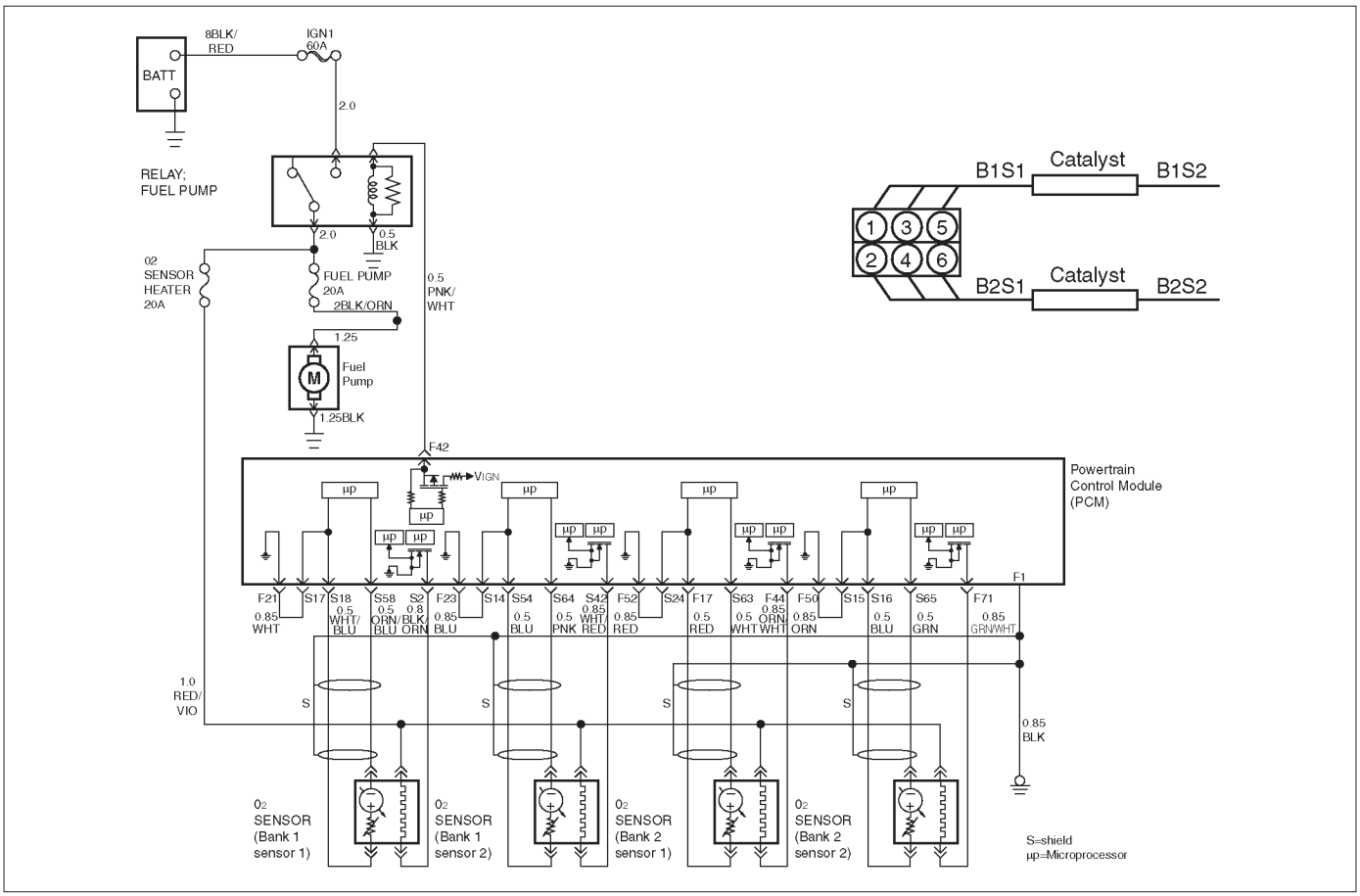
DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-out mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0158 until the DTC P0158 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0158 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*

DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF". 2. Disconnect Bank 2 HO2S 2. 3. Ignition "ON". 4. At the HO2S Bank 2 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON", engine "OFF". 2. At Bank 2 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 2 PCM-side connector. 2. With the HO2S 2 connector disconnected, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2



060R200054

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0160 will be set.

Heated Oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is in "closed loop" operation.
- Bank 2 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0160 will clear after 40 consecutive warm-up cycles have occurred without a fault.

▼ DTC P0160 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

▼ Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

▼ Faulty HO2S heater or heater circuit – With the ignition "ON", engine "OFF", the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.

▼ Intermittent test – With the ignition "ON", monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0160 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

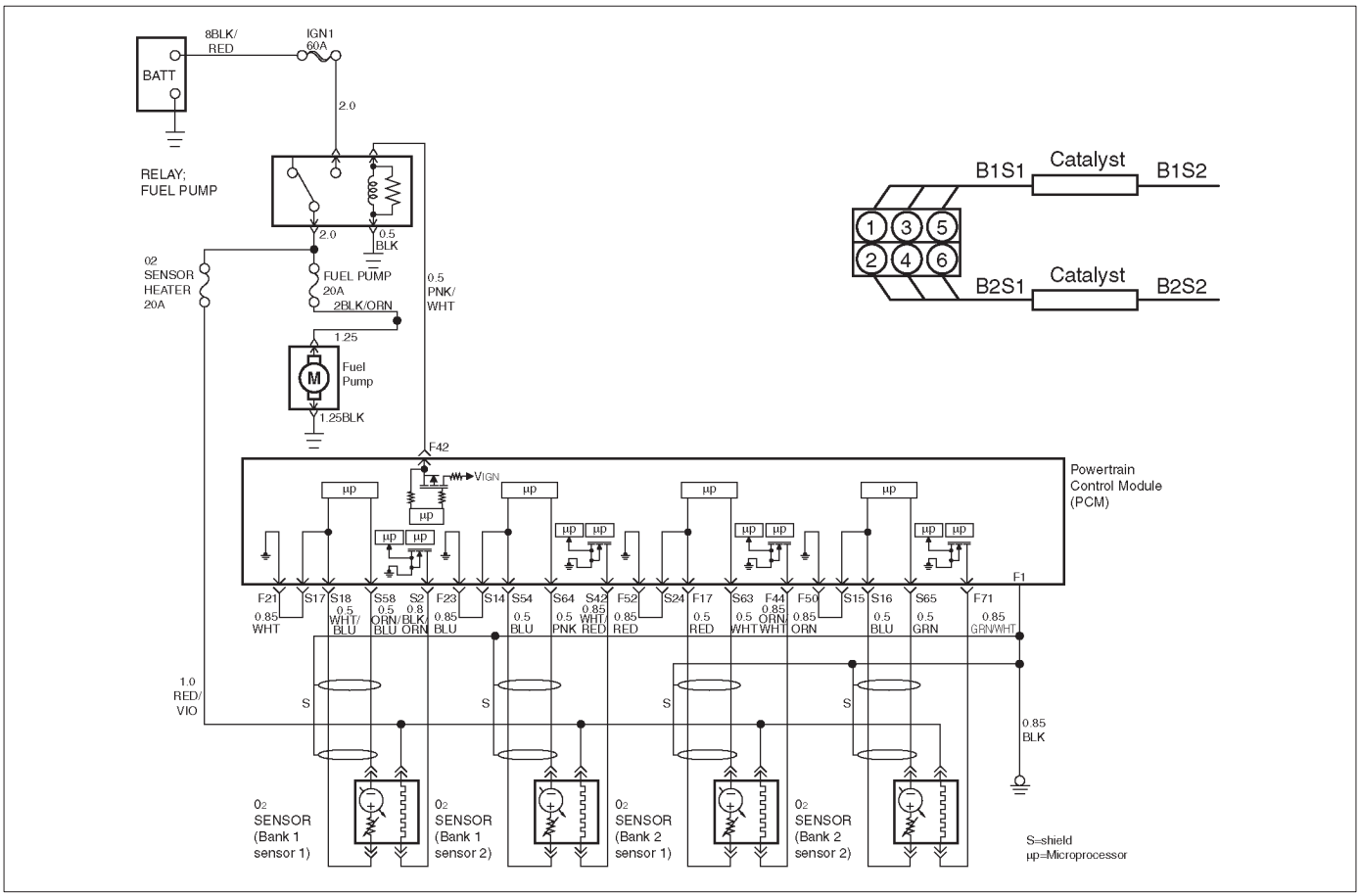
DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0160 until the DTC P0160 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0160 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the Bank 2 HO2S 2 harness connector and replace terminal(s) if necessary. Did either terminal require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*

DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 high circuit. 3. If the Bank 2 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF". 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 low circuit measures over 5 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON", engine "OFF". 2. Disconnect Bank 2 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0161 HO2S Heater Circuit Bank 2 Sensor 2



060R200054

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started, the PCM will monitor the HO2S voltage. When the Bank 2 HO2S 2 voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 2 to become active, a DTC P0161 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 23 g/second.
- Bank 2 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0161 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0161 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- ▼ Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- ▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

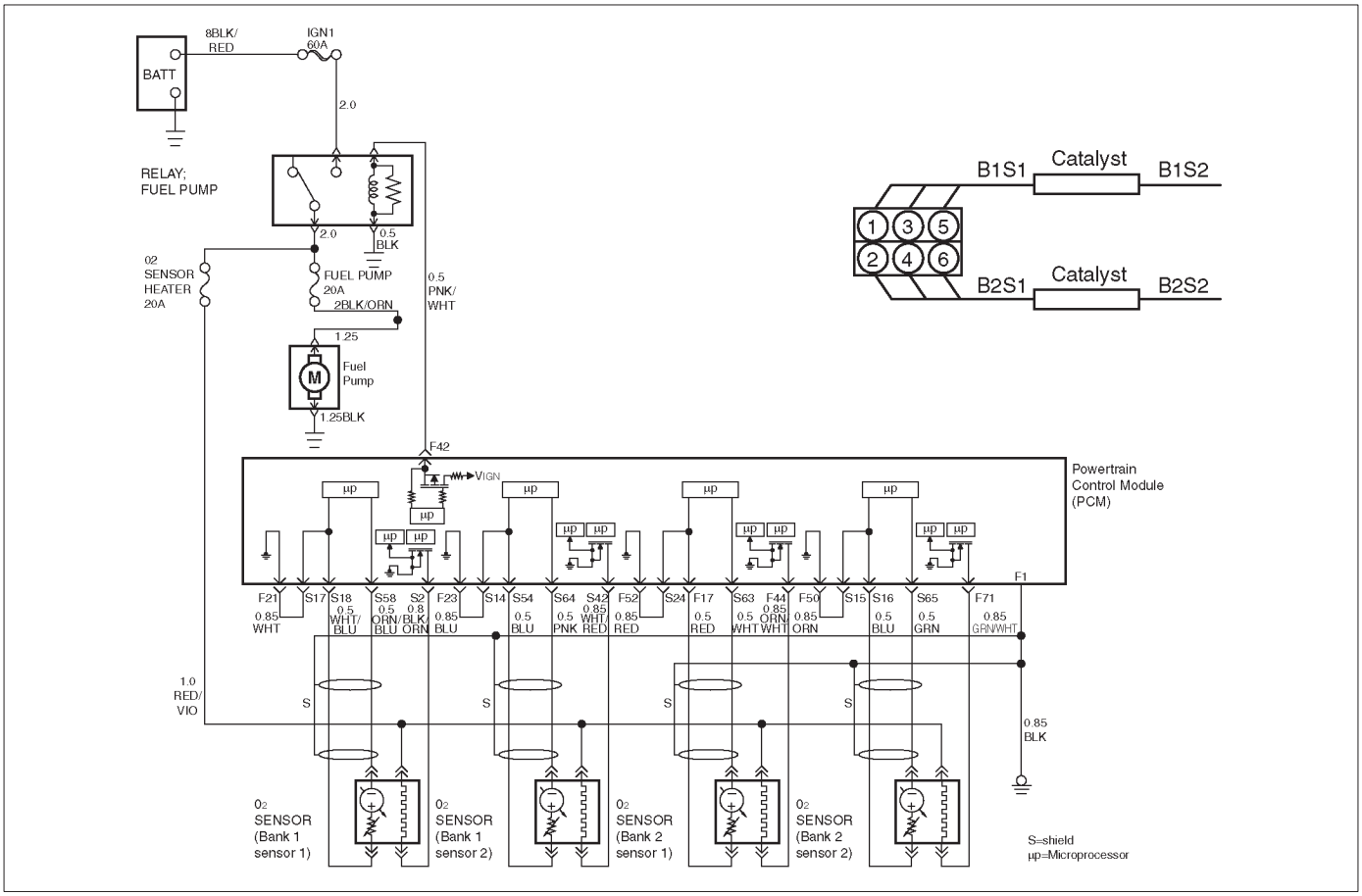
DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition "OFF". 4. Install a Tech 2. 5. Ignition "ON", engine "OFF". 6. Monitor the Bank 2 HO2S 2 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or Below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition "OFF". 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 2 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 2 heater ground or Bank 2 HO2S 2 low), probe the ignition feed circuit at the Bank 2 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground at the Bank 2 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 2 ignition feed circuit to Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF". 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the Bank 2 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0171 Fuel Trim System Lean Bank 1



060R200054

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set DTC P0171.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12% (manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- None of the following: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TP sensor DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0% if on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0171 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

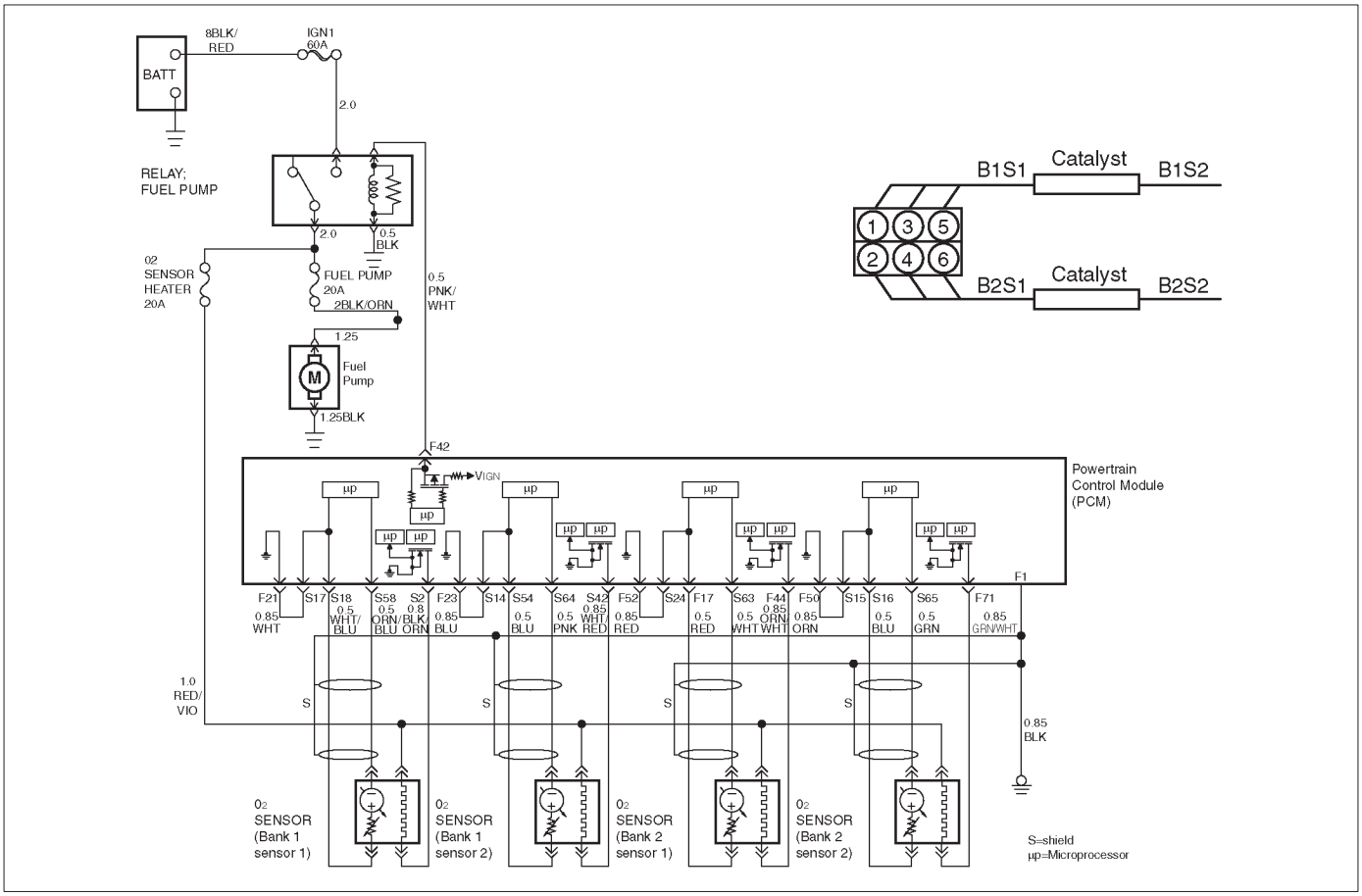
DTC P0171 – Fuel Trim System Lean Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0171 and P0174?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop". 2. Observe the "BANK 1 L.T. FUEL TRIM" display on the Tech 2. Is the displayed value greater than the specified value?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0171 test runs and note the test result. Does the Tech 2 indicate DTC P0171 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0174 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step11*
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*

DTC P0171 – Fuel Trim System Lean Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for the procedure) and correct the contaminated fuel condition if present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 S.T. FUEL TRIM" displayed on the Tech 2. Does "BANK 1 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test", and correct any problem found (refer to *Fuel Metering System*). Did Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0172 Fuel Trim System Rich Bank 1



060R200054

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensors (HO2S) 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set DTC P0172.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12 (manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- None of the following was set: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TPS DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0%, if “ON”.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0172 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0172 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.

4. If the DTC P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0172 – Fuel Trim System Rich Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop". 2. Observe "B1 Long Term Fuel Trim" display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0172 test runs and note test result. Does the Tech 2 indicate DTC P0172 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.
5	Is DTC P0175 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 8*

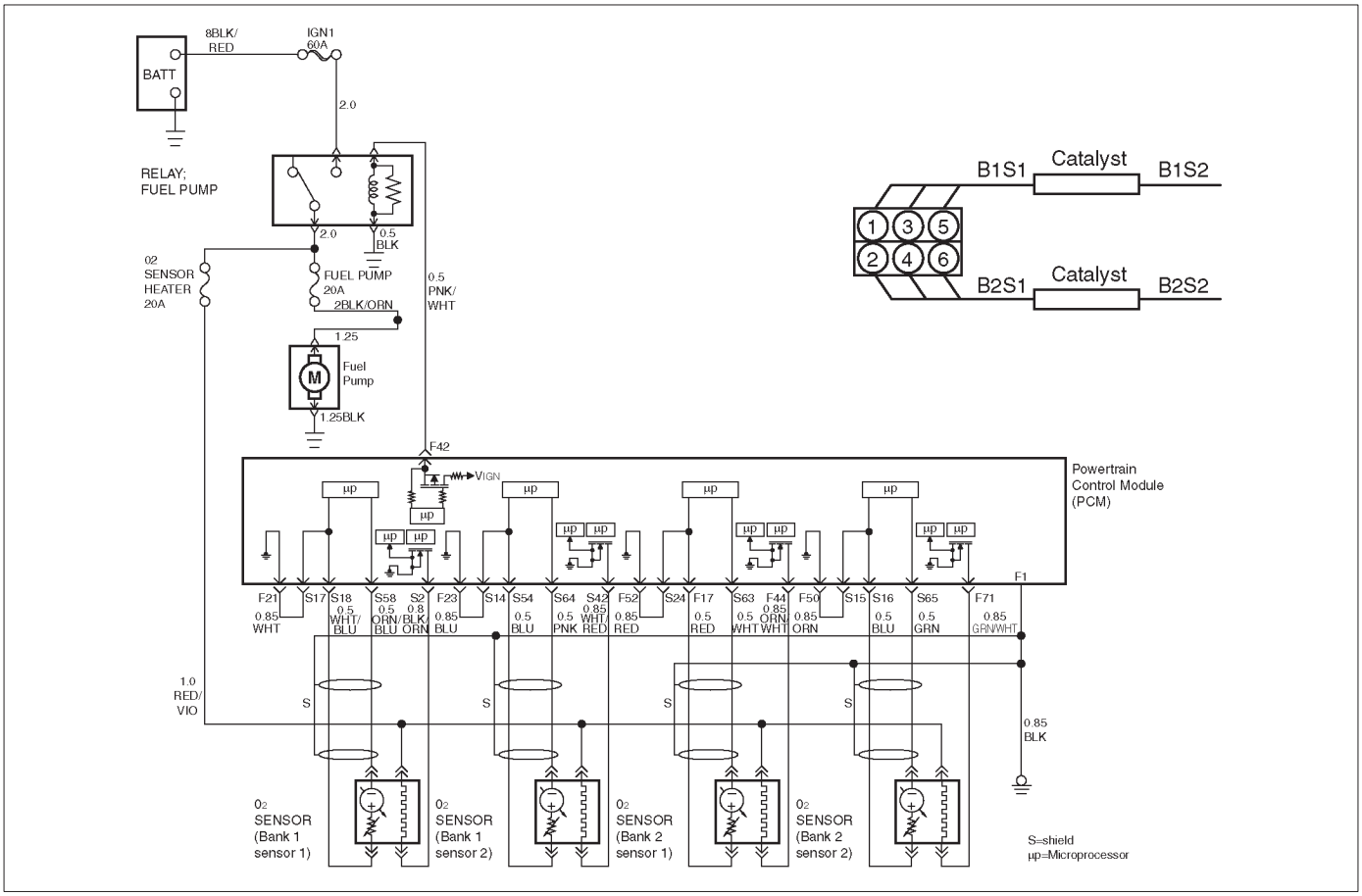
DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Ignition "OFF". 2. Physically inspect the throttle body bore and throttle plate for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	Ignition "ON", engine "OFF", monitor the TP1 Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S. T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*
14	1. Perform "Fuel System Pressure Test". 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON", engine "OFF". 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*
16	Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*
17	Repair the short to ground. Is the action complete?	—	Verify repair	—

DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the "Injector Balance Test". 2. If Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0174 Fuel Trim System Lean Bank 2



060R200054

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 2, the PCM will set DTC P0174.

The PCM’s maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TP sensor, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0%, if “ON”.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0174 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0174 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0174 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

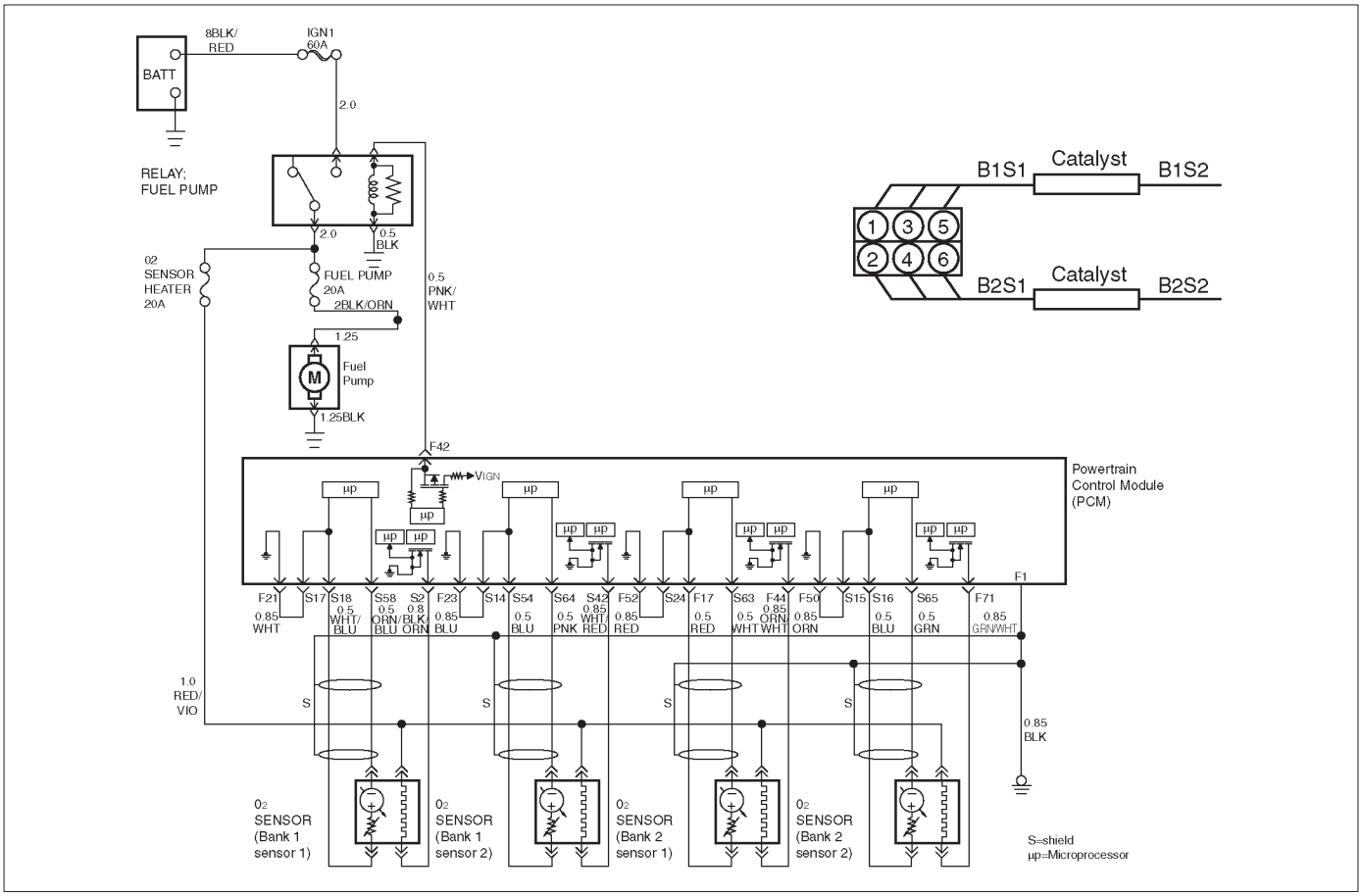
DTC P0174 – Fuel Trim System Lean Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0174 and P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop". 2. Observe the "BANK 2 L.T. FUEL TRIM" display on the Tech 2. Is the displayed values greater than the specified values?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0174 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0174 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0174 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0171 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*

DTC P0174 – Fuel Trim System Lean Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for procedure) and correct the contaminated fuel condition is present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 S.T. FUEL TRIM" displayed on the Tech 2. Does the "BANK 2 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 2 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test" and correct any problem found (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 2 HO2S 1 to ensure that it is installed securely and that the Bank 2 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0175 Fuel Trim System Rich Bank 2



060R200054

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 2, the PCM will set DTC P0175.

The PCM’s maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TPS, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0175 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0175 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed -out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records Vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.

4. If the DTC P0175 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0175 – Fuel Trim System Rich Bank 2

Step	Action	Value(s)	Yes	No
1	Was the ”On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in “closed loop”. 2. Observe the “BANK 2 L.T. FUEL TRIM” display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0175 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0175 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0175 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.
5	Was DTC P0172 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*

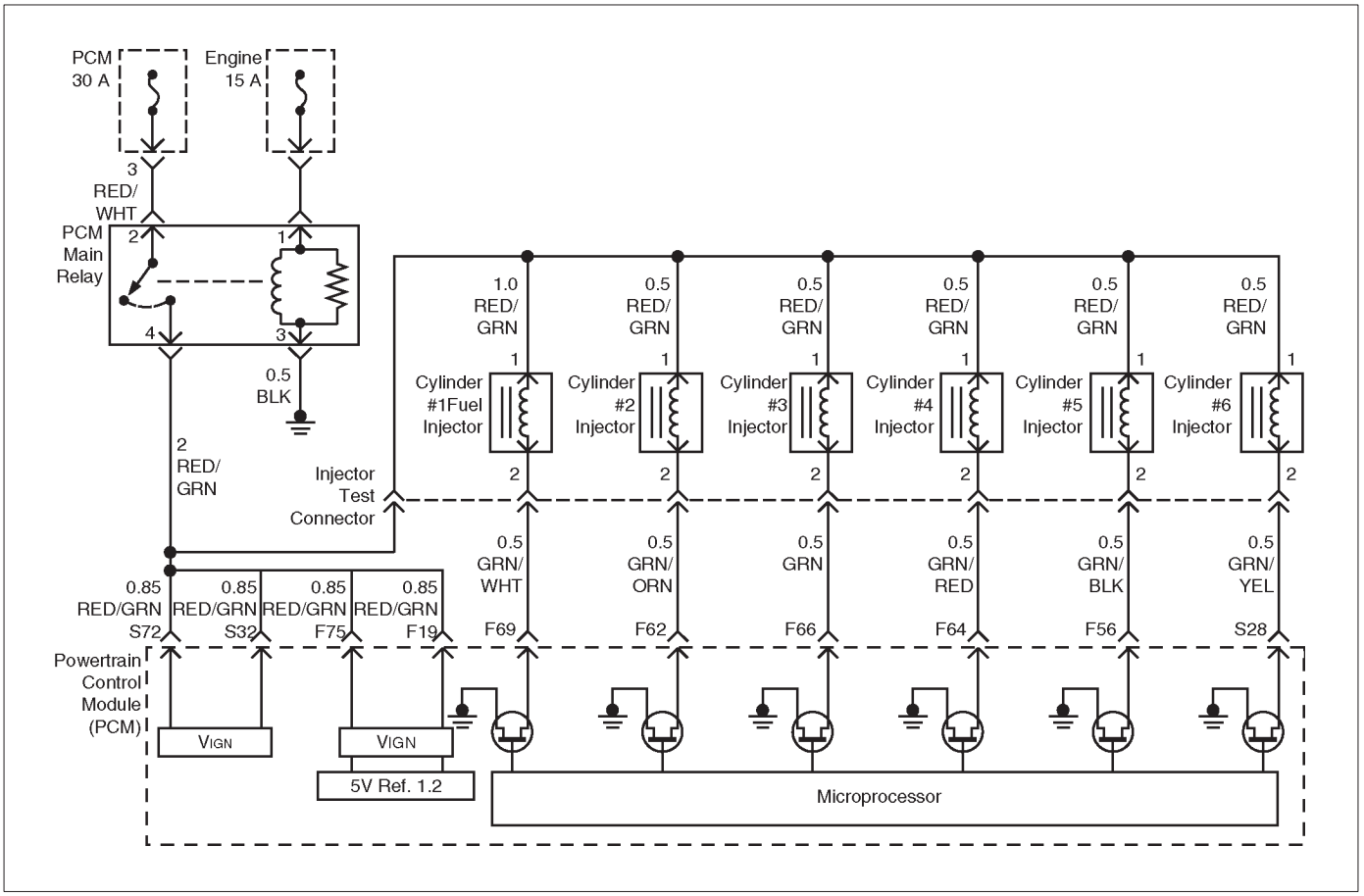
DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Turn the ignition off and physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 2. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	1. Ignition "ON", engine "OFF". 2. Monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 L.T. FUEL TRIM" and "BANK 2 S.T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*
14	1. Perform the "Fuel System Pressure Test". 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON", engine "OFF". 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*
16	Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*

DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
17	Repair the short to ground. Is the action complete?	—	Verify repair	—
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the "Injector Balance Test". 2. If the Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 2 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 2 HO2S 1, replace the contaminated sensor. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0201 Injector 1 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0201 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0201 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

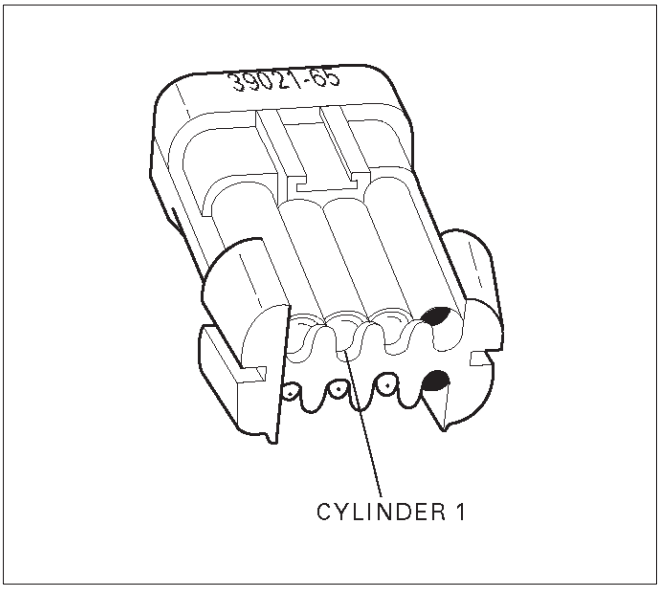
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 1 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321054

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

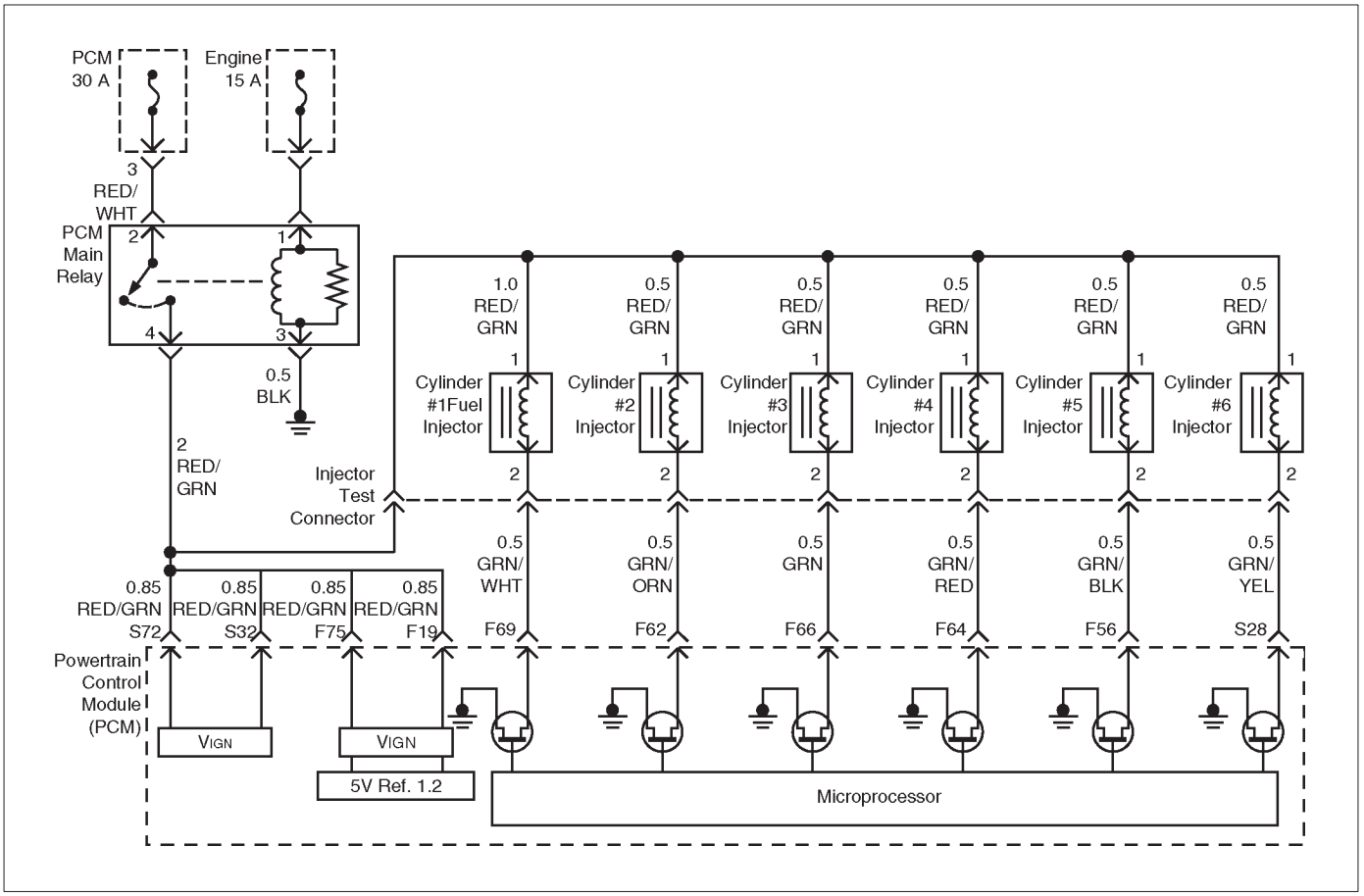
DTC P0201 – Injector 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine “OFF”. 2. Disconnect the injector connector. 3. Install an injector test light J-39021-65 on the injector test connector. 4. Crank the engine and note the light. Does the injector test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*

DTC P0201 – Injector 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 1 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 1 (green with white tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/white wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0202 Injector 2 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0202 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0202 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

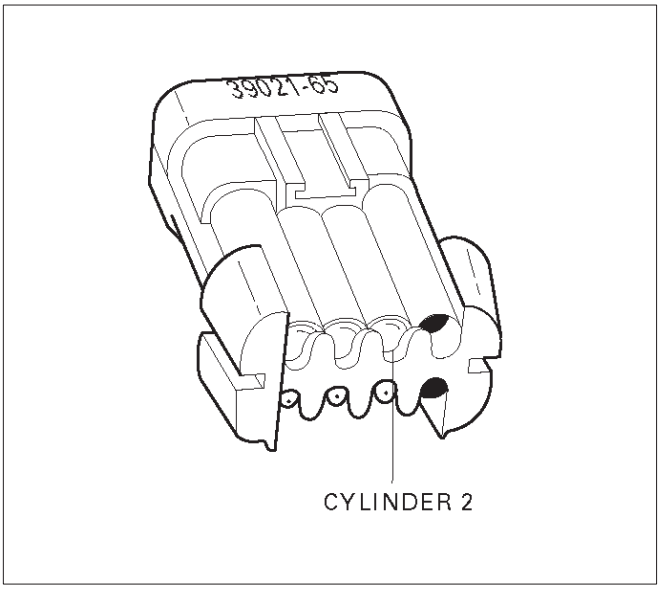
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 2 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321055

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

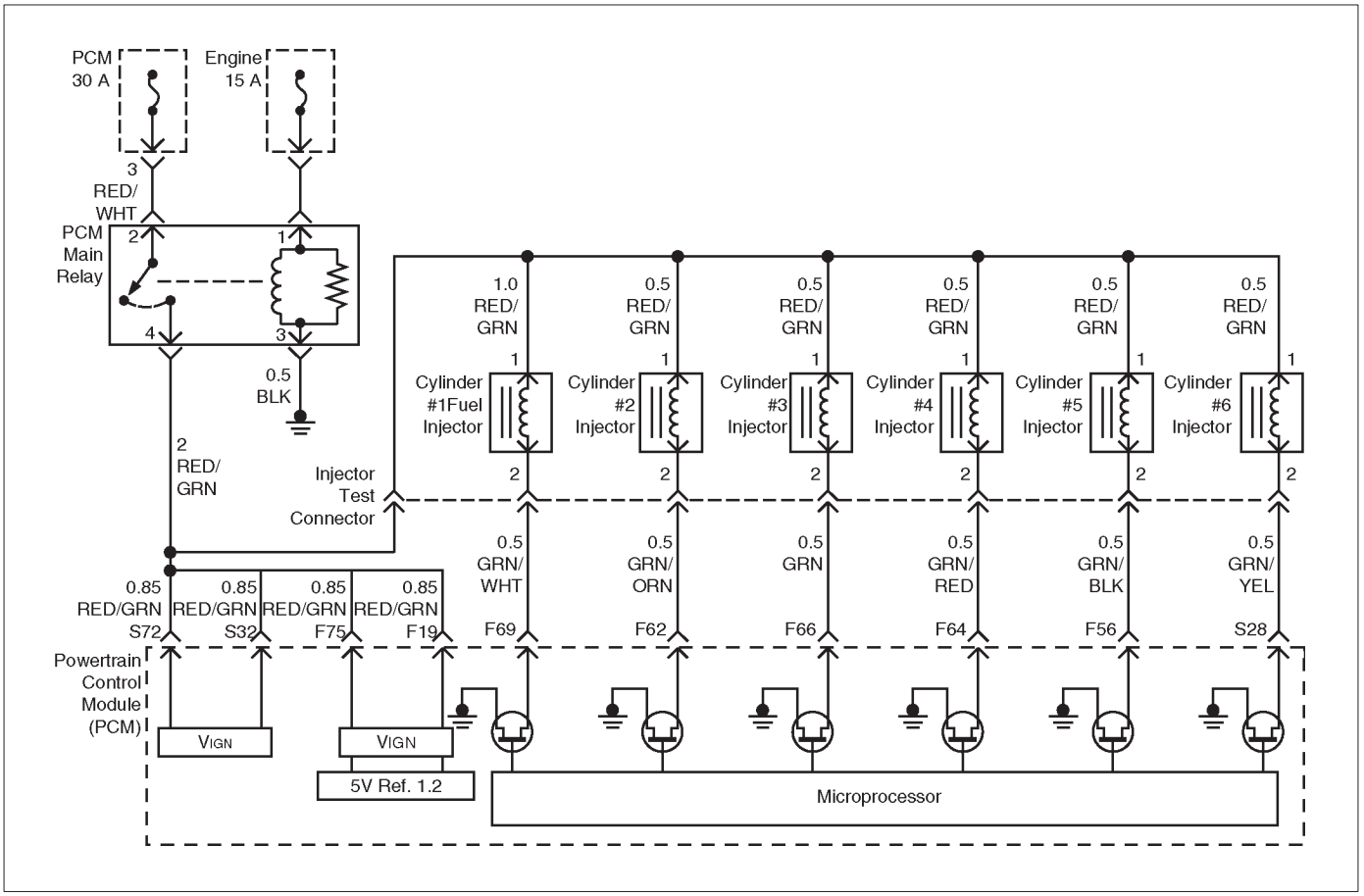
DTC P0202 – Injector 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine "OFF". 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 2 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*

DTC P0202 – Injector 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 2 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 2 (green with orange tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/orange wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0203 Injector 3 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0203 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0203 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

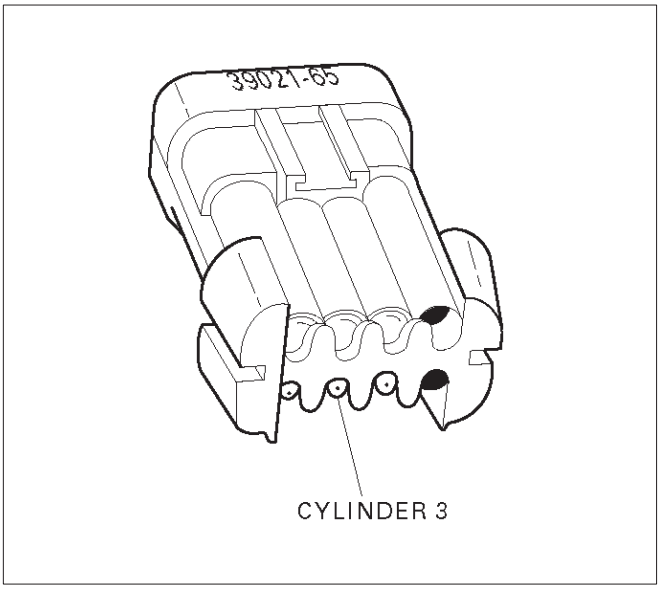
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 3 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321056

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

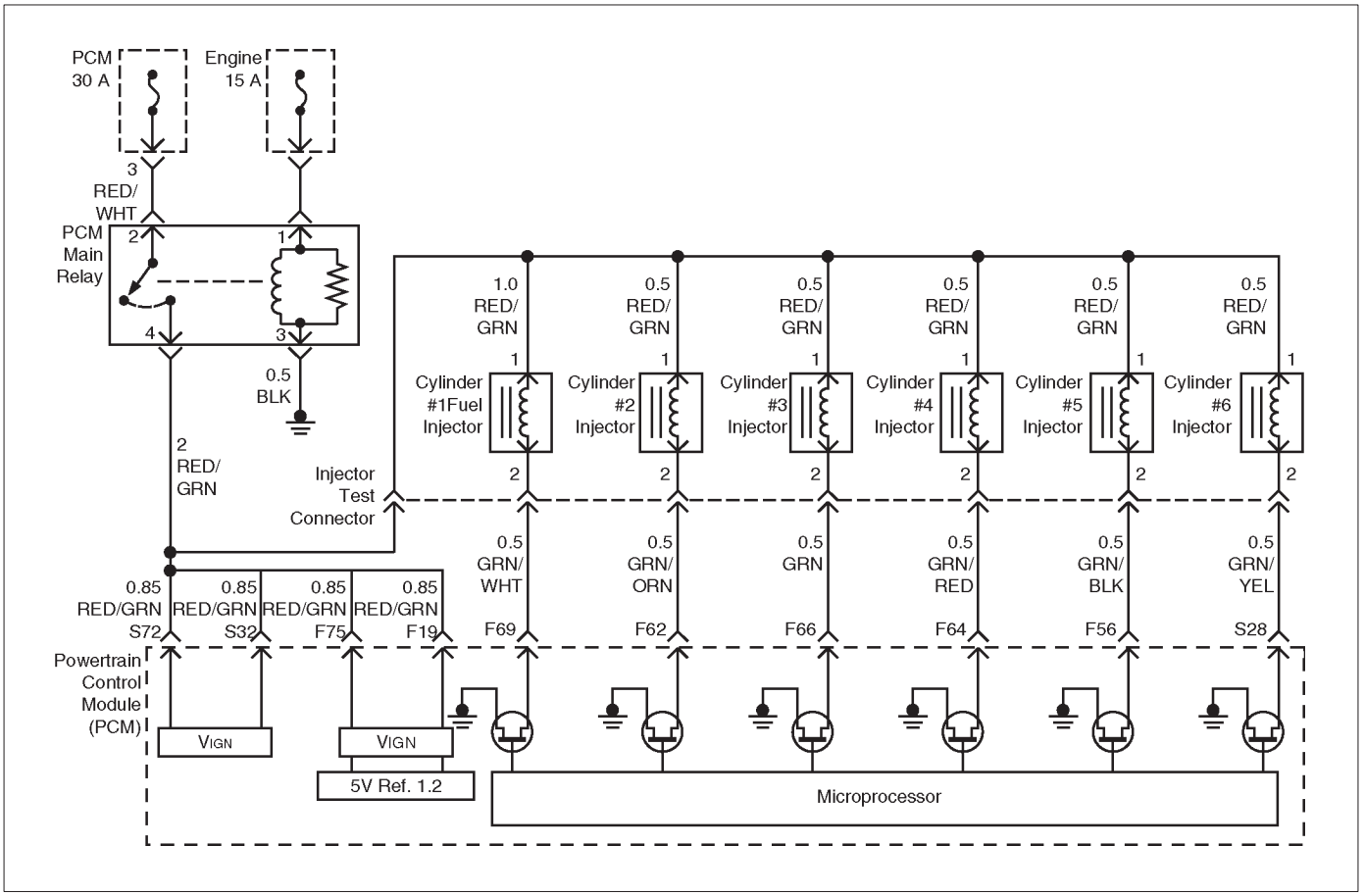
DTC P0203 – Injector 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine “OFF”. 2. Disconnect the injector test connector . 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 3 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*

DTC P0203 – Injector 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 3 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 3 (green). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0204 Injector 4 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0204 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0204 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

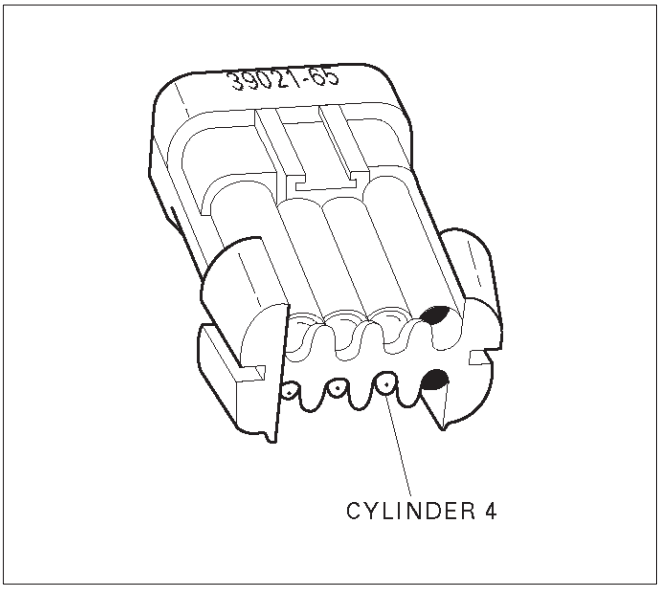
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 4 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321057

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

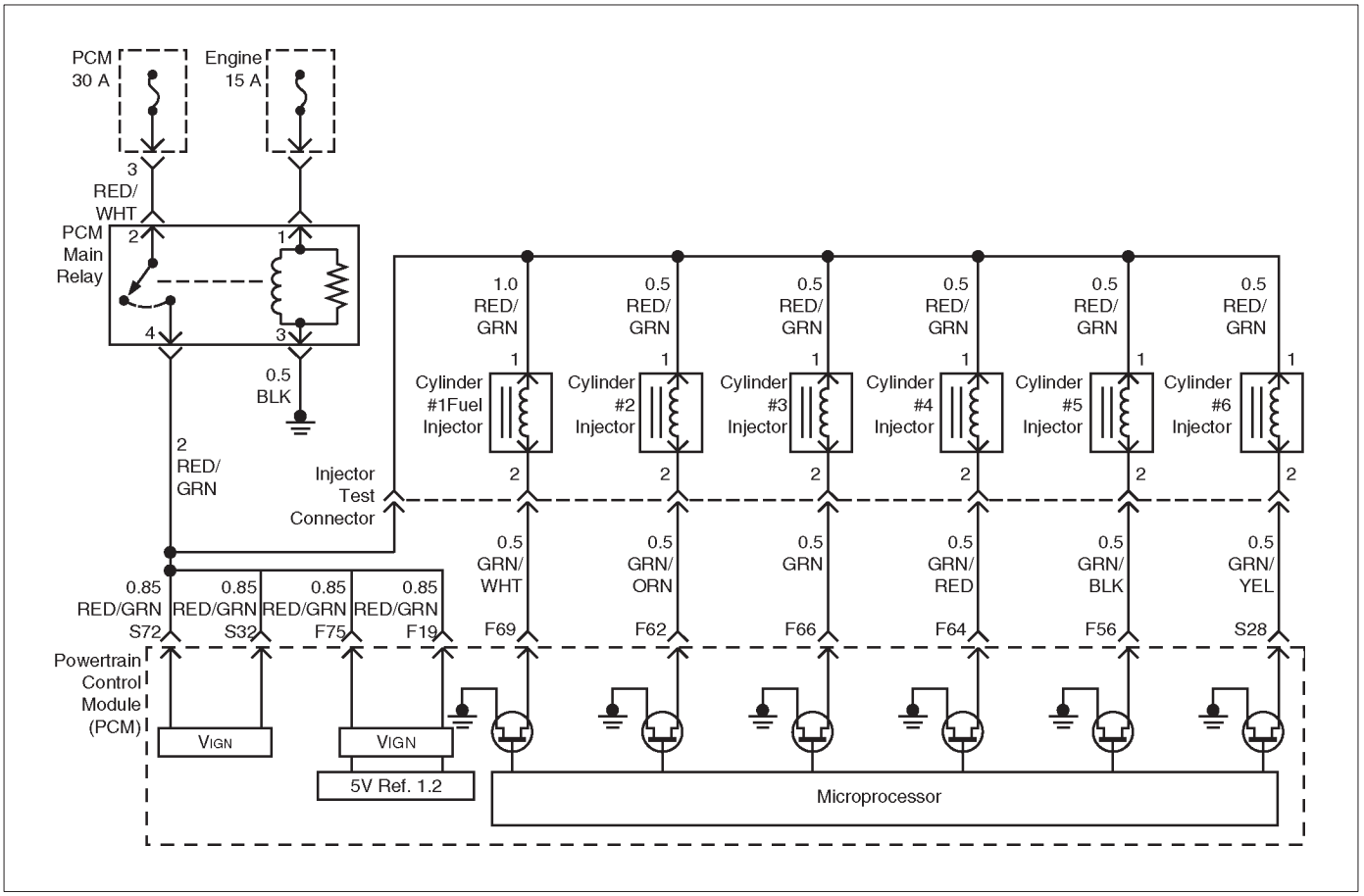
DTC P0204 – Injector 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine "OFF". 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 4 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to Step 6

DTC P0204 – Injector 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 4 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 4 (green/red). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/red wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0205 Injector 5 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0205 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0205 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0205 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

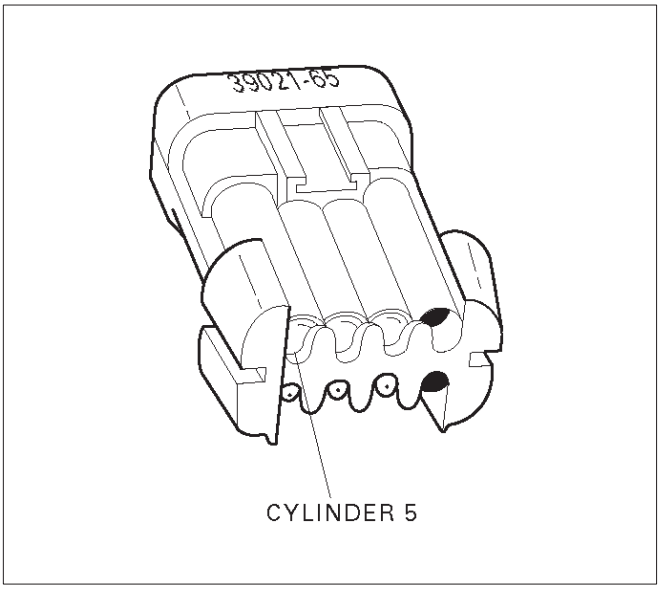
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0205 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 5 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321058

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

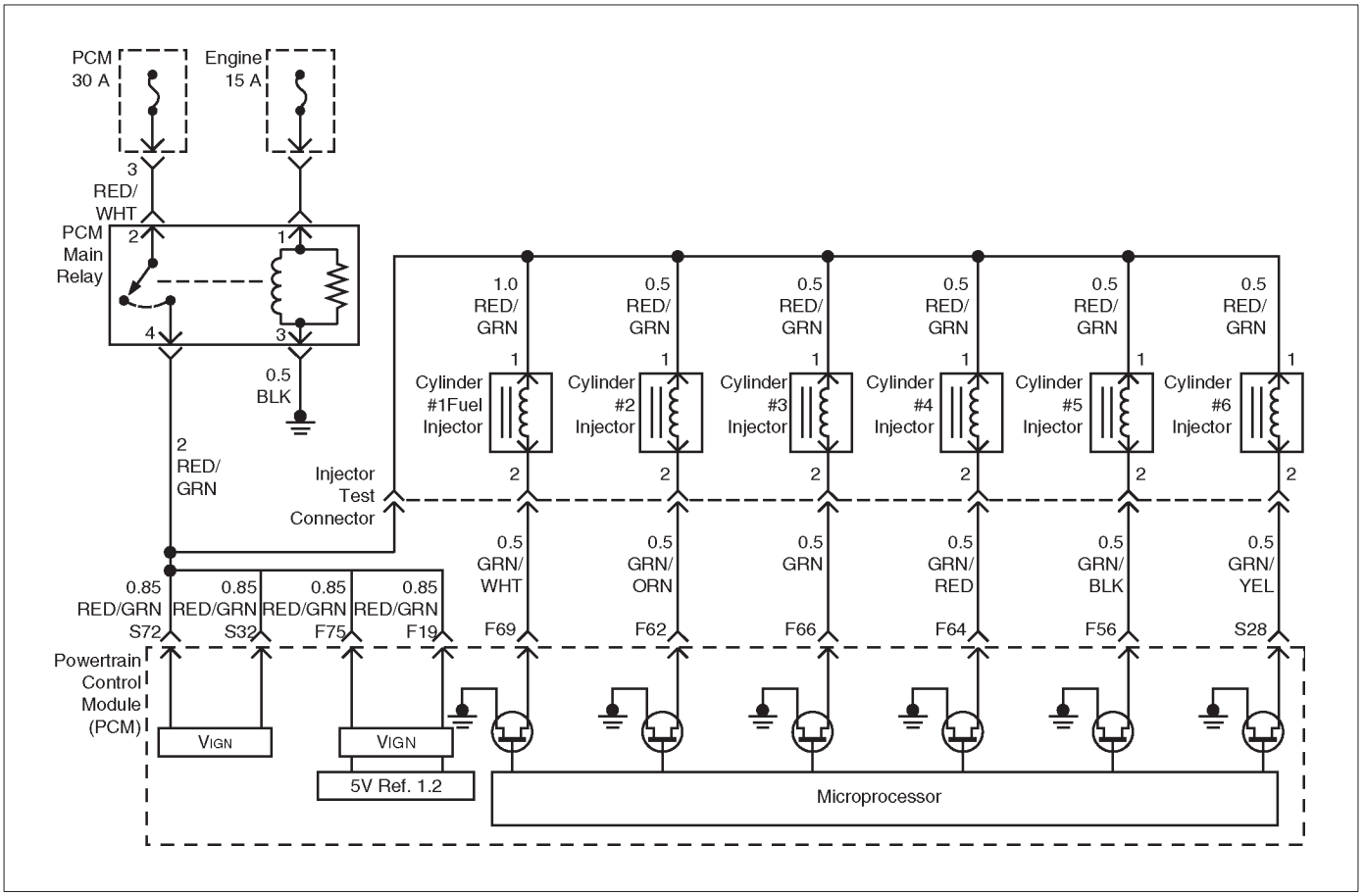
DTC P0205 – Injector 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0205 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0205 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine “OFF”. 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 5 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*

DTC P0205 – Injector 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 5 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 5 (green with black tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/black wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0206 Injector 6 Control Circuit



060R200023

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0206 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0206 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0206 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

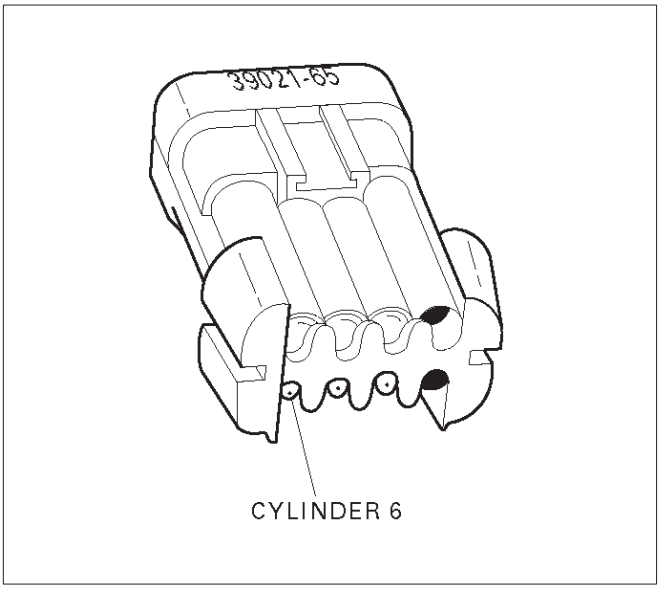
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0206 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 6 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321059

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

DTC P0206 – Injector 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0206 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0206 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. Engine “OFF”. 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 6 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*

DTC P0206 – Injector 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	Note whether the injector test light for cylinder 6 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 6 (green with yellow tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/yellow wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0300 Engine Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ION Sensing Module. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0300 will determine if a multiple cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, VSS, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine temperature sensor (ECT) indicates an engine temperature between –7˚C (20˚F) and 110˚C (230˚F).
- Throttle angle is steady and throttle changes less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will disable the TCC operation.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0300 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0300 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

The Tech 2 display “Misfire Cur. #1 through #6” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- MAF – A mass air flow (MAF) sensor output that causes the PCM to sense a lower than normal air flow will cause a lean condition.
- Air induction system – Air leaks into the induction system which bypass the MAF sensor will cause a lean condition. Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O-rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.
- Fuel quality – Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Although alcohol-enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the cold driveability of the engine. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall when changes by the refineries may not coincide with changes in the weather.
- Vehicle marshalling – The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL with a P0300 Misfire DTC.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0300 – Engine Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder. Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 4*
4	1. Visually and physically inspect the following areas for vacuum leaks: ▼ The intake manifold ▼ The injector O-rings ▼ The EGR adapter ▼ The EGR feed pipes ▼ ION Sensing Module 2. If a problem is found, repair the vacuum leak as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 5*
5	1. Visually and physically inspect the crankcase ventilation valve for improper installation or damaged grommet. 2. If a problem is found, repair as necessary (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem?	—	Verify repair	Go to *Step 6*
6	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects that may partially block the air flow sample through the MAF sensor. 2. If a problem is found, repair or replace the MAF sensor as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 7*
7	1. Remove the EGR valve and visually/physically inspect the valve to ensure that the pintle is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely. 2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 8*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Install a spark tester at the spark plug end of the ignition coil for a cylinder that indicated a misfire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 14*	Go to *Step 9*
9	1. Remove and visually/physically inspect the ignition coil(s) associated with the cylinders that were indicated as misfiring. Ensure that the coil(s) are free of cracks. 2. If a problem is found, replace the damaged ignition coil(s) as necessary. Did any ignition coils require replacement?	—	Verify repair	Go to *Step 10*
10	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to *Engine Mechanical Diagnosis*	Go to *Step 11*
11	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S.T. FUEL TRIM" display on the Tech 2. Do both values decrease below the specified values?	"BANK 1 L.T. FUEL TRIM" below +20%; "BANK 1 S.T. FUEL TRIM" below +50%	Go to *Step 13*	Replace the ignition coil of the affected cylinder
13	Replace the ignition coil control module. Is the action complete?	—	Verify repair	—
14	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to *Step 15*
15	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to *Engine Fuel or Fuel Metering System*). Was a fuel system problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to *Diagnosis* in *Engine Fuel* for procedure). 2. If a problem is found, correct the contaminated fuel condition as necessary. Was the fuel contaminated?	—	Verify repair	Go to *Step 17*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Perform the "Injector Coil/Balance Test". 2. If a problem is found, replace faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 18*
18	1. Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ Incorrect valve timing ▼ A leaking head gasket ▼ A loose or broken motor mount 2. If a problem is found, repair as necessary. Was a basic engine mechanical problem found and repaired?	—	Verify repair	Go to *Step 19*
19	1. Check for a transmission TCC problem. Refer to *4L30-E Automatic Transmission Diagnosis*. 2. If a problem is found, repair the transmission as necessary. Refer to *4L30-E Automatic Transmission Unit Repair*. Was a transmission problem found and repaired?	—	Verify repair	Go to *Step 20*
20	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0301 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0301 will determine if the No.1 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0301 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0301 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0301 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #1” on the Tech 2. Is “Misfire Cur. #1” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #1” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #1” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #1 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0301 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #1. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #1 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0302 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0302 will determine if the No.2 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0302 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0302 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0302 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #2” on the Tech 2. Is “Misfire Cur. #2” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #2” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #2” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #2 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0302 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #2. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #2 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0303 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0303 will determine if the No.3 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0303 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0303 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector — Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0303 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #3” on the Tech 2. Is “Misfire Cur. #3” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #3” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #3” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #3 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0303 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #3. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #3 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0304 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0304 will determine if the No.4 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0304 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0304 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0304 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #4” on the Tech 2. Is “Misfire Cur. #4” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #4” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #4” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #4 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0304 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #4. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #4 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0305 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0305 will determine if the No.5 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor,vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0305 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0305 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0305 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #5” on the Tech 2. Is “Misfire Cur. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #5” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #5 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0305 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #5. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #5 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0306 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0306 will determine if the No.6 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0306 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0306 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

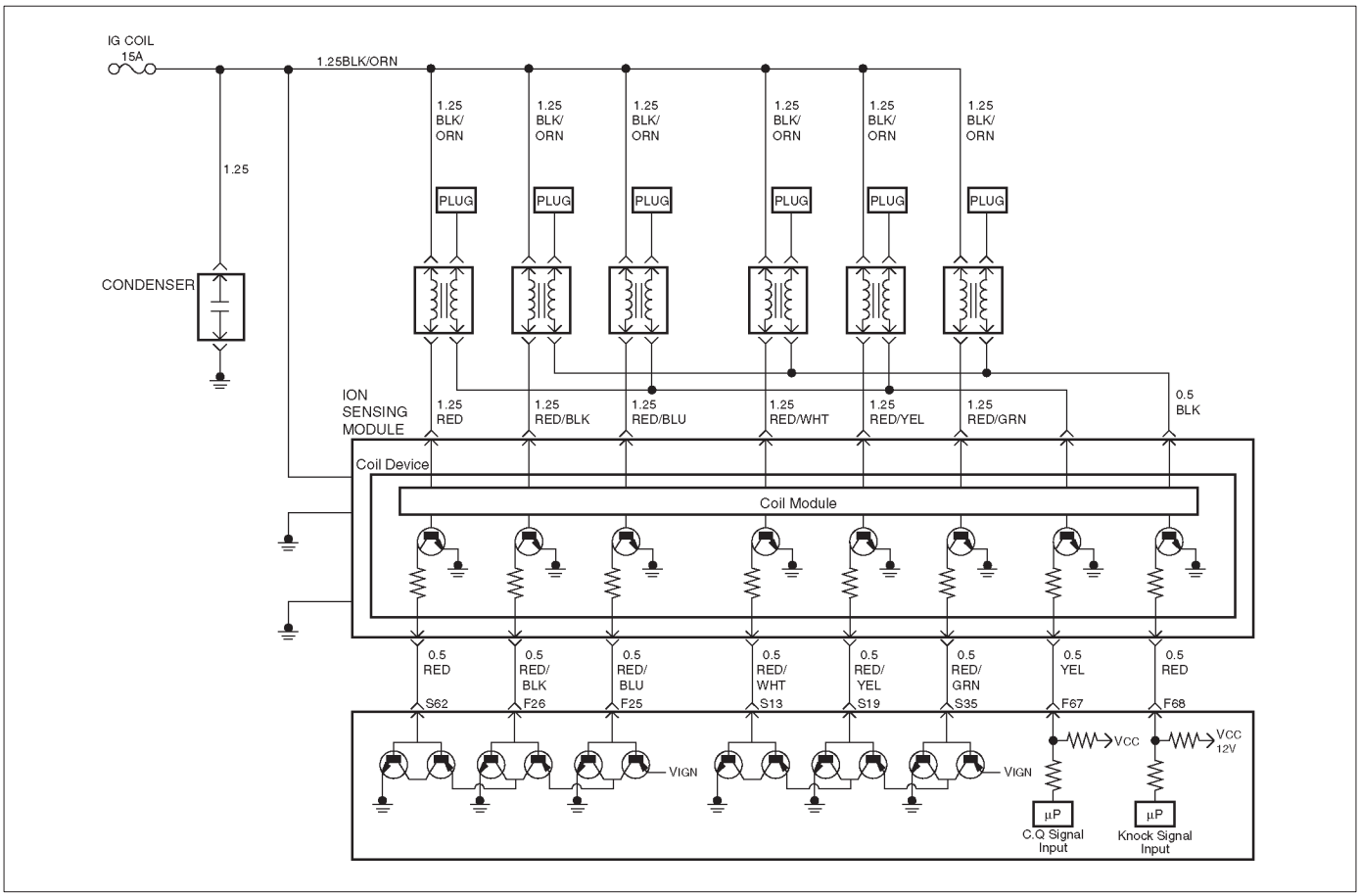
DTC P0306 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #6” on the Tech 2. Is “Misfire Cur. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #6” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #6 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0306 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #6. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #6 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test". 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the intake manifold and the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: ▼ A faulty or incorrect camshaft ▼ Leaking or sticky valves or rings ▼ Excessive valve deposits ▼ Weak valve springs ▼ A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0325
ION Sensing Module/ION Sensing Knock Intensity Circuit Fault



060R200055

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evacuate the Knock Intensity (KI) signal pulse width if it is within a predetermined range. If the KI signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the KI line circuit, ION module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No EST DTCs set.
- No Misfire DTCs set.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0325 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0325 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM- Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage.

If the harness appears to be OK, observe the Knock Present, Knock Sensor Noise Channel display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P0325 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0325 Diagnostic Chart may isolate the cause of the fault.

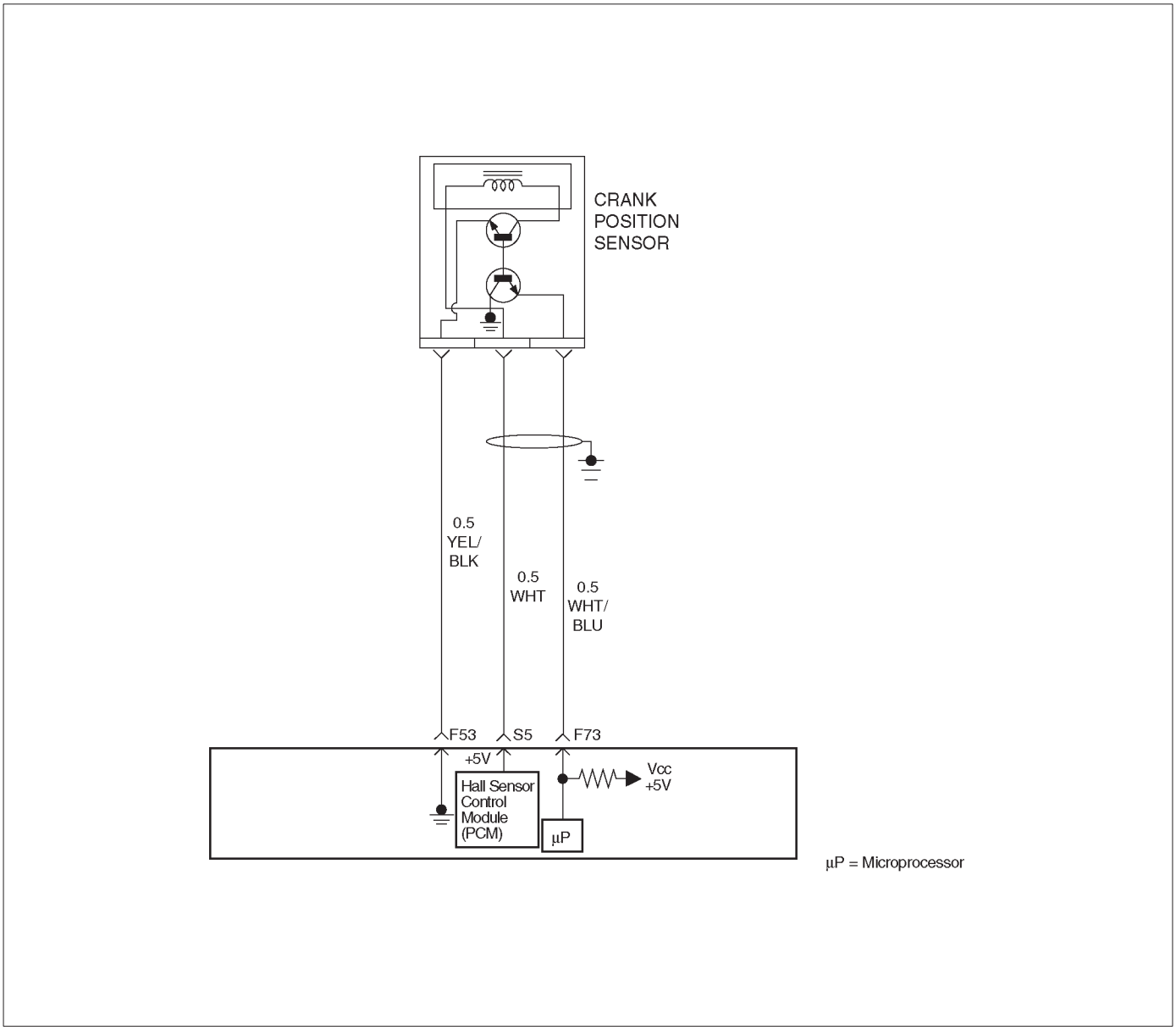
DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0325. Does the Tech 2 indicate DTC P0325 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF”. 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	—
4	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	—
6	Check the ION sensing harness for open or short circuit between the ignition coil and ION sensing module circuit at the harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Repair wiring harness. Is the action complete?	—	Verify repair	Go to *Step 11*

DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not .And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0336 58X Reference Signal Circuit



060R200066

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit. If the PCM receives an incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0336 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

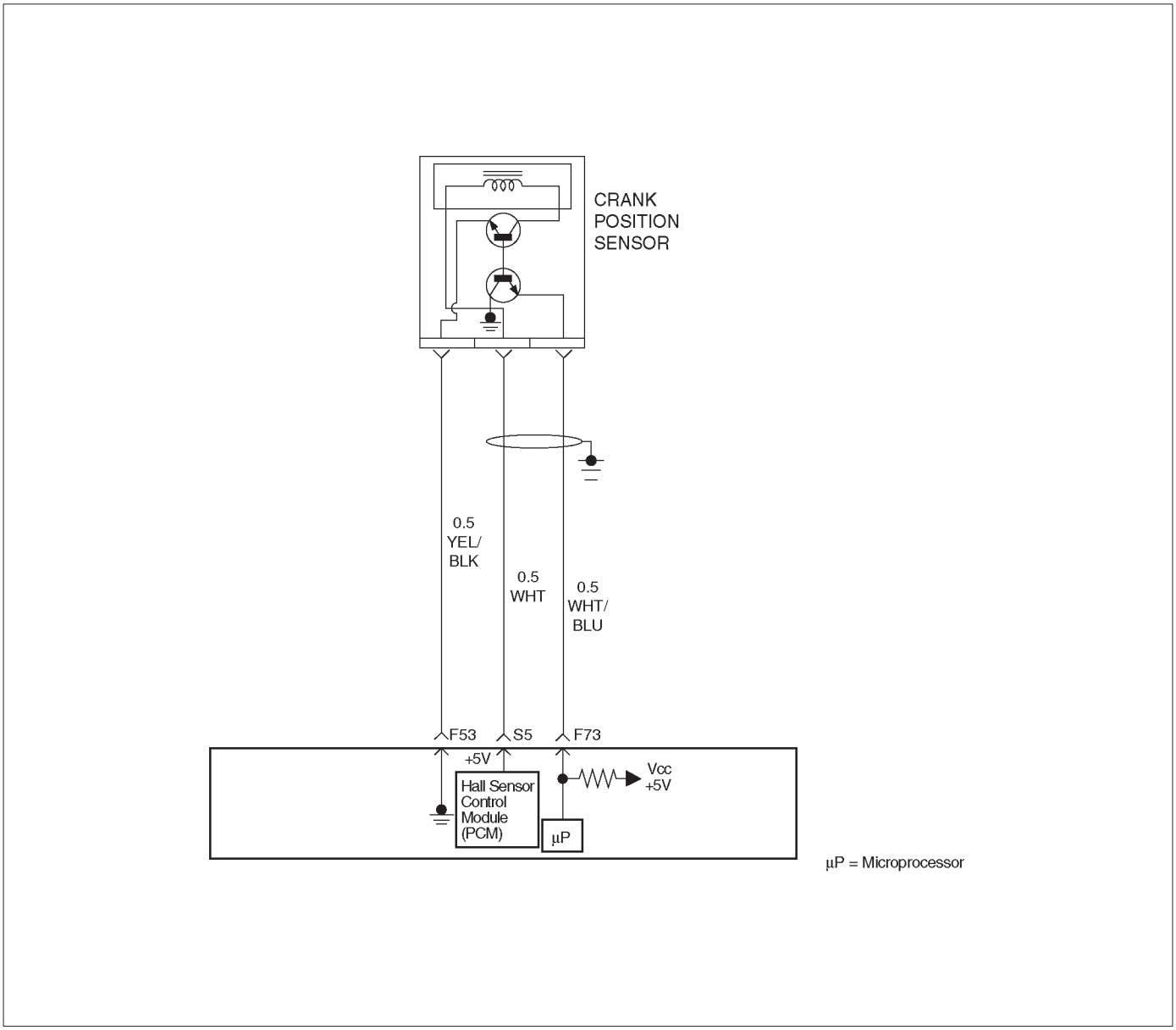
- Poor connection - Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Reference Signal Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *"Engine Cranks But Will Not Run"* chart
3	1. Review and record Failure Records information. 2. Clear DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0336 set?	—	Go to *Step 4*	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 8*	Go to *Step 6*
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	Replace the CKP sensor. Use caution to avoid any hot oil that may drip out. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0337 CKP Sensor Circuit Low Frequency



060R200066

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit. If the PCM does not receive pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 8 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0337 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0337 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

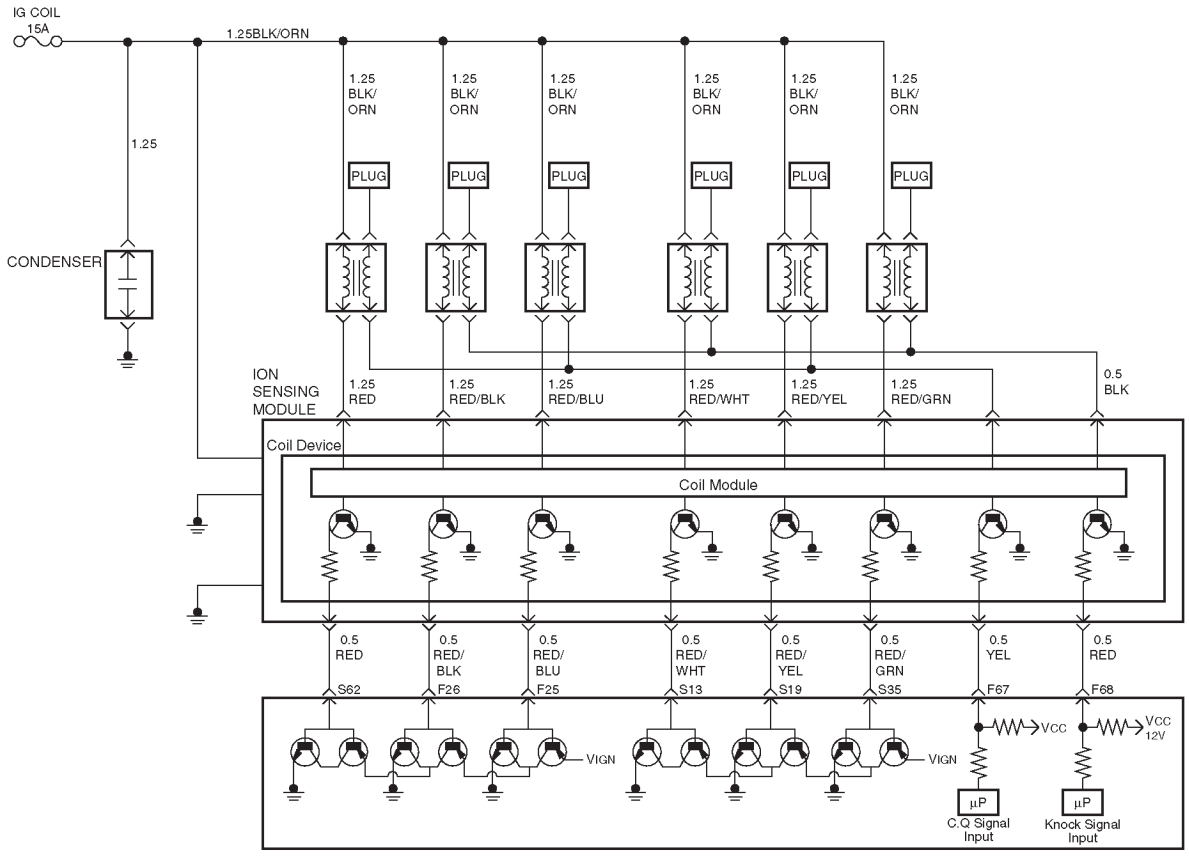
DTC P0337 – CKP Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Chart 3*
3	1. Review and record Failure Records information. 2. Clear DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0337 set?	—	Go to *Step 4*	Refer to *Diagnostic Aid*
4	1. Disconnect the CKP sensor. 2. Ignition "ON". 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 4-6 volts and ground available at the sensor?	—	Go to *Step 7*	Go to *Step 5*
5	1. Ignition "ON". 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to *Step 6*	Go to *Step 11*
6	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
7	1. Ignition "OFF". 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 11*	Go to *Step 9*
9	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*

DTC P0337 – CKP Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the CKP sensor. Use caution and avoid hot oil that may drip out. Is the action complete?	—	Verify repair	—
11	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0351 Ignition 1 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 1, it will set a DTC P0351.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0351 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

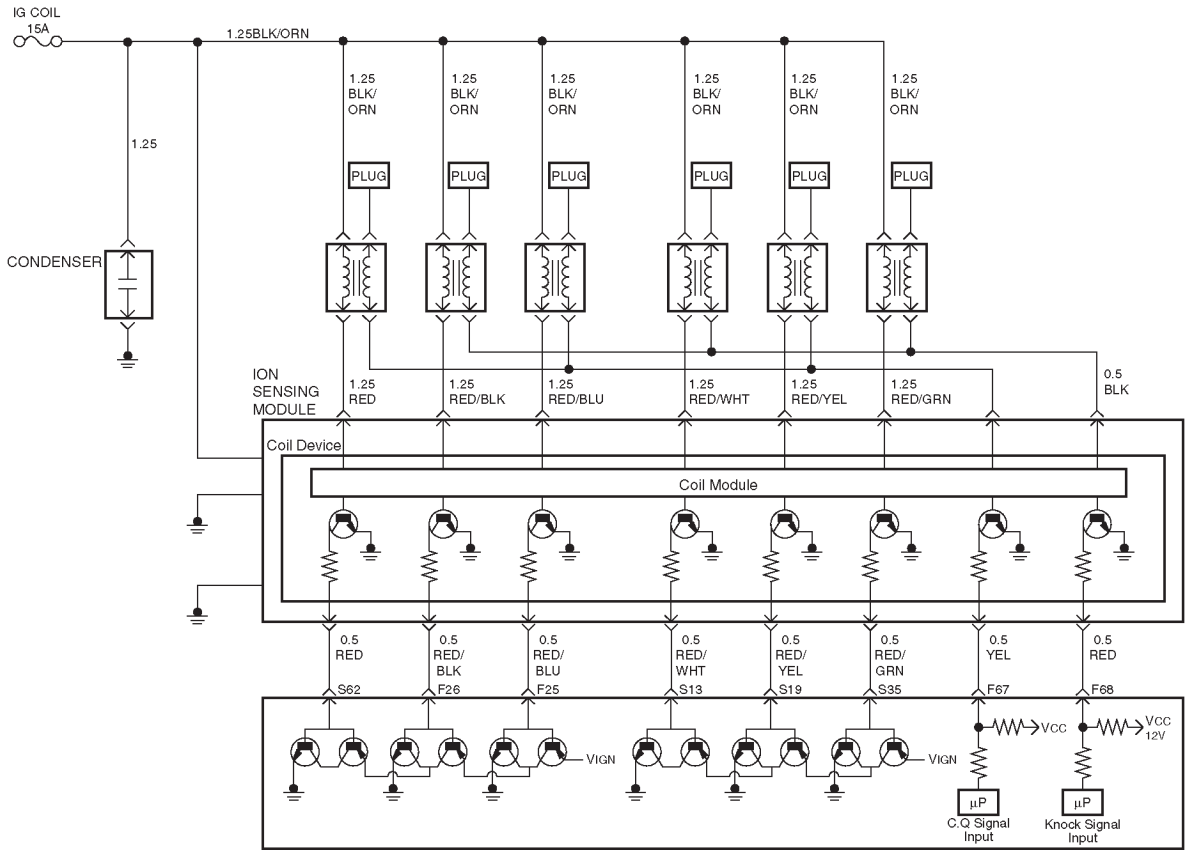
DTC P0351 – Ignition 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0351 until the DTC P0351 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0351 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 1 at the ION Sensing Module with a DVM. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin and connector at the ignition coil. 3. Check ignition control circuit 1 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 1 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 1 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0351 – Ignition 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0352 Ignition 2 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 2, it will set a DTC P0352.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58 X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0352 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0352 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

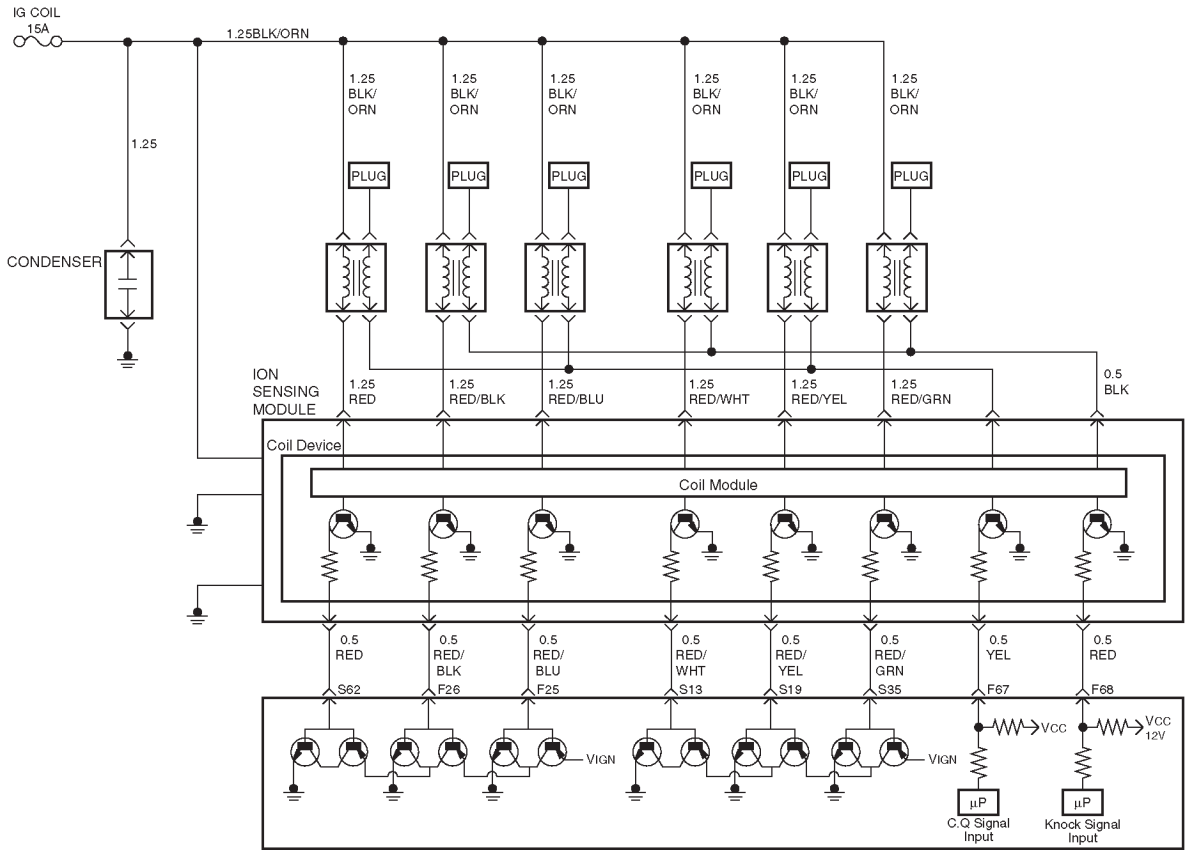
DTC P0352 – Ignition 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0352 until the DTC P0352 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0352 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 2 at the ION Sensing Module with a DVM . Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 2 voltage at the ignition coil connector while cranking the engine connector. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 2 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 2 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0352 – Ignition 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 2. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0353 Ignition 3 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 3, it will set a DTC P0353.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0353 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0353 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0353 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

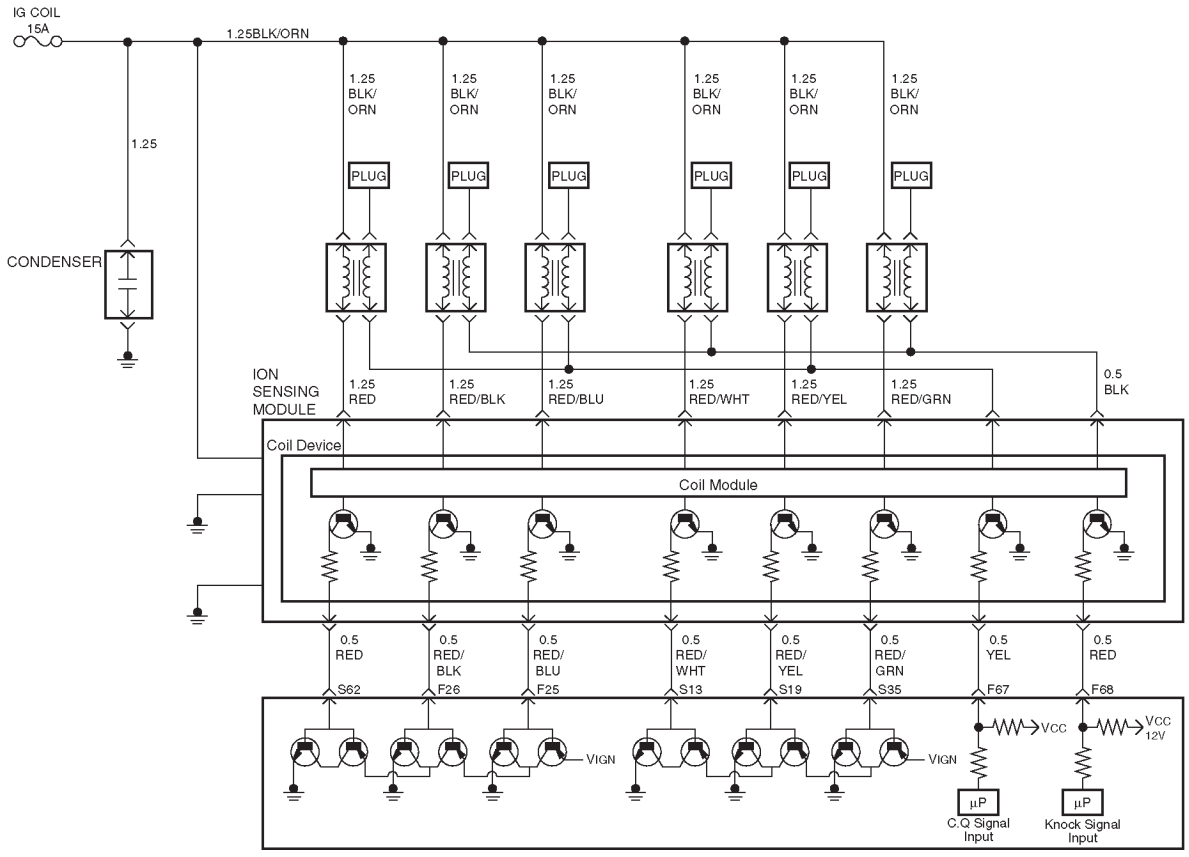
DTC P0353 – Ignition 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0353 until the DTC P0353 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0353 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 3 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 3 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 3 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 3 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0353 – Ignition 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 3. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0354 Ignition 4 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 4, it will set a DTC P0354.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0354 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0354 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0354 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

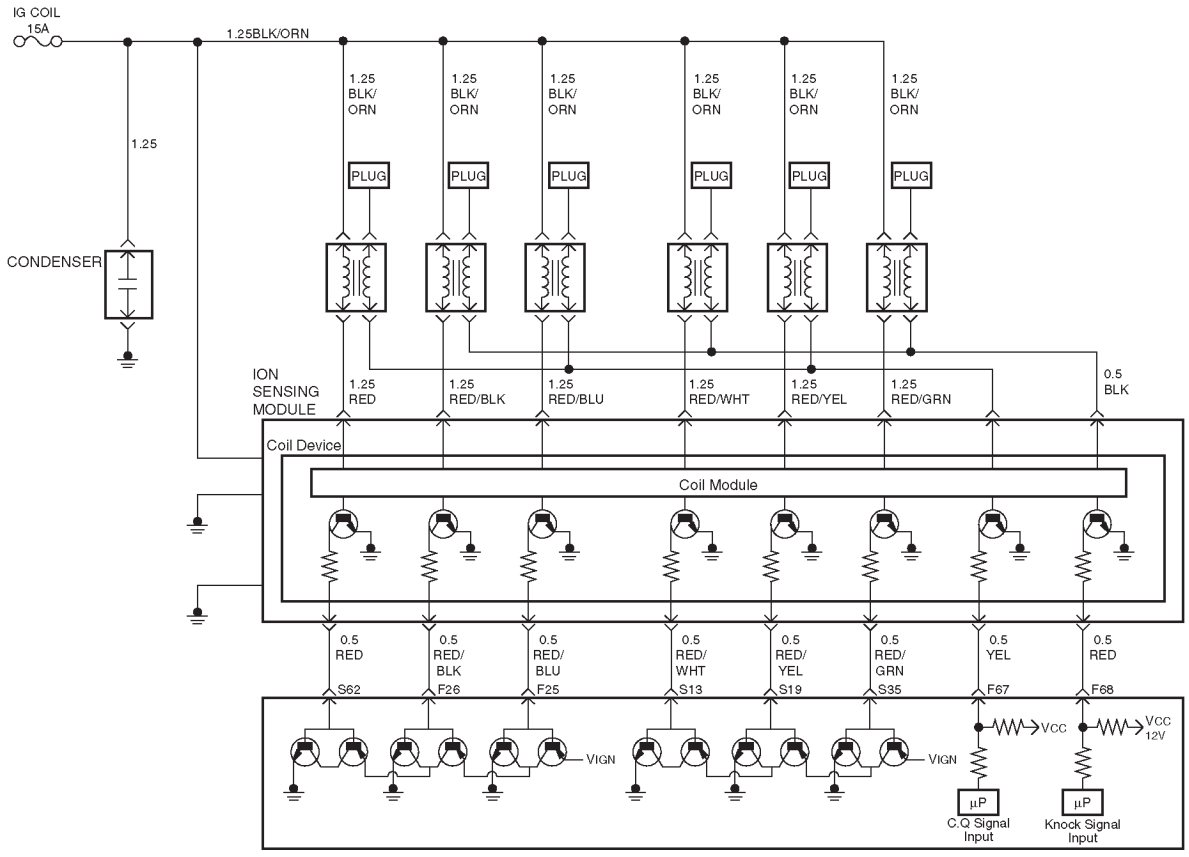
DTC P0354 – Ignition 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0354 until the DTC P0354 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0354 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 4 at the ION Sensing with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 4 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 4 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 4 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0354 – Ignition 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 4. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open in ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0355 Ignition 5 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST in control circuit 5, it will set a DTC P0355.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0355 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0355 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0355 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

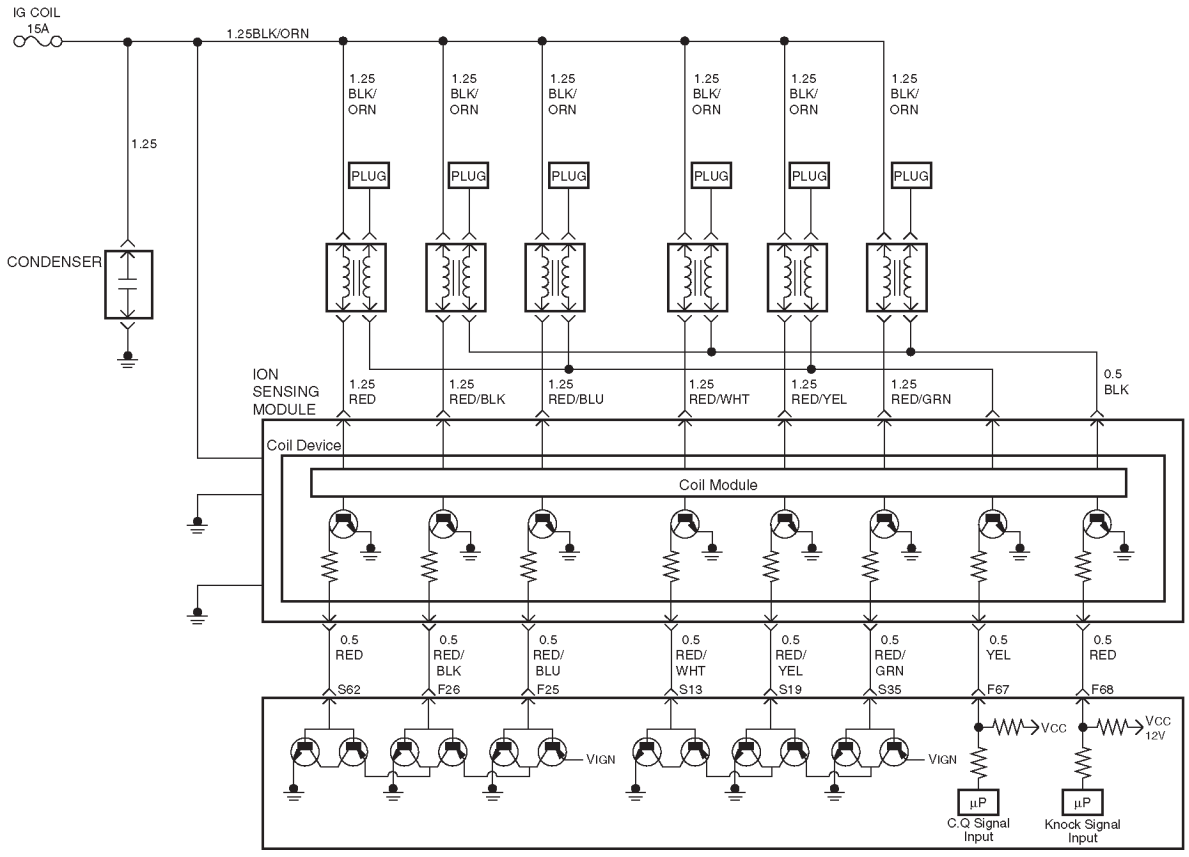
DTC P0355 – Ignition 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0355 until the DTC P0355 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0355 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 5 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 5 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 5 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 5 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0355 – Ignition 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 5. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0356 Ignition 6 Control Circuit



060R200055

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 6, it will set a DTC P0356.

Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0356 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0356 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0356 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

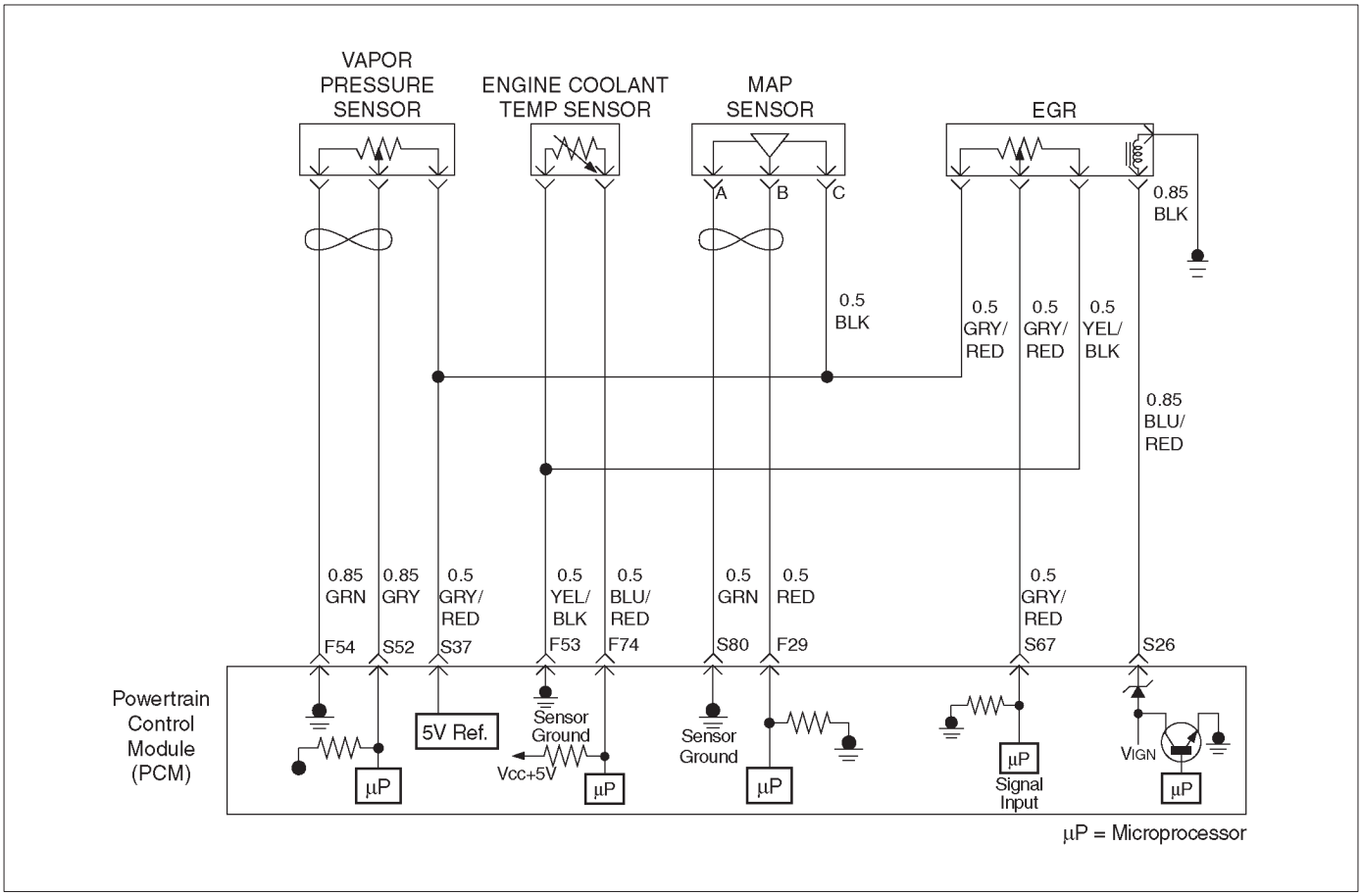
DTC P0356 – Ignition 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0356 until the DTC P0356 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0356 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON", engine "OFF". 2. Back probe the ignition control circuit 6 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON", engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF". 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 6 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF". 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 6 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 6 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0356 – Ignition 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 6. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0401 EGR Flow Insufficient



060R200050

Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 “Clear Info” or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test.

Conditions for Setting the DTC

- No TP sensor, vehicle speed sensor (VSS), MAP sensor, IAT sensor, IAC, EGR Pintle Position sensor, ECT sensor, misfire, or automatic transmission DTCs set.
- Engine coolant temperature is greater than 60˚C (140˚F).
- Ignition voltage between 11.5 and 16 volts.
- Vehicle speed is greater than 24 km/h (15 mph).
- A/C clutch status is unchanged.
- TCC status is unchanged.

Start Test

- TP angle is less than 0.8%.
- EGR duty cycle is less than 1%.
- MAP is steady, changing less than 2 kPa.
- Engine speed is between 1100 RPM and 2000 RPM (M/T).
- MAP between 10 kPa and 40 kPa.
- Engine speed is between 900 RPM and 1500 rpm (A/T).

  The test will be aborted if the vehicle speed changes by more than 16 km/h (10 mph), engine speed changes by more than 100 RPM or the EGR is opened less than 95% of commanded position.
- The PCM will only run the EGR test during a closed throttle condition.
- The PCM will only run the EGR test at vehicle speeds above 24 km/h (15 mph).
- Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See *On-Vehicle Service*.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

Test Description

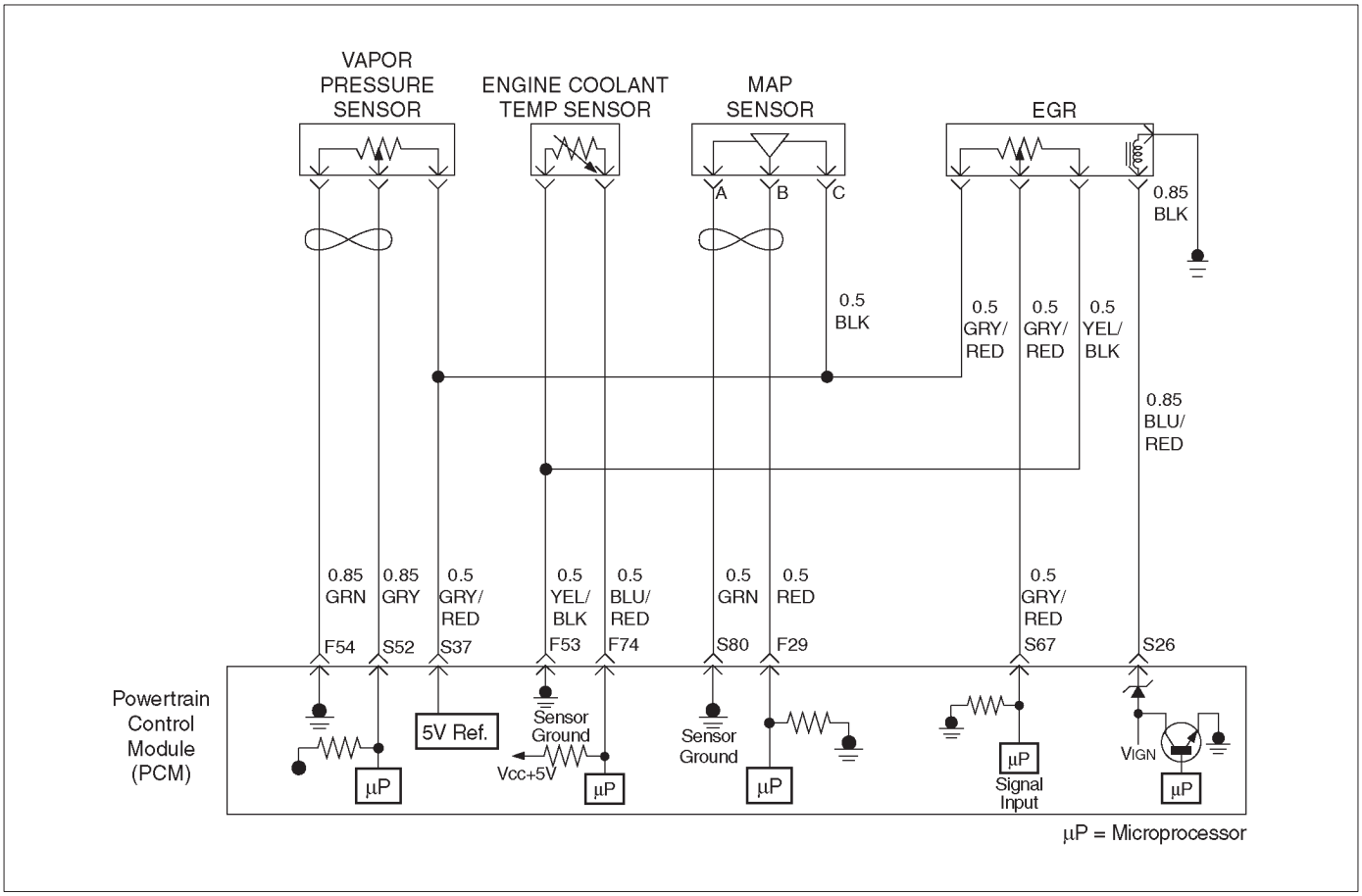
Number(s) below refer to the step number(s) on the Diagnostic Chart

3. A malfunctioning MAP sensor can set an EGR DTC. The MAP sensor could send a constant signal which is not low enough to set a low MAP DTC. The constant signal from the MAP sensor also may not be high enough to set a high MAP DTC. This step verifies that the MAP sensor is responding.

DTC P0401 – EGR Flow Insufficient

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P1404 also set?	—	Go to *DTC 1404*	Go to *Step 3*
3	1. Start the engine. 2. Monitor the MAP signal with a Tech 2 while idling. 3. While idling, jab the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the Tech 2 show an immediate large change?	—	Go to *Step 5*	Go to *Step 4*
4	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
5	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem is found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 7*
7	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Refer to *Diagnostic Aids*
8	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC and monitor the Tech 2 System Info Screen while operating the vehicle as specified in "Diagnostic Aids". 3. Using a Tech 2, monitor "DTC" info for DTC P0401 until the DTC P0401 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0401 failed this ignition?	—	—	Repair complete

Diagnostic Trouble Code (DTC) P0402 EGR Pintle Crank Error



060R200050

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is stuck open. If the PCM detects a pintle position signal indicates more than 21.5% and more than for 625 msec during cranking, the PCM will set DTC P0402.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- At Engine revolution less than 600 RPM, EGR pintle position indicates more than 21.0% and more than for 625 msecs.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0402 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

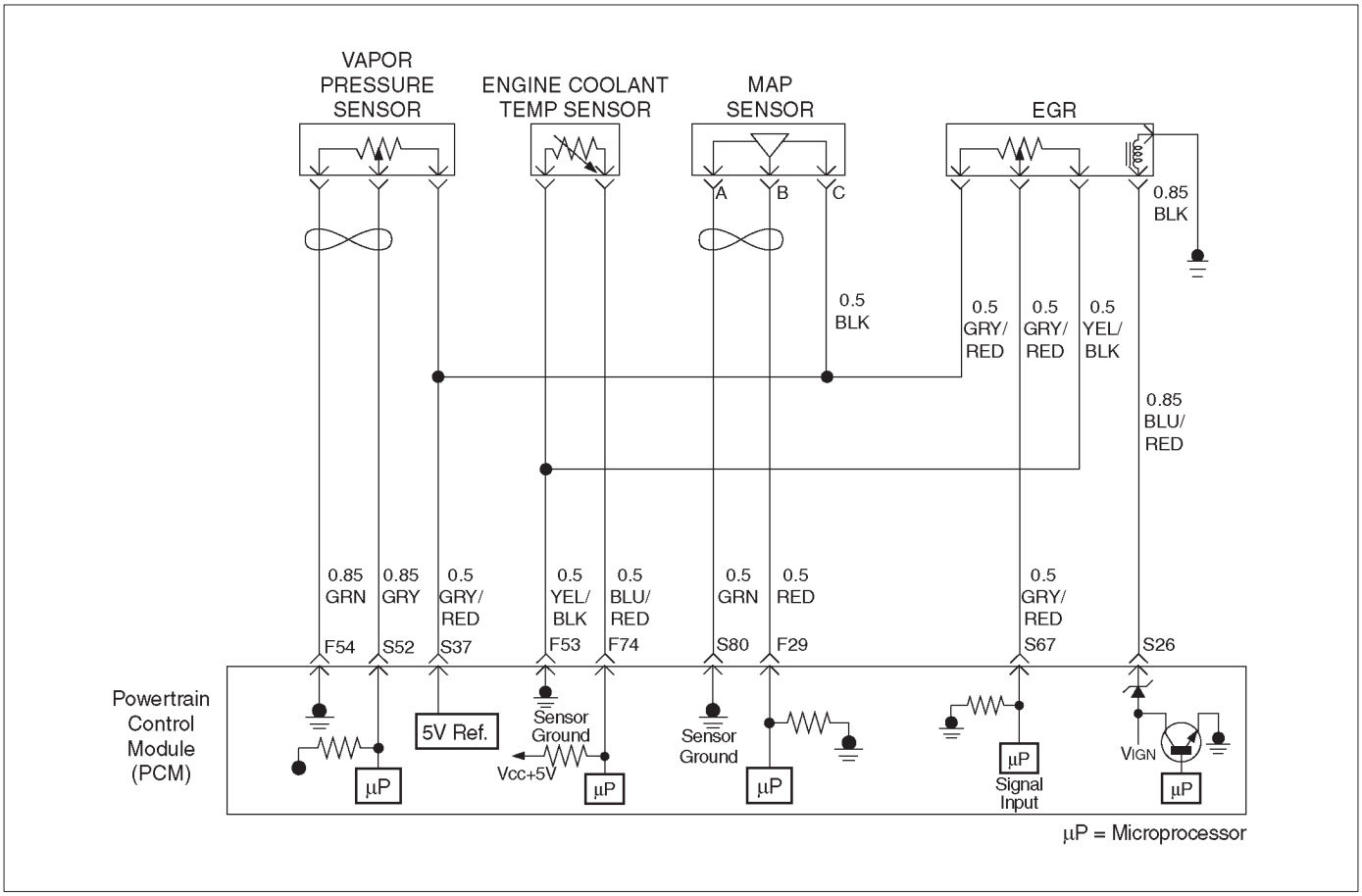
- Foreign material on EGR valve between pintle and seat may cause EGR stuck open. Inspect foreign material in EGR valve.
- Excessive carbon deposit may cause unsmooth operation of EGR valve shaft. Inspect for carbon deposit and clean up inside of carbon deposit.
- Poor connection or damaged harness–inspect the wiring harness for damage If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

DTC P0402 – EGR Pintle Crank Open Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0402 until the DTC P0402 test runs. Note the result. Does the Tech 2 indicates DTC P0402 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any foreign material between seat and pintle. Was any foreign material in EGR valve?	—	Go to *Step 6*	Go to *Step 7*
6	1. Remove EGR valve foreign material from EGR valve and clean up inside. 2. Visually inspect for damage of pintle and seat, which leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 7*	Verify repair Go to *Step 8*
7	1. Reconnect. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Run the engine at idle. 5. On Tech-II, select special function for EGR. 6. Use the “UP” arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0402 still fail “DTC” test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0404 EGR Open Stuck



060R200050

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is different from commanded position. If the PCM detects a pintle position signal indicates more than 15 points different between current and commanded and more than 15 seconds, the PCM will set DTC P0404.

Conditions for Setting the DTC

- The engine is running.
- Ignition voltage is between 11 and 16 volts.
- Intake Air Temp is more than 3˚C (37.4˚F).
- Desire EGR position is less than 3%.
- The difference between desired EGR and current EGR is less than 3%.
- Difference EGR pintle position between current and commanded position becomes more than 15% and last more than 15 seconds, and this condition meets three times in a trip. Then it trigger, the PCM lights on.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

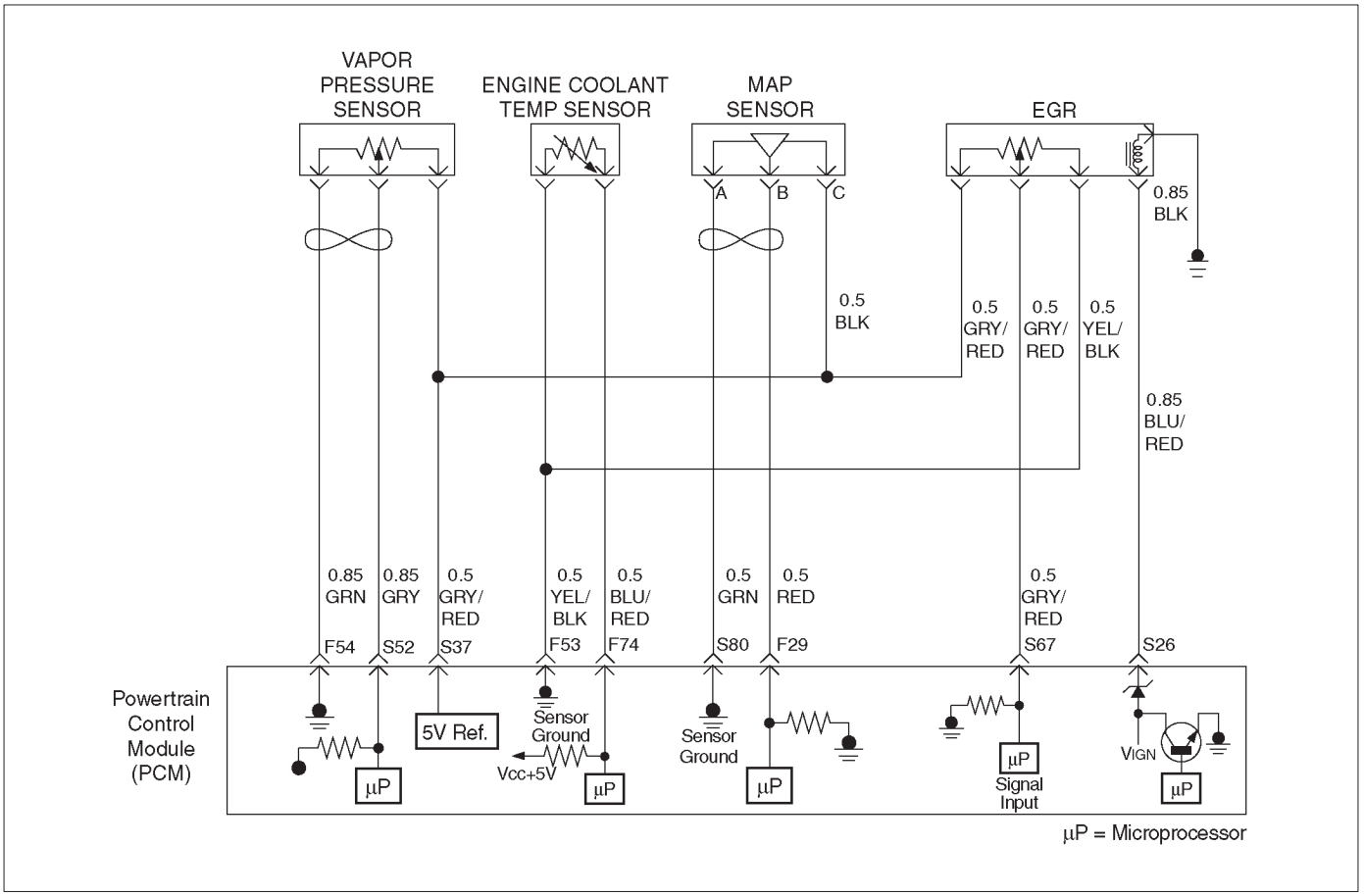
Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft may cause EGR stuck open or unsmooth operation. Those carbon deposit may occur by unusual port operation. Clean up carbon may make smooth function of EGR valve.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

DTC P0404 – EGR Open Stuck

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0404 until the DTC P0404 test runs. Note the result. Does the Tech 2 indicates DTC P0404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal.	—	Verify repair	Is the action complete?
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft. Was excessive carbon deposit on EGR valve shaft?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Visually inspect damage of pintle and seat if is bent, leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 8*	Verify repair Go to *Step 7*
7	1. Reconnect. 2. Ignition "OFF". 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0404 still fail "DTC" test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0405 EGR Low Voltage



060R200050

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates less than 0.1 V and last more than 10 seconds, then the PCM will set DTC P0405.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air Temp is more than 3˚C (37.4˚F).
- EGR pintle position is less than 2% and last more than 10 sec. Action taken when the DTC sets.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0405 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

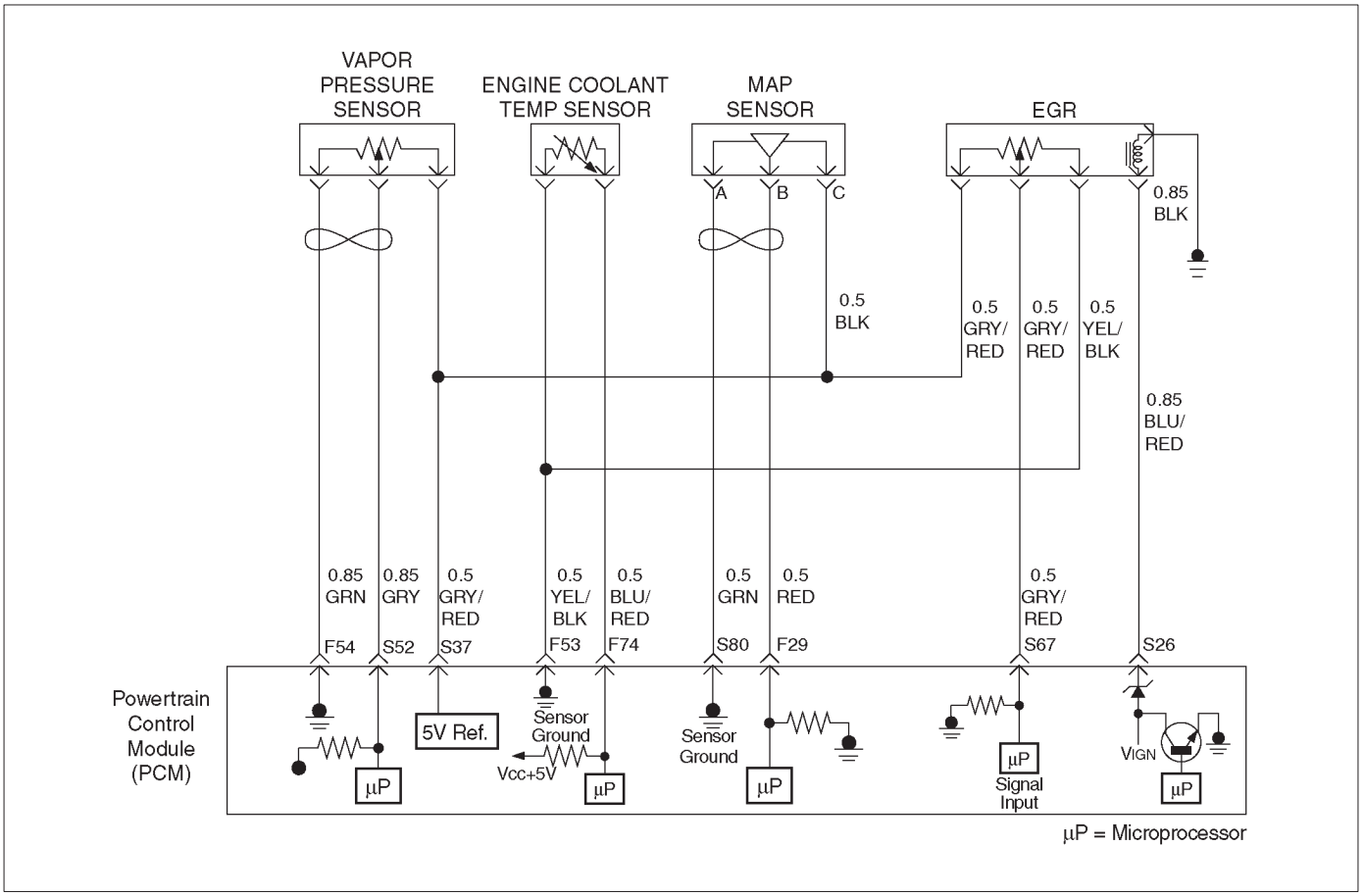
DTC P0405 – EGR Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0405 until the DTC P0405 test runs. Note the result. Does the Tech 2 indicates DTC P0405 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (BLU/RED) and ground. Did the DVM indicate the specified value?	4–6 V	Go to *Step 6*	Go to *Step 7*
6	1. Disconnect the EGR harness connector. 2. Measure resistance between terminal 5 volt reference wire and ground. Was resistance in range?	5–5.5 KΩ	Go to *Step 10*	Go to *Step 17*
7	1. Ignition "ON". 2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 18*
8	Repair the open 5 volt reference circuit. Is the action complete?	—	Verify repair	—
9	Repair the damaged sensor ground wire. Is the action complete?	—	Verify repair	—
10	1. Disconnect the EGR harness 2. Use an ohmmeter to measure between the pintle position pin and the sensor ground pin on the EGR valve. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the ohmmeter reading approximately equal to the specified value?	1 to 1.25 KΩ	Go to *Step 13*	Go to *Step 17*
11	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at EGR valve pintle position pin and sensor ground pin. Was voltage in range?	Less than 0.1 V	Go to *Step 17*	Go to *Step 12*

DTC P0405 – EGR Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at PCM sensor ground pin and pintle position pin. Was voltage in range?	Less than 0.1 V	Go to *Step 13*	Go to *Step 18*
13	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Check short circuit between EGR pintle position circuit and EGR ground circuit. Was any short circuit?	—	Go to *Step 14*	Go to *Step 18*
14	Locate and repair the short to ground in the pintle position circuit Is the action complete?	—	Verify repair	—
15	1. Ignition "OFF". 2. Disconnect the PCM. 3. Ignition "ON". 4. Measure the voltage between the EGR pintle position circuit and ground. Is the measured voltage near the specified value?	Less than 0.1 V	Go to *Step 17*	Go to *Step 16*
16	Check for a short circuit between other wires and the pintle position circuit Is there any short circuit?	—	Repair short circuit and then Verify repair	Go to *Step 17*
17	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 18*	Verify repair
18	Examine the PCM pin and terminal connection. Was there a damaged terminal?	—	Go to *Step 4*	Go to *Step 19*
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0406 EGR High Voltage



060R200050

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates more than 4.8 V and last more than 10 seconds, then the PCM will set DTC P0406.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3˚C (37.4˚F).
- EGR pintle position is more than 99% and last more than 10 sec.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

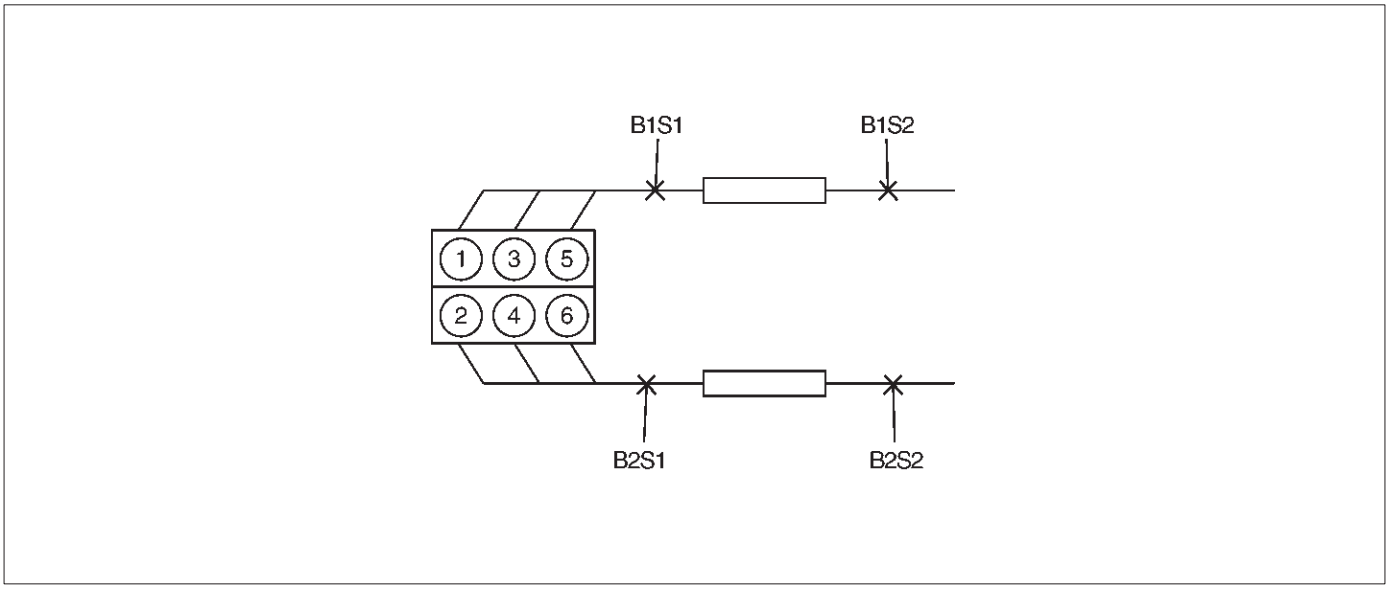
DTC P0406 – EGR High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0406 until the DTC P0406 test runs. Note the result. Does the Tech 2 indicates DTC P0406 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	Is the action complete?
5	1. Disconnect the EGR harness connector. 2. Ignition “ON”. 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (BLU/RED). Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 6*
6	1. Ignition “ON”. 2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 7*	Go to *Step 16*
7	Repair the open 5 volt reference circuit Is the action complete?	—	Verify repair	—
8	1. Ignition “OFF” 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between 5 V reference and Sensor Ground at EGR sensor terminals. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the measured resistance in range?	5 to 5 KΩ	Go to *Step 9*	Go to *Step 15*
9	1. Ignition “OFF”. 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between Sensor Ground and Signal Wire at EGR sensor terminal. Is there an open circuit?	—	Go to *Step 15*	Go to *Step 10*
10	1. Ignition “OFF”. 2. Disconnect the EGR harness at PCM connector. 3. Use a DVM to check for shorted wire between S37 and F53. Is there a shorted wire?	—	Go to *Step 14*	Go to *Step 11*

DTC P0406 – EGR High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition "ON". 2. Use a DVM to backprobe at terminal Connector of EGR valve for voltage. Was measured voltage more than 4.8 V?	more than 4.8 V	Go to *Step 12*	Go to *Step 12*
12	1. Ignition "ON". 2. Stay the EGR harness connected. 3. Check voltage by backprobing at PCM S37 terminal. Was voltage more than 4.8 V?	4.8 V	Go to *Step 16*	Go to *Step 13*
13	1. Locate short circuit at EGR harness between BLU/RED to GRY/RED or GRY/RED to YEL, BLU/RED. 2. Replace EGR harness. Is the action complete?	—	Verify repair	—
14	Replace EGR harness. Is the action complete?	—	Verify repair	—
15	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 16*	Verify repair
16	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0420 TWC System Low Efficiency Bank 1



T321075

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0420 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop",
- Engine air load is below 99%.
- Engine coolant temperature is between 70˚C (158˚F) and 120˚C (248˚F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350˚C (662˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake Air Temperature is between –10˚C (14˚F) and 70˚C (158˚F).
- Throttle angle is less than 1.5%.
- Barometric Pressure is more than 72 kPa.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0420 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0420 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst

will require three or more 50-sample tests to report a failure.

Test Description

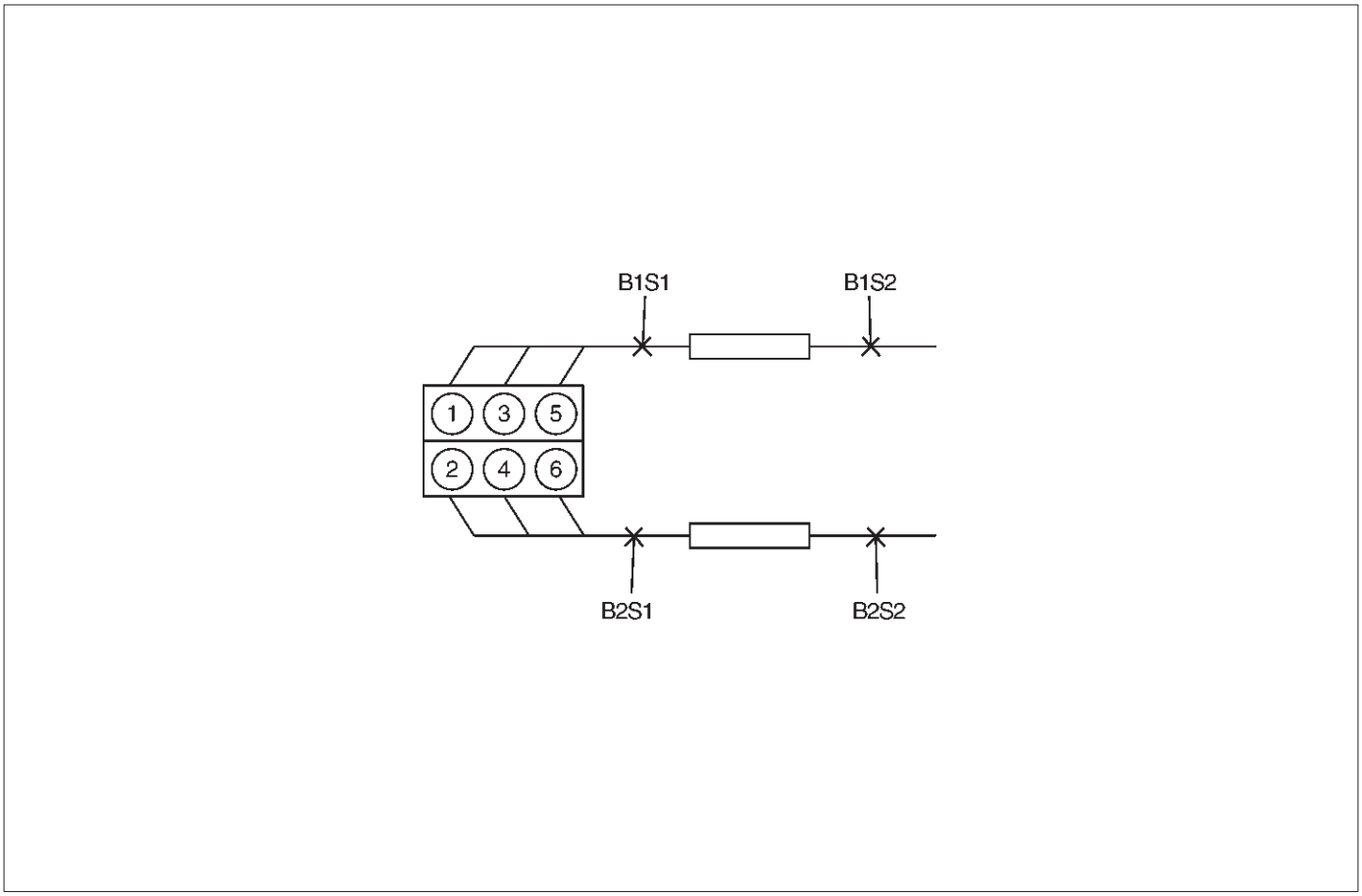
Number(s) below refer to the step number(s) on the Diagnostic Chart.

7. Difficulty completing the DTC P0420 “Status This Ign”, test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0420 “Status This Ign”, test, use the following procedure:
   - ▼ Allow the engine to warm up completely.
   - ▼ With the vehicle in “Park”, monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - ▼ Operate the vehicle in second or third gear to remain in the DTC P0420 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     - – Place the vehicle in “Park” or “Neutral”,
     - – Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

DTC P0420 – TWC System Low Efficiency Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0140)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: ▼ dents ▼ severe discoloration caused by excessive temperatures ▼ holes ▼ internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 1 HO2S 2. 2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0420. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 2 minutes. 5. Operate the vehicle to maintain DTC P0420 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor "DTC" info for DTC P0420 until the DTC P0420 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0420 passed this ignition?	Engine coolant temp: greater than 60˚C (140˚F). Mass air flow: between 8 g/second and 50 g/second	Complete repair. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0430 TWC System Low Efficiency Bank 2



T321075

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the PCM detects a level of Bank 2 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0430 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- Engine air load is below 99%.
- Engine coolant temperature is between 70˚C (158˚F) and 120˚C (248˚F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Change in engine load is below 8%.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350˚C (662˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake air temperature is between –20˚C (4˚F) and 70˚C (158˚F).
- Throttle angle is less than 1.5%.
- Barometric Pressure is more than 72 kPa.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0430 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0430 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

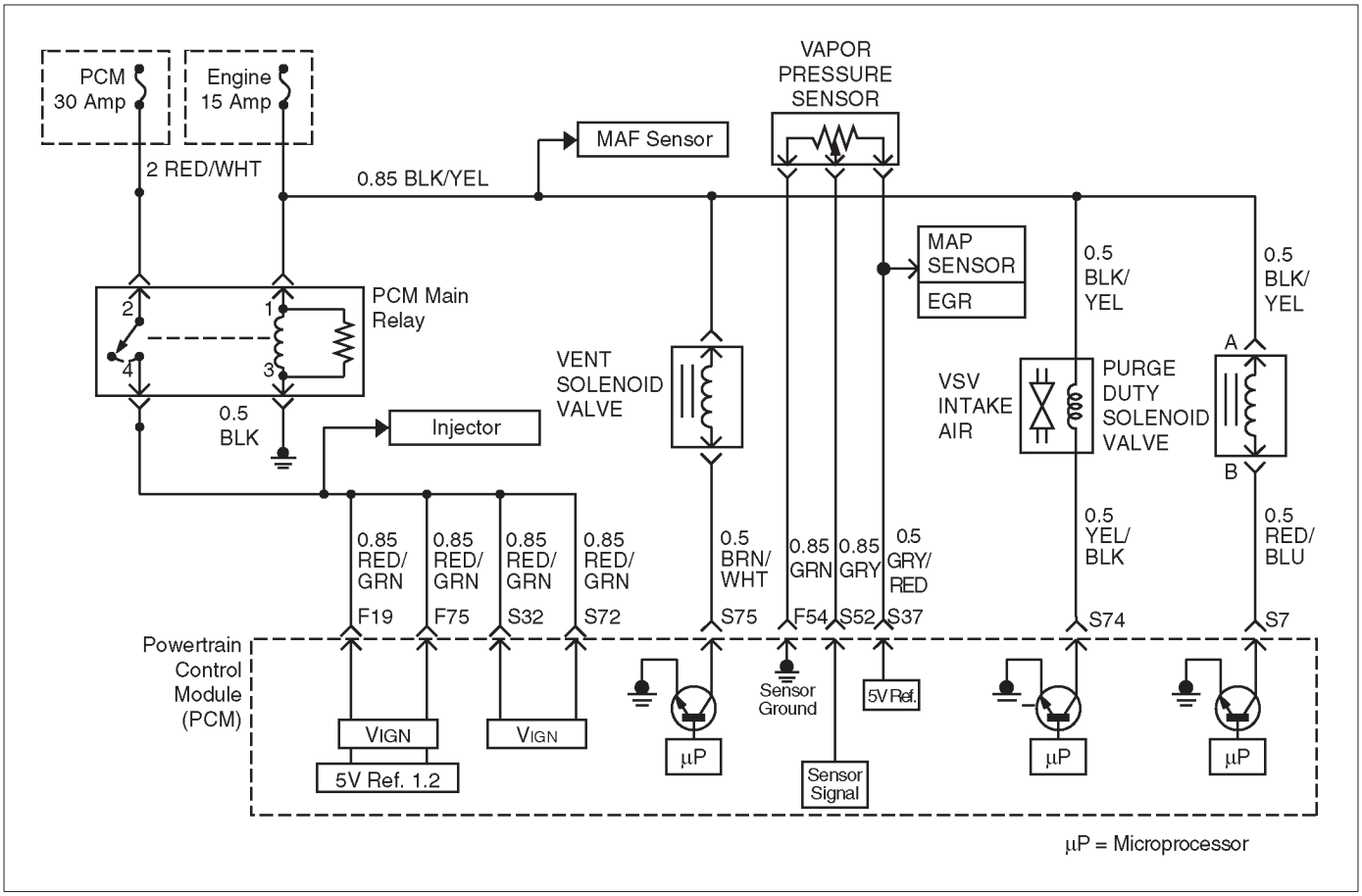
7. Difficulty completing the DTC P0430 “Status This Ign”, test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0430 “Status This Ign”, test, use the following procedure:
   - Allow the engine to warm up completely.
   - With the vehicle in “Park”, monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0430 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     – Place the vehicle in “Park” or “Neutral”,
     – Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

The “TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

DTC P0430 – TWC System Low Efficiency Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0160)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: ▼ dents ▼ severe discoloration caused by excessive temperatures ▼ holes ▼ internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 2 HO2S 2. 2. Ensure that the Bank 2 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0430. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 6 minutes. 5. Operate the vehicle to maintain DTC P0430 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor "DTC" info for DTC P0430 until the DTC P0430 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0430 passed this ignition?	Engine coolant temp: greater than 70˚C (158˚F). Mass air flow: between 2.5 g/second and 10 g/second	Complete repair. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0440 EVAP System



060RY00398

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister purge duty solenoid valve
- Fuel tank (vapor) pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister vent valve (purge solenoid)

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. If a sufficient vacuum level cannot be achieved, a large leak or a faulty EVAP canister purge solenoid is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister duty solenoid
- Open ignition feed circuit to the EVAP canister vent solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set DTC P0440.

Conditions for Setting the DTC

- No TP sensor, IAT sensor, ECT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32˚C (90˚F).
- Start-up engine coolant temperature is not more than 7˚C (13˚F) greater than start-up intake air temperature.
- Start-up intake air temperature is greater than 4˚C (39˚F) .
- Start-up intake air temperature is not more than 2˚C (4˚F) greater than start-up engine coolant temperature.
- Vehicle speed is less than 5 mph (8 km/h).
- Throttle position is greater than 3%.
- Minimal fuel slosh.
- BARO is greater than 70 kPa.
- The EVAP system is unable to achieve or maintain vacuum during the diagnostic test.

▼Engine speed is less than 1200 RPM.
▼Above conditions are present for 60 to 180 seconds.

Action Taken When the DTC Sets

▼The PCM will ON the MIL after second trip with detected the fault.
▼The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼The PCM will turn the MIL "OFF" when the diagnostic has been run and the fault condition is no longer present.
▼A history DTC P0440 will clear after 40 consecutive warm-up cycles have occurred without a fault.
▼DTC P0440 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

▼Cracked or punctured EVAP canister.
▼Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
▼Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
▼Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
▼Kinked, pinched, or plugged vacuum source, EVAP purge, or fuel tank vapor line–Verify that the lines are not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0440.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Determines whether or not the EVAP system can be sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
8. Checks for a blocked EVAP canister purge solenoid. The PCM commands the EVAP canister purge solenoid "OFF" (open) and the vent solenoid "ON" (closed) with the Tech 2 "System Perf", EVAP output control function activated. Any pressure in the system should be released through the EVAP canister purge solenoid within a few seconds when "System Perf", is activated.
9. Ensures that sufficient source vacuum is present at the EVAP canister purge solenoid.

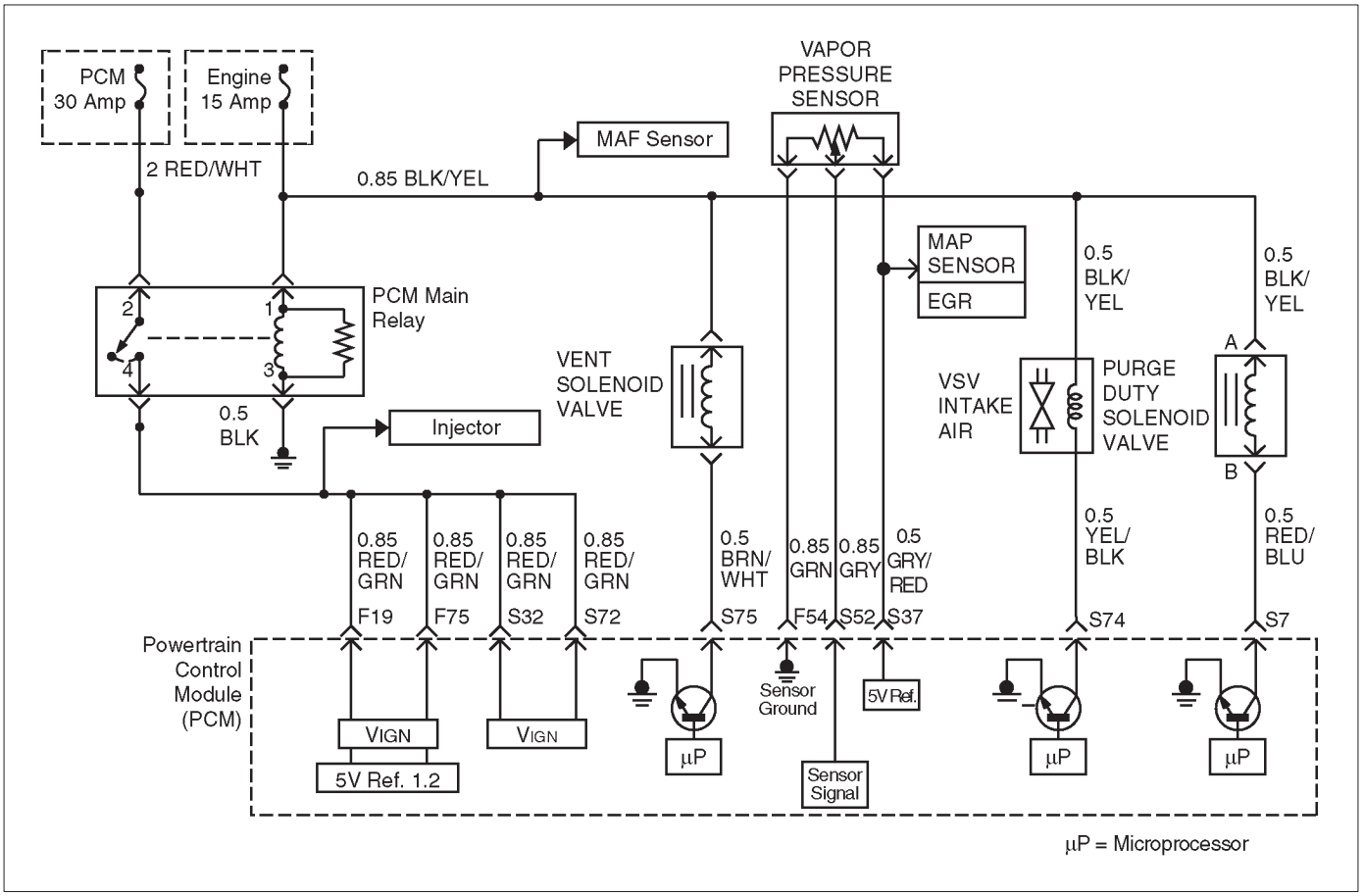
DTC P0440 – EVAP System

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0452 or P0453 also set?	—	Go to *other DTC first*	Go to *Step 3*
3	1. Ignition "OFF". 2. Remove the fuel cap. 3. Ignition "ON". 4. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51 V	Go to *Step 4*	Go to *DTC P0452* or *DTC P0453*
4	1. Replace the fuel cap. 2. Engine is running. 3. Observe "Fuel Tank Vacuum" on the Tech 2. Does Tech 2 indicate "Fuel Tank Vacuum" at the specified value?	1.47–1.51 V	Go to *Step 7*	Go to *Step 6*

DTC P0440 – EVAP System (Cont'd)

Step	Action	Value(s)	Yes	No
5	Ignition "OFF". 1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 5. Attempt to apply vacuum to the EVAP canister. Observe "Fuel tank pressure" on the Tech 2. Does the Tech 2 indicate "Fuel tank pressure" at the specified value?	1.47–1.51 V	Go to *Step 8*	Go to *Step 7*
6	1. Visually/physically check for the following conditions: ▼ Restricted fuel tank vapor line. ▼ Restricted EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *DTC P0452* or *DTC P0453*
7	1. Visually/physically check for the following conditions: ▼ Vent hose disconnected or the damaged. ▼ EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
8	1. Visually/physically check for the following conditions: ▼ Missing or faulty fuel cap. ▼ Disconnected or leaking fuel tank vapor line. ▼ Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Replace the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
10	Locate and repair cause of no source vacuum to the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
11	Replace the EVAP canister vent solenoid. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0442 EVAP System Small Leak Detected



060RY00398

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank (vapor) pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF”, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- BARO is more than 70 kPa.
- Engine speed is less than 1200 RPM.
- Fuel level is between 15% and 85%.
- Vehicle speed is less than 5 mph (8 km/h).
- The DTC P0440 diagnostic test has passed.
- A vacuum decay condition, indicating a small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0442 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0442 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0442.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

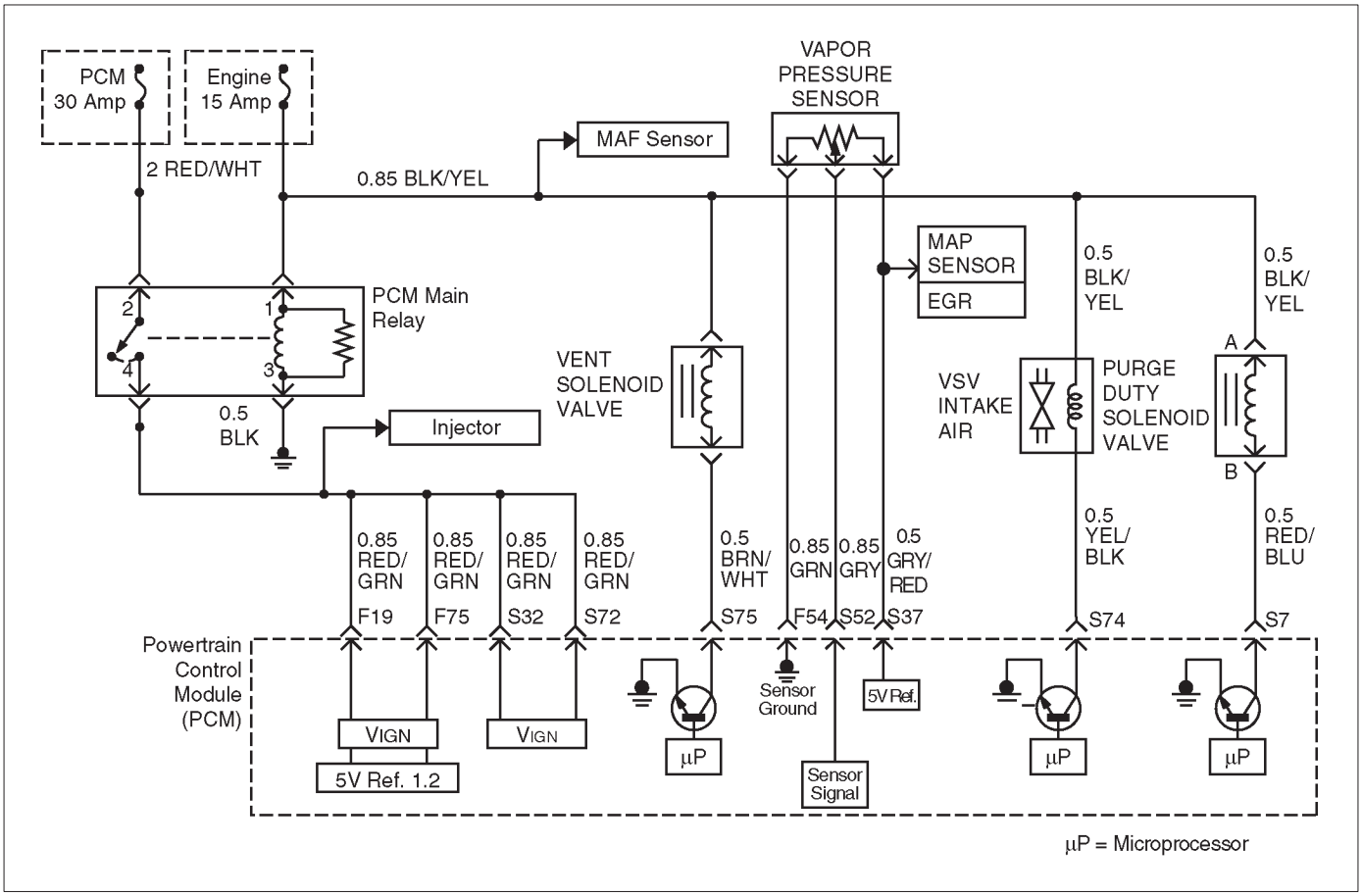
DTC P0442 – EVAP System Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”. 2. Remove the fuel cap. 3. Ignition “ON”. 4. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 1. Replace the fuel cap. 2. Capture Failure Records data for DTC P0442 and clear DTCs. 3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 4. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed). 5. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 6. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.47V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Ignition “ON”, engine idling. 2. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to 15 in. H_2O. 4. Switch the rotary switch on the cart to “HOLD” and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to *Step 5*	Refer to *Diagnostic Aids*

DTC P0442 – EVAP System Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 5. Attempt to apply vacuum to the EVAP canister. Can the vacuum be maintained at the specific value?	1.46V	Go to *Step 8*	Go to *Step 6*
6	1. Visually/physically check for the following conditions: ▼ Vent hose disconnected or damaged. ▼ EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 10*	—
8	1. Visually/physically check for the following conditions: ▼ Missing or faulty fuel cap. ▼ Disconnected or leaking fuel tank vapor line. ▼ Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 9*
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. With the cart connected to the EVAP service port, continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurize position. 3. Using ultrasonic leak detector J 41416, locate and repair leak in EVAP system. (It may be necessary to partially lower the fuel tank to examine the connections on top of the tank.) Is the action complete?	—	Go to *Step 10*	—
10	1. Ignition "ON", engine not running. 2. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H_2O. 4. Switch the rotary switch on the cart to "HOLD" and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	Go to *Step 2*	Verify repair

Diagnostic Trouble Code (DTC) P0444 EVAP Purge Control Circuit Open



060RY00398

Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM).The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0444 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0444 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the EVAP purge solenoid display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

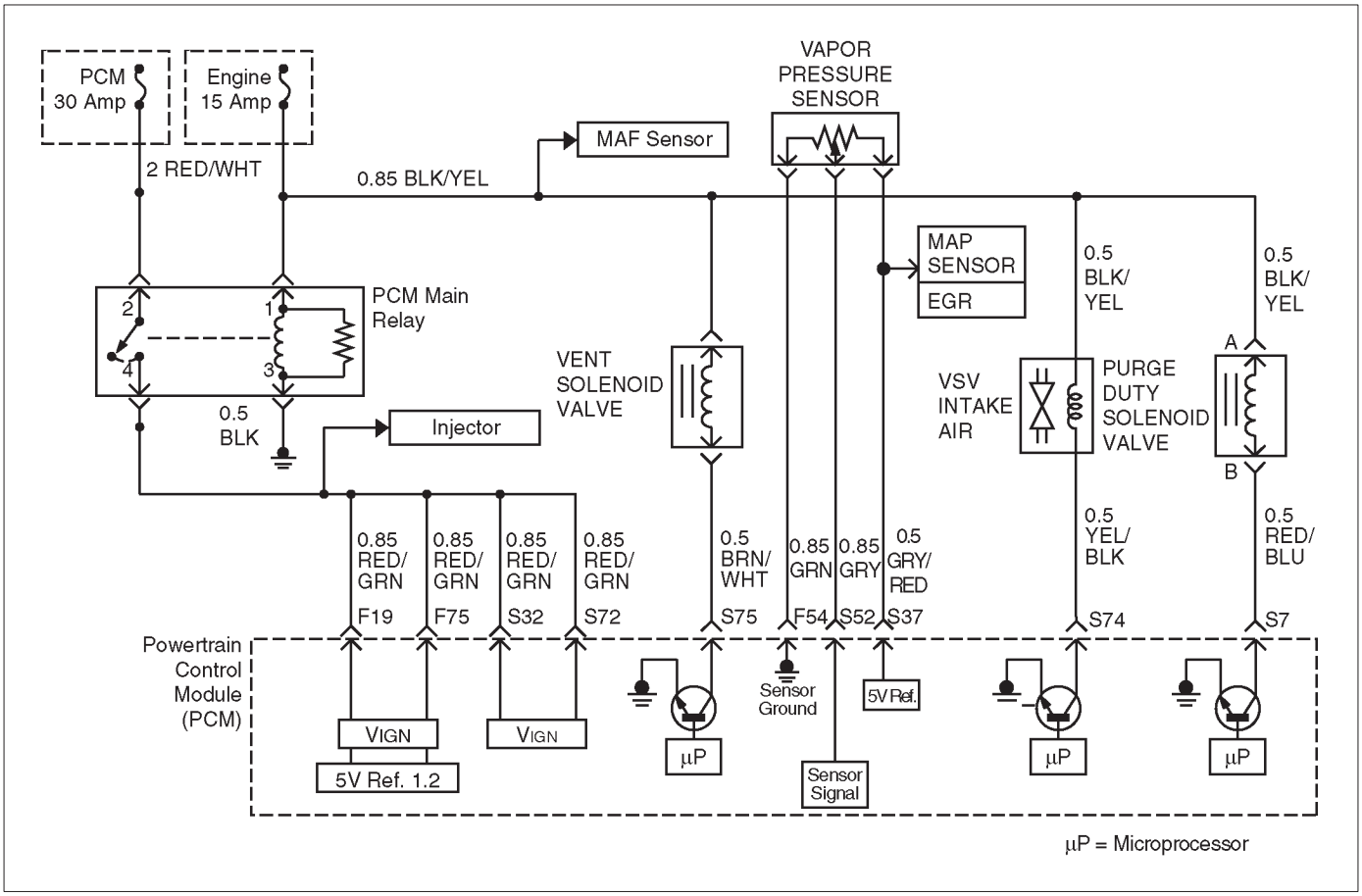
  A change in the display will indicate the location of the fault. If DTC P0444 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0444 Diagnostic Chart may isolate the cause of the fault.

DTC P0444 EVAP Purge Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Ignition is “ON”, 3. Engine is “ON” and operate the accelerator pedal for 3 or 4 times. 4. Observe the EVAP purge solenoid reading on the Tech 2. Is the EVAP purge solenoid reading near the specified value?	More than 1%	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Check the power supply circuit. 1. Ignition is “OFF”. 2. Disconnect the canister purge solenoid valve. 3. Ignition is “ON”. 4. Using a DVM, measure at the EVAP purge solenoid connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to *Step 4*	Go to *Step 5*
4	Check the signal circuit for the EVAP purge solenoid. 1. Ignition is “OFF”. 2. Disconnect the canister purge solenoid valve. 3. Disconnect the PCM. 4. Check the circuit between EVAP purge solenoid connector and PCM connector. Is the problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
6	Check the canister purge solenoid valve. Using a DVM, measure resistance for purge solenoid valve connector terminal. Is the purge solenoid valve resistance within the specified values?	25–30 Ω (at 68˚F{20˚C})	Go to *Step 8*	Go to *Step 7*
7	Replace the canister purge solenoid valve. Is the action complete?	—	Verify repair	—
8	Replace the **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures*. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0445 EVAP Purge Control Circuit Short



060RY00398

Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM). The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0445 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0445 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the EVAP purge solenoid display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

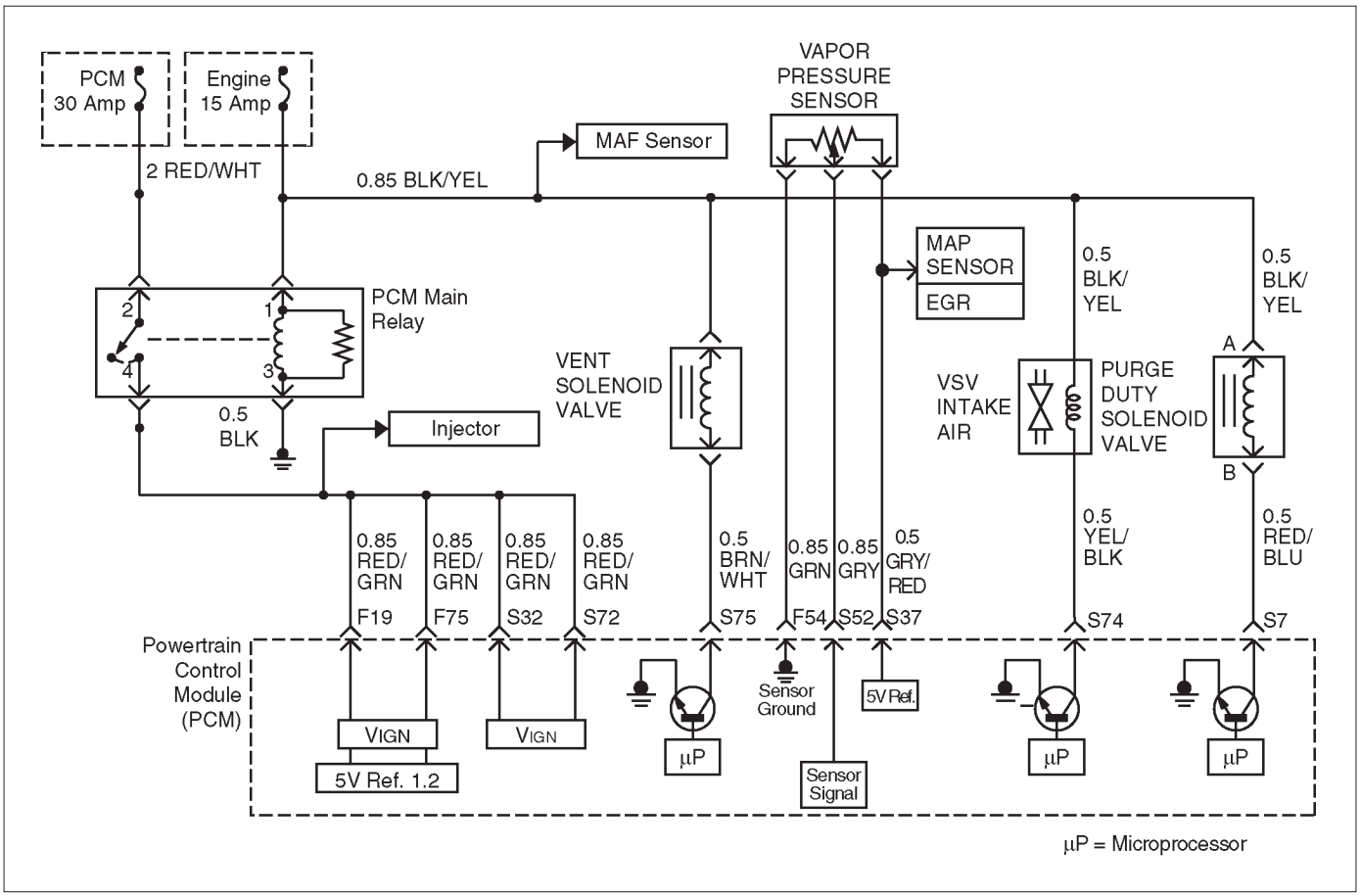
  A change in the display will indicate the location of the fault. If DTC P0445 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0445 Diagnostic Chart may isolate the cause of the fault.

DTC P0445 EVAP Purge Control Circuit Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Ignition is “ON”, 3. Observe the EVAP purge solenoid reading on the Tech 2. Is the EVAP purge solenoid reading near the specified value?	0%	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Check the signal circuit for canister purge solenoid valve. 1. Ignition is “OFF”. 2. Disconnect the canister purge solenoid valve. 3. Disconnect the PCM. 4. Check the circuit between EVAP purge solenoid connector and PCM connector. Is the problem found?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
5	Check the canister purge solenoid valve. Using a DVM, measure resistance for purge solenoid valve connector terminal. Is the purge solenoid valve resistance within the specified values?	25–30 (at 68˚F{20˚C})	Go to *Step 7*	Go to *Step 6*
6	Replace the canister purge solenoid valve. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0446 EVAP Canister Vent Control Malfunction



060RY00398

Circuit Description

The evaporative system includes the following components:

- ▼Fuel tank
- ▼EVAP canister vent solenoid
- ▼Fuel tank (vapor) pressure sensor
- ▼Fuel pipes and hoses
- ▼Vapor lines
- ▼Fuel cap
- ▼Evaporative emissions canister
- ▼Purge lines
- ▼EVAP canister purge solenoid

An incorrect fuel tank pressure sensor signal is detected by monitoring fuel tank pressure when the key is first turned “ON” during a cold start. If the fuel tank pressure signal is out of range, DTC P0446 will set. A restricted or blocked EVAP vent path is detected by monitoring fuel tank pressure during normal operation (EVAP canister vent solenoid open, EVAP canister purge solenoid normal). With the EVAP canister vent solenoid open, vacuum level in the system should be very low unless the vent path is blocked. A blockage can be caused by the following condition:

- ▼Faulty EVAP canister vent solenoid (stuck closed).
- ▼Plugged, kinked or pinched vent hose.
- ▼Shorted EVAP canister vent solenoid driver circuit.
- ▼Plugged evaporative canister.

If any of these conditions are present, DTC P0446 will set.

Conditions for Setting the DTC

- ▼No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- ▼Start-up engine coolant temperature and start-up intake air temperature are more than 4˚C (39˚F) but less than 34˚C(93˚F).
- ▼Start-up engine coolant temperature is not more than 7˚C (13˚F) greater than start-up intake air temperature.
- ▼Fuel tank level is between 15% and 85%.
- ▼BARO is greater than 70 kPa.

Action Taken When the DTC Sets

- ▼The PCM will ON the MIL after second trip with detected the fault.
- ▼The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

Conditions for Clearing the MIL/DTC

- ▼The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- ▼A history DTC P0446 will clear after 40 consecutive warm-up cycles have occurred without a fault.

▼ DTC P0446 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

▼ Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

▼ Kinked, pinched, or plugged vent hose–Verify that the vent hose between the EVAP canister and EVAP canister vent solenoid is not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If a vent solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0446.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
6. Checks for a blocked EVAP canister.

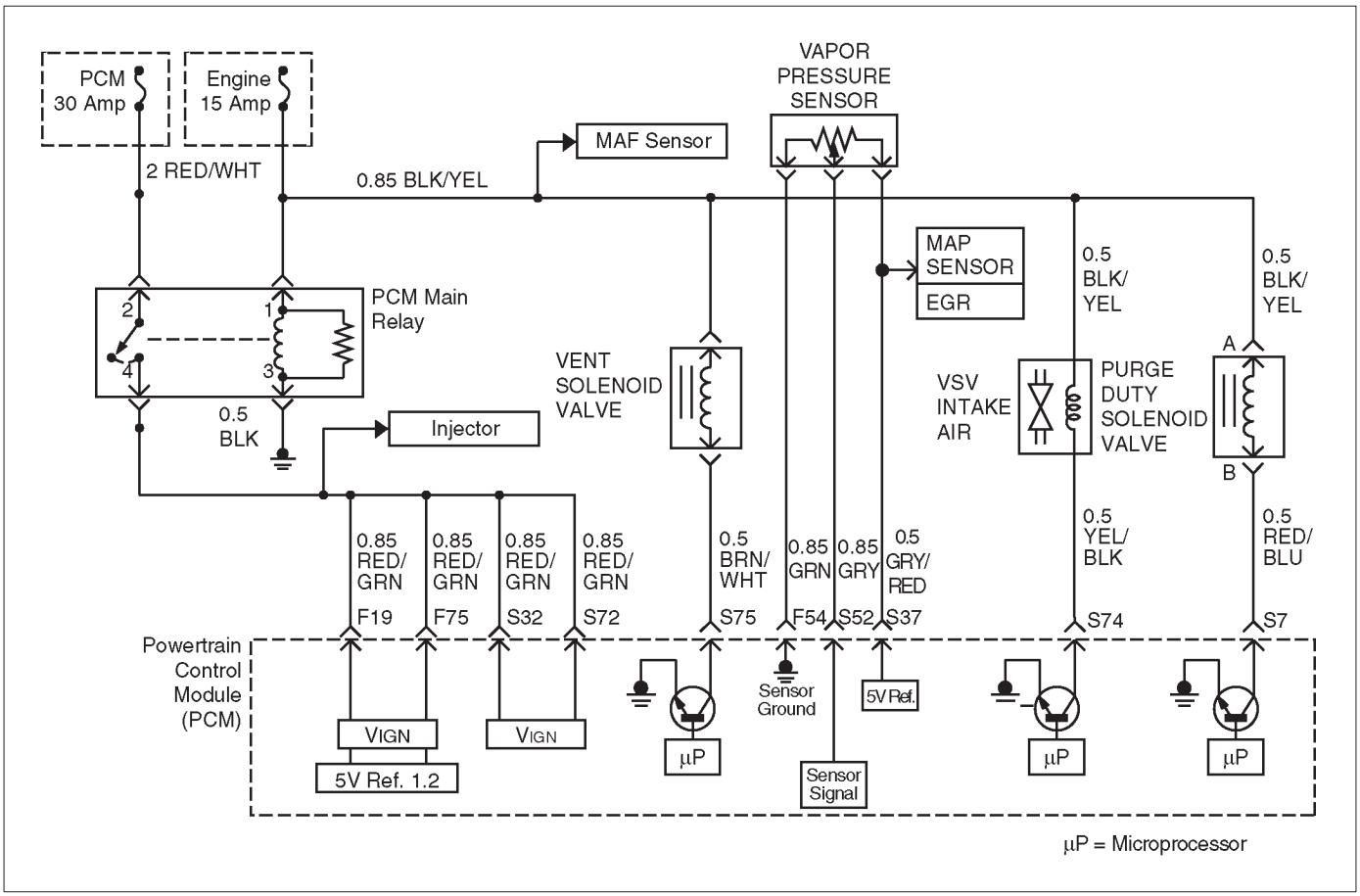
DTC P0446– EVAP Canister Vent Control Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON." 2. Capture Failure Records data for DTC P0446 and clear DTCs. 3. Ignition "OFF." 4. Remove the fuel cap. 5. Ignition "ON." 6. Observe "Fuel Tank Pressure" on the Tech 2. Does Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on the EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 7. Replace the fuel cap. 8. Using the Tech 2, command the EVAP vent solenoid "ON" (closed). 9. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 10. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 11. Observe "Fuel Tank Pressure" on the Tech 2. Does Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.52 – 1.69V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Maintain the EVAP pressure at 5 in. at H_2O. 2. Using Tech 2, command the EVAP vent solenoid "OFF" (open) while observing the EVAP pressure gauge on the cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H_2O	Refer to *Diagnostic Aids*	Go to *Step 5*

DTC P0446– EVAP Canister Vent Control Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the large vent hose (marked "AIR") from the EVAP canister. 2. Switch the rotary switch on the cart J 41413 to "PURGE." 3. Ignition "ON," engine idling at normal operating temperature. 4. Observe vacuum gauge for 5 seconds while holding the engine speed at 2500 RPM. Does the vacuum remain less than the specified value?	30 in. H_2O	Go to *Step 6*	Go to *Step 8*
6	1. Inspect the vent hose between the EVAP canister and the EVAP canister vent solenoid for kinks, pinched areas, or any other form of blockage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 9*	—
8	Replace the EVAP canister. Is the action complete?	—	Go to *Step 9*	—
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H_2O. 3. Switch the rotary switch on cart J 41413 to "HOLD." 4. Using the Tech 2, command the EVAP canister vent solenoid "OFF" (open) while observing the EVAP pressure gauge on cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H^2O	Verify repair	Go to *Step 2*

Diagnostic Trouble Code (DTC)
P0447 EVAP Vent Solenoid Circuit Open



060RY00398

Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM).The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister vent solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0447 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0447 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the EVAP vent valve display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

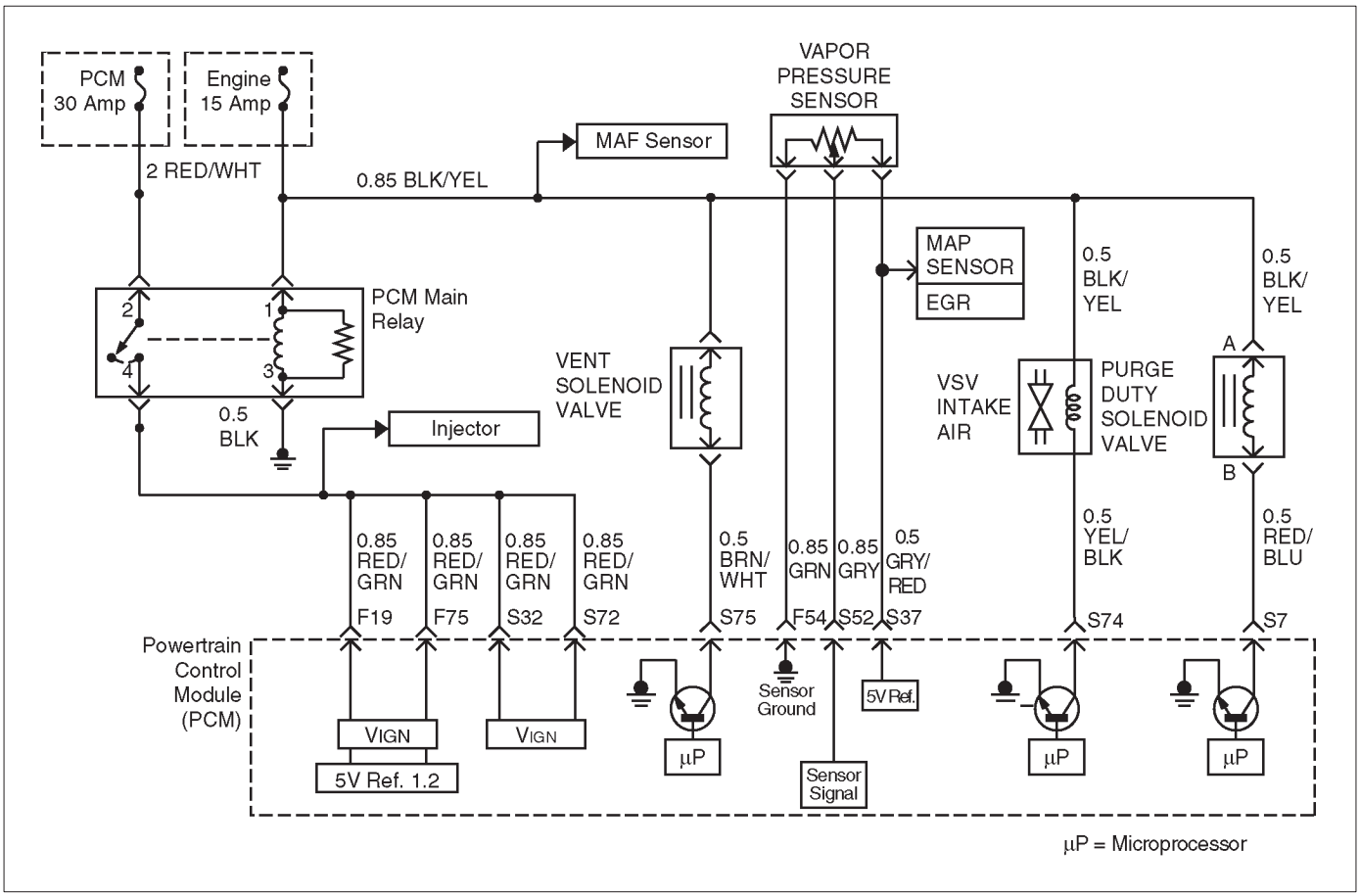
  A change in the display will indicate the location of the fault. If DTC P0447 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0447 Diagnostic Chart may isolate the cause of the fault.

DTC P0447 EVAP Vent Solenoid Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Ignition is “ON”, 3. Engine is “ON”and operate the acceleration pedal for 3 or 4 times. 4. Observe the EVAP vent solenoid reading on the Tech 2. Is the EVAP vent solenoid reading to “ON”?	—	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Check the power supply circuit. 1. Ignition is “OFF”. 2. Disconnect the canister vent solenoid valve. 3. Ignition is “ON”. 4. Using a DVM, measure at the EVAP vent solenoid connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to *Step 4*	Go to *Step 5*
4	Check the signal circuit for vent solenoid valve. 1. Ignition is “OFF”. 2. Disconnect the canister vent solenoid valve. 3. Disconnect the PCM. 4. Check the circuit between EVAP vent solenoid connector and PCM connector. Is the problem found?	—	Go to *Step 5*	—
5	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
6	Check the canister vent solenoid valve. Using a DVM, measure resistance for vent solenoid valve connector terminal. Is the vent solenoid valve resistance within the specified values?	—	21.8-28.5Ω (at 68˚F{20˚C})	—
7	Replace the canister vent solenoid valve. Is the action complete?	—	Verify repair	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0448 EVAP Vent solenoid Circuit Short



060RY00398

Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM). The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister vent solenoid is "ON," allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

Conditions for setting the DTC

- The Ignition is "ON".
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0448 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0448 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the EVAP vent valve display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

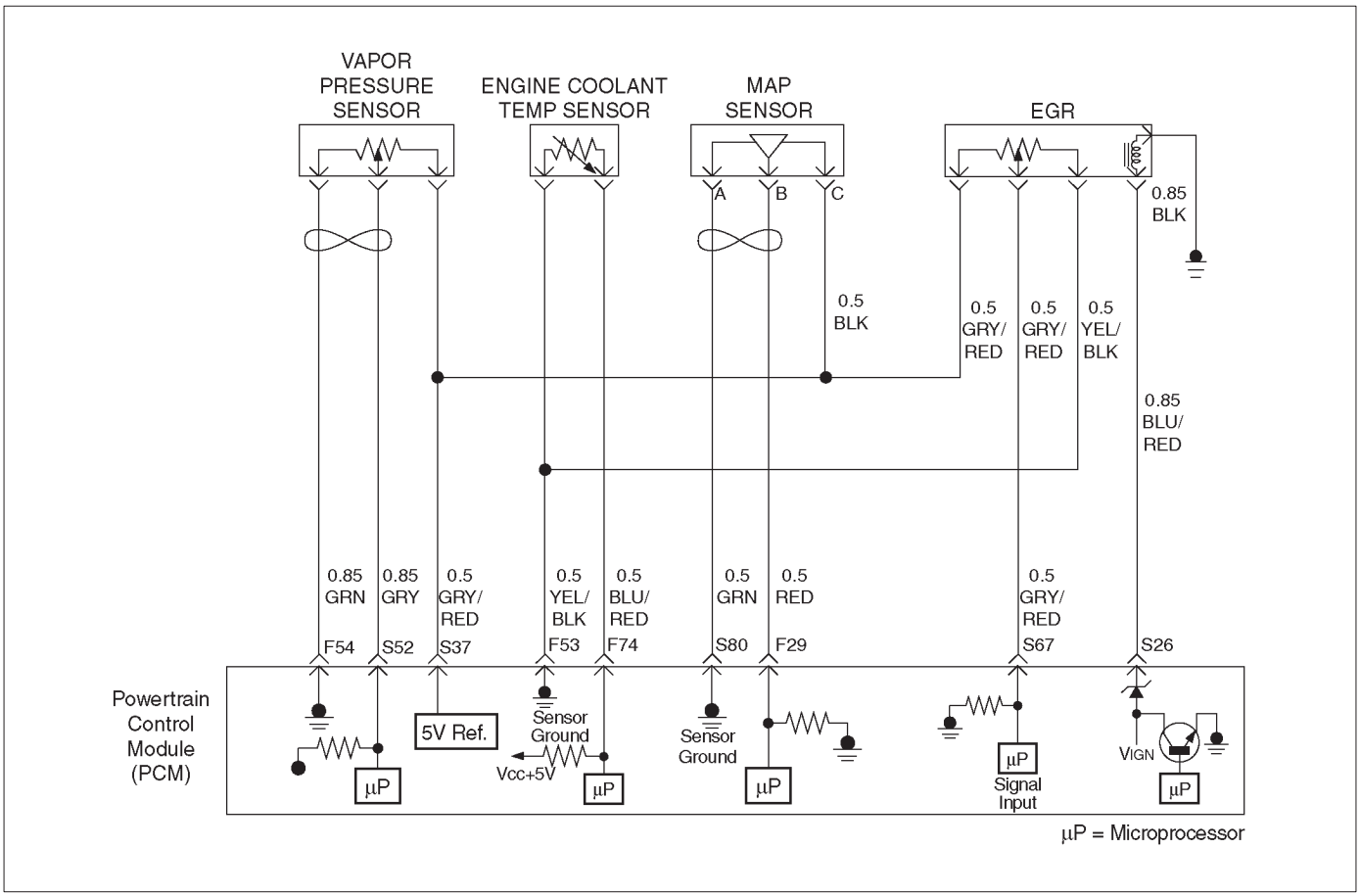
  A change in the display will indicate the location of the fault. If DTC P0448 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0448 Diagnostic Chart may isolate the cause of the fault.

DTC P0448 EVAP Vent Solenoid Circuit Short

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Ignition is “ON”, 3. Observe the EVAP vent solenoid reading on the Tech 2. Is the EVAP vent solenoid reading near the specified value?	0%	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Check the signal circuit for canister vent solenoid valve. 1. Ignition is “OFF”. 2. Disconnect the canister vent solenoid valve. 3. Disconnect the PCM. 4. Check the circuit between EVAP vent solenoid connector and PCM connector. Is the problem found?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the circuit as necessary. Is the action complete?	—	Verify repair	—
5	Check the canister vent solenoid valve. Using a DVM, measure resistance for purge solenoid valve connector terminal. Is the vent solenoid valve resistance within the specified values?	21.8-28.5Ω (at 68˚F{20˚C})	Go to *Step 7*	Go to *Step 6*
6	Replace the canister vent solenoid valve. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin.* Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0452 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) Low Voltage



060R200050

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evap system. When the tank pressure output indicates low voltage, PCM will set DTC P0452.

Conditions for Setting the DTC

- Tank sensor output is less than 0.2 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452, and P0107 at the same time.
- Open circuit or short circuit to ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452 and P0107 at the same time.
- Tank fuel pressure sensor malfunction may cause P0452.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

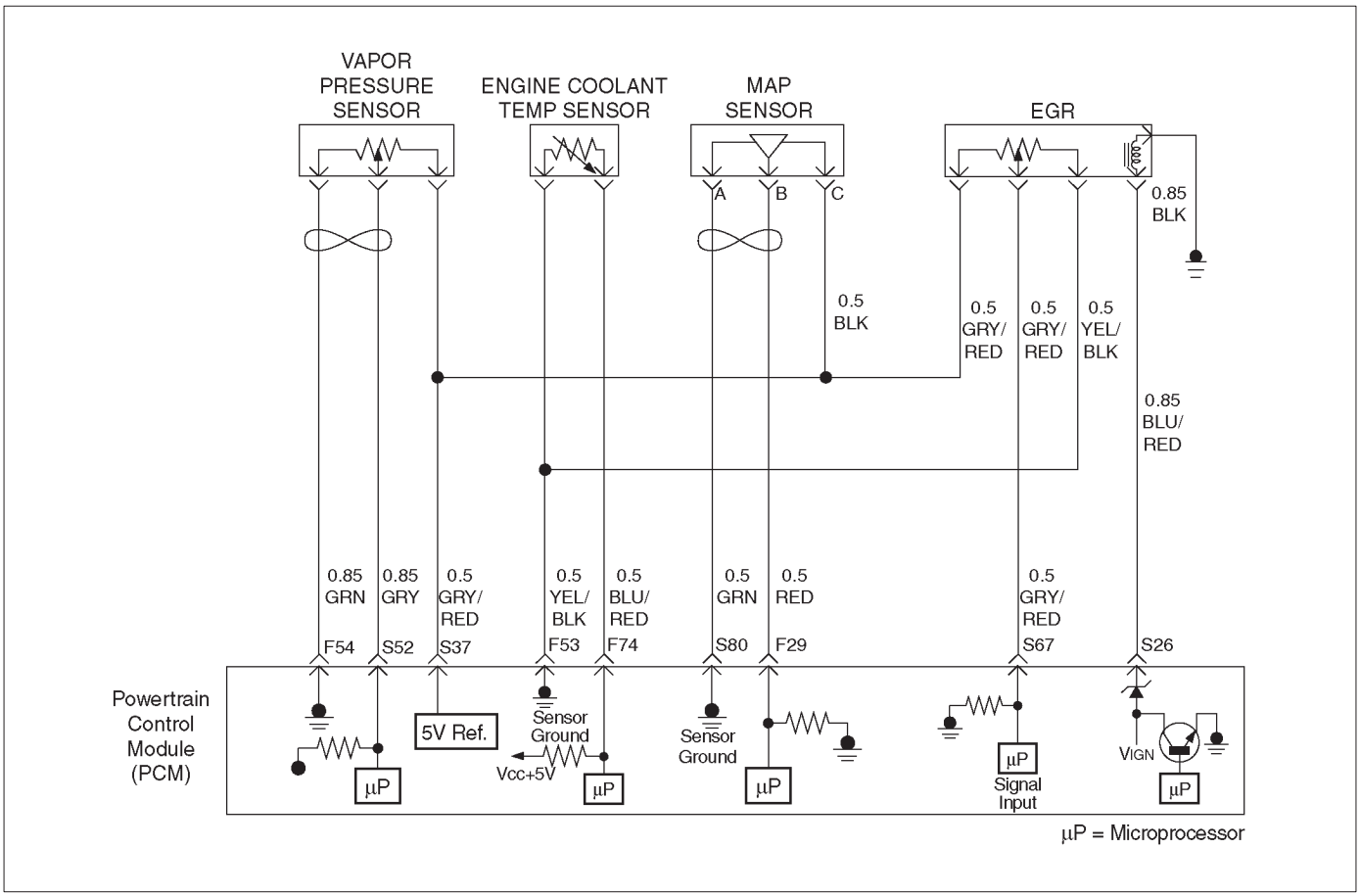
DTC P0452 – Tank Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0452 until the DTC P0452 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0452/P0107 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect connector at the PCM. 3. Ignition "ON". 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition "OFF". 2. Connect the PCM connector to the PCM. 3. Backprobe with a DVM at fuel tank pressure sensor between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0452 go to *Step 5* and for P0107, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of 5 volt reference circuit from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON" 2. At the PCM connector, backprobe with a DVM at the sensor output for the voltage. Was voltage within the range?	Less than 0.2 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output Was voltage within range?	Less than 0.2 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—

DTC P0452 – Tank Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0453 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) High Voltage



060R200050

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evap system. When the tank pressure output indicates high voltage , PCM will set DTC P0453.

Conditions for Setting the DTC

- Tank sensor output is more than 4.9 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0453 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- Info function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of sensor ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453, and P0108 at the same time.
- Open circuit or short circuit to 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453 and P0108 at the same time.
- Tank fuel pressure sensor malfunction may cause P0453.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

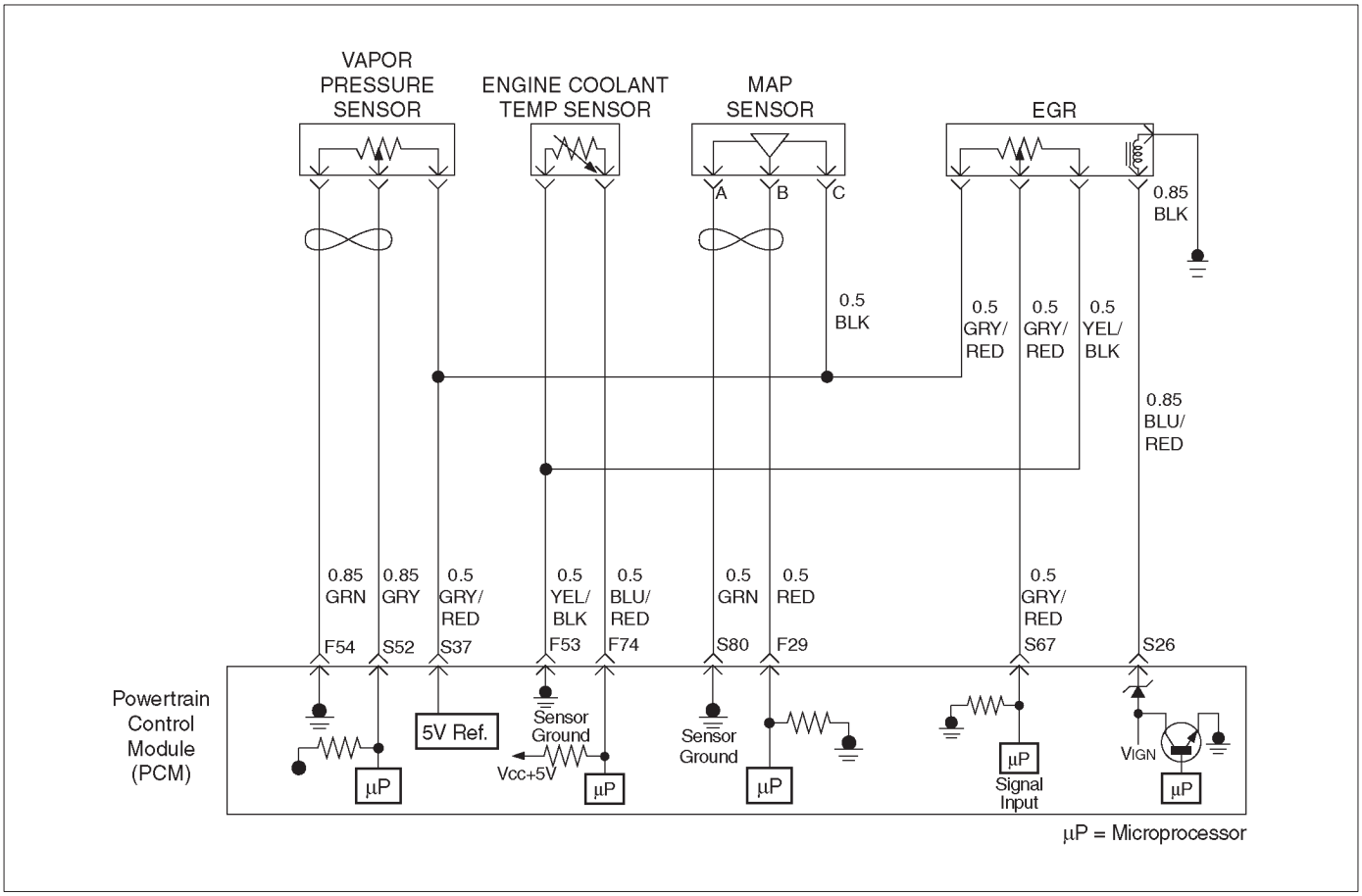
DTC P0453 – Fuel Tank Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0453 until the DTC P0453 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0453/P0108 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect connector at the PCM. 3. Ignition "ON". 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range of voltage?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition "OFF". 2. Connect the PCM connector to the PCM. 3. Disconnect sensor harness at fuel pressure sensor. Measure voltage with a DVM at the end of the tank pressure wiring between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0453 go to *Step 6* and for P0108, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of ground line from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON". 2. At the PCM connector, backprobe with a DVM at the sensor output for the voltage. Was voltage within range?	More than 4.9 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output. Was the voltage within range?	More than 4.9 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—

DTC P0453 – Fuel Tank Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the tank pressure sensor. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0456 EVAP Very Small Leak



060R200050

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank (vapor) pressure sensor
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module(PCM)monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a very small look on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF”, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant.

A very small leak in the system will cause DTC P0456 to be set.

Conditions for setting the DTC

- No MAP DTC’s set.
- No TPS DTC’s set.
- No IAT DTC’s set.
- No ECT DTC’s set.
- No tank pressure sensor DTC’s set.
- Baro is more than 70KPa.
- Fuel level is between 40% and 80%.
- Throttle angle is less than 3%.
- Engine speed is less than 1200 RPM.
- Vehicle speed is less than 5 mph (8 km/h).
- A vacuum decay condition, indicating a very small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

  Warm up cycles have occurred without a fault.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0456 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0456 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line. to wire connection.
- Poor connection at PCM–Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness to the EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

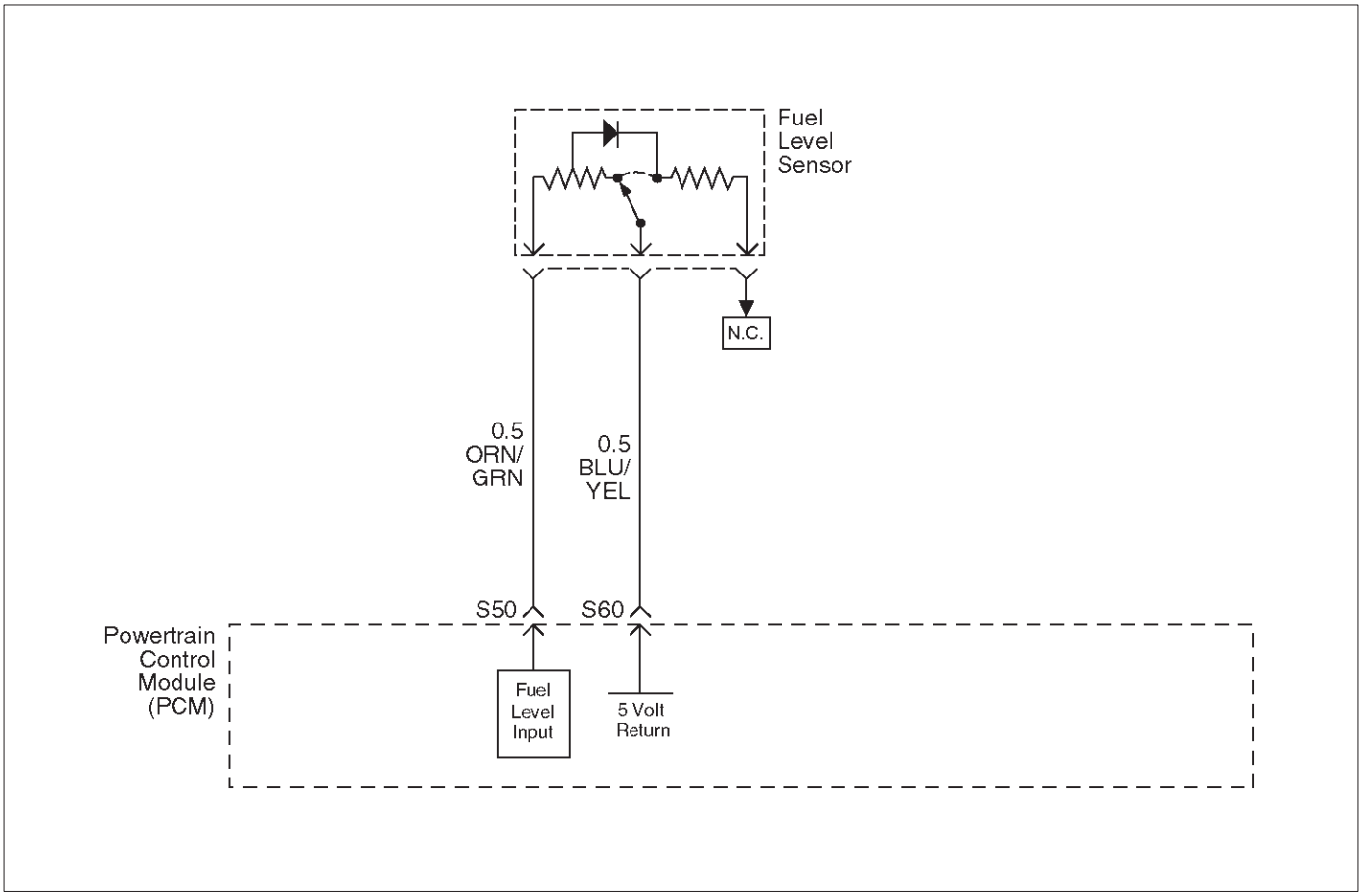
  Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs.

  This may assist in diagnosing the condition.

Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”. 2. Remove the fuel cap. 3. Ignition “ON”. 4. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	1. Visually/physically check for the following conditions: ▼ Vent hose disconnected or damaged. ▼ EVAP canister damaged. ▼ Fuel cap damaged 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Ignition “ON”, engine “OFF”. 2. Install the fuel cap. 3. Review and record Tech 2 Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using theTech 2,monitor the “DTC” info for DTC P0456. Does the Tech 2 indicate DTC P0456?	—	Go to *Step 5*	Refer to *Diagnostic Aids*
5	1. Ignition “ON”, engine idling. 2. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	—	Refer to *Diagnostic Aids*	Go to *Step 6*
6	1. Ignition “ON”, engine idling. 2. Using theTech 2, command the EVAP canister vent solenoid “ON” (closed) 3. Observe “EVAP canister vent solenoid operation” second value? 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Visually/physically check for the following conditions: ▼ Disconnected or leaking fuel tank vapor line. ▼ Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0461 Fuel Level Sensor Performance



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0461 is set.

Conditions for Setting the DTC

- Sensor output change is more than 2% within 200km.
  Or Sensor movement position change is less than 15% within 200km.
- IAT is more than 0˚C.
- MAP changing in 3 sec is less than 10kPa.
- Engine speed changing in 3 sec is less than 50rpm.

When there are 12 test failures within 80 test samples, it is stored.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the DTC

- DTC P0461 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

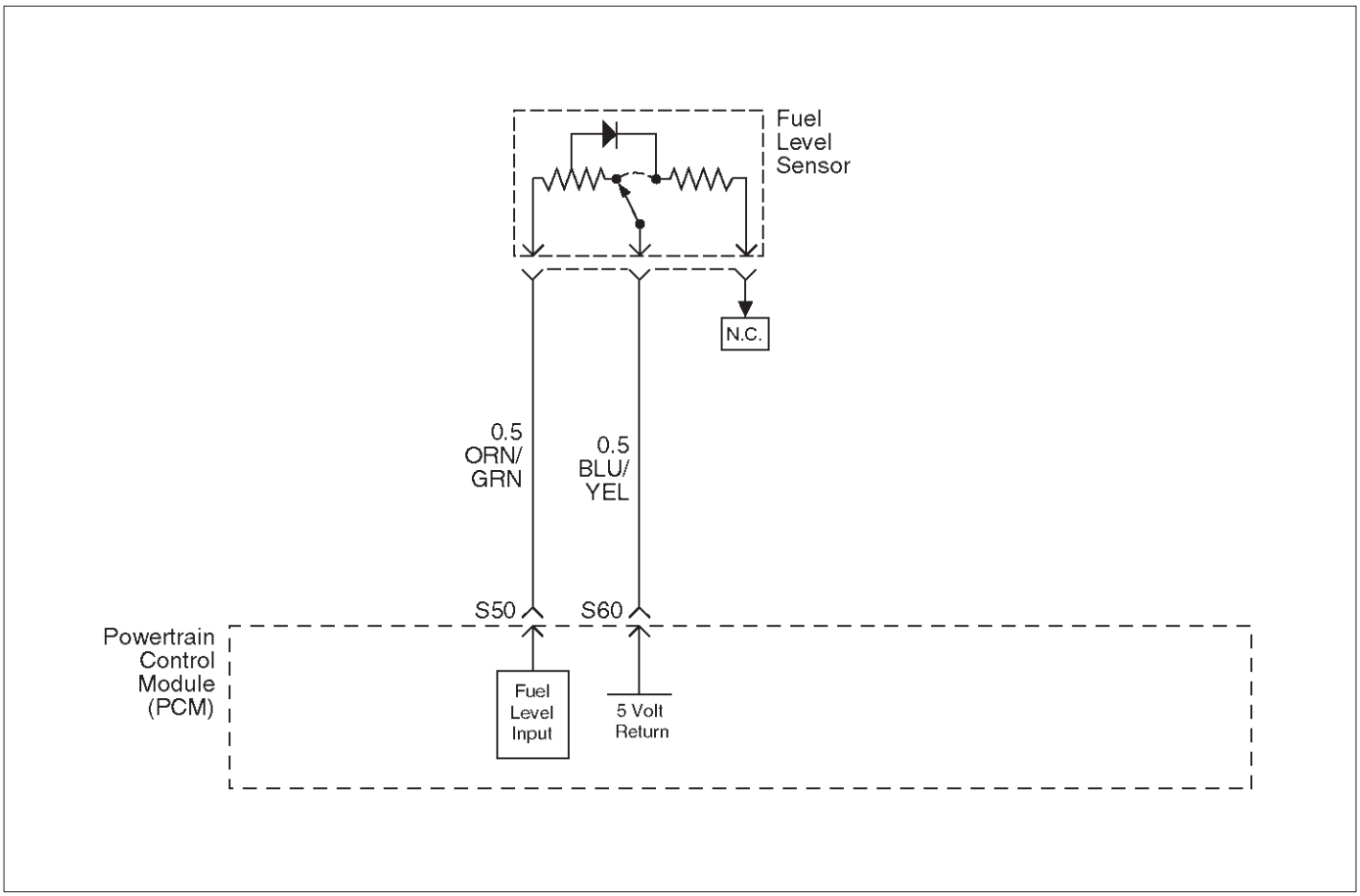
Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

DTC P0461– Fuel Level Sensor Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “Off”, Engine “Off”. 2. Install Tech 2. 3. Ignition “On”, Engine “Off”. 4. Check DTC P0462, P0463. Was the DTC stored?	—	Go to *applicable DTC table*	Go to *Step 3*
3	Check DTC P0464. Was the DTC stored?	—	Go to *DTC P464 table*	Go to *Step 4*
4	1. Ignition “Off”, Engine “Off”. 2. Replace the fuel level sensor. Was the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0462 Fuel Level Sensor Circuit–Low Voltage



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is more than 85% or less than 15% full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0462 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is less than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4˚C (40˚F) from the start-up ECT, and ECT exceeds 71˚C (160˚F) during that same ignition cycle).
- DTC P0462 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

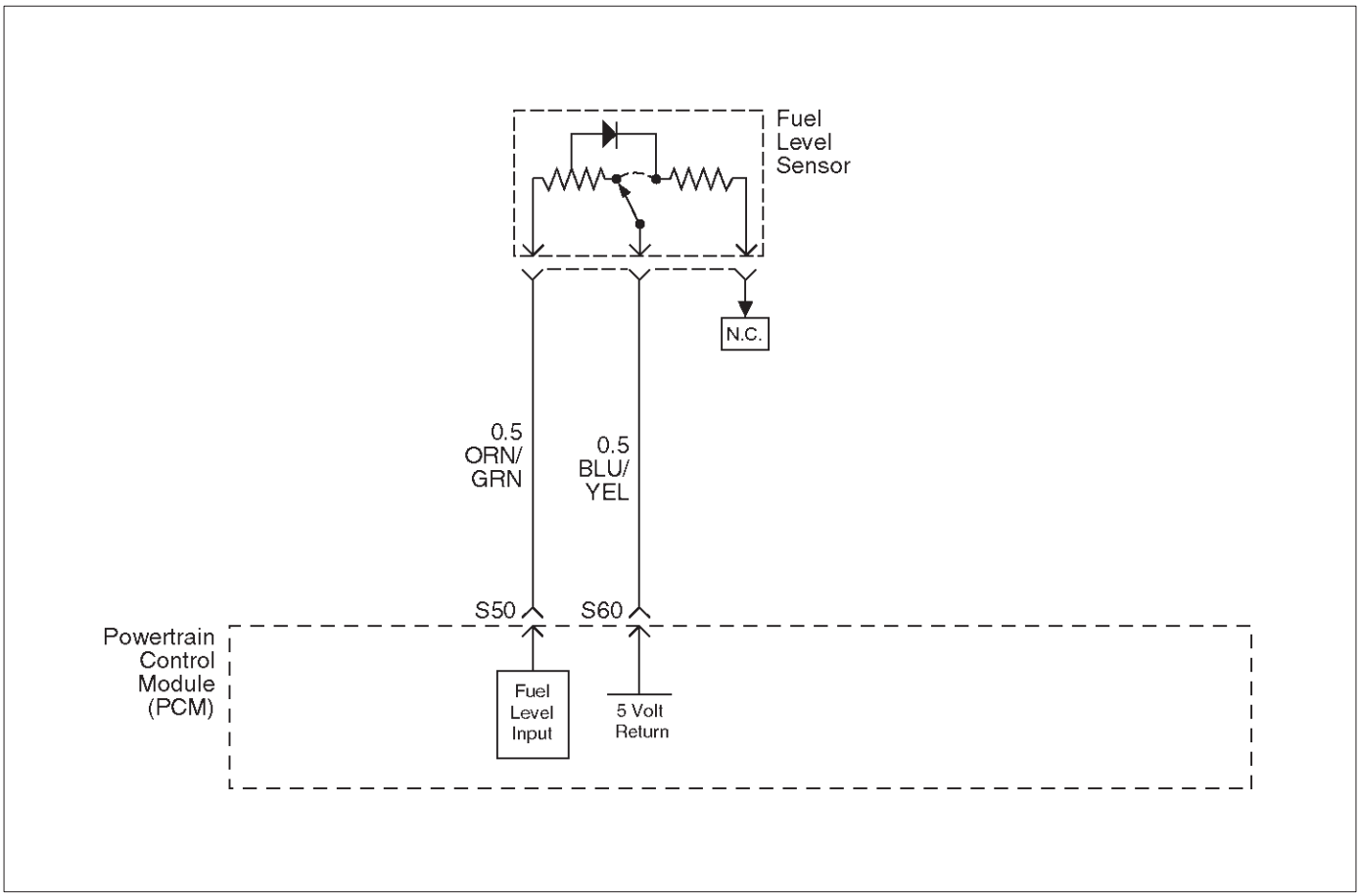
Number(s) below refer to the step number(s) on the Diagnostic Chart.

8. The following chart can be used to check the sending unit:

DTC P0462– Fuel Level Sensor Circuit –Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition "ON", engine "OFF". 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 6*	Go to *Step 3*
3	1. Ignition "ON", engine "OFF". 2. With a DVM, backprobe the PCM connector at the terminal which supplies 5 volts to the fuel level sensor. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 4*	Go to *Step 9*
4	1. Ignition "ON", engine "OFF". 2. Fuel level sensor disconnected from wiring harness. 3. With a DVM, probe the 5-volt supply wire at the sensor harness. Is the voltage approximately equal to the value measured in Step 4?	—	Go to *Step 5*	Go to *Step 9*
5	Check for open or high resistance connection in the ground wire between the PCM and the fuel level sensor. Is the action complete?	—	Verify repair	—
6	Remove the fuel level sensor and check the following: ▼ Does the arm move freely? ▼ Are the wires open or intermittently open when wiggled? ▼ Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 7*	Go to *Step 9*
7	Replace the fuel level sensor. Is the action complete?	—	Verify repair	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
9	Short to ground between the PCM connector and the fuel level sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0463 Fuel Level Sensor Circuit–High Voltage



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is more than 85% or less than 15%, full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. High fuel level causes low resistance in the sending unit. This is recognized by the PCM because the circuit operates at a corresponding high voltage. When the circuit is continuously shorted to a voltage source greater than a specified value, or when the 5 volt signal is shorted to ground, DTC P0463 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is greater than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4˚C (40˚F) from the start-up ECT, and ECT exceeds 71˚C (160˚F) during that same ignition cycle) or the scan tool clearing function has been used.
- DTC P0463 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

▼ Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

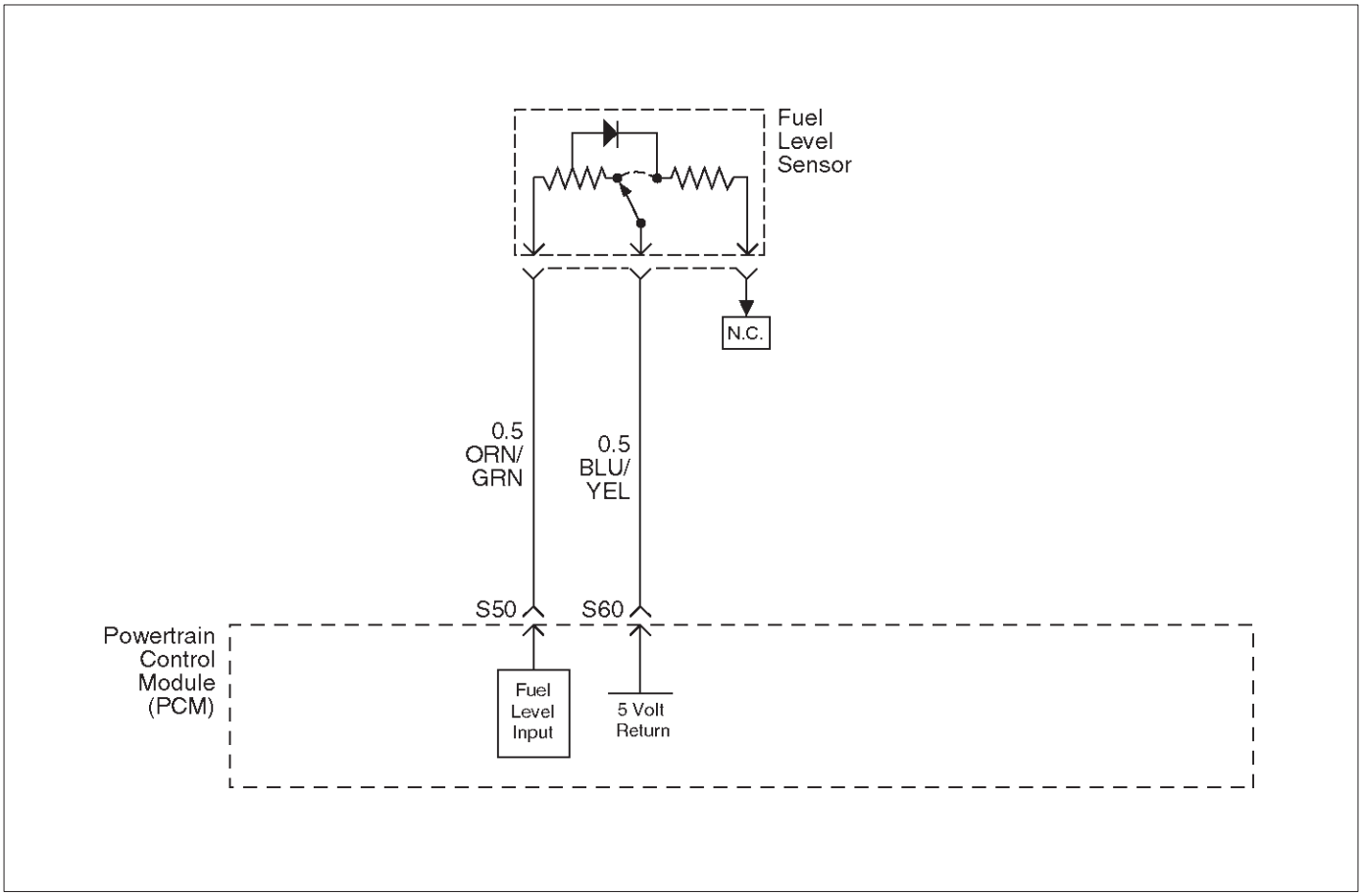
2. The ETC and MAP sensors share a ground at PCM terminal D9.

9. Equates the resistance values at various float positions to the following fuel gauge readings:

DTC P0463– Fuel Level Sensor Circuit –High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition "ON", engine "OFF". 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 8*	Go to *Step 3*
3	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor ground wire with the harness still disconnected. Does the DVM indicate a short to a voltage source?	—	Go to *Step 4*	Go to *Step 5*
4	Repair short to voltage between the sensor and the PCM. Is the repair complete?	—	Verify repair	—
5	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor positive wire with the harness still disconnected. Does the DVM indicate a voltage greater than the specified value?	5 V	Go to *Step 4*	Go to *Step 6*
6	Open circuit between the PCM connector and the fuel level sensor?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
8	Remove the fuel level sensor and check the following: ▼ Does the arm move freely? ▼ Are the wire leads shorted together? ▼ Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
9	Replace the fuel level sensor. Is the repair complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0462 Fuel Level Sensor Noisy Signal



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0464 is set.

Conditions for Setting the DTC

- Sensor output changing is more than 15%.
- Fuel volume level is more than 0.01%.
- IAT is more than 0˚C.
- Vehicle speed is more than 1km/h.
- Throttle position is more than 2%.

When there are 12 test failures within 80 test samples, it is stored.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the DTC

- DTC P0464 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

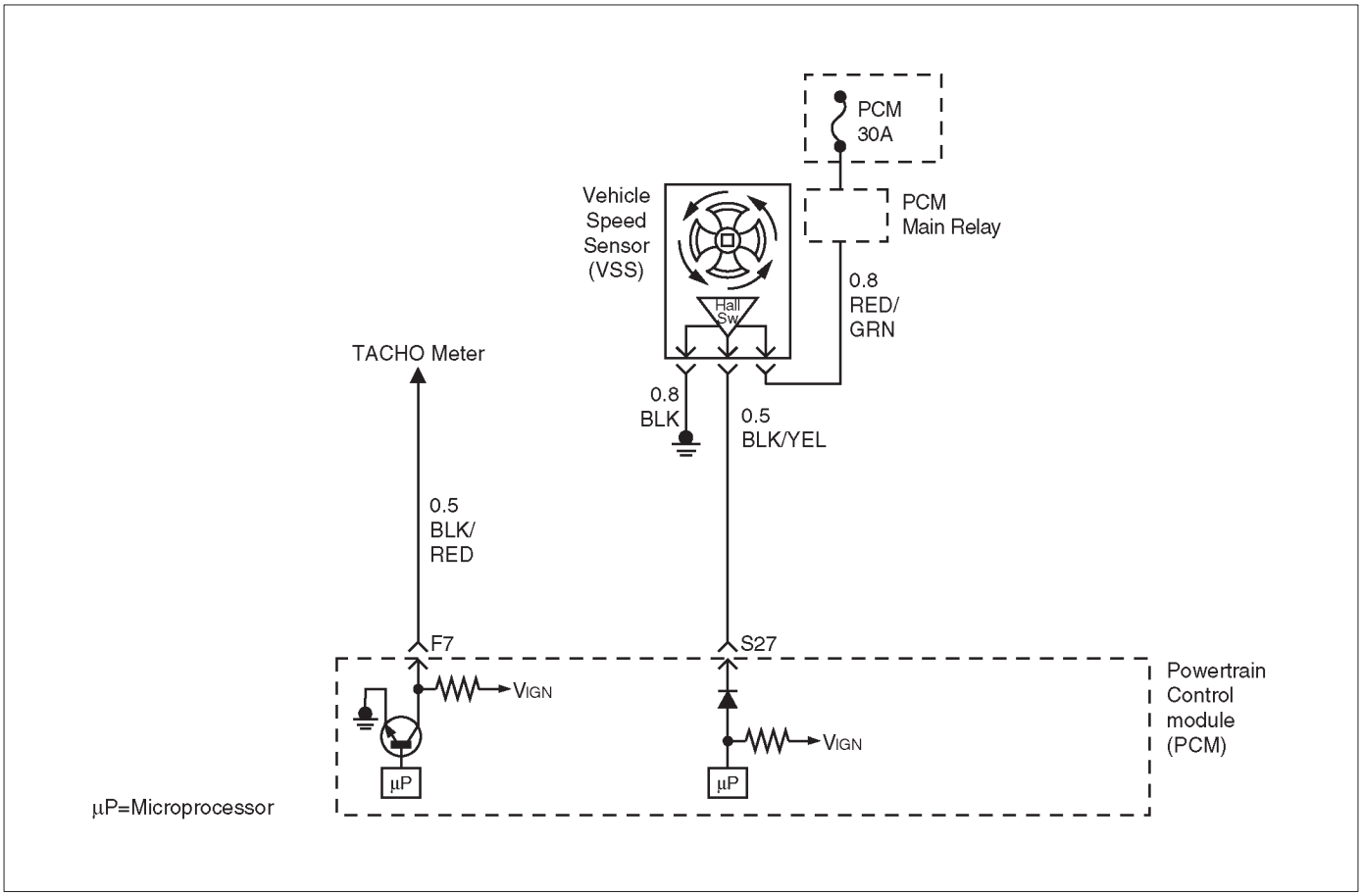
Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

DTC P0464 – Fuel Level Sensor Noisy Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “Off”, Engine “Off”. 2. Perform “Visual/Physical Check” for following points. ▼ Lose harness connector ▼ Clacked harness connector ▼ Poor wire condition ▼ Fuel tank condition ▼ Poor sensor condition 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Disassemble fuel tank on the vehicle. 2. Check the below items. ▼ Fuel sender Was a problem found?	—	Go to *Step 4*	Go to *Step 5*
4	Replace the Fuel sender. Was the action complete?	—	Verify repair	Go to *Step 5*
5	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Was the action completed?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0502 VSS Circuit Low Input



060R200056

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit the interacts with the magnetic field treated by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

Conditions for Setting the DTC

- Engine is running.
- Engine speed is between 1800 RPM and 2500 RPM.
- Throttle angle is between 10% and 40%.
- Engine load is greater than 50 kPa.
- PCM detects no VSS signal for 12.5 seconds over a period of 15 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0502 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0502 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

10. To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connects to the engine harness. Power and ground are applied by jumpers to the VSS through the connectors which are located to the rear of the air cleaner assembly. The VSS signal is monitored with a DVM as the rear driveshaft turns. The wheels can be turned to rotate the driveshaft, or in 2-wheels-drive vehicles the driveshaft can be turned directly.

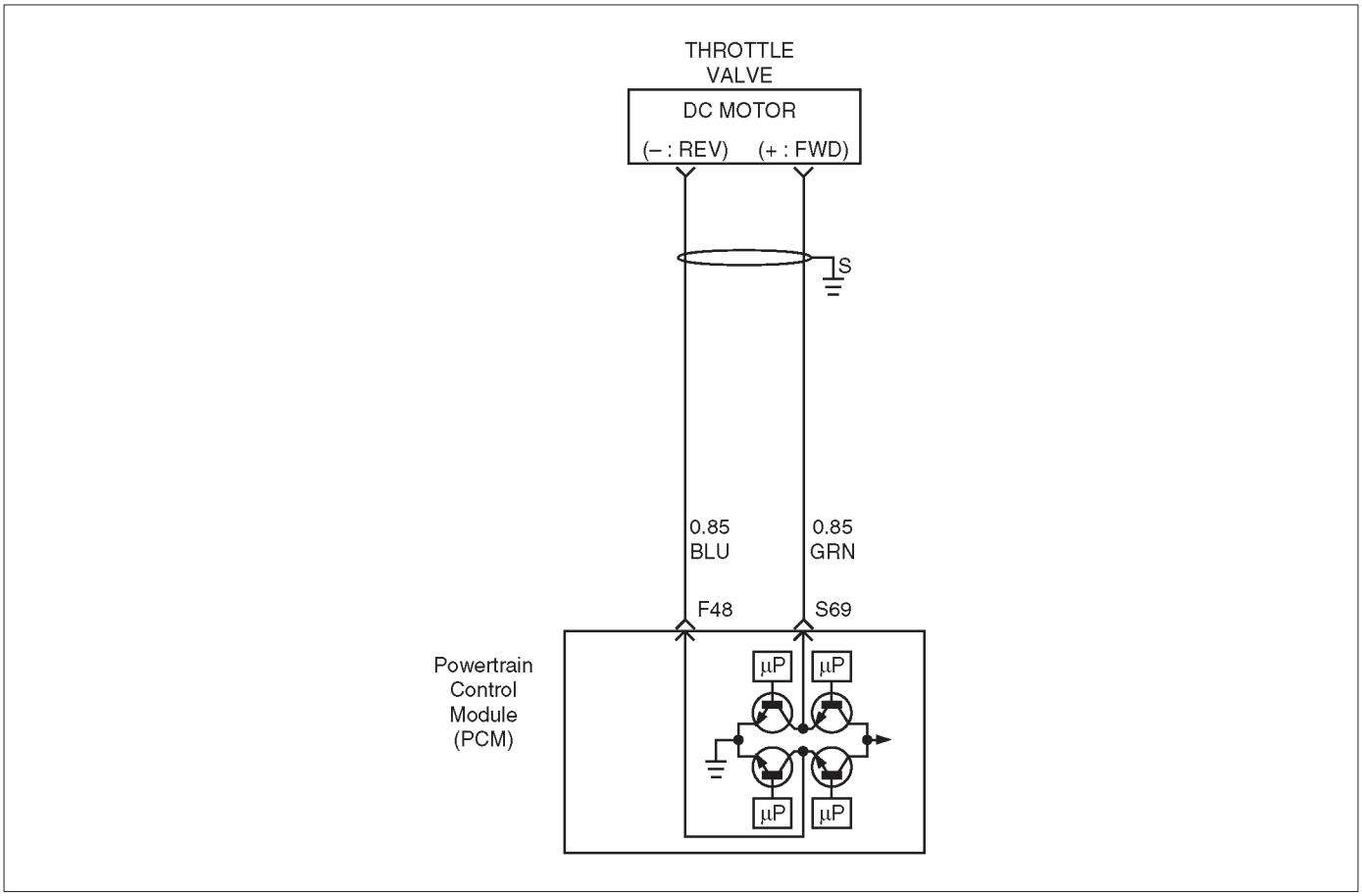
DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Does the speedometer work?	—	Go to *Step 10*	Go to *Step 3*
3	1. Disconnect the VSS connector. 2. Ignition “ON”. 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the sensor ground. Is the action complete?	—	Verify repair	—
5	1. Ignition “ON”, sensor disconnected. 2. Using a DVM, measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to *Step 7*	Go to *Step 6*
6	Repair the open or short to ground which may have blown the meter fuse. Is the action complete?	—	Verify repair	—
7	1. Ignition “ON”, VSS disconnected. 2. Using a DVM, measure at the VSS connector between ground and the wire from the speedometer. Was the measurement near the specified value?	7.5-8 V	Go to *Step 9*	Go to *Step 8*
8	Check for an open or short circuit between the speedometer and the VSS. Was an open or short circuit located?	—	Verify repair	Go to *Step 9*
9	Replace the speedometer. Is the action complete?	—	Verify repair	—

DTC P0502 – VSS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition "OFF". 2. Disconnect the MAF sensor. The connector attaches the VSS wires from the transmission harness to the left-side engine harness. 3. Disconnect the black 16-way connector. 4. Select a terminal adapter from kit J 35616 that can be used with a jumper to supply B+ to the blue wire with a yellow tracer (transmission side of the connector). 5. Use another terminal adapter to attach a voltmeter to the light-green wire with a white tracer (next to the wire in the previous step.) 6. Disconnect the blue connector next to the black 16-way connector, and locate the black/red tracer wire at one corner of the blue connector. The black/red wire is the VSS ground. Use a terminal adapter to attach a jumper to ground to the black/red VSS ground wire at the transmission side of the blue connector. 7. Raise the rear wheels off the ground with transmission in neutral. Does the DVM toggle back and forth between 0.6 V and 10 V as the wheels (and driveshaft) are rotated?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the VSS. Is the action complete?	—	Verify repair	—
12	Check for an open or short between the PCM and the speedometer. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0506 Idle Air Control System Low RPM



060R200057

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0506 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, MAP, IAT, low voltage, fuel system, canister purge, injector control, or ignition control DTCs are set.
- MAP is less than 60 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle more than 10%.
- All conditions are met for 10 seconds.
- Barometric pressure is more than 74.5 kPa.
- Engine speed is more than 100-200 RPM lower than desired idle based upon coolant temperature.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0506 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the ETC passage or throttle bore, excessive deposits in the

ETC passage and on the ETC position, and excessive deposits in the throttle bore and on the throttle plate.

▼ Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

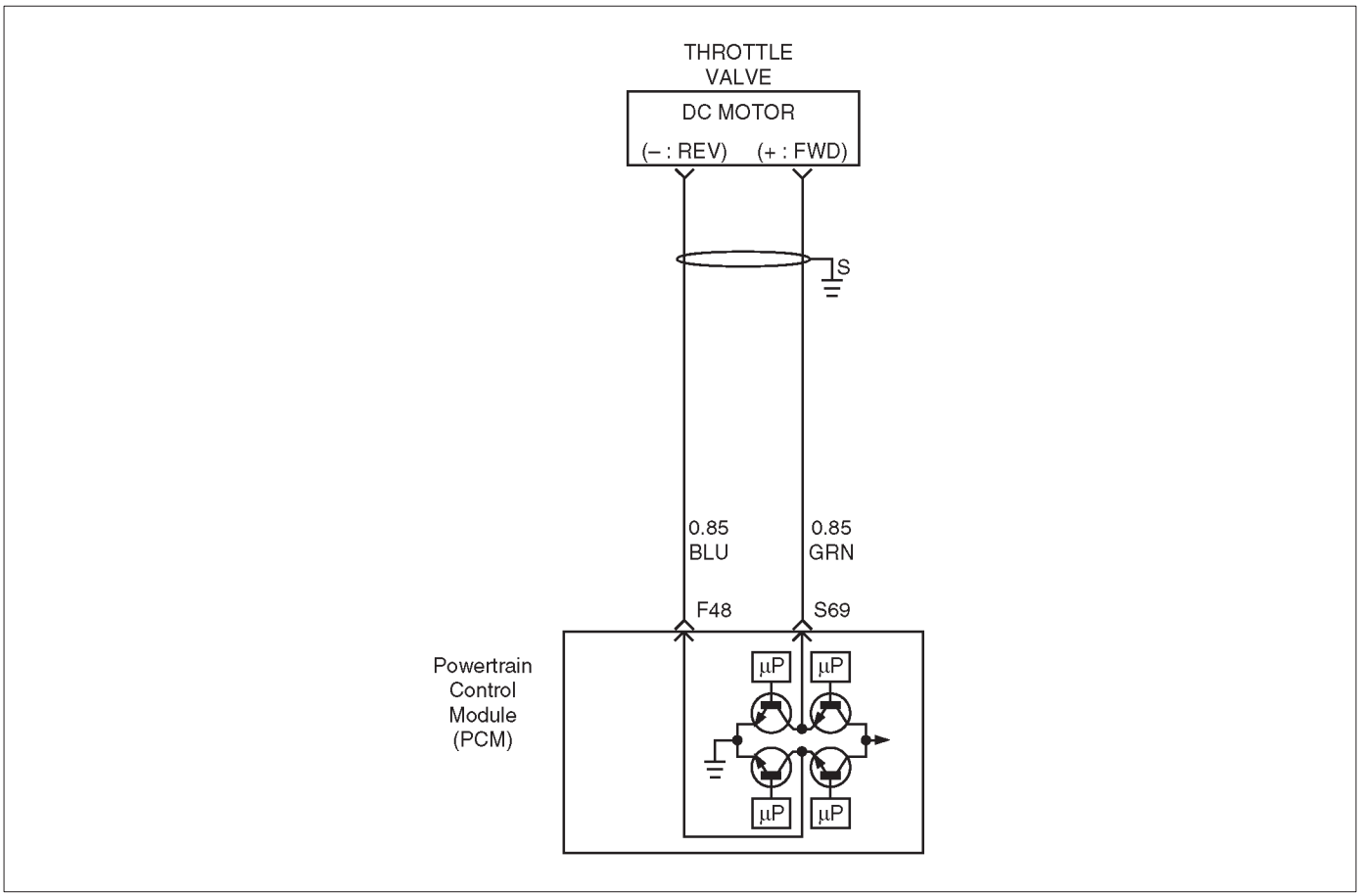
DTC P0506 – Idle Air Control System Low RPM

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ▼ Throttle body tampering. ▼ Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ▼ Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 3*
3	Visually/physically inspect for the following conditions: ▼ Acceleration pedal tampering. ▼ Acceleration pedal : Check for objects blocking the spring or pedal arm. ▼ Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriatesection for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Throttle position sensor 1 circuit. ▼ Throttle position sensor 2 circuit. ▼ Throttle DC motor circuit. ▼ Throttle position sensor resistance. ▼ Throttle DC motor resistance. ▼ If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance0.3 – 100Ω	Verify repair	Go to *Step 6*

DTC P0506 – Idle Air Control System Low RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: Accelerator position sensor 1 circuit. Accelerator position sensor 2 circuit. Sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-DND change resistance	Verify repair	Go to *Step 8*
8	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 10*
10	Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0507 Idle Air Control System High RPM



060R200057

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.

If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0507 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, MAP, IAT, low voltage, fuel system, canister purge, injector control or ignition control DTCs are set.
- Barometric pressure is above 75 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle is more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM higher than desired idle based upon coolant temperature.
- Barometric pressure is more than 74.5 kPa.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0507 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0507 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or

damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.
- Throttle body – Check for sticking throttle plate. Also inspect the air passage for deposits or objects which will not allow the ETC position to fully extend or properly seat.

If DTC P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

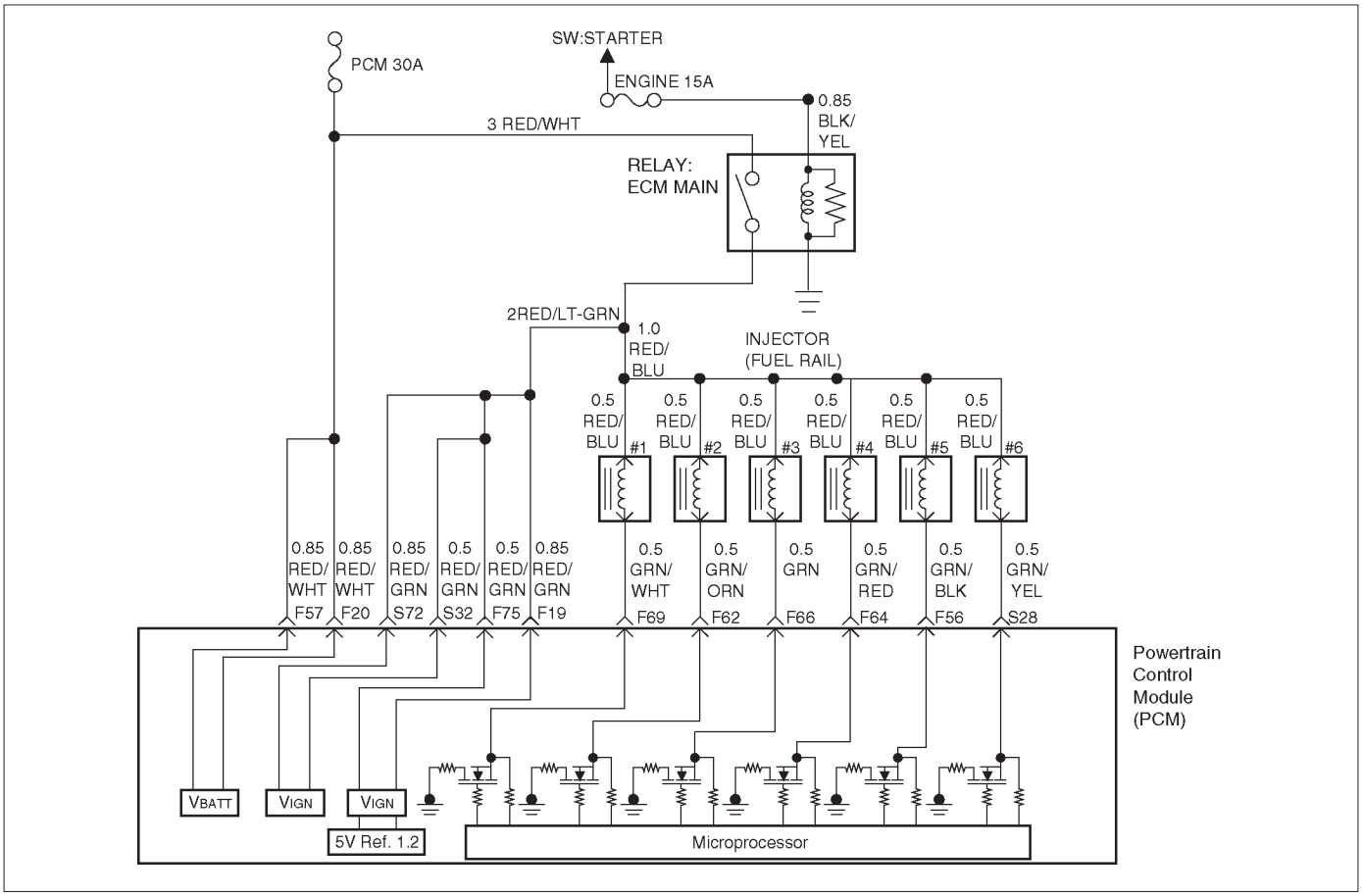
DTC P0507 – Idle Air Control System High RPM

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ▼ Throttle body tampering. ▼ Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ▼ Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
3	Visually/physically inspect for the following conditions: ▼ Accelerator pedal tampering. ▼ Accelerator pedal : Check for objects blocking the spring or pedal arm. ▼ Accelerator pedal : Check for objects move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the accelerator position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*

DTC P0507 – Idle Air Control System High RPM (Cont'd)

Step	Action	Value(s)	Yes	No
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Throttle position sensor 1 circuit. ▼ Throttle position sensor 2 circuit. ▼ Throttle DC motor circuit. ▼ Throttle position sensor resistance. ▼ Throttle DC motor resistance. ▼ If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-GND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 6*
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Accelerator position sensor 1 circuit. ▼ Accelerator position sensor 2 circuit. ▼ Sensor 3 circuit. ▼ Sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-GND change resistance	Verify repair	Go to *Step 8*
8	Replace the accelerator position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Stored DTCs: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 10*
10	Stored DTCs: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0562 System Voltage Low



060R200058

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage DTC will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition “ON”.
- System voltage is below 11.5 volts for 40 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0562 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0562 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

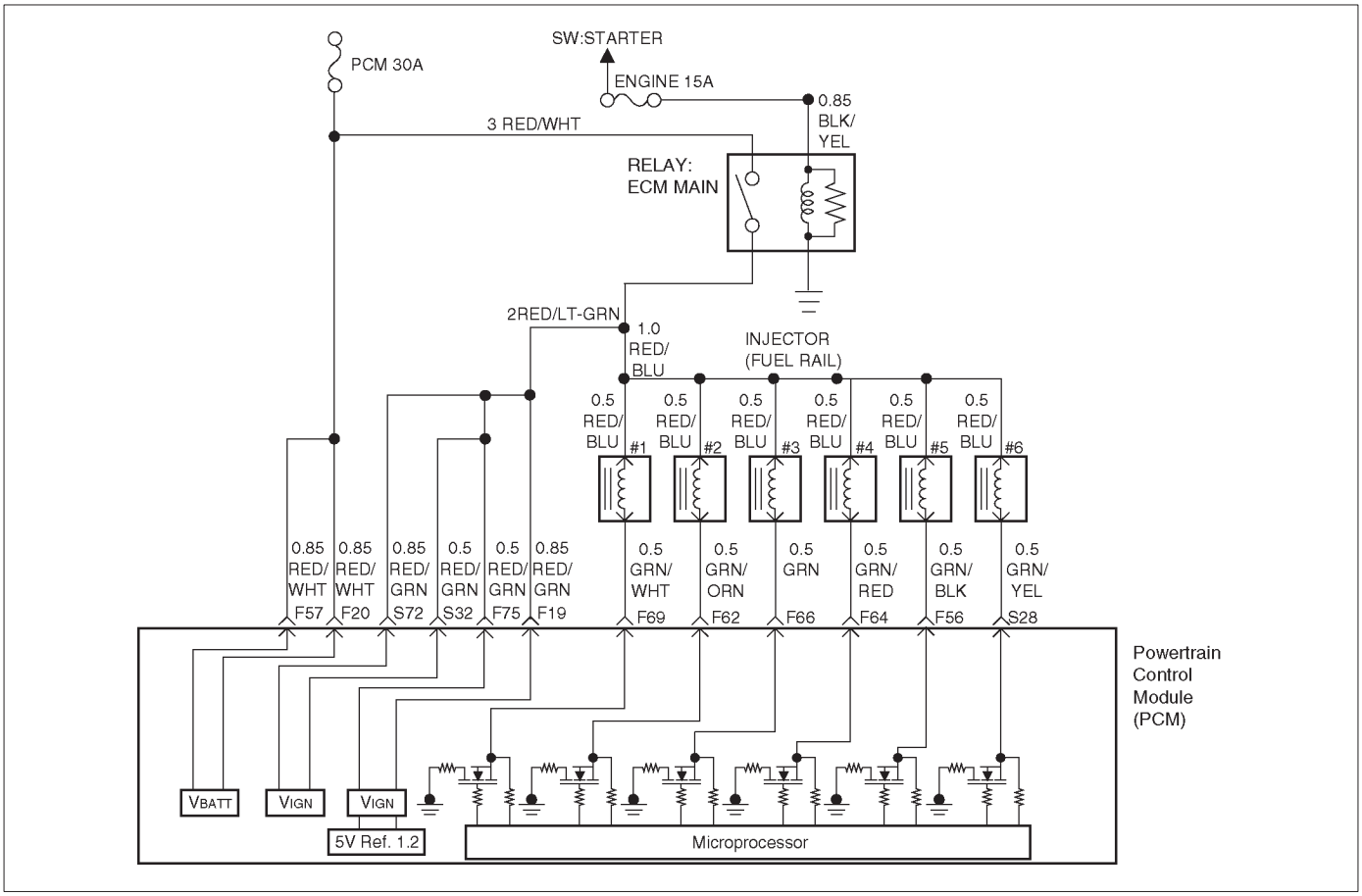
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0562 – System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to *Step 3*	Charge battery, then go to *Step 3*
3	1. Install a Tech 2. 2. Select “Ignition Volts” on the Tech 2. 3. Start the engine and raise the engine speed to the specified value. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	2000 RPM 12.8-14.1 V	Go to *Step 4*	Go to *Starting/Charging*
4	1. Ignition “OFF”. 2. Disconnect the PCM connector at the PCM. 3. Using a DVM, measure the battery voltage at the PCM connector F-20 and F-57. Is it approximately equal to battery voltage?	—	Go to *Step 5*	Go to *Step 6*
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to *Step 7*
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0563 System Voltage High



060R200058

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Conditions for Setting the DTC

- Ignition “ON”.
- System voltage is above 16 volts for 40 seconds.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- A history DTC P0563 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0563 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

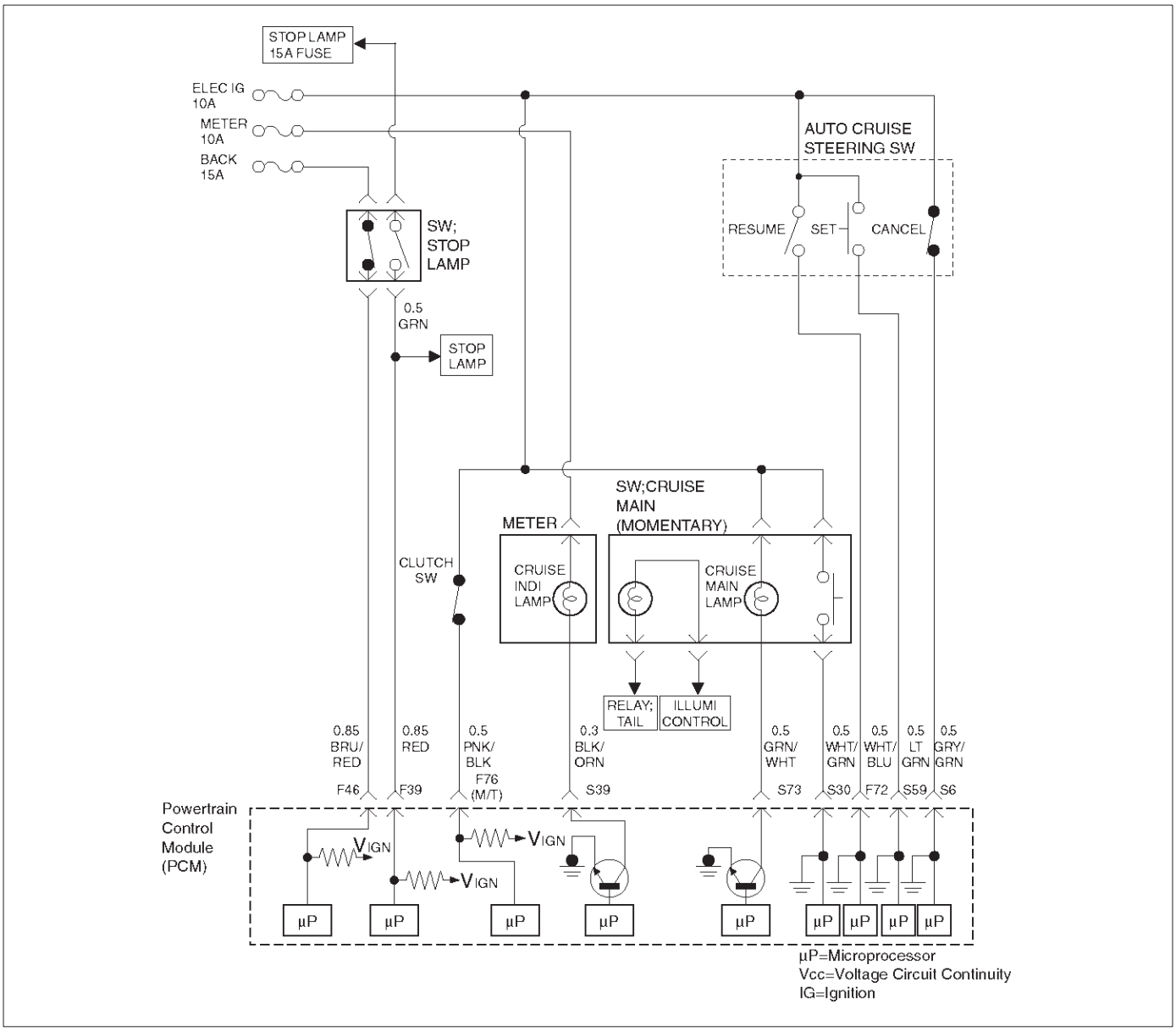
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0563 – System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the “ON-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage less than the specified value?	11.5 V	Go to *Step 3*	Go to *Step 4*
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage less than the specified value?	11.5 V	Replace battery	Go to *Step 4*
4	1. Turn “OFF” all the accessories. 2. Install a Tech 2. 3. Select the ignition voltage parameter on the Tech 2. 4. Start the engine and raise the engine RPM to the specified value. Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3?	2000 RPM	Go to *Starting/ Charging*	Go to *Step 5*
5	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0565 Cruise Main Switch Circuit Error



060R100094

Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to power train control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remains on for 15 seconds or more.
- Noises are generated by poor switch contact 60 times within 1 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0565 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0565 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the cruise main switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

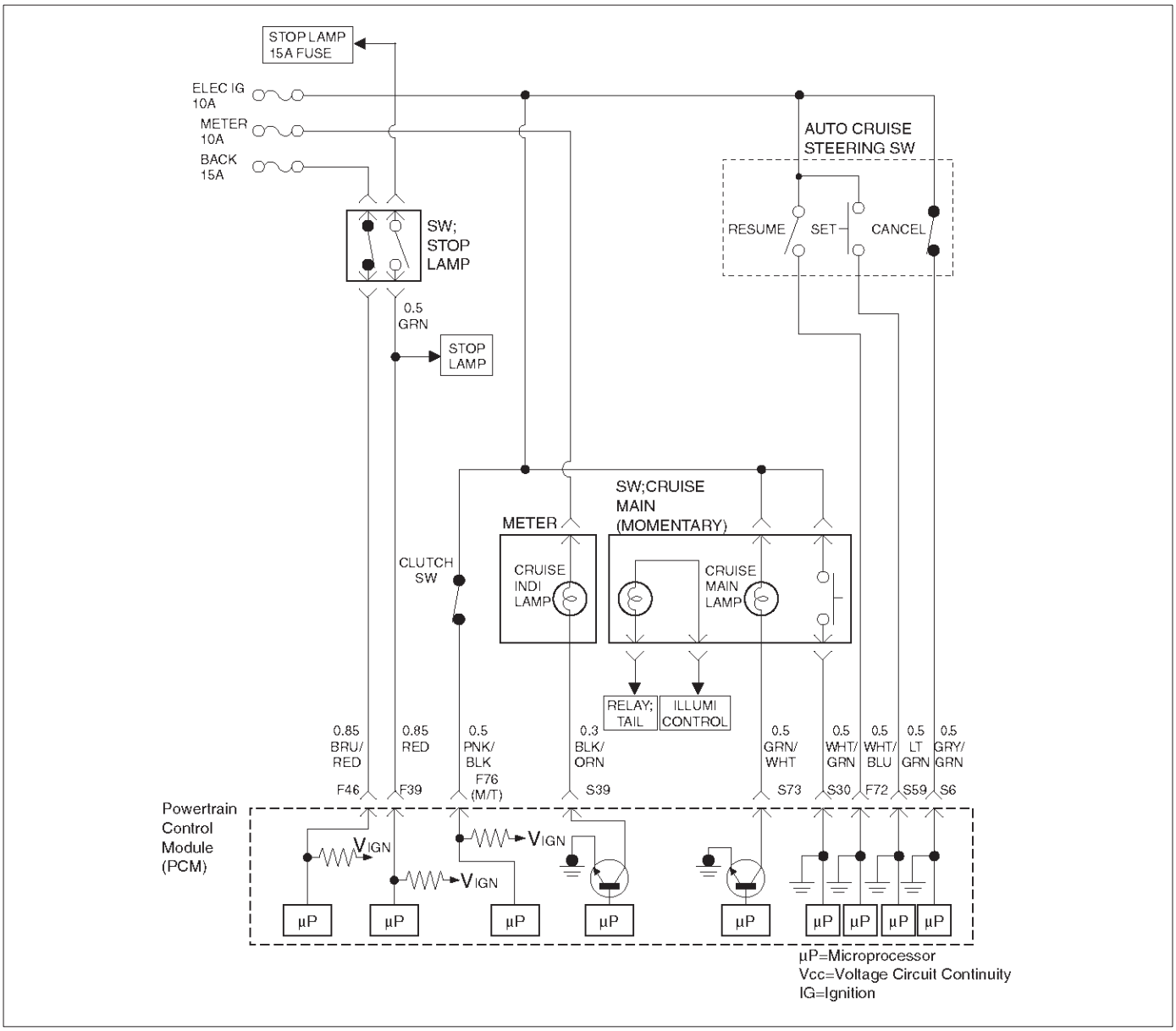
If DTC P0565 cannot be duplicated, the information included n the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0565 Diagnostic Chart may isolate the cause of the fault.

DTC P0565 Cruise Main Switch Circuit Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “ON.” 2. Observe the cruise main lamp in the switch. Is the cruise main lamp “ON?”	—	Go to *Step 3*	Go to *Step 4*
3	1. Push the auto cruise main switch. 2. Observe the cruise main lamp in the switch. Is the cruise main lamp “OFF?”	—	Go to *Diagnostic Aids*	Go to *Step 4*
4	Check the signal circuit for auto cruise main switch. 1. Ignition is “OFF”. 2. Disconnect the powertrain control module(PCM). 3. Disconnect the cruise main switch. Check for an open cruise main switch signal circuit between the PCM and the cruise main switch. Is a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the auto cruise main switch signal circuit. Is the action complete?	—	Verify repair	—
6	Check the auto cruise main switch and lamp circuit. Is a problem found?	—	Go to *Step 7*	Go to *Step 8*
7	Repair or replace the auto cruise main switch and lamp circuit. Is the action complete?	—	Verify repair	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0566 Cruise Cancel Switch Circuit Error



060R100094

Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the cancel switch is “ON”, cruise system is “OFF”.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remains on for 40 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0566 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

- DTC P0566 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the cruise cancel switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

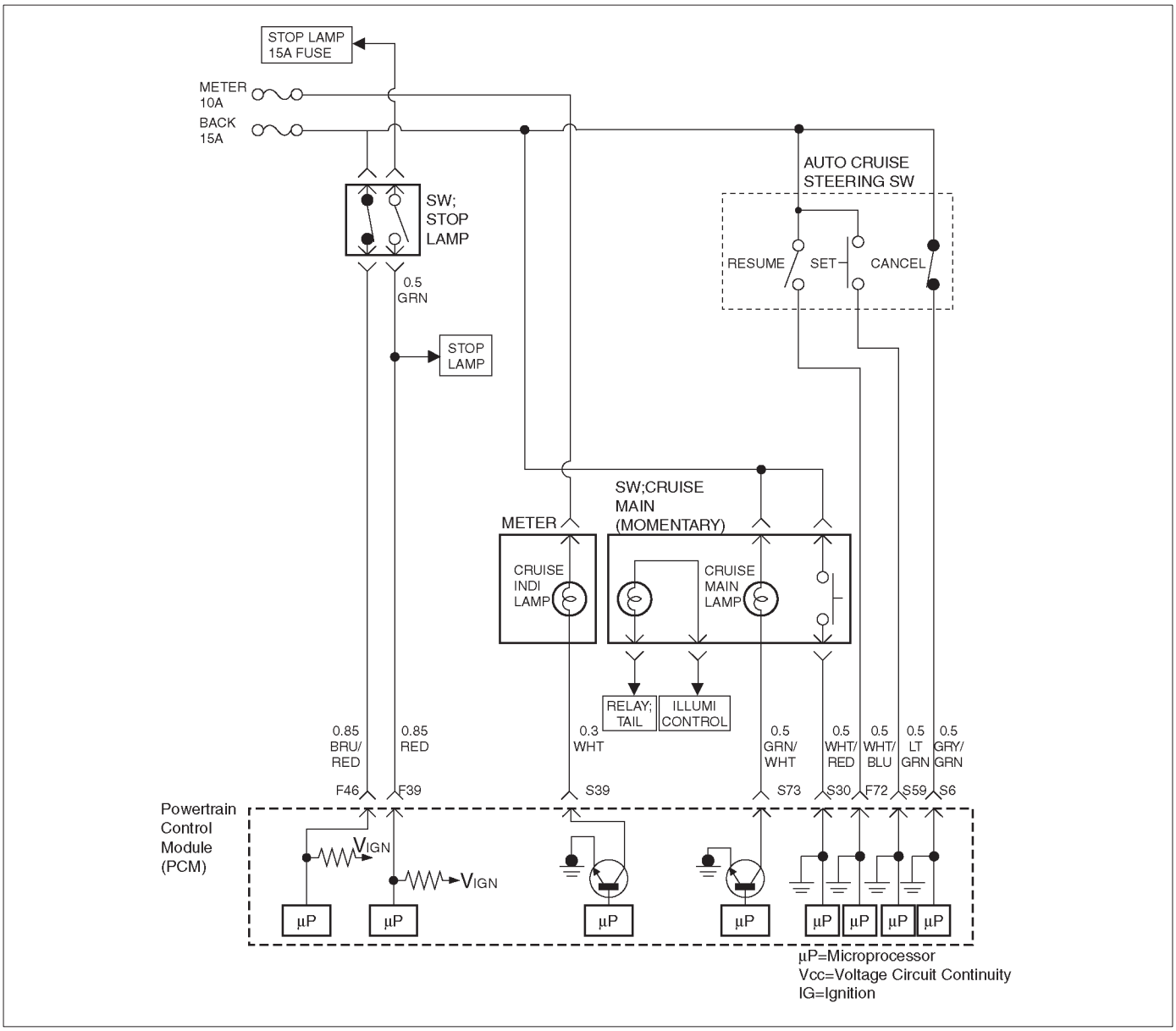
  A change in the display will indicate the location of the fault. If DTC P0566 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP0566 Diagnostic Chart may isolate the cause of the fault.

DTC P0566 Cruise Cancel Switch Circuit Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the signal circuit for auto cruise cancel switch. 1. Ignition is “OFF”. 2. Disconnect the powertrain control module(PCM). 3. Disconnect the cruise cancel switch. Check for cruise cancel switch signal circuit between the PCM and the cruise cancel switch. Is a problem found?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the main cruise cancel switch signal circuit. Is the action complete?	—	Verify repair	—
4	Check the auto cruise main switch. Is a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Repair or replace the main cruise main switch. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0567 Cruise Resume Switch Circuit Error



060R200086

Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the resume switch is “ON”, vehicle speed is reset to the previous set speed.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remain on for 50 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0567 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0567 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage.

If the harness appears to be OK, observe the Cruise resume switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

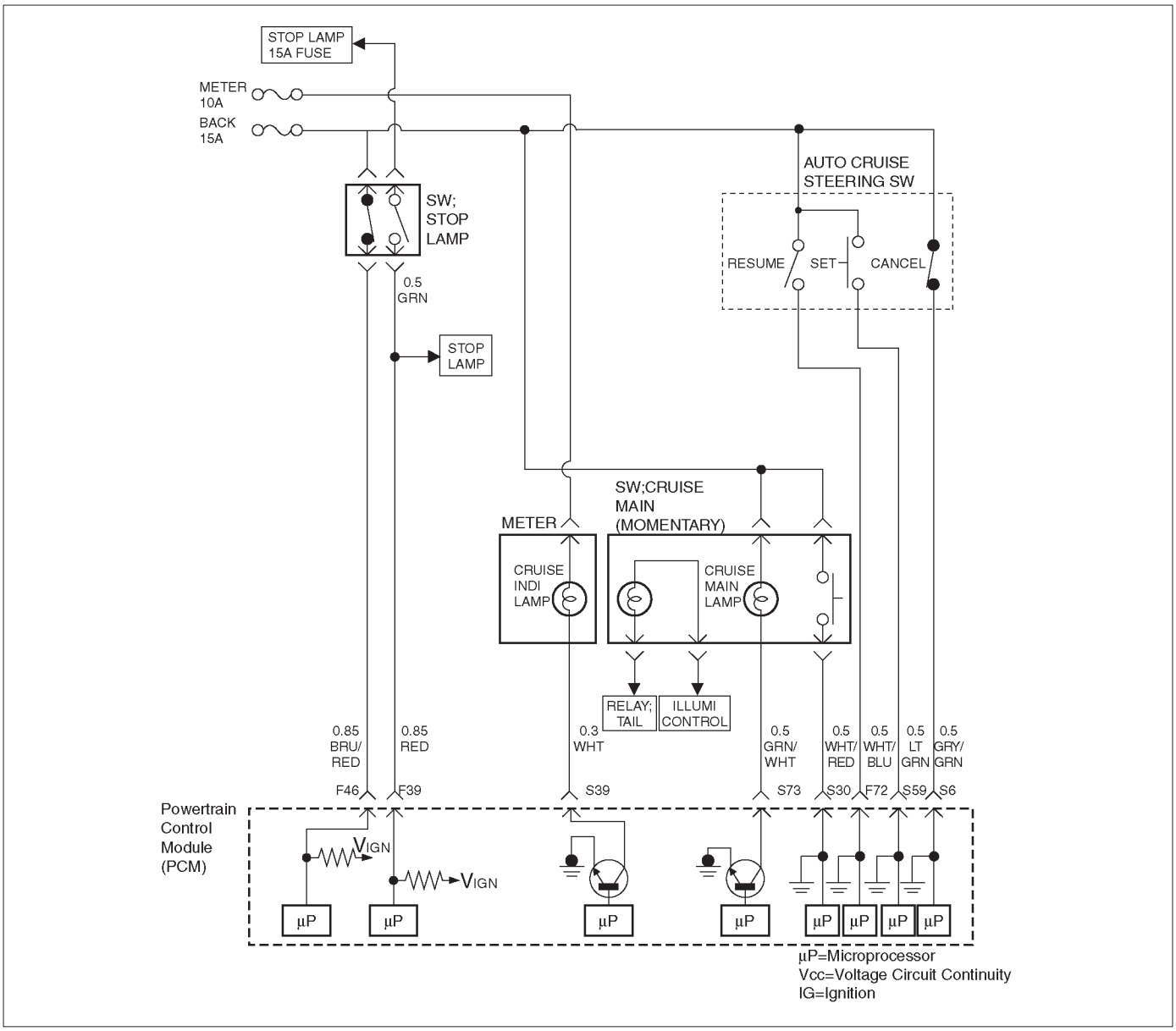
If DTC P0567 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTCP0567 Diagnostic Chart may isolate the cause of the fault.

DTC P0567 Cruise Resume Switch Circuit Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the signal circuit for auto cruise resume switch. 1. Ignition is “OFF”. 2. Disconnect the powertrain control module (PCM). 3. Disconnect the cruise resume switch. Check for cruise resume switch signal circuit between the PCM and the cruise resume switch. Is a problem found?		Go to *Step 3*	Go to *Step 4*
3	Repair the main cruise resume switch signal circuit. Is the action complete?	—	Verify repair	—
4	Check the auto cruise resume switch. Is a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Repair or replace the main cruise resume switch. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0568 Cruise Set Switch Circuit Error



060R200086

Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module (PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the set switch is “ON”, vehicle speed is set.

Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remain on for 120 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0568 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

- DTC P0568 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the cruise set switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

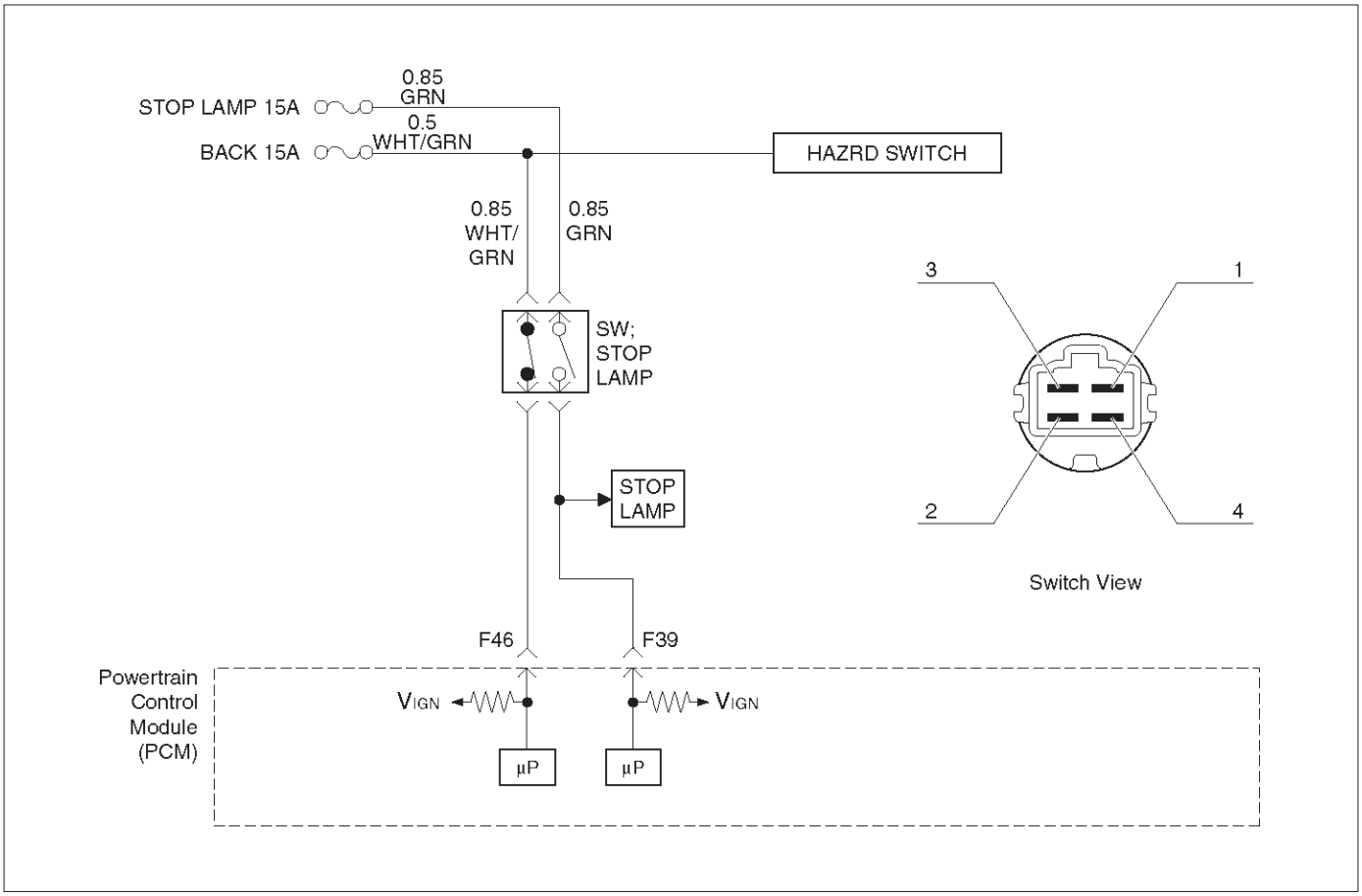
  If DTC P0568 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP0568 Diagnostic Chart may isolate the cause of the fault.

DTC P0568 Cruise Set Switch Circuit Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “ON.” 2. Observe the cruise indicator lamp in the meter. Is the cruise indicator lamp “ON?”	—	Go to *Step 3*	Go to *Step 4*
3	1. Push the auto cruise set switch. 2. Observe the cruise indicator lamp in the meter. Is the cruise indicator lamp “OFF ?”	—	Go to *Diagnostic Aids*	Go to *Step 5*
4	Check the signal circuit for auto cruise set switch. 1. Ignition is “OFF”. 2. Disconnect the powertrain control module (PCM). 3. Disconnect the cruise set switch. Check for cruise set switch signal circuit between the PCM and the cruise set switch. Is a problem found?		Go to *Step 5*	Go to *Step 6*
5	Repair the main cruise set switch signal circuit. Is the action complete?	—	Verify repair	—
6	Check the auto cruise set switch. Is a problem found?	—	Go to *Step 7*	Go to *Step 8*
7	Repair or replace the main cruise set switch. Is the action complete?	—	Verify repair	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0571 No Brake Switch Signal



060R100093

Circuit Description

The brake switch has 3 functions.

- Brake pedal operation check
- Brake light operation (On and off)
- Cruise control (Cancel)

The PCM receives vehicle speed and switch position signals from the brake switch. The PCM sets brake operating conditions in response to these signals.

If the brake switch is on, the brake system is in normal operation (cruise control cancelled).

Conditions for Setting the DTC

- Two brake switch signals not acknowledged after signal changed.
- VSS not defective.
- Engine is running.
- Vehicle speed above 20km/h.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- DTC P0571 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

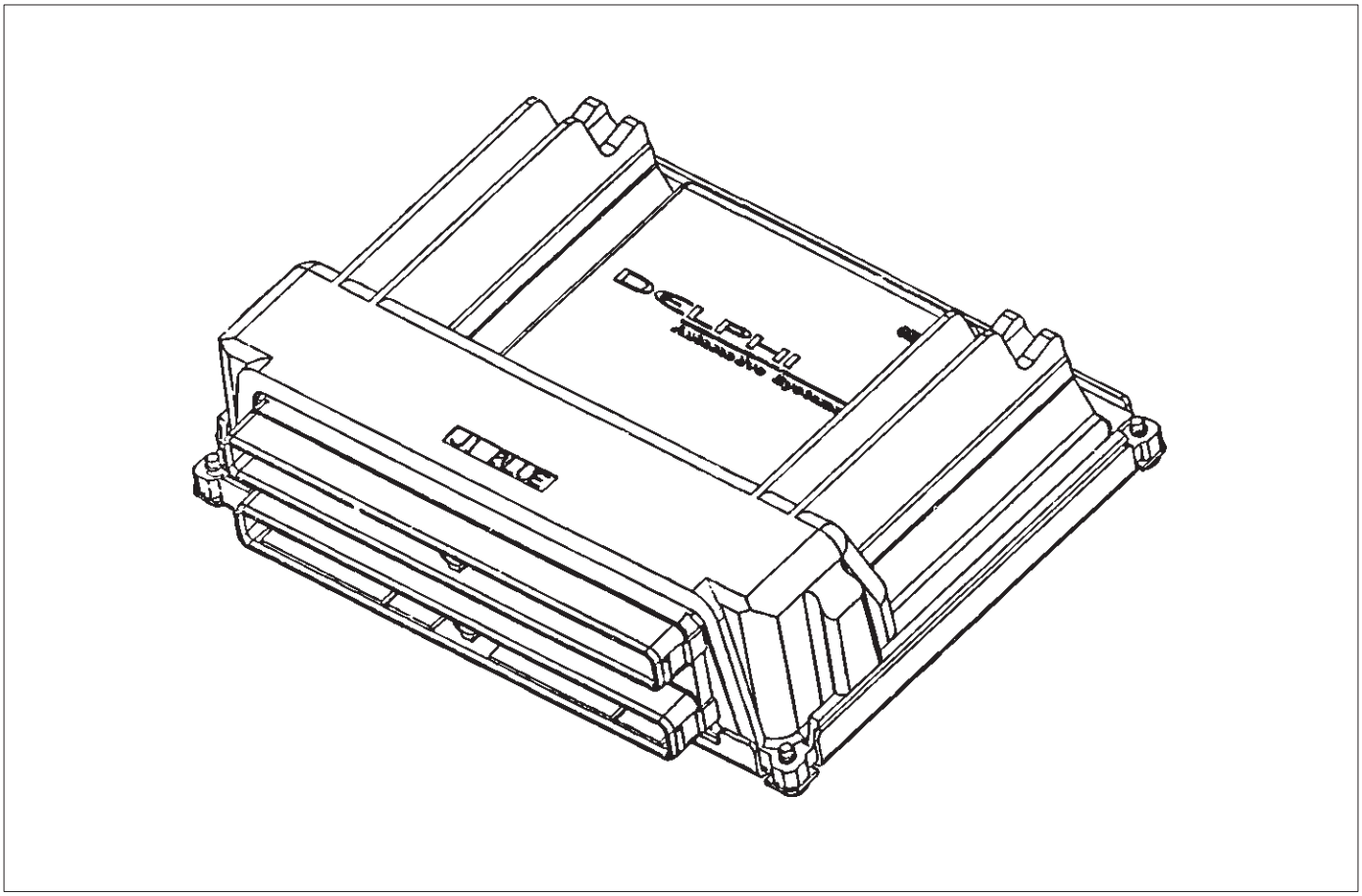
Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

DTC P01571 No Brake Switch Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “Off”. Engine “Off”. 2. Check following fuses. ▼ BACK 15A ▼ STOP LAMP 15A Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Make adjustment to the brake switch. The brake switch is installed to the brake pedal assembly. (Refer to *“Brake switch” in “10A CRUISE CONTROL SYSTEM”.*) Was the problem found?	—	Verify repair	Go to *Step 4*
4	1. Push the shaft at brake switch. 2. Check shaft operation for smooth movements. Was the problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the connector at brake switch. 2. Check following terminal pin at ohmmeter. (Leave the shaft position at brake switch. Don’t push it.) ▼ Between pin 1 and pin 2 ▼ Between pin 3 and pin 4 Was it specified value?	Between pin1 and pin2 is 0Ω, Between pin3 and pin4 is ∞Ω	Go to *Step 6*	Go to *Step 9*
6	1. Disconnect the connector at brake switch. 2. Check following terminal pin at ohmmeter. (Push the shaft position at brake switch and hold it) ▼ Between pin 1 and pin 2 ▼ Between pin 3 and pin 4 Was it specified value?	Between pin1 and pin2 is ∞Ω, Between pin3 and pin4 is 0Ω	Go to *Step 7*	Go to *Step 9*
7	1. Probe related circuits for open or short to ground. 2. If a problem was found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Replace the ECM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Was the action completed?	—	Verify repair	—
9	1. Replace the brake switch. Was the action completed?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0601 PCM Memory



060RY014

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read-only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for the EEPROM programming procedure.

Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0601 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0601 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

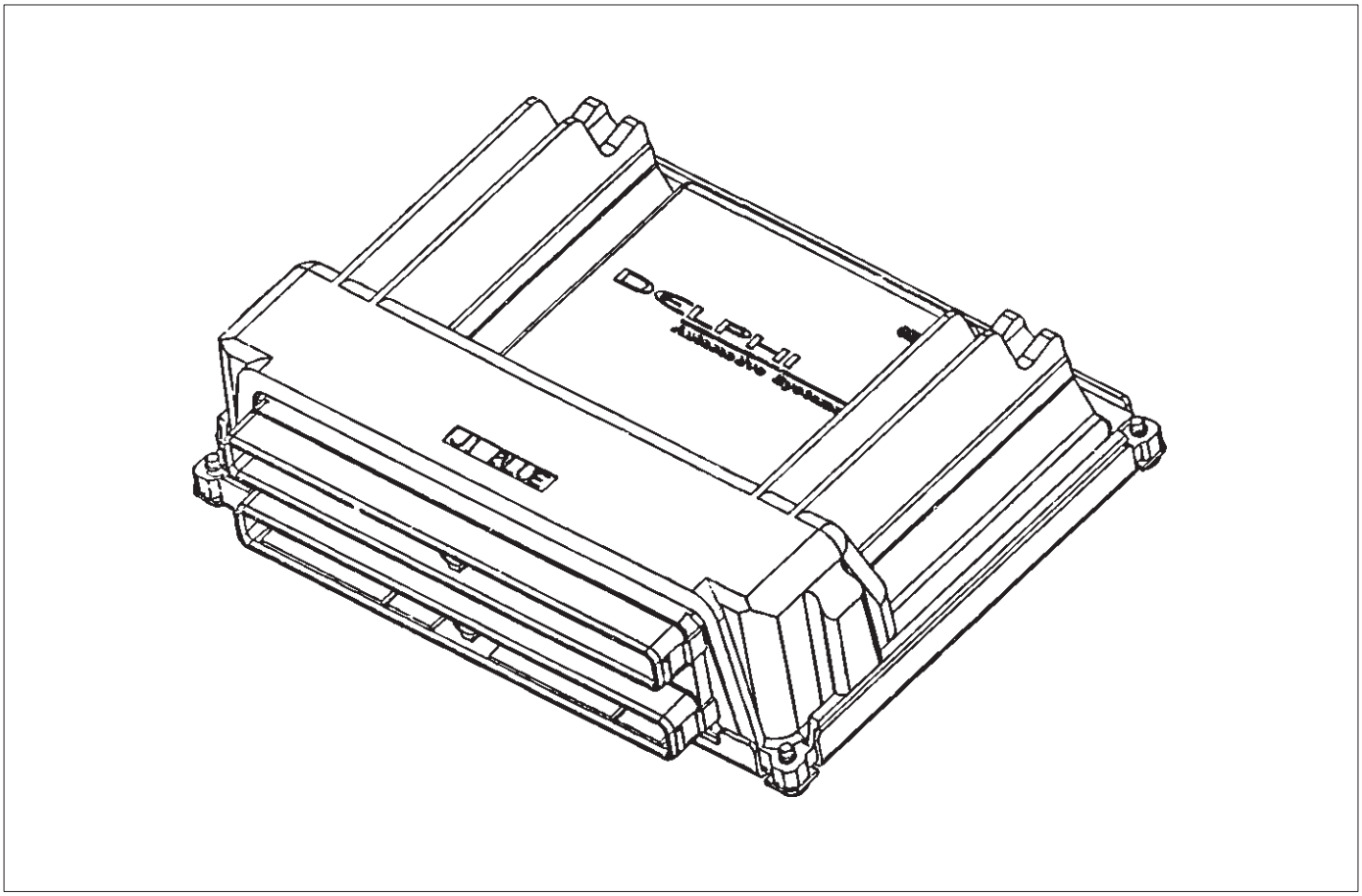
Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement. Remember to program the replacement PCM with the correct software and calibration for the vehicle.

DTC P0601 – PCM Memory

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0602 PCM Programming Error



060RY014

Circuit Description

The powertrain control module (PCM) uses Main CPU and Watchdog CPU software/calibration.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU and Watchdog CPU software/calibration.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

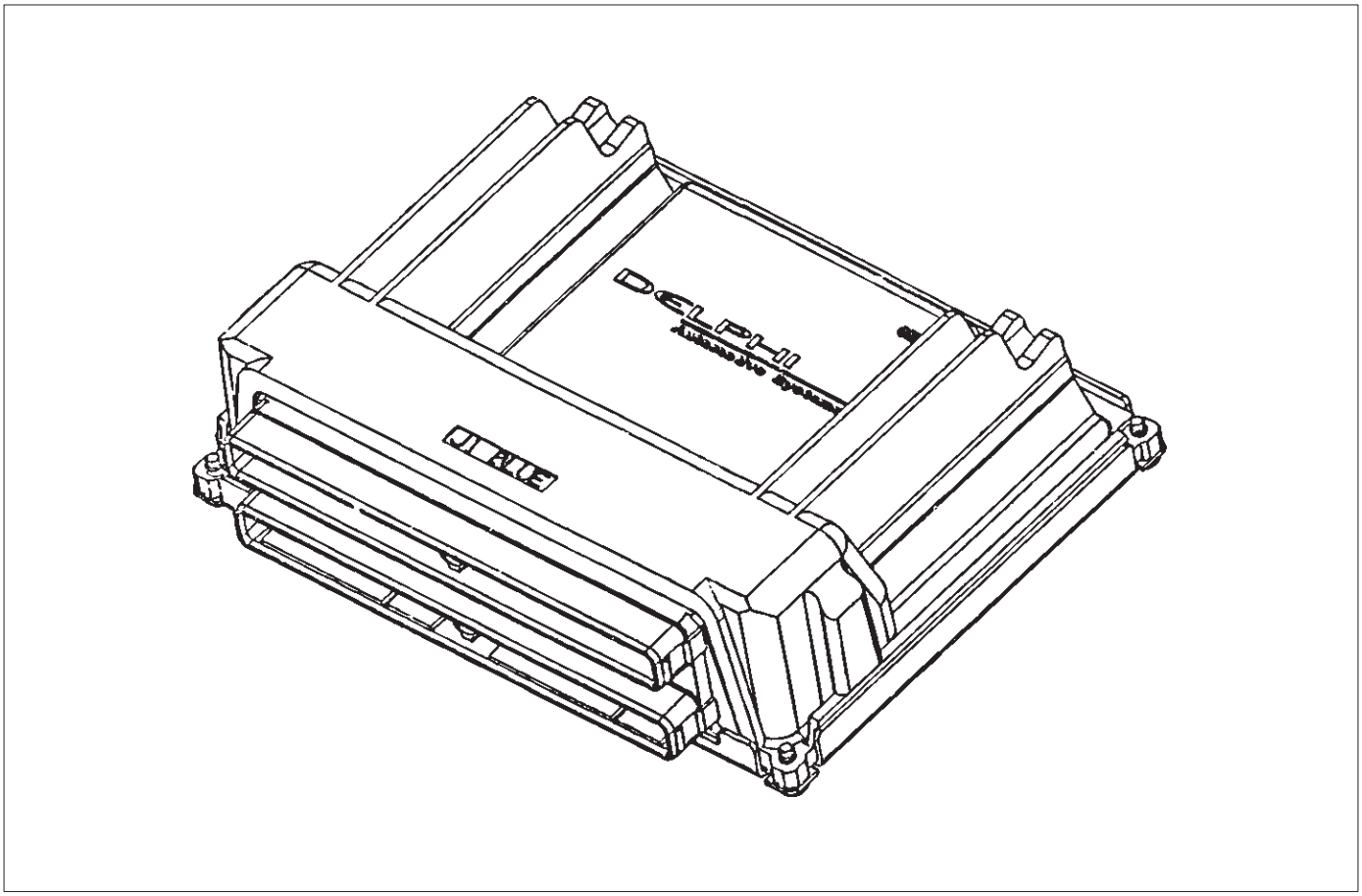
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0602 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0602 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0602 – PCM Programming Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0604 PCM RAM Error



060RY014

Circuit Description

The powertrain control module (PCM) uses Main CPU RAM and Watchdog CPU RAM.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU RAM and Watchdog CPU RAM.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

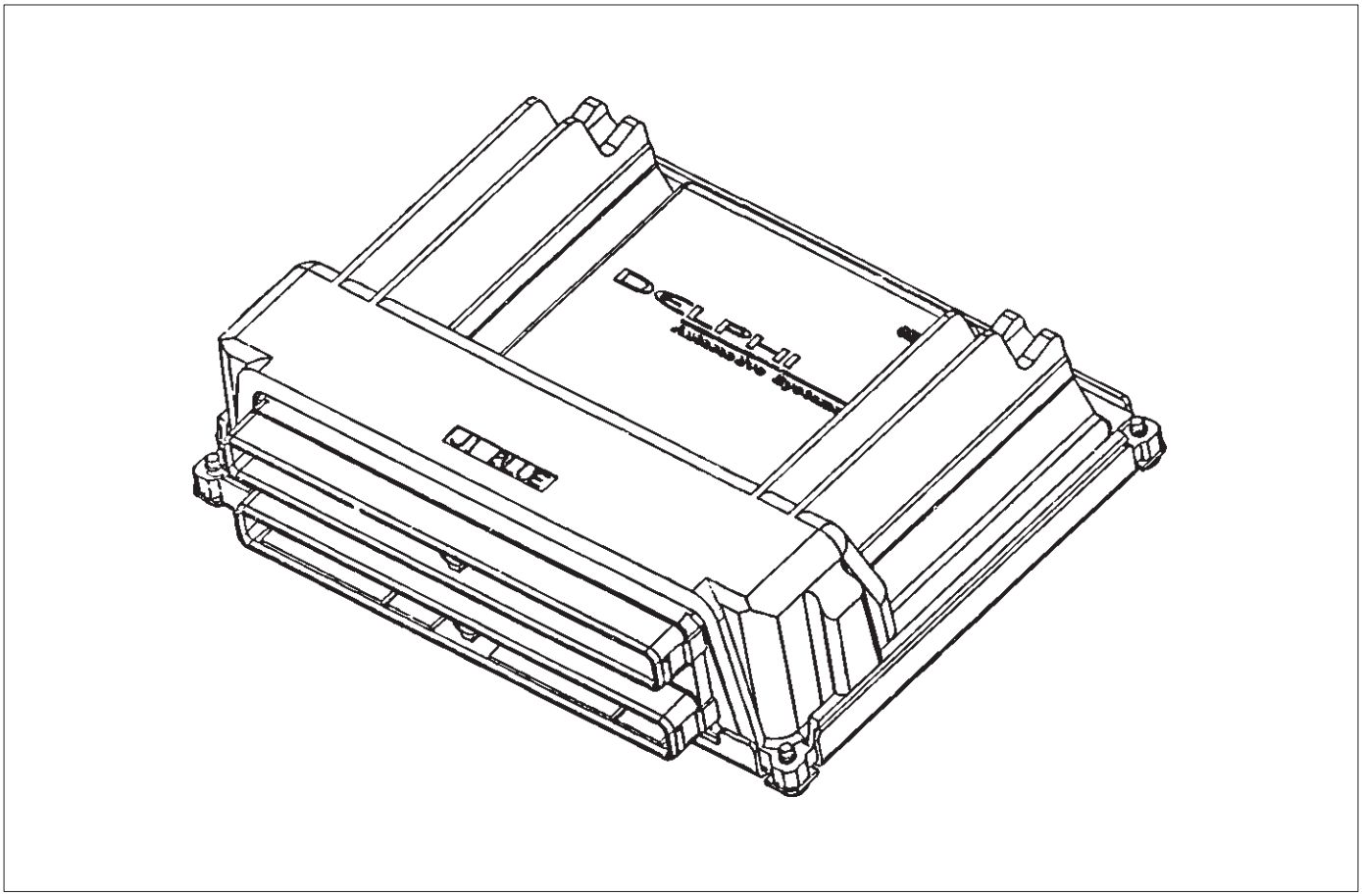
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0604 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0604 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0604 – PCM RAM Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0606 PCM Internal Performance



060RY014

Circuit Description

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON”. These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU A/D converters and Watchdog CPU A/D converters.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

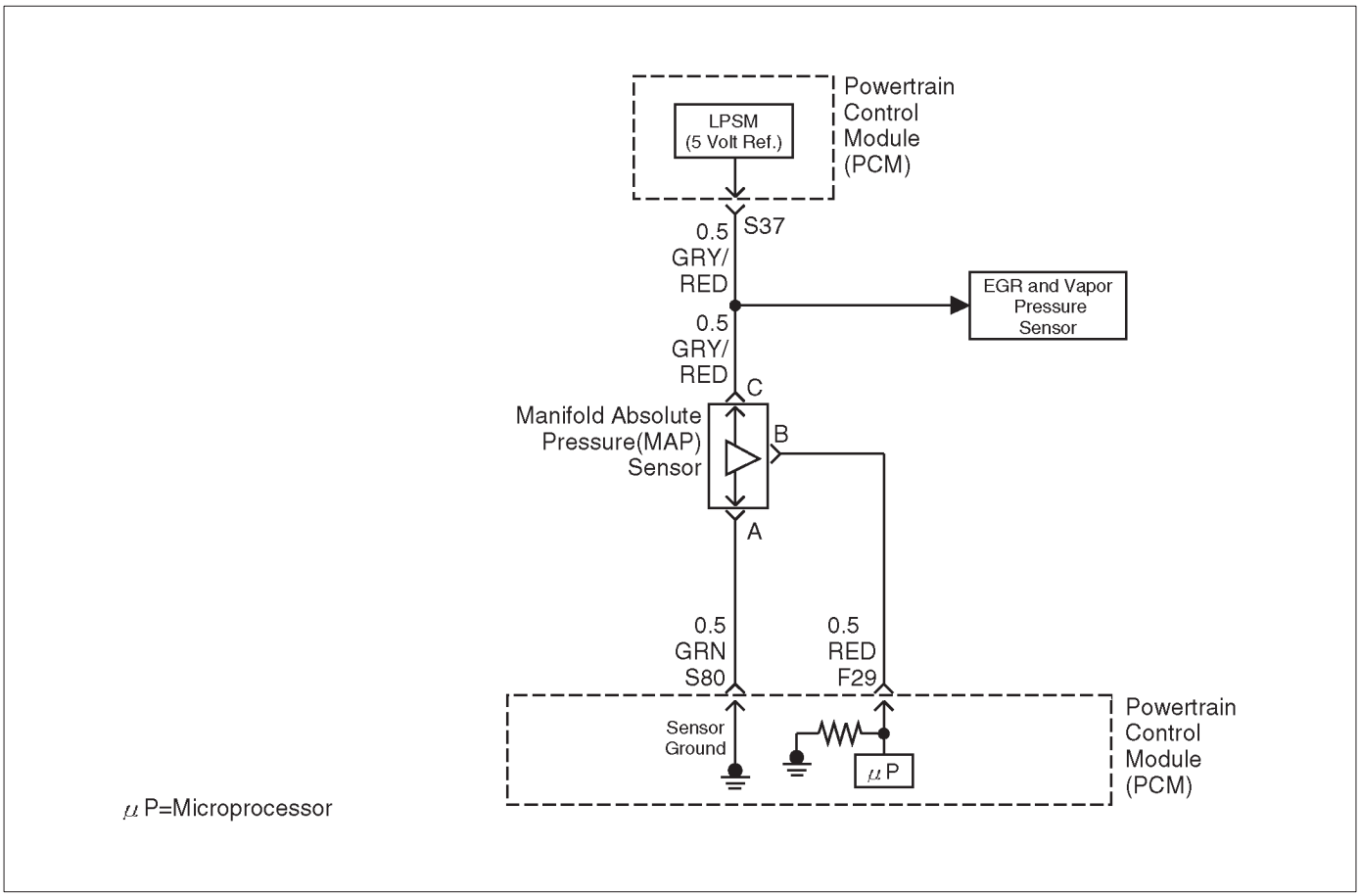
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0606 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0606 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0606 – PCM Internal Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1106 MAP Sensor Circuit Intermittent High Voltage



Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the liner EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, DTC P1106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running for at least 10 seconds.
- Throttle angle is below 3% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

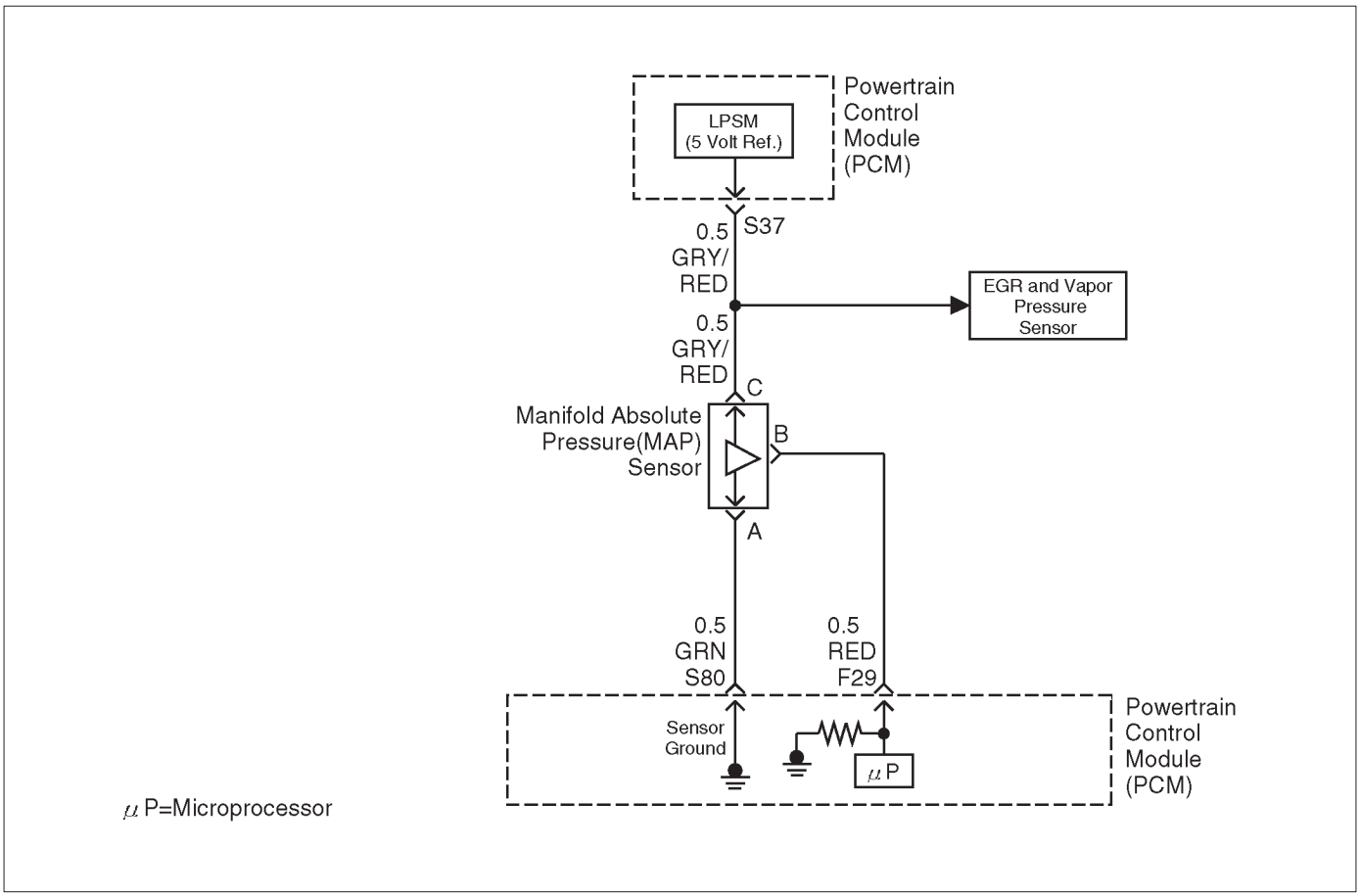
the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

- The MAP sensor shares a 5 Volt Reference with the Fuel Tank Pressure sensor. Check the 5 Volt reference if this DTC is also set.
- The MAP sensor shares a ground with the Fuel Tank Pressure sensor and the ECT Sensor. Check the ground if these other DTCs are also set.

DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0108 also set?	—	Go to *DTC P0108* chart first	Go to *Step 3*
3	Are DTC P1111, P1115, and/or P1120 also set?	—	Go to *Step 6*	Go to *Step 4*
4	Check for a poor sensor ground circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 9*	Go to *Step 5*
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to *Step 10*	Go to *Step 8*
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: ▼ MAP sensor ▼ EGR valve ▼ TP sensor Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Check for a poor sensor ground circuit terminal connection at the PCM. Was a problem found?	—	Go to *Step 9*	Go to *Step 8*
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found?	—	Go to *Step 10*	Refer to *Diagnostic Aids*
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Locate and repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1107 MAP Circuit Intermittent Low Voltage



060R200051

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running.
- Ignition voltage is more than 11 volts.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 3% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure below 11 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1107 will Clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1107 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- The MAP Sensor shares a 5 Volt reference with the EGR Valve. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The MAP Sensor share a ground with the EGR Valve and the IAT Sensor.

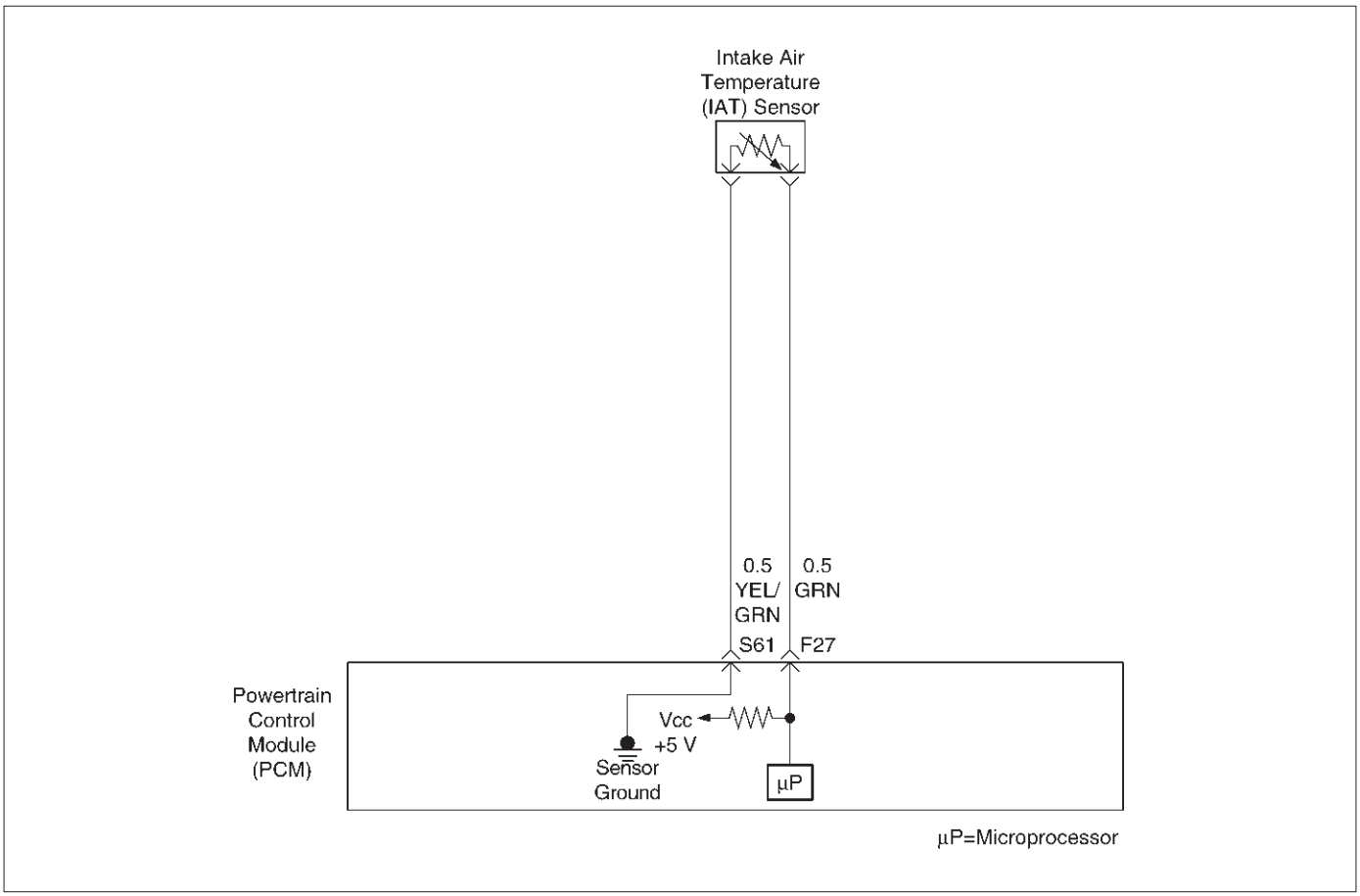
▼ Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0107 also set?	—	Go to *DTC P0107* chart first	Go to *Step 3*
3	Check for a poor 5 volt reference circuit or MAP signal circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 8*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
5	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: ▼ MAP sensor ▼ EGR valve ▼ TP sensor Was a problem found?	—	Go to *Step 9*	Go to *Step 6*
6	Check for a poor 5 volt reference terminal connection at the PCM. Was a problem found?	—	Go to *Step 8*	Go to *Step 7*
7	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (If no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 9*	Refer to *Diagnostic Aids*
8	Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the MAP signal circuit as necessary. Is the action complete?	—	Verify repair	—
9	Repair intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1111 IAT Sensor Circuit Intermittent High Voltage



Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 30 seconds.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60˚C (140˚F).
- Mass air flow is less than 20g/second.
- IAT signal voltage indicates and intake air temperature intermittently less than –39˚C (–38˚F) (about 5 volts) for approximately 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the MIL.

Conditions for Clearing the MIL/DTC

- A history DTC P1111 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1111 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM –Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

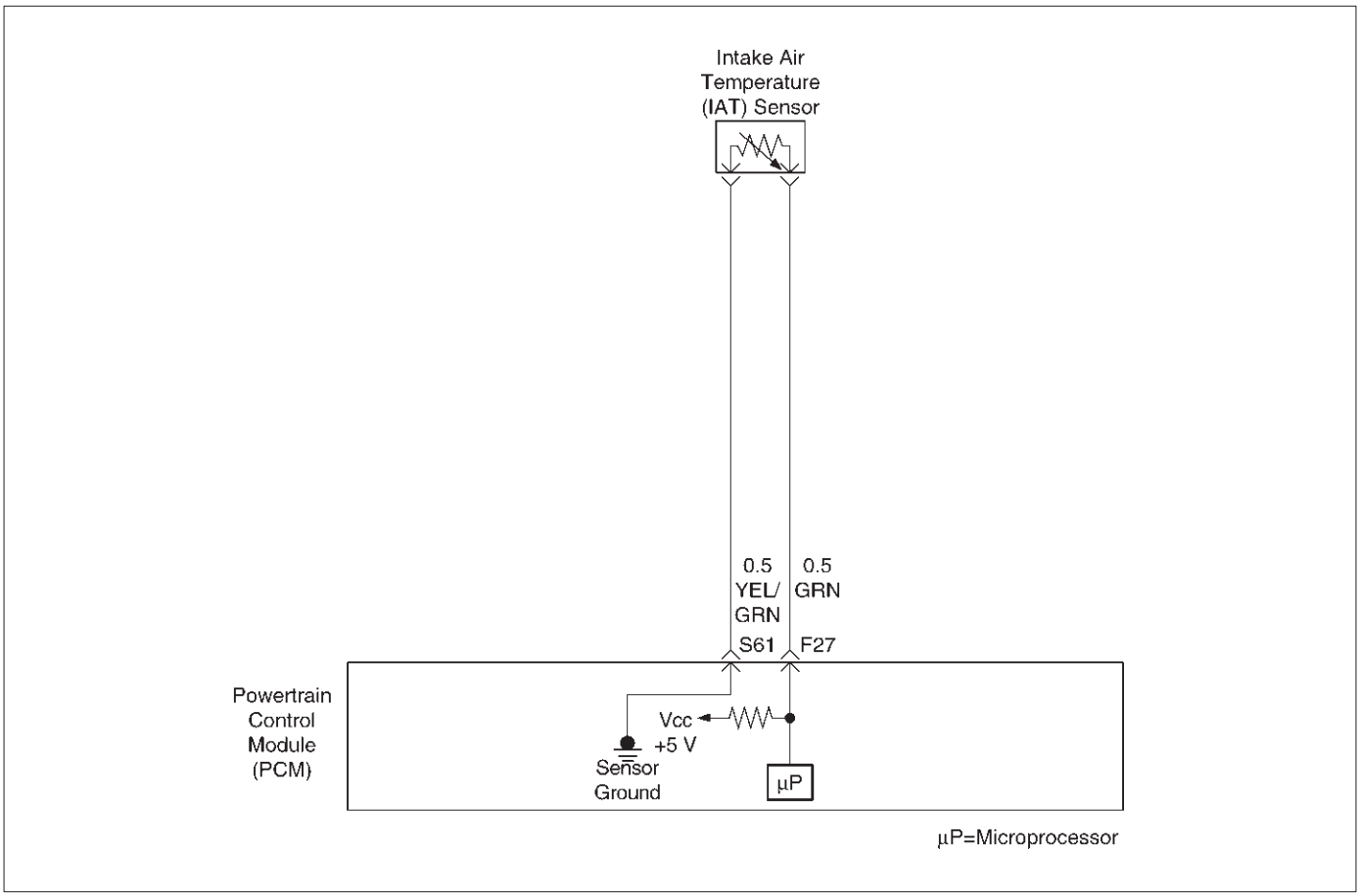
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1111 –IAT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0113 also set?	—	Go to *DTC P0113* chart first	Go to *Step 3*
3	Is DTC P1115, also set?	—	Go to *Step 6*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor IAT signal circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1112 IAT Sensor Circuit Intermittent Low Voltage



Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. DTC P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 15 seconds.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148˚C (298˚F) (about 0.10 volt) for a total of 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

Conditions for Clearing the MIL/DTC

- A history DTC P1112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.

3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart". The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

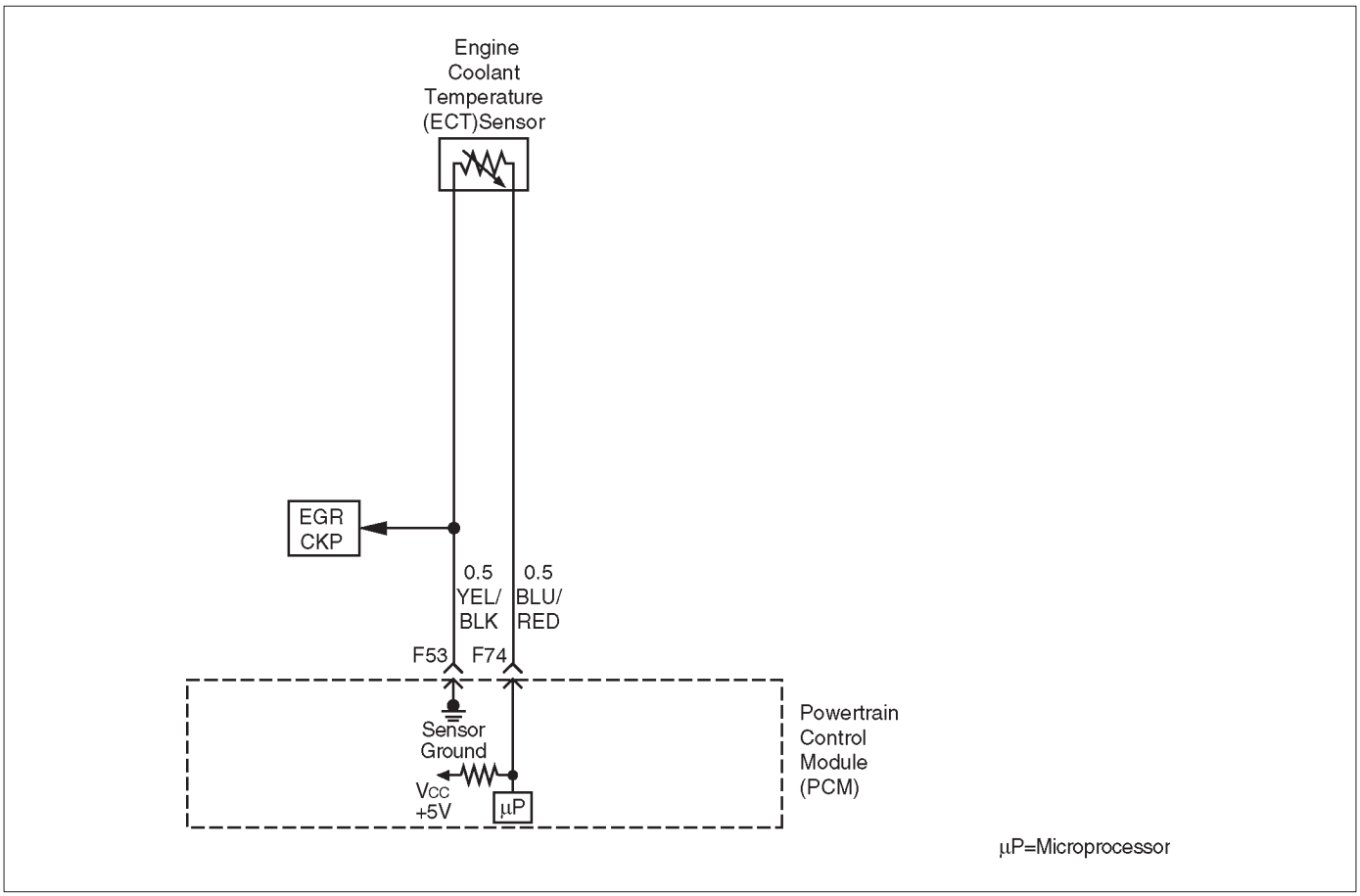
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0112 also set?	—	Go to *DTC P0112* first	Go to *Step 3*
3	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1114 ECT Sensor Circuit Intermittent Low Voltage



060R200053

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, DTC P1114 will set.

Conditions for Setting the DTC

- Engine run time longer than 120 seconds.
- The ECT sensor signal is intermittently greater than 150˚C (302˚F) (about 0.10 volt) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1114 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1114 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

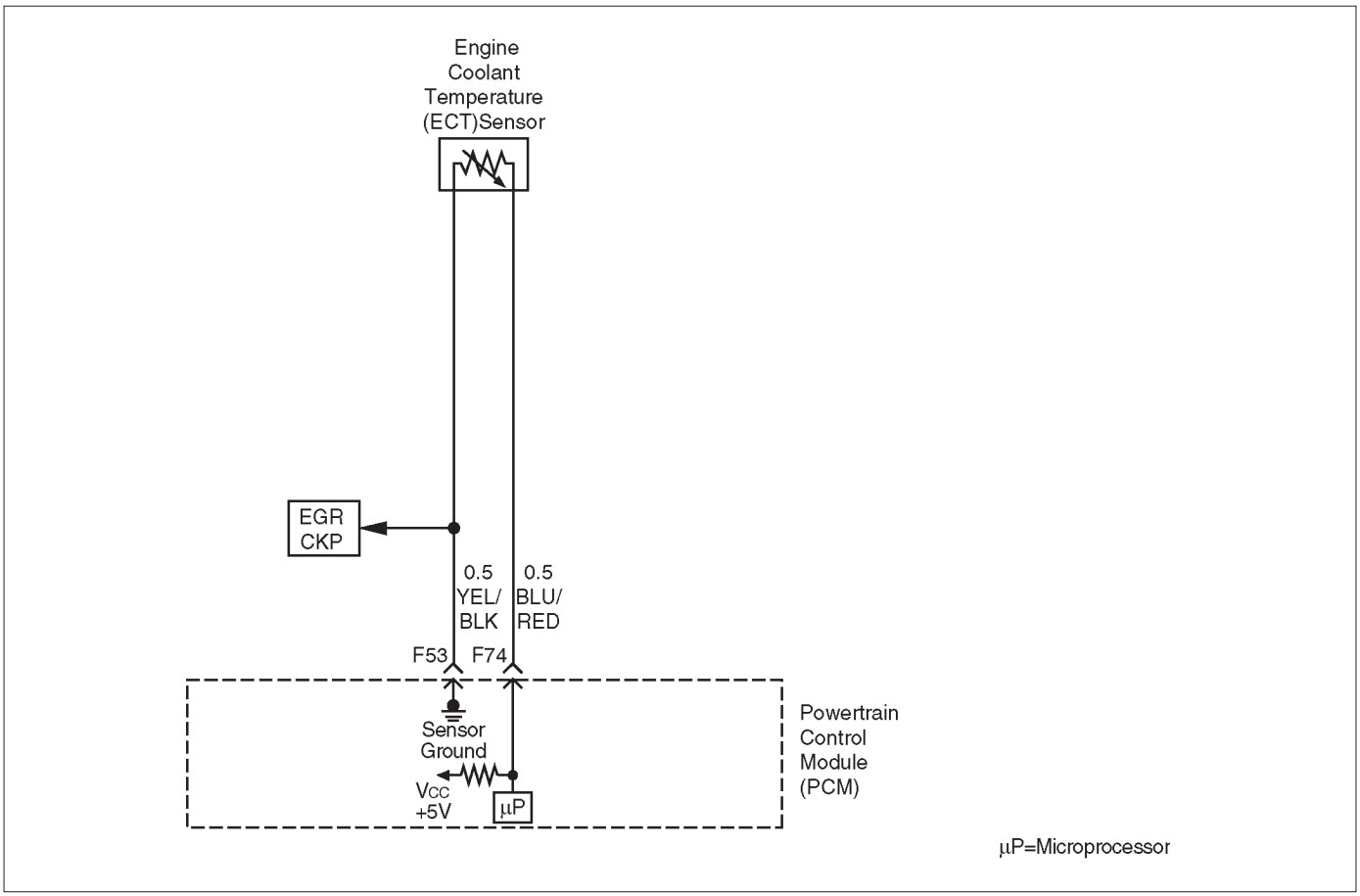
Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1114 – ECT Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0117 also set?	—	Go to *DTC P0117* first	Go to *Step 3*
3	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1115 ECT Sensor Circuit Intermittent High Voltage



060R200053

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, DTC P1115 will set.

Conditions for Setting the DTC

- Engine running time longer than 90 seconds.
- The ECT sensor signal is intermittently greater than –39˚C (–38˚F) (about 5 volts) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1115 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1115 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

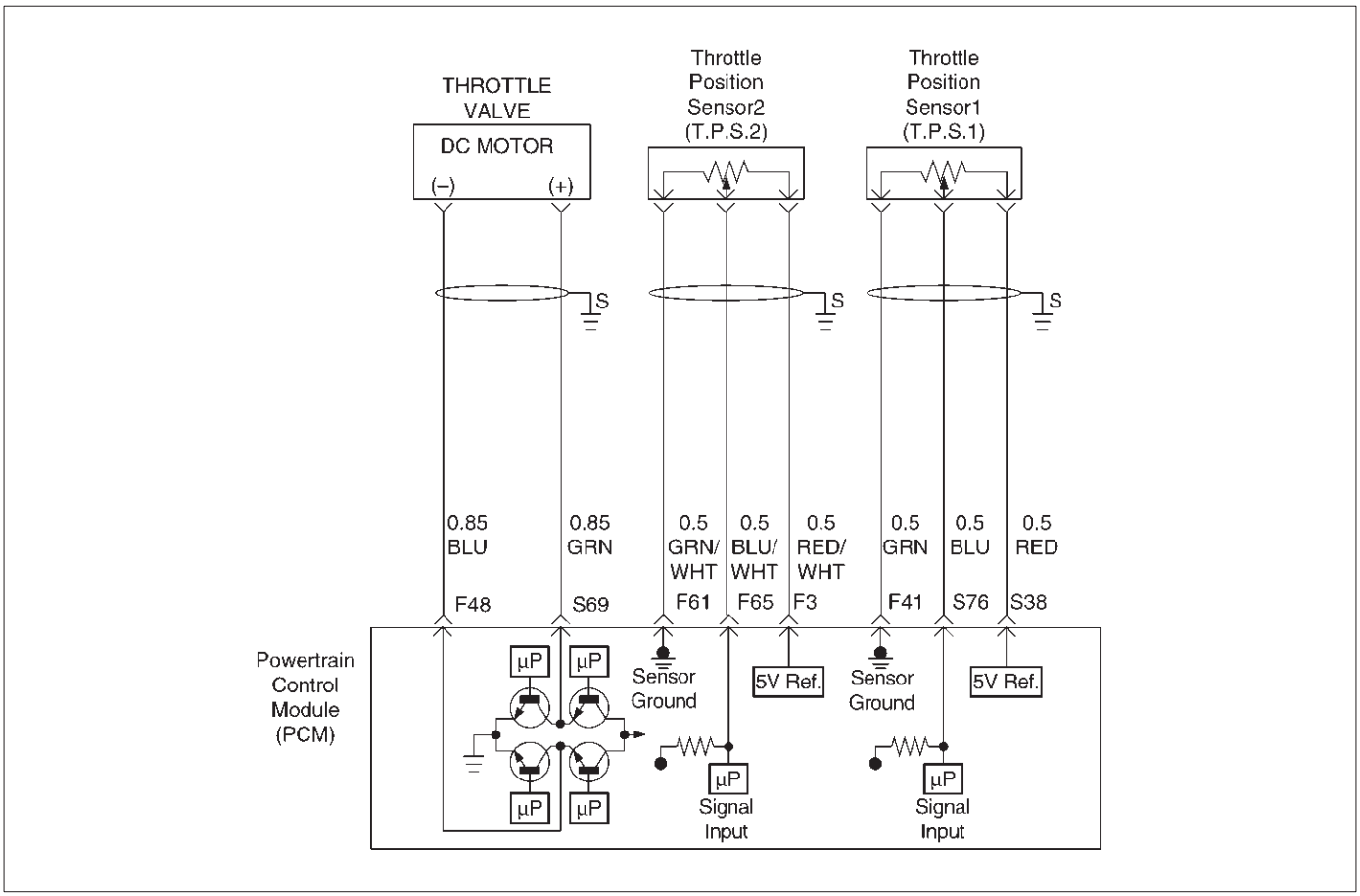
Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1115 – ECT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0118 also set?	—	Go to *DTC P0118* chart first	Go to *Step 3*
3	Is DTC P1111 also set?	—	Go to *Step 8*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor ECT signal circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code(DTC)
P1120-TPS 1 Throttle Position Sensor (TPS1) Output Abnormal



D06RY00111

Circuit Description

▼The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

The TPS1 voltage will vary about 8% (0.4V) to about 92% (4.6V) at Wide Open Throttle (WOT) in the specified voltage (about 5V).

This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

▼The Ignition is “ON”.

▼The TPS1 output is more than 93.6 milliseconds, less than 2.5% or more than 97.5% in the specified voltage (5V).

Action Taken When the DTC Sets

▼The PCM will turn “ON” the MIL after second trip with detected fault.

▼The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼A history DTC P1120 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼DTC P1120 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼Poor connections.

▼Misrouted harness.

▼Rubbed through wire insulation.

▼Broken wire inside the insulation.

Check for the following conditions:

▼Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TPS 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P1120 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

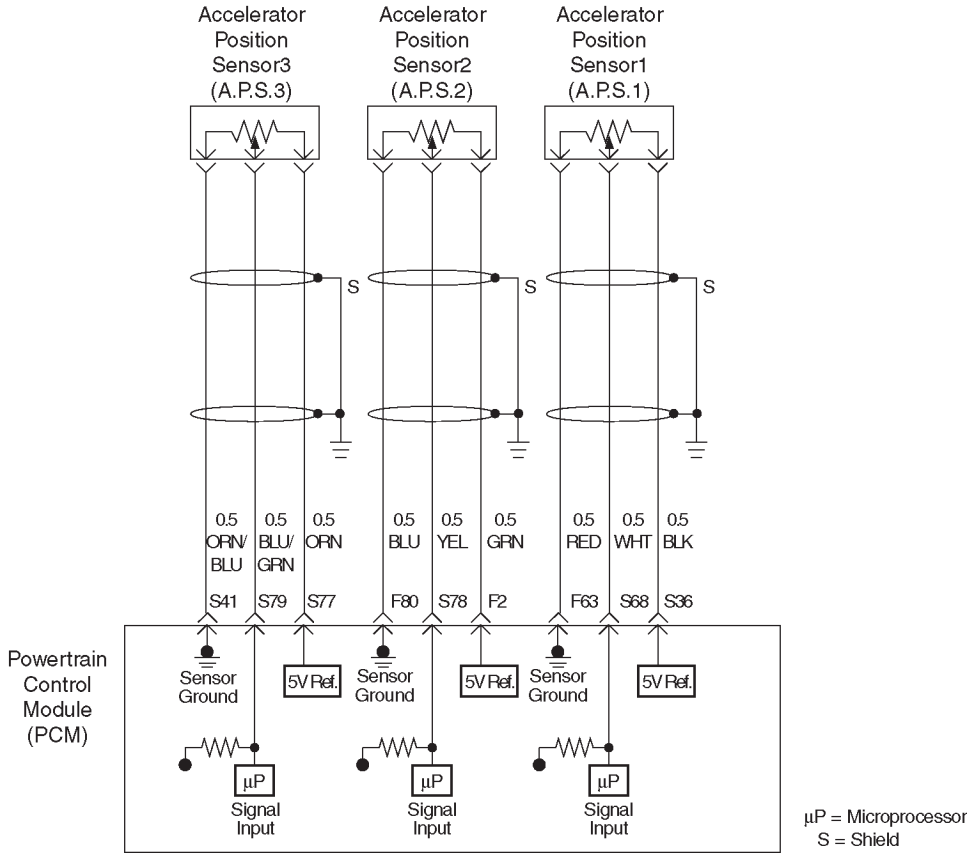
Diagnostic Trouble Code(DTC)P1120-TPS 1 Output Abnormal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 3*	Go to *Step 6*
3	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 5*	Go to *Step 4*
4	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 12*
5	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
6	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Throttle Closed TPS1 8–10 % TPS2 8–10 % Wide Open Throttle TPS1 90–92 % TPS2 90–92 %	Refer to *Diagnostic Aids*	Go to *Step 7*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5Volt reference circuit and the TP sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 signal circuit for a short to voltage. 2. TP1 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Diagnostic Trouble Code(DTC)P1120-TPS 1 Output Abnormal (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP signal circuit or 5 volt reference circuit for a poor connection. 2. TP signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1125 ETC (Electric Throttle Control) Limit Performance Mode



060R200064

Circuit Description

▼ The accelerator position (AP1) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal angle will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

This code detects if the system is in Limit Performance Mode (Fail safe Mode) and Multiple DTCs performance Mode.

Conditions for setting the DTC

▼ The Ignition is " ON".

▼ Limit Performance Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

▼ The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.

▼ The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1125 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.

▼ DTC P1125 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Mis routed harness.

- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P1125 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1125 Diagnostic Chart may isolate the cause of the fault.

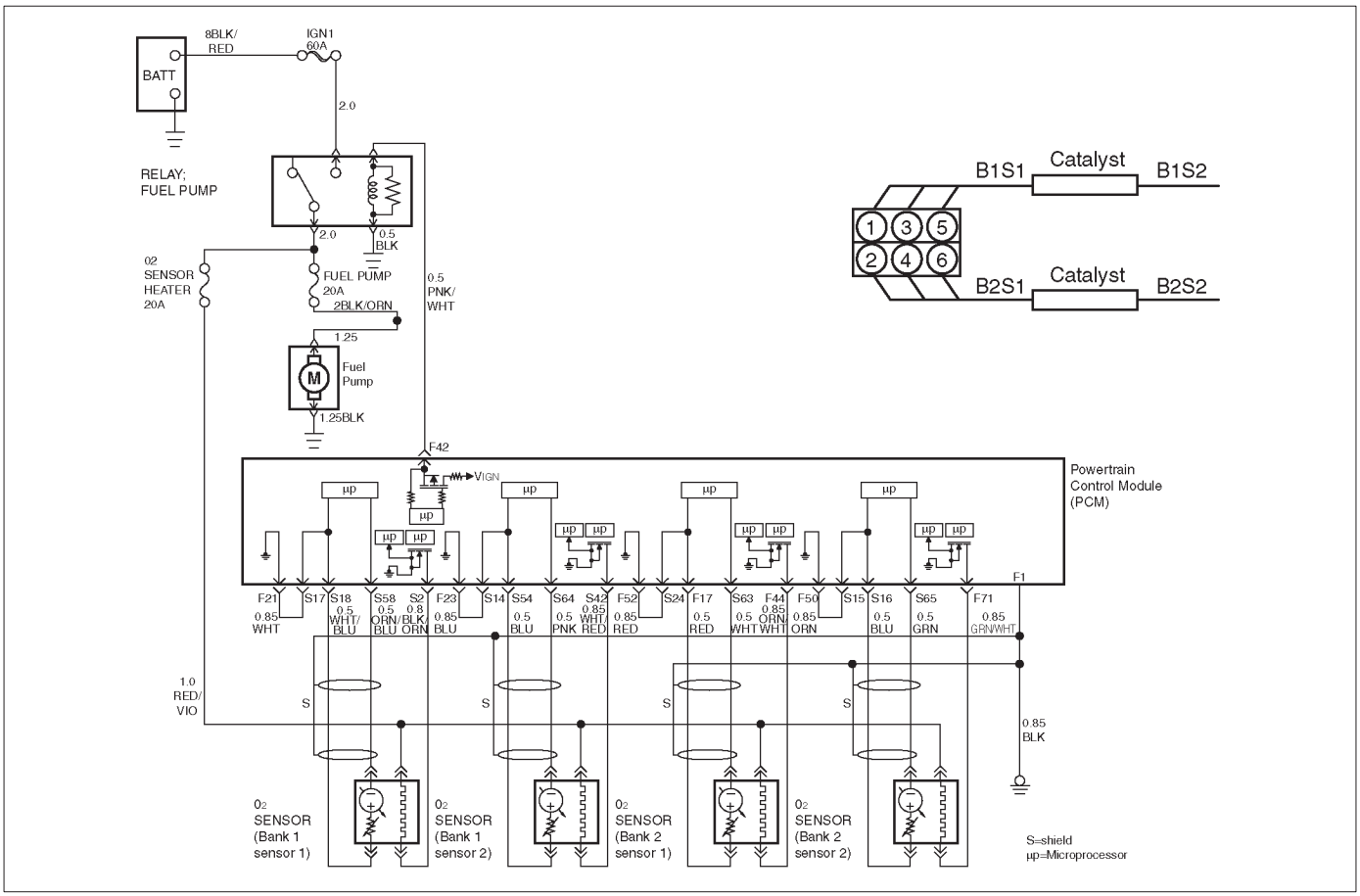
DTC P1125 – ETC Limit Performance Model

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position AP sensor 1 =13 % AP sensor 2, 3 =85 ~ 89 % open throttle AP sensor 1 =85 ~ 89 % AP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltage supply circuit and the AP1, AP2 AND AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1, AP2 or AP3 signal circuit for a short to voltage. 2. AP1, AP2 or AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 or AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1125 – ETC Limit Performance Model (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the following items; 1. AP1, AP2 or AP3 signal circuit or 5 voltage supply circuit for a poor connection. 2. AP1, AP2 or AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP1, AP2 or AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1133 HO2S Insufficient Switching Bank 1 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich threshold. If the PCM determines that the HO2S did not switch enough times, DTC P1133 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- Engine coolant temperature (ECT) is above 60˚C (140˚F).
- Engine is operating in “closed loop”.
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for 3 seconds.
- 90 seconds after “closed loop” and stoichiometric operation have been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 23 rich-to-lean and lean-to-rich switches are detected, DTC P1133 will be set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1133 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1133 continues to set, replace the Bank 1 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.

11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 or P1154) refer to those DTCs before proceeding with this diagnostic chart. 1. Engine idling at operating temperature. 2. Operating the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1133 until the DTC P1133 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P1133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate that the P1153 or P1154 tests failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the bolt/nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

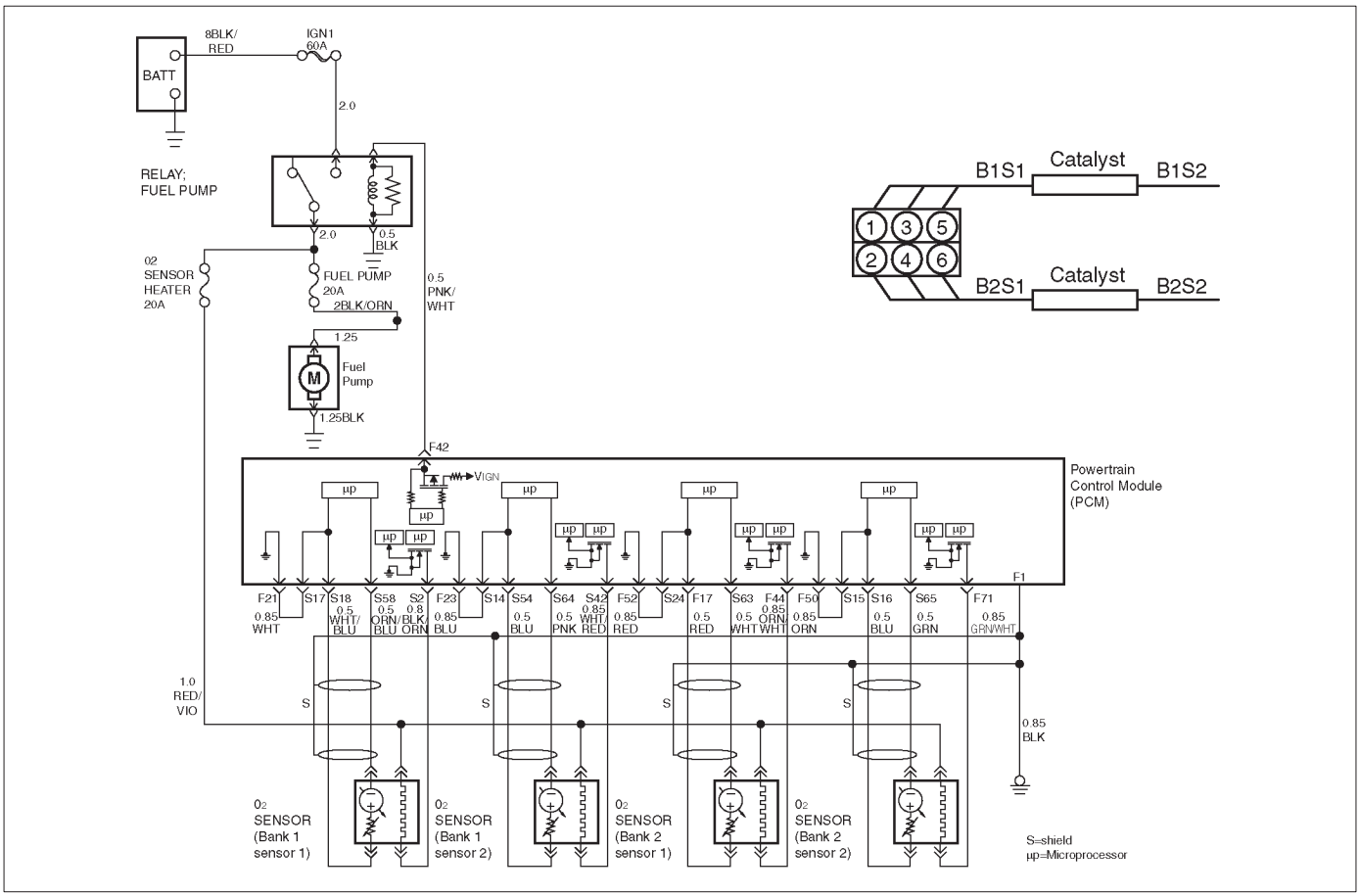
DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ▼ Ensure that the Bank 1 HO2S 1 is securely installed. ▼ Check for corrosion on the terminals. ▼ Check the terminals at Bank 1 HO2S 1 and at the PCM. ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4 mV	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "OFF". 2. Check for damage to PCM pins or terminals. Was a problem found.	—	Verify repair	Go to *Step 17*
17	Check for a short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF". 2. Disconnect the PCM connector. 3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination ▼ Use of improper RTV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1134 HO2S Transition Time Ratio Bank 1 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 60˚C (140˚F).
- Engine is operating in “closed loop”,
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 18 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 1 HO2S 1 transition ratio between lean-to-rich and rich-to-lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1134 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1134 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1134 until the DTC P1134 test runs. 4. Note the test result. Does Tech 2 indicate DTC 1134 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1153, and/or P1154 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

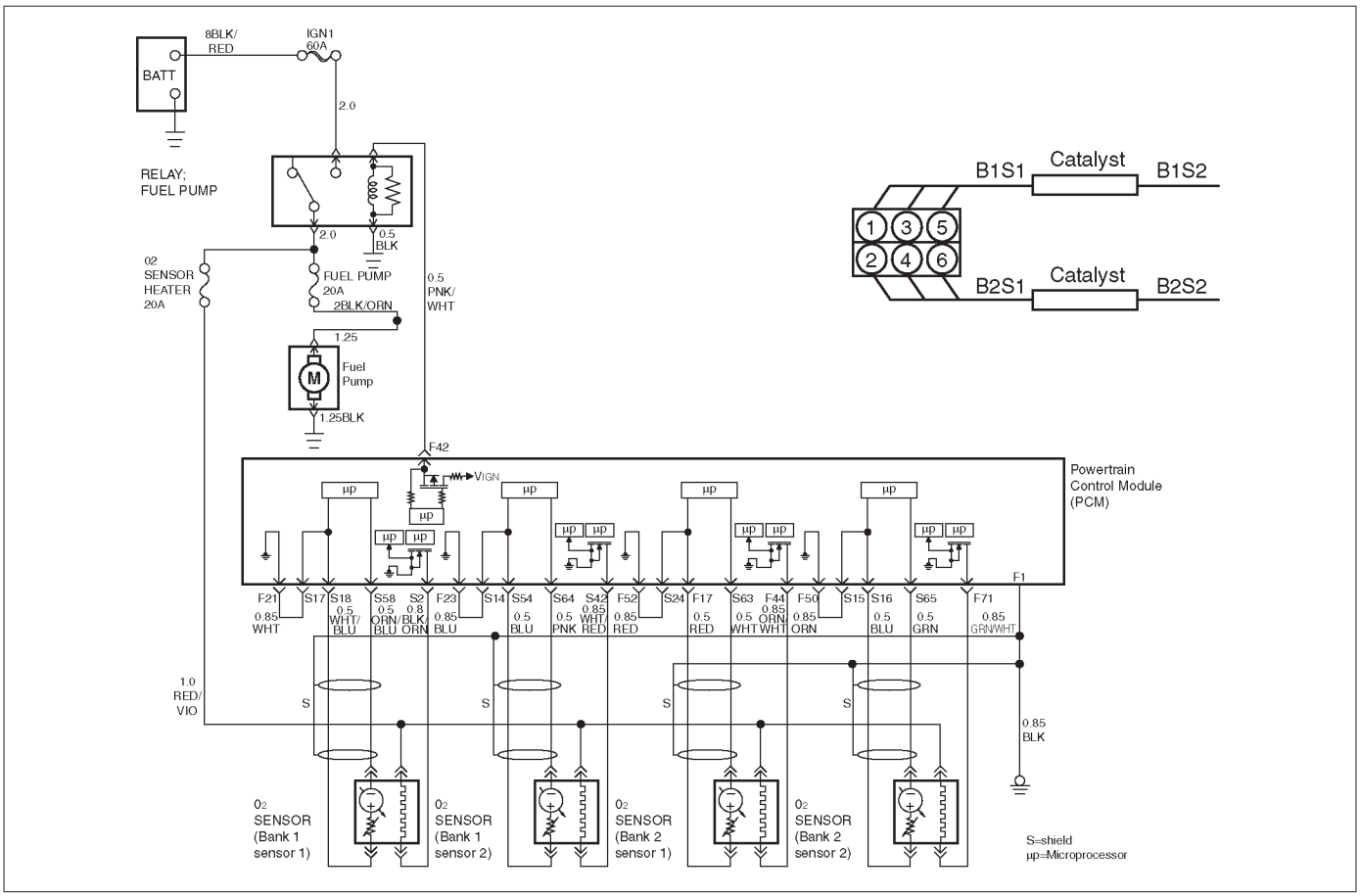
DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ▼ Ensure that the Bank 1 HO2S 1 is securely installed. ▼ Check for corrosion on terminals. ▼ Check the terminal tension (at Bank 1 HO2S 1 and at the PCM). ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. 4. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON". 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination. ▼ Use of improper RTV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	Go to *Step 7*

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1153 HO2S Insufficient Switching Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich thresholds. If the PCM determines that the HO2S did not switch enough times, DTC P1153 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- The engine is operating in “closed loop”,
- Engine coolant temperature (ECT) is above 60˚C (140˚F).
- The engine has been running for over 60 seconds.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 8 g/second and 42 g/second.
- Above conditions are present for a 3 seconds.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, the PCM monitors the oxygen sensor switching above and below 450 mV. If fewer than 27 rich-to-lean and lean-to-rich switches for Bank 2 HO2S 1 are detected, DTC P1153 will set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1153 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1153 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1153 continues to set, replace the Bank 2 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set, (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1153 until the DTC P1153 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133 and/or P1134 test failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

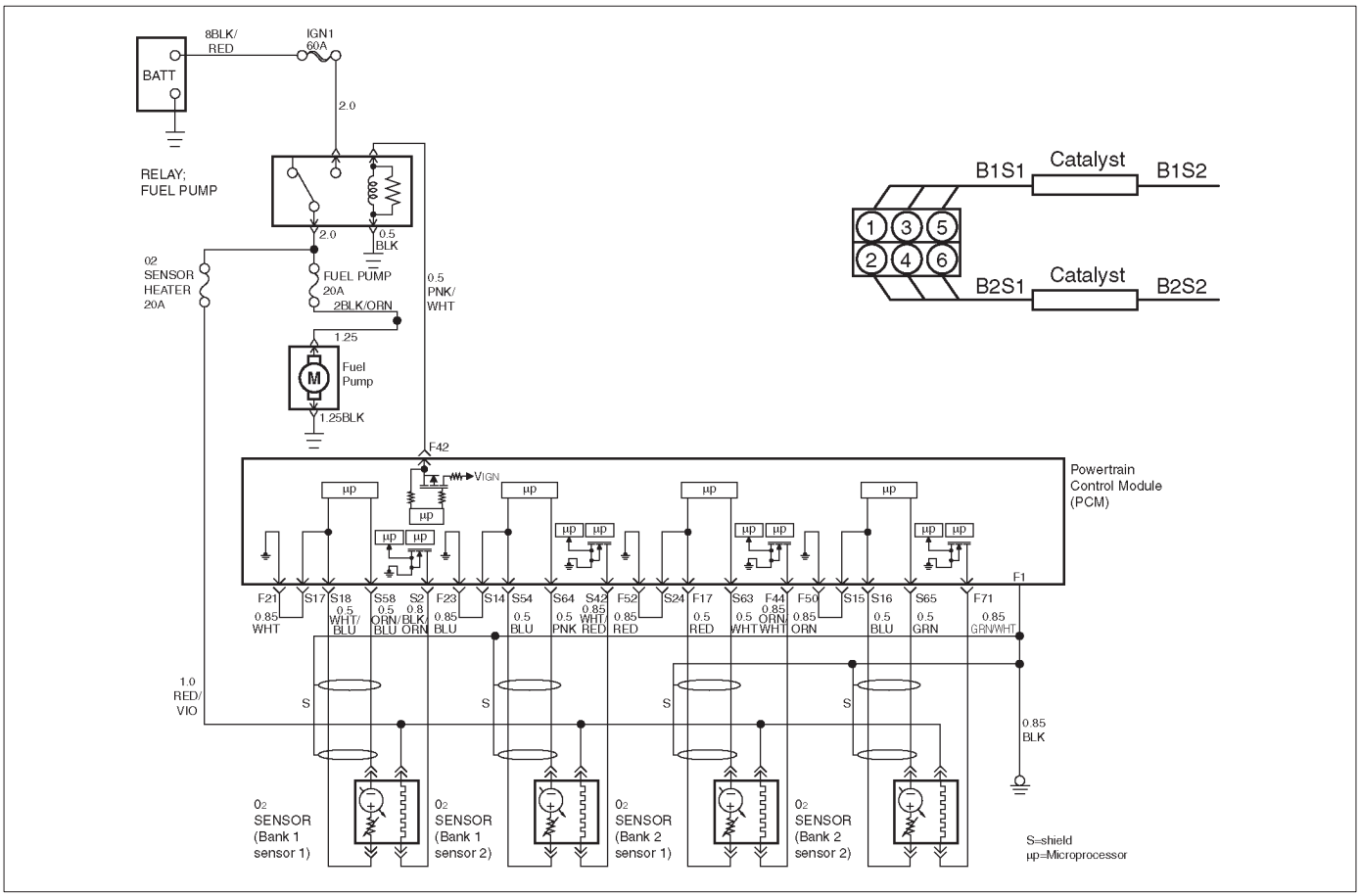
DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ▼ Ensure that the Bank 2 HO2S 1 is securely installed. ▼ Check for corrosion on terminals. ▼ Check the terminal tension at Bank 2 HO2S 1 and at the PCM. ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "ON". 2. Check for damage to PCM pins or terminals. Was a problem found?	—	Verify repair	Go to *Step 17*
17	Check for short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF". 2. Disconnect the PCM connector. 3. With HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 2 HO2S 1 disconnected from the harness, check Bank 2 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination. ▼ Use of improper RTV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1



060R200054

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During the monitor period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1154 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 60˚C (140˚F).
- The engine is operating in “closed loop”,
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 18 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 2 HO2S 1 transition ratio between lean to rich and rich to lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1154 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A multifunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1154 to set. Check HO2S heater circuitry for intermittent faults or poor connections.

If connections and wiring are OK and DTC P1154 continues to set, replace the Bank 2 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any other DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1154 until the DTC P1154 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133, and/or P1134 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

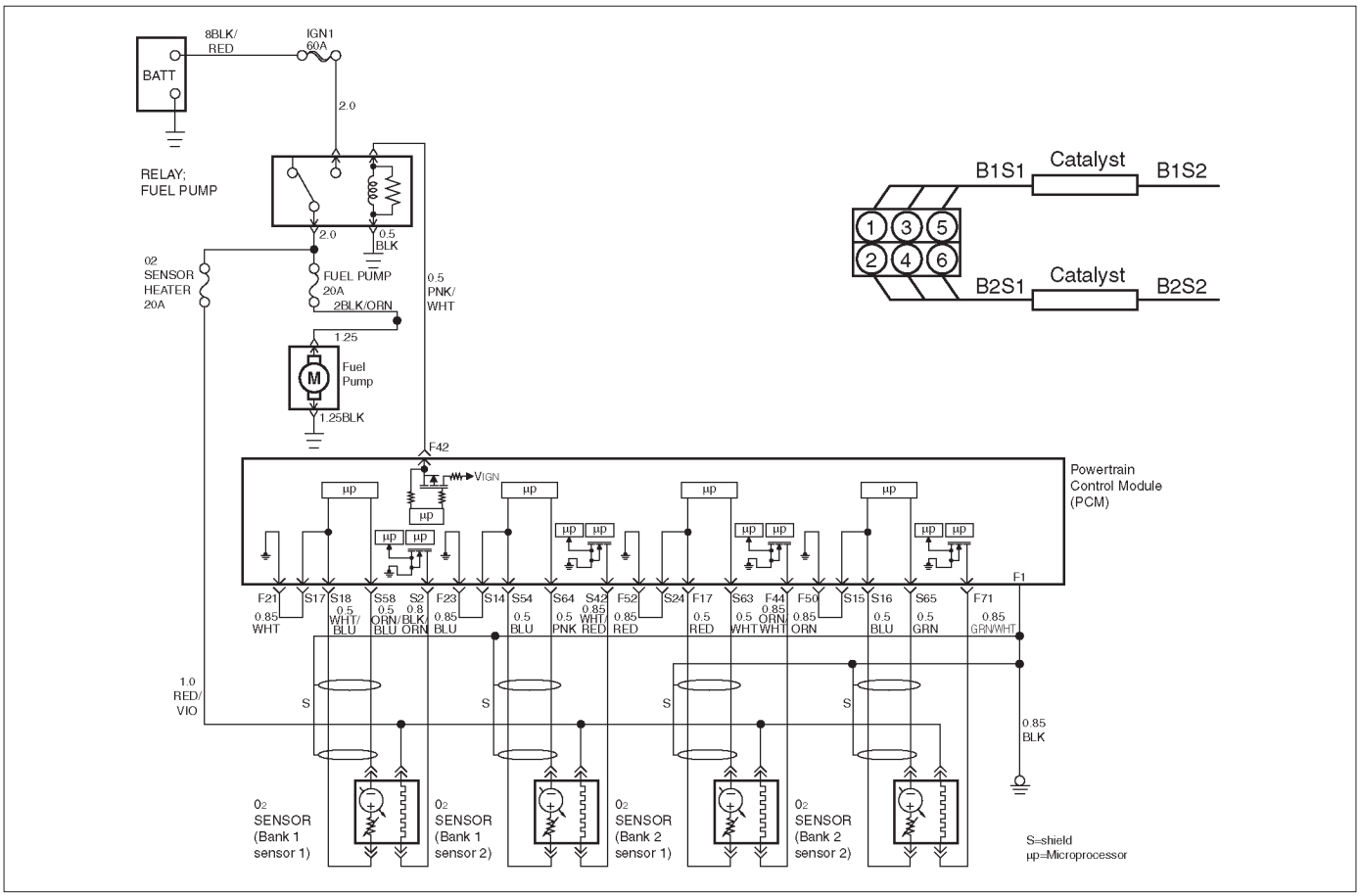
DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ▼ Ensure that the Bank 2 HO2S 1 is securely installed. ▼ Check for corrosion on terminals. ▼ Check terminal tension (at Bank 2 HO2S 1 and at the PCM). ▼ Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON". 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON". 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ▼ Fuel contamination. ▼ Use of improper RTV sealant. ▼ Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank 1)



060R200054

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean response is indicated and adds the amount of time it look to complete all rich to lean transitions and lean to rich transitions.
This code detects if Bank1 O2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 ˚C (140 ˚F).
- Engine is operating in “closed loop” power enrichment mode for 3 seconds.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1167 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1167 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

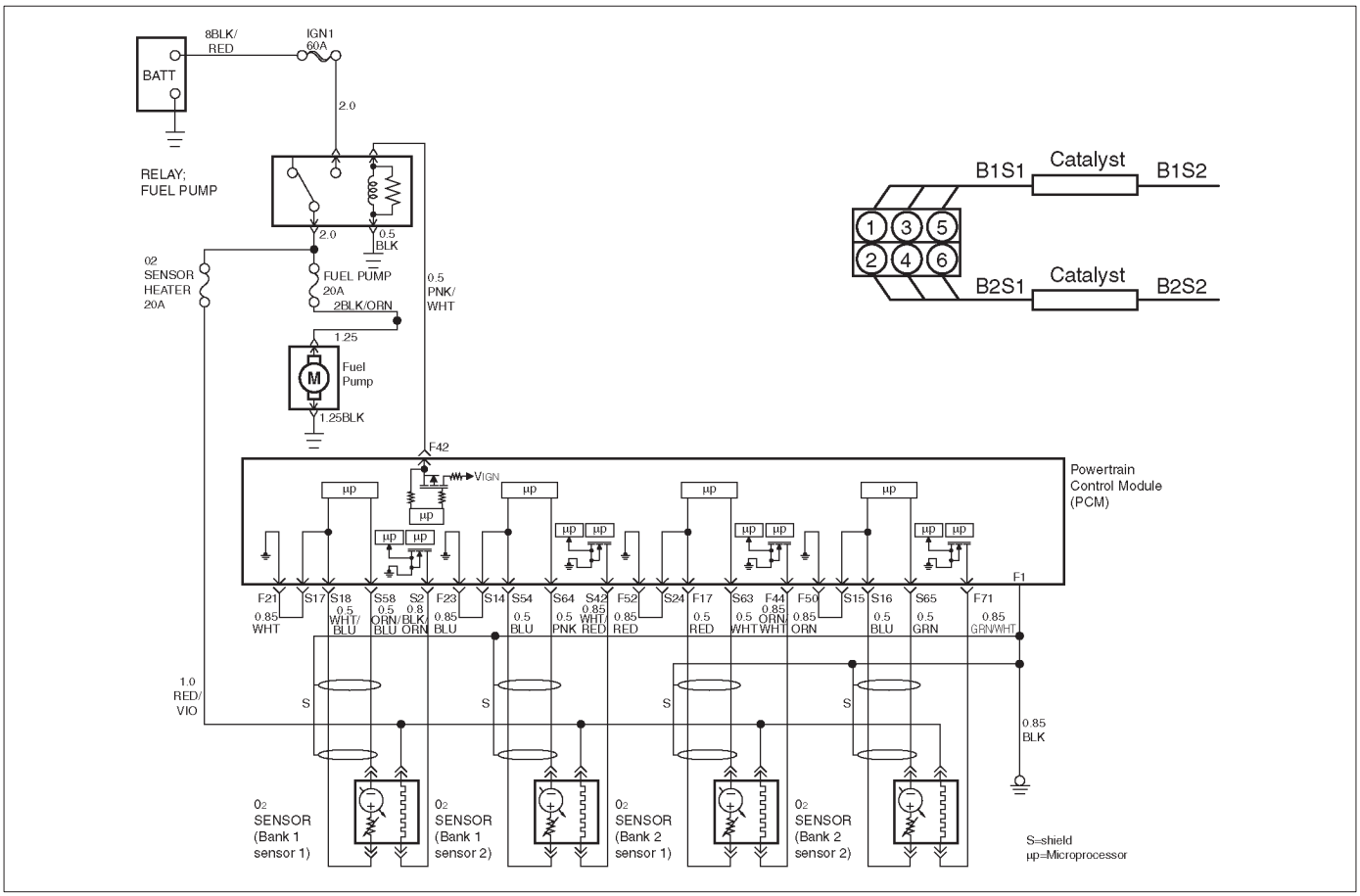
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank1)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 1 voltage while running warm engine 75 ˚C – 95 ˚C (167 ˚F – 203 ˚F) at 1200 RPM. 3. HO2S 1 voltages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throttle for a few seconds. Did the voltage suddenly rise toward the low end of the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition "OFF". 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the fuel pressure gauge reading near the specified value?	325KPa (46psi) 414KPa (60psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; ▼ Faulty fuel pump ▼ Incorrect fuel pump ▼ Incorrect fuel being used ▼ Cold fuel If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1169 Fuel System Rich During Decel Fuel Cut Off (Bank 2)



060R200054

Circuit Description

The powertrain control module(PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean response is indicated and adds the amount of time it look to complete all rich to lean transitions and lean to rich transitions.

This code detects if Bank2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 ˚C (140 ˚F).
- Engine is operating in “closed loop” power enrichment mode for 3 seconds.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp(MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1169 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1169 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

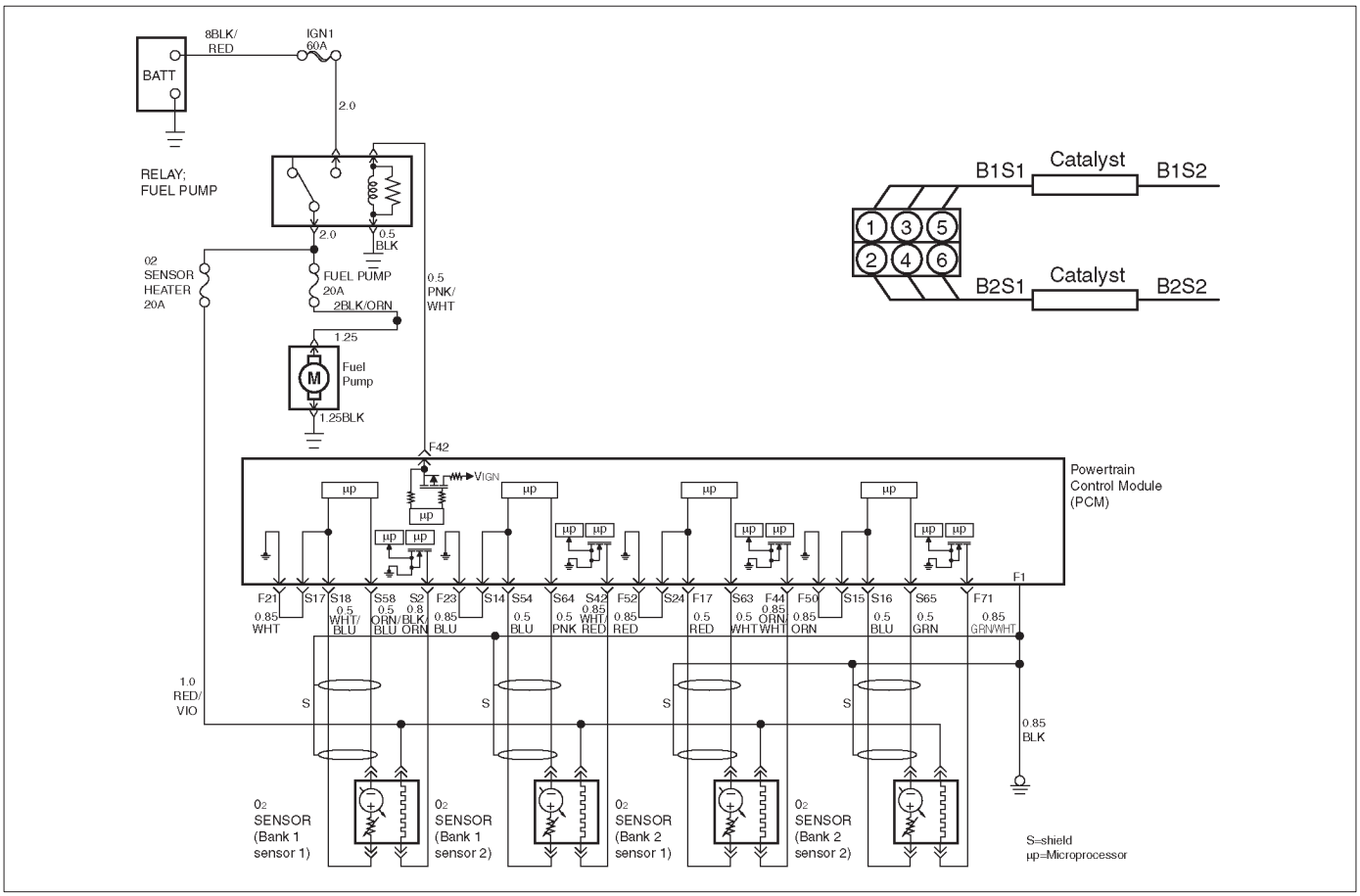
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.
- Check the pressure regulator.

Diagnostic Trouble Code (DTC)
P1169 Fuel System Rich During Decel Fuel Cut Off (Bank2)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 2 voltage while running warm engine75 C – 95 C (167 F – 203 F) at 1200 RPM. 3. HO2S 1 voltages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throttle for a few seconds. Did the voltage suddenly rise toward the low end of the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition "OFF". 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the fuel pressure gauge reading near the specified value?	325KPa (46psi) 414KPa (60psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; ▼ Faulty fuel pump ▼ Incorrect fuel pump ▼ Incorrect fuel being used ▼ Cold fuel. If a problem is found, repair one as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1171 Fuel System Lean During Acceleration



060R200054

Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during “closed loop” operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a “rich” condition (high oxygen sensor voltage). If this “rich” exhaust is not detected at this time, a DTC P1171 will set. A plugged fuel filter, restricted fuel line, restricted in-tank filter or defective fuel pump can prevent adequate amounts of fuel from being supplied during power enrichment mode.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop power enrichment” mode for 3 seconds.
- Engine coolant temperature is above 60˚C (140˚F).
- While in “power enrichment” mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1171 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- A restricted fuel filter or fuel line, restricted in-tank filter, or a defective fuel pump may supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

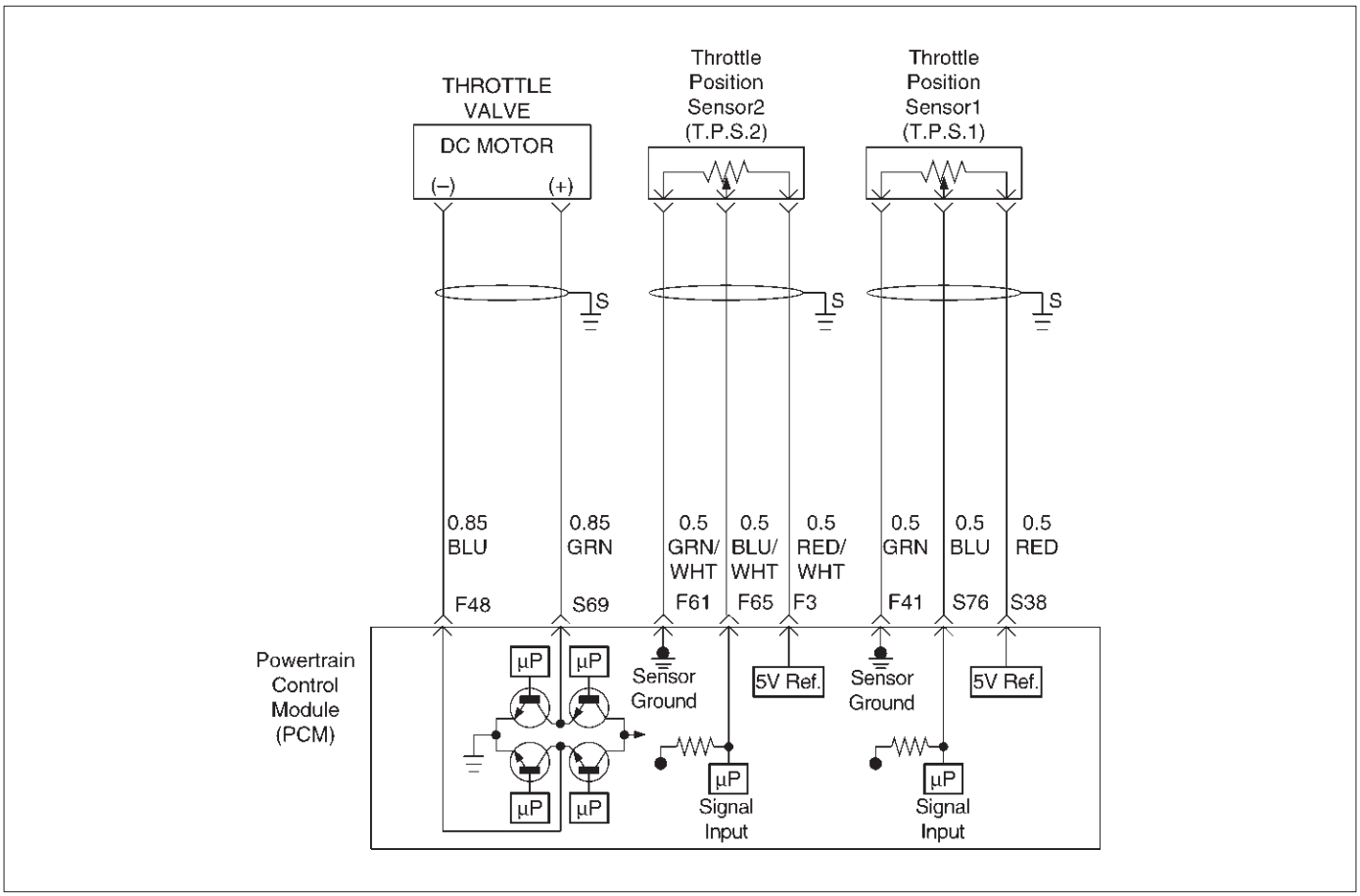
Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. It is possible to measure a satisfactory fuel pressure at idle even though the pressure may drop at high flow requirements. It may be necessary to watch fuel pressure at high engine load.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing gauge. Ignition “ON”, pump pressure should be 280-320 kPa.
7. Add Caution, Use correct pliers so damage to fuel lines will not occur.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component-related DTCs set?	—	Go to component DTC charts	Go to *Step 3*
3	1. Check the vehicle's fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle's fuel tank if the tank is almost empty. Was fuel added to the vehicle's fuel tank?	—	Go to *Step 4*	Go to *Step 5*
4	1. Place the transmission in park. 2. Using a Tech 2, observe HO2S 1 voltage while running warm engine 75˚C-95˚C (167˚F-203˚F) at 1200 RPM. 3. HO2S 1 voltage should vary within the specified range. 4. Quickly open the throttle too halfway for a few seconds. Did the voltage suddenly rise toward the high end of the specified range?	100-900 mV	Go to *Fuel System Electrical Test*	Go to *Step 5*
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280-325 kPa (41-46 psi)	Go to *OBD System Check*	Go to *Step 6*
6	Check for restricted fuel lines or restricted in-line filter. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Ignition "OFF". 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second specified value?	325 kPa (46 psi) 414 kPa (60 psi)	Go to *Diagnostic Aids*	Go to *Step 8*
8	Check for: ▼ Faulty fuel pump ▼ Restricted fuel pump strainer (sock) ▼ Incorrect fuel pump ▼ Incorrect fuel being used ▼ Hot fuel Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1220 Throttle Position Senser2 (TPS2) Circuit Fault



D06RY00111

Circuit Description

▼The throttle position (TP2) sensor circuit provides a voltage signal relative to throttle blade angle.

The TPS2 voltage will vary from about 8% (0.4V) to about 92% (4.6V) at Wide Open Throttle (WOT) in the specified voltage (about 5V).

This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

▼The Ignition is “ON”.

▼The TPS2 output is more than 93.6 milliseconds, less than 2.5% or more than 97.5% in the specified voltage (5V).

Action Taken When the DTC Sets

▼The PCM will ON the MIL after second trip with detected fault.

▼The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼A history DTC P1120 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼DTC P1120 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼Poor connections.

▼Misrouted harness.

▼Rubbed through wire insulation.

▼Broken wire inside the insulation.

Check for the following conditions:

▼The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.

▼The MAP sensor shares a ground with the Fuel Tank Pressure, the ECT sensor, and the Transmission Fluid

▼Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1120 cannot be duplicated, the

information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC

P1120 Diagnostic Chart may isolate the cause of the fault.

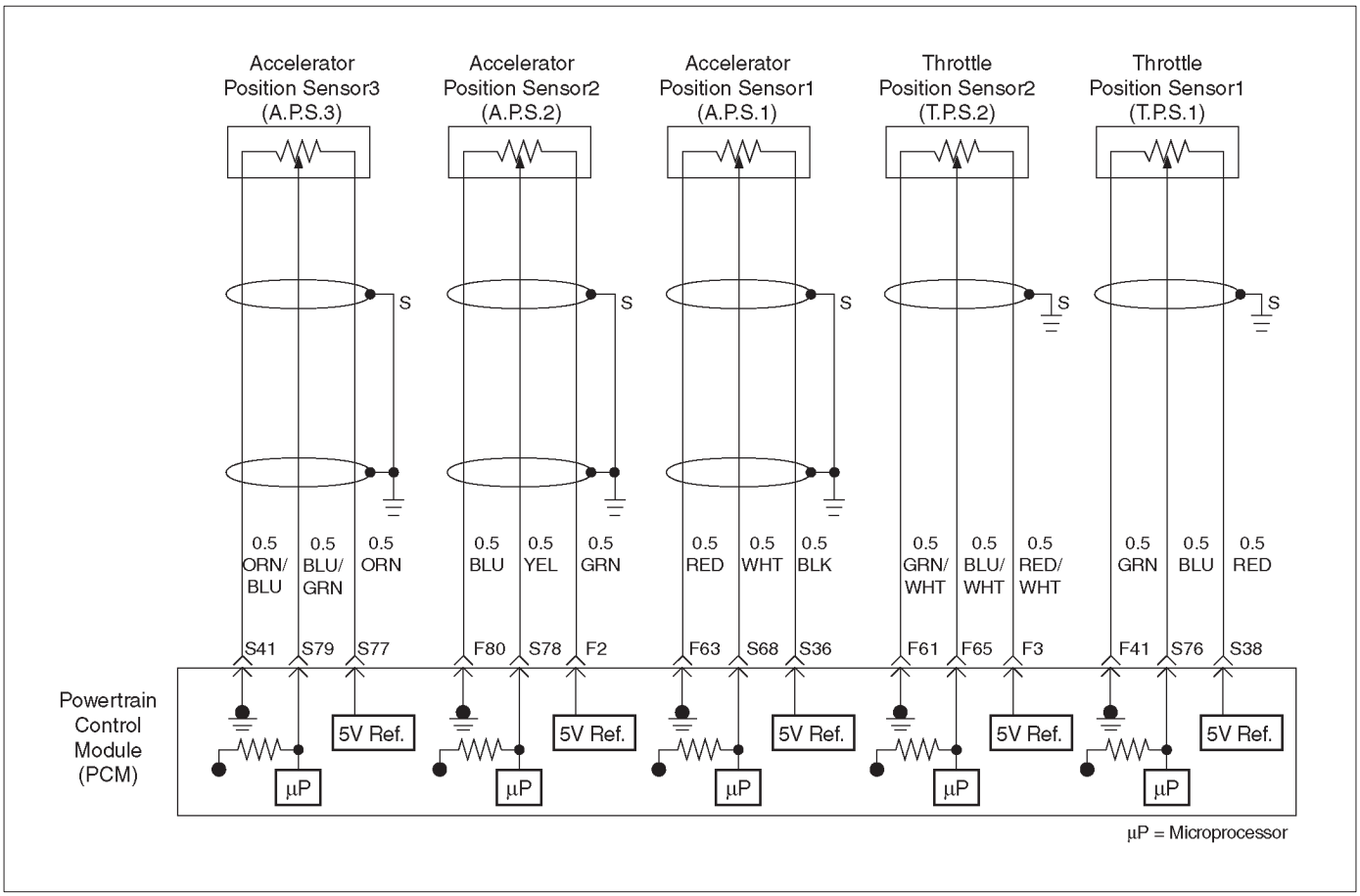
DTC P1220-TPS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition "ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65 kPa	Go to *Step 4*	Go to *Step 7*
4	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 6*	Go to *Step 5*
5	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
6	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
7	Observe the TP angle reading on the Tech-2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed TPS1 8–10 % TPS2 8–10 % WTO TPS1 90–92 % TPS2 90–92 %	Refer to *Diagnostic Aids*	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1220-TPS 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP2 signal circuit for a short to voltage. 2. TP2 sensor ground circuit for high resistance between the PCM and the TP2 sensor. 3. TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnosis Trouble Code(DTC)
P1221 TPS1 – TPS2 Correlation(Circuit Performance)



060R200069

Circuit Description

▼ The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to DC motor coil in duty (%) to adjustment the valve into a passage in the throttle body to air flow.

This method allows highly accurate control of engine speed and quick response to changes in engine load.

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal angle (AP1) will vary from about 13% at idle position to about 87% at open throttle(WOT).

APS signal is used to determine which DC will adjust throttle position.

After the APS signal has been processed by the PCM, it will command the DC motor to move the throttle position.

▼ Accelerator pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the accelerator pedal arm and on the accelerator pedal.

Conditions for Setting the DTC

▼ The ignition is “ON”.

▼ A difference of between TPS1 and TPS2 correlation of over 6.5% within 125 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will not turn the malfunction indicator lamp (MIL) “ON”.

▼ The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Condition for Clearing the MIL/DTC

▼ A history DTC 1221 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC 1221 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.

3.Visually/physically inspect for the following accelerator pedal conditions.

5.Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.

7.Check the following circuits for accelerator pedal problems. Check the following AP sensor resistance.

9.Following DTC: Software detect Error for ETC system.

10.Following DTC: Software detect Error for ETC system.

Diagnostic Aids

▼An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

▼Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.

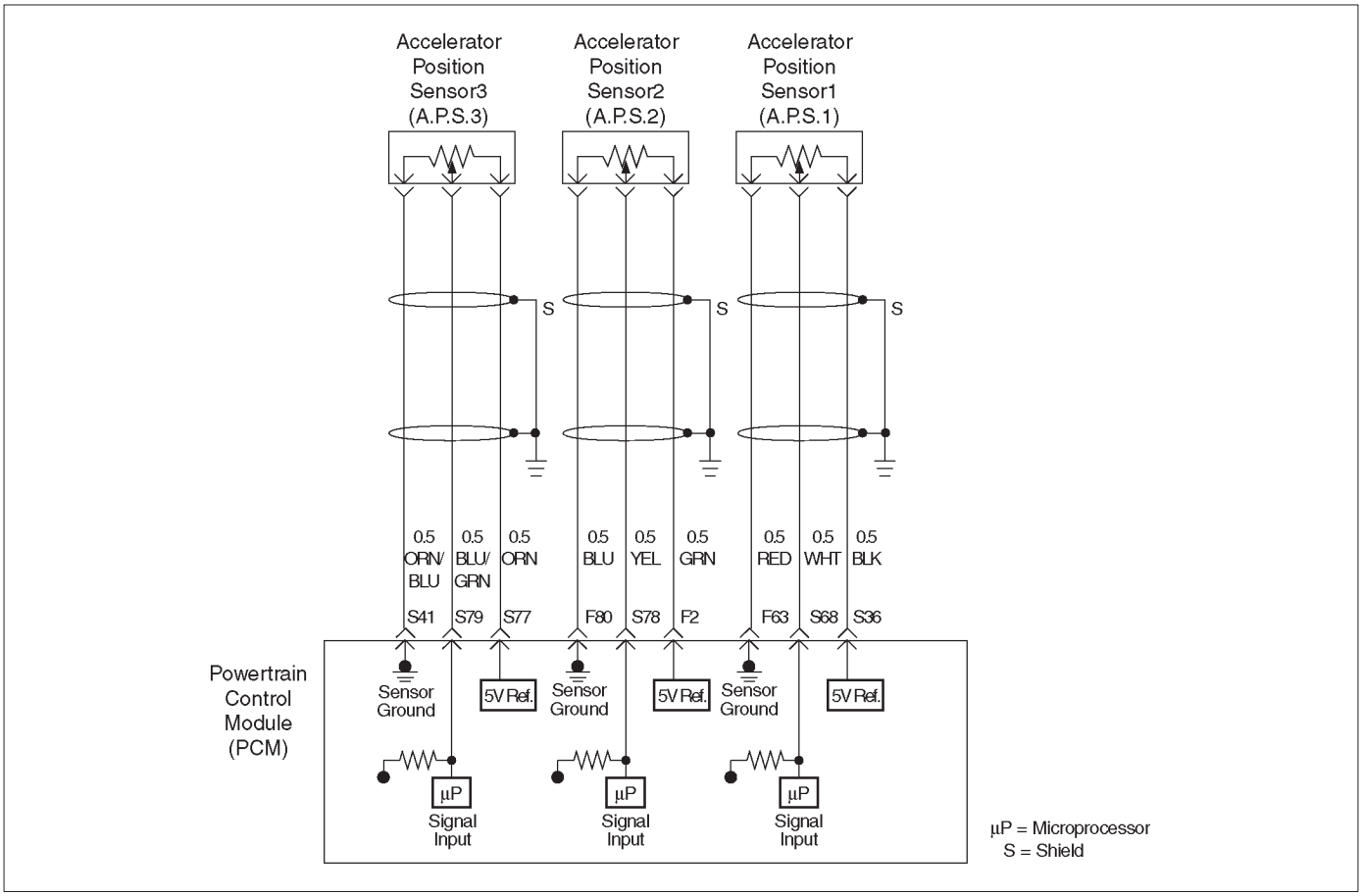
Diagnosis Trouble Code(DTC) P1221 TPS1 – TPS2 Correlation(Circuit Performance)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Visually/physically inspect for the following conditions: ▼ Throttle body tampering. ▼ Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ▼ Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 4*
4	Visually/physically inspect for the following conditions: ▼ Accelerator pedal tampering. ▼ Accelerator pedal : Check for objects blocking the spring or pedal arm. ▼ Accelerator pedal : Check for objects move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 5*
5	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the accelerator position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*

Diagnosis Trouble Code(DTC)
P1221 TPS1 – TPS2 Correlation(Circuit Performance) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: Throttle position sensor 1 circuit. Throttle position sensor 2 circuit. Throttle DC motor circuit. Throttle position sensor resistance. Throttle DC motor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-GND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 7*
7	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ▼ Accelerator position sensor 1 circuit. ▼ Accelerator position sensor 2 circuit. ▼ Sensor 3 circuit. ▼ Sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-GND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 8*
8	Replace the accelerator position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Stored DTCs; P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 10*
10	Stored DTCs; P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1271 APS 1– 2 Correlation Error



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle(WOT) to specified voltage (about 5V).

This code detects a correlation error between APS1 and APS2.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The accelerator pedal angle difference is more than 4.5 % between ASP1 and APS2 for more than 265 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will not turn the malfunction indicator lamp (MIL) “ON”.

▼ The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1271 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1271 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Mis routed harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1271 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTCP1271 Diagnostic Chart may isolate the cause of the fault.

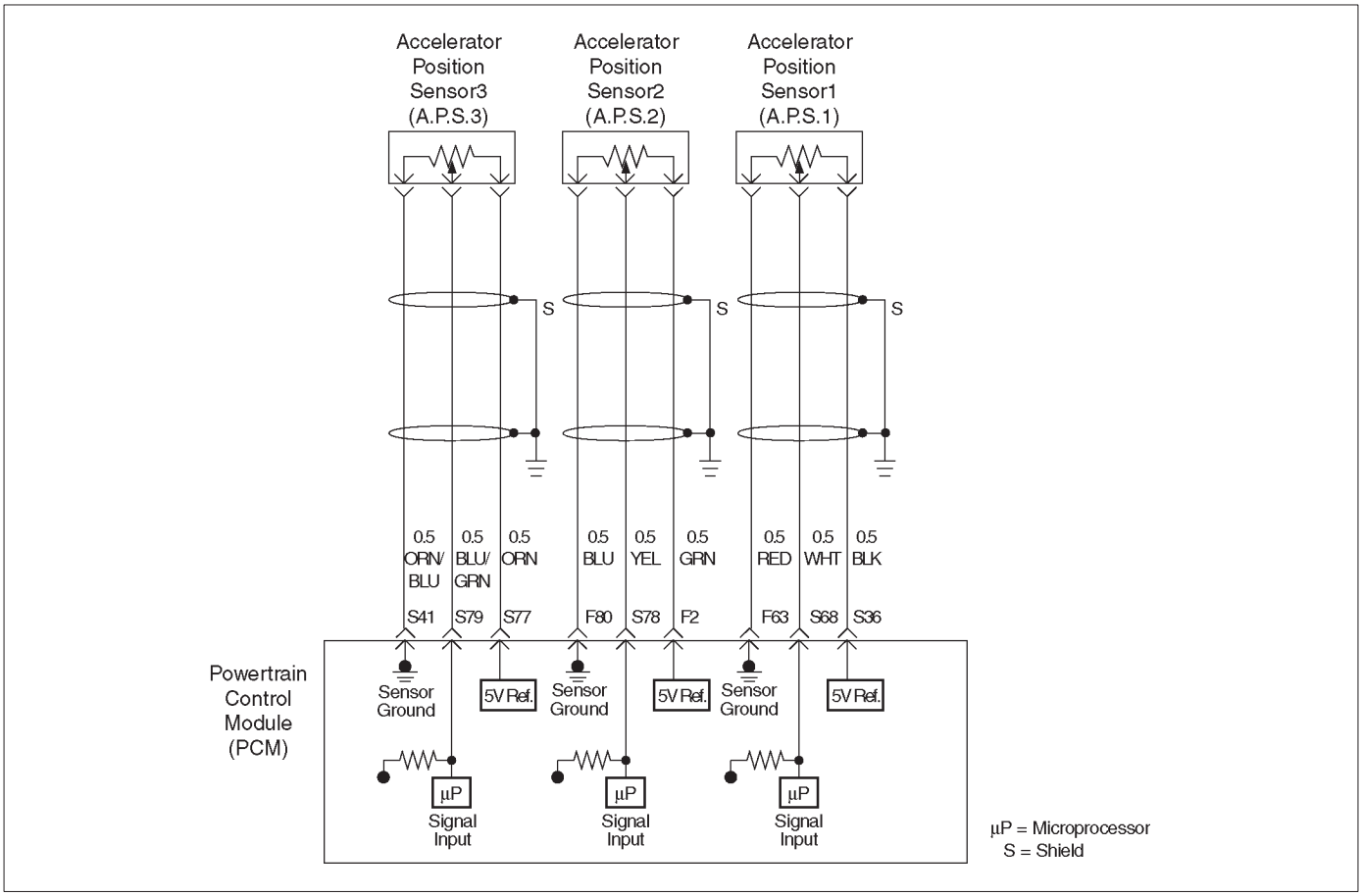
DTC P1271 – APS 1– 2 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position AP sensor 1 =13 % AP sensor 2 =85 ~ 89 % Wide open throttle AP sensor 1 =85 ~ 89 % AP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 V supply circuit and the AP sensor signal circuit at the AP1, AP2 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP1and AP2 signal circuit for a short to voltage. 2. AP1and AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1and AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1and AP2 signal circuit or 5 V supply circuit for a poor connection. 2. AP1and AP2 signal circuit or 5 V supply circuit for high resistance between the PCM and the AP1 and AP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*

DTC P1271 – APS 1– 2 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1272 APS 2 – 3 Correlation Error



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP2) will vary from about 87 % at idle position to about 13 % at wide open throttle (WOT) to specified voltage (about 5V).

This code detects a correlation error betweenAPS2 and APS3.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The acceleration pedal angle difference is more than 4.5 % between ASP2 and APS3 for more than 265 millisecond.

Action Taken When the DTC Sets

▼ The PCM will not turn the malfunction indicator lamp (MIL) “ON”.

▼ The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1272 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1272 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Misrouted harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1272 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC

P1272 Diagnostic Chart may isolate the cause of the fault.

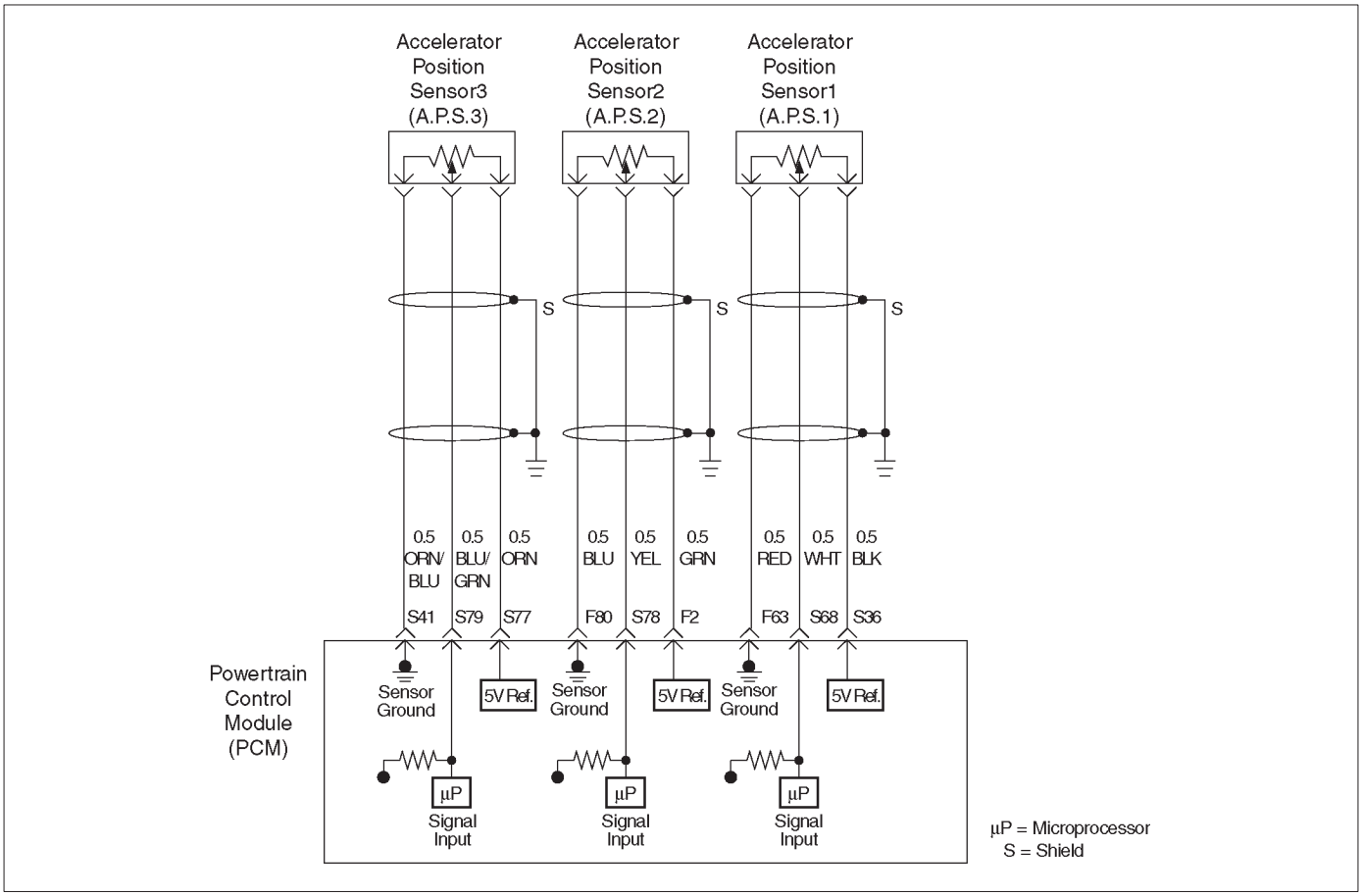
DTC P1272 – APS 2 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition AP sensor 2 =86 ~ 88 % AP sensor 3 =86 ~ 88 % Wide open throttle AP sensor 2 =12 ~ 14 % AP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltage supply circuit and the AP sensor signal circuit at the AP2 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP2 and AP3 signal circuit for a short to voltage. 2. AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 and AP3 signal circuit or 5 voltage supply circuit for a poor connection. 2. AP2 and AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*

DTC P1272 – APS 2 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1273 APS 1 – 3 Correlation Error



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT) to specified voltage (about 5V).

This code detects a correlation error between APS1 and APS3.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The accelerator pedal angle difference is more than 4.5 % between ASP1 and APS3 for more than 265 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will not turn the malfunction indicator lamp (MIL) “ON”.

▼ The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1273 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1273 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Misrouted harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 1, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1273 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently,performing the DTC

P1273 Diagnostic Chart may isolate the cause of the fault.

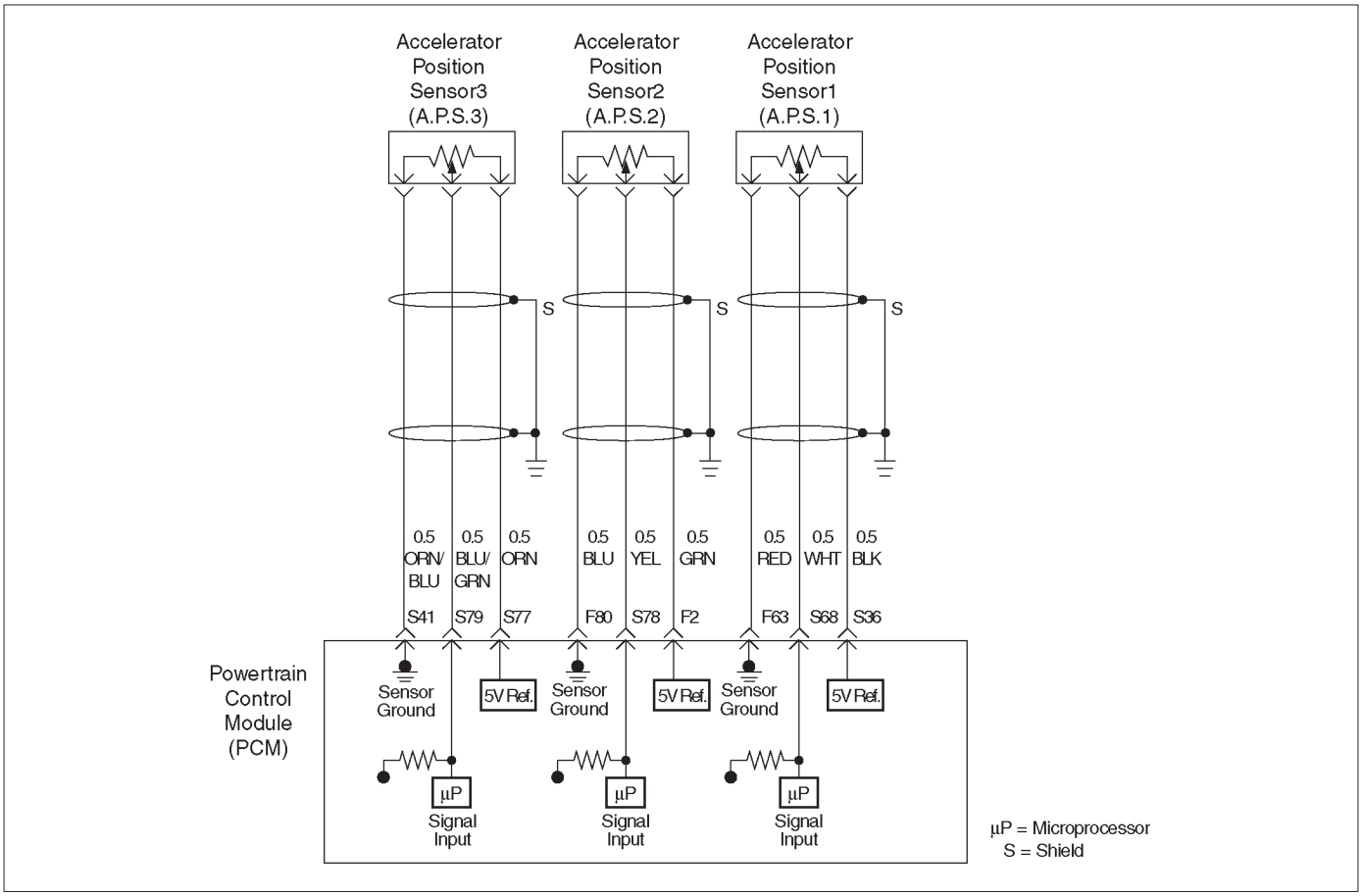
DTC P1273 – APS 1 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition AP sensor 1 =13 % AP sensor 3 =85 ~ 89 % Wide open throttle AP sensor 1 =85 ~ 89 % AP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltage supply circuit and the AP sensor signal circuit at the AP1 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP1 and AP3 signal circuit for a short to voltage. 2. AP1 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 and AP3 signal circuit or 5 voltage supply circuit for a poor connection. 2. AP1 and AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP1 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*

DTC P1273 – APS 1 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1275 APS 1 Output Fault



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT) to specified voltage (about 5V).

This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The accelerator pedal sensor 1 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will ON the MIL after second trip with detected fault.

▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1275 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1275 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Misrouted harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1275 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

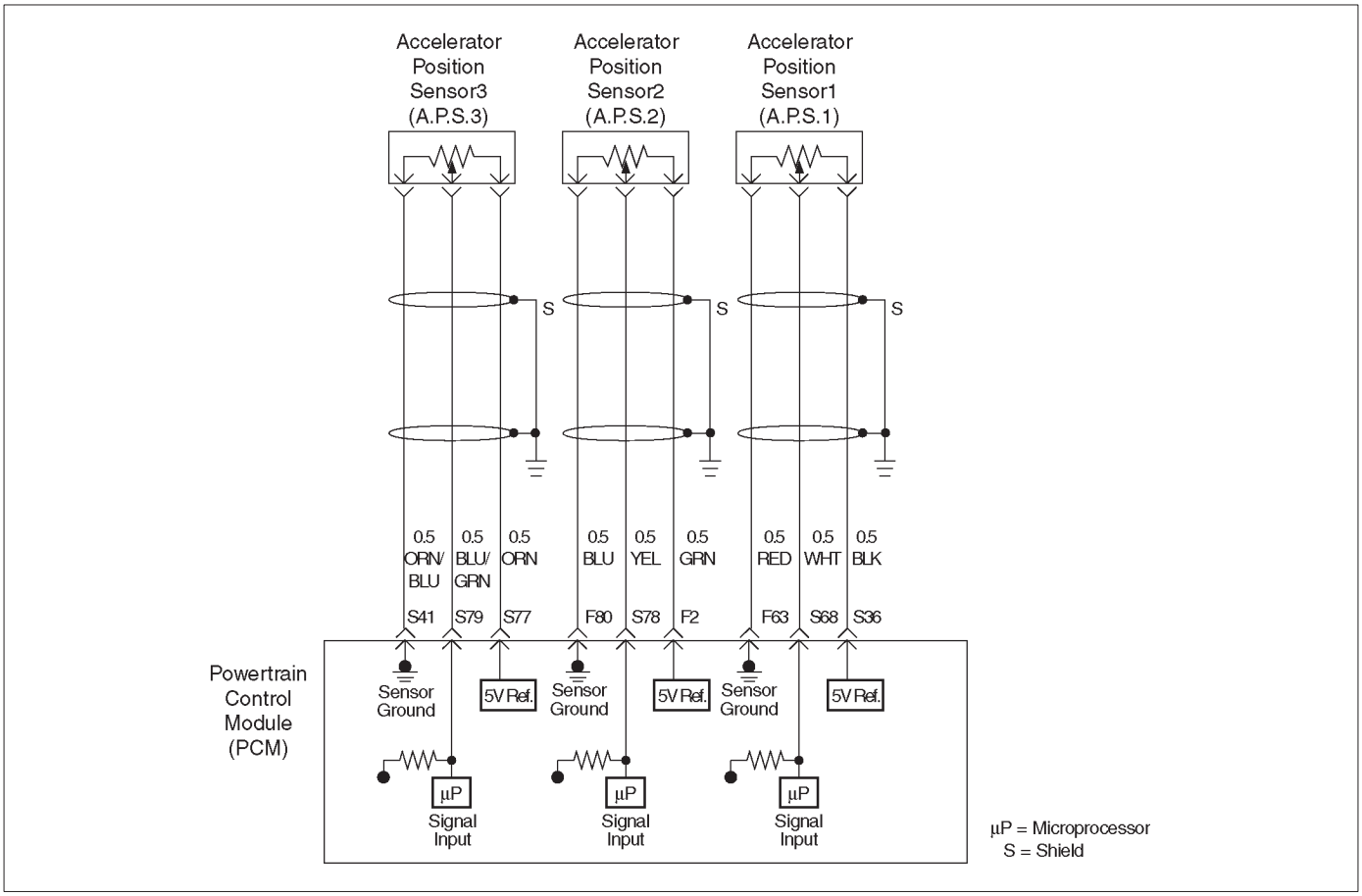
If it is determined that the DTC occurs intermittently, performing the DTC

P1275 Diagnostic Chart may isolate the cause of the fault.

DTC P1275 – APS 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =12 ~ 14 % Wide open throttle =86 ~ 88 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Volt supply circuit and the AP1 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP1 signal circuit for a short to voltage. 2. AP1 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 signal circuit or 5 volt supply circuit for a poor connection. 2. AP1 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP1 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1280 APS 2 Output Fault



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP2) will vary from about 87 % at idle position to about 13 % at wide open throttle(WOT) to specified voltage (about 5V).

This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The accelerator pedal sensor 2 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will ON the MIL after second trip with detected fault.

▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1280 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1280 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Misrouted harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1280 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

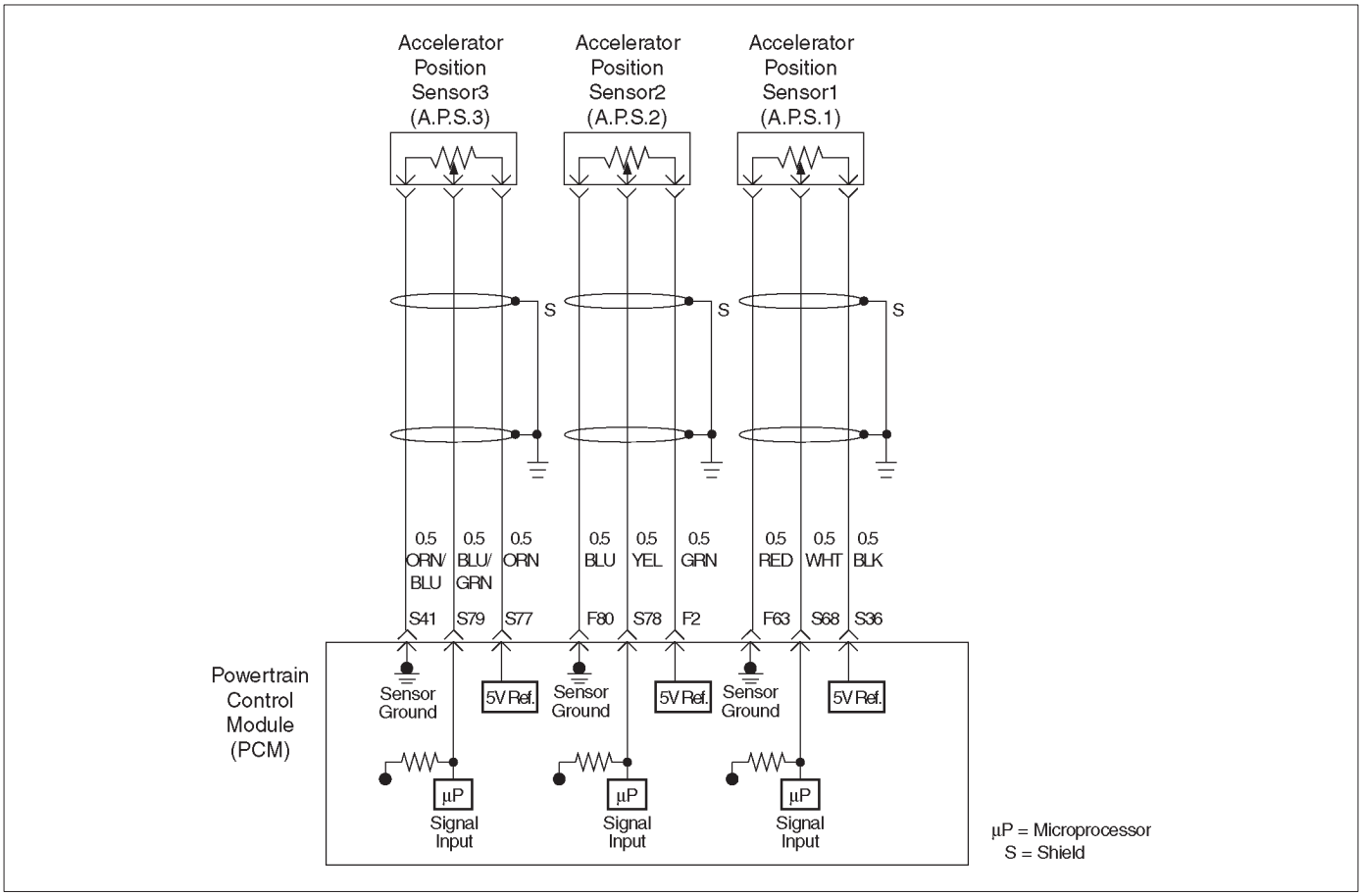
If it is determined that the DTC occurs intermittently, performing the DTC

P1280 Diagnostic Chart may isolate the cause of the fault.

DTC P1280 - APS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =12 ~ 14 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 voltage supply circuit and the AP2 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP2 signal circuit for a short to volt. 2. AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 signal circuit or 5 volt supply circuit for a poor connection. 2. AP2 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1285 APS 3 Output Fault



060R200064

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal sensor (AP3) will vary from about 87 % at idle position to about 34 % at wide open throttle(WOT) to specified voltage (about 5V).

This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ The accelerator pedal sensor 3 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

Action Taken When the DTC Sets

▼ The PCM will ON the MIL after second trip with detected the fault.

▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1285 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1285 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Misrouted harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1285 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

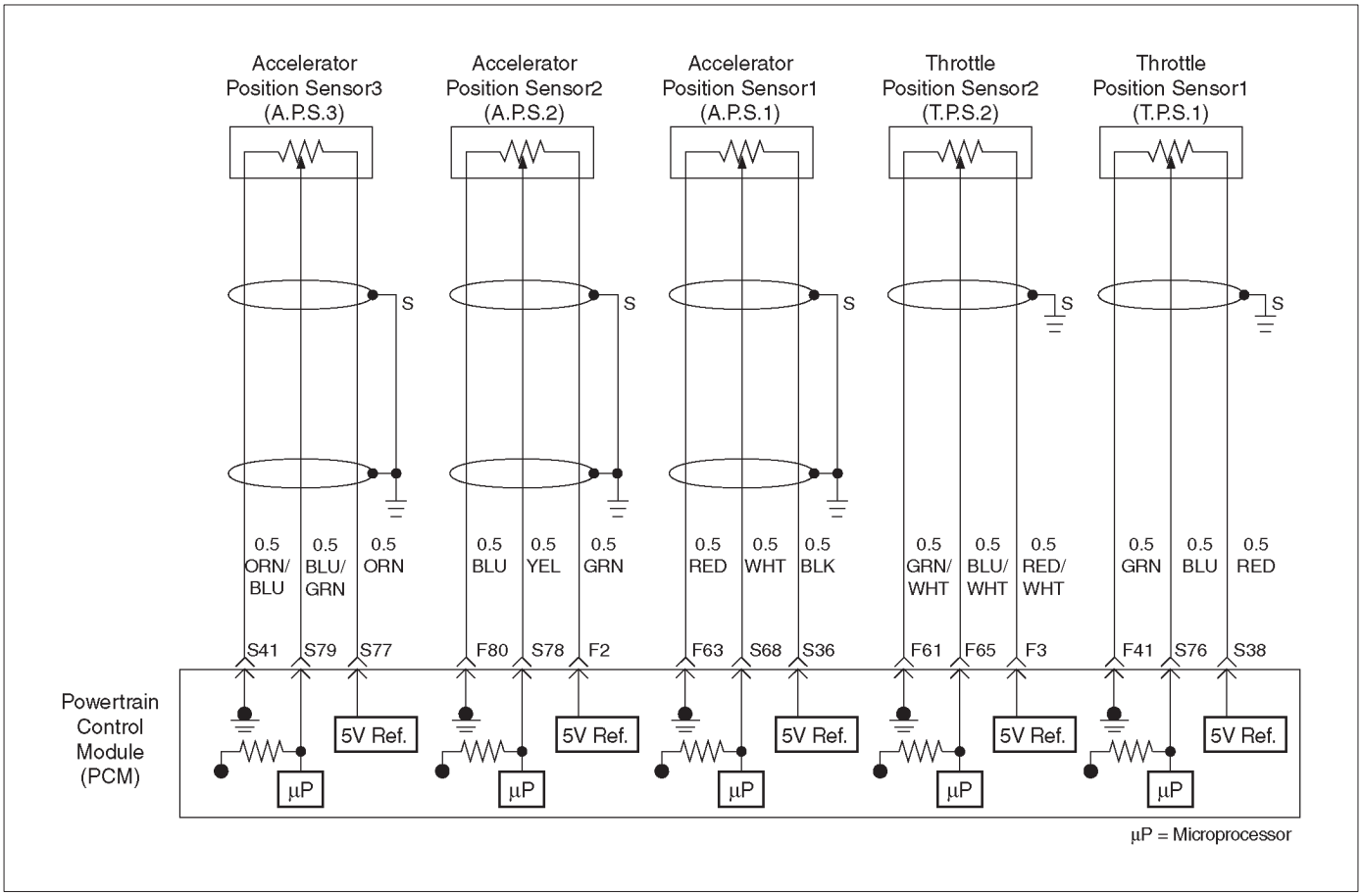
If it is determined that the DTC occurs intermittently, performing the DTC

P1285 Diagnostic Chart may isolate the cause of the fault.

DTC P1285 – APS 3 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 volt supply circuit and the AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP3 signal circuit for a short to voltage. 2. AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP3 signal circuit or 5 volt supply circuit for a poor connection. 2. AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1290 ETC Forced Idle Mode



060R200069

Circuit Description

▼ The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

The accelerator pedal angle (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT).

This code detects that if the system is in Forced Idle Mode. (Fail safe Mode)

Conditions for setting the DTC

▼ The Ignition is “ON”.

▼ Forced Idle Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

▼ The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.

▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1290 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼ DTC P1290 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.

▼ Mis routed harness.

▼ Rubbed through wire insulation.

▼ Broken wire inside the insulation.

Check for the following conditions:

▼ Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1290 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC

P1290 Diagnostic Chart may isolate the cause of the fault.

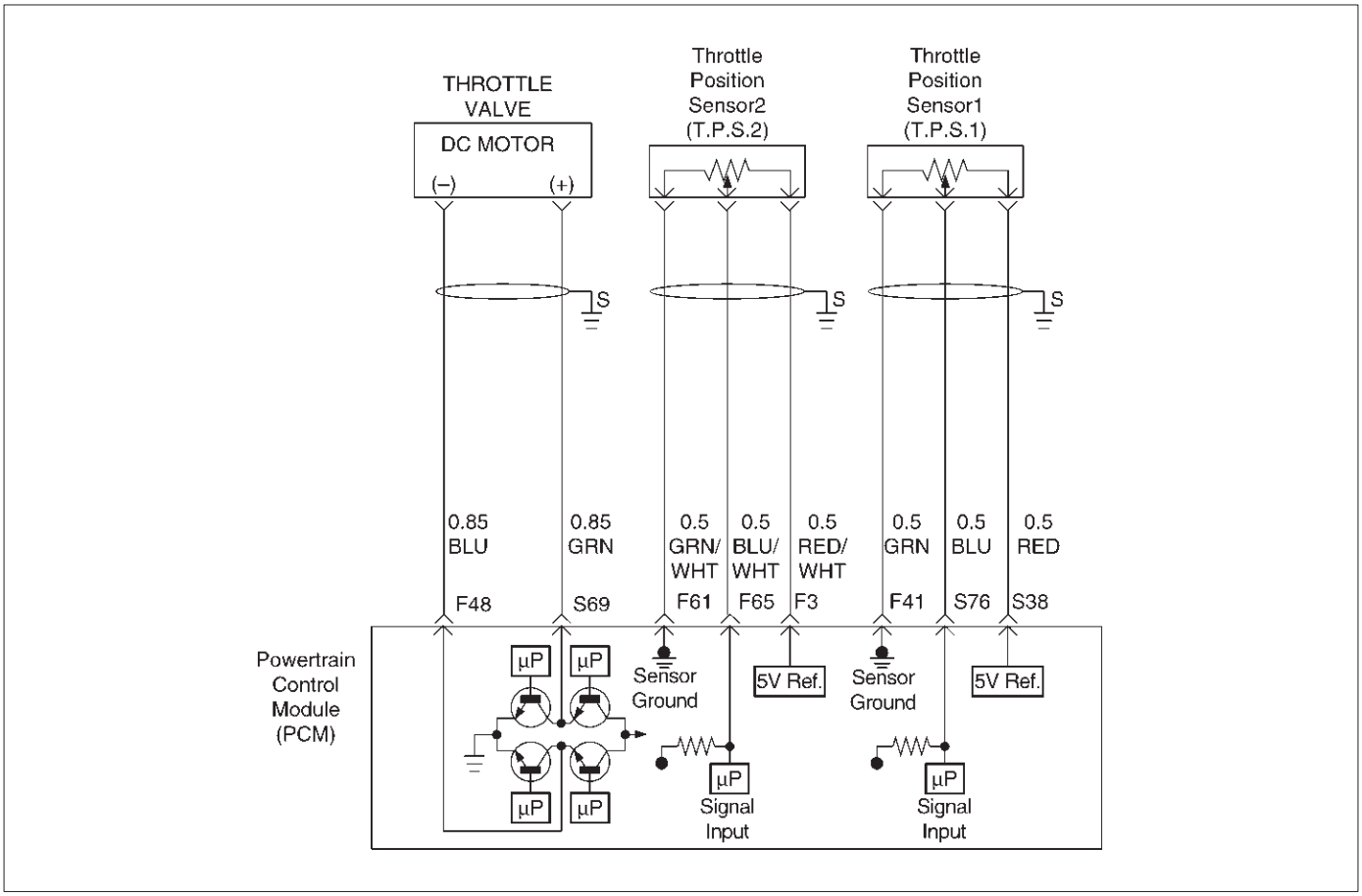
DTC P1290 - ETC Forced Idle Mode

Step	Action	Value(s)	Yes	No
1	Was the “On - Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position AP sensor 1 =12 ~ 14 % AP sensor 2, 3 =86 ~ 88 % Wide open throttle AP sensor 1 =86 ~ 88 % AP sensor 2 =12 ~ 14 % AP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 voltage supply circuit and the AP1, AP2 and AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech2. Is the AP sensor reading near the specified value?	5V	Go to *Step 8*	Go to *Step 7*
6	Check the following items; 1. AP1,AP2 and AP3 signal circuit for a short to voltage. 2. AP1, AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1, AP2 and AP3 signal circuit or 5 volt supply circuit for a poor connection. 2. AP1, AP2 and AP3 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP1, AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1290 - ETC Forced Idle Mode (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1295 ETC Power Management Mode



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC detects that if the system is in Power Management Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- Power Management Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on throttle blade position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1295 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1295 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1295 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determining that the DTC occurs intermittently, performing the DTC

P1295 Diagnostic Chart may isolate the cause of the fault.

DTC P1295 - ETC Power Management Mode

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1295. Does the Tech 2 indicate DTC P1295 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 9*	Go to *Step 5*
5	1. Ignition "OFF". 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 8*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 8*
8	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	—
9	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 10*	Go to *Step 11*

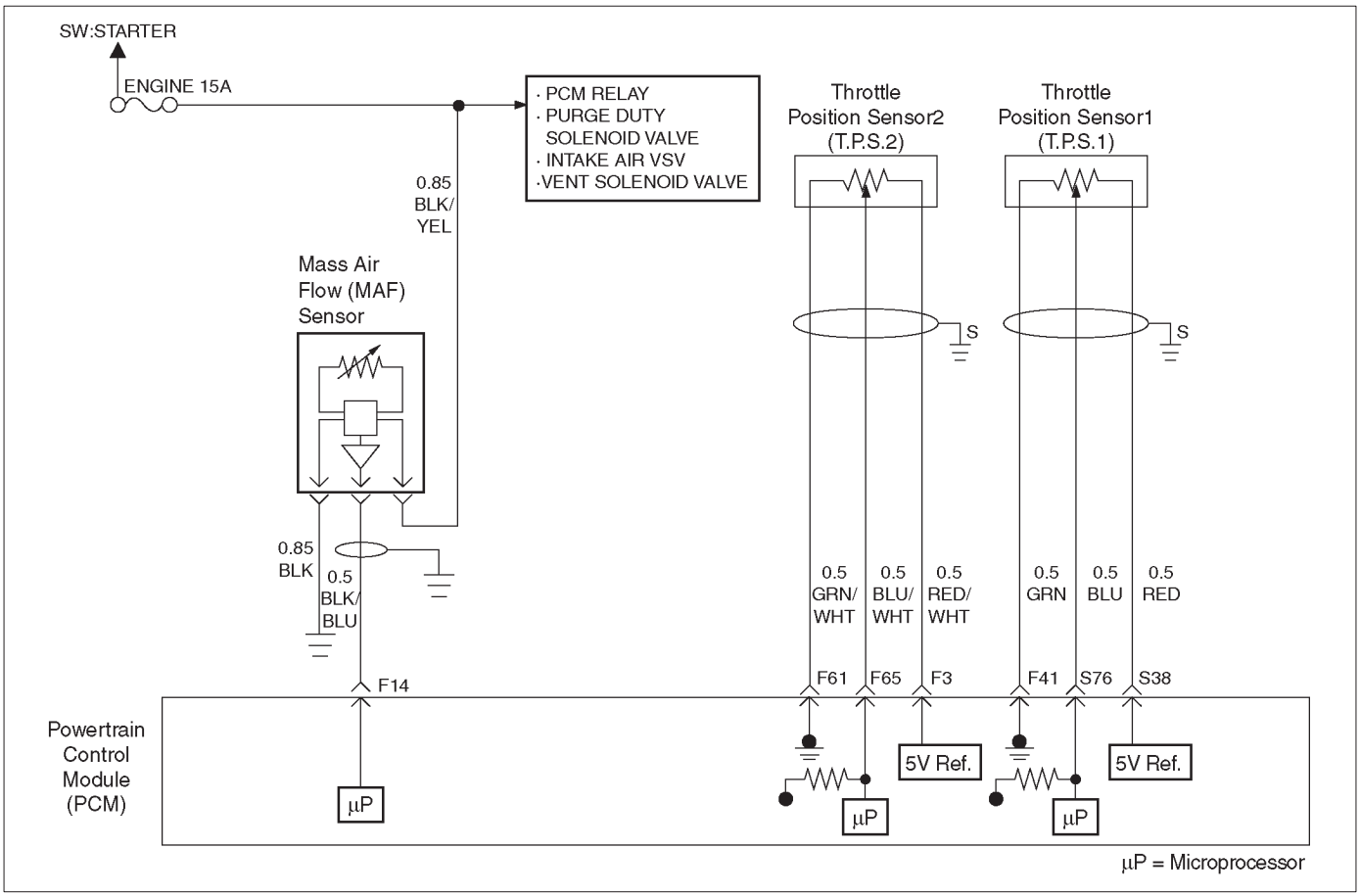
DTC P1295 - ETC Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Connect a test light between the 5Volt reference "A" circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 13*	Go to *Step 12*
11	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
12	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
13	Replace the TP sensor. Is the action complete?	—	Verify repair	—
14	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
15	1. Ignition "OFF". 2. Disconnect the MAF sensor connector. 3. Ignition "ON", engine idling. 4. Using a Tech 2, monitor "MAF Frequency". Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 16*	Go to *Step 17*
16	Replace the MAF sensor. Is the action complete?	—	Verify repair	—
17	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 23*
18	1. With the engine idling, monitor "MAF Frequency" display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at the specified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 19*

DTC P1295 - ETC Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Ignition "ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 20*	Go to *Step 23*
20	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	5V	Go to *Step 22*	Go to *Step 21*
21	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 23*
22	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
23	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1299 ETC Forced Engine Shutdown Mode



060R200061

Circuit Description

- The throttle position sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8% at closed throttle to about 92% at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC detects if the system is in ETC Forced Engine Shutdown Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- ETC Forced Engine Shutdown Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1299 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1299 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal to wire connection.

▼ Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1299 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determining that the DTC occurs intermittently, performing the DTC P1299 Diagnostic Chart may isolate the cause of the fault.

DTC P1299 - ETC Forced Engine Shutdown Mode

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 8*	Go to *Step 4*
4	1. Ignition “OFF”. 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100Ω	Go to *Step 5*	Go to *Step 7*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 7*
7	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

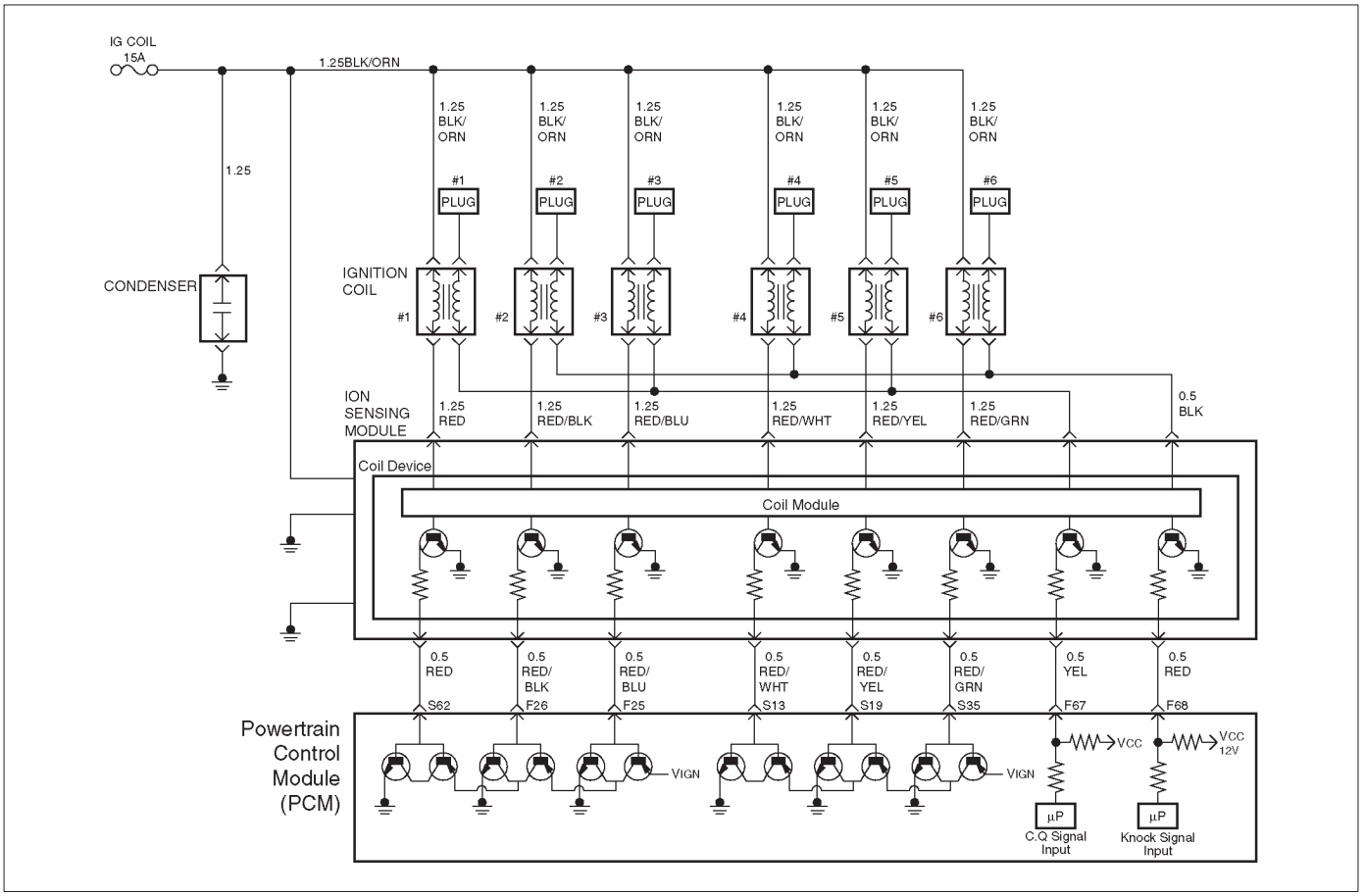
DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 17*
14	1. Ignition "OFF". 2. Disconnect the MAF sensor connector. 3. Ignition "ON", engine idling. 4. Using a Tech 2, monitor "MAF Frequency". Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 15*	Go to *Step 16*
15	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 18*
16	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 22*
17	1. With the engine idling, monitor "MAF Frequency" display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
18	1. Ignition "ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 19*	Go to *Step 22*

DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?(If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 20*	Go to *Step 21*
20	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted ,repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 22*
21	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1310 ION Sensing Module Diagnosis



060R200068

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The Deceleration Fuel Cut Off (DFCO) test is performed to evaluate the Combustion Quality (CQ) signal pulse width
- If it is below a predetermined value, the value it is expected to be during DFCO conditions. If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Power Enrichment (PE) test is performed to evaluate the Combustion Quality (CQ) signal pulse width
- If it is below a predetermined value, the value is expected to be during PE conditions.

  If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Combustion Quality (CQ) test is performed to check if inappropriate (CQ) signal status were detected. If missing CQ pulses or multiple CQ pulses or CQ pulse width calculation errors were detected, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 19%.
- Engine speed is between 650rpm and 6500rpm.
- No Crank DTCs set.
- No System voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1310 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1310 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1310 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1310 Diagnostic Chart may isolate the cause of the fault.

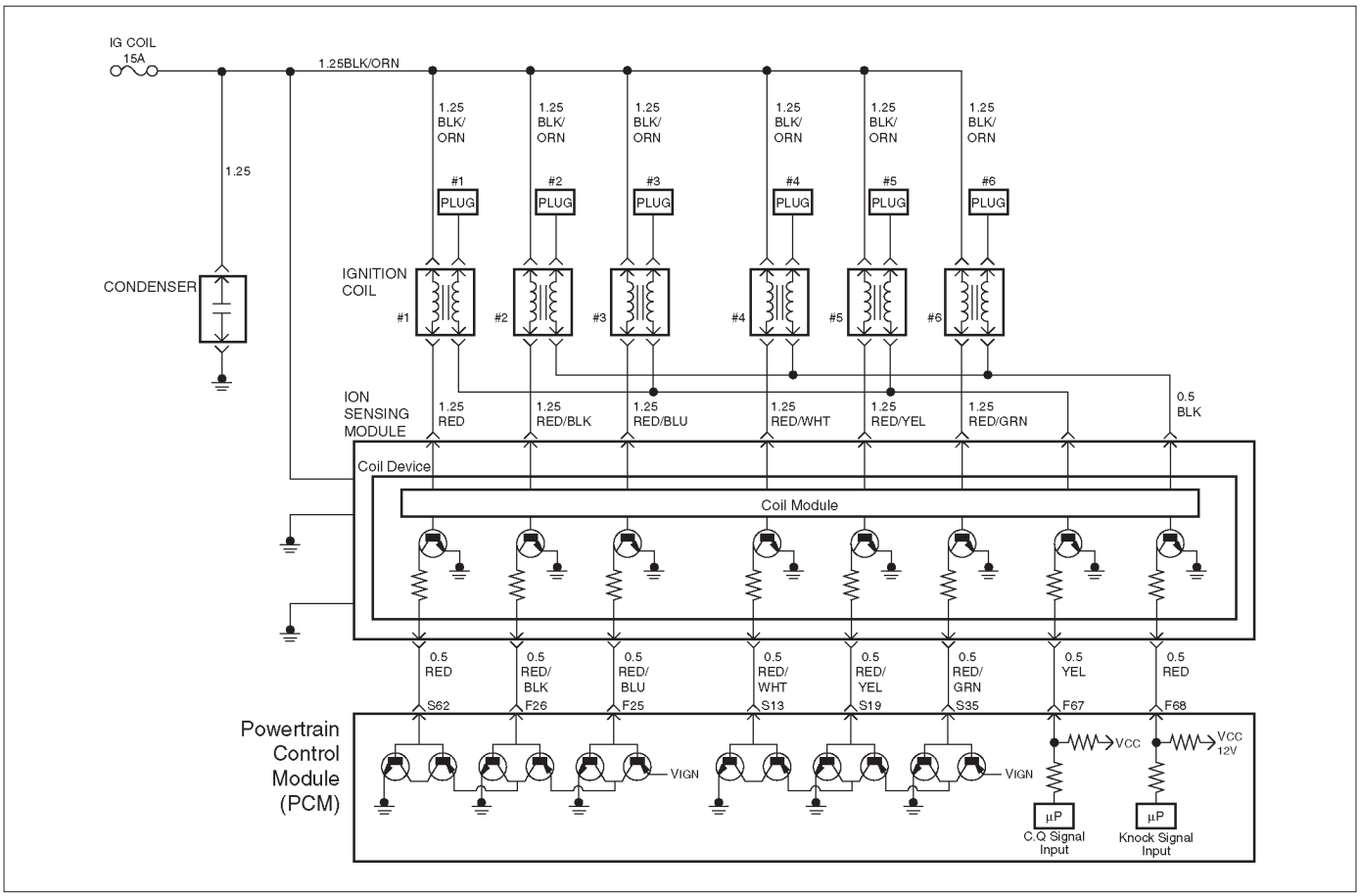
DTC P1310 - ION Sensing Module Diagnostic

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1310. Does the Tech 2 indicate DTC P1310 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF”. 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing harness between the PCM and ION Sensing module circuit harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P1310 - ION Sensing Module Diagnostic (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1311 ION Sensing Module SEC Line 1 Circuit Fault



060R200068

Circuit Description

▼ The Power Control Module (PCM) will compare the secondary current reading to predetermined maximum and minimum thresholds.

If the secondary current signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

▼ Ignition voltage is between 10volt and 16 volts.
▼ MAP sensor signal is between 26kPa and 100 kPa.
▼ Fuel level is more than 19%.
▼ Engine speed is between 650rpm and 6500rpm.
▼ ION Sensing Module circuit is open or shorted signals on the SEC 1 line.

Action Taken When the DTC Sets

▼ The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
▼ The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
▼ A history DTC P1311 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
▼ DTC P1311 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.
▼ Misrouted harness.
▼ Rubbed through wire insulation.
▼ Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.
- A change in the display will indicate the location of the fault. If DTC P1311 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.
- If it is determined that the DTC occurs intermittently, performing the DTC P1311 Diagnostic Chart may isolate the cause of the fault.

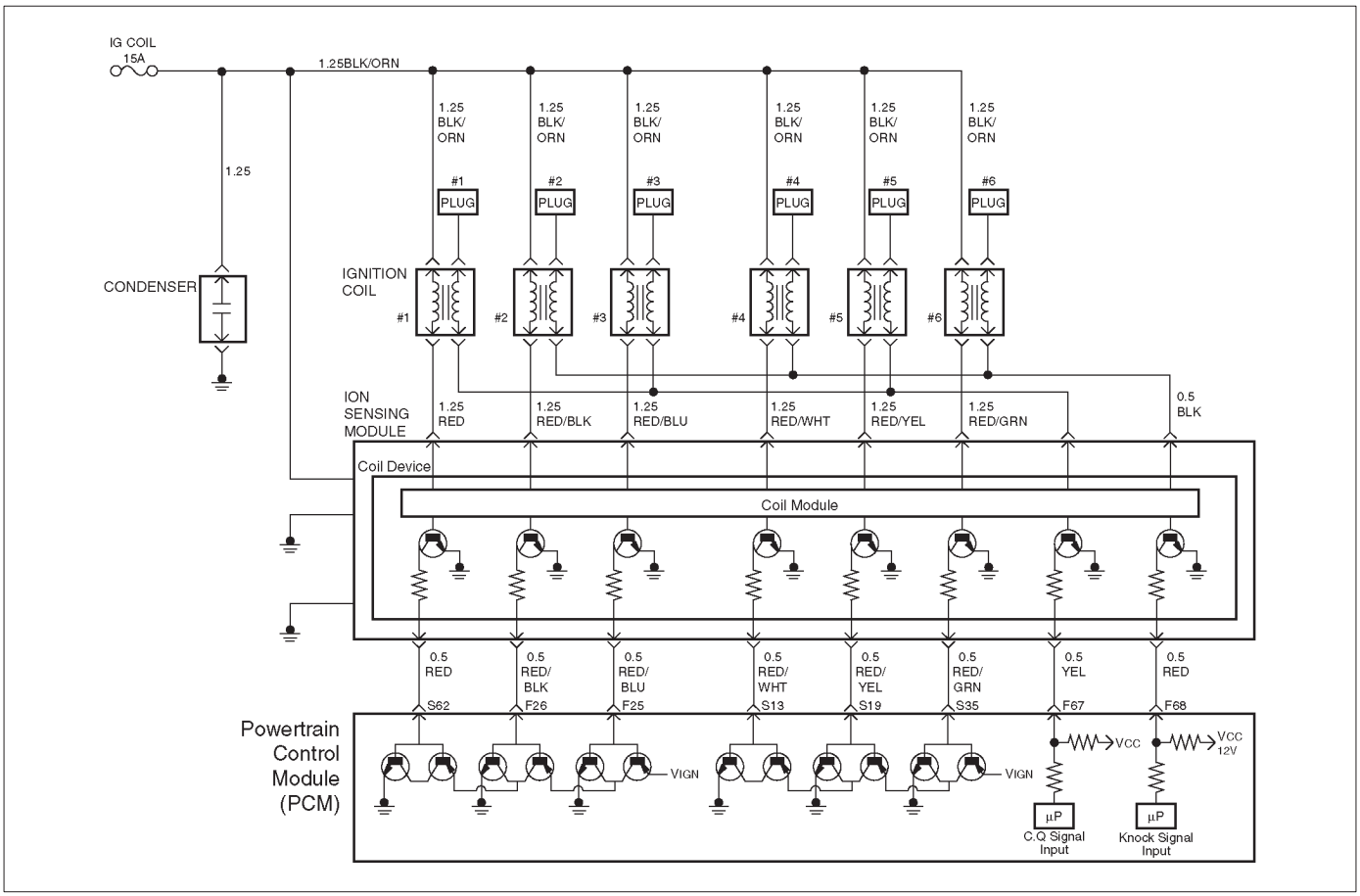
DTC P1311 - ION Sensing Module SEC Line 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1311. Does the Tech 2 indicate DTC P1311 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the ION Sensing module harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 1 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P1311 - ION Sensing Module SEC Line 1 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1312 ION Sensing Module SEC Line 2 Circuit Fault



060R200068

Circuit Description

▼ The Power Control Module (PCM) will compare the secondary current reading to predetermined maximum and minimum thresholds.

If the secondary current signal pulse width is out of the predetermined range, the fail counter will be incremented. If the fail counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

▼ Ignition voltage is between 10volt and 16 volts.
▼ MAP sensor signal is between 26kPa and 100 kPa.
▼ Fuel level is more than 19%.
▼ Engine speed is between 650rpm and 6500rpm.
▼ ION Sensing Module circuit is open or shorted signals on the SEC 2 line.

Action Taken When the DTC Sets

▼ The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
▼ The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
▼ The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
▼ A history DTC P1312 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
▼ DTC P1312 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼ Poor connections.
▼ Misrouted harness.
▼ Rubbed through wire insulation.
▼ Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1312 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1312 Diagnostic Chart may isolate the cause of the fault.

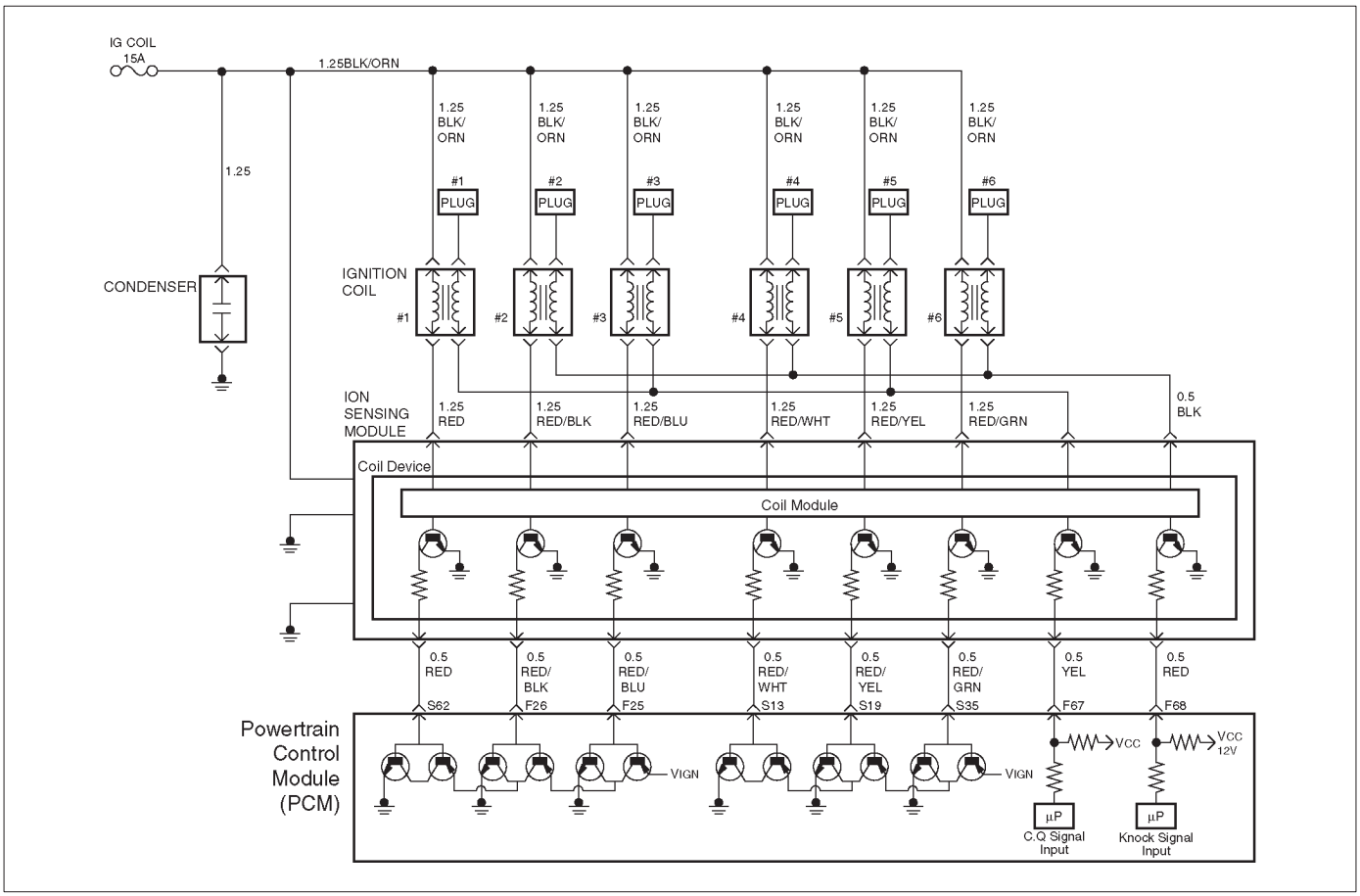
DTC P1312 - ION Sensing Module SEC Line 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1312. Does the Tech 2 indicate DTC P1312 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 2 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P1312 - ION Sensing Module SEC Line 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1326 ION Sensing Module Combustion Quality Input Circuit Fault



060R200068

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evacuate the Combustion Quality (CQ) signal pulse width if it is within a predetermined range. If the CQ signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the CQ line circuit, ION Sensing module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No cylinder ID DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1326 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1326 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1326 cannot be duplicated, the information included in the Failure Records data can

be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1326 Diagnostic Chart may isolate the cause of the fault.

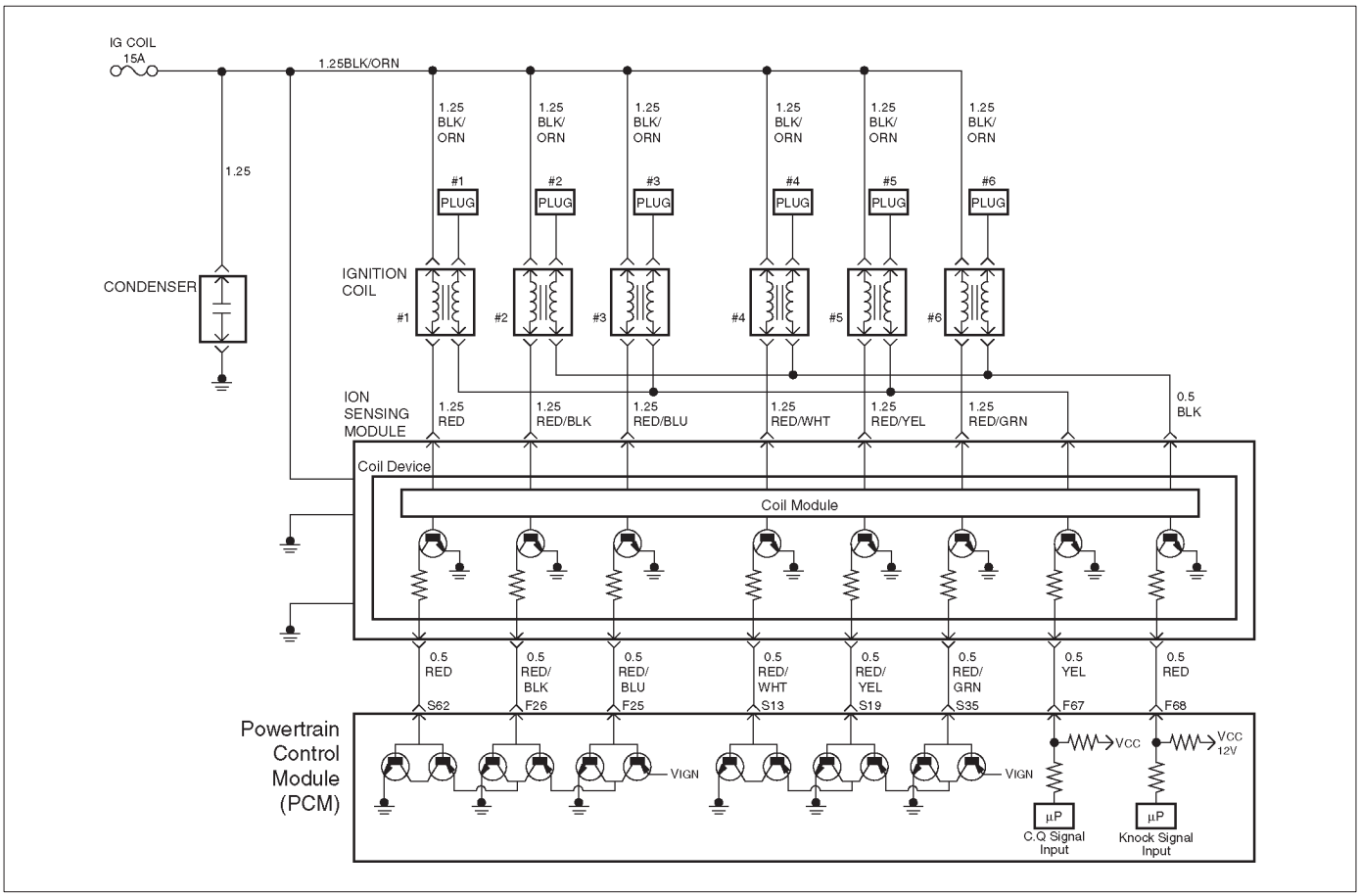
DTC P1326 - ION Sensing Module Combustion

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1326. Does the Tech 2 indicate DTC P1326 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P1326 - ION Sensing Module Combustion (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin .Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1340 ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)



060R200068

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- This test will return a fault if the cylinder synchronization routine has not been completed after a predetermined number of events after crank. This test will detect fault that will prevent the PCM from synchronization, such as Knock Signal (KI) - Combustion Quality (CQ) lines being swapped, shorted spark plugs, ION Sensing module faults, an PCM hardware faults.

Conditions for setting the DTC

- Ignition voltage is between 11volts and 16 volts.
- Engine speed is between 650rpm and 6250rpm.
- No ECT DTCs set.
- No injector DTCs set.
- No Fuel Trim DTCs set.
- No Misfire DTCs set.
- No system voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1340 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1340 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1340 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1340 Diagnostic Chart may isolate the cause of the fault.

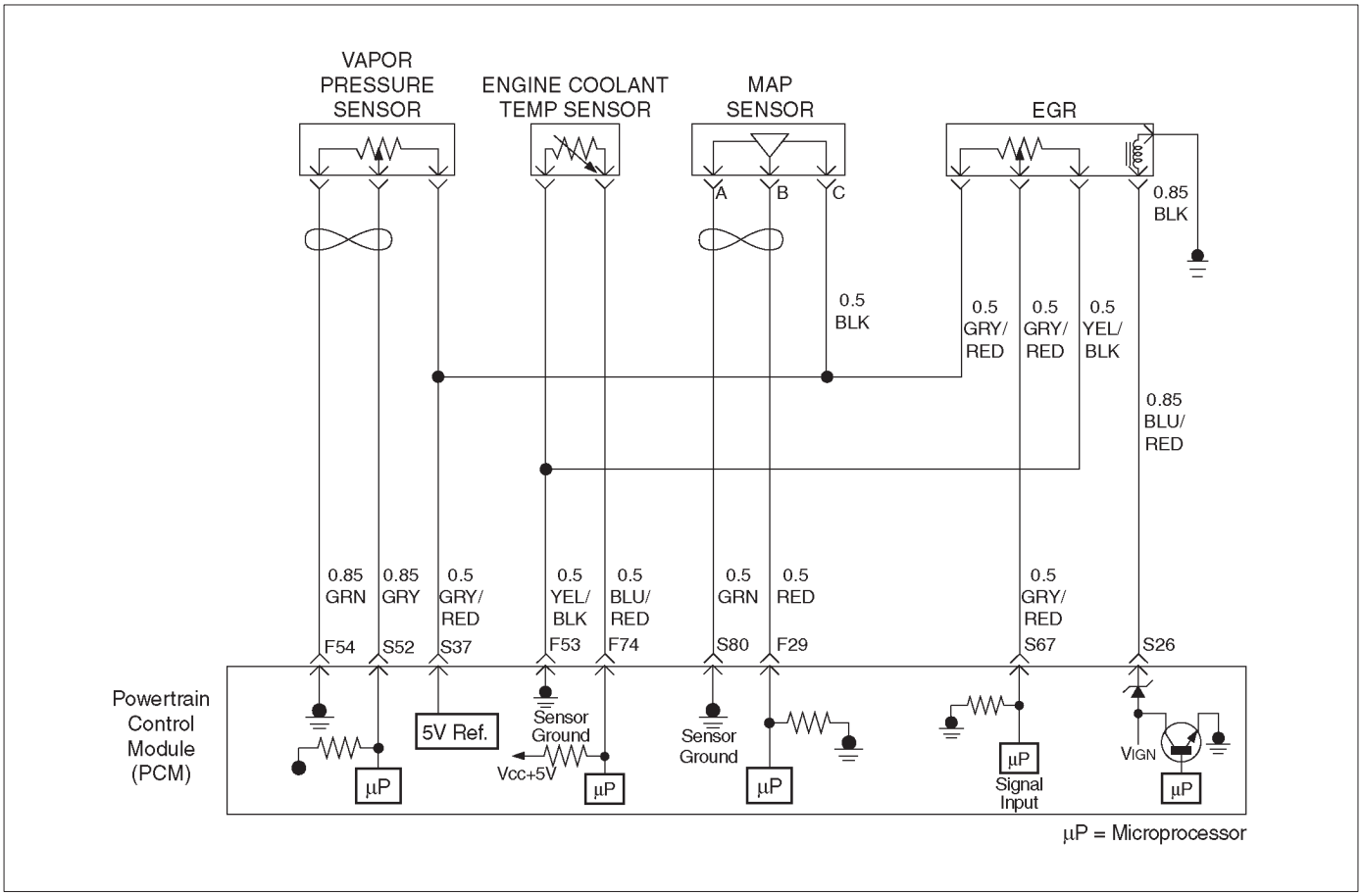
DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF". 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor " DTC" info for DTC P1340. Does the Tech 2 indicate DTC P1340 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1404 EGR Stuck Closed



060R200050

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if current pintle zero position is different from the learned zero position. If the PCM detects a pintle position signal indicates more than 30 % different between current zero position and the learned zero position for more than 5 seconds, and this condition exists 3 times during trip, then the PCM will set DTC P1404.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3˚C.
- Desired EGR position is more than 3 %.
- Difference of EGR pintle position between current and the learned zero is more than 30 % for more than 5 seconds, and exists three times to the above condition during a trip the PCM will set DTC 1404. Then it trigger the PCM light on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft and/or foreign material may cause the EGR valve not to fully seat. The carbon deposit may occur by unusual port operation. Remove foreign material and/or excessive carbon deposit on EGR valve shaft and to allow the EGR valve to be fully seated.
- Poor connection or damaged harness – Inspect the wiring harness for damage.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

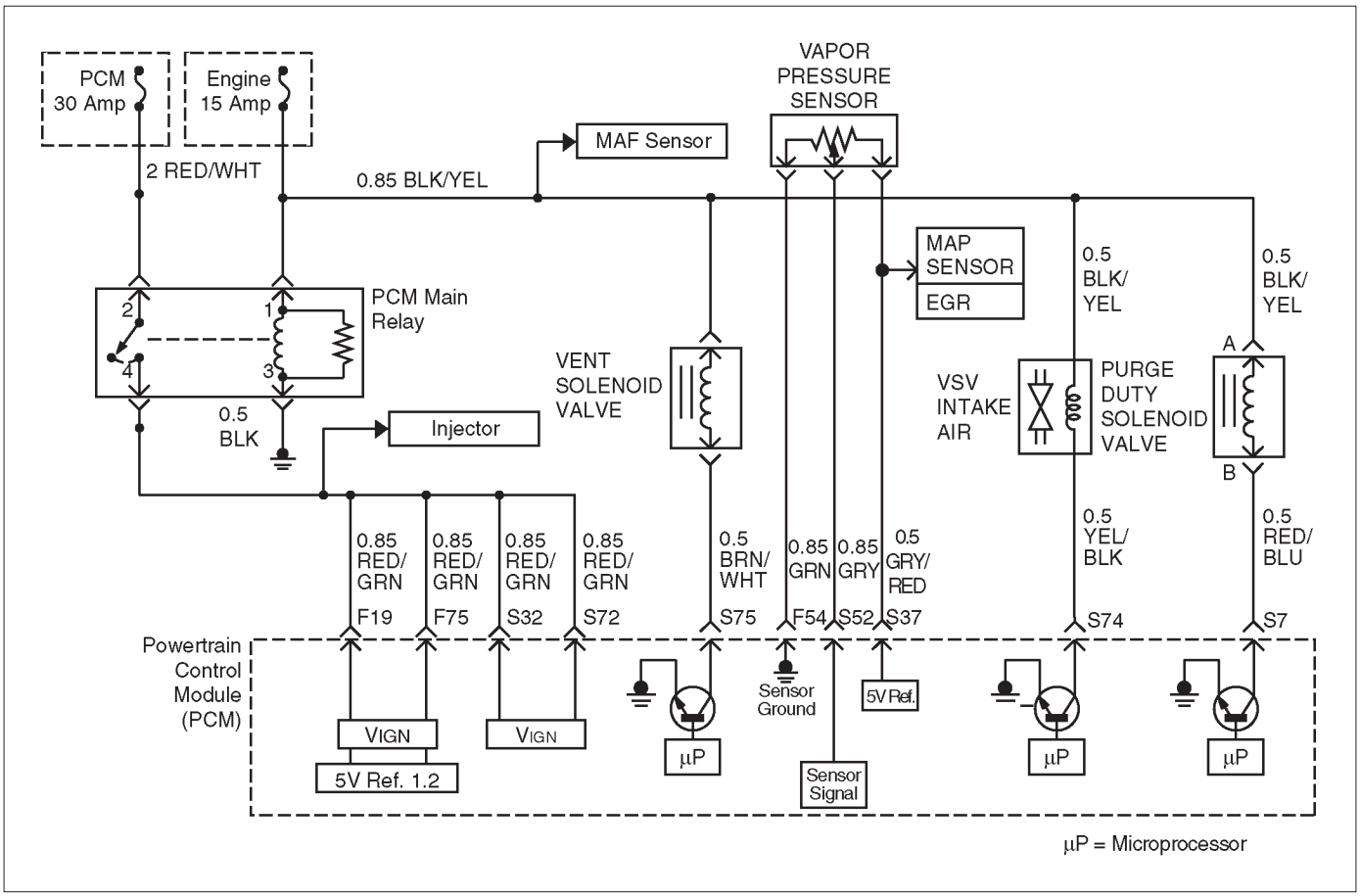
DTC P1404 – EGR Stuck Closed

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC inf.” for DTC P1404 until the DTC P1404 test runs. Note the result. Does the Tech 2 indicates DTC P1404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve for any excessive carbon deposit on EGR shaft. 3. Inspect for any foreign material inside of EGR valve. Was excessive carbon deposit on EGR valve shaft and/or foreign material in EGR valve ?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Remove foreign material from EGR valve. 3. Visually inspect damage of pintle and seat to see if it is bent. If damaged, leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 9*	Verify repair Go to *Step 7*
7	1. Install the EGR valve. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the “UP” arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	Verify repair	Go to *Step 8*
8	1. Reset the learned zero EGR valve position. 2. Repeat step 7. Did EGR work properly?	—	Verify repair	Go to *Step 9*

DTC P1404 – EGR Stuck Closed (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the EGR valve. Does DTC P1404 still fail "DTC" test on the Tech 2?	—	Go to *Step 10*	Verify repair
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1441 EVAP System Flow During Non-Purge



060RY00398

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is pulse-width modulated (PWM) or turned “ON” and “OFF” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

Conditions for Setting the DTC

- No active ECT sensor, IAT sensor, MAP sensor, or TP sensor DTCs set.
- BARO reading is above 85 kPa.
- Engine coolant temperature is below 70˚C (158˚F).
- Start-up intake air temperature (IAT) and start-up engine coolant temperature (ECT) are both above 5˚C (41˚F).
- The difference between start-up ECT and start-up IAT is less than 25˚C (45˚F).
- TP sensor indicates a throttle position above 12%.
- Battery voltage is between 11.5 volts and 16 volts.
- Engine speed is between 800 and 6,000 RPM.
- Canister purge duty cycle is below 3%.
- Fuel level is between 15% and 85%.
- All conditions are present for at least 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P1441 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wring harness for damage. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

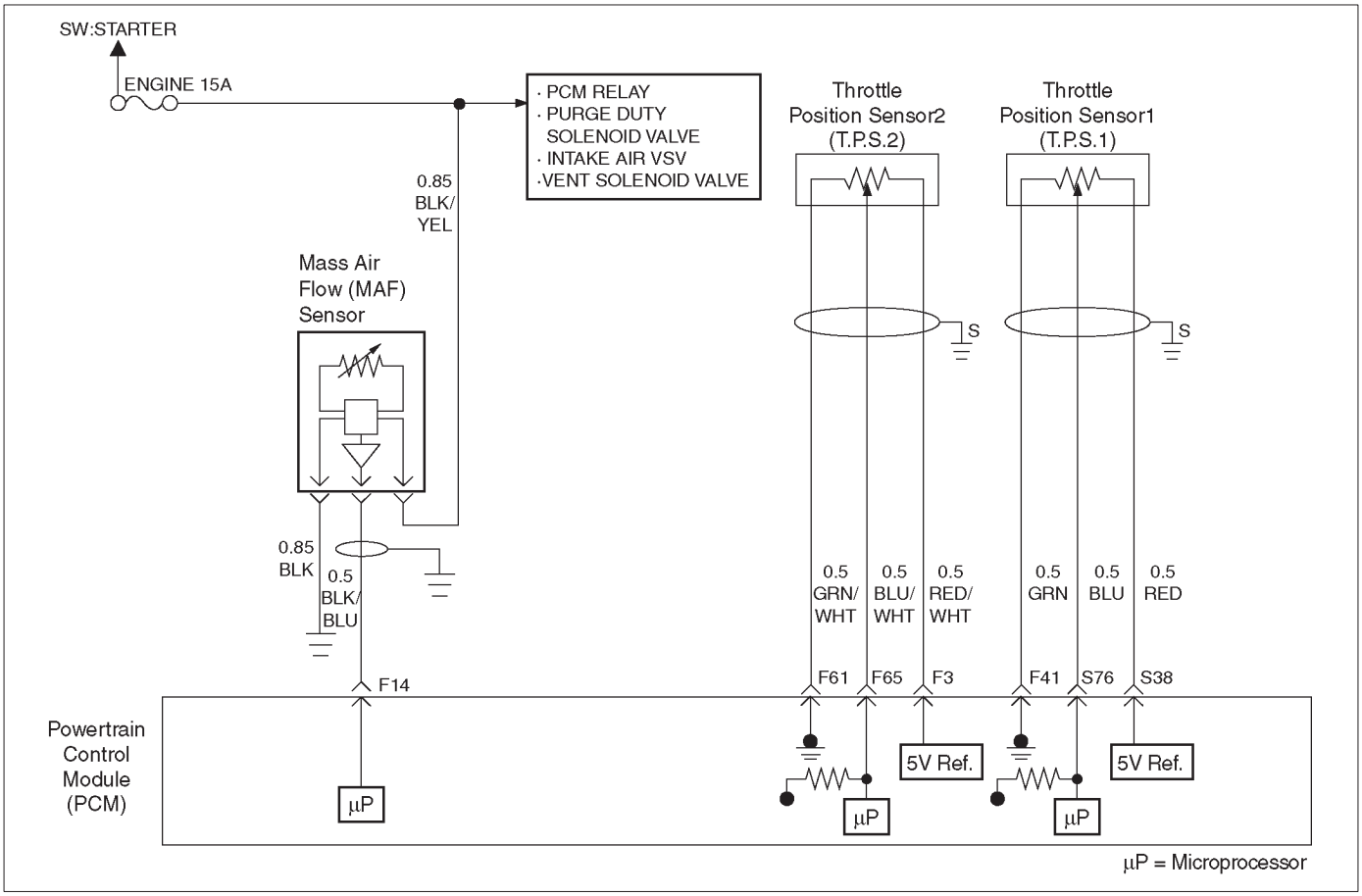
DTC P1441 – EVAP System Flow During Non-Purge

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”. 2. Remove the fuel filler cap. 3. Ignition “ON”. 4. Observe “Fuel Tank Pressure” on the Tech 2. Is “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *DTC P0452 or P0453*
3	1. Re-install the fuel filler cap. 2. Using the Tech 2, command the EVAP Vent Solenoid Valve “ON” (Closed). 3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister. **IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure/purge cart J41413 (refer to the tool operating instructions). And them monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank pressure remain the specified value?	1.52 - 1.60V	Go to *Step 4*	Go to *Step 6*
4	1. Disconnect the EVAP pressure/purge cart J41413, and then plug the hose end. 2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine). 3. Connect the vacuum hand pump to this rubber hose end. 4. Then apply the -15 in H2O vacuum by the vacuum pump. 5. Monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank inner pressure hold the specified value?	1.47 - 1.51V	Go to *Step 6*	Go to *Step 5*
5	Replace the Purge Solenoid Valve.	—	Verify Repair	—

DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not. 2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve. Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly.	—	Verify Repair	Go to *Step 7*
7	1. Start engine. 2. Remove the Fuel Filler cap. 3. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%). 4. Replace the Fuel Filler Cap. 5. Run the engine at 2500RPM constant while monitoring "Fuel Tank Vacuum" on the Tech 2. Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%)?	30 - 40 %	Verify Repair	Go to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P1514 TPS - MAF Correlation Error



060R200061

Circuit Description

▼The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle (WOT).

▼The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.

Conditions for setting the DTC

▼The engine is running.

▼No MAF sensor DTCs are set.

▼Throttle actuation mode is not off.

▼MAF reading-ETC estimated air flow is less than 40g/s for 250 failures within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

▼The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.

▼The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.

▼The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

▼The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault conditions is no longer present.

▼A history DTC P1514 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

▼DTC P1514 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

▼Poor connections.

▼Misrouted harness.

▼Rubbed through wire insulation.

▼Broken wire inside the insulation.

Check for the following conditions:

▼Poor connection at PCM - Inspect harness connectors for backed out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal to wire connection.

- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow, TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide - open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3 – 6 g/s at idle to 100 g/s or greater at the time of the 1 – 2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault. If DTC P1514 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1514 Diagnostic Chart may isolate the cause of the fault.

DTC P1514 - TPS-MAF Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1514. Does the Tech 2 indicate DTC P1514 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is the “MAF Frequency” below the specified value?	6 ~ 10 g/s	Go to *Step 5*	Go to *Step 8*
5	1. Ignition “OFF”. 2. Disconnect the MAF sensor connector. 3. Ignition “ON”, engine idling. 4. Using a Tech 2, monitor “MAF Frequency”. Does the Tech 2 indicate a “MAF Frequency” at the specified value?	0g/s	Go to *Step 6*	Go to *Step 7*
6	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 9*
7	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 19*
8	1. With the engine idling, monitor “MAF Frequency” display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a “MAF Frequency” at the specified value?	6 ~ 10 g/s	Go to *Step 6*	Go to *Step 9*
9	1. Ignition“ON”, engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 10*	Go to *Step 13*

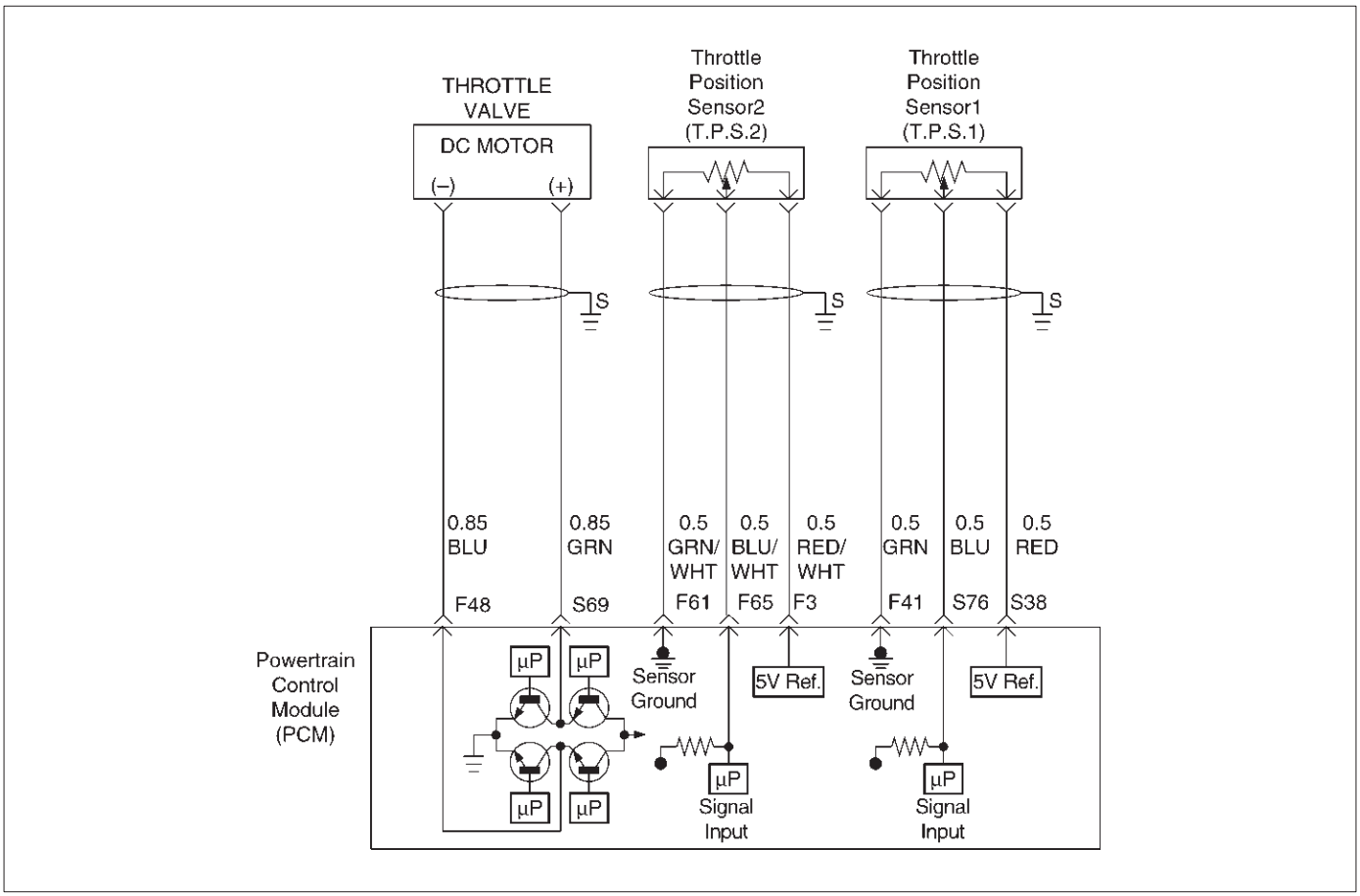
DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.)	—	Go to *Step 11*	Go to *Step 12*
11	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Refer to *Diagnostic Aids*	Go to *Step 14*
14	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 15*	Go to *Step 16*
15	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 18*	Go to *Step 17*
16	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
17	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Replace the TP sensor. Is the action complete?	—	Verify repair	—
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1515 Command - Actual TPS Correlation Error



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the difference between actual throttle position and command throttle position.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle actuation mode is normal.
- Command Throttle position - Actual Throttle position is more than + 5 % for 100 counts within 1000 test samples (15.6 m sec) else Actual Throttle position is less than + 40 % and Command Throttle position - Actual Throttle position is more than - 5 % or Command Throttle position - Actual Throttle position is more than - 20 % for 150 failures within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on throttle blade position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1515 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1515 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, proper mating, locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while

moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1515 cannot be duplicated, the information included in the Failure Records data can be useful in determing vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1515 Diagnostic Chart may isolate the cause of the fault.

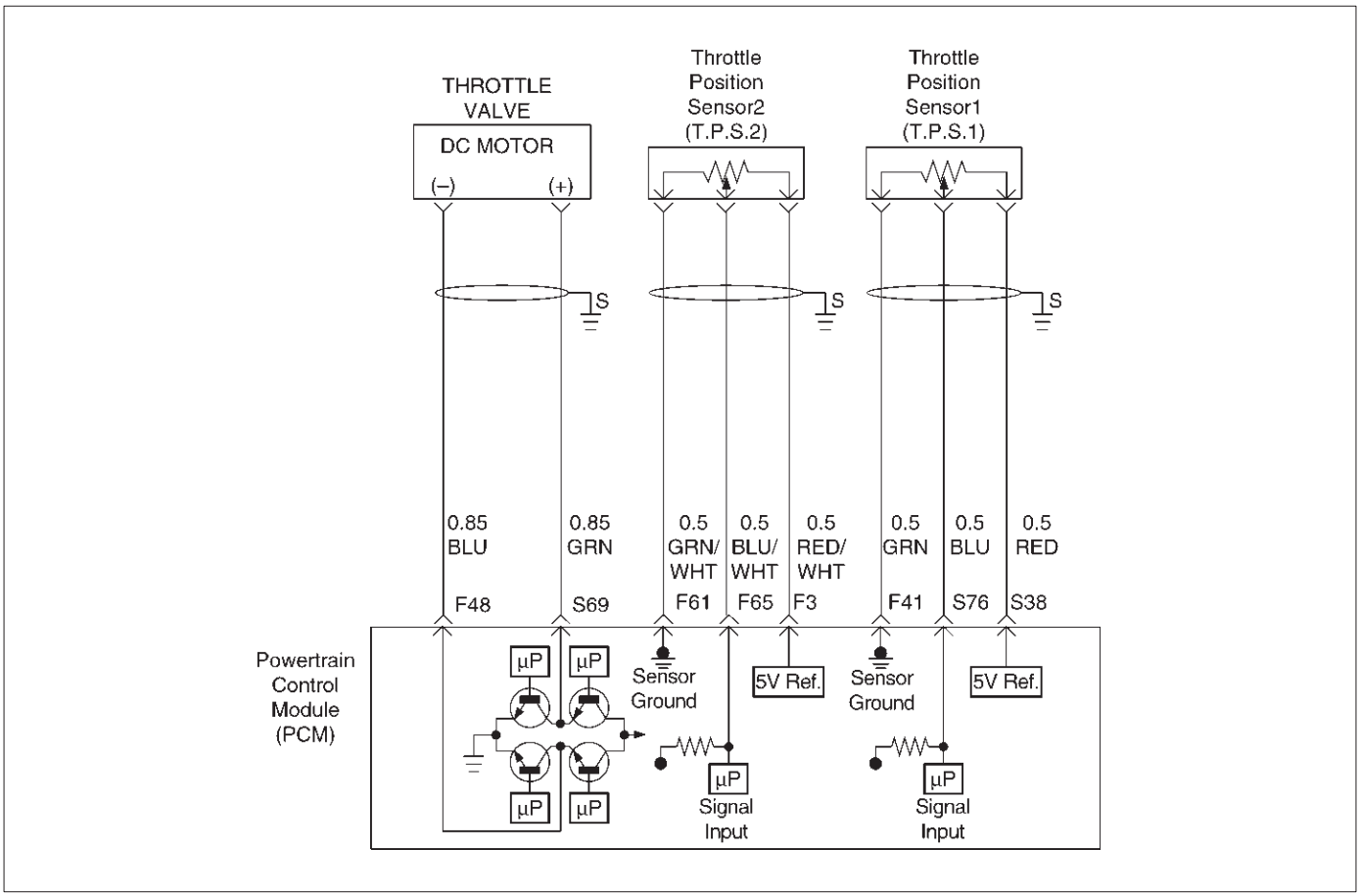
DTC P1515 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “ DTC” info for DTC P1515. Does the Tech 2 indicate DTC P1515 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 5*	Go to *Step 8*
5	1. Ignition “OFF”. 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1515 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1516 Command - Actual TPS Correlation Error



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle). The throttle blade angle will vary from about 8% at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the difference between actual throttle position and command throttle position in steady state.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle Actuation mode is normal.
- Command Throttle position-Actual Throttle position is less than 8 % when desired TPS is steady within 0.5 % for 30 seconds within test samples (30 second)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1516 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1516 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1516 cannot be duplicated, the

information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1516 Diagnostic Chart may isolate the cause of the fault.

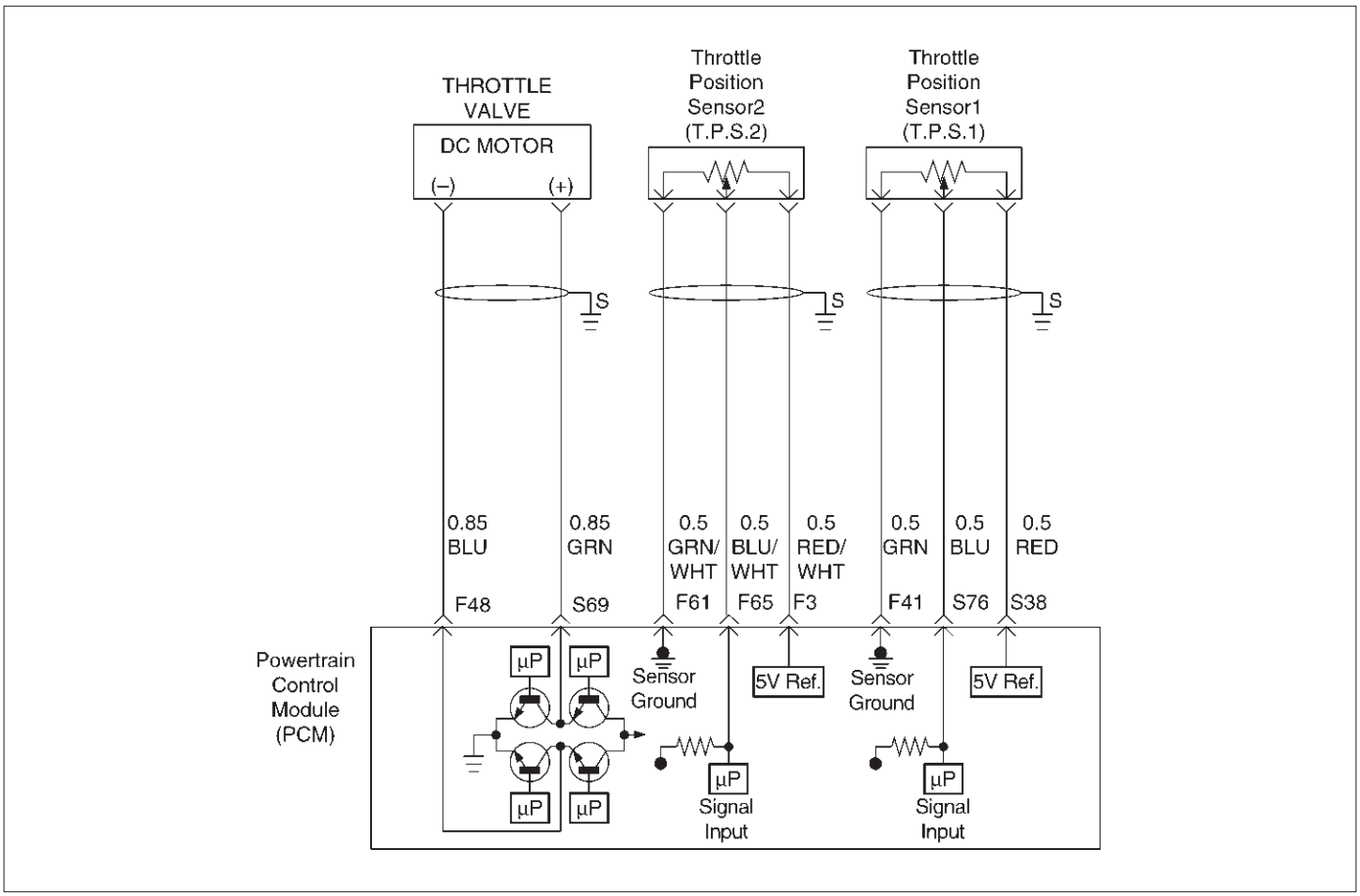
DTC P1516 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1516. Does the Tech 2 indicate DTC P1516 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 5*	Go to *Step 8*
5	1. Ignition “OFF”. 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1516 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1 and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1523 Actuator Control Return Performance



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects if the throttle return to the default position at key on is steady.

Conditions for setting the DTC

- The ignition is “ON”.
- Normalized TPS is less than 7 % or Normalized TPS is more than 25 %.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1523 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1523 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1523 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1523 Diagnostic Chart may isolate the cause of the fault.

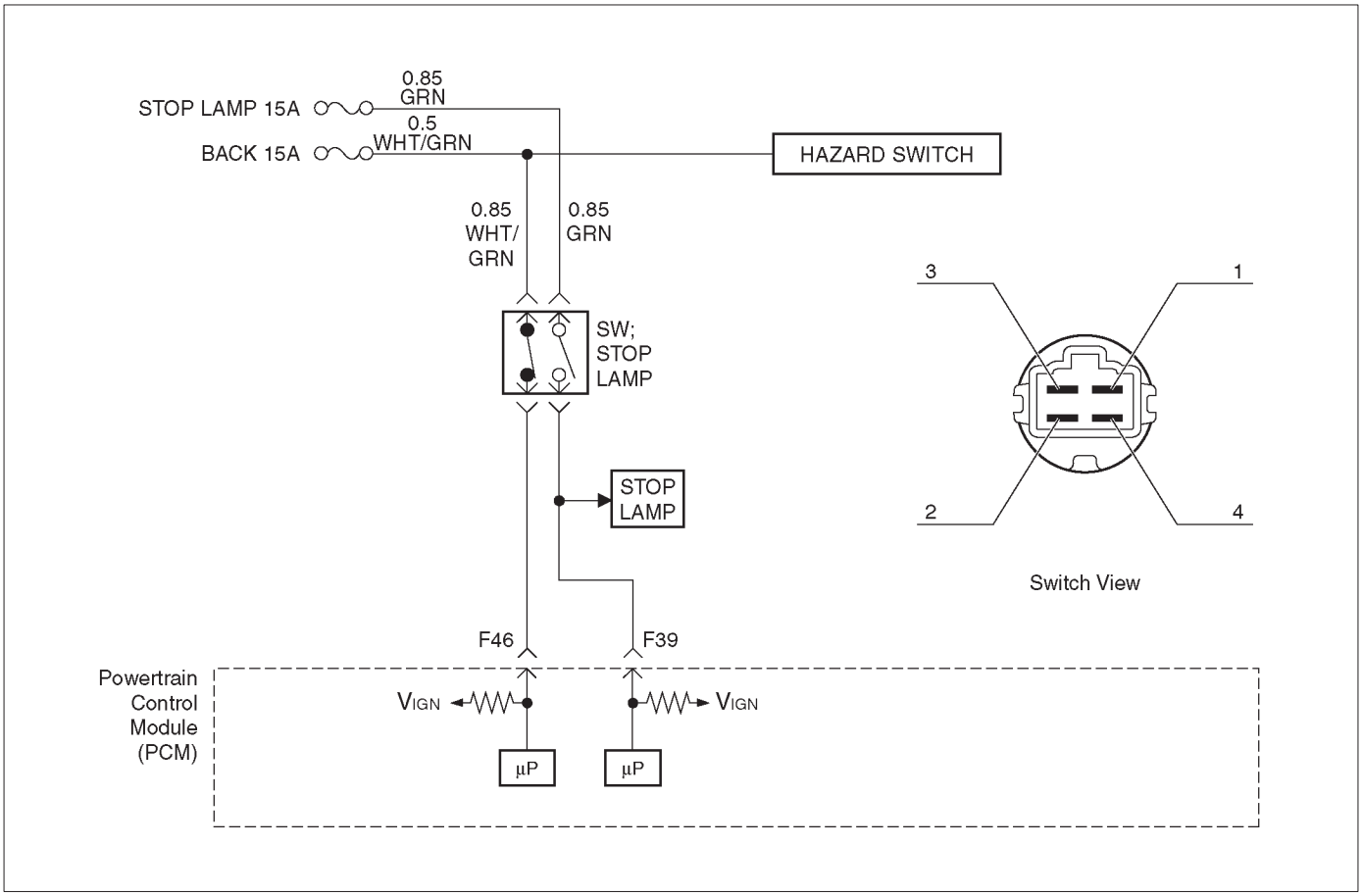
DTC P1523 - Actuator Control Return Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 4*	Go to *Step 7*
4	1. Ignition “OFF”. 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 5*	Go to *Step 6*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
6	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 5*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

DTC P1523 - Actuator Control Return Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1571 Brake Switch No Operation



060R200067

Circuit Description

The brake switch has 3 functions.

- Brake pedal operation check
- Brake light operation (On and off)
- Cruise control (Cancel)

The PCM receives vehicle speed and switch position signals from the brake switch. The PCM sets brake operating conditions in response to these signals.

If the brake switch is on, the brake system is in normal operation (cruise control cancelled).

Conditions for Setting the DTC

- Two break switch signals do not acknowledge after signal changed.
- Switch does not change during accelerating vehicle or decelerating.
- VSS is not fault.
- Engine is running.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- DTC P1571 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

DTC P1571 Brake Switch No Operation

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "Off". Engine "Off". 2. Check following fuses. ▼ BACK 15A ▼ STOP LAMP 15A Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Make adjustment to the brake switch. (Refer to *"Brake switch" in "10A CRUISE CONTROL SYSTEM".*) Was the problem found?	—	Verify repair	Go to *Step 4*
4	1. Push the shaft on brake switch. 2. Check shaft operation for smooth movement. Was the problem found?	—	Verify repair	—
5	1. Disconnect the connector at brake switch. 2. Check following terminal pin by ohmmeter. (Leave the shaft position at brake switch. Don't push it.) ▼ Between pin 1 and pin 2 ▼ Between pin 3 and pin 4 Was it specified value?	Between pin1 and pin2 is 0Ω, Between pin3 and pin4 is ∞Ω	Go to *Step 6*	Go to *Step 9*
6	1. Disconnect the connector at brake switch. 2. Check following terminal pin at ohmmeter. (Don't press the button of the brake switch.) ▼ •Between pin 1 and pin 2 ▼ •Between pin 3 and pin 4 Was it specified value?	Between pin1 and pin2 is ∞Ω, Between pin3 and pin4 is 0Ω	Go to *Step 7*	Go to *Step 9*
7	1. Probe related circuits for open or short to ground. 2. If a problem was found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Was the action completed?	—	Verify repair	—
9	1. Replace the brake switch. Was the action completed?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only record code DTC P1625.

Conditions for Setting the DTC

▼ Clock or COP (Computer Operating Properly) reset.

Action Taken When the DTC Sets

▼ The PCM will not illuminate the malfunction indicator lamp (MIL).

▼ The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

▼ The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

▼ A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.

▼ DTC P1625 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

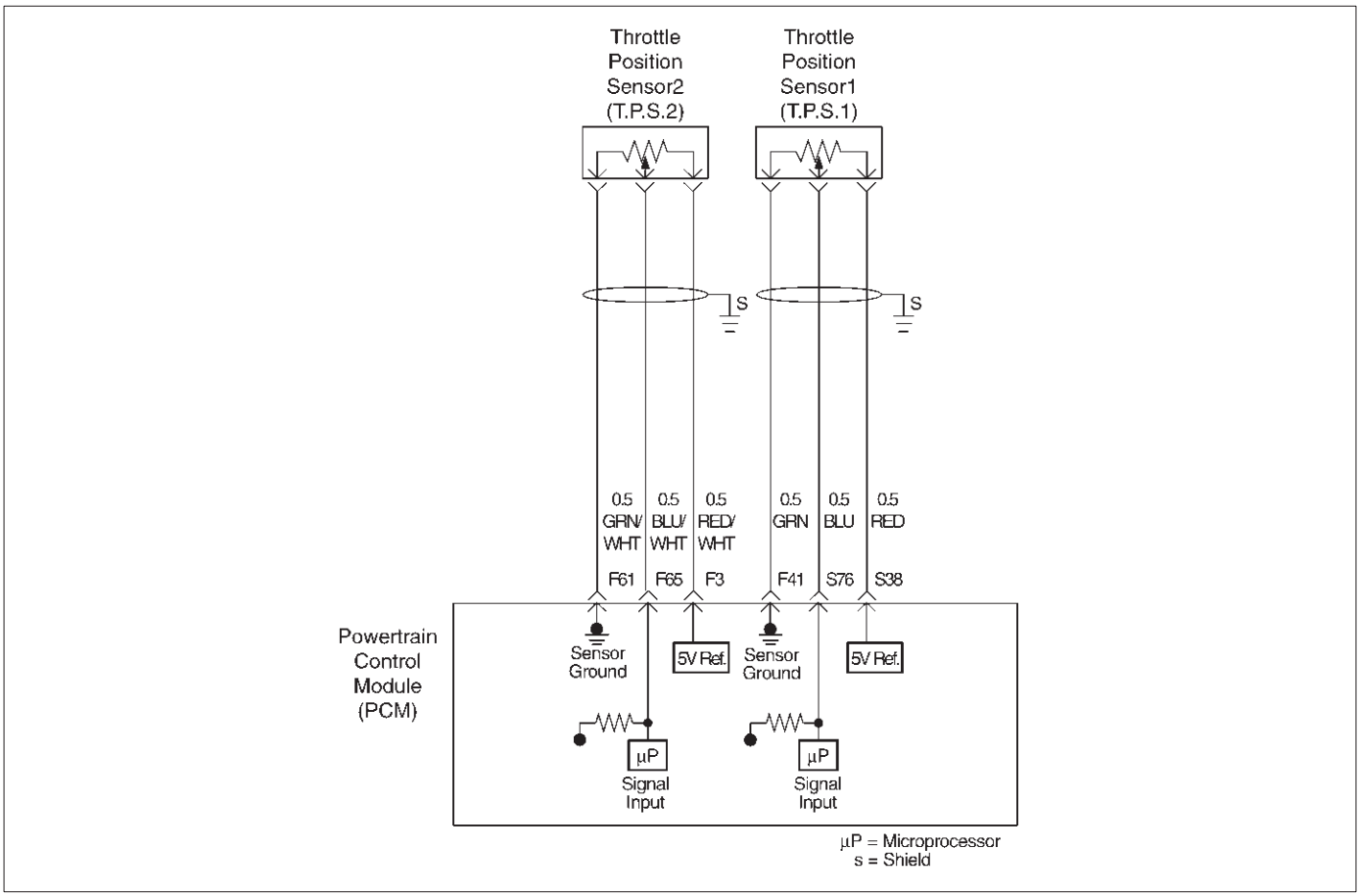
Check for the following conditions:

▼ P1625 stored alone does not need diagnosis. Clear DTC code.

DTC P1625 – PCM Unexpected Reset

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Ignition is “ON”. 2. Install the Tech 2. 3. Start the engine and let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	1. Ignition is “ON”. 2. Clear DTC P1625 by using the Tech 2 “Clear Info”. 3. Start the engine and let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Check for aftermarket electronics, such as transceiver, stereos, and anti theft devices. They may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.) 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1635 Reference Voltage # 1 Circuit Fault



D06RY00093

Circuit Description

The TP sensor # 1 shares a 5 Volt reference with the PCM.
If the PCM detects the 5 Volt reference for the TP sensor # 1 is failure, DTCP1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the TP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the TP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) .
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

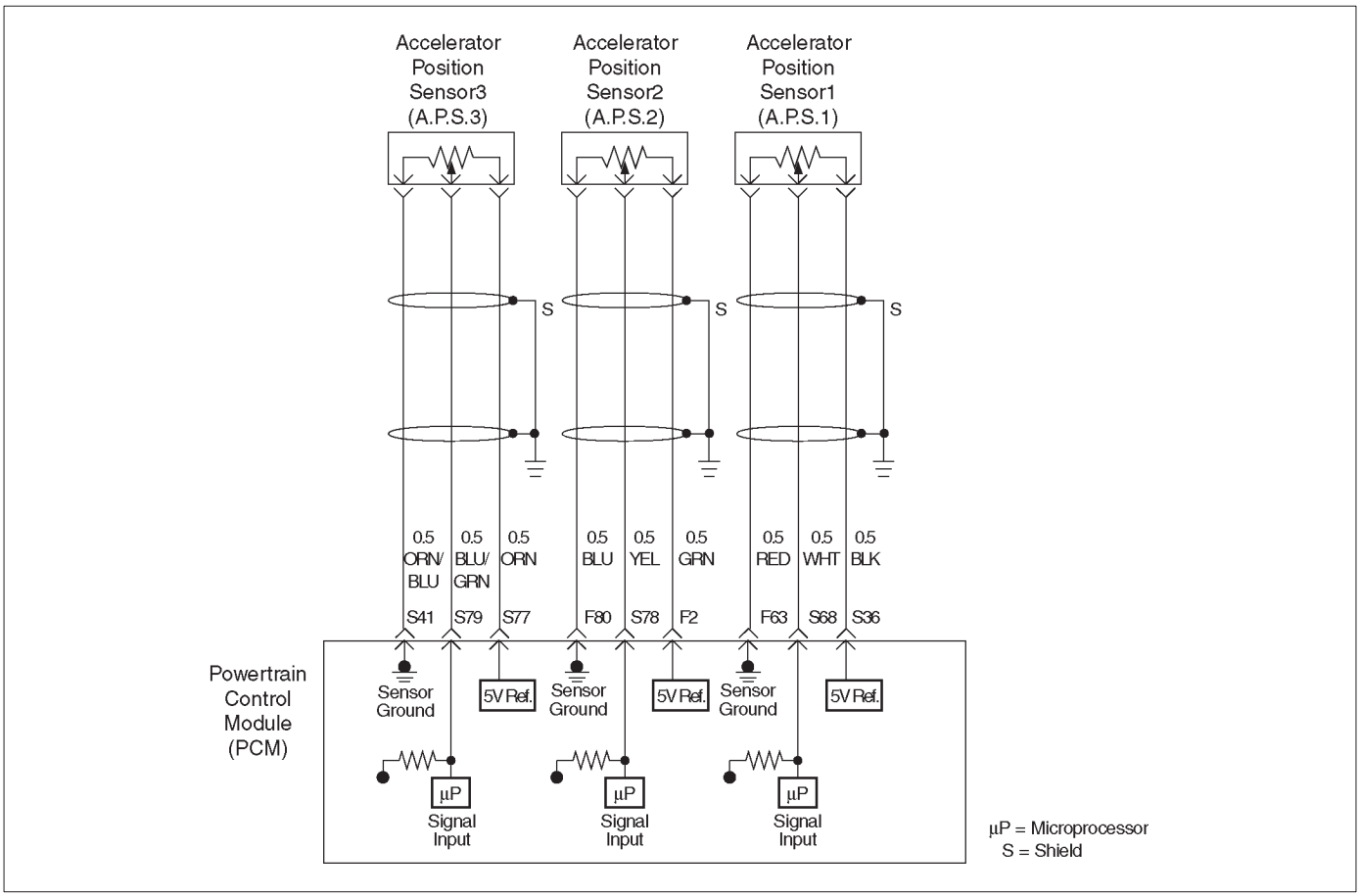
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1635will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1635 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech2 “ Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal S38 (RED) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal F20 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal F57 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If a problems found, repair it as necessary. Was the problem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1639 Reference Voltage # 2 Circuit Fault



060R200064

Circuit Description

The AP sensor # 1shares a 5 Volt reference with the PCM. If the PCM detects the 5 Volt reference for the AP sensor # 1 is failure, DTC P1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the AP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the AP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1639 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1639 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC)
P1639 Reference Voltage # 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal S36 (BLK) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition "ON", engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal F20(RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition "ON", engine not running. 2. Using a DVM at the PCM side of the connector, check the voltage at terminal F57 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If a problem is found, repair it as necessary. Was the problem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1640 Driver-1-Output Circuit Fault (ODM)

Circuit Description

Output driver modules (ODMs) are used by the powertrain control module (PCM) to turn “ON” many of the current-driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding “ON”.

Unlike the Quad Driver Modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

Since A/C is an option, No A/C will cause the air conditioning clutch relay output to always fail. If a fault is seen on the air conditioning clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

Conditions for Setting the DTC

- Ignition “ON”.
- Engine running.
- Ignition voltage is above 13.2 volts for 4 seconds.
- Output voltage does not equal ignition voltage when output is “OFF” or output voltage is not less than 1 volt when output is “ON”.
- Above conditions occur for at least 1 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1640 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P1640 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition “ON” and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses related to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: Instrument cluster harness, canister purge solenoid, A/C clutch relay. An open ignition feed circuit at any of these components will cause DTC P1640 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate “short circuit” even when the problem is an open circuit. The cause of an open circuit may be in the component itself-lamp, purge, solenoid, or A/C compressor relay.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1640 – Driver-1-Output Circuit Fault (ODM)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for “Check Engine” or “Check Trans” indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition “ON”. 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition “ON”. 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition “OFF”. 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1640 – Driver-1-Output Circuit Fault (ODM) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1650 Quad Driver Module "A" Fault

Circuit Description

The Quad Driver Module (QDMs) are used by the powertrain control module (PCM) to turn "ON" current–driven devices that are needed to control two engine functions. The PCM monitors open or short circuit of either of Canister Control Purge (CCP) Vent solenoid or Variable Intake Manifold (VIM).

Conditions for Setting the DTC

- Ignition "ON".
- Engine running.
- Ignition voltage.
- Output voltage does not equal voltage and is not less than 1 volt when out put is "ON".
- Above conditions occur for at least 0.5 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1650 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1650 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: canister purge solenoid, fuel level sensor. An open ignition feed circuit at any of these components will cause DTC P1650 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The following PCM pins are controlled by Quad driver modules (QDMs):

- S74 – VIM
- S48 – Canister control purge

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1650 – Quad Driver Module (QDM) Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for "Check Engine" or "Check Trans". indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition "ON". 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition "ON". 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF". 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1650 – Quad Driver Module (QDM) Fault (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Symptom Diagnosis

Preliminary Checks

Before using this section, perform the "On-Board Diagnostic (OBD) System Check" and verify all of the following items:

- The powertrain control module (PCM), and malfunction indicator lamp (MIL) (Check Engine lamp) and Reduced Power Lamp (RPL) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Ignition components for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

Intermittents

IMPORTANT: An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions. The scan tool has several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Tech 2's "Freeze Frame" buffer or "Failure Records" buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned "OFF". If not, the PCM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *PCM Connector Symptom* tables.

- Check the "Calibration ID" of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM's reprogrammable memory has been released. To check the "Calibration ID", connect the Tech 2, then look for "Powertrain", then select "Calibration ID". This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the "Calibration ID" is not the most current available, it is advisable to reprogram the PCM's EEPROM memory, which may either help identify a hard-to-find problem or may fix the problem.
- Calibration ID (example)

Part number	9377709
Broadcast Code	CYYD
Identifier	801

Hard Start Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stall. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/ Physical Check*
5	Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect the Tech 2. With the ignition "ON" and the engine not running, compare engine coolant temperature to intake air temperature. Are ECT and IAT within the specified value of each other?	± 5˚C (± 9˚F)	Go to *Step 10*	Go to *Step 6*
6	1. Using a Tech 2, display the engine coolant temperature and note the value. 2. Check the resistance of the engine coolant temperature sensor. 3. Refer to *Engine Coolant Temperature Sensor Temperature vs. Resistance* chart on *DTC P0118 Diagnostic Support* for resistance specifications. Is the resistance value near the resistance for the temperature noted?	—	Go to *Step 8*	Go to *Step 7*
7	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
8	Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground. Is the action complete?	—	Verify repair	—
9	1. Check for a faulty, plugged, or incorrectly installed PCV valve. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Hard Start Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Remove the ignition coils and check the ignition coils for cracks or carbon tracking. 2. If a problem is found, replace affected coil(s) as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check for the following engine mechanical problems (refer to *Engine Mechanical*): ▼ Low compression ▼ Leaking cylinder head gaskets ▼ Worn or incorrect camshaft ▼ Camshaft drive belt slipped or stripped 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Surges and/or Chuggles Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/ Physical Check*
5	Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner's manual. Inform the customer how the TCC and the A/C clutch operate. Is the customer experiencing a normal condition?	—	System OK	Go to *Step 6*
6	1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicone or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
14	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the injector connections. 2. If any of the injector connectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Check the exhaust system for possible restriction: ▼ Inspect the exhaust system for damaged or collapsed pipes. ▼ Inspect the muffler for heat distress or possible internal failure. ▼ Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 20*
20	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lack of Power, Sluggish, or Spongy Symptoms

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/ Physical Check*
5	1. Remove and check the air filter element for dirt or restrictions. Refer to *Air Intake System* in *ON-Vehicle Service*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 6*
6	1. Check for low fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Install the Tech 2. 2. Run the engine at idle. 3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold. 4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2. 5. Check to see if the actuator works normally. 6. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Lack of Power, Sluggish, or Spongy Symptoms (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the PCM grounds for cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: ▼ Inspect the exhaust system for damaged or collapsed pipes. ▼ Inspect the muffler for heat distress or possible internal failure. ▼ Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check the torque converter clutch (TCC) for proper operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Detonation/Sparks Knock Symptoms

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	If Tech 2 readings are normal (refer to *Typical Scan Values*) and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87 and re-evaluate the vehicle performance. Is detonation present?	—	Go to *Step 5*	Verify repair
5	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for obvious overheating problems: ▼ Low engine coolant. ▼ Restricted air flow to radiator, or restricted water flow through radiator. ▼ Correct coolant solution should be a 50/50 mix of approved antifreeze/coolant and water. Refer to *Engine Cooling*. ▼ EGR operation. Refer to *DTC P0401*. ▼ ION sensing module fault. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF". 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 9*	—
9	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector. Was a problem found?	—	Verify repair	Go to *Step 10*

Detonation/Sparks Knock Symptoms (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 11*	—
11	Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 16*
15	Replace the ION sensing module. Is the action complete?	—	Verify repair	Go to *Step 16*
16	1. Check fuel pressure. Refer to Chart Fuel System Pressure Test. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check items that can cause an engine to run lean (long term fuel trim significantly in the positive range). For a lean condition, refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Spark plugs for proper heat range. Refer to *General Information*. 2. If incorrect spark plugs are installed, replace spark plugs as necessary. Did any spark plugs require replacement?	—	Verify repair	Go to *Step 19*
19	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re-evaluate vehicle performance. Is detonation still present?	—	Go to *Step 20*	Verify repair

Detonation/Sparks Knock Symptoms (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check for an engine mechanical problem. Perform a cylinder compression check. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Rough, Unstable, or Incorrect Idle, Stalling Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/ Physical Check*
5	1. Check the PCM grounds for cleanliness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: ▼ The engine is fully warm. ▼ The accessories are "OFF". 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: ▼ Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or a disconnected brake booster hose. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing Module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	Using a Tech 2, monitor the throttle position 1 and 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC* for further diagnosis
20	1. Check the positive crankcase ventilation (PCV) valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check for the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: ▼ Low compression ▼ Sticking or leaking valves ▼ Worn camshaft lobe(s) ▼ Camshaft drive belt slipped or stripped ▼ Incorrect valve timing ▼ Worn rocker arms ▼ Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Poor Fuel Economy Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Non-standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.) Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	Check owner's driving habits. ▼ Is the A/C "ON" full time (defroster mode "ON")? ▼ Are tires at the correct pressure? ▼ Are excessively heavy loads being carried? ▼ Is acceleration too much, too often? Was a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Review the items in Step 4 with the customer and advise as necessary. Is the action complete?	—	System OK	—
6	1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Remove and check the air filter element for dirt or for restrictions. Refer to *Air Intake System*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 8*
8	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Spark Plug Replacement*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for low engine coolant level. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Poor Fuel Economy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for an incorrect or faulty engine thermostat. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for low engine compression. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: ▼ Inspect the exhaust system for damaged or collapsed pipes. ▼ Inspect the muffler for heat distress or possible internal failure. ▼ Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?	—	Go to *Step 16*	Go to *Step 15*
15	Diagnose and repair an inaccurate speedometer condition as necessary. Refer to *Vehicle Speed Sensor* in *Electrical Diagnosis*. Was a problem found?	—	Verify repair	—
16	1. Check the air intake system and the crankcase for air leaks. Refer to *Air Intake System* and *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. When all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records buffer ▼ All connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Perform the procedure in *Fuel System Pressure Test*. Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

Excessive Exhaust Emissions or Odors Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions.) Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 13*	Go to *Step 3*
3	Was a thorough visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc. 2. If a problem is found, repair as necessary. Were any vacuum leaks located?	—	Go to *Step 13*	Go to *Step 5*
5	1. Check the fuel cap for proper installation. 2. Secure the fuel cap if necessary. Was the fuel cap installed properly?	—	Go to *Step 6*	Go to *Step 13*
6	1. Check the fuel pressure. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 7*
7	1. Check for a faulty, plugged, or incorrectly installed crankcase ventilation valve; also check the crankcase ventilation system for plugging. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 8*
8	1. Check the injector connections. 2. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 9*
9	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*
10	1. Refer to *Engine Cooling* for cooling system diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 11*
11	1. Check EVAP canister for fuel loading. Refer to *Evaporative Emission Control System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 12*

Excessive Exhaust Emissions or Odors Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Remove excessive carbon buildup with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
13	Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
14	Does the exhaust emission test indicate excessive CO and HC levels or is long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 15*	Go to *Step 16*
15	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
16	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
17	1. Check the EGR system (refer to *DTC P0401*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 18*
18	1. Check for an engine mechanical problem. Perform a cylinder compression check (refer to *Engine Mechanical*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 19*
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records butter ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Dieseling, Run-On Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine continues to run after key is turned "OFF," but runs very rough. If engine runs smooth, check ignition switch and adjustment. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	1. Check for a short between B+ and any of the ignition feed circuits. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records butter ▼ All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Backfire Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	1. Check for proper ignition voltage coil output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. Refer to *DTC P0172* to determine the cause of a rich condition or *Engine Mechanical* for an oil fouling condition. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Visually/physically inspect the ignition coils for cracks. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for an intermittent ignition system malfunction: ▼ Intermittent CKP 58X signal. ▼ Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

Backfire Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Check for the following engine mechanical conditions. Refer to *Engine Mechanical* for diagnosis procedures: ▼ Low compression ▼ Sticking or leaking valves ▼ Worn camshaft lobe(s) ▼ Camshaft drive belt slipped or stripped ▼ Incorrect valve timing 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the intake and exhaust manifold(s) for casting flash. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records butter ▼ All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Cuts Out, Misses Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/ Physical Check*
4	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 5*	Go to *ETC System Check*
5	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: ▼ The engine is fully warm. ▼ The accessories are "off". 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: ▼ Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ▼ Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*
19	Using a Tech 2, monitor the TP 1, 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC P0123* for further diagnosis

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check the PCV valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: ▼ Low compression ▼ Sticking or leaking valves ▼ Worn camshaft lobe(s) ▼ Camshaft drive belt slipped or stripped ▼ Incorrect valve timing ▼ Worn rocker arms ▼ Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records butter ▼ All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Hesitation, Sag, Stumble Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/ Physical Check*
5	1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the fuel pressure. Refer to *Fuel System Pressure Test.* 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Observe the TP 1, 2 angle display on the Tech 2 while slowly increasing accelerator pedal depression. Does the TP angle display steadily increase from 8 ~ 10% at closed throttle to 90 ~ 92% at WOT?	—	Go to *Step 8*	Go to *Step 9*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in Electrical Diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 17*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ▼ Visual/physical inspection ▼ Tech 2 data ▼ Freeze Frame data/Failure Records butter ▼ All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Bank 1 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 1 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: ▼ Collapsed pipe ▼ Heat distress ▼ Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Bank 2 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 2 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 2 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: ▼ Collapsed pipe ▼ Heat distress ▼ Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 2 HO2S 2. 2. Install the Exhaust Back pressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Default Matrix Table

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is “ON” in diagnostics. Engine does not start and run.	Ignition System Check
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	1. On-board Diagnostic (OBD) system check. 2. Careful visual/physical inspections.	Chassis Electrical
Hard Starts	1. OBD system check. 2. ETC system check. 3. Sensors (ECT, MAP, MAF, TP) ; MAP output chart. 4. Fuel system electrical test, fuel system diagnosis. 5. Ignition system.	Engine Mechanical, Ignition System Check, Exhaust System Diagnosis

Symptoms	Initial Diagnosis	Default Section(s)
Surges and/or Chuggles	1. OBD system check. 2. ETC system check. 3. Heated oxygen sensors. 4. Fuel system diagnosis. 5. Ignition system.	Calibration ID/Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis, 4L30-E System Test
Lack of Power, Sluggish or Spongy	1. OBD system check. 2. ETC system check. 3. Fuel system diagnosis. 4. Ignition system. 5. EGR operation. 6. EGR system check.	Refer to *Exhaust System* in *Engine Exhaust*, TCC Operation, Calibration ID/Service Bulletins
Detonation/Spark Knock	1. OBD system check. 2. Transmission range switch. 3. EGR operation. 4. EGR system check. 5. TCC operation. 6. Fuel system diagnosis. 7. Ignition system. 8. ION sensing module check.	TCC operation, Cooling System, Ignition System Check, Calibration ID/Service Bulletins
Rough, Unstable, or Incorrect Idle, Stalling	1. OBD system check. 2. ETC system check. 3. Fuel injector and fuel injector balance test. 4. EVAP emission canister purge valve check. 5. Ignition system. 6. EGR operation.	MAP Output Check, Throttle Linkage, EGR System Check, A/C Clutch Control Circuit Diagnosis, Crankcase Ventilation System, Calibration ID/Service Bulletins, Generator Output Voltage (refer to *Chassis Electrical*), Exhaust Diagnosis
Poor Fuel Economy	1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system.	TCC Operation, Exhaust System (refer to *Engine Exhaust*)
Hesitation, Sag, Stumble	1. OBD system check. 2. ETC system check. 3. TP. 4. MAP output check. 5. Fuel system diagnosis. 6. Fuel injector and fuel injector balance test. 7. EVAP emission canister purge valve. 8. Ignition system.	EGR Operation, EGR System Check, Generator Output Voltage (refer to *Chassis Electrical*), Calibration ID/Service Bulletins, Ignition System Check
Cuts Out, Misses	1. OBD system check. 2. Cylinder balance test. 3. ETC system check.	Ignition System Check
Engine Cranks But Will Not Run	1. OBD system check.	Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector and Fuel Injector Balance Test.

Symptoms	Initial Diagnosis	Default Section(s)
Excessive Exhaust Emissions or Odors	1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Crankcase ventilation system. 8. Ignition system. 9. MAP output check.	EGR System Check, Exhaust Diagnosis, Calibration ID/Service Bulletins
Dieseling, Run-On	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Backfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test. 5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check
Misfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test.	Vibrations, Transmission, Driveshaft and Axle
Catalyst Monitor	1. OBD system check. 2. Careful visual/physical inspection. 3. Heated oxygen sensors.	Exhaust System
Fuel Trim	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 4. Heated oxygen sensors, MAF sensors.	Exhaust System Intake Air System
Evaporative Emissions	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Heated Oxygen Sensors	1. OBD system check. 2. Careful visual/physical inspection.	Exhaust System

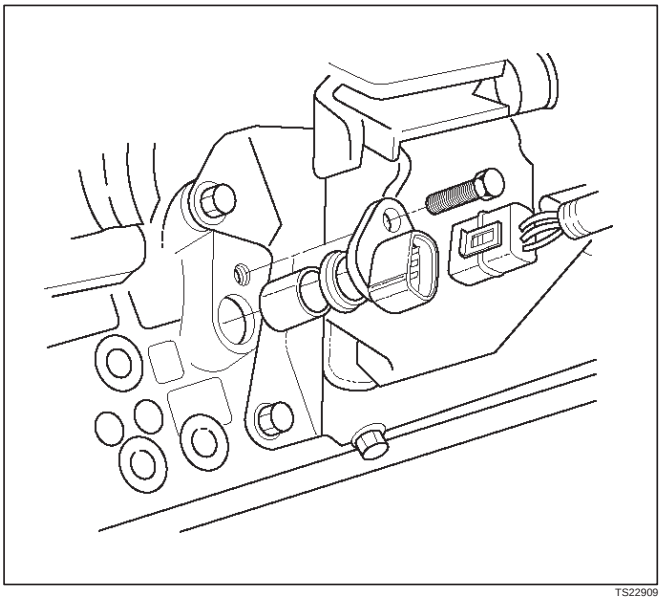
On Vehicle

Service Crankshaft Position (CKP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CKP sensor.
3. Remove one bolt and the CKP sensor from the right side of the engine block, just behind the mount.

NOTE: Use caution to avoid any hot oil that might drip out.



TS22909

Inspection Procedure

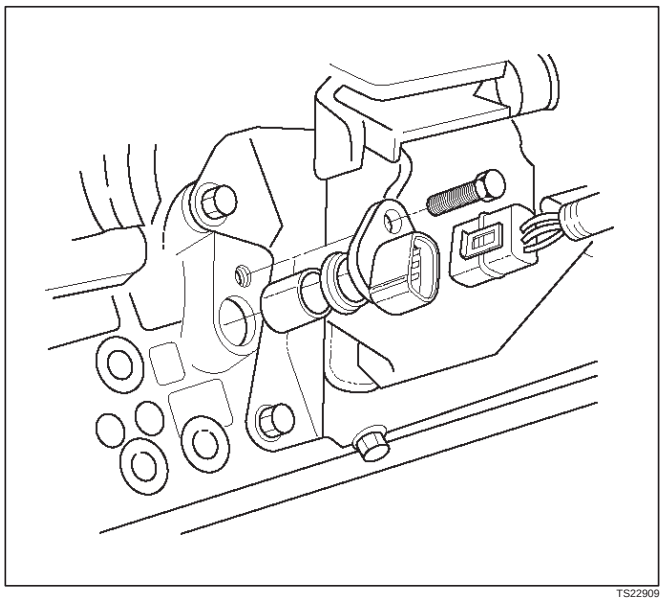
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

Tighten

▼Tighten the mounting bolt to 9 N·m (78 lb in.).



TS22909

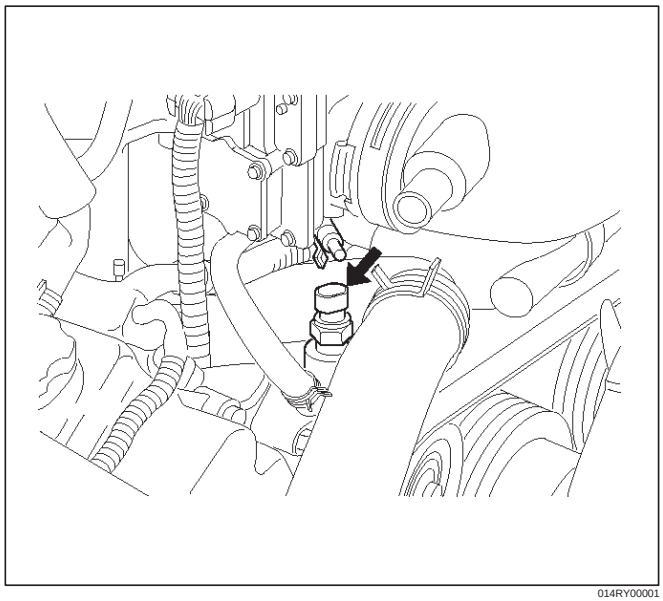
3. Connect the electrical connector to the CKP sensor.
4. Connect the negative battery cable.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

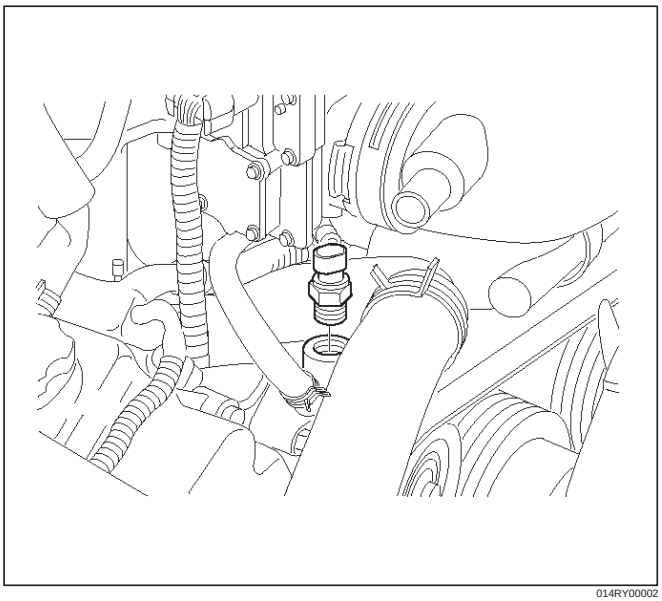
NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
3. Disconnect the electrical connector.



014RY00001

4. Remove the ECT sensor from the coolant crossover.



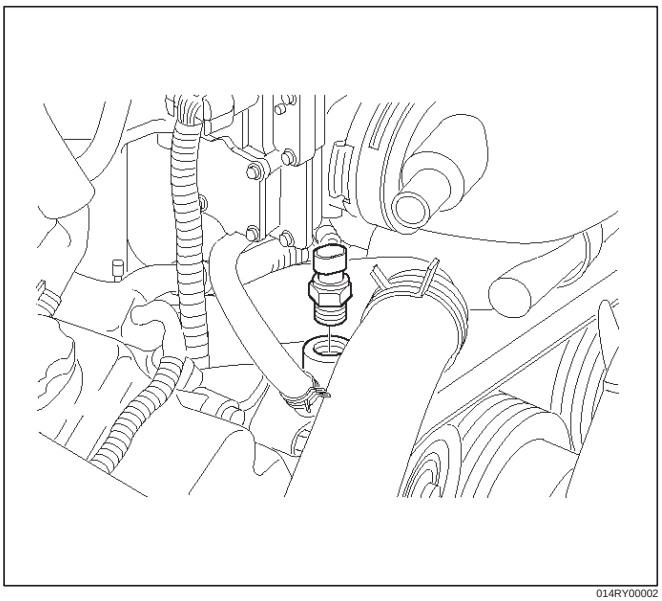
014RY00002

Installation Procedure

1. Apply sealer or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the coolant crossover.

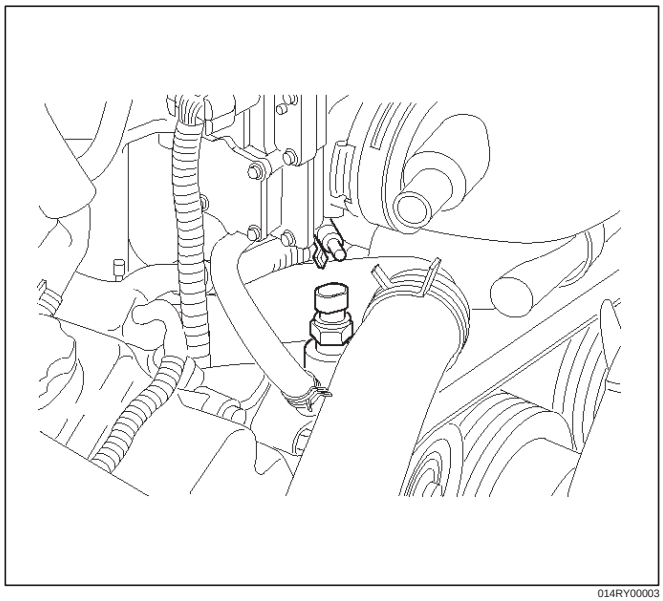
Tighten

▼Tighten the ECT sensor to 30 N·m (22 lb ft.).



014RY00002

3. Connect the electrical connector.



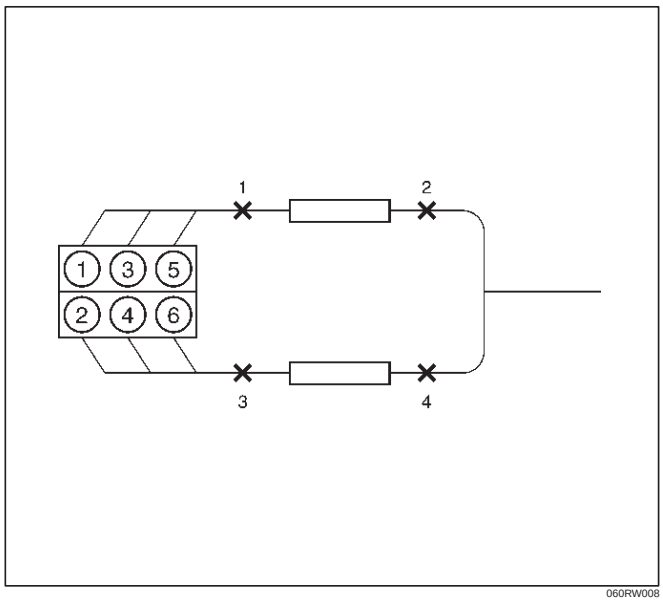
014RY00003

4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
5. Connect the negative battery cable.

Heated Oxygen Sensor (HO2S)

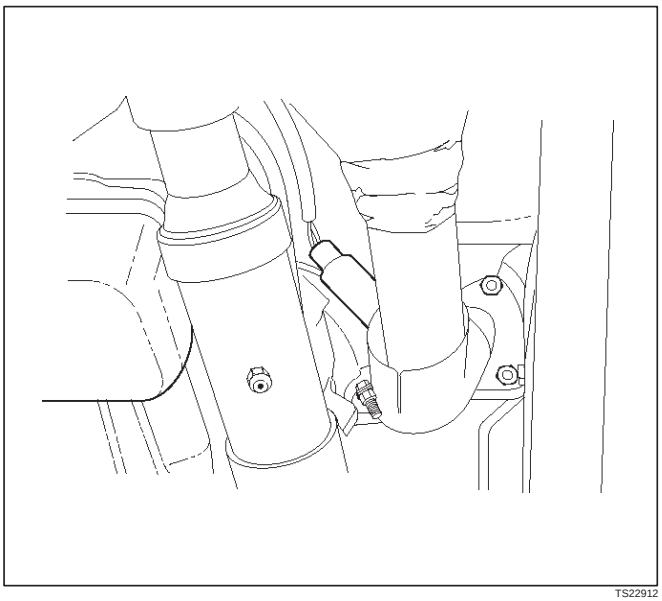
Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the four oxygen sensors.

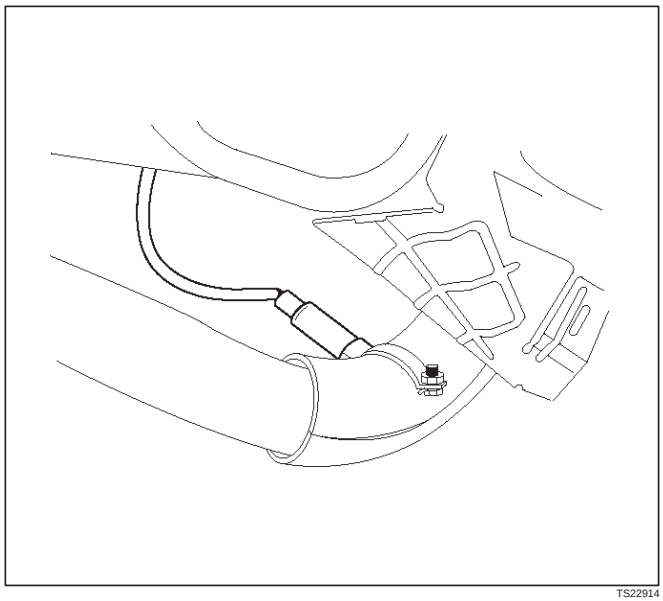


060RW008

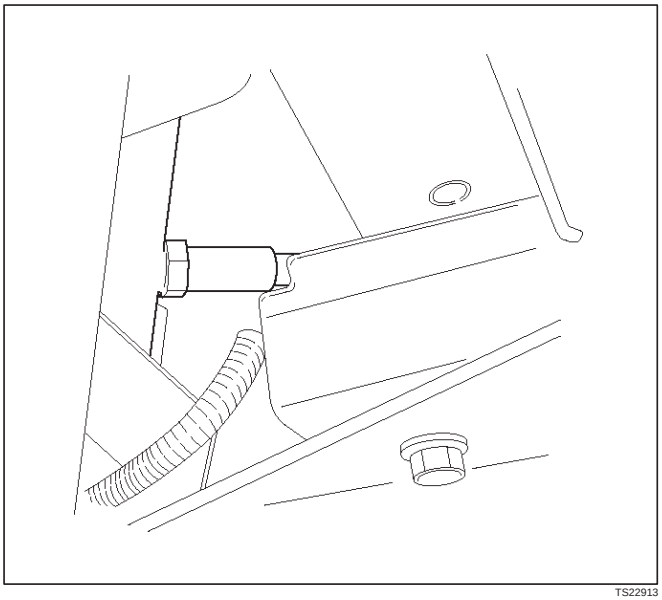
▼Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the right-hand catalytic converter.


TS22912

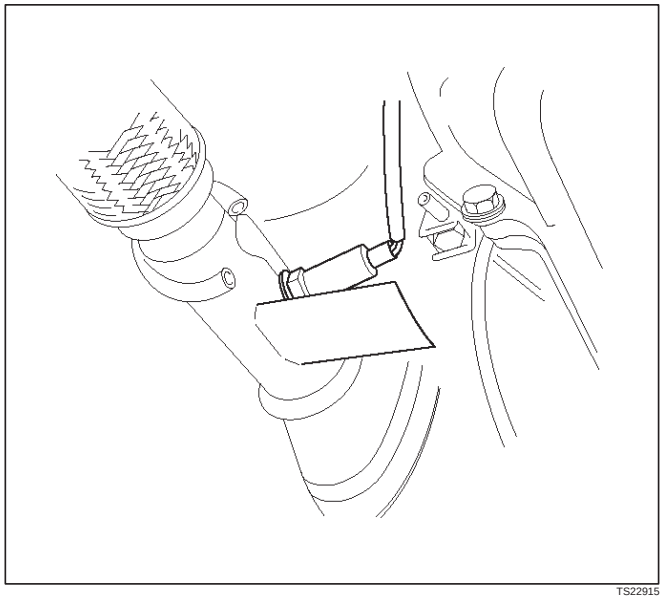
▼Bank 2 sensor 1 is mounted on the exhaust pipe ahead of the left-hand catalytic converter.


TS22914

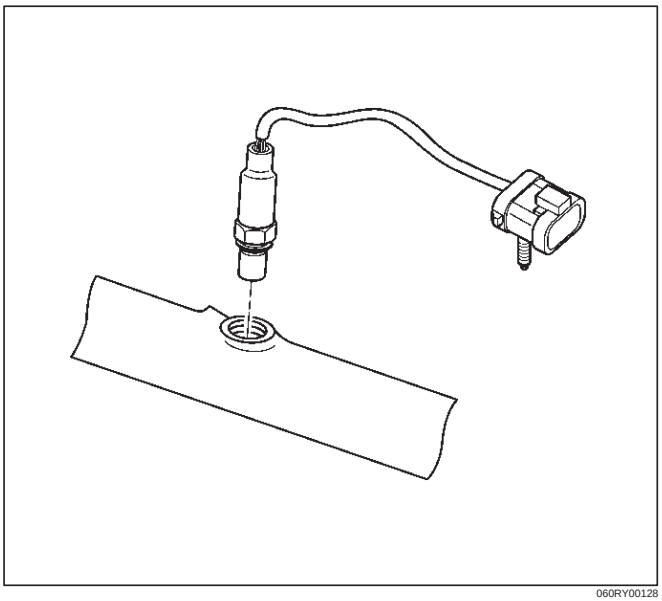
▼Bank 1 sensor 2 is mounted behind the right-hand catalytic converter.


TS22913

▼Bank 2 sensor 2 is mounted behind the left-hand catalytic converter.


TS22915

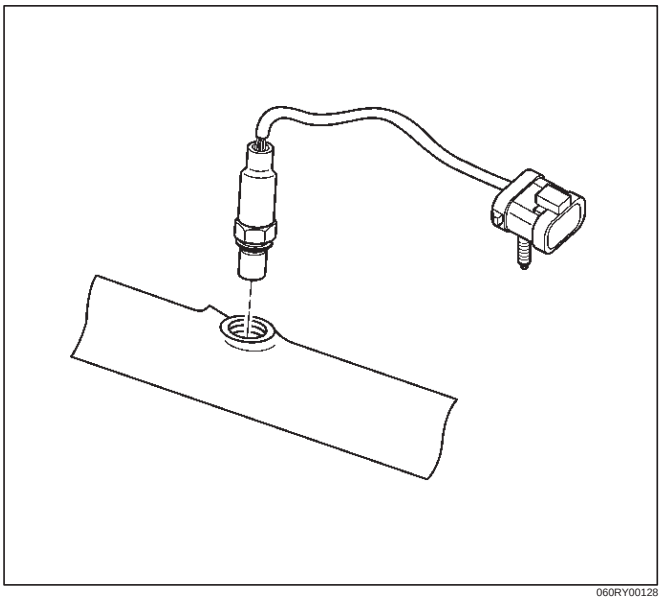
3. Disconnect the pigtail from the wiring harness.


060RY00128

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

NOTE: Do not use a torch to remove an HO2S unless the sensor is being replaced. Using a torch could damage the sensor.

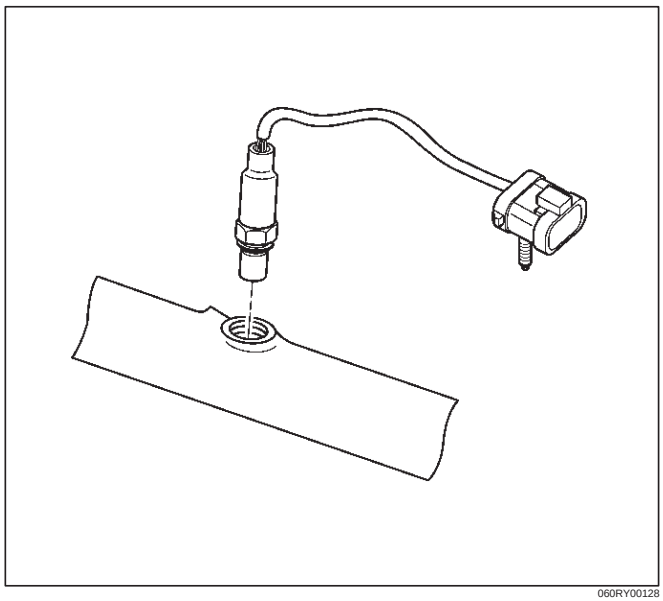
4. Remove the sensor from the exhaust pipe.
   - ▼Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48˚C (120˚F).


060RY00128

Inspection Procedure

All four sensors are identical. Inspect each in the same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion, and bare wires or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, or other contaminations.


060RY00128

Installation Procedure

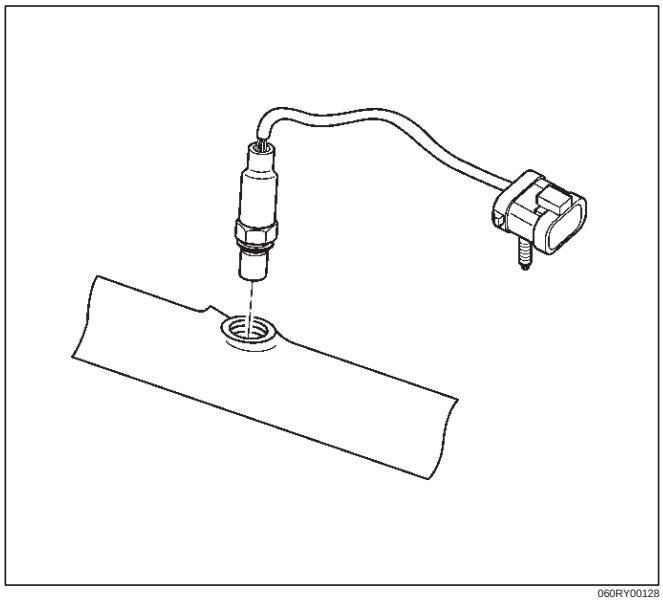
IMPORTANT:

- ▼There is a special anti-seize compound on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with engine heat, but the glass beads will remain, making the sensor easier to remove.
- ▼New or service sensors will already have the compound applied to the threads. If a sensor is removed and is to be reinstalled for any reason, the threads must have anti-seize compound applied.

1. Apply anti-seize compound or the equivalent to the threads of the oxygen sensor, if necessary.
2. Install the oxygen sensor on the exhaust pipe in its original position.

Tighten

▼Tighten the oxygen sensor to 55 N·m (40 lb ft.).

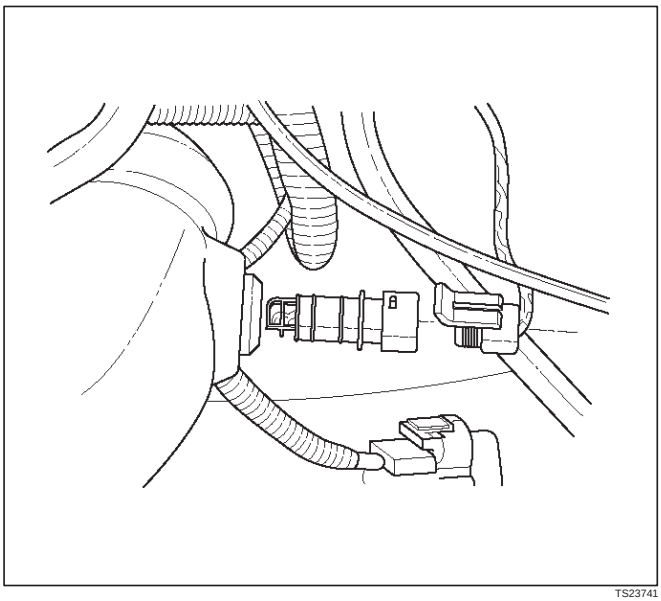

060RY00128

3. Connect the pigtail to the wiring harness.
4. Connect the negative battery cable.

Intake Air Temperature (IAT) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover
3. The IAT sensor is located in the intake air duct, behind the throttle body.
4. Disconnect the electrical connector from the IAT sensor.

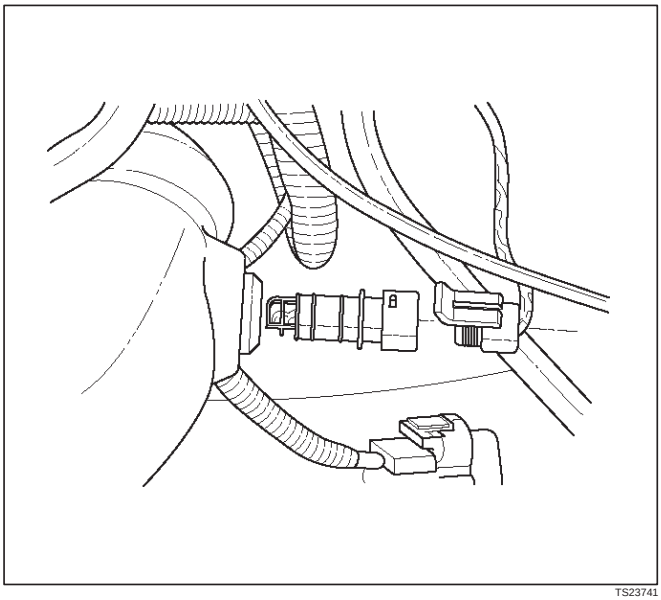


TS23741

5. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.

Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.
2. Correct the IAT electrical connector.



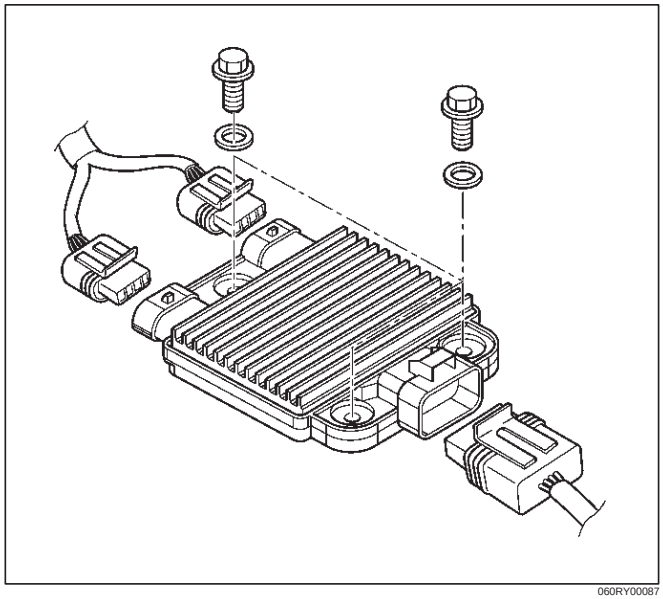
TS23741

3. Install the engine cover.
4. Connect the negative battery cable.

ION Sensing Module

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ION sensing module connector.
3. Remove the bolts and the ION sensing module from the common chamber.



060RY00087

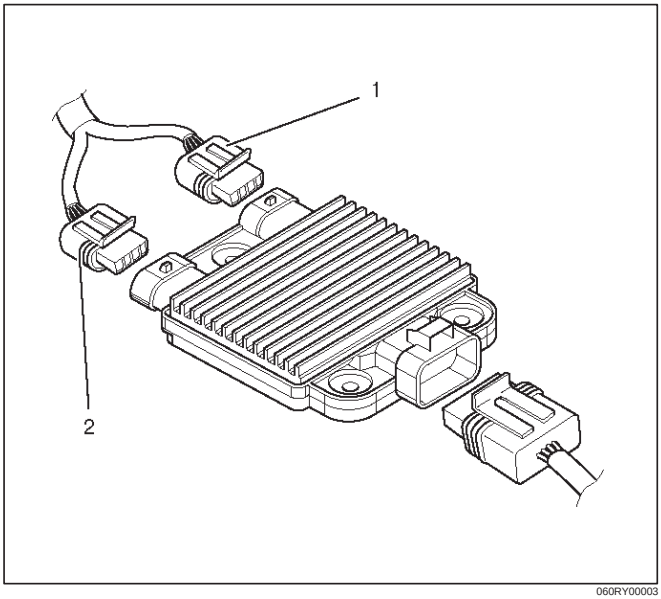
Installation Procedure

1. Install the ION sensing module on the common chamber with the bolts.

Tighten

▼Tighten the ION sensing module to 4 N·m (35 lb in.).

2. Connect the ION sensing module connectors as shown in the illustration.



060RY00003

Legend

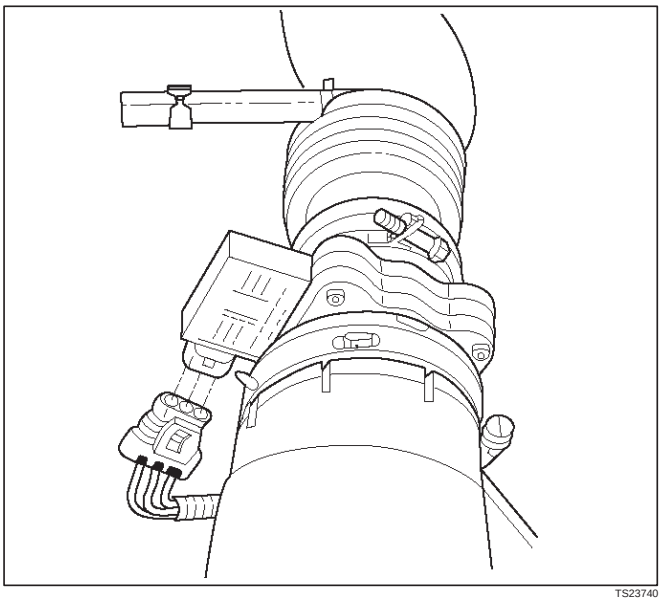
(1) Green Color Connector
(2) Blue Color Connector

3. Connect the negative battery cable.

Mass Air Flow (MAF) Sensor

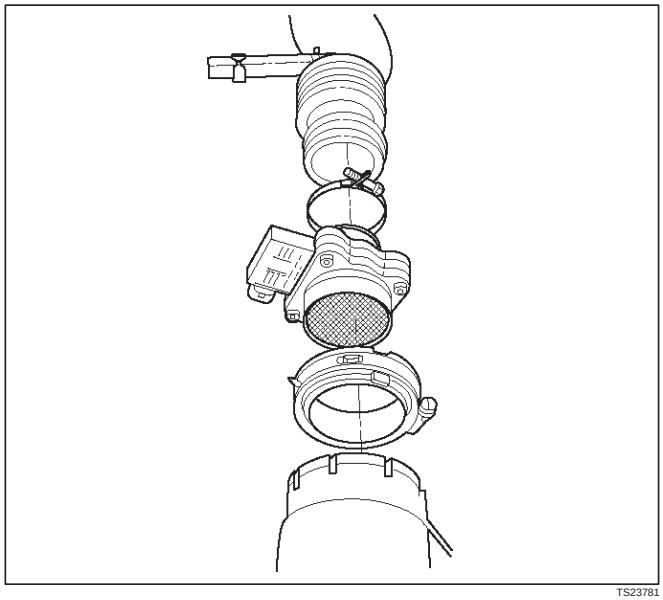
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAF sensor.



TS23740

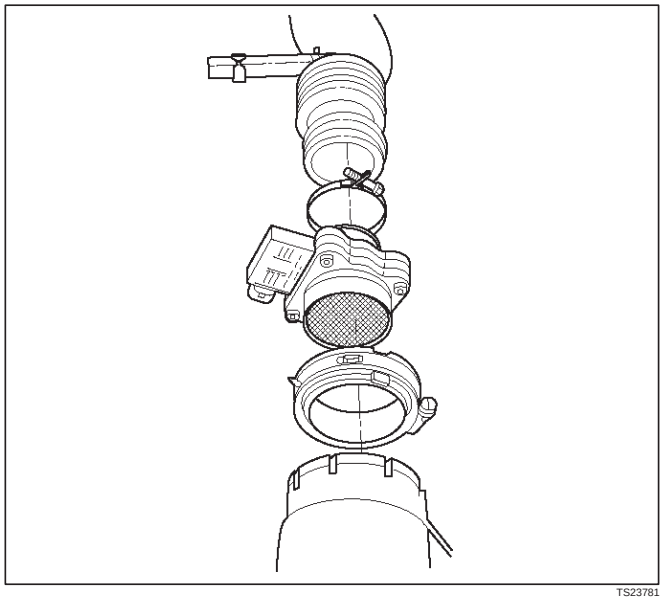
3. Loosen the clamps which secure the intake air duct and the air cleaner to the MAF sensor.
4. Remove the intake air duct from the MAF sensor.
5. Remove the MAF sensor from the air cleaner.



TS23781

Installation Procedure

1. Install the MAF sensor on the air cleaner with the clamp.
2. Install the intake air duct and the clamp on the MAF sensor.



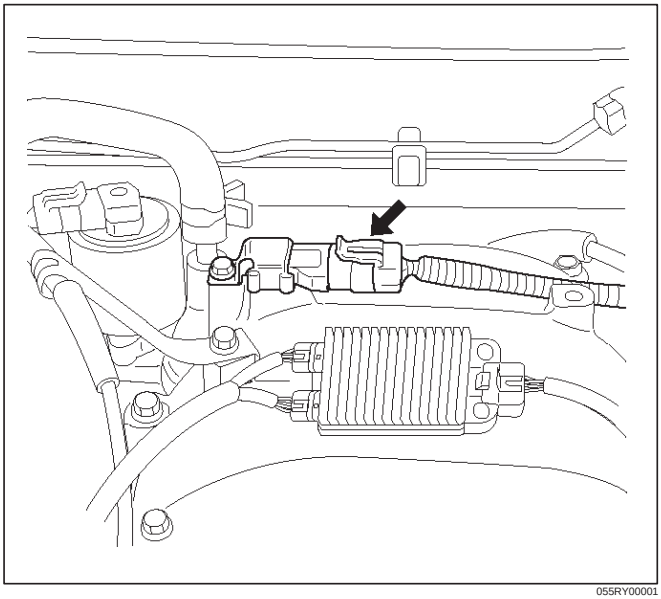
TS23781

3. Tighten the clamps to secure the MAF sensor to the intake air duct and the air cleaner.
4. Connect the MAF electrical connector.
5. Connect the negative battery cable.

Manifold Absolute Pressure (MAP) Sensor

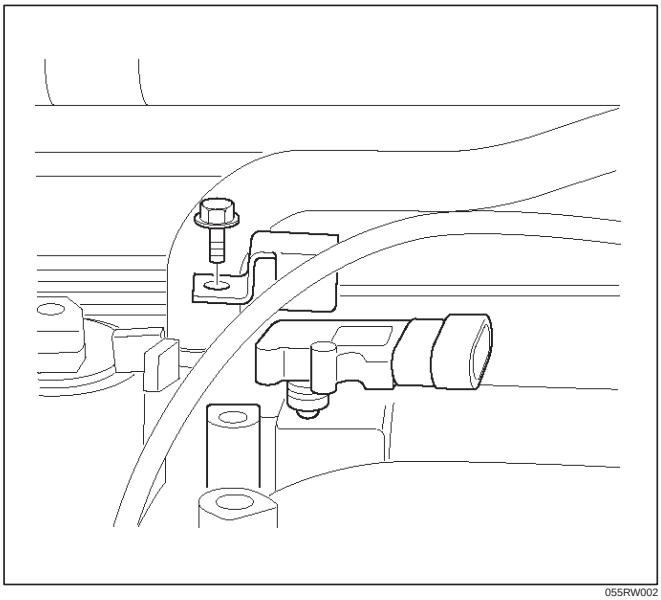
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP sensor.



055RY00001

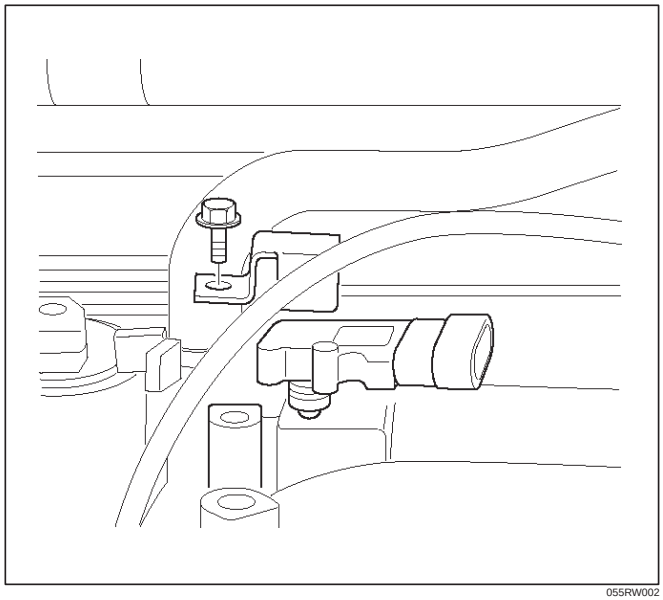
3. Remove the bolt securing the MAP sensor to the mounting bracket on the common chamber.
4. Remove the MAP sensor from the mounting bracket.



055RW002

Installation Procedure

1. Install the MAP sensor in the mounting bracket.



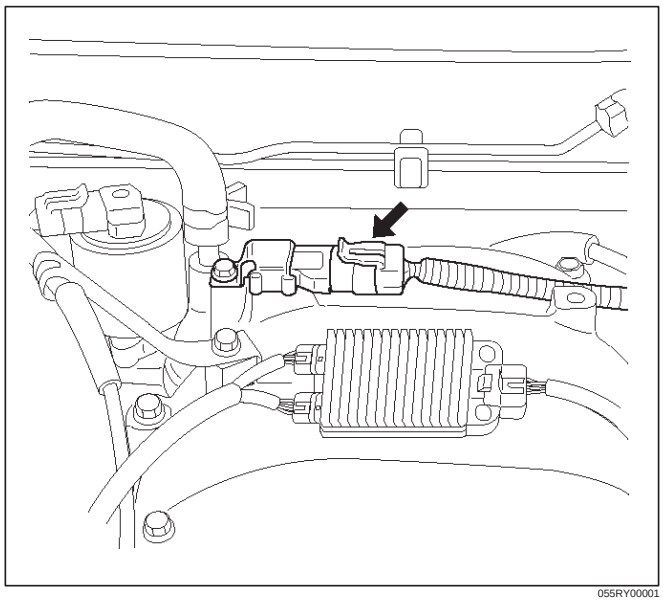
055RW002

2. Install the mounting bracket retaining bolt on the common chamber.

Tighten

▼Tighten the bolt to 20 N·m (12 lb ft.).

3. Connect the MAP electrical connector.



055RY00001

4. Connect the negative battery cable.

Malfunction Indicator Lamp (MIL)

Removal and Installation Procedure

Refer to Warning light bulb, indicator light valve, illumination light bulb, A/T indicator light bulb in Meter and Gauge.

Reduced Power Lamp

The reduced power lamp (RPL) turns on when the ignition key is moved to the ON position. It should turn off in approximately 3 seconds or immediately after the engine starts.
If the RPL turns on during vehicle operation, a vehicle system failure resulting in reduced engine output is indicated.
If both the reduced RPL and the check engine light turn on, a serious problem affecting vehicle performance is indicated.
Refer to the *OBD system check NO and RPL "ON" steady* in this manual.

Powertrain Control Module (PCM)

Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.
Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal PCM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the PCM (for example: battery cable, PCM pigtail, PCM fuse, jumper cables, etc.).

IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on the metal PCM cover.

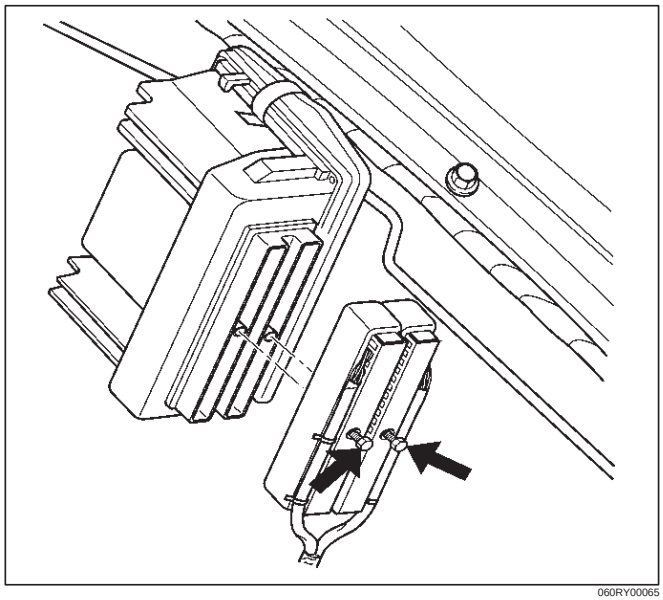
IMPORTANT: The ignition should always be in the "OFF" position in order to install or remove the PCM connectors.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to ensure it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

The service PCM EEPROM will not be programmed. DTC P0601 indicates the check sum error.

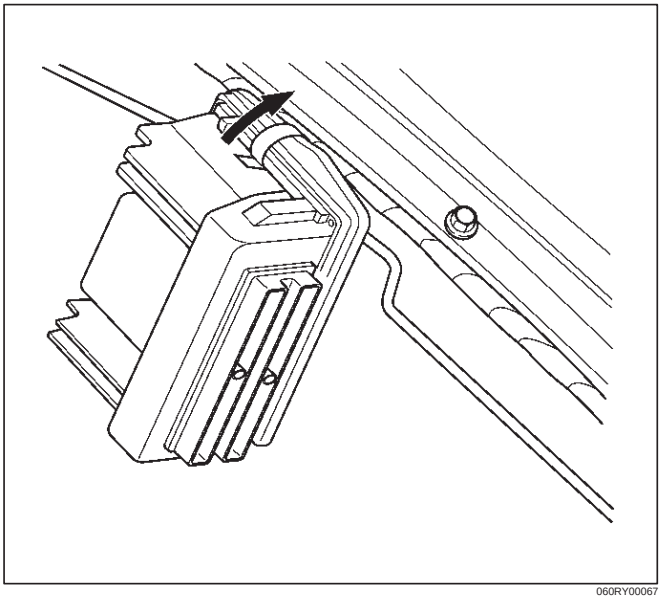
Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove the two screws from the PCM electrical connectors.
4. Disconnect the PCM electrical connectors.



060RY00065

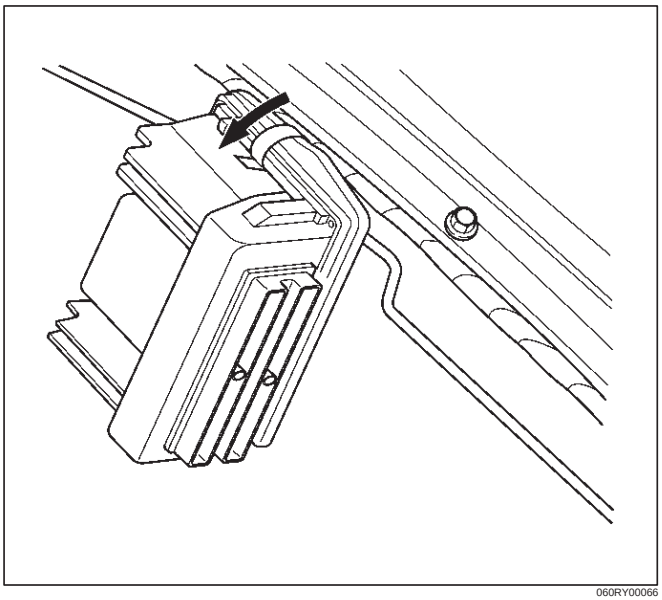
5. After removing the clip which fixes the PCM to the bracket, remove PCM.



060RY00067

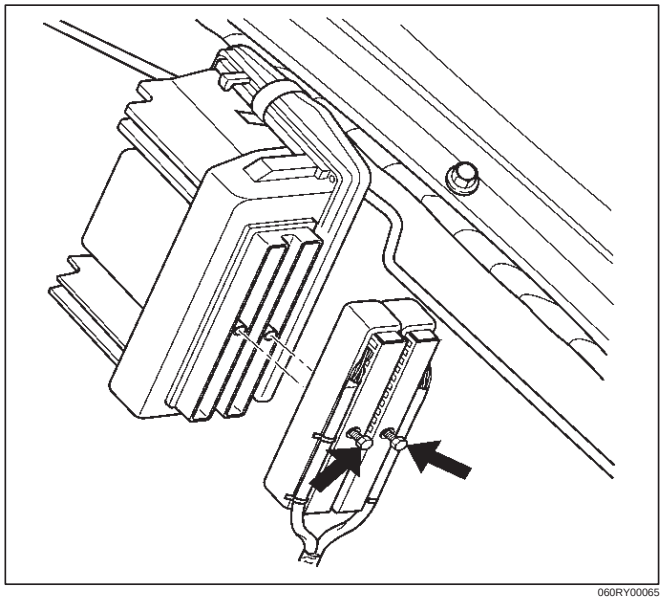
Installation Procedure

1. Install the PCM to bracket and fix with the clip.



060RY00066

2. Connect the PCM electrical connectors.
3. Install the two screws to PCM electrical connectors.



060RY00065

EEPROM

General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control powertrain operation.

EEPROM Programming

1. Set-up – Ensure that the following conditions have been met:
   - ▼The battery is fully charged.
   - ▼The ignition is “ON.”
   - ▼The Vehicle Interface Module cable connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user’s instructions.
3. If the PCM fails to program, proceed as follows:
   - ▼Ensure that all PCM connections are OK.
   - ▼Check the Techline equipment for the latest software version.
   - ▼Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. The replacement PCM must be programmed.

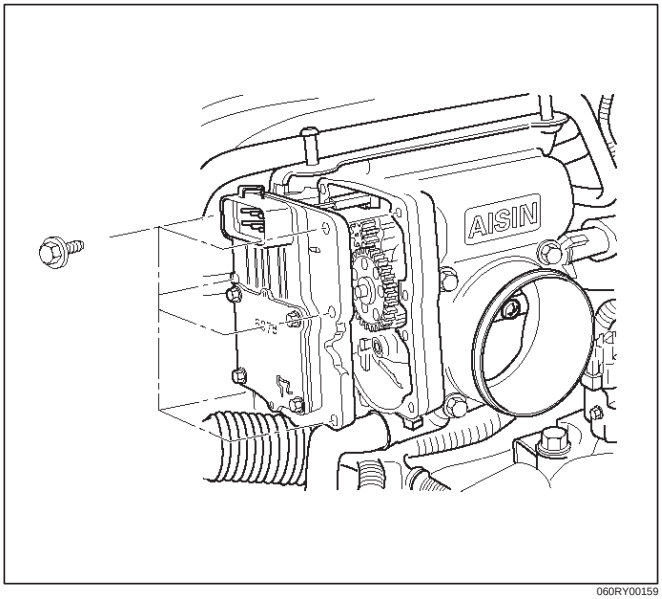
Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the bolts and the TP sensor from the throttle body.



060RY00159

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

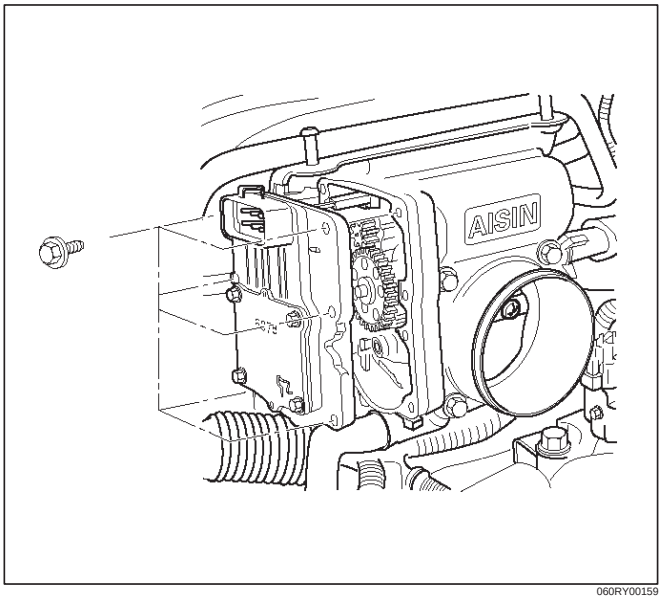
Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

- ▼The voltage should be TP1 about 0.4V, TP2 about 4.6V and TP3 about 4.6V.
- ▼If the reading is abnormal value, check the throttle shaft to see if it is binding.

Installation Procedure

1. Install the TP sensor on the throttle body with the bolts.



060RY00159

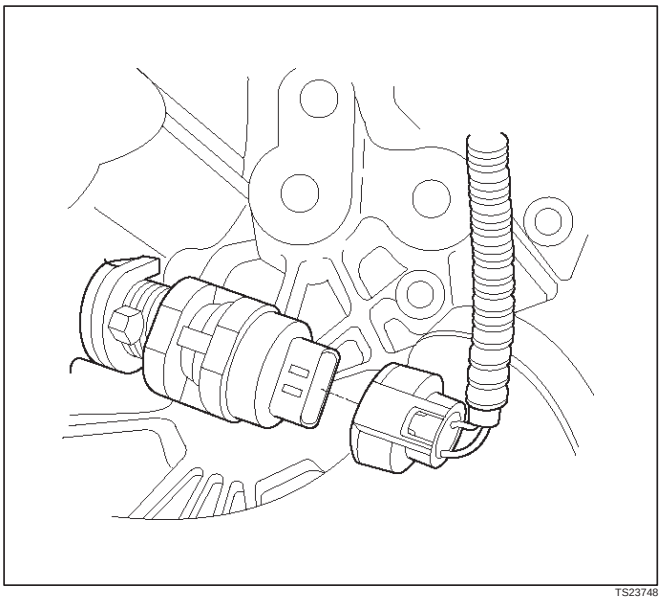
2. Connect the TP electrical connector.
3. Install the negative battery cable.

Vehicle Speed Sensor (VSS)

Removal Procedure

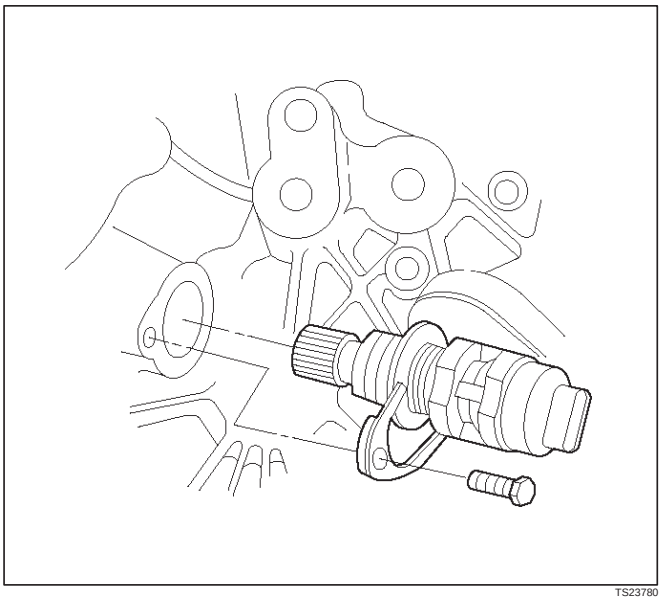
CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes for 4WD and on the extension cover for 2WD. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.

1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.


TS23748

3. Remove the bolt and the clamp securing the VSS in place.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case for 4WD and on the extension cover for 2WD.


TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

Inspection Procedure

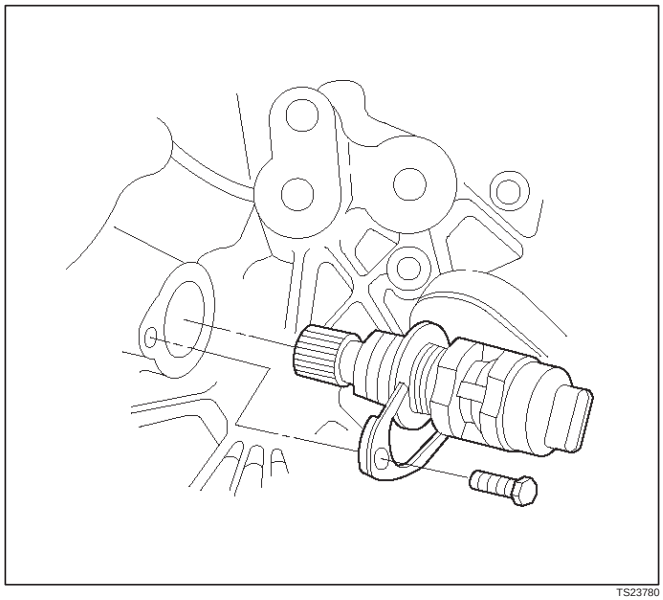
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

Installation Procedure

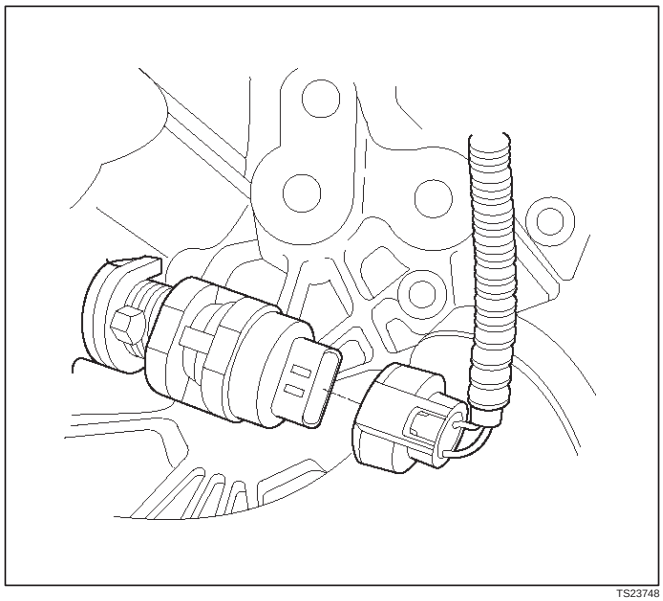
1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

Tighten

▼Tighten the bolt to 16 N·m (12 lb ft.).


TS23780

3. Connect the VSS electrical connector.

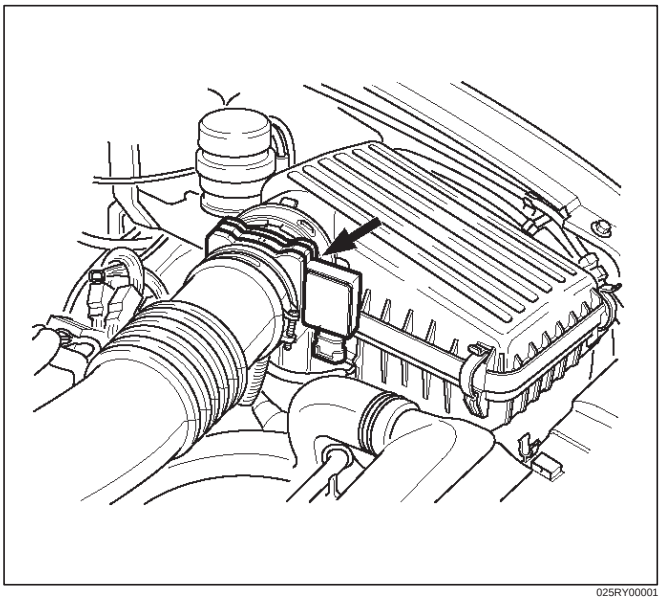

TS23748

4. Check the transfer case oil level. Add fluid if necessary.
5. Connect the negative battery cable.

Air Cleaner/Air Filter

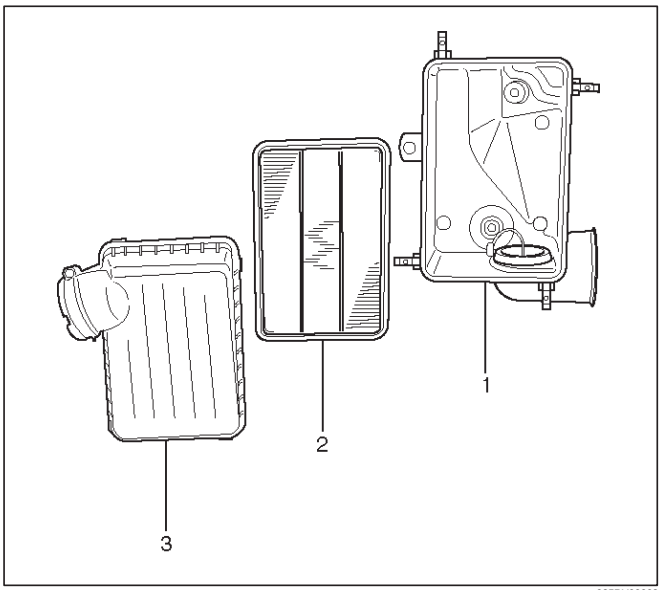
Removal Procedure

1. Loosen the clamp between the air cleaner lid and the mass air flow sensor.



025RY00001

2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.
4. Remove the air filter element.
5. Remove the retaining bolts and the air cleaner housing from the vehicle.



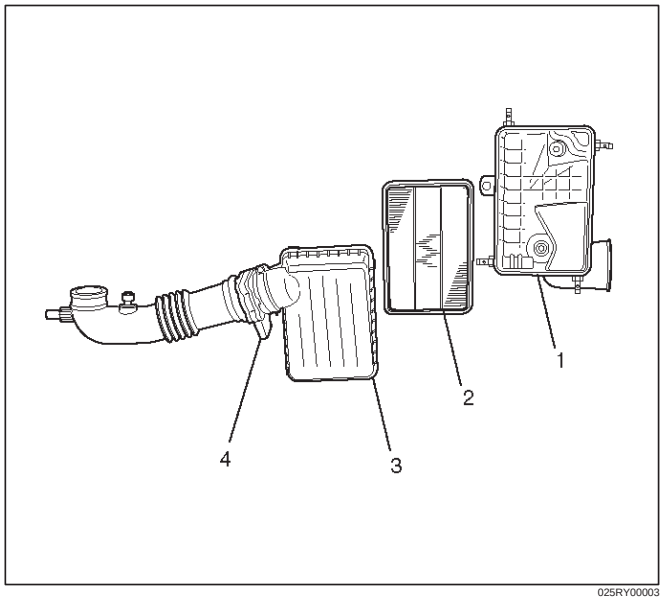
025RY00002

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid

Installation Procedure

1. Install the air cleaner housing in the vehicle with the retaining bolts.
2. Install the air filter element in the air cleaner housing.
3. Install the air cleaner lid on the MAF sensor and the air cleaner housing.



025RY00003

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid
(4) Mass Air Flow Sensor

4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

Common Chamber

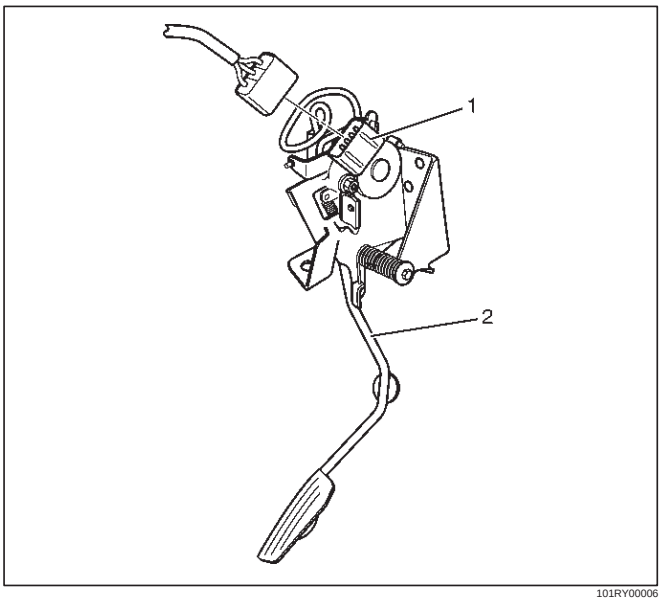
Removal and Installation Procedure

Refer to Common Chamber in Engine Mechanical section.

Accelerator Pedal Replacement

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the accelerator position sensor.

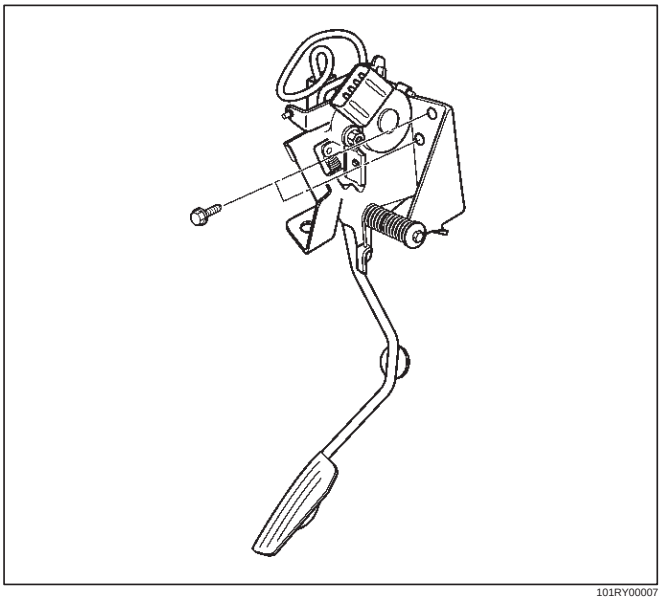


101RY00006

Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

3. Remove the two screws from the accelerator pedal assembly.



101RY00007

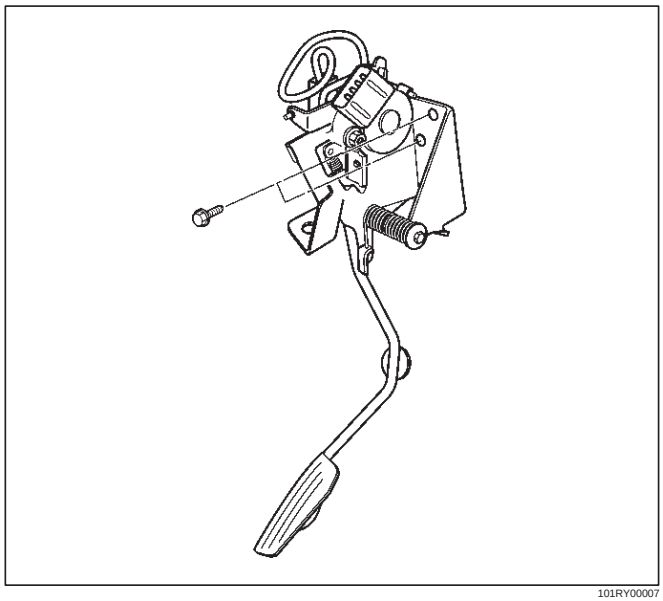
4. Remove the accelerator pedal assembly from the bulkhead.

Installation Procedure

1. Install the accelerator pedal assembly on the bulkhead.
2. Install the two screws to the accelerator pedal assembly.

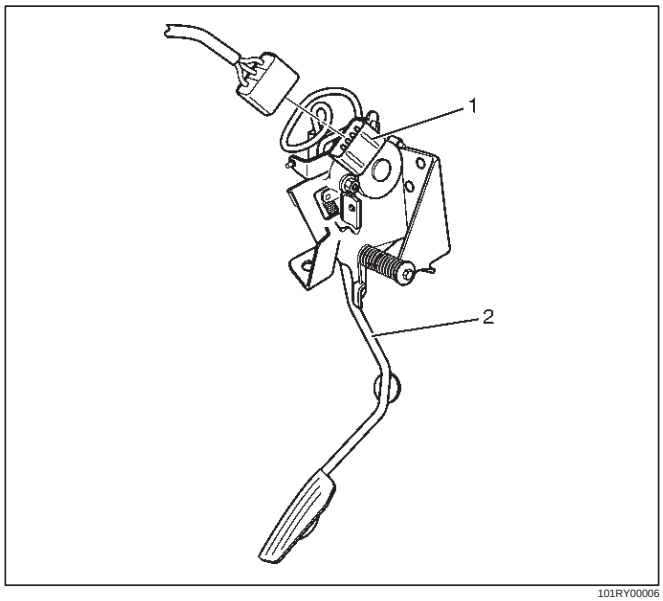
Tighten

▼Tighten the screws to 22 N·m (16 lb ft.).



101RY00007

3. Connect the electrical harness to the accelerator position sensor.



101RY00006

Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

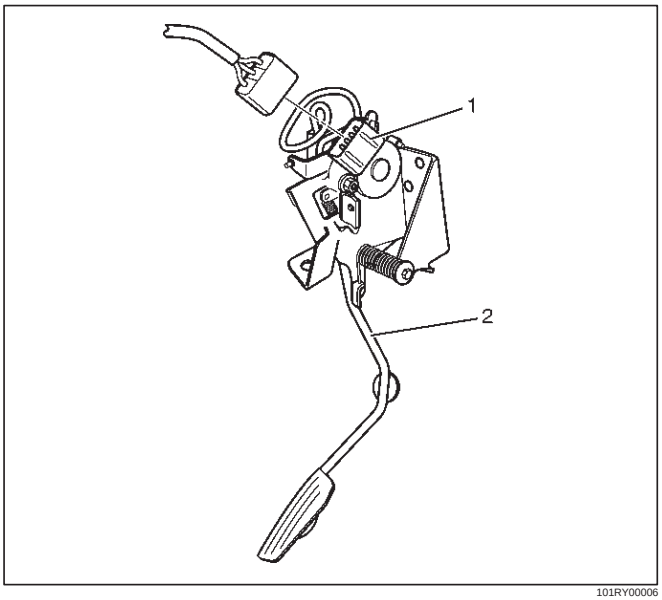
4. Install the negative battery cable.

Accelerator Position Sensor Replacement

CAUTION: Remove the Accelerator (A) pedal assembly as a unit to have it serviced. Do not remove the Accelerator Position (AP) sensor on the A pedal. If the AP sensor is removed for emergency cause, refer to following items as necessary.

Removal Procedure

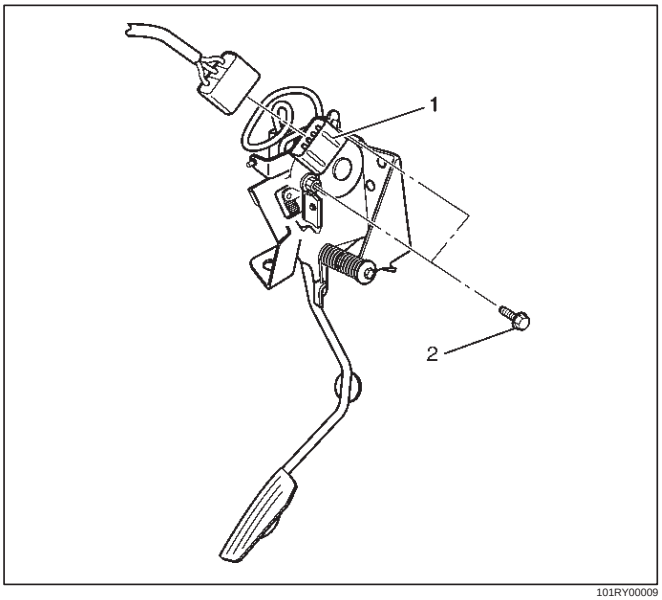
1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the AP sensor.



101RY00006

Legend
(1) AP Sensor
(2) A Pedal Assembly

3. Remove the AP sensor.



101RY00009

Legend
(1) AP Sensor
(2) AP Screw

Installation Procedure

1. Install the accelerator position (AP) sensor to bolts with accelerator (A) pedal.
2. Connect the connector to AP sensor.
3. Install the negative battery cable.

Accelerator Position Sensor Adjustment

AP sensor is controled three maltiple control system, and adjust the idle position and WOT position are between A and B for AP sensor 1, AP sensor 2, and AP sensor 3. Refer to *"How to adjust for AP sensor".*

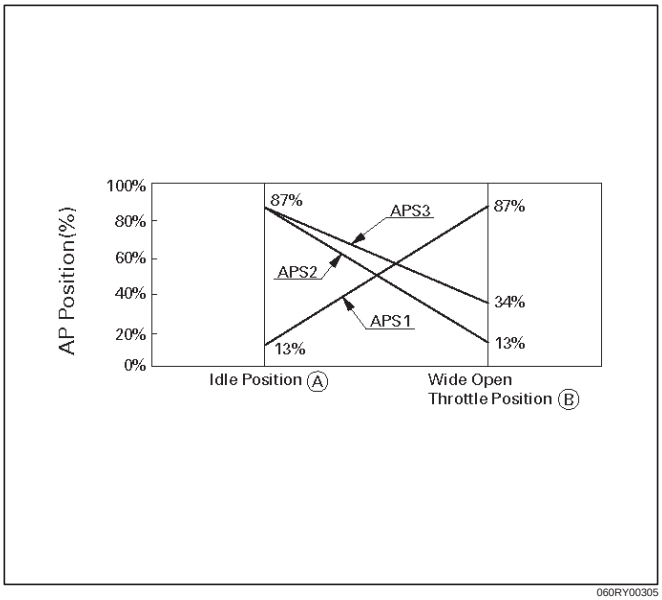
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the AP sensor.

How To Adjust For AP Sensor

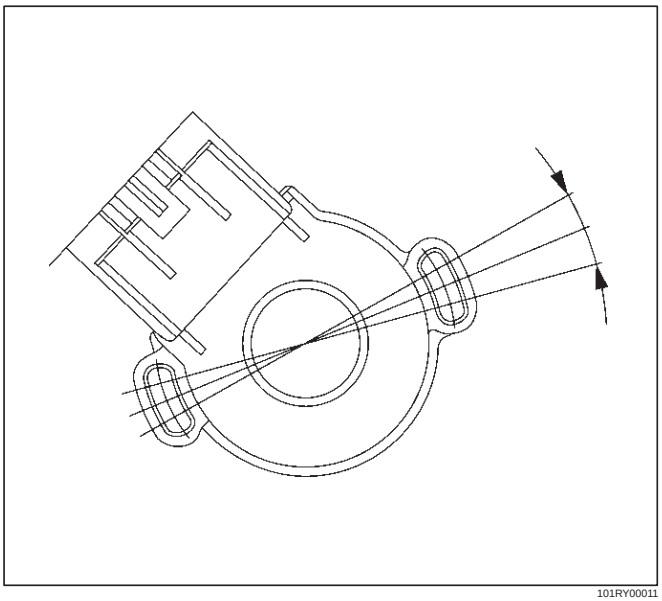
1. Connect the Tech 2 to DLC on vehicle.
2. Ignition "ON," engine "OFF.".
3. Display the APS date list. Check the following item for AP position (%).

	AP position (%)	
	Idle position A	WOT position B
APS1	13%	87 ± 2%
APS2	87 ± 2%	13 ± 2%
APS3	87 ± 1%	34 ± 2%



060RY00305

4. If the problem was found, adjust as necessary.

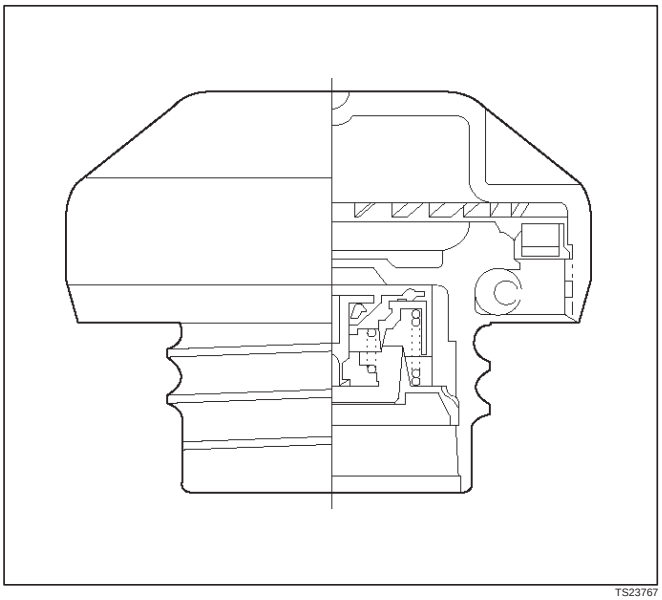


101RY00011

Fuel Filler Cap

General Description

The fuel filler cap includes a vacuum valve and a pressure valve.
If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank.



TS23767

Inspection Procedure

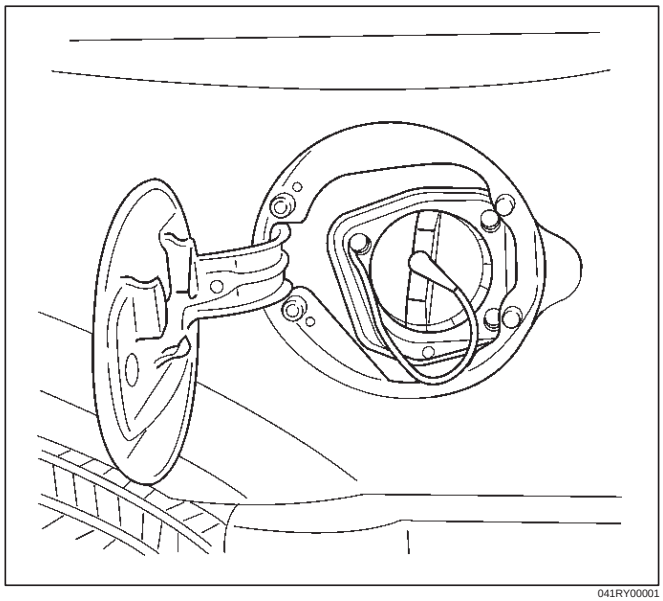
NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- ▼ Check the seal ring in the filler cap for any abnormality and for seal condition.
- ▼ Replace the filler cap if any abnormality is found.

Fuel Filter

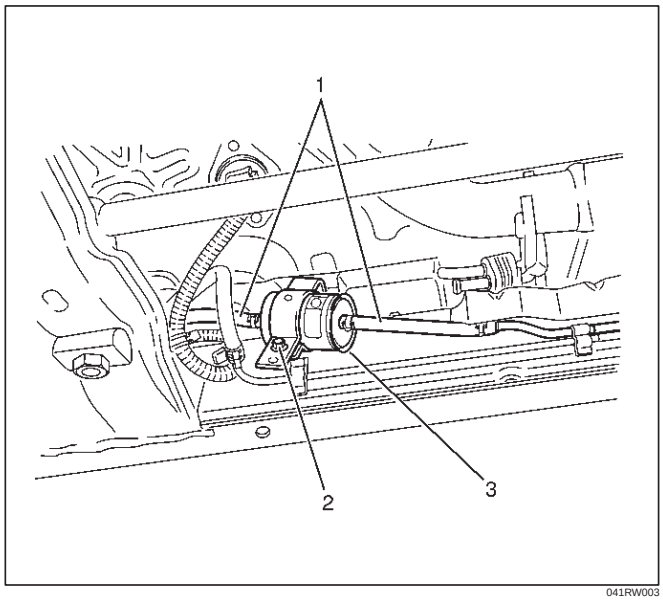
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



041RY00001

3. Disconnect the fuel hose from the fuel filter on the engine side.
4. Disconnect the fuel hose from the fuel filter on the fuel tank side.
5. Remove the bolt on the fuel filter holder.



041RW003

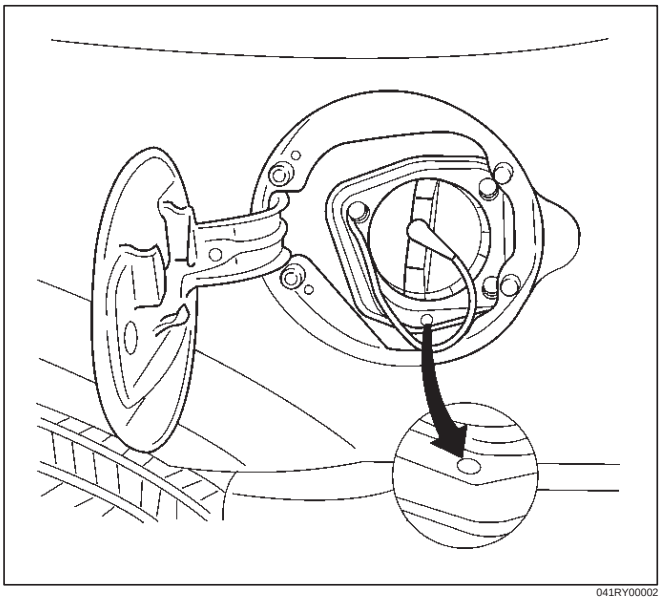
Legend

(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

6. Remove the fuel filter.

Inspection Procedure

1. Replace the fuel filter when the following occur:
   - ▼Fuel leaks from the fuel filter body.
   - ▼The fuel filter body is damaged.
   - ▼The fuel filter is clogged with dirt or sediment.
2. If the drain hole is clogged, clean the drain.



041RY00002

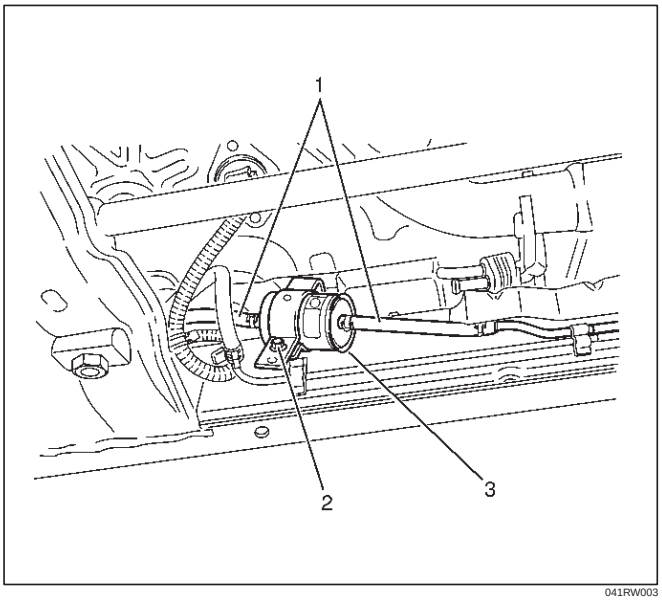
Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.

Tighten

▼Tighten the screws to 20 N·m (14 lb ft.).

3. Connect the fuel hose on the engine side.
4. Connect the fuel hose on the fuel tank side.

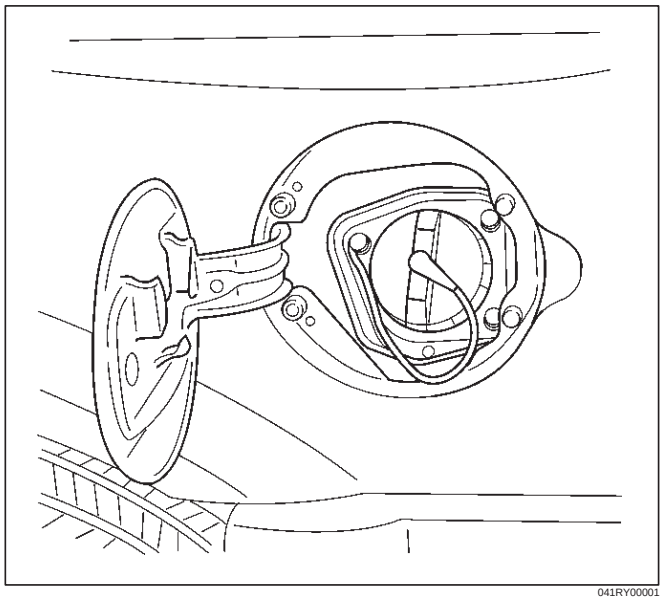


041RW003

Legend

(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

5. Install the fuel filler cap.



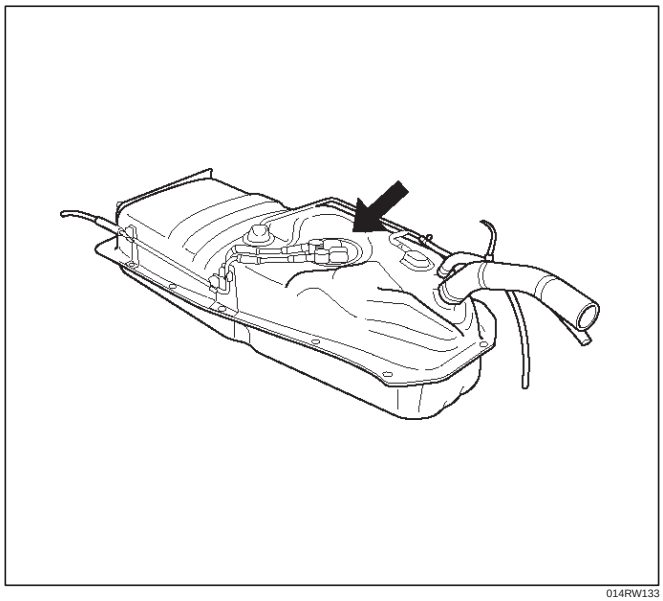
041RY00001

6. Connect the negative battery cable.

Fuel Gauge Unit

Removal Procedure

Refer to *Fuel Gauge Unit Engine Fuel* section.



014RW133

Fuel Injectors

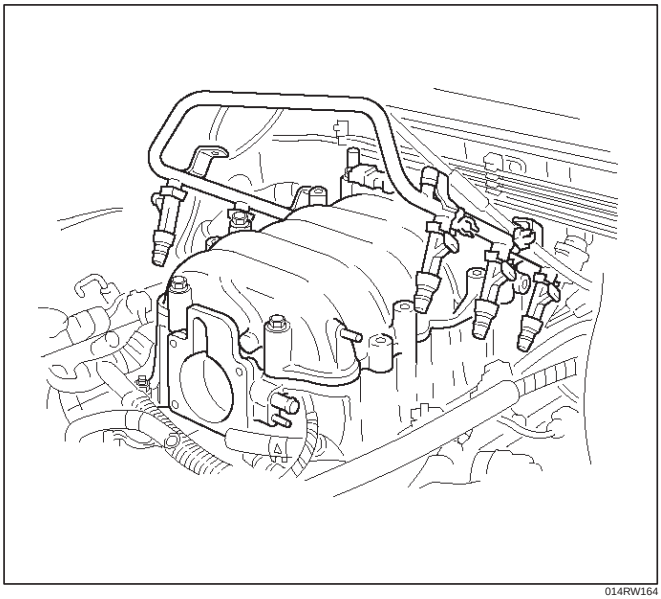
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and the filter if necessary.

NOTE: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

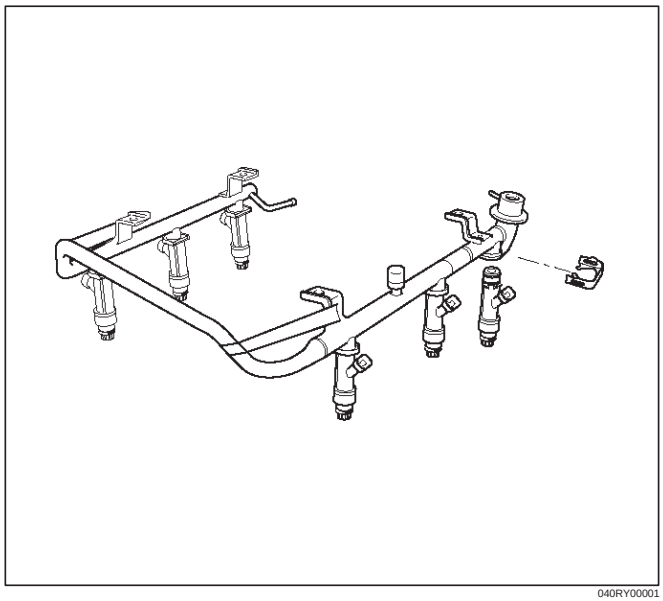
IMPORTANT: Fuel injectors are serviced as a complete assembly only.

1. Disconnect the negative battery cable.
2. Remove the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
3. Remove the fuel rail. Refer to *Fuel Rail* section.



014RW164

4. Remove the injector retainer clip.



040RY00001

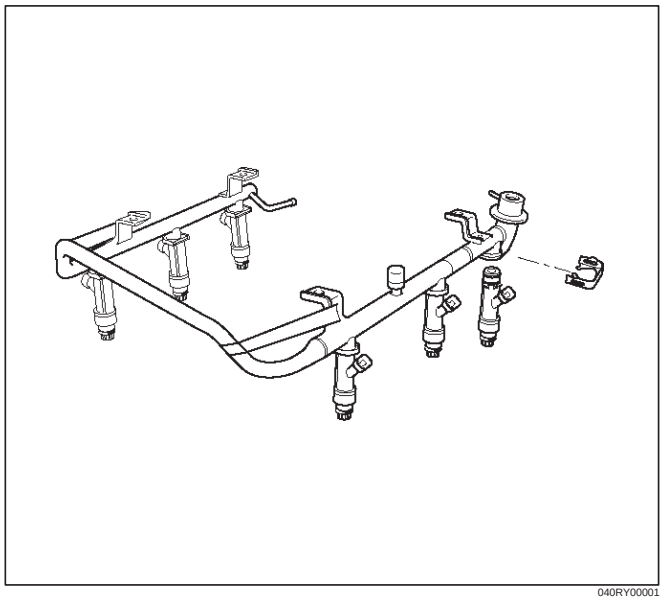
5. Remove the fuel injector assembly.
6. Remove the O-ring from the fuel injector.
7. Remove the O-ring backup from the fuel injector .

Inspection Procedure

1. Inspect the O-rings for cracks or leaks.
2. Replace worn or damaged O-rings.
3. Lubricate the new O-rings with engine oil before installation.

Installation Procedure

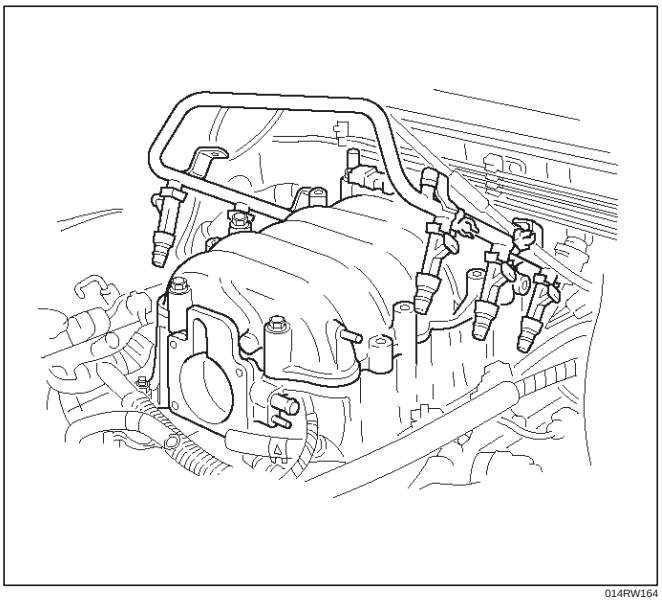
1. Install the O-ring backup on the fuel injector.
2. Install the new O-ring on the fuel injector.
3. Install the fuel injector on the fuel rail.



040RY00001

4. Use new fuel injector retainer clips to retain the fuel injector to the fuel rail.
5. Coat the end of the fuel injector with gasoline.

6. Install the fuel rail. Refer to *Fuel Rail* section.



014RW164

7. Install the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
8. Install the engine cover.
9. Connect the negative battery cable.

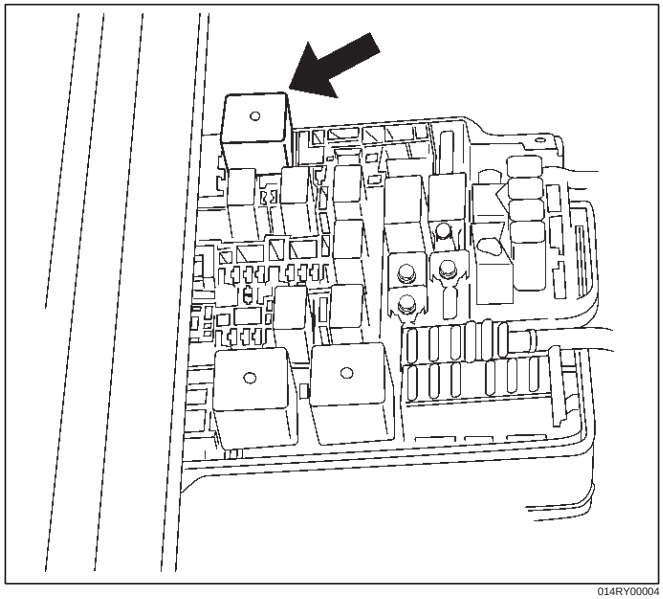
Fuel Metering System

Fuel Pressure Relief Procedure

CAUTION: To reduce the risk of fire and personal injury, there are necessary to relieve the fuel system pressure before filler and gauge unit servicing the fuel system components.

CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before you disconnect the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay box. Refer to *Fuel Pump Relay* section.



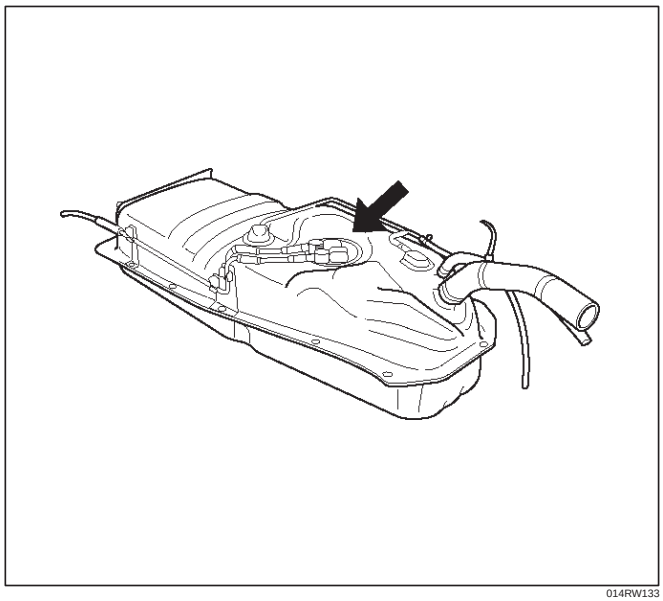
014RY00004

3. Start the engine and allow it to stall.
4. Crank the engine for 30 seconds.
5. Disconnect the negative battery cable.

Fuel Pump Assembly

Removal Procedure

Refer to *Fuel Tank In Fuel Pump Relay* section.

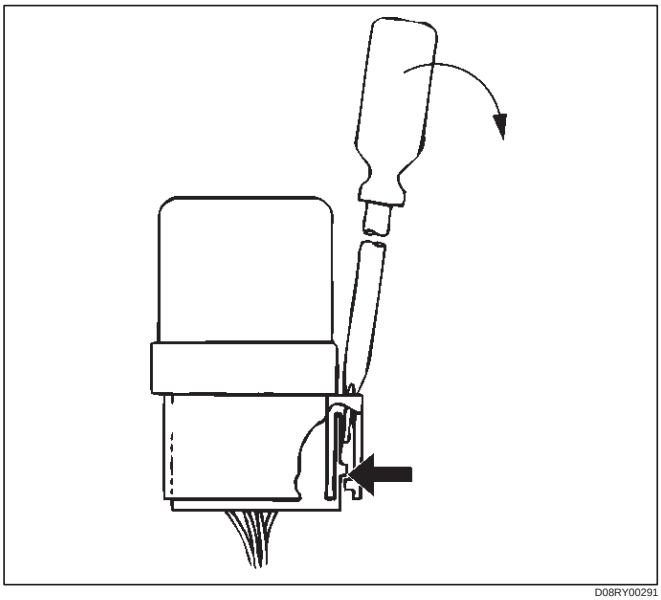


014RW133

Fuel Pump Relay

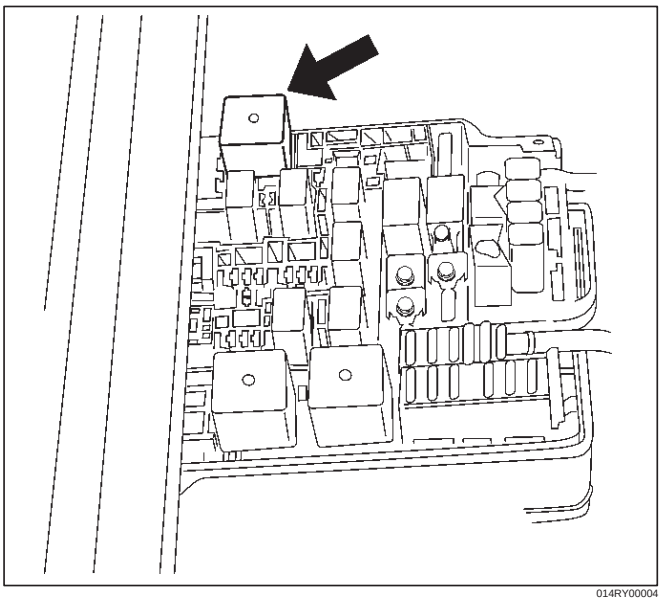
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   ▼The screwdriver blade will release the catch inside.



D08RY00291

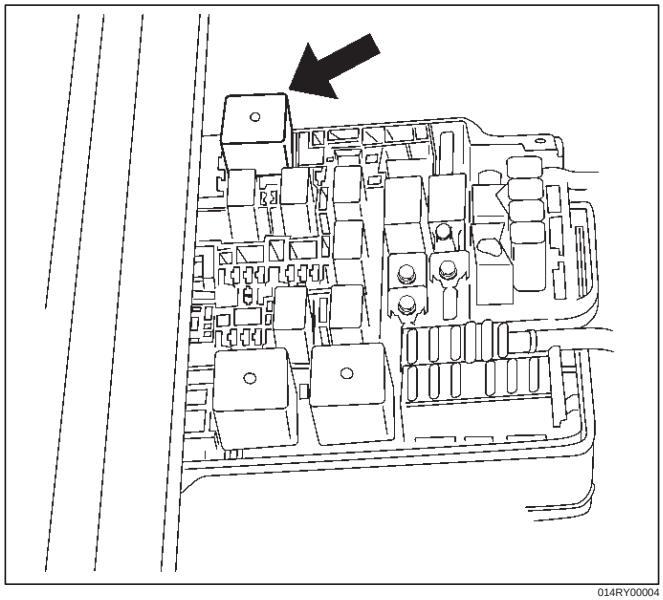
4. Pull the relay straight up and out of the fuse and relay box.



014RY00004

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   ▼An audible “click” will be heard.



014RY00004

3. Install the fuse and relay box cover.

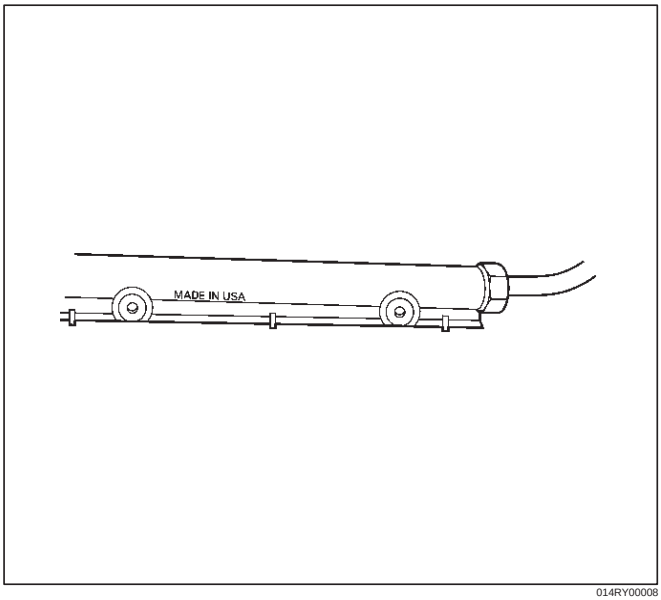
Fuel Rail Assembly

Removal Procedure

NOTE:

- Do not attempt to remove the fuel inlet fitting on the fuel rail. It is staked in place. Removing the fuel inlet fitting will result in damage to the fuel rail or the internal O-ring seal.
- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminals and the injector spray tips.
- Fittings should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passages.

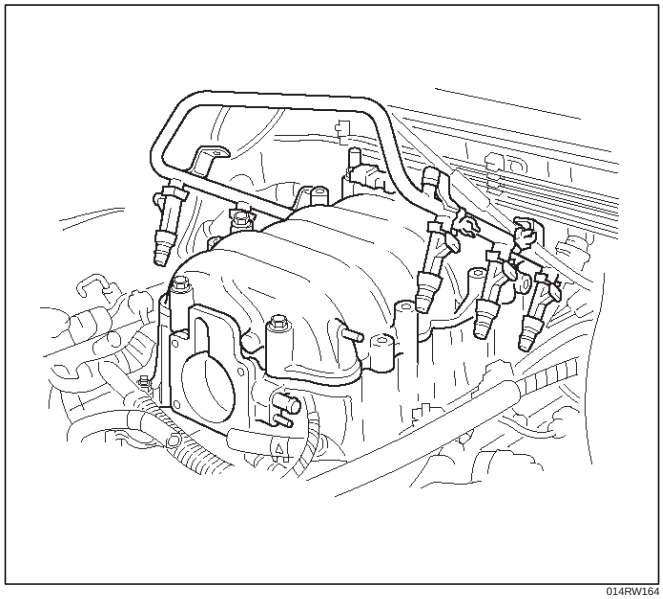
IMPORTANT: An eight-digit identification number is stamped on the side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.



014RY00008

Before removal, the fuel rail assembly may be cleaned with a spray type engine cleaner. Follow the spray package instructions. Do not immerse the fuel rails in liquid cleaning solvent.

1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure in this Section.
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Disconnect the throttle position sensor electrical connector from throttle body.
5. Disconnect the connectors from manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Disconnect the vacuum hose on canister VSV and positive crankcase ventilation hose.
7. Remove the common chamber. Refer to the common chamber in Engine Mechanical section.
   1. Lift up carefully on the fuel injectors. Do not separate the fuel injectors from the fuel rail.
   2. If an injector becomes separated from the fuel rail, the infector O-ring seals and the retainer clip must be replaced.
   3. Drain residual fuel into an approved container.

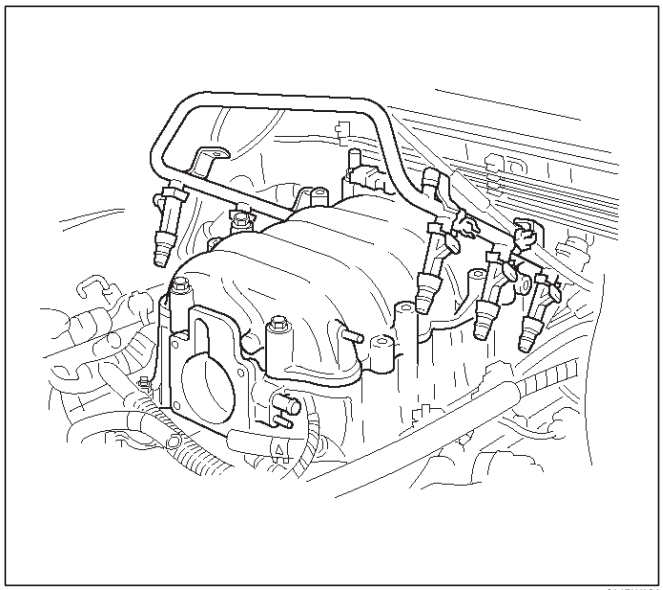


014RW164

8. If removal of the fuel pressure regulator is necessary, refer to *Fuel Pressure Regulator* section.
9. If removal of the fuel injectors is necessary, refer to *Fuel Injectors* section.

Installation Procedure

1. If the fuel injectors were removed, install them. Refer to *Fuel Injectors* section.
2. If the fuel pressure regulator was removed, install it. Refer to *Fuel Pressure Regulator* section.
3. Install the common chamber. Refer to common chamber in engine Mechanical section.



014RW164

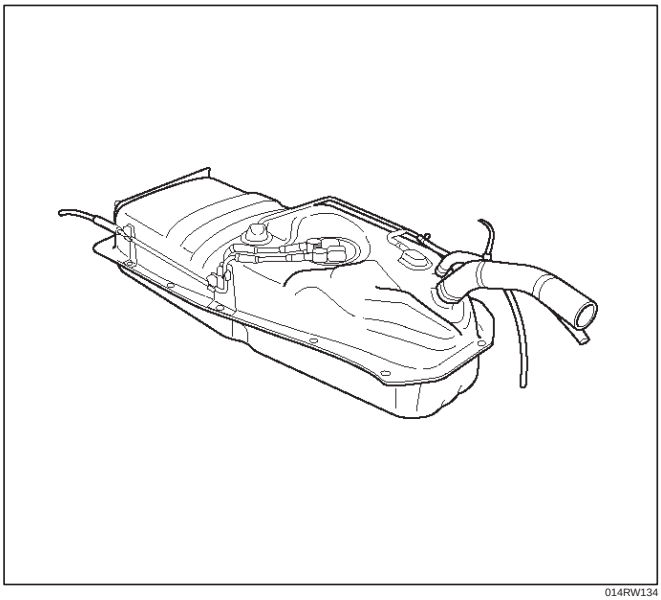
4. Connect the vacuum hose on Canister VSV and positive crankcase ventilation hose.

5. Connect the connectors to manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Connect the throttle position sensor electrical connector to throttle body.
7. Install the engine cover.
8. Connect the negative battery cable.
9. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel rail and in the injectors.

Fuel Tank

Removal Procedure

Refer to *Fuel Tank In Fuel Pump Relay*

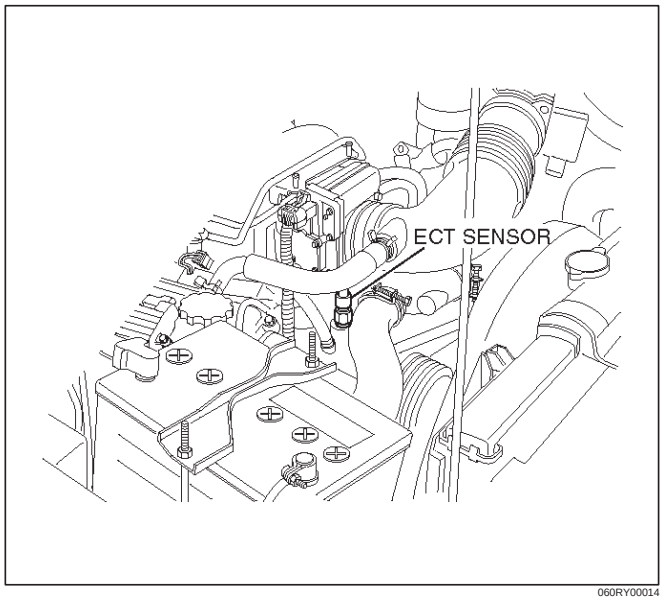


014RW134

Throttle Body (TB)

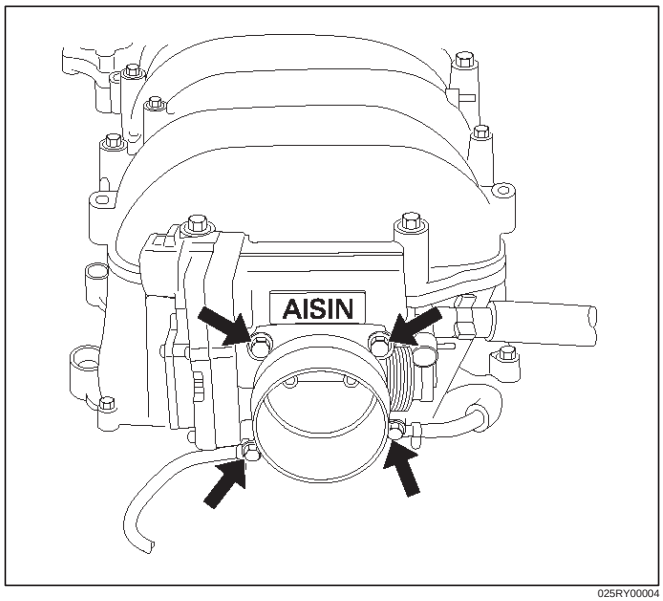
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Cooling System* section.
3. Disconnect the electrical connectors:
   - ▼Throttle position (TP) sensor.
   - ▼Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.



060RY00014

4. Disconnect the vacuum hose below the air horn.
5. Remove the intake air duct clamp.
6. Disconnect the intake air duct.
7. Disconnect the coolant lines from the throttle body.
8. Remove the bolts from the common chamber.
9. Remove the throttle body from the common chamber.
10. Remove the gasket from the common chamber.



025RY00004

11. Remove the TP sensor. Refer to *Throttle Position (TP) Sensor* section.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

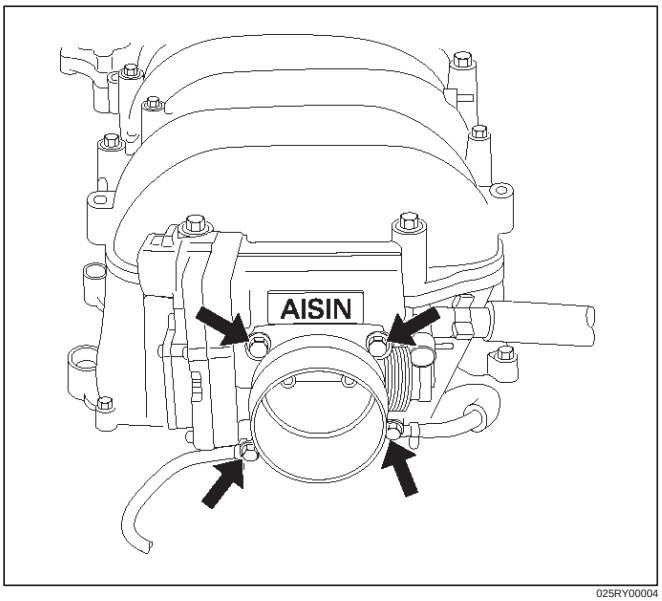
- ▼If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
- ▼Do not leave any scratches in the aluminum casting.

Installation Procedure

1. Install the TP sensor. Refer to *Throttle Position (TP) Sensor* section.
2. Install the gasket on the common chamber.
3. Install the throttle body on the common chamber.
4. Secure the gasket and the throttle body with the four bolts.
   - ▼The vacuum lines must be properly routed under the throttle body before tightening the mounting bolts.

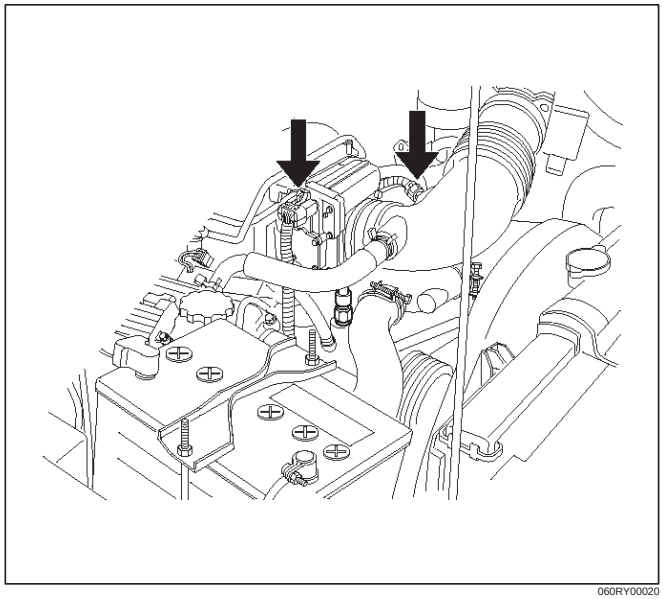
Tighten

▼Tighten the throttle body mounting bolts to 10 N·m (87 lb in).



025RY00004

5. Install the coolant lines.
6. Connect all the vacuum lines.
7. Install the intake air duct.
8. Tighten the intake air duct clamp.
9. Connect all the electrical connectors:
   - ▼Throttle position (TP) sensor.
   - ▼Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.



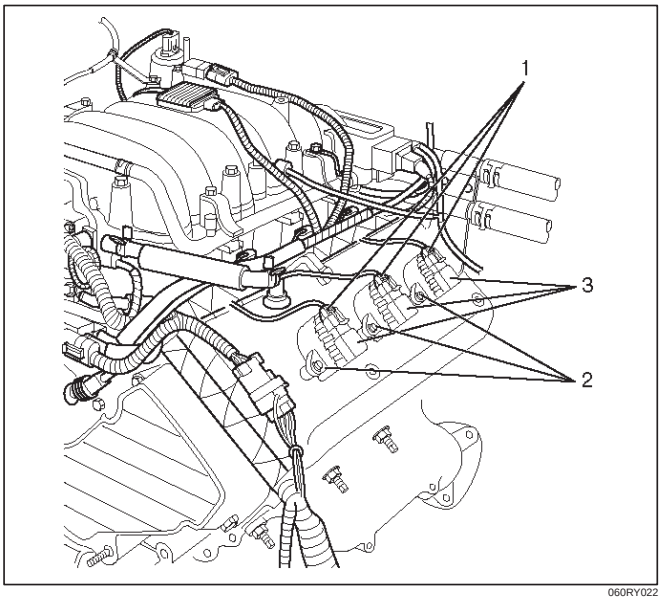
060RY00020

10. Install the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System* section.
11. Fill the cooling system. Refer to *Cooling System* section.
12. Install the negative battery cable.

Electronic Ignition System

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition coil connector at the ignition coil assemblies.
3. Remove the two screws that secure the ignition coil assemblies to the rocker cover.



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Remove the ignition coil assemblies and the spark plug boot from the spark plug.
   ▼Twist the ignition coil assemblies while pulling it straight up.
5. Use the appropriate spark plug socket in order to remove the spark plug from the engine.

Installation Procedure

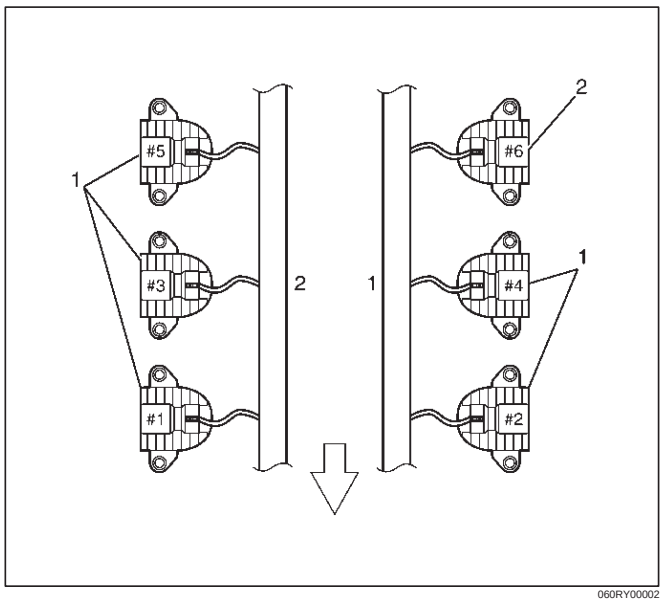
NOTE: The plug must thread smoothly into the cylinder head and be fully seated. Use a thread chaser if necessary to clean the threads in the cylinder head. Cross-threading or failure to fully seat the spark plug can cause plug overheating, exhaust blow-by gases, or thread damage. Do not overtighten the spark plugs. Over tightening can cause aluminum threads to strip.

1. Install the spark plug in the engine. Use the appropriate spark plug socket.

   Tighten

   ▼Tighten the spark plug to 18 N·m (13 lb ft.).
2. Install the ignition coil assemblies and spark plug boot over the spark plug.

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly #1 to #5. Ignition coil assemblies #6 is short type. Be careful it when installing ignition coil assembly of #6.



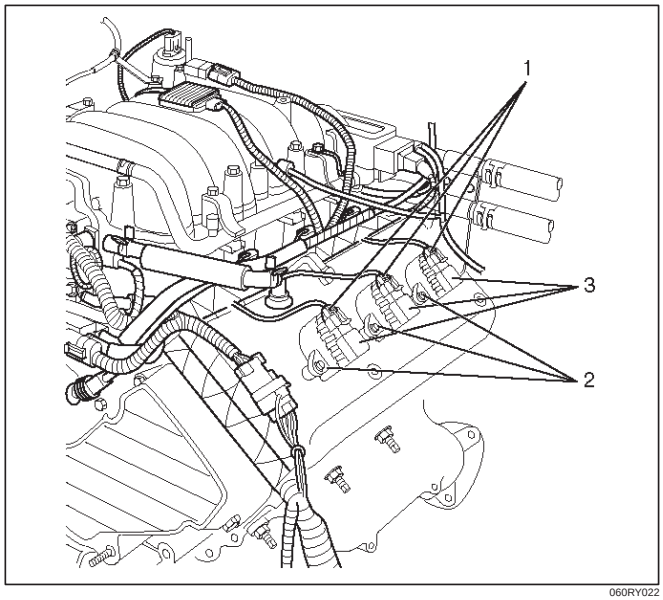
060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (#1 ~ #5)
(2) Short Type Ignition Coil Assembly (#6)

3. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

   Torque: 4 N·m (35.4 lb in)



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Connect the ignition coil connector at the ignition coil assemblies.
5. Connect the negative battery cable.

Catalytic Converter

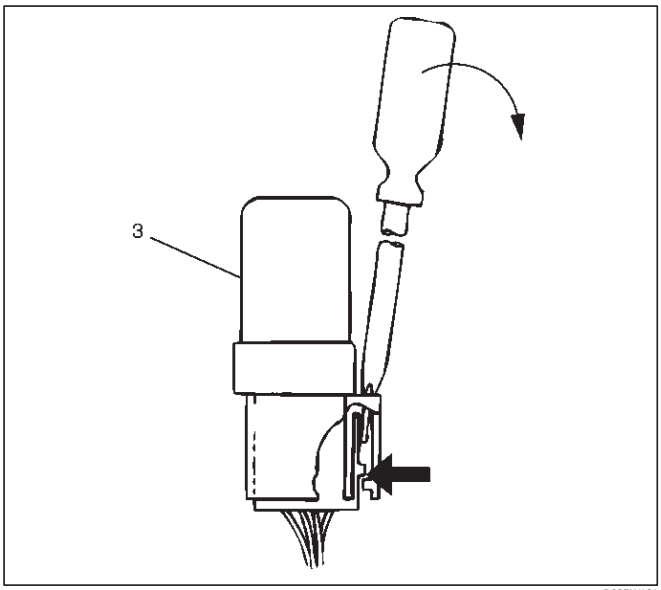
Removal and Installation Procedure

Refer to *Engine Exhaust in Engine* section.

Air Conditioning Thermo Relay

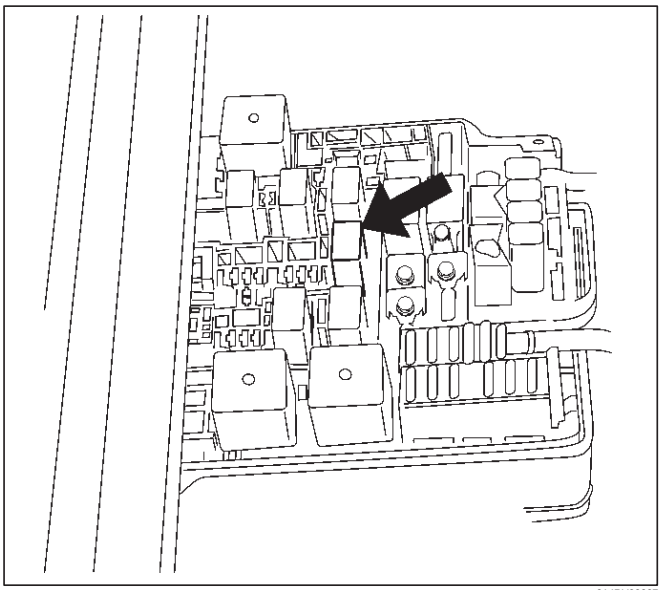
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   ▼The screwdriver blade will release the catch inside.



D08RW131

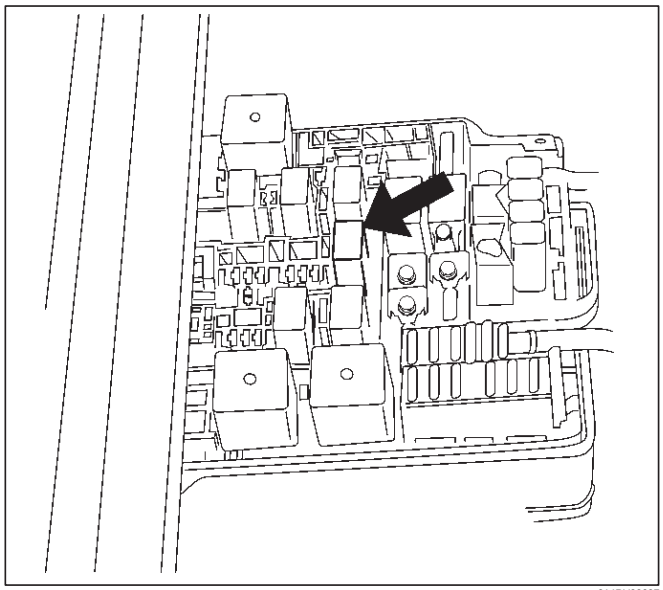
4. Pull the relay straight up and out of the fuse and relay box.



014RY00007

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   ▼An audible “click” will be heard.
3. Install the fuse and relay box cover.



014RY00007

EVAP Canister Hoses

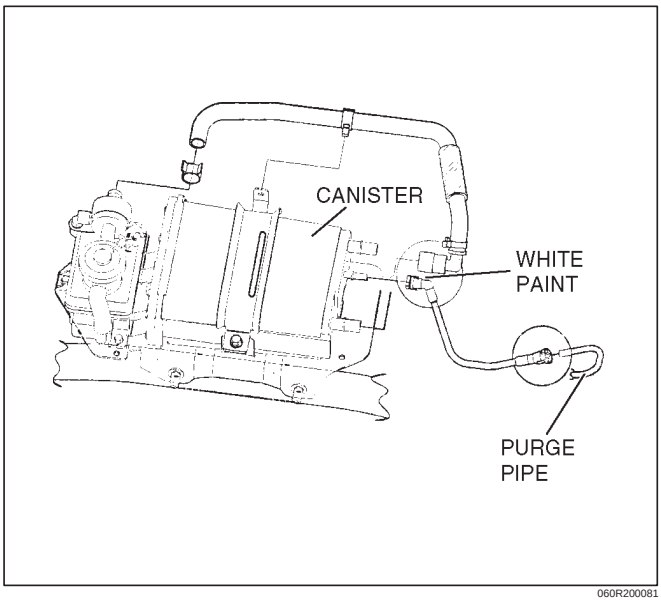
Service Information

To view the routing of the EVAP canister hoses, refer to *Vehicle Emission Control Information* in *Diagnosis*. Use 6148M or equivalent when you replace the EVAP canister hoses.

EVAP Canister

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the two hoses from the EVAP canister.
3. Disconnect the fuel vapor connector and the purge hose from the EVAP canister vent solenoid.
4. Remove the two retaining bolts the EVAP canister to the mounting bracket on the cross member.
5. Remove the retaining bolt on the mounting bracket the slide the canister out of mounting bracket.



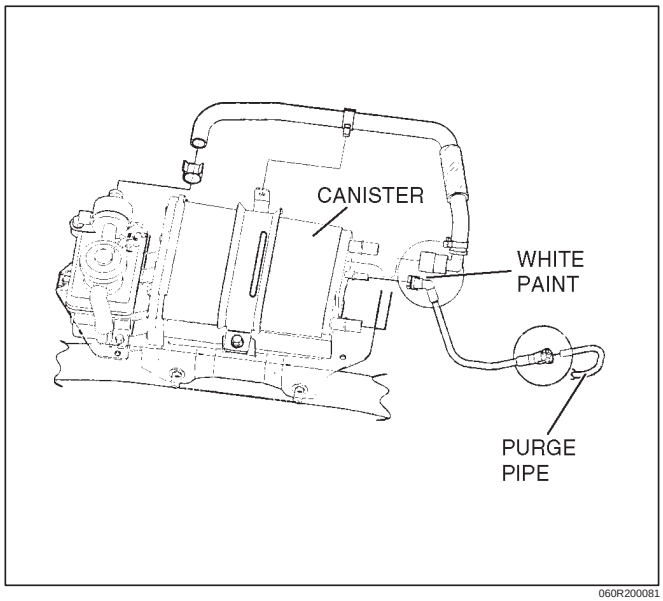
060R200081

Inspection Procedure

1. Inspect the hoses for cracks and leaks.
2. Inspect the canister for a damaged case.

Installation Procedure

1. Slide the canister into mounting bracket and install the mounting bracket bolt.
2. Install the retaining bolts the EVAP canister to the mounting bracket on the cross member.
3. Connect the fuel vapor connector to the EVAP canister vent solenoid.
4. Connect the two hoses to the EVAP canister.



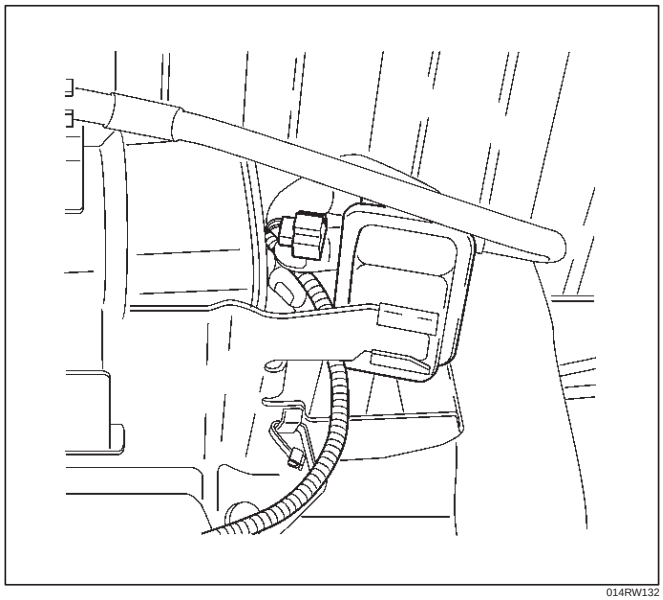
060R200081

5. Disconnect the negative battery cable.

EVAP Canister Vent Solenoid

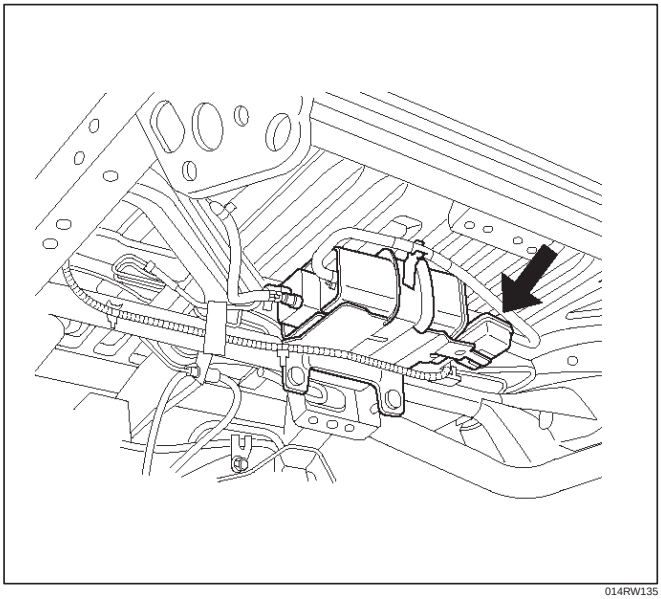
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the connector and hose.



014RW132

3. Slide the out of EVAP canister vent solenoid from mounting bracket.



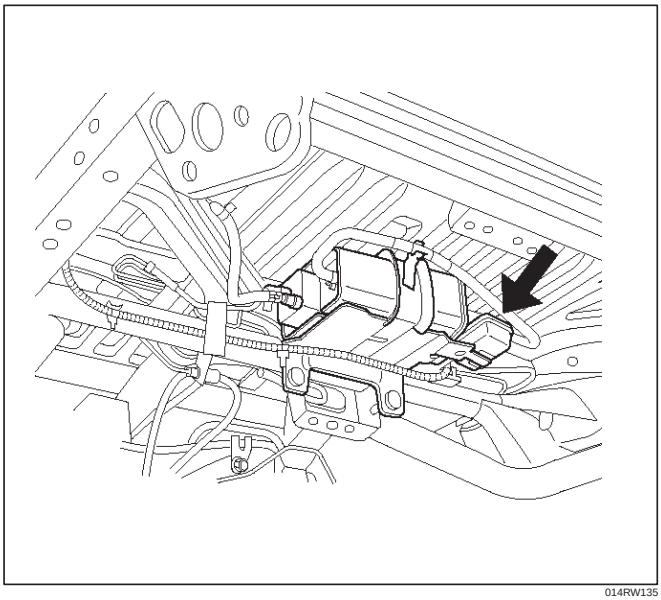
014RW135

Inspection Procedure

1. Check for cracks or leaks.
2. Energize the solenoid and try to blow through it. The solenoid should not allow passage of air when energized. (J 35616 Connector Test Kit can be used to easily attach jumper wires from the battery to the solenoid).

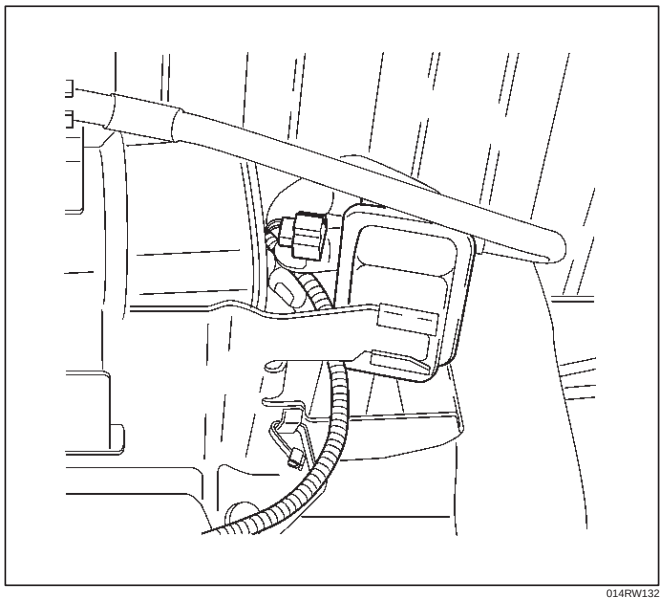
Installation Procedure

1. Slide the into EVAP canister vent solenoid into the mounting bracket.



014RW135

2. Connect the connector and hose.



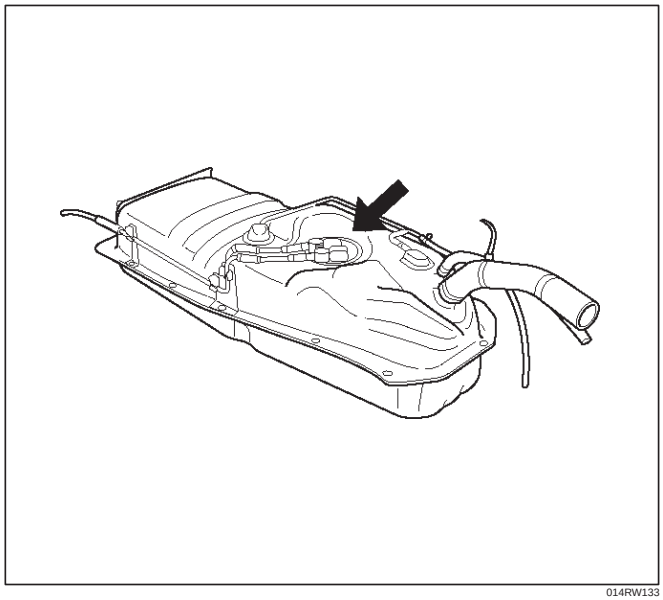
014RW132

3. Connect the negative battery cable.

Fuel Tank Pressure (Vapor Pressure) Sensor

Removal Procedure

1. Remove the fuel pump assembly. Refer to *Fuel Tank In Fuel Pump*.
2. Carefully pry the fuel tank pressure sensor out of the top of the fuel pump assembly.



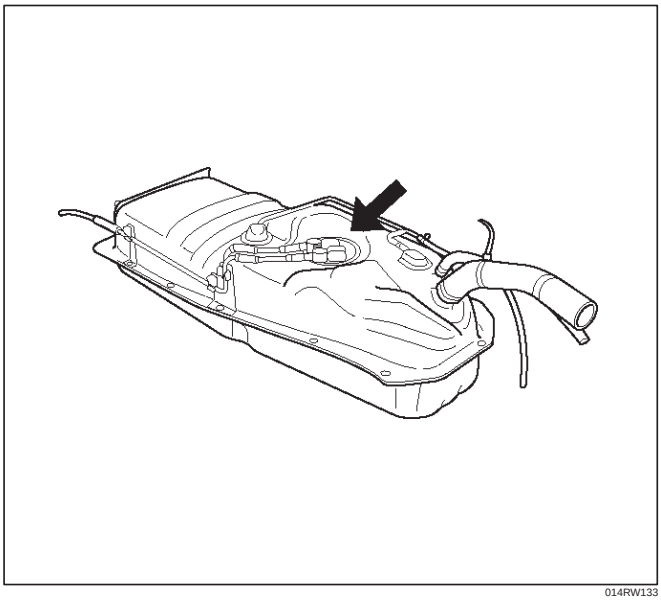
014RW133

Inspection Procedure

1. Inspect the vapor pressure sensor for cracks in the housing and corrosion on the electrical terminals.
2. Inspect the rubber grommet for tears and signs of rot.

Installation Procedure

1. Install the rubber grommet on the fuel pump assembly.

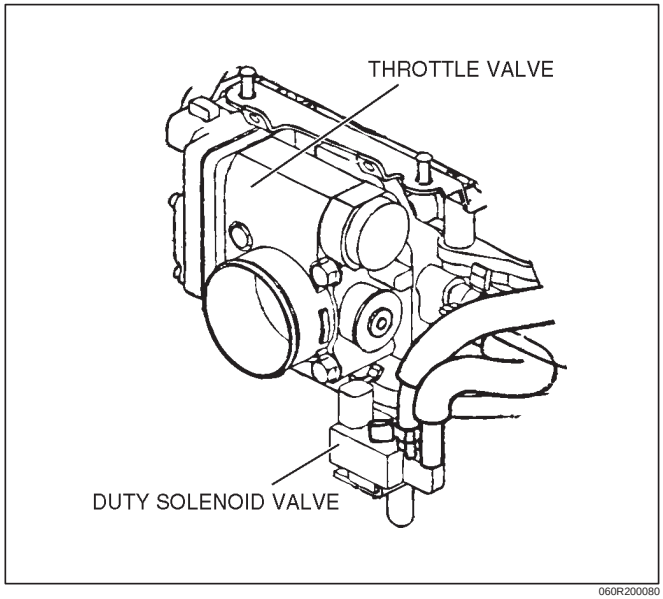


2. Install the fuel tank vapor pressure sensor on the fuel pump assembly.
   - ▼Insert the sensor nipple firmly into the grommet.
   - ▼Keep twisting and pushing the sensor until the wide portion of the nipple shows on the other side of the grommet.
3. Install the fuel pump assembly on the fuel tank. Refer to *Fuel Tank In Fuel Pump.*.

EVAP Canister Purge Solenoid (Purge Duty Solenoid Valve)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the EVAP canister purge solenoid.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.



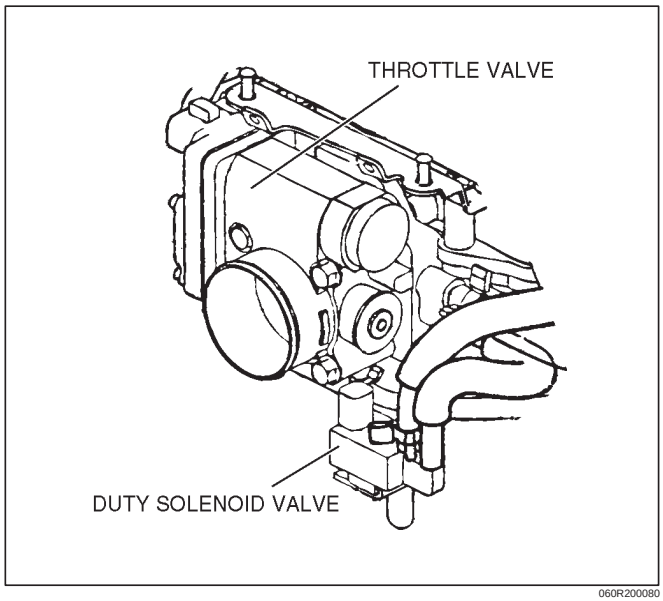
4. Remove the EVAP canister purge solenoid retaining bolt from the common chamber.
5. Remove the EVAP canister purge solenoid.

Installation Procedure

1. Install the EVAP canister purge solenoid on the upper intake manifold.
2. Install the EVAP canister purge solenoid retaining bolt.

   Tighten

   ▼Tighten the bolts to 20 N·m (16 lb ft.).
3. Connect the vacuum hoses to the EVAP canister purge solenoid.
4. Connect the electrical connector to the EVAP canister purge solenoid.



Fuel Tank Vent Valve (Vent Solenoid Valve)

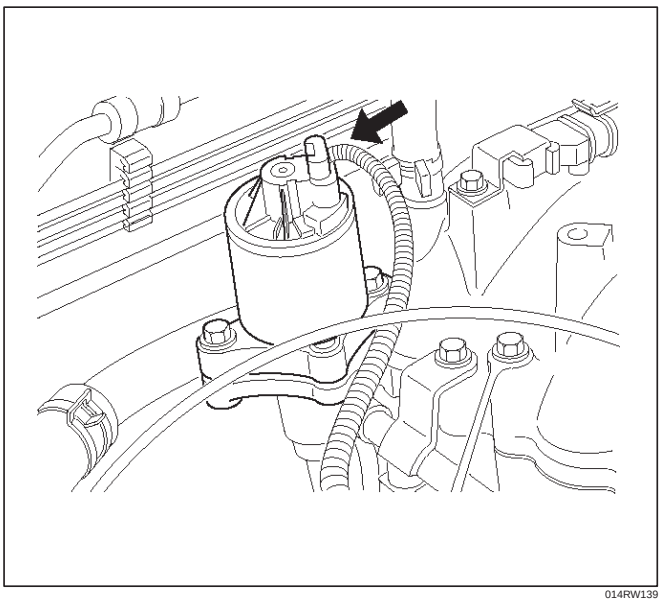
Removal and Installation Procedure

Refer to *Fuel Pump* section.

Linear Exhaust Gas Recirculation (EGR) Valve

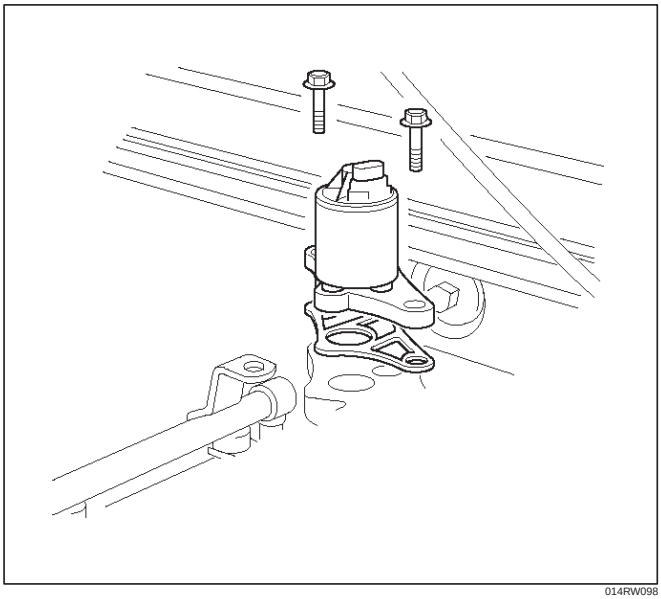
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector at the EGR valve.



014RW139

3. Remove the bolts from the common chamber.



014RW098

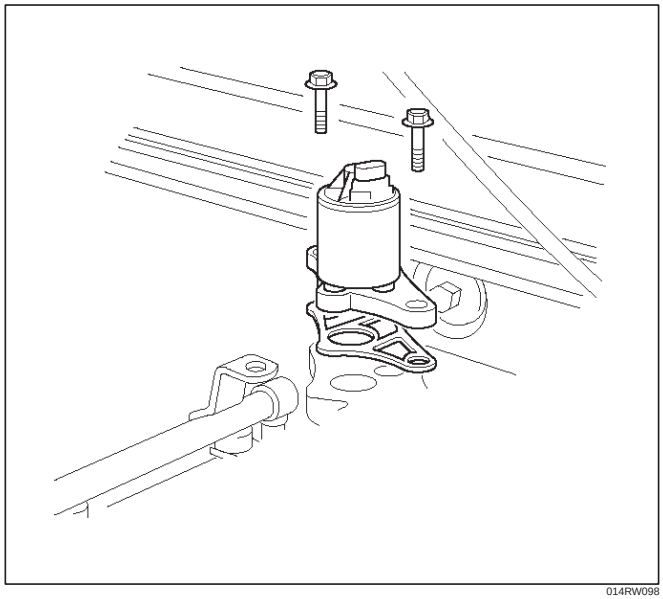
4. Remove the EGR valve from the common chamber manifold.
5. Remove the gasket from the common chamber manifold.

Installation Procedure

1. Install the gasket on the common chamber.
2. Install the EGR valve on the common chamber.
3. Secure the EGR valve and the gasket with the bolts.

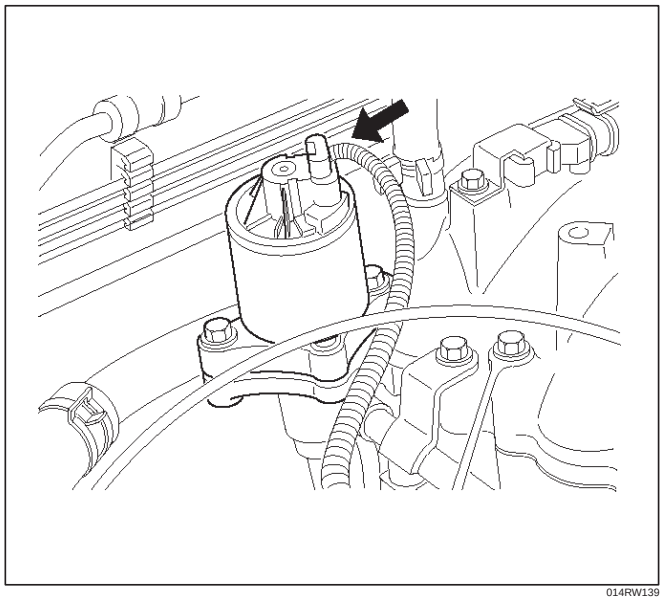
   Torque: 25 N·m (18 lb ft)

NOTE: It is possible to install the EGR valve rotated 180˚ from the correct position. Make sure that the base of the valve is placed so that it aligns with the mounting flange.



014RW098

4. Connect the electrical connector at the EGR valve.



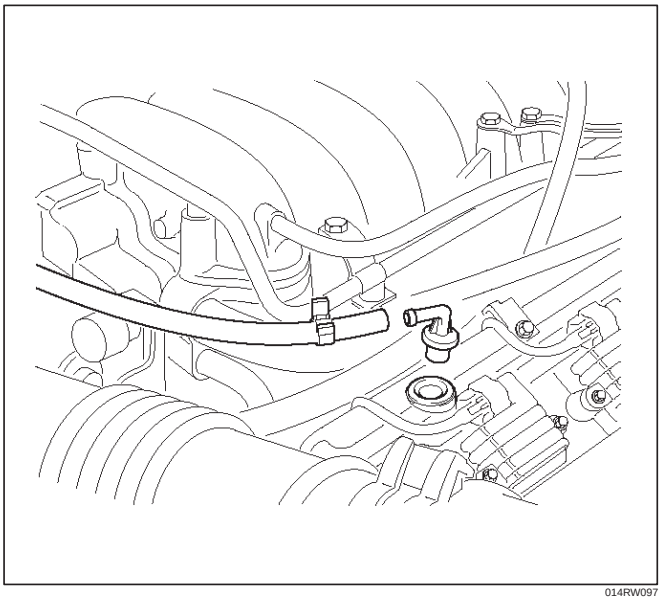
014RW139

5. Connect the negative battery cable.

Positive Crankcase Ventilation (PCV) Valve

Removal Procedure

1. Remove the vacuum hose at the PCV valve.
   ▼Slide the clamp back to release the hose.
2. Pull the PCV valve from the rubber grommet in the right valve cover.



014RW097

Inspection Procedure

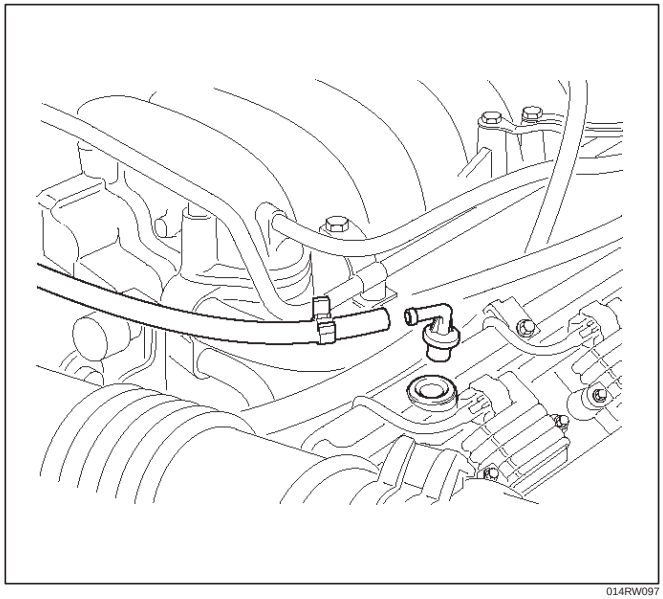
Before inspecting the PCV valve, make sure that the hoses are connected properly and are in good condition. Also check that the oil pan and rocker cover gaskets are sealing properly.

PCV Valve

1. Run the engine at normal operating temperature.
2. Disconnect the valve from the rocker cover.
   RESULT: A hissing noise should be heard from the valve. If no noise is heard, the PCV valve or hose is plugged.
3. Remove the PCV valve from the engine.
   a. Blow air into the rocker cover side of the valve.
   RESULT: Air should pass freely.
   b. Blow air into the air cleaner side of the valve.
   RESULT: Air should not pass through the valve.
4. Re-install the PCV valve and remove the oil filler cap.
   RESULT: A small vacuum should be felt at the oil filler hole.

Installation Procedure

1. Push the PCV valve into the rubber grommet in the left valve cover.
2. Install the vacuum hose on the PCV valve and secure the vacuum hose with the clamp.



014RW097

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.
Replace wire harnesses with the proper part number replacement.
Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.
The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* section for all wire harness repair procedures.

Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.
Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.
Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

PCM Connectors and Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

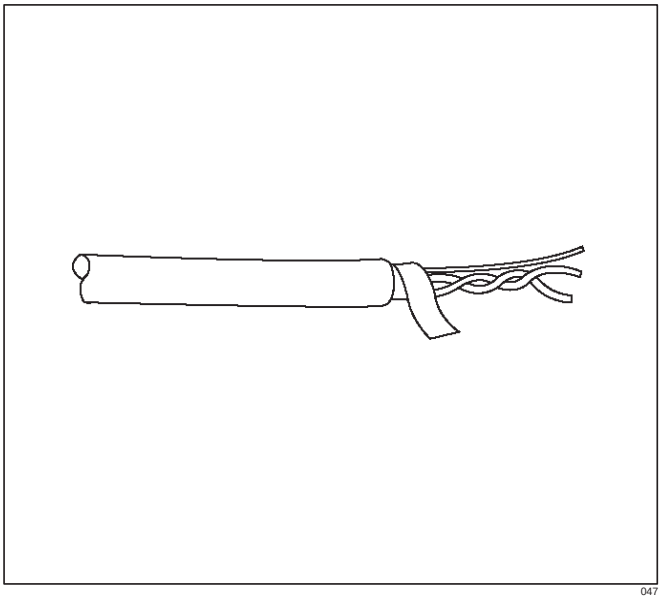
Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulled into position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

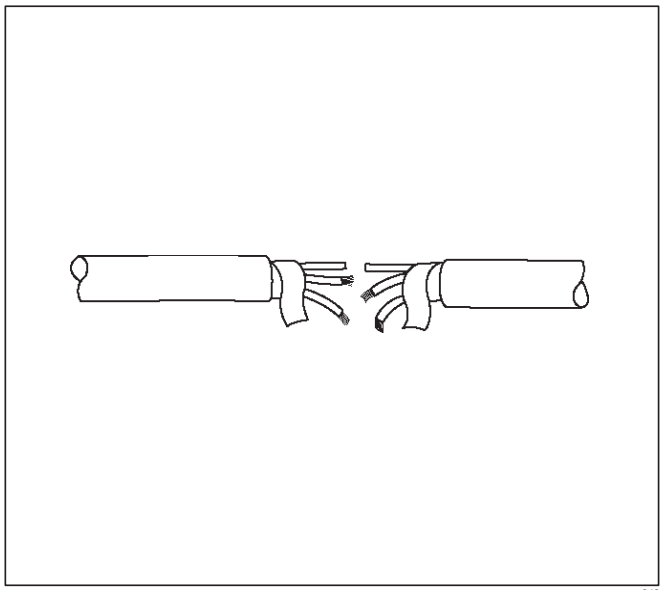
Wire Harness Repair: Twisted Shielded Cable

Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.

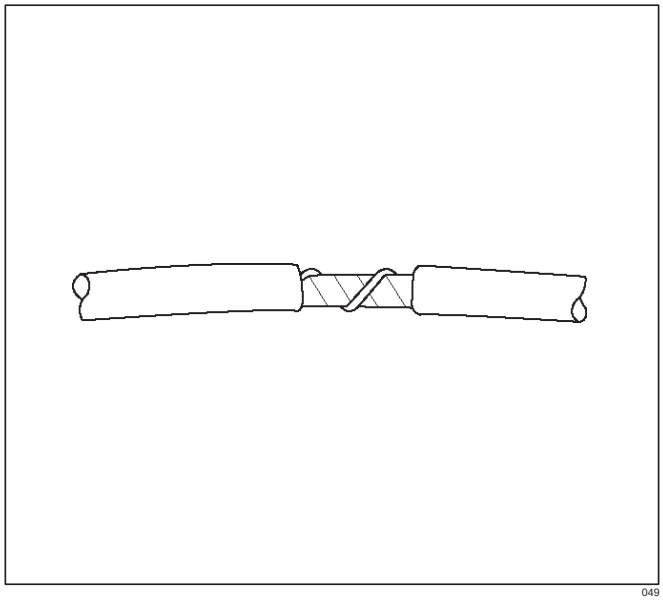


3. Untwist the conductors.
4. Strip the insulation as necessary.

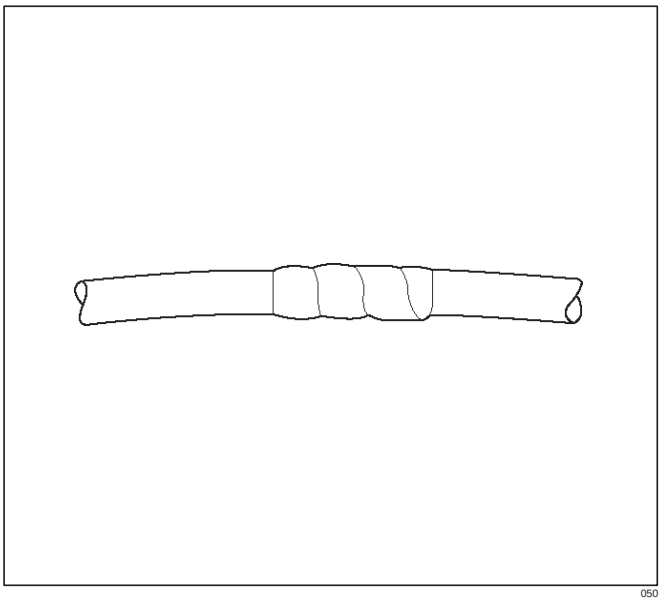


Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



4. Tape over the whole bundle to secure.

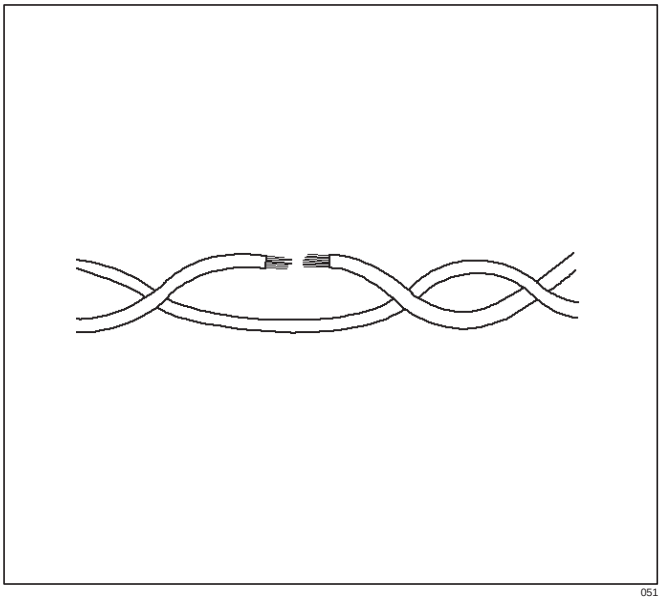


050

Twisted Leads

Removal Procedure

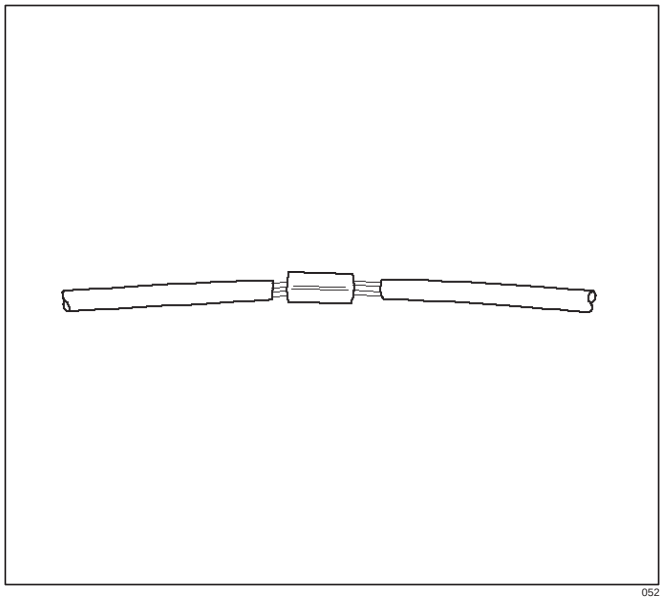
1. Locate the damaged wire.
2. Remove the insulation as required.



051

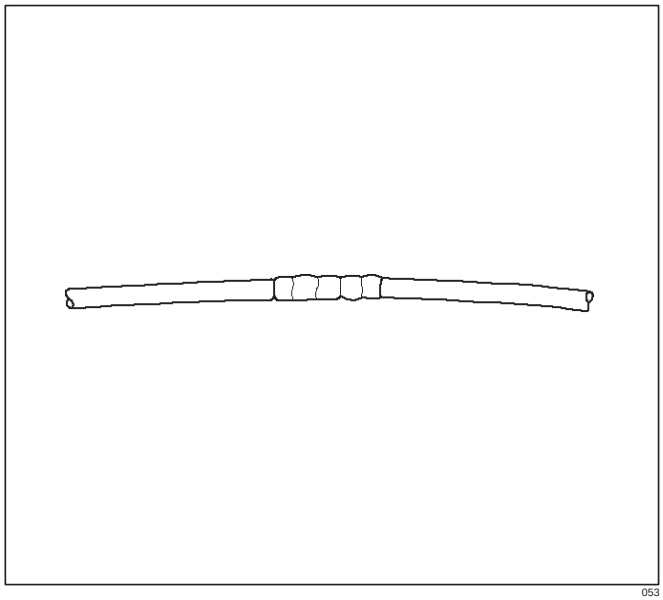
Installation Procedure

1. Use splice clips and rosin core solder in order to splice the two wires together.



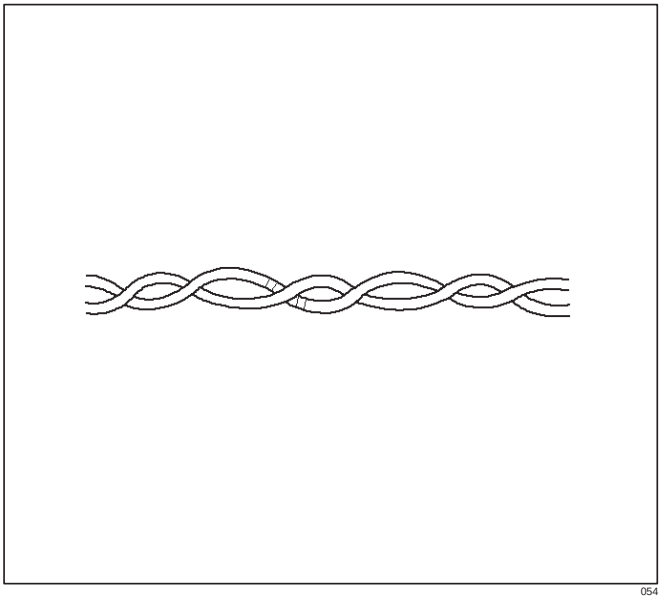
052

2. Cover the splice with tape in order to insulate it from the other wires.

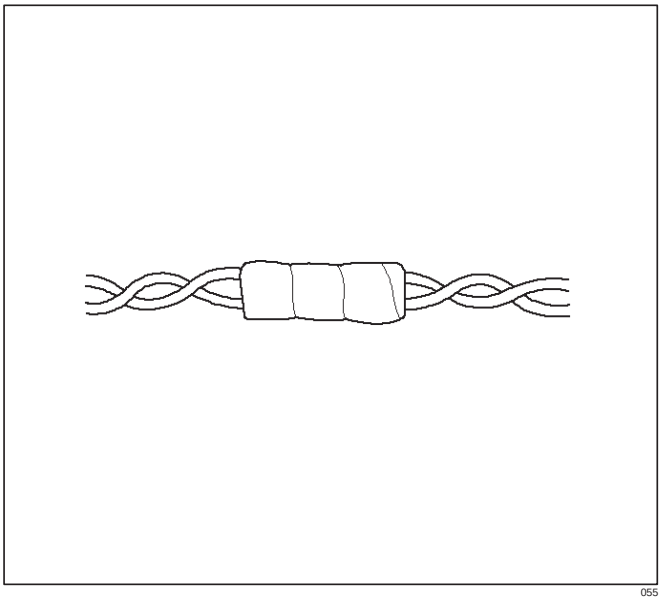


053

3. Twist the wires as they were before starting this procedure.



4. Tape the wires with electrical tape. Hold in place.



Weather-Pack Connector

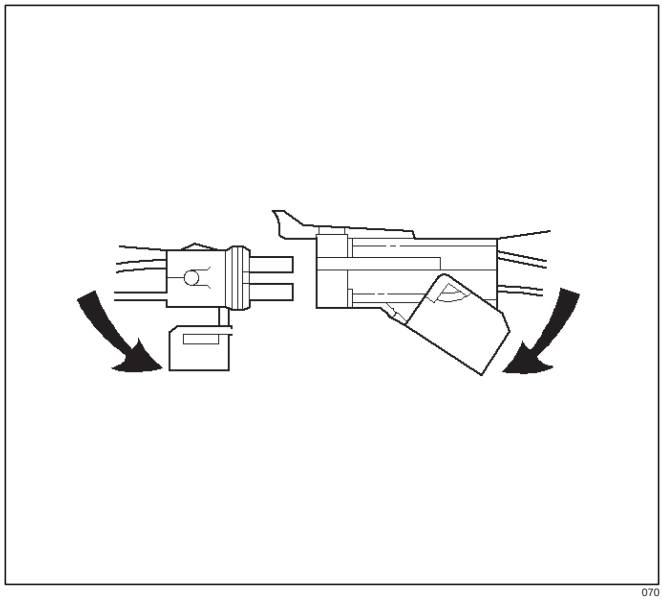
Tools Required

J 28742-A Weather-Pack II Terminal Remover

Removal Procedure

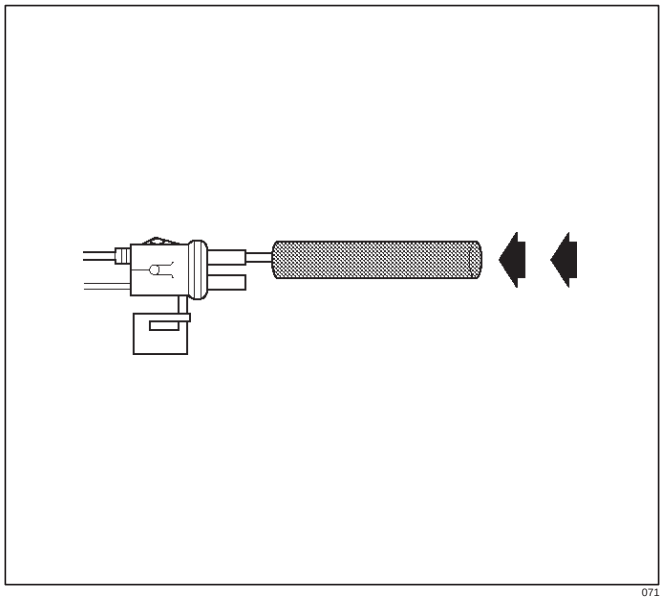
A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could form oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

1. Open the secondary lock hinge on the connector.

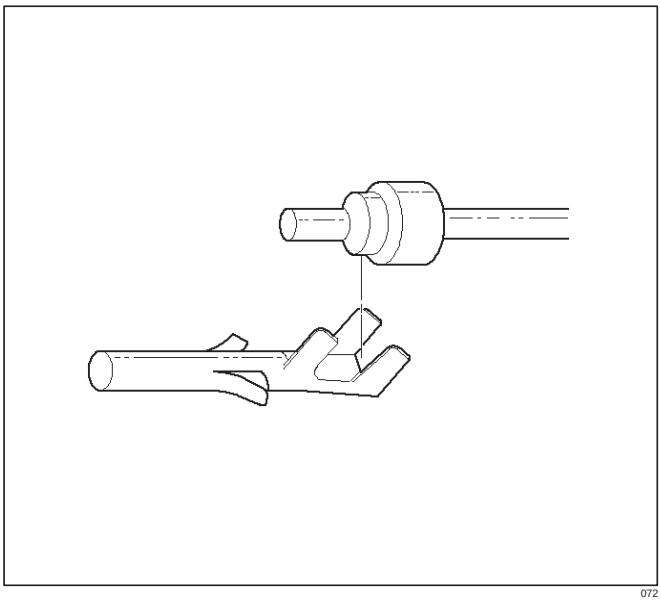


2. Use tool J 28742-A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742-A to release.

NOTE: Do the use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



3. Cut the wire immediately behind the cable seal.

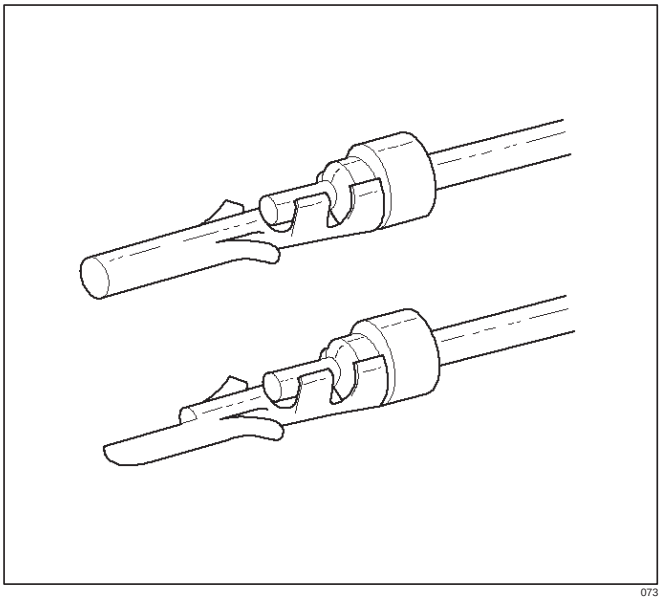


Installation Procedure

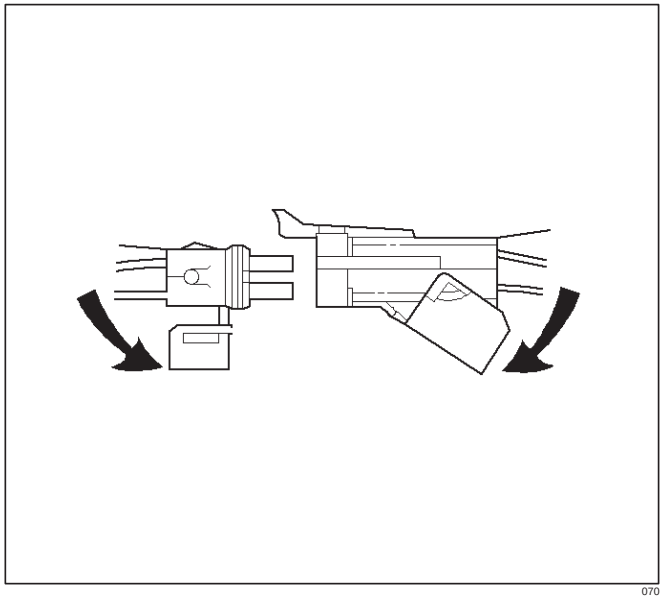
Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



5. Push the terminal and the connector to engage the locking tangs.



6. Close the secondary locking hinge.

Com-Pack III

General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or equivalent. These will damage the terminals.

Metri-Pack

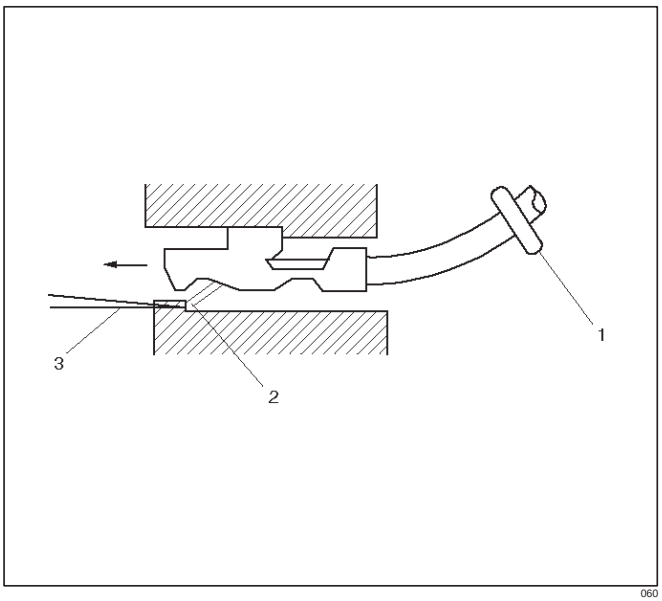
Tools Required

J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).

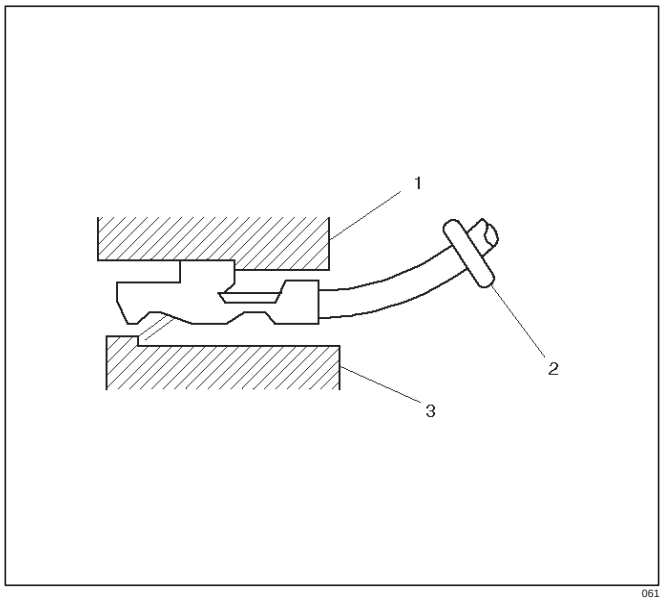


3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

Installation Procedure

Metri-Pack terminals are also referred to as “pull-to-seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.



3. Then the terminal is pulled back into the connector to seat it in place.

General Description (PCM and Sensors)

58X Reference PCM Input

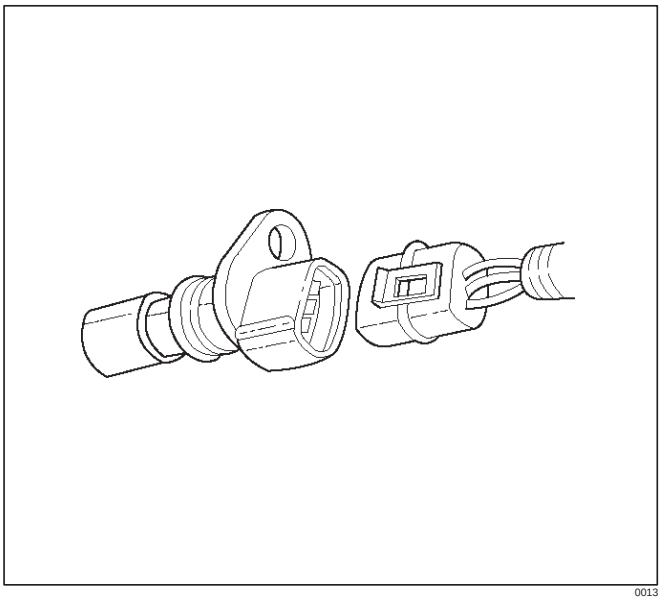
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning “ON” the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for the A/C electrical system.

Crankshaft Position (CKP) Sensor

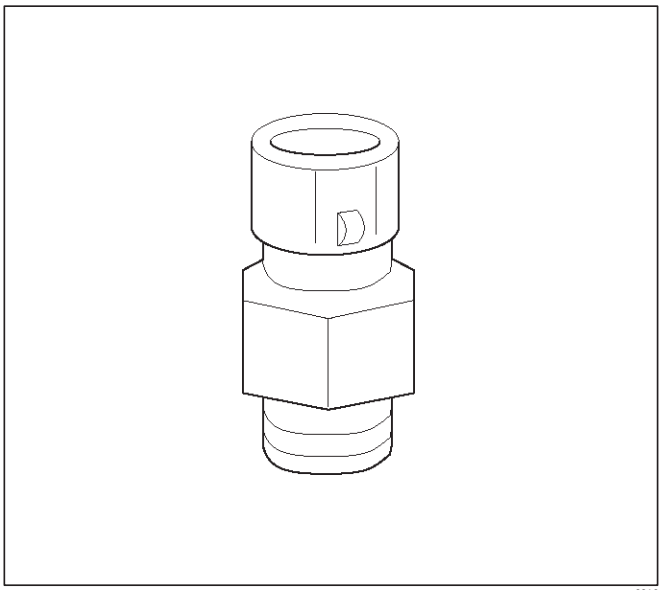
The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position.
Refer to *Electronic Ignition System* section for additional information.



0013

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes a low resistance of 70 ohms at 130˚C (266˚F). The PCM supplies a 5-volt signal to the ECT sensor through resistors in the PCM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.
The Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85˚C (185˚F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0177 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

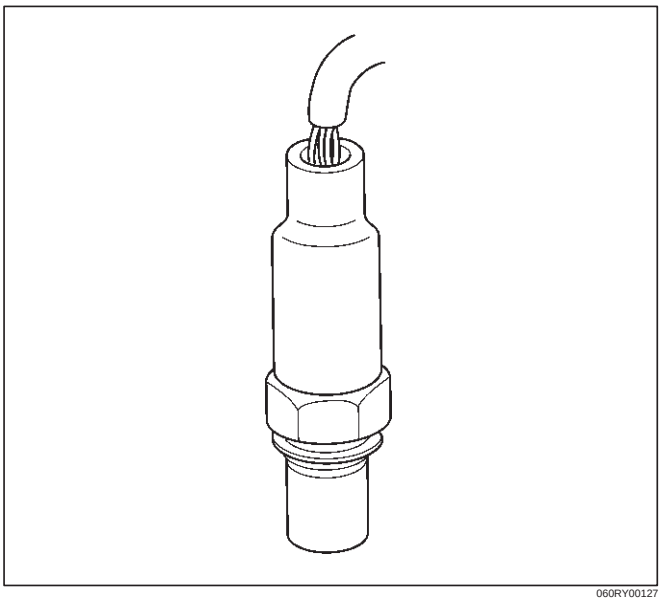
The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensors

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust stream where they can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400-500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. Faults in the Bank 2 HO2S 1 signal circuit will cause DTC 0154 (open circuit), DTC P0151 (grounded circuit), or DTC P0152 (signal voltage high) to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. A fault in the Bank 2 HO2S 1 heater circuit will cause DTC P0155 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.



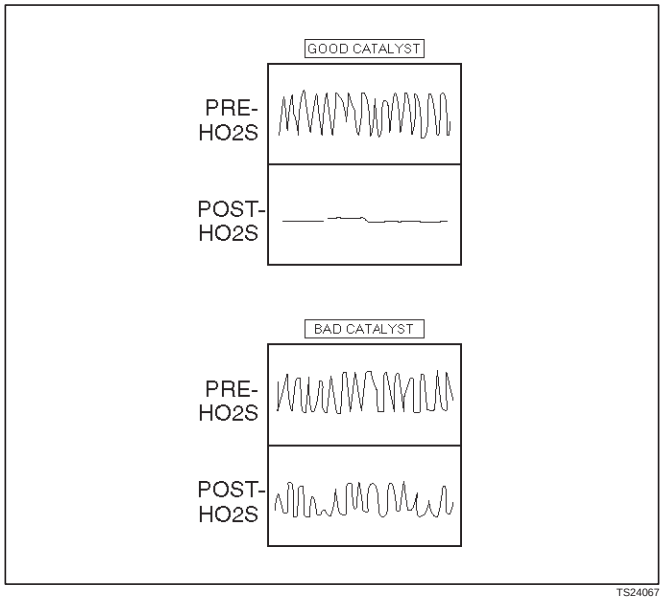
060RY00127

Catalyst Monitor Heated Oxygen Sensors

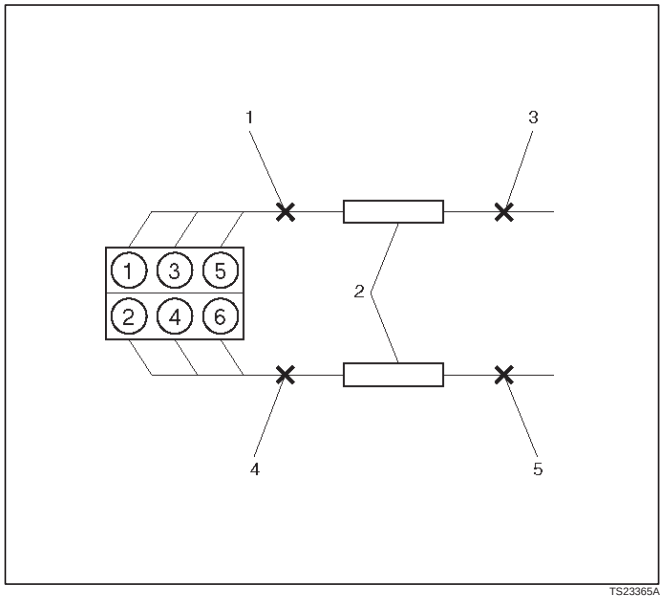
Three-way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The PCM can monitor this process using the Bank 1 HO2S 2 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 and the Bank 2 HO2S 1 sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors produce an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 and the Bank 2 HO2S 1 signals will be more active than the signals produced by the Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, or P0140, depending on the specific condition. A problem with the Bank 2 HO2S 2 signal circuit will set DTC P0157, P0158, or P0160, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower sensor response. This may cause incorrect catalyst monitor diagnostic results.



TS24067



TS23365A

Legend

(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)
(4) Bank 2 Sensor 1 (Fuel Control)
(5) Bank 2 Sensor 2 (Catalyst Monitor)

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high

resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes low resistance of 70 ohms at 130˚C (266˚F) . The PCM supplies a 5-volt signal to the sensor through a resistor in the PCM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.

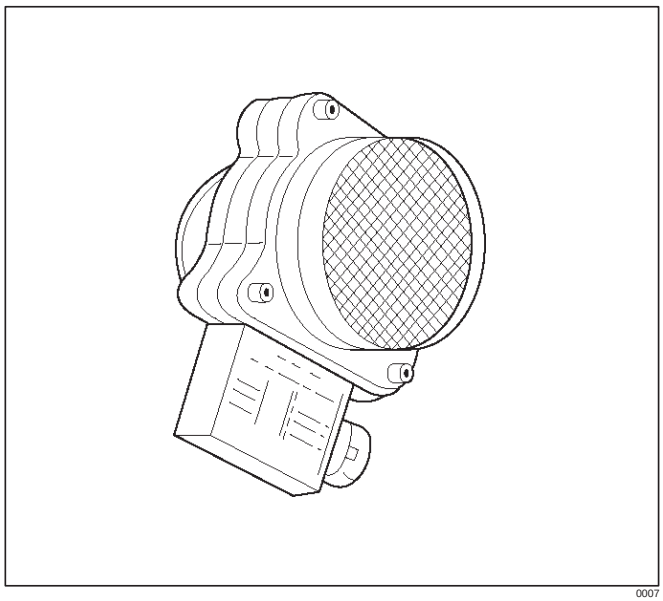
Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the difference between the volume and the quantity of air that enters the engine. “Volume” means the size of the space to be filled. “Quantity” means the number of air molecules that will fit into the space. This information is important to the PCM because heavier, denser air will hold more fuel than lighter, thinner air. The PCM adjusts the air/fuel ratio as needed depending on the MAF value. The Tech 2 reads the MAF value and displays it in terms of grams per second (gm/s). At idle, the Tech 2 should read between 4-7 gm/s on a fully warmed up engine. Values should change quickly on acceleration. Values should remain stable at any given RPM. A failure in the MAF sensor or circuit will set DTC P0101, DTC P0102, or DTC P0103.



0007

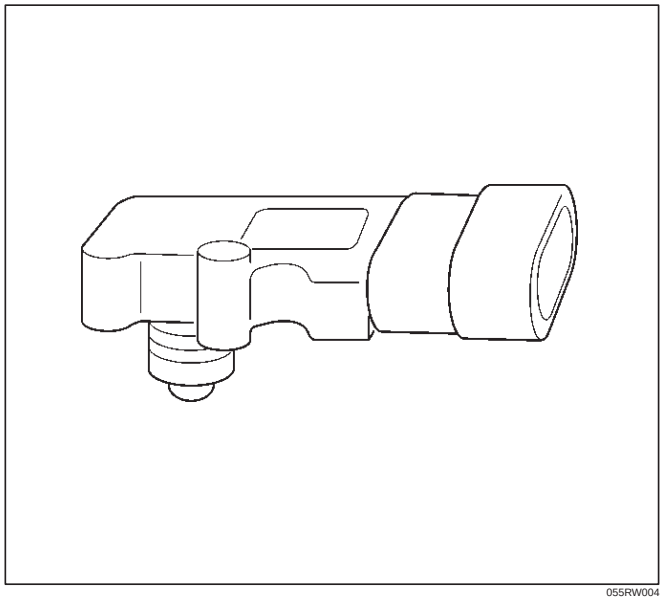
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to *DTC P0401*.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.



055RW004

Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

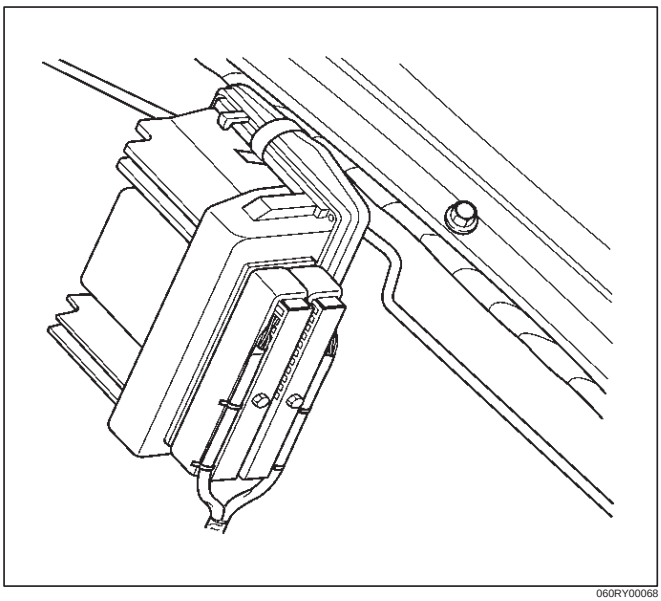
- Fuel metering system.
- Transmission shifting (automatic transmission only).
- Ignition timing.
- On-board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Check Engine lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement. The PCM controls output circuits such as the injectors, fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)



060RY00068

PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- ION sensing module
- Automatic transmission shift functions
- Cruise control
- Evaporative emission (EVAP) purge
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the PCM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON.” These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

PCM Input/Outputs

Inputs – Operating Conditions Read

- Air Conditioning “ON” or “OFF”
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Mass Air Flow
- Engine Knock
- Acceleration Position

Outputs – Systems Controlled

- EVAP Canister Purge
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Control
- ION Sensing Module
- Electric Fuel Pump
- Air Conditioning

▼ Diagnostics
  – Malfunction Indicator Lamp
  – Data Link Connector (DLC)
  – Data Output
▼ Transmission Control Module

PCM Service Precautions

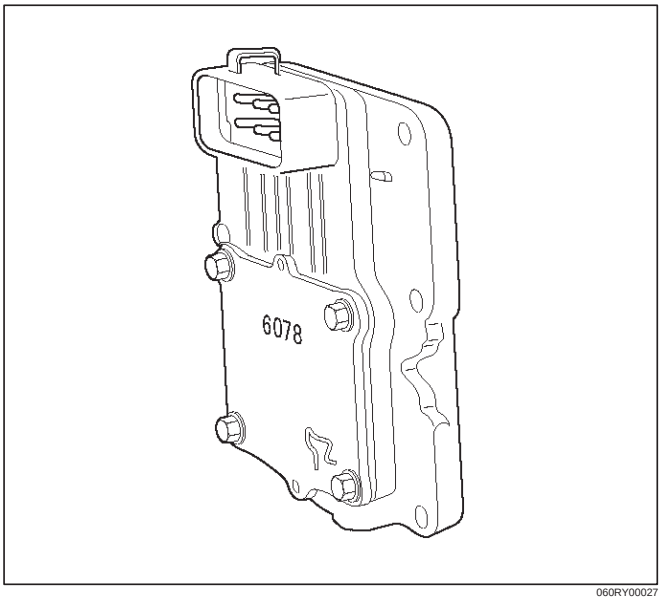
The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.

Reprogramming The PCM

Reprogramming of the PCM is done without removing it from the vehicle . This provides a flexible and cost-effective method of making changes in software calibrations.
Refer to the latest Techline information on reprogramming or flashing procedures.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP1 sensor is low. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be above 92% (Tech 2 Display).
The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving.



060RY00027

Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is a thermistor which changes its resistance based on the temperature of the transmission fluid. For a complete description of the TFT sensor, refer to *4L30-E Automatic Transmission Diagnosis* section.
A failure in the TFT sensor or associated wiring will cause DTC P0712 or DTC P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value and the transmission will operate normally.

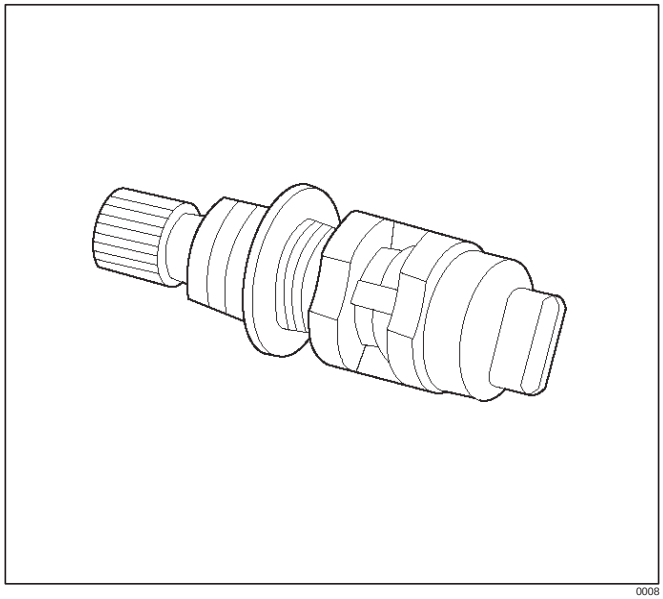
Transmission Range Switch (Mode Switch)

IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR operation.
For more information on the transmission on the transmission range switch, refer to *4L30-E Automatic Transmission* section.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a pulsing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the cruise control, speedometer, and the TCC and shift solenoids in the transmission. For more information on the TCC and shift solenoids, refer to *4L30-E Automatic Transmission* section.


0008

Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

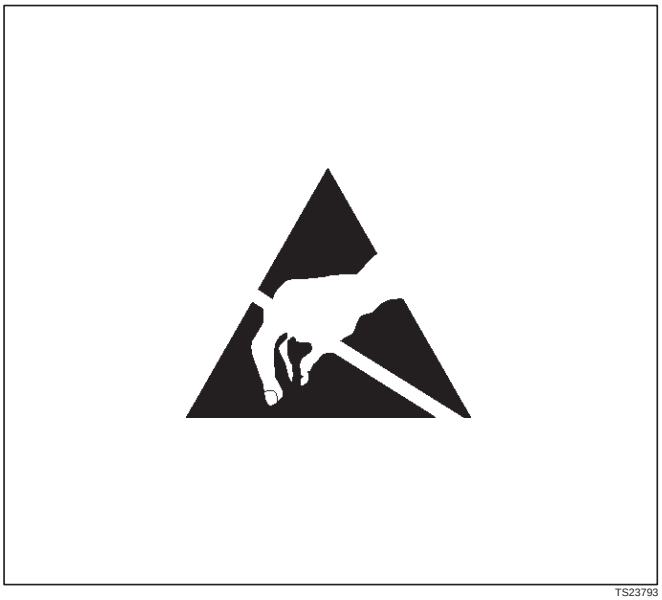
NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.



TS23793

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentary touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

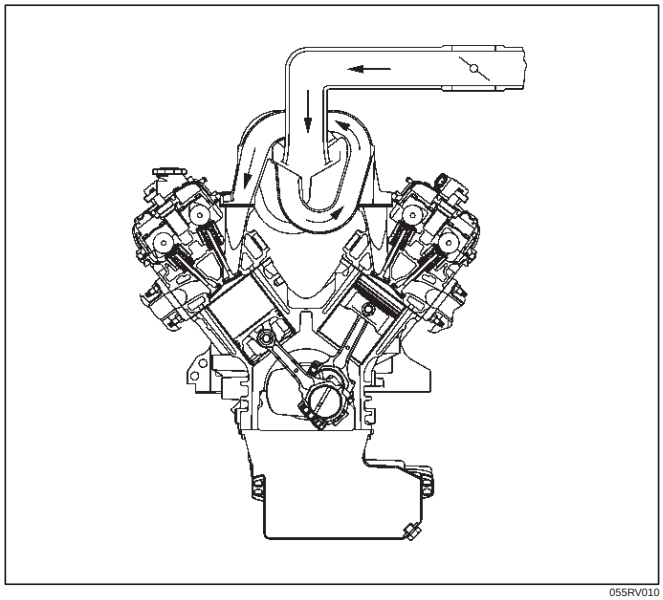
- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

General Description (Air Induction)

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by to following steps:

1. Through the throttle body.
2. Into the common chamber.
3. Through the cylinder head intake ports.
4. Into the cylinders.



055RV010

General Description (Fuel Metering)

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.
- Ignition dwell time.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de-energizes the fuel injectors. The PCM holds the fuel injectors de-energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors “ON” and “OFF,” allowing fuel into the cylinders.

Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increases above 6400 RPM. The fuel injectors are turned back on when engine speed decreases below 6150 RPM.

Fuel Cutoff Mode

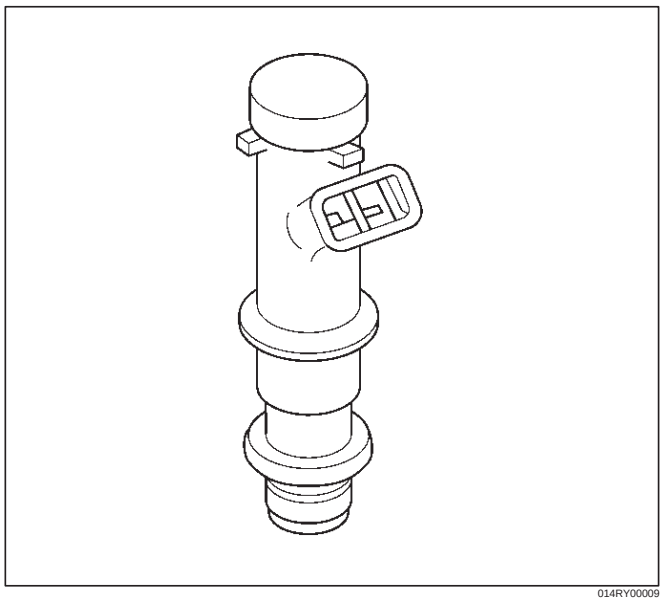
No fuel is delivered by the fuel injectors when the ignition is “OFF.” This prevents engine run-on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid-operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



014RY00009

Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.
- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The ION sensing module.
- The fuel pump.
- The fuel pump relay.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to *Section 6C* for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

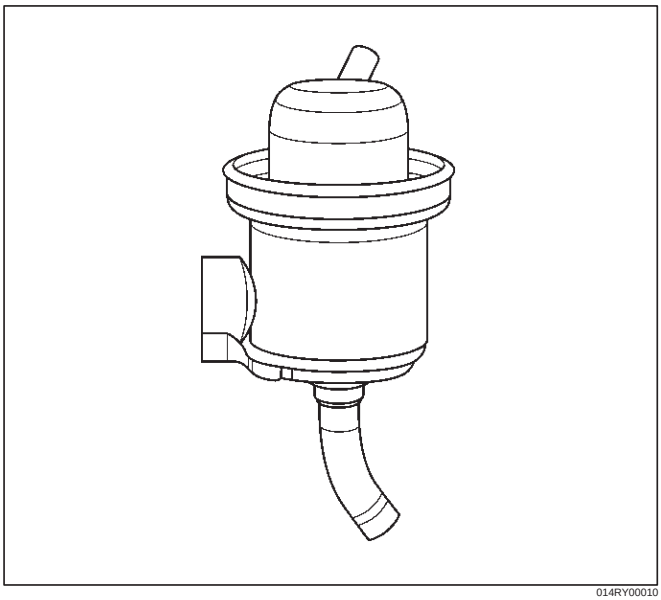
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that fuel injector is “ON.” The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a “closed loop” system.

The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called “modes.” All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm-operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separtely.

If the pressure is too low, poor performance and a DTC P0131, DTC P0151,DTC P0171 or DTC P1171 will be the result. If the pressure is too high, excessive odor and/or a DTC P0132, DTC P0152,DTC P0172 will be the result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.



014RY00010

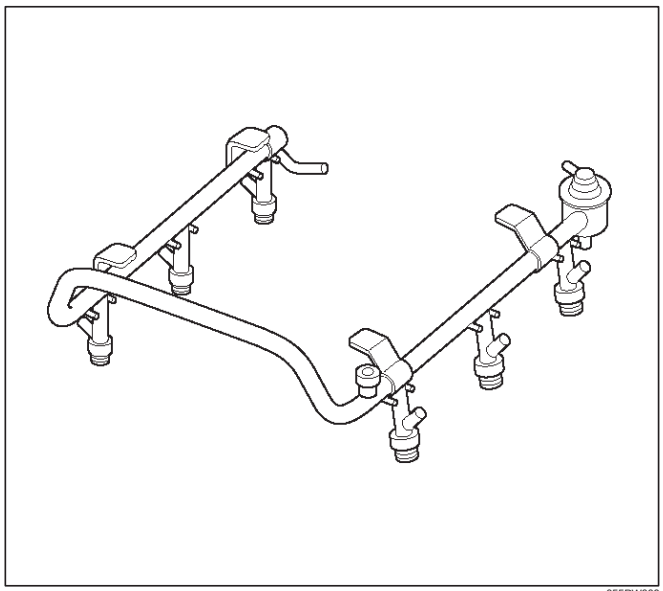
Fuel Pump Electrical Circuit

When the key is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58 X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in-tank fuel pump.

An inoperative fuel pump will cause a “no-start” condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



055RW009

Run Mode

The run mode has the following two conditions:

- Open loop
- Closed loop

When the engine is first started the system is in “open loop” operation. In “open loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in “open loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start-up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters “closed loop” operation. In “closed loop,” the PCM calculates the air/fuel ratio (injector on-time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

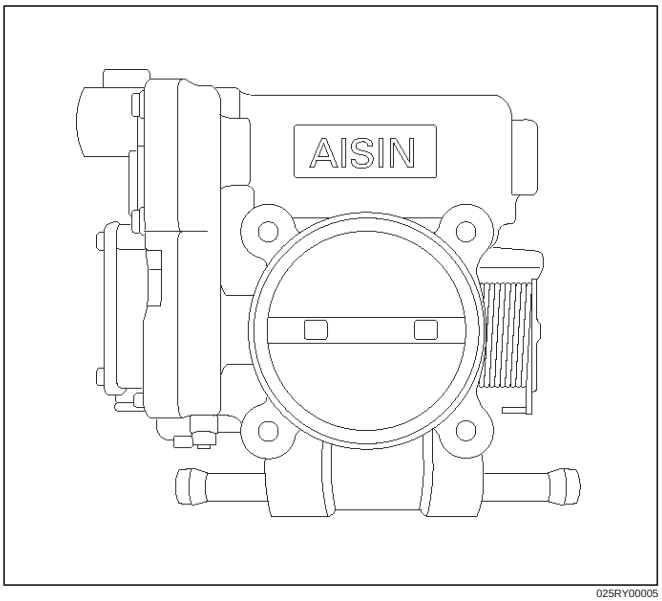
Starting Mode

When the ignition is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor are also mounted on the throttle body. Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components.
Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.



025RY00005

General Description (Electronic Ignition System)

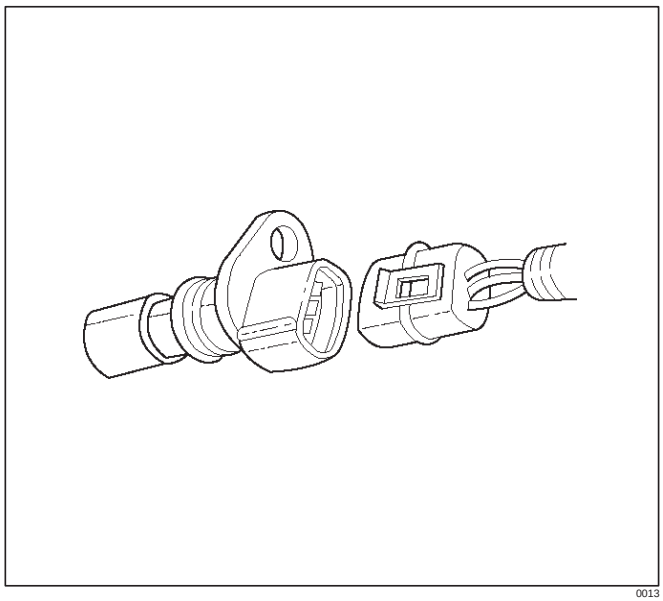
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. Refer to *Electronic Ignition System* section for additional information.

Electronic Ignition

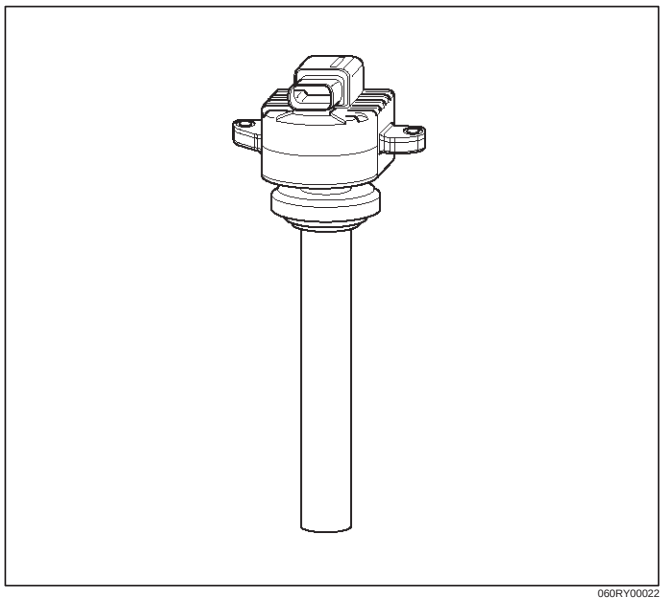
The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.


0013

Ignition Coils

A separate coil-at-plug module is located at each spark plug. The coil-at-plug module is attached to the engine with two screws. It is installed directly to the spark plug by an electrical contact inside a rubber boot. A three-way connector provides 12-volt primary supply from the 15-amp ignition fuse, a ground-switching trigger line from the PCM, and a ground.

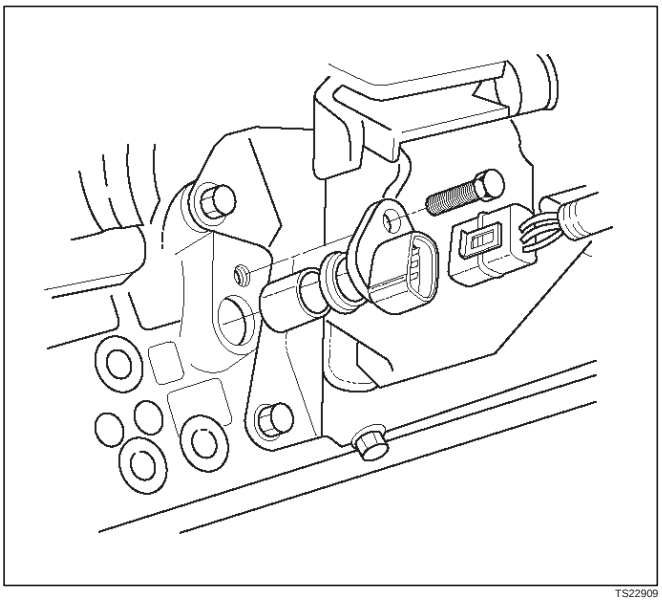

060RY00022

Ignition Control

The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell. The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

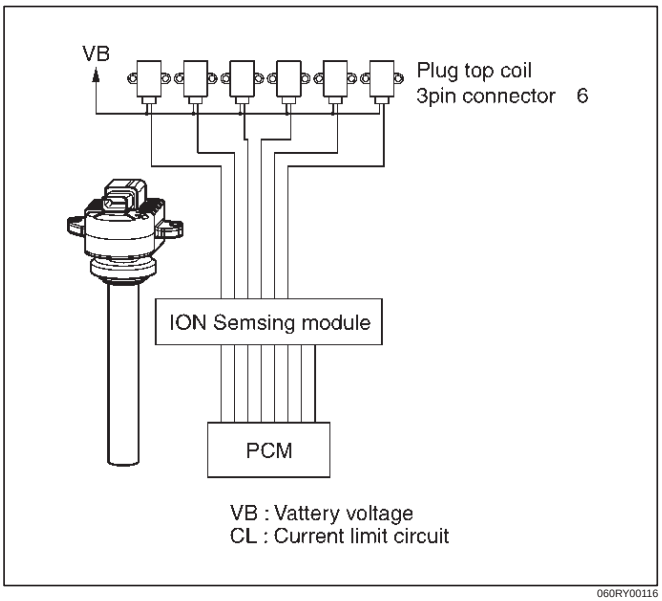
- Engine speed.
- Crankshaft position (58X reference).
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- ION sensing module.
- Park/Neutral position (PRNDL input).

- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.
- The crankshaft position (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.



TS22909

Based on these sensor signals and engine load information, the PCM sends 5V to each ignition coil.



060RY00116

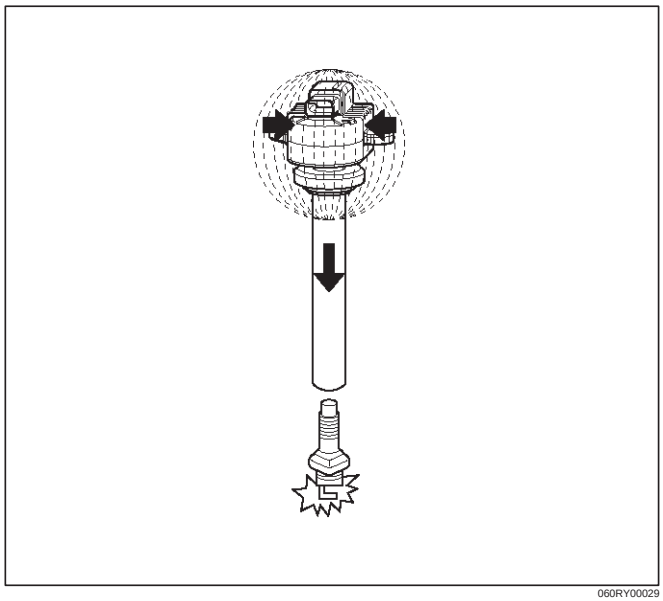
This module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The Throttle PCM controls ignition timing and dwell time.

Continuity and out-or-range value check:

This diagnosis detects open circuit or short-circuiting in the Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

Diagnosis enabling conditions are as follows:

- RPM is higher than the specified threshold.
- EST line is enabled.



060RY00029

Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5-volt output signal to the ignition control (IC) module. Each spark plug has its own primary and secondary ignition coil assembly (”coil-at-plug”) located at the spark plug itself. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil-at -plug module. When the PCM shuts off the 5-volt signal to the ION sensing module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

The circuit between the PCM and the ignition coil is monitored for open circuits, shorts to voltage, and shorts to ground. If the PCM detects one of these events, it will set one of the following DTCs:

- P0351: Ignition coil Fault on Cylinder #1
- P0352: Ignition coil Fault on Cylinder #2
- P0353: Ignition coil Fault on Cylinder #3
- P0354: Ignition coil Fault on Cylinder #4
- P0355: Ignition coil Fault on Cylinder #5
- P0356: Ignition coil Fault on Cylinder #6

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Mass air flow (MAF) sensor.
- PRNDL input from transmission range switch.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS) .

▼ Crankshaft position (CKP) sensor.

Spark Plug

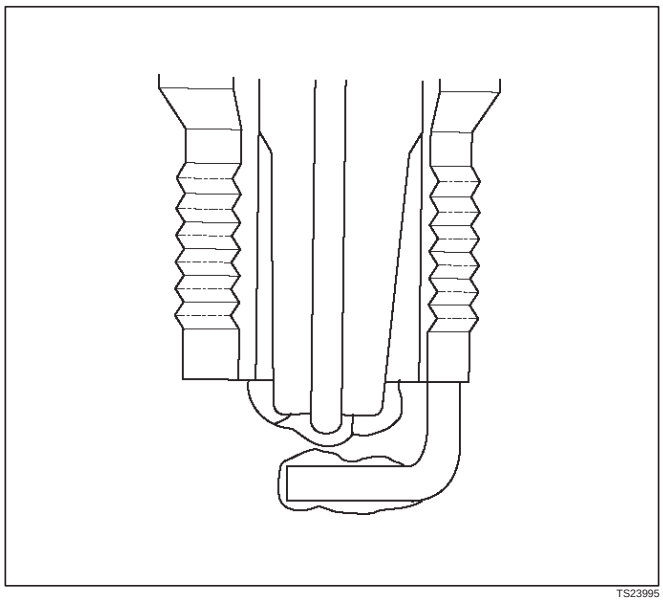
Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequency fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to *Maintenance and Lubrication* section.

Normal spark plug operation will result in brown to grayish-tan deposits appearing on the insulator portion of the spark plug. A small amount of red-brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by-products of fuels and lubricating oils with additives. Some electrode wear will also occur. Engines which are not running properly are often referred to as “misfiring.” This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to *DTC P0300*. Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as “pre-ignition.”

Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

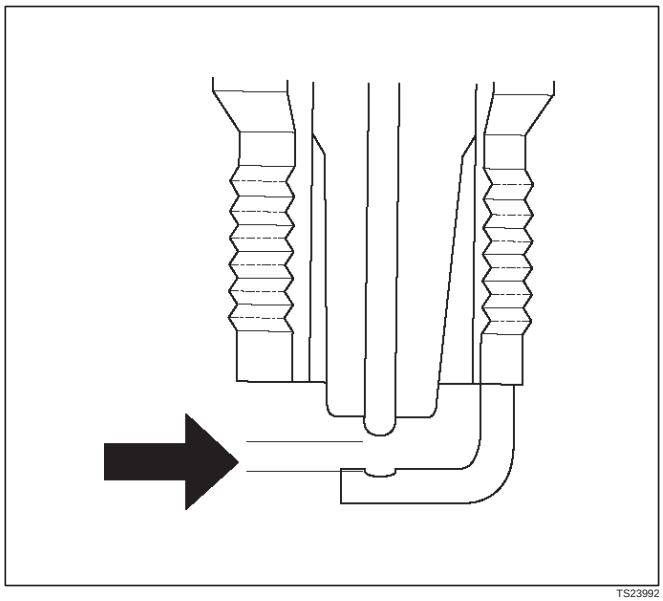
Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause. Refer to DTC P0172.

Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break-in of new or newly overhauled engines. Deposit fouling of the spark plug occurs when the normal red-brown, yellow or white deposits of combustion by products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.



TS23995

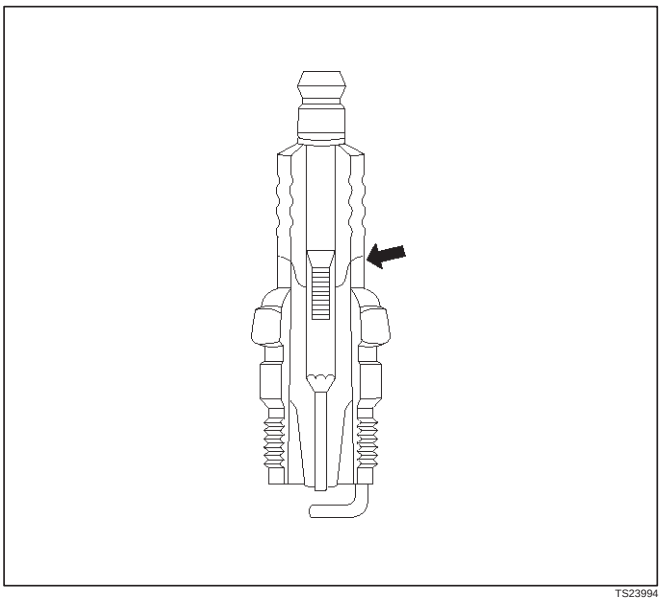
Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.



TS23992

Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact

between the seats. In extreme cases, exhaust blow-by and damage beyond simple gap wear may occur.
Cracked or broken insulators may be the result of improper installation, damage during spark plug re-gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.


TS23994

A/C Clutch Diagnosis

A/C Clutch Circuit Operation

A 12-volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.
The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The throttle is greater than 90%.
- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119˚C (246˚F).
- The IAT is less than 5˚C (41˚F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improvises idle quality during compressor clutch engagement.
- It improvises wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

- The A/C control head.
- The A/C refrigerant pressure switches.
- The A/C compressor clutch.
- The A/C compressor clutch relay.
- The PCM.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for A/C electrical system.

General Description (Evaporative (EVAP) Emission System)

EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled “TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60˚C (140˚F), the IAT reading is over 10˚C (50˚F), and the engine has been running. Air is drawn into the canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse-width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle positron, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

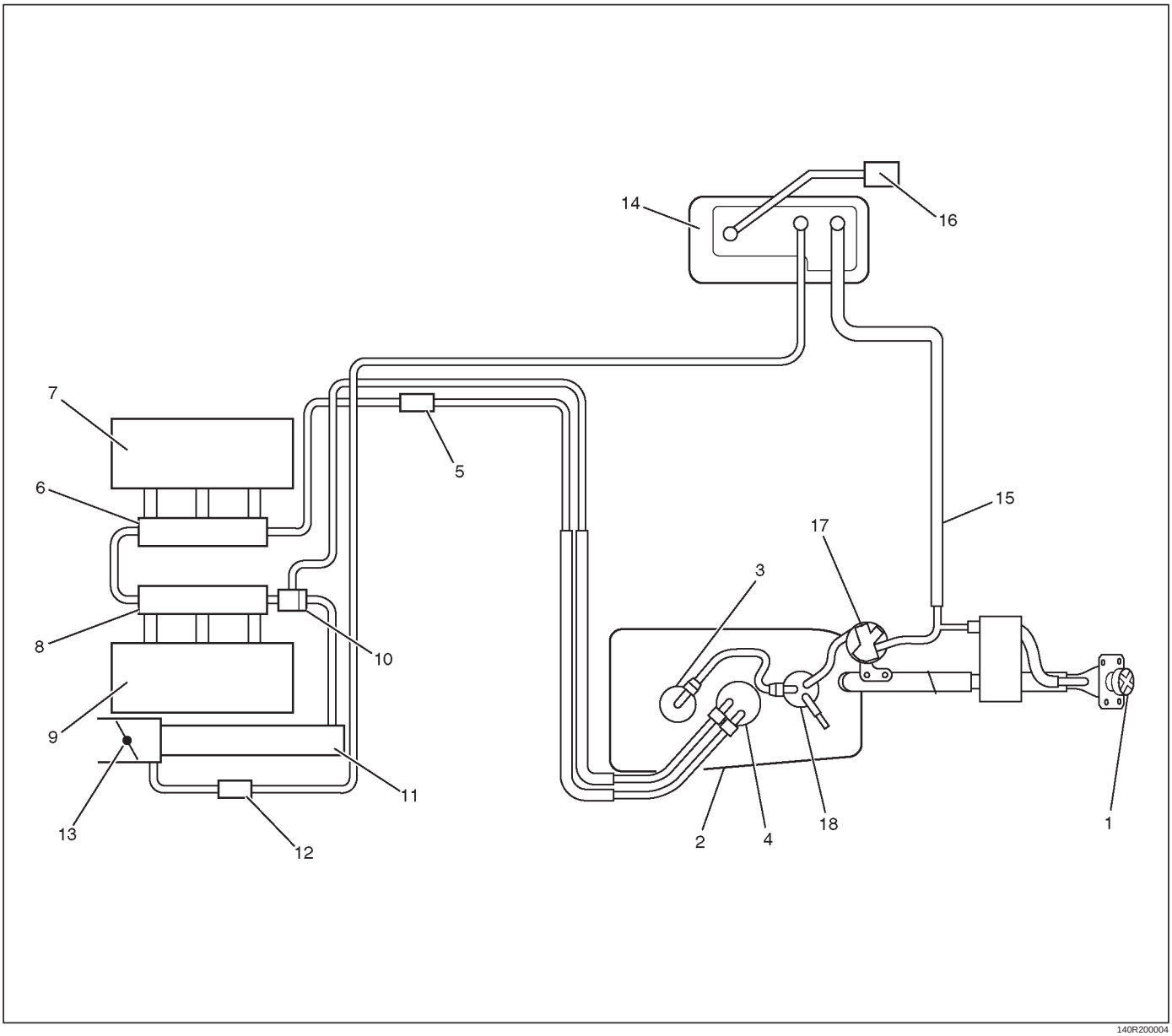
- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10˚C (50˚F).

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441.
Poor idle, stalling and poor driveability can be caused by:

- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal-filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold.
The difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.
The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.020 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub-tests to detect fault conditions. If the diagnostic fails a sub-test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of detected.



140R200004

Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve (EVAP Purge Solenoid)
(13) Throttle Valve
(14) Canister (EVAP Canister)
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve) and Vapor Pressure Sensor

Electrical Components

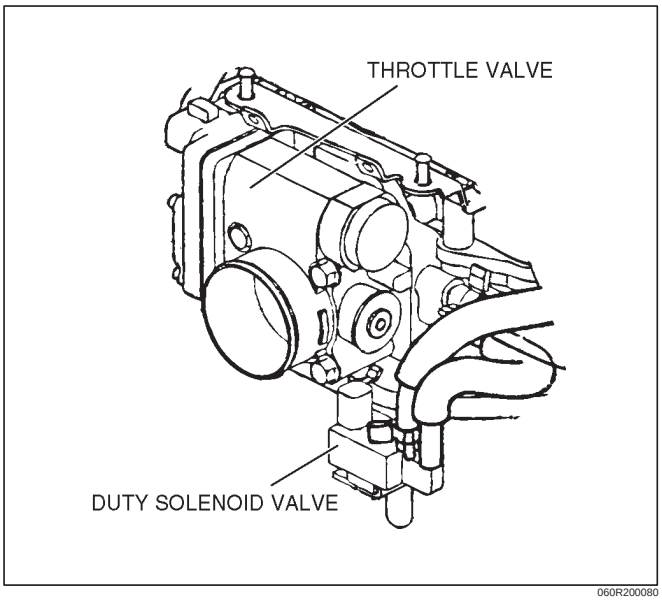
The electrical components that make up the enhanced EVAP system are:

▼ Fuel Tank (Vapor) Pressure Sensor. The fuel tank pressure sensor is a three-wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

The sensor mounts at the top of the fuel pump assembly. A three-wire electrical harness connects it to the PCM. The PCM supplies a five-volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

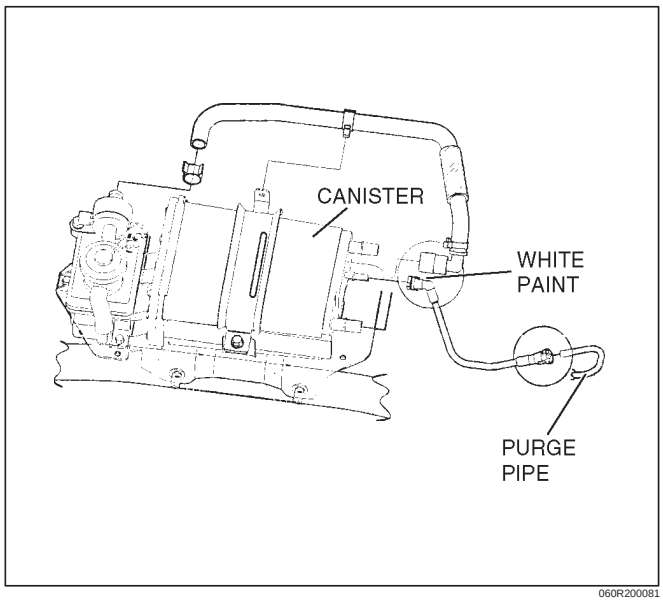
When the air pressure in the fuel tank is 4.5 in. H2O (1.25 kPa), the sensor output voltage will be 0.5 ± 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H2O (–3.75 kPa), the sensor voltage will be 4.5 ± 0.2 V.

▼ EVAP Canister Purge Solenoid. Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on the water pipe to front of the engine assembly.



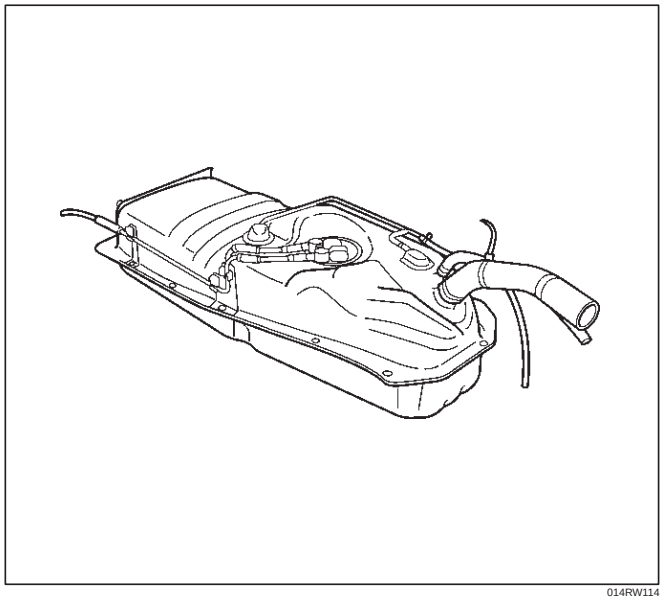
060R200080

▼ EVAP Canister Vent Solenoid. Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.



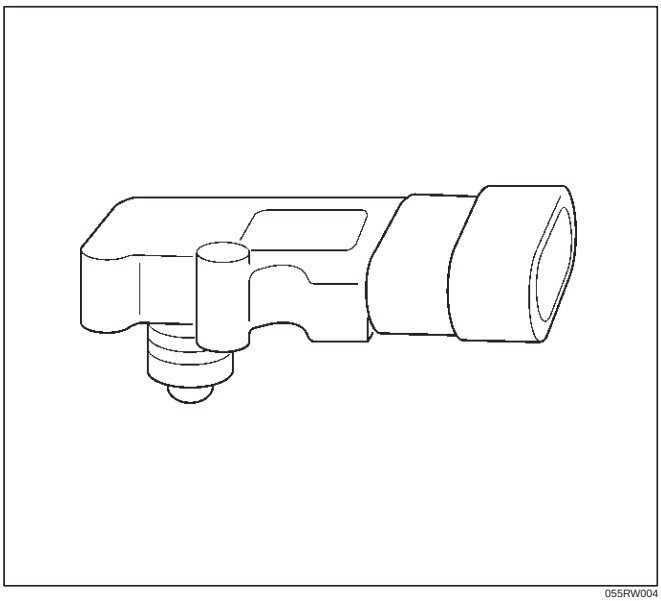
060R200081

▼ Fuel Level Sensor. The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.



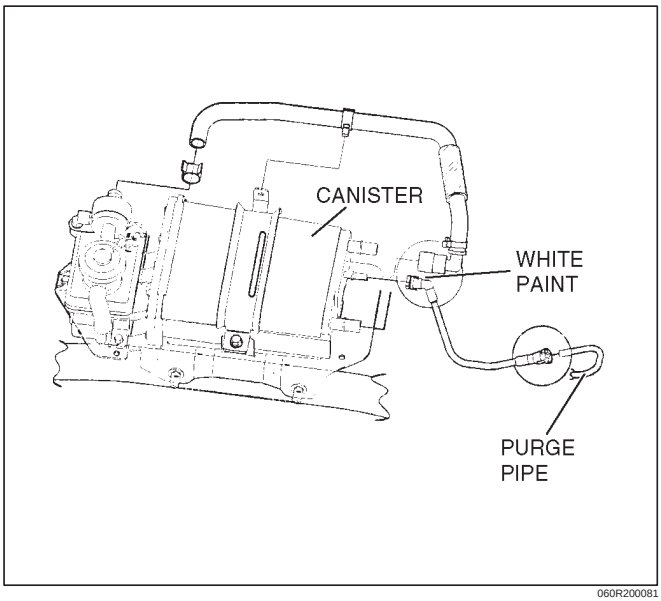
014RW114

▼ Manifold Absolute Pressure (MAP) Sensor. The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained the EVAP system.


055RW004

Non-Electrical Components

- Purge/Vacuum Hoses. Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.
- EVAP Canister. Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be removed and burned.
- Fuel Tank. The tank has a built-in air space designed for the collection of gasoline fumes.



060R200081

- Vacuum Source. The vacuum source is split between two ports, one on either side of the throttle body.
- Fuel Cap. The fuel cap is designed to be an integral part of the EVAP system.

System Fault Detection

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned “ON,” allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning “OFF” the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid “OPEN,” EVAP purge Pulse Width Modulate (PWM) “0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

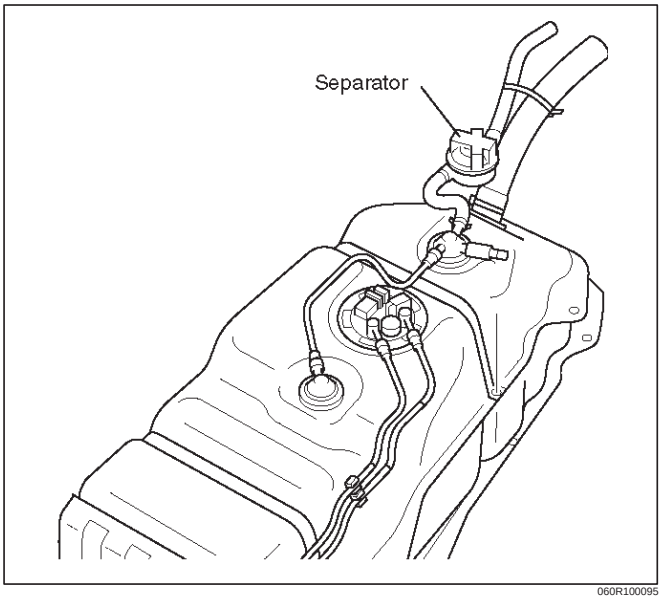
- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge “ON”). The EVAP purge control is PWM, or turned “ON” and “OFF,” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid “ON” and the EVAP purge solenoid “OFF” (EVAP vent solenoid “CLOSED,” EVAP purge PWM “0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be cause by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

Fuel vapor recovery system



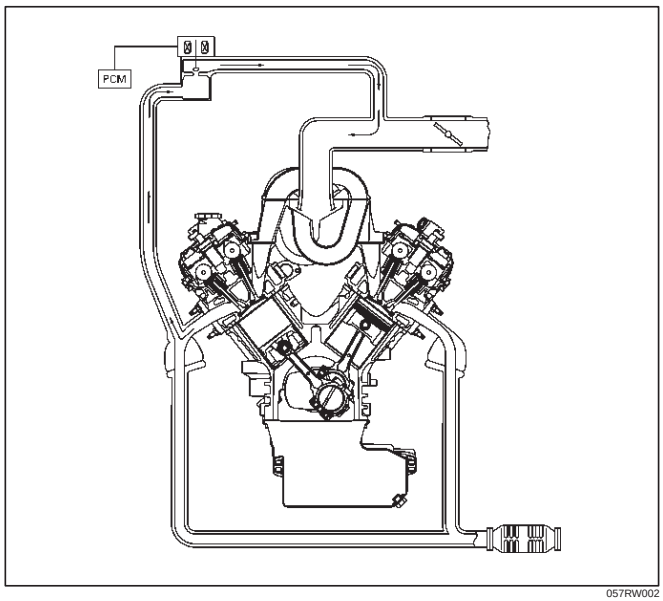
060R100095

Separator attaches after hose evaporative fuel. It protects EVAP Canister from liquid fuel. It guarantees EVAP Canister performance. When vibration bounces fuel level, liquid fuel will accrete to EVAP Canister. It separates liquid fuel.

General Description (Exhaust Gas Recirculation (EGR) System)

EGR Purpose

The exhaust gas recirculation (EGR) system is use to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.



057RW002

Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual positron and adjusts the pintle position accordingly. The uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Linear EGR Valve Operation and Results of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as “Actual EGR Pos.” “Actual EGR Pos.” should always be near the commanded EGR position (”Desired EGR Pos.”). If a problem with the EGR system will not allow the PCM to control the pintle position properly, DTC P1406 will set. The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTCs P0401 and/or P1406 are set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

- Warm engine operation.
- Above-idle speed.

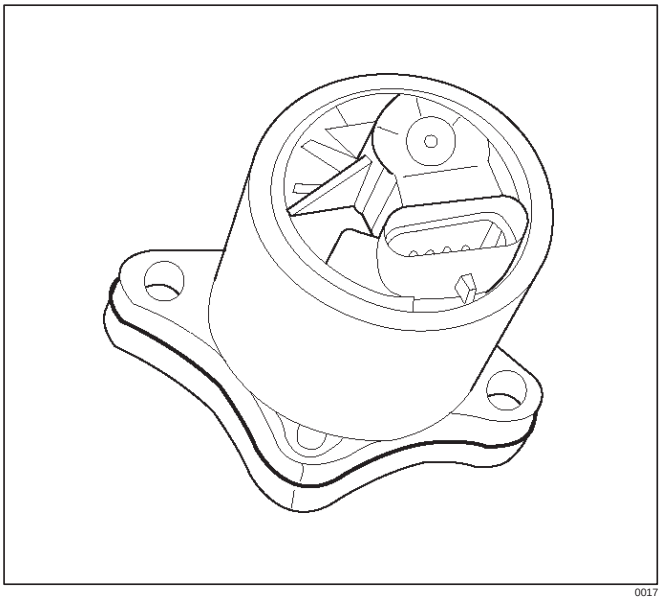
Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.

- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR flow test).
- Poor fuel economy.


0017

EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to endure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1406.

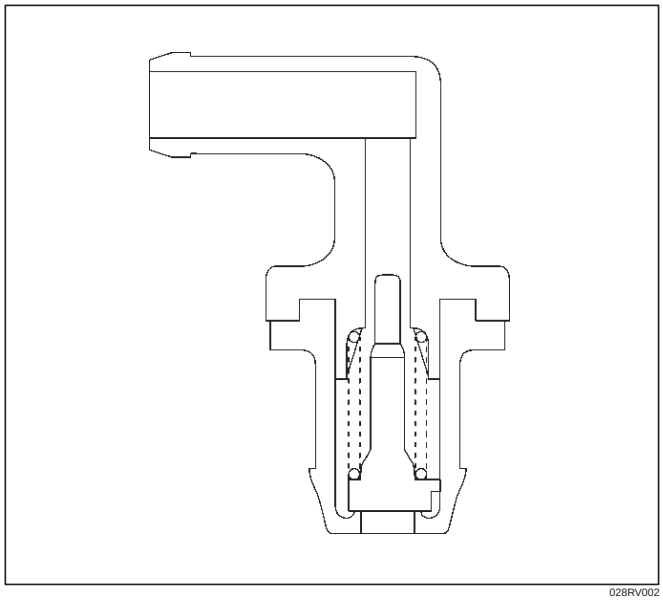
General Description (Positive Crankcase Ventilation (PCV) System)

Crankcase Ventilation System Purpose

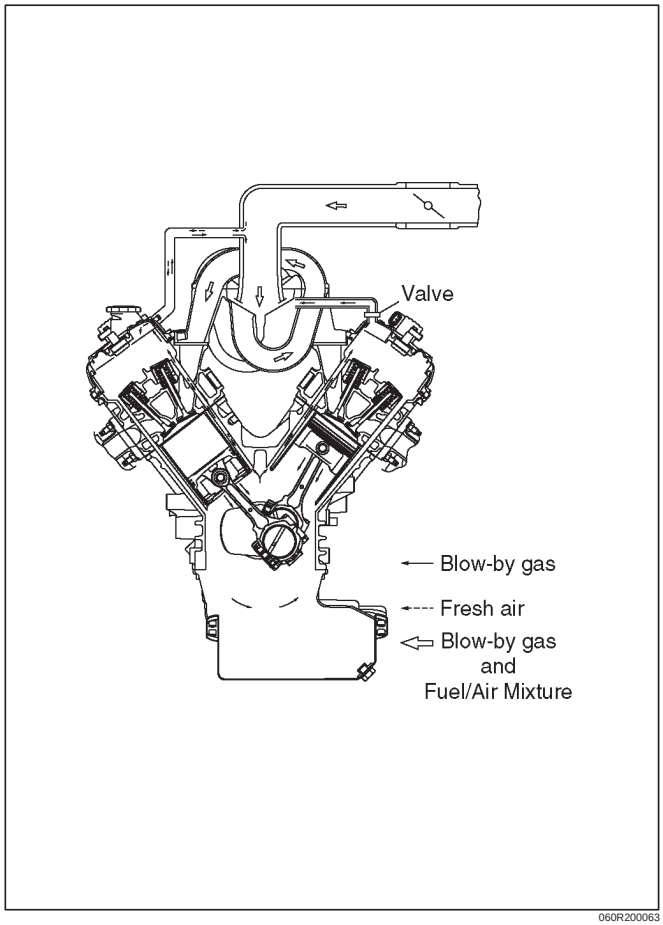
The crankcase ventilation system is use to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow-by gases. This mixture is then passed through the positive crankcase ventilation (PCV) valve into the common chamber.

Crankcase Ventilation System Operation

The primary control is through the positive crankcase ventilation (PCV) valve. The PCV valve meters the flow at a rate that depends on the intake vacuum. The PCV valve restricts the flow when the inlet vacuum is highest. In addition, the PCV valve can seal the common chamber off in case of sudden high pressure in the crankcase.


028RV002

While the engine is running, exhaust fuses and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



060R200063

During normal, part-throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling of slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

Special Tools

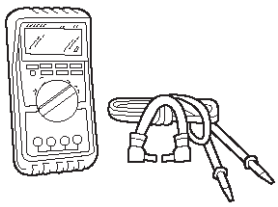
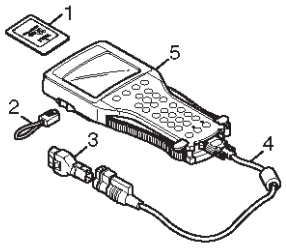
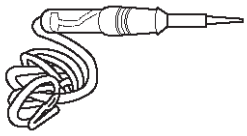
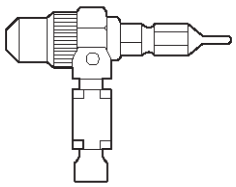
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39200** High Impedance Multimeter (Digital Voltmeter – DVM)
	(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2
	**J 34142-B** Unpowered Test Light
	Connector Test Adapter Kit J 35616-A/BT-8637
	**J 26792/BT-7220-1** Spark Tester
	J 34730-E Port Fuel Injection Diagnostic Kit

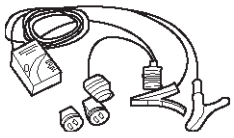
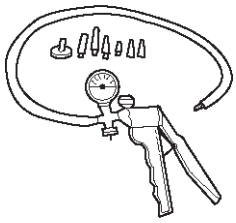
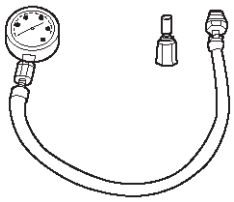
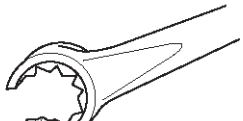
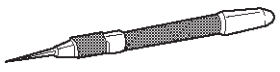
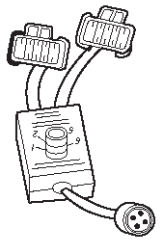
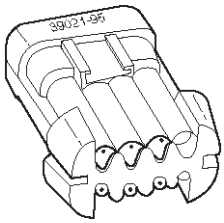
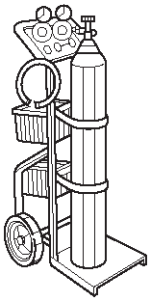
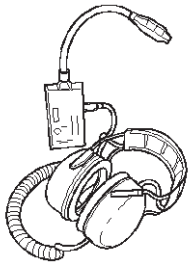
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 37027-A** IAC Motor Analyzer
	**J 23738-A** Vacuum Pump with Gauge
	**BT-8515/8515V** Exhaust Back Pressure Tester
	**J 39194-B** Heated Oxygen Sensor Wrench
	**J 35689-A** Terminal Remover
	J 28742-A Weather Pack II Terminal Remover

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39021-90** Injector Switch Box
	**J 39021-65** Injector Test Light
	**J 41413**[1] EVAP Pressure/Purge Diagnostic Station
	**J 41416**[2] Ultrasonic Leak Detector

1. J 41413 EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. J 41416 Ultrasonic Leak Detector is a microprocessor-based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

AXIOM

ENGINE

ENGINE EXHAUST (6VE1 3.5L)

CONTENTS

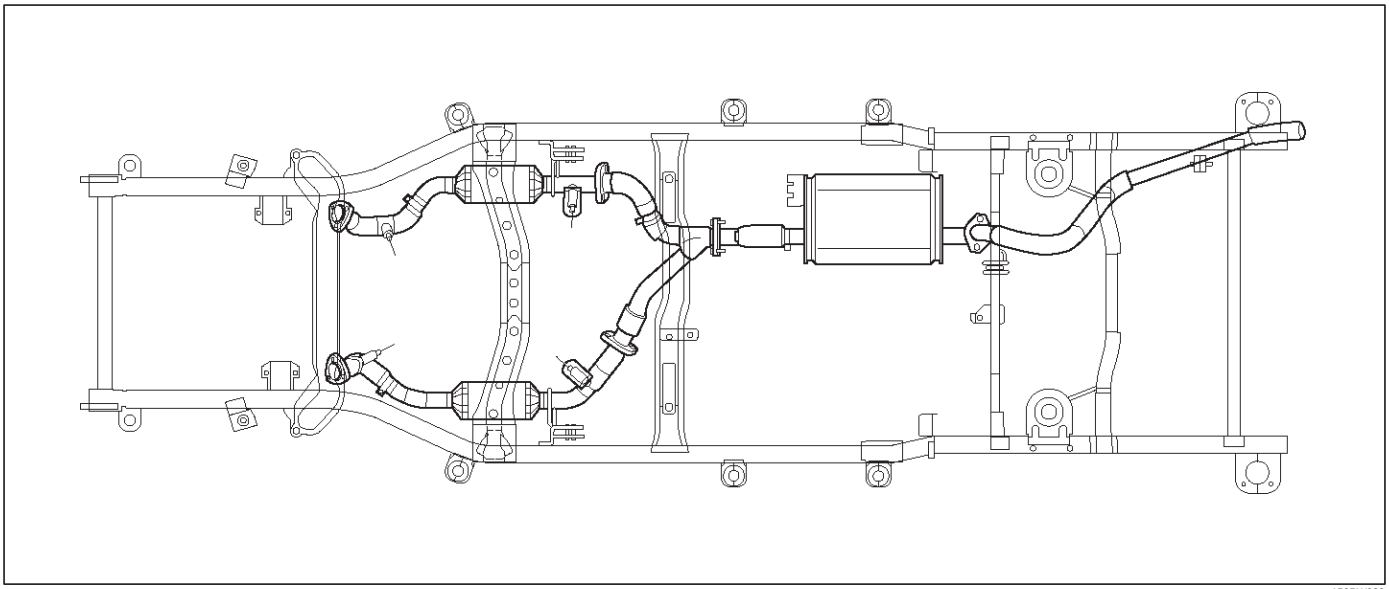
Service Precaution 6F–1
General Description 6F–2
Three Way Catalytic Converter RH and Forked Exhaust Pipe 6F–3
Three Way Catalytic Converter RH and Forked Exhaust Pipe and Associated Parts 6F–3
Removal 6F–3
Installation 6F–3
Three Way Catalytic Converter LH and Forked Exhaust Pipe 6F–4
Three Way Catalytic Converter LH and Forked Exhaust Pipe and Associated Parts 6F–4
Removal 6F–4
Installation 6F–4
Forked Exhaust Pipe 6F–5
Forked Exhaust Pipe and Associated Parts 6F–5
Removal 6F–5
Installation 6F–5
Exhaust Silencer 6F–6
Exhaust Silencer and Associated Parts . . . 6F–6
Removal 6F–6
Installation 6F–6
Rear Exhaust pipe 6F–7
Rear Exhaust pipe and Associated Parts . 6F–7
Removal 6F–7
Installation 6F–7
Main Data and Specifications 6F–8

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



150RW023

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

CAUTION: The catalytic converter requires the use of unleaded fuel only.

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Converter Types:

Three way (Reduction/Oxidation) catalyst

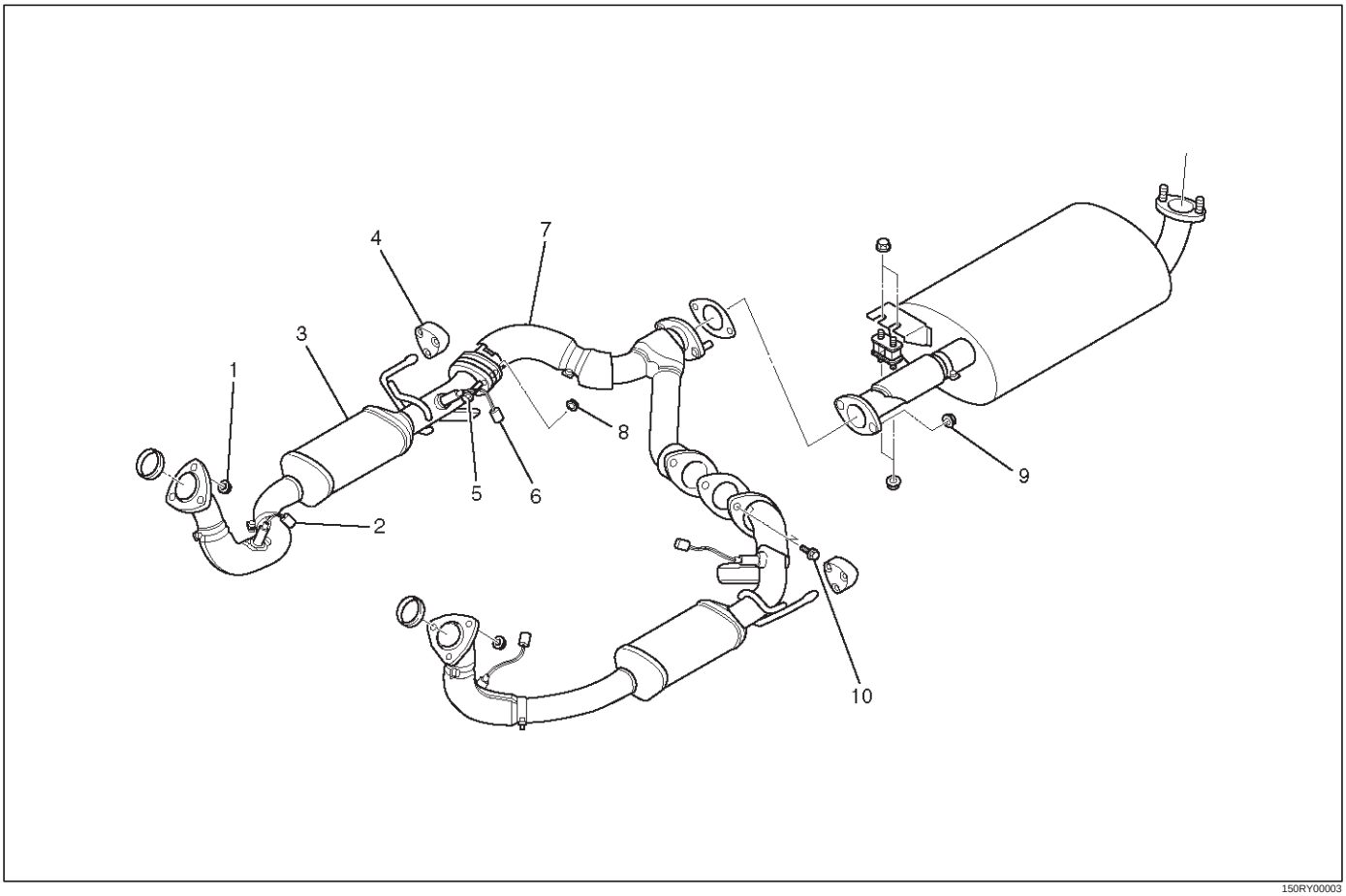
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NOx) as well as hydrocarbons (HC) and carbon monoxide (Co).

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

Three Way Catalytic Converter RH and Forked Exhaust Pipe

Three Way Catalytic Converter RH and Forked Exhaust Pipe and Associated Parts



150RY00003

Legend

(1) Front Exhaust Pipe Assembly Fixing Nuts
(2) O_2 Sensor Terminal Connector
(3) Three Way Catalytic Converter RH
(4) Mounting Rubber
(5) Forked Exhaust Pipe Fixing Bolts
(6) O_2 Sensor Terminal Connector
(7) Forked Exhaust Pipe
(8) Forked Exhaust Pipe Fixing Nuts
(9) Exhaust Silencer Fixing Nuts
(10) Forked Exhaust Pipe Fixing Bolts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect O_2 sensor harness connectors (2) (6).
4. Remove the forked exhaust pipe fixing bolts and nuts (5) (8) (10) and the exhaust silencer fixing nuts (9), then remove the forked exhaust pipe (7) and the mass damper.
5. Remove the front exhaust pipe assembly fixing nuts (1) and the mounting rubber (4), then remove the three way catalytic converter (3).

Installation

1. Install the three way catalytic converter (3) and the mounting rubber (4), and tighten the fixing nuts (1) to the specified torque.

   Torque

   Nuts : 67 N·m (49 lb ft)
2. Install the forked exhaust pipe (7), and tighten the fixing bolts (5) & nuts (8) (9) to the specified torque.

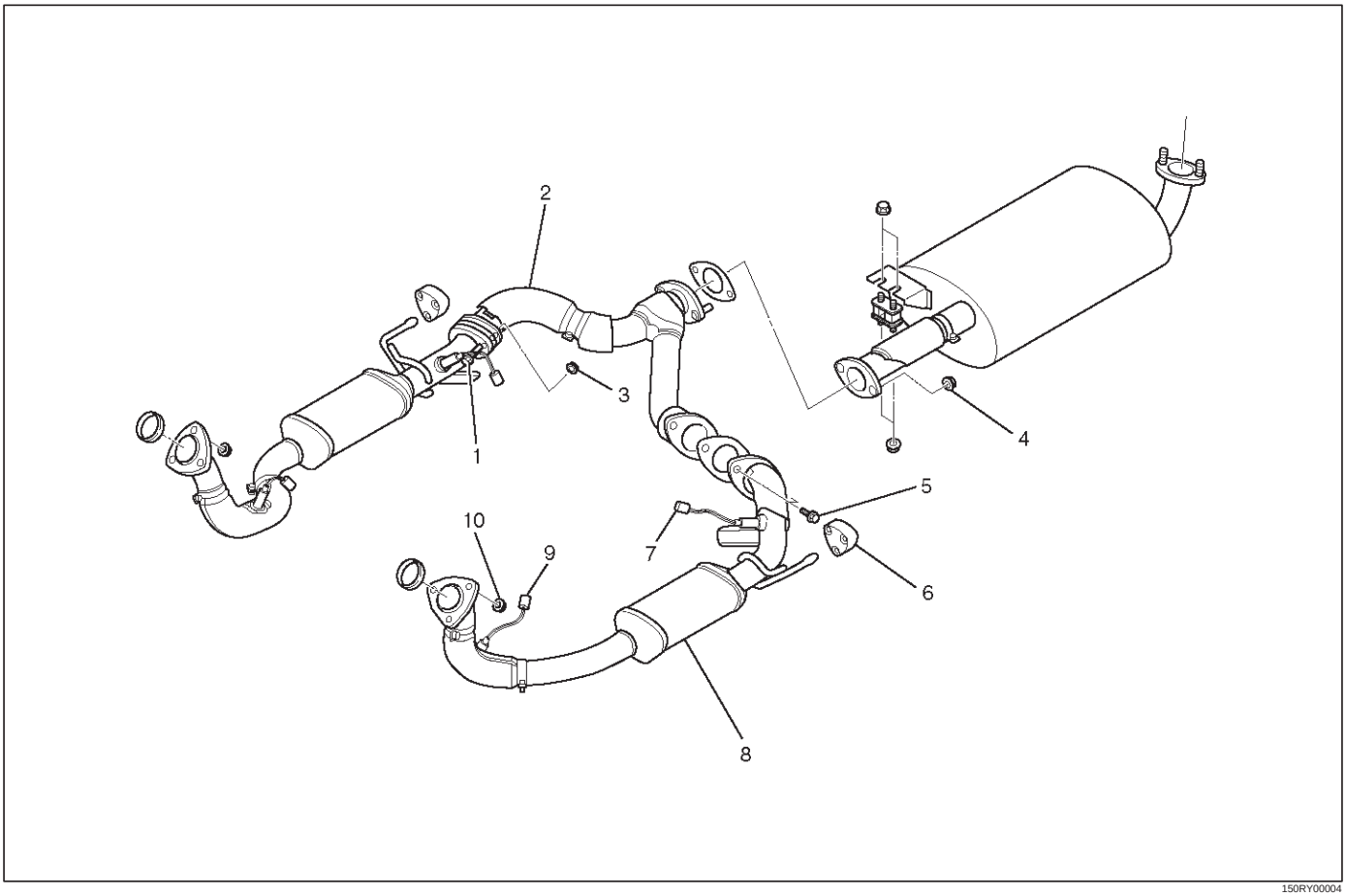
   Torque

   Bolts&Nuts : 43 N·m (32 lb ft)

   Nuts : 43 N·m (32 lb ft)
3. Connect the O_2 sensor connectors (2) (6).

Three Way Catalytic Converter LH and Forked Exhaust Pipe

Three Way Catalytic Converter LH and Forked Exhaust Pipe and Associated Parts



150RY00004

Legend

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts
(6) Mounting Rubber
(7) O_2 Sensor Terminal Connector
(8) Three Way Catalytic Converter LH
(9) O_2 Sensor Terminal Connector
(10) Front Exhaust Pipe Assembly Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect O_2 sensor harness connectors (7) (9).
4. Remove the forked exhaust pipe fixing bolts and nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).
5. Remove the front exhaust pipe assembly fixing nuts (10) and the mounting rubber (6), then remove the three way catalytic converter (8).

Installation

1. Install the three way catalytic converter (8) and the mounting rubber (6), and tighten the fixing nuts (10) to the specific torque.

   Torque

   Nuts: 67 N·m (49 lb ft)
2. Install the forked exhaust pipe (2) and tighten the fixing bolts (1) (5) and nuts (3) (4) to the specified torque.

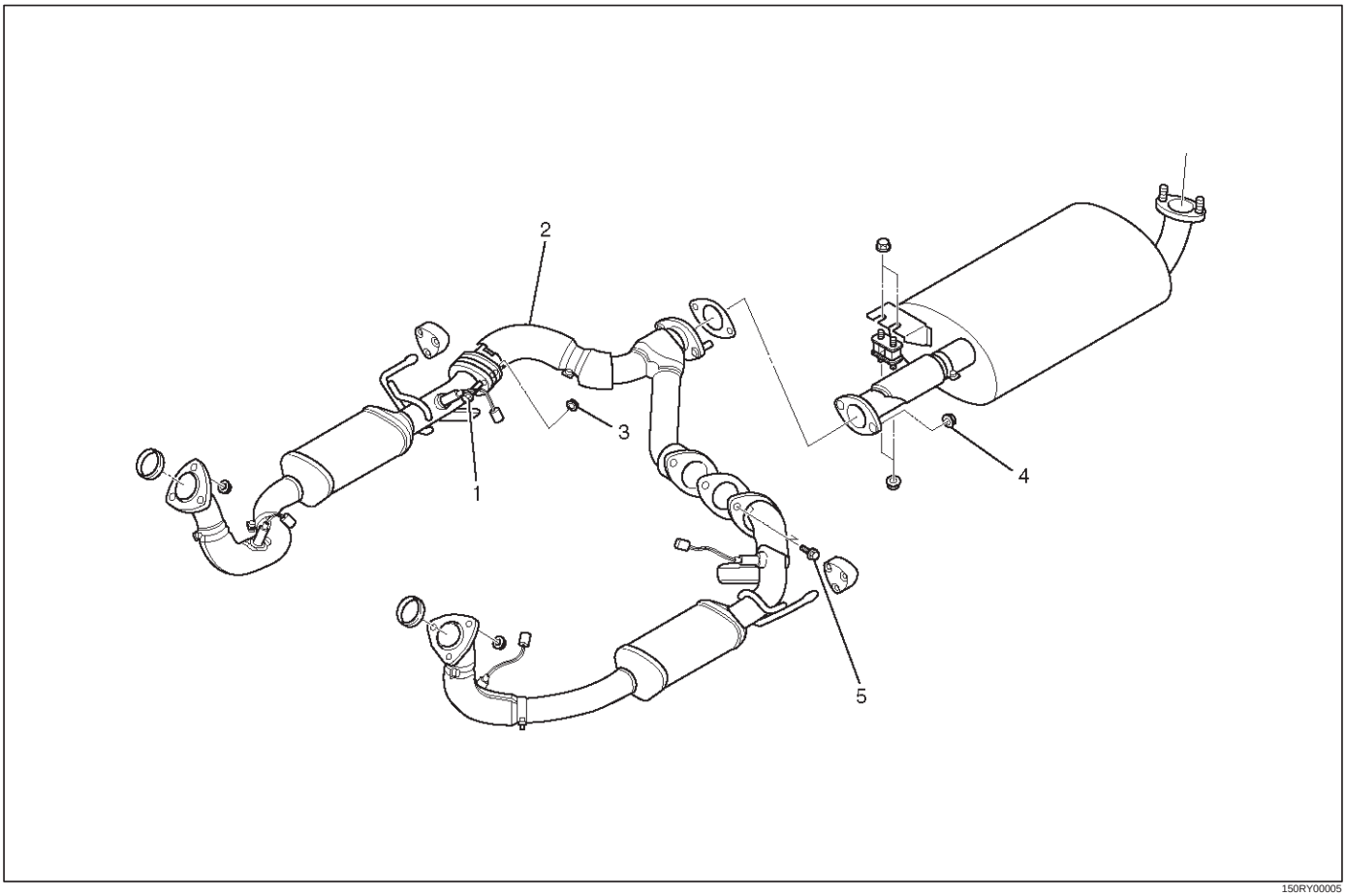
   Torque

   Bolts&Nuts: 43 N·m (32 lb ft)

   Nuts: 43 N·m (32 lb ft)
3. Connect the O_2 sensor connectors (7) (9).

Forked Exhaust Pipe

Forked Exhaust Pipe and Associated Parts



150RY00005

Legend

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the forked exhaust pipe fixing bolts & nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).

Installation

1. Install the forked exhaust pipe (2), and tighten the fixing bolts (1) (5) and the nuts (3) (4) to the specified torque.

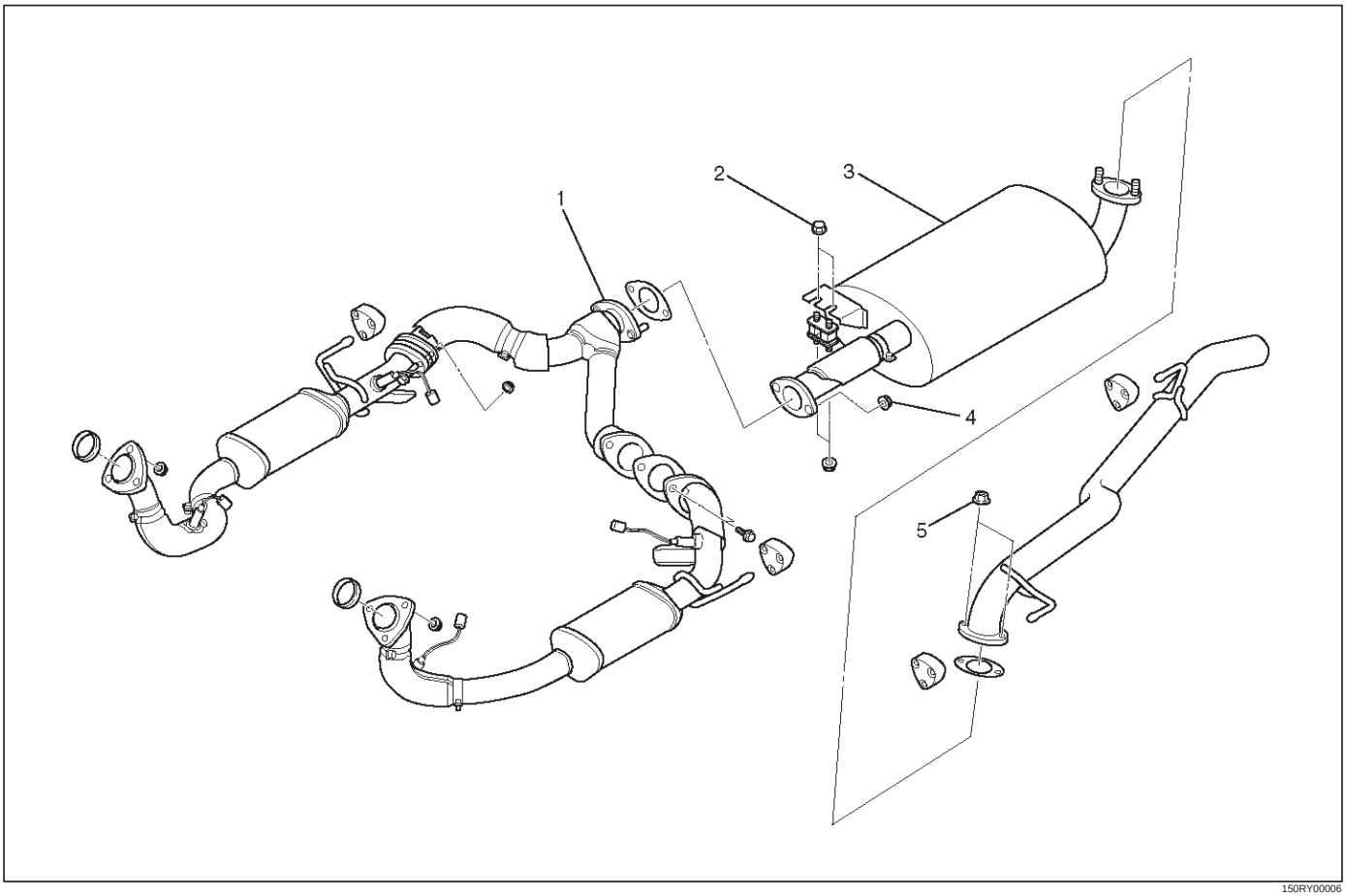
Torque

Bolts&nuts : 43 N·m (32 lb ft)

Nuts : 43 N·m (32 lb ft)

Exhaust Silencer

Exhaust Silencer and Associated Parts



Legend

(1) Forked Exhaust Pipe
(2) Support Rubber Fixing Nuts
(3) Exhaust Silencer
(4) Exhaust Silencer Fixing Nuts
(5) Rear Exhaust Pipe Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the support rubber fixing nuts (2), the exhaust silencer fixing nuts (4) and rear exhaust pipe fixing nuts (5), then remove the exhaust silencer (3).

Installation

1. Install the exhaust silencer (3) and tighten the fixing nuts (4) (5) to the specified torque.

   Torque

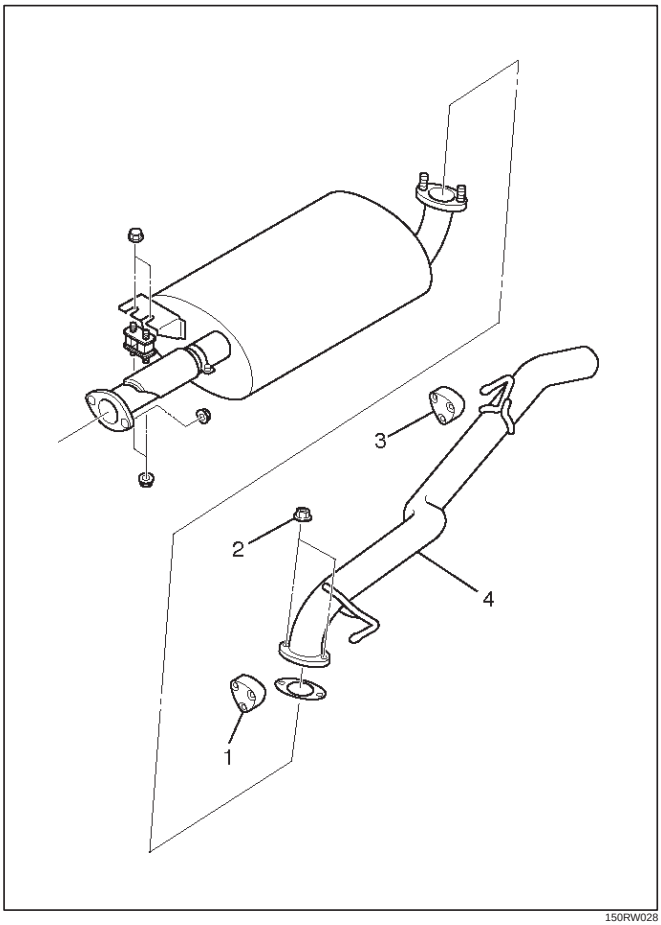
   Nuts: 43 N·m (32 lb ft)
2. Tighten the support rubber fixing nuts (2) to the specified torque.

   Torque

   Bolts: 15 N·m (11 lb ft)

Rear Exhaust pipe

Rear Exhaust pipe and Associated Parts



150RW028

Legend

(1) Mounting Rubber
(2) Rear Exhaust Pipe Fixing Nuts
(3) Mounting Rubber
(4) Rear Exhaust Pipe

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the rear exhaust fixing nuts (2) and the mounting rubbers (1) (3), then remove the rear exhaust pipe (4).

Installation

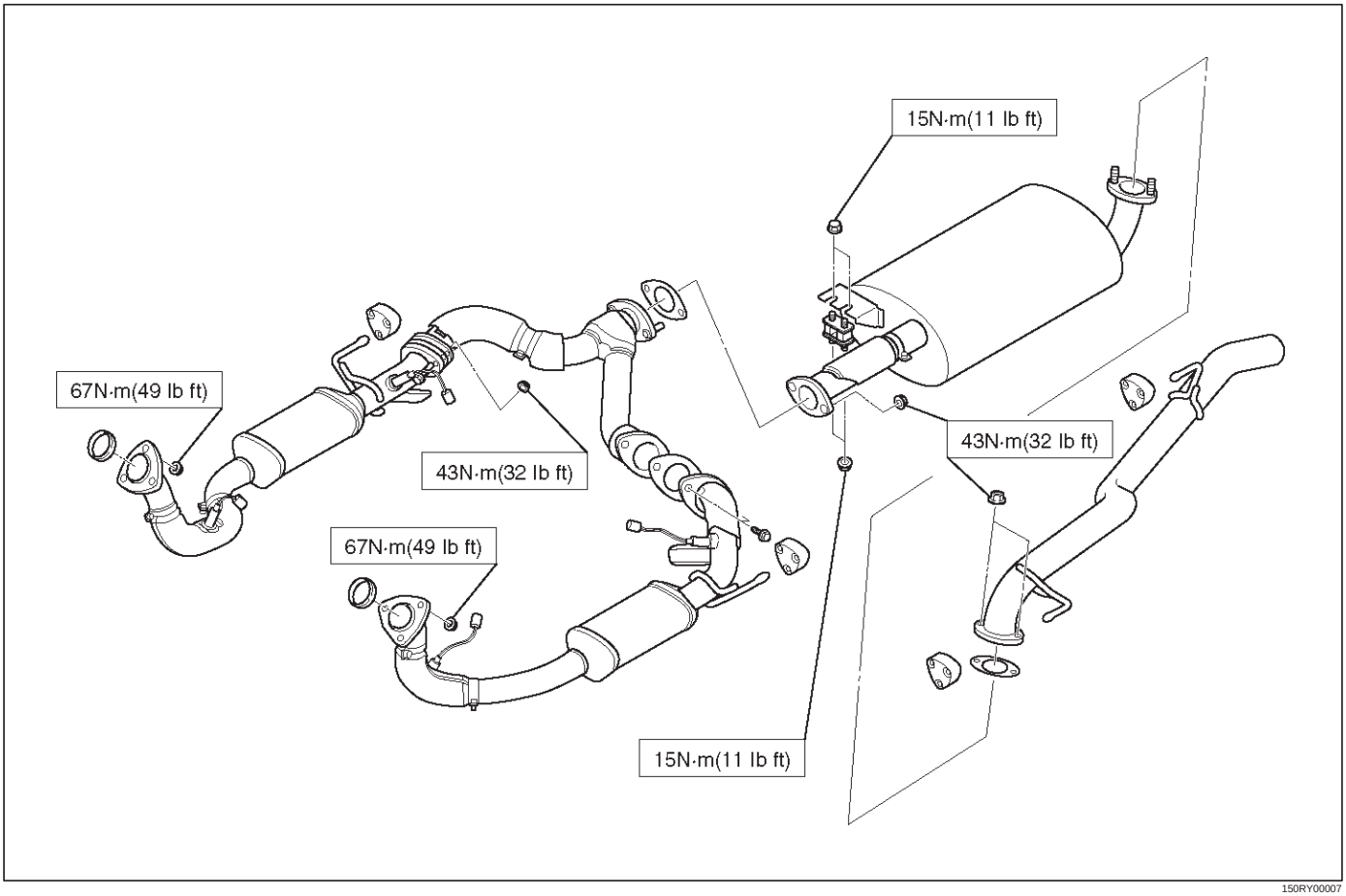
1. Install the rear exhaust pipe (4) and the mounting rubbers (1) (3), then tighten the fixing nuts (2) to the specified torque.

Torque

Nuts: 43 N·m (32 lb ft)

Main Data and Specifications

Torque Specifications



150RY00007

AXIOM

ENGINE

ENGINE LUBRICATION (6VE1 3.5L)

CONTENTS

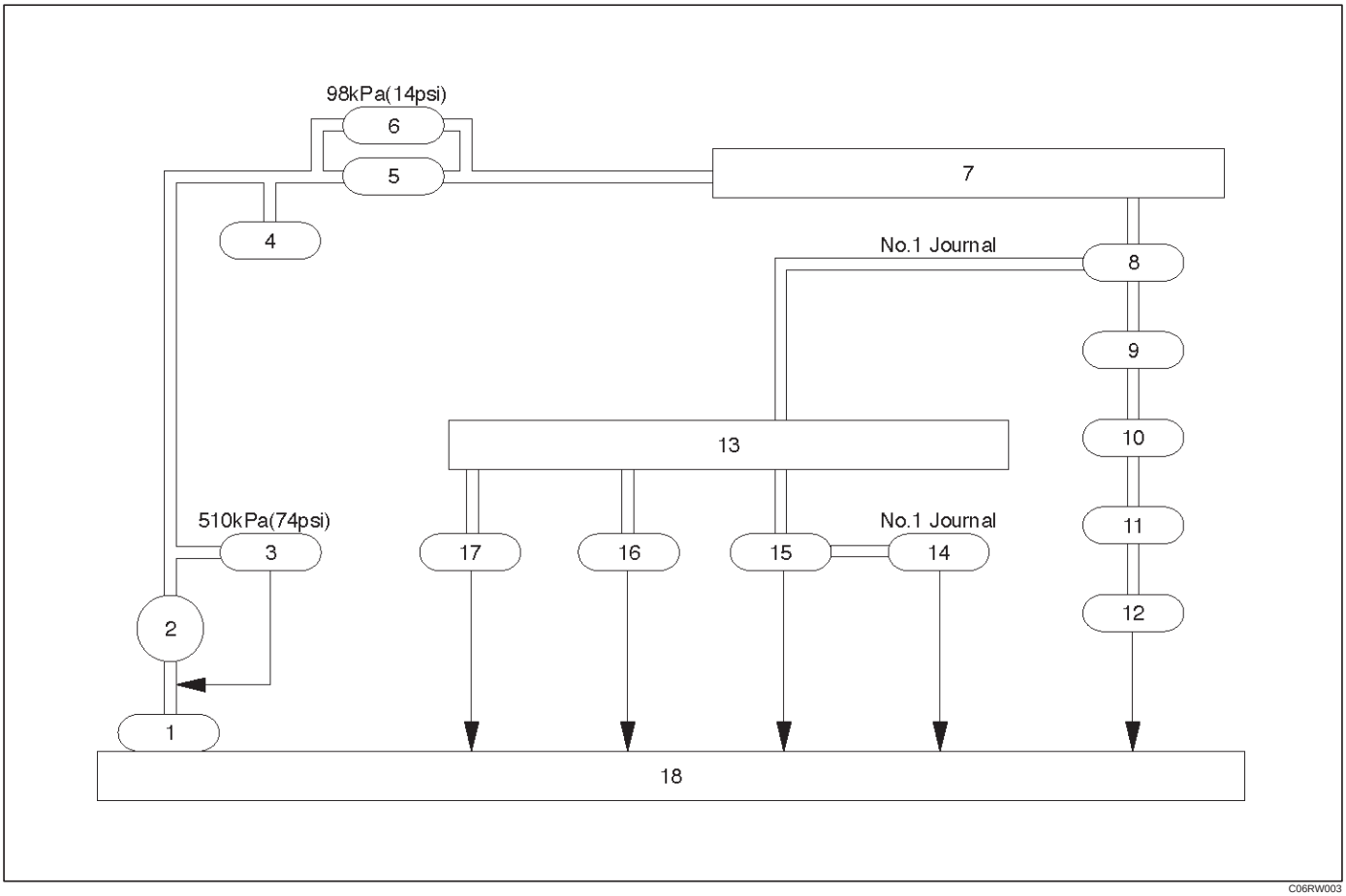
Service Precaution 6G–1
General Description 6G–2
Oil Pump 6G–3
Oil Pump and Associated Parts 6G–3
Disassembly 6G–4
Inspection and Repair 6G–4
Reassembly 6G–5
Oil Pan and Crankcase 6G–7
Removal 6G–7
Installation 6G–7
Oil Pump 6G–9
Removal 6G–9
Installation 6G–9
Oil Pump Oil Seal 6G–11
Removal 6G–11
Installation 6G–11
Oil Filter 6G–12
Removal 6G–12
Installation 6G–12
Main Data and Specification 6G–13

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

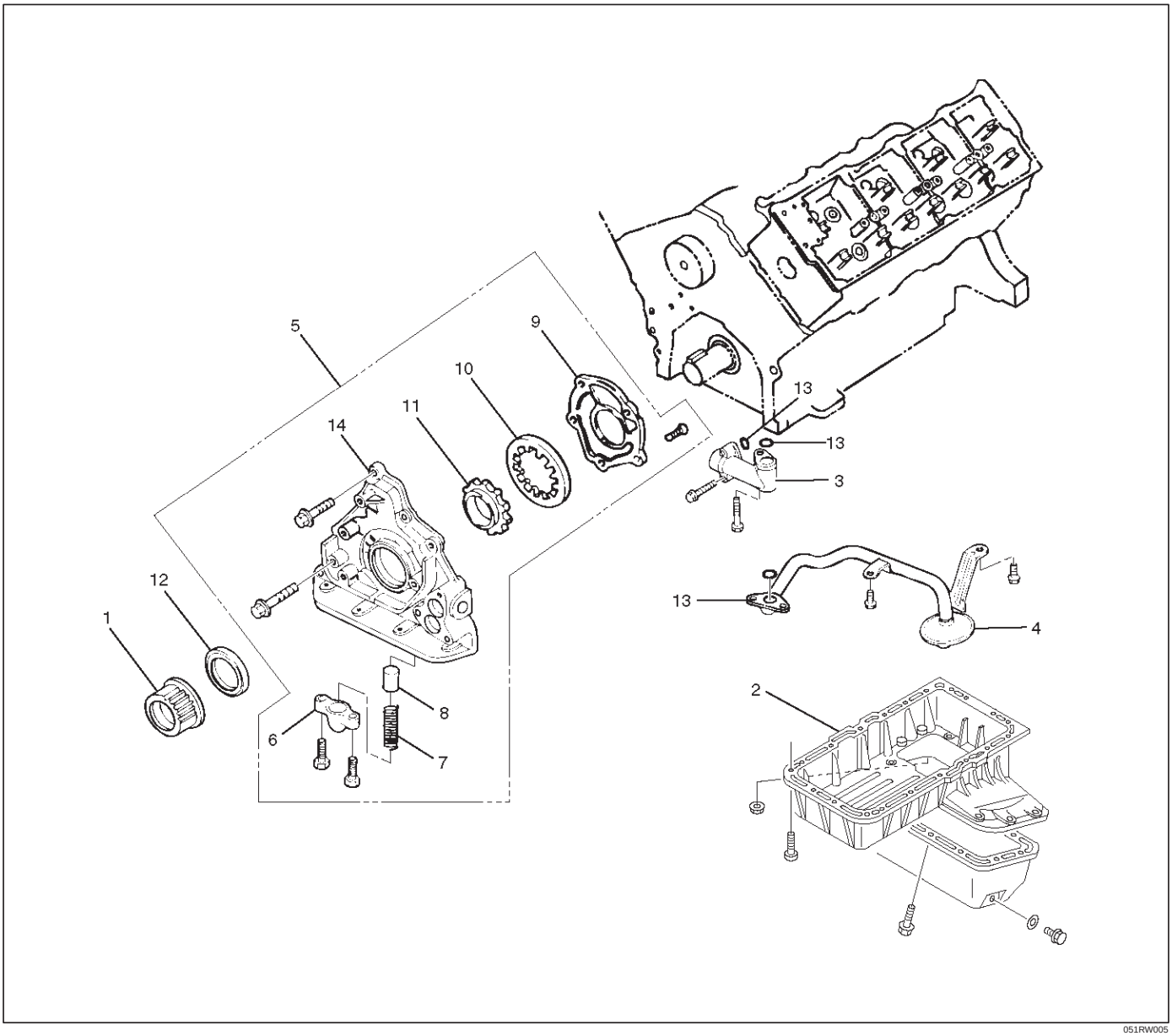


Legend

(1) Oil Strainer
(2) Oil Pump
(3) Relief Valve
(4) Oil Pressure Switch
(5) Oil Filter
(6) Safety Valve
(7) Oil Gallery
(8) Crankshaft Bearing
(9) Crankshaft
(10) Connecting Rod Bearing
(11) Connecting Rod
(12) Piston
(13) Oil Gallery; Cylinder Head
(14) Camshaft
(15) Camshaft Journal
(16) Front Journal; Camshaft Drive Gear
(17) Rear Journal; Camshaft Drive Gear
(18) Oil Pan

Oil Pump

Oil Pump and Associated Parts



051RW005

Legend

(1) Crankshaft Timing Pulley
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Pump Assembly
(6) Plug
(7) Spring
(8) Relief Valve
(9) Oil Pump Cover
(10) Driven Gear
(11) Drive Gear
(12) Oil Seal
(13) O-ring
(14) Oil Pump Body

Disassembly

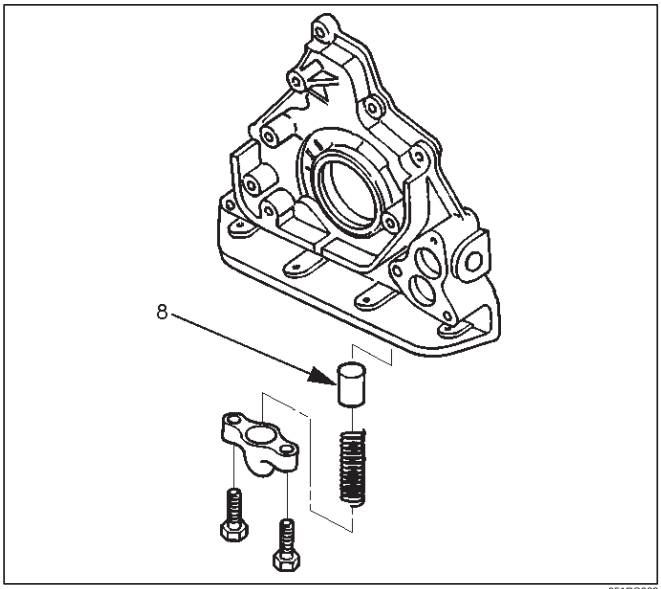
1. Remove crankshaft timing pulley.
2. Remove crankcase with oil pan.
3. Remove oil pipe.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove plug.
7. Remove spring.
8. Remove relief valve.
9. Remove oil pump cover.
10. Remove driven gear.
11. Remove drive gear.
12. Remove oil seal.
13. Remove O-ring.

Inspection and Repair

CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found during inspection.

Relief Valve

- ▼ Check to see that the relief valve slides freely.
- ▼ The oil pump must be replaced if the relief valve does not slide freely.
- ▼ Replace the spring and/or the oil pump assembly (5) if the spring is damaged or badly worn.



051RS002

Body and Gears

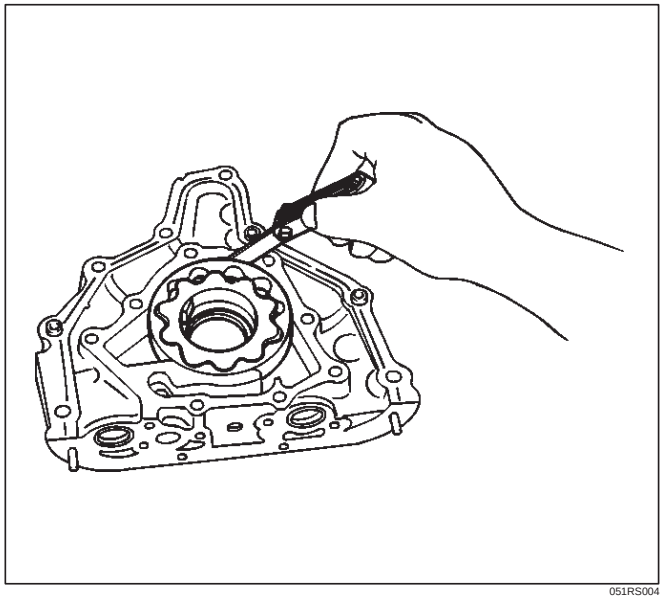
The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

- ▼ Badly worn or damaged driven gear (10).
- ▼ Badly worn drive gear (11) driving face.
- ▼ Badly scratched or scored body sliding face (14) or driven gear (10).
- ▼ Badly worn or damaged gear teeth.

Measure the clearance between the body and the driven gear with a feeler gauge.

Standard : 0.10 mm–0.18 mm (0.0039 in.–0.0070 in)

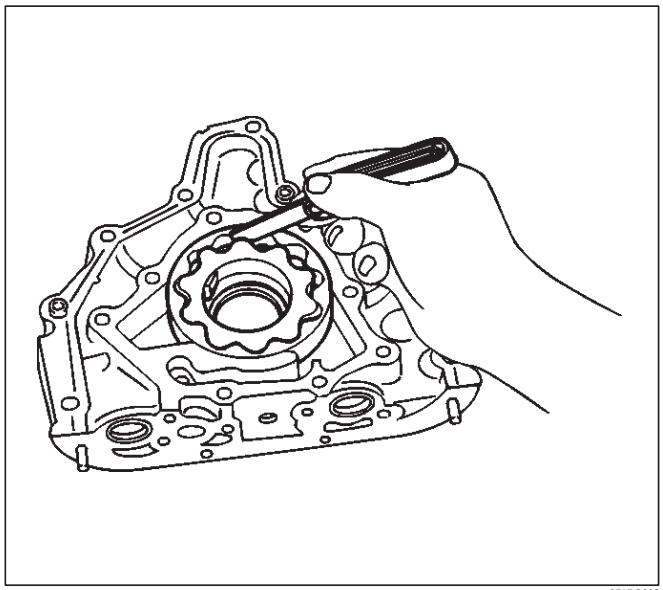
Limit : 0.20mm (0.0079 in)


051RS004

- ▼ Measure the clearance between the drive gear and driven gear with a feeler gauge.

Standard : 0.11 mm–0.24 mm (0.0043 in–0.0094 in)

Limit : 0.35mm (0.0138 in)

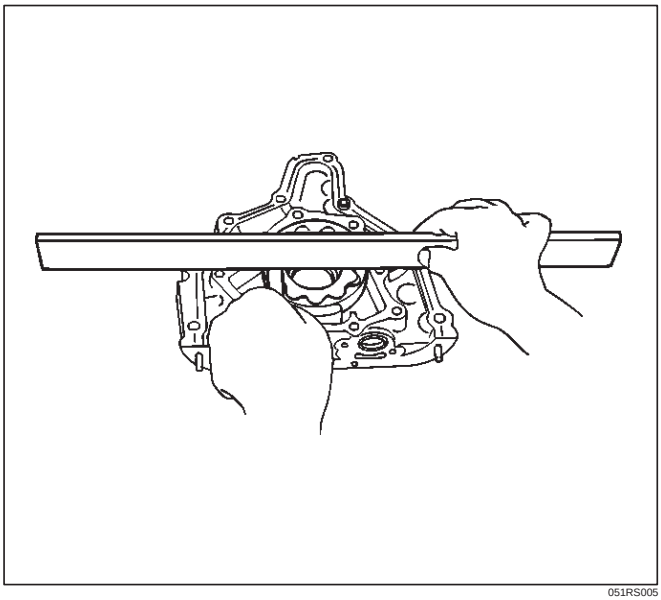

051RS003

▼Measure the side clearance with a precision straight edge and a feeler gauge.

Clearance

Standard : 0.03 mm–0.09 mm (0.0011 in–0.0035 in)

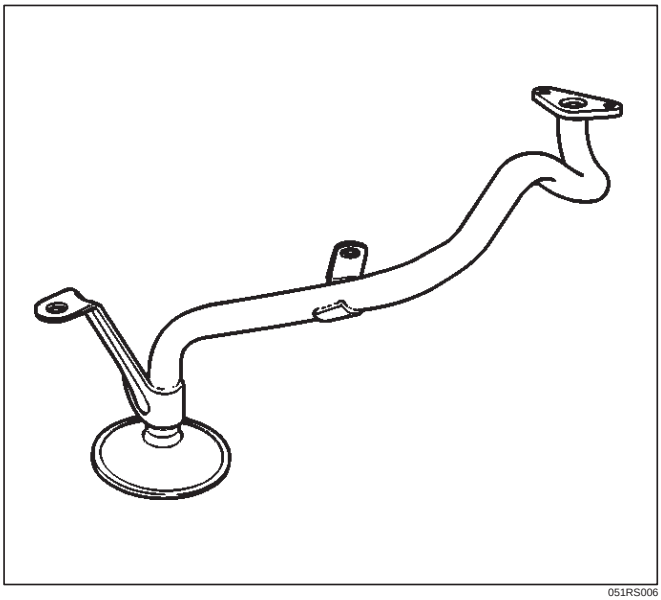
Limit : 0.15mm (0.0059 in)



051RS005

Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.



051RS006

Reassembly

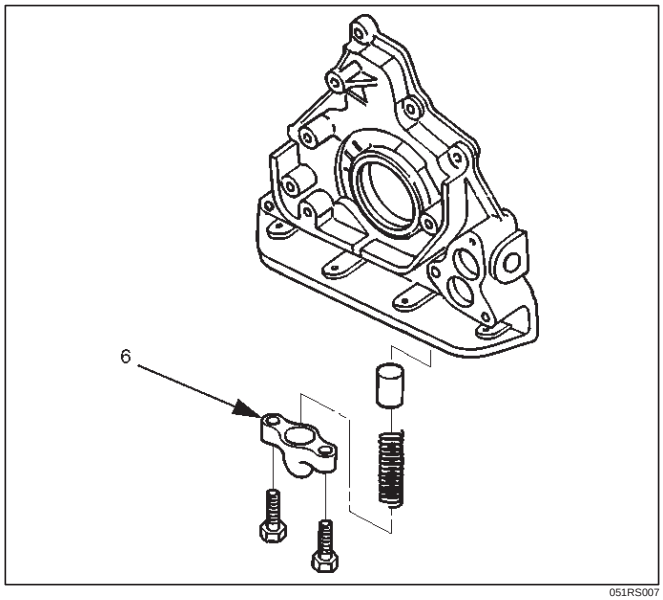
1. Install drive gear (11).
2. Install driven gear (10).
3. Install oil pump cover (9) and first, loosely tighten all of the attaching screws. Next, tighten the attaching screws to the specified torque.

Torque : 10 N·m (87 lb in)

After installation, check that the gear rotates smoothly.

4. Install relief valve (8) and apply engine oil to the relief valve and spring (7).
5. Install spring (7).
6. Install the plug (6).

Torque : 8 N·m (69 lb in)



051RS007

7. Install oil pump assembly (5).

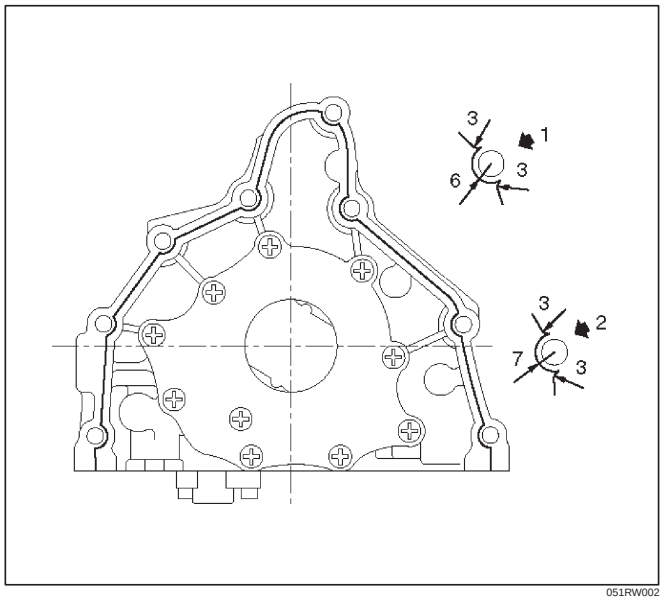
▼Carefully remove any oil from the cylinder body and the pump. Apply sealant (TB–1207B or equivalent) to the pump fitting face as shown in illustration. Take care that sealant is not applied to oil port surfaces. The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

CAUTION: Do not apply an excessive amount of sealant to the contact surface. Applying too much sealant will overflow the contact surfaces. This could cause serious damage to the engine.

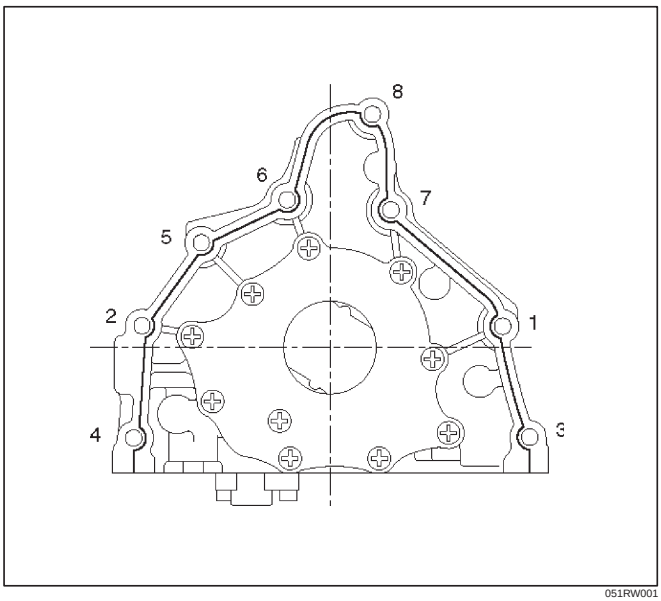
▼Attach oil pump assembly to cylinder body.

▼Tighten the oil pump fixing bolts.

Torque : 25 N·m (18 lb·ft)



051RW002

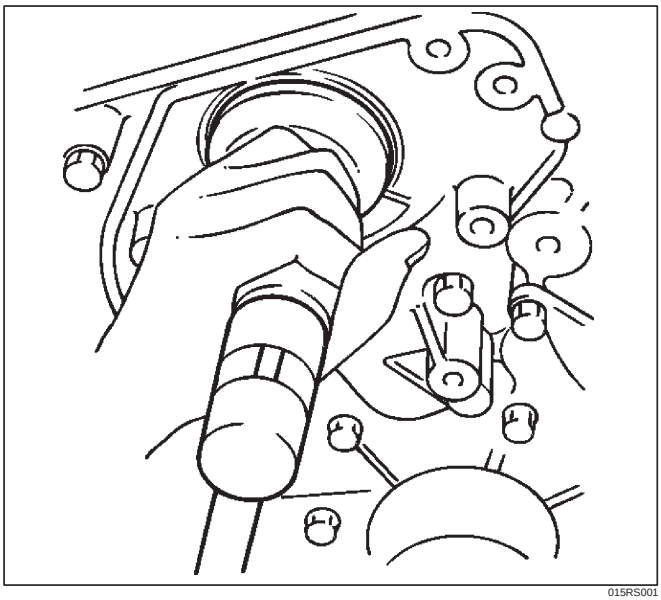


051RW001

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

8. Install the new oil seal (12). Apply engine oil to the oil seal lip before installation then use J–39202 oil seal Installer, install oil seal.


015RS001

9. Install oil strainer (4) with O-ring (13).

Torque: 25 N·m (18 lb ft)

10. Install oil pipe (3) with O-ring (13).

Torque: 25 N·m (18 lb ft)

11. Install crankcase with oil pan (2).

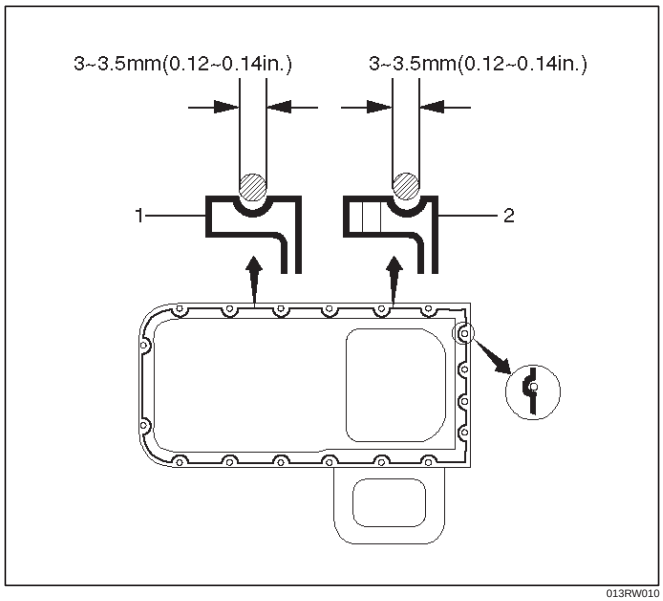
▼Remove oil on crankcase mounting surface and dry the surface.

▼Apply a proper 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.

▼The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

▼Tighten fixing bolts to the specified torque.

Torque : 10 N·m (87 lb in)



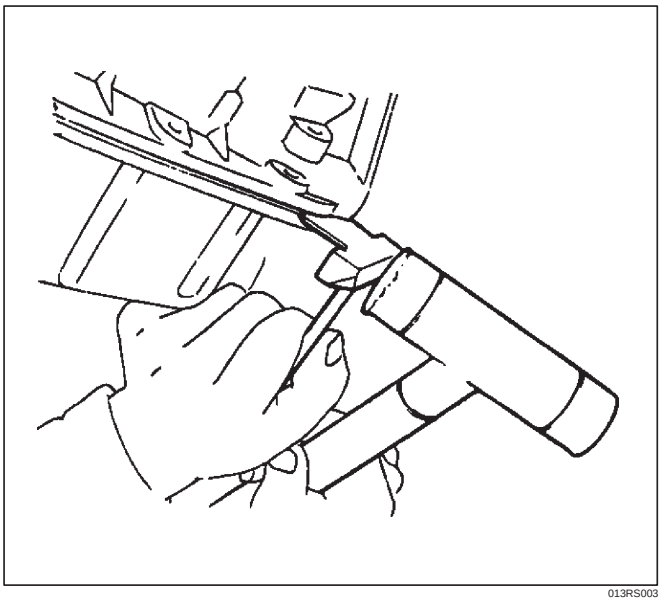
013RW010

12. Install crankshaft timing pulley.

Oil Pan and Crankcase

Removal

1. Disconnect battery ground cable.
2. Lift vehicle by supporting the frame.
3. Remove under cover.
4. Drain engine oil.
5. Remove front wheels.
6. Remove oil level dipstick from level gauge tube.
7. Remove radiator under fan shroud.
8. Remove shift on the fly from axle housing.
9. Remove suspension cross member fixing bolts, 2 pcs each per side and remove suspension cross member.
10. Remove axle housing assembly four fixing bolts from housing isolator side and mounting bolts from wheel side. At this time support the axle with a garage jack and remove axle housing assembly. (for 4×4)
11. Remove the steering unit assembly.
12. Remove starter fixing bolts.
13. Remove oil pan fixing bolts.
14. Remove oil pan, using J-37228 sealer cutter, remove oil pan.

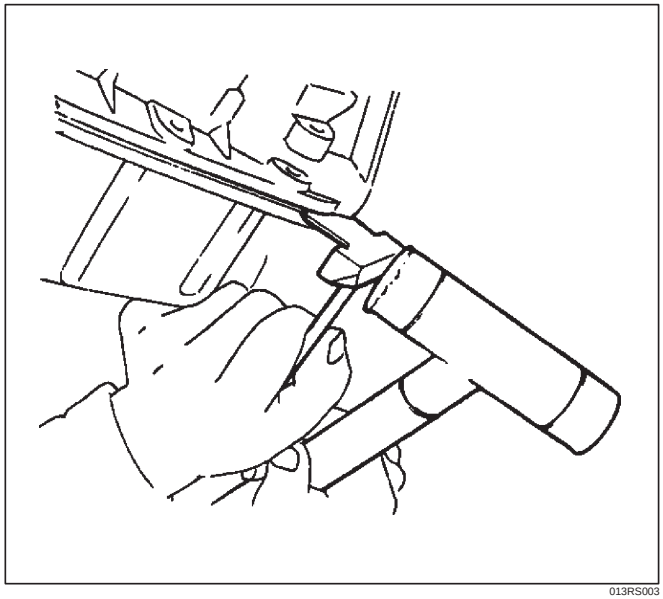


013RS003

15. Remove crankcase fixing bolts.
16. Remove crankcase, using J-37228 sealer cutter, remove crankcase.

NOTE: Do not deform or damage the flange of oil pan and crankcase.

Replace the oil pan and/or crankcase if deformed or damaged.



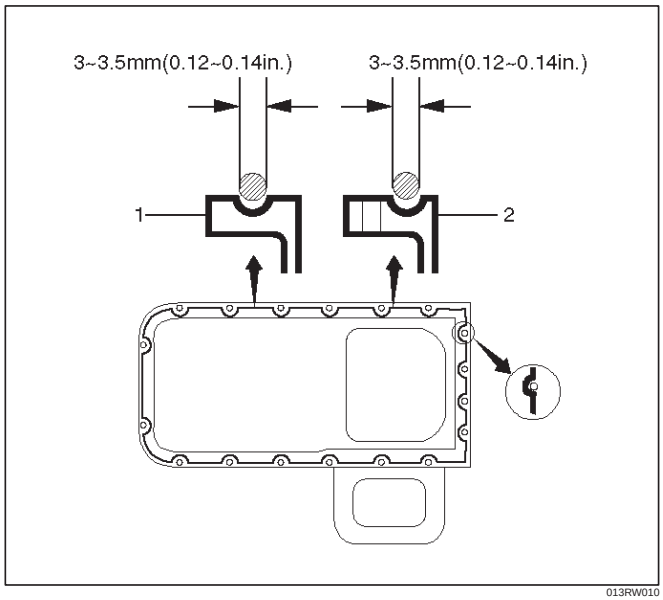
013RS003

Installation

1. Install crankcase.
   A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
   B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of crankcase.

   Sealant bead must be continuous.

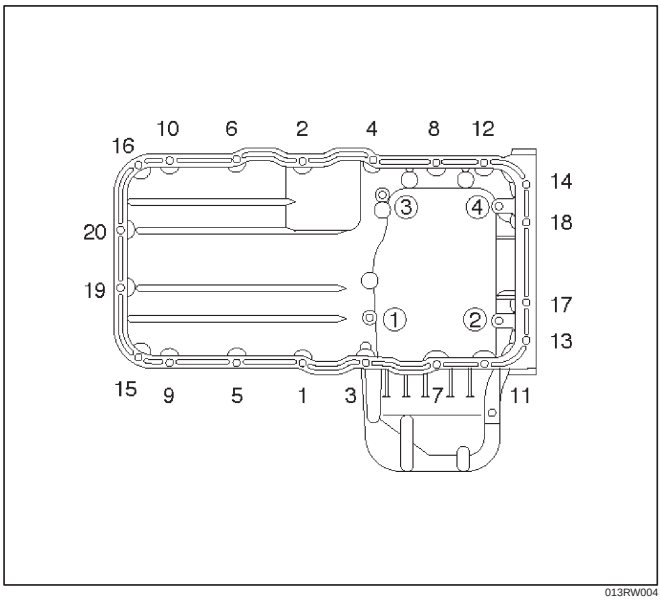
▼The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



013RW010

C. Install crankcase, tighten crankcase fixing bolts to the specified torque.

Torque : 10 N·m (87 lb in)



013RW004

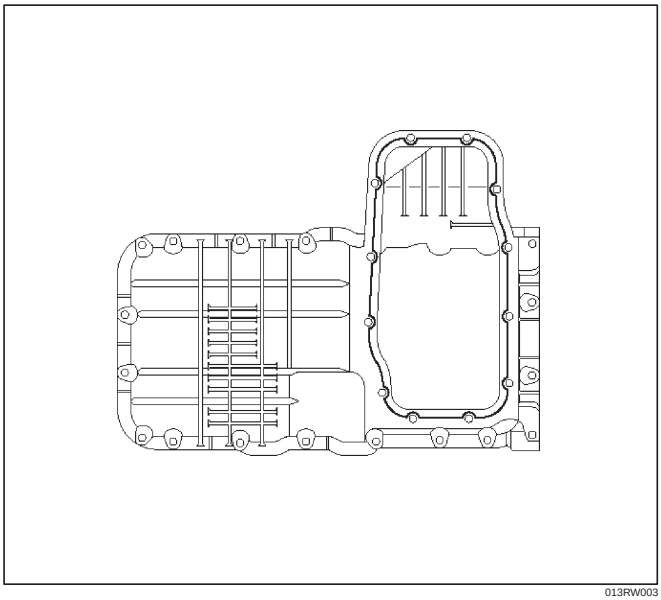
2. Install oil pan

A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.

B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of oil pan.

Sealant beat must be continuous.

▼The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.


013RW003

C. Install oil pan, tighten oil pan fixing bolts to the specified torque.

Torque : 10 N·m (87 lb in)

3. Install starter and tighten fixing bolts.

Torque: 40 N·m (30 lb ft)

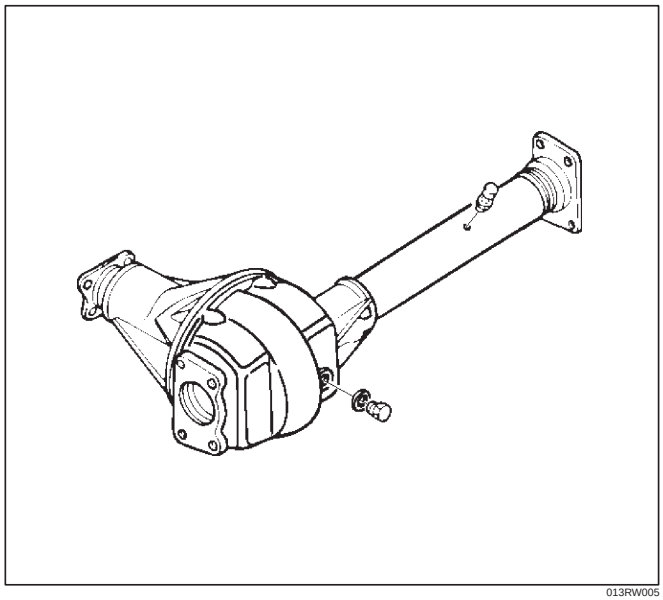
4. Install axle housing assembly and tighten fixing bolts to the specified torque. (for 4×4)

Axle case bolts

Torque : 82 N·m (61 lb ft)

Mounting bolts

Torque : 152 N·m (112 lb ft)


013RW005

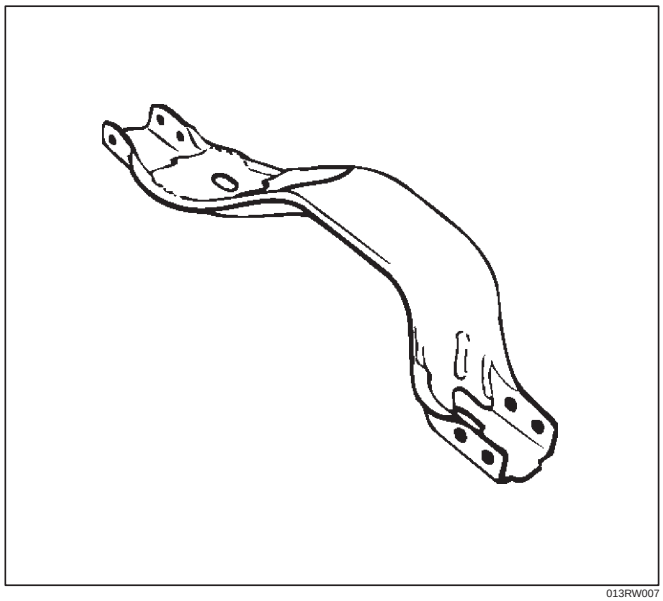
5. Install the shift on the fly.

6. Install relay lever assembly and tighten fixing bolts.

Torque: 44 N·m (33 lb ft)

7. Install suspension cross member and tighten fixing bolts to the specified torque.

Torque : 78 N·m (58 lb ft)


013RW007

8. Install radiator under fan shroud.

9. Install under cover.

10. Install engine oil level dipstick.

11. Fill engine oil until full level on engine oil gauge dipstick.

Oil Pump

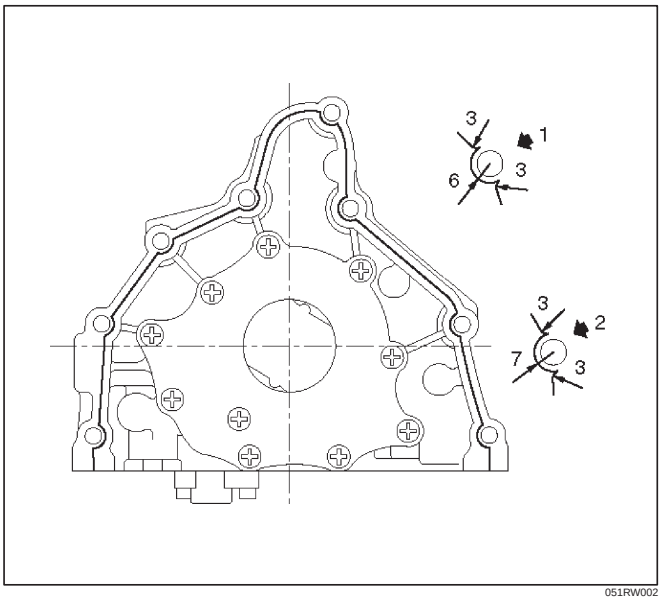
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankcase assembly.
   ▼ Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove crankshaft pulley.
   ▼Refer to removal procedure for Crankshaft Pulley in this manual.
5. Remove timing belt.
   ▼Refer to removal procedure for Timing Belt in this manual.
6. Remove timing pulley from crankshaft.
7. Remove four fixing bolts from oil filter assembly.
8. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.
9. Remove three bolts from oil pipe and O-ring.
10. Remove eight oil pump fixing bolts, then oil pump assembly.
11. Remove sealant from mounting surface of oil pump assembly, cylinder block and take care not to damage mounting surfaces of oil pump and cylinder block.

Installation

1. Install oil pump assembly
   ▼Apply sealant (TB-1207B or equivalent) to the oil pump mounting surfaces as shown in the illustration.
   ▼The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

NOTE: Do not apply sealant to the oil ports.



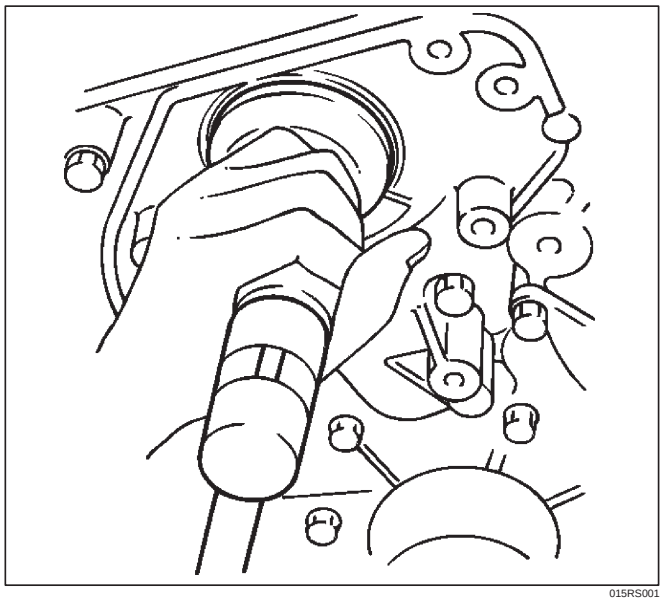
051RW002

▼Use J-39202 installer when installing new oil seal.

▼Apply engine oil to oil seal lip.

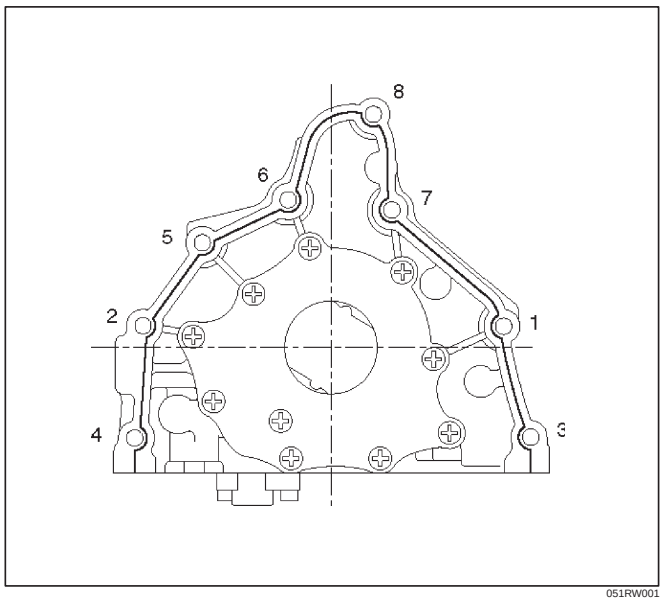
▼Install oil pump assembly to the cylinder block.

NOTE: Do not damage oil seal during installation of oil pump assembly.


015RS001

▼Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



051RW001

2. Install oil pipe with O-ring, tighten fixing bolt to the specified torque.

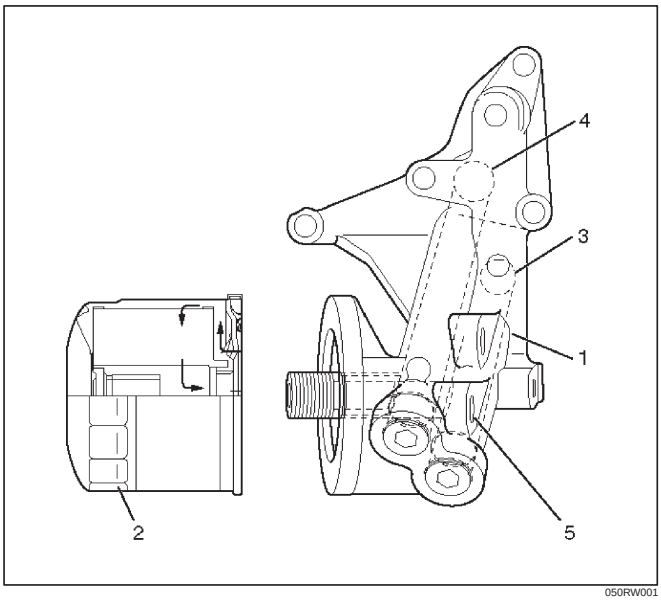
   Torque : 10 N·m (87 lb in)

3. Install oil strainer with O-ring, tighten fixing bolt to the specified torque.

   Torque : 25 N·m (18 lb ft)

4. Install oil filter assembly and tighten bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



050RW001

Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

5. Install timing pulley on crankshaft.
   Install timing belt.
   ▼Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   ▼Refer to install procedure for Crankshaft Pulley in this manual.
7. Install crankcase assembly.
   ▼Refer to installation procedure for Oil Pan and Crankcase in this manual.
8. Refill engine oil until full level on engine oil dipstick.

Oil Pump Oil Seal

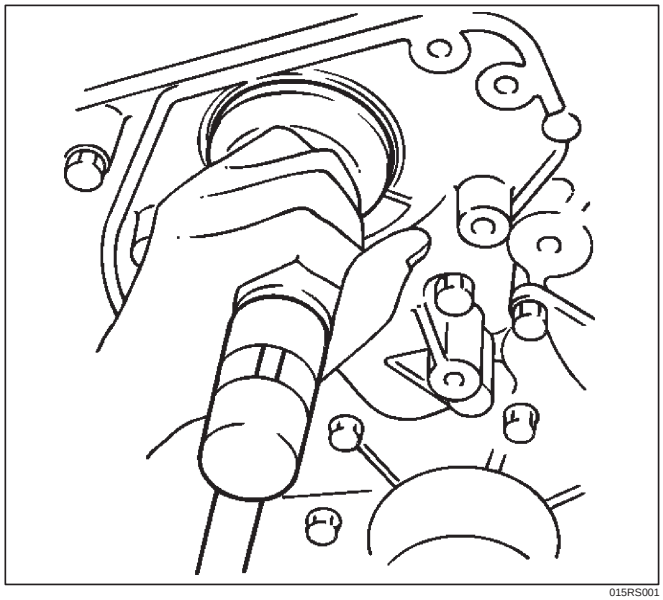
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankshaft pulley.
   ▼Refer to removal procedure for Crankshaft Pulley in this manual.
4. Remove timing belt.
   ▼Refer to removal procedure for Timing Belt in this manual.
5. Remove timing pulley from crankshaft.
6. Remove oil pump oil seal using a sealer puller.

NOTE: Take care not to damage sealing surfaces of oil pump and crankshaft when removing oil seal.

Installation

1. Install oil pump oil seal, apply engine oil to oil seal lip, then install oil seal using J-39202 installer.



015RS001

2. Install timing pulley to crankshaft.
3. Install timing belt.
   ▼Refer to installation procedure for Timing Belt in this manual.
4. Install crankshaft pulley.
   ▼Refer to installation procedure for CRANKSHAFT PULLEY in this manual.
5. Refill engine oil until full level.

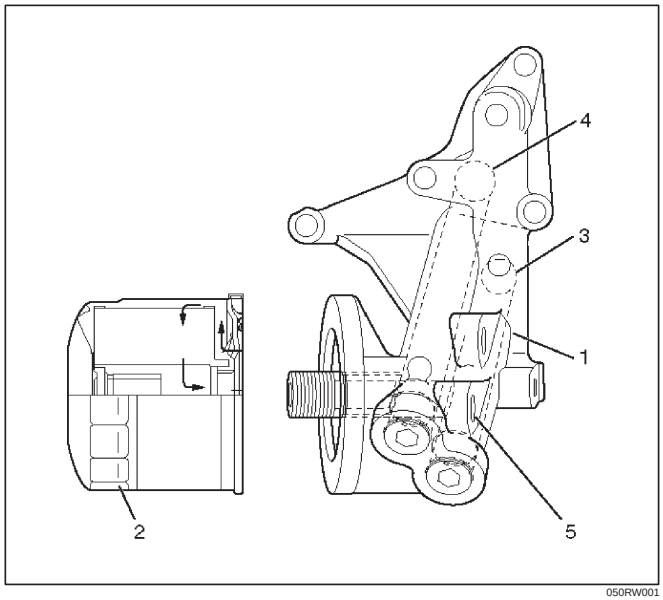
Oil Filter

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove oil filter using J-36390 filter wrench.

Installation

1. Apply a light coat of engine oil to the oil filter gasket.
2. Hand tighten the filter until the gasket contacts the sealing face.
3. Using J–36390 filter wrench, tighten the filter an additional 7/8 turn or by torque 22 N·m (16 lb ft).



050RW001

Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Filter
(5) To Filter

4. Fill the oil to the proper lever by following the oil level check procedures.
5. Reconnect battery ground cable.
6. Run the engine and inspect for leaks.

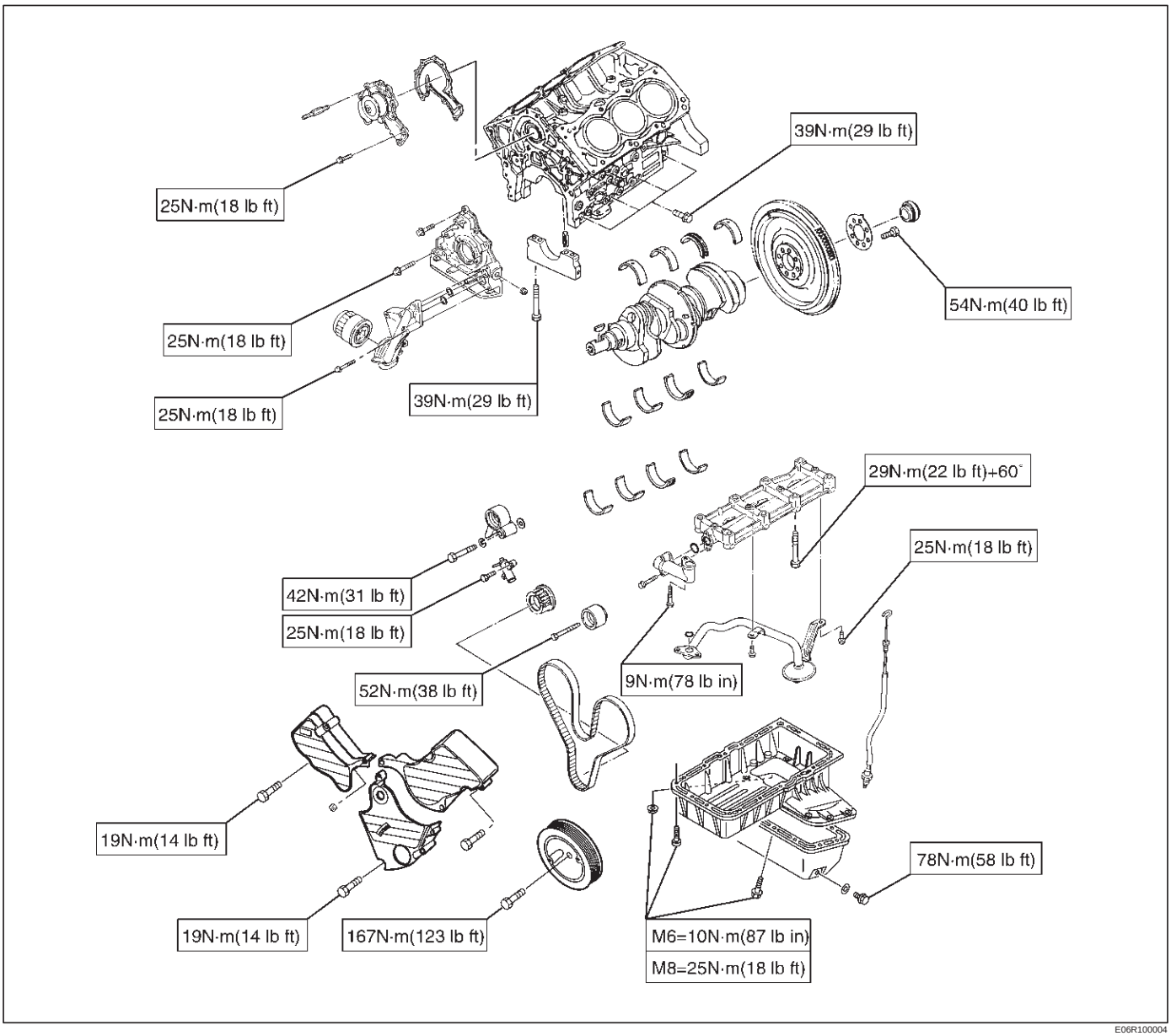
Main Data and Specification

General Specification

Item	Specifications
	6VE1
Oil capacity	5.3 liters

Torque Specifications

Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer



E06R100004

AXIOM

ENGINE

ENGINE SPEED CONTROL SYSTEM

CONTENTS

Service Precaution 6H–1
Accelerator Pedal 6H–2
Accelerator Pedal and Associated Parts . . 6H–2
Removal 6H–2
Installation 6H–2

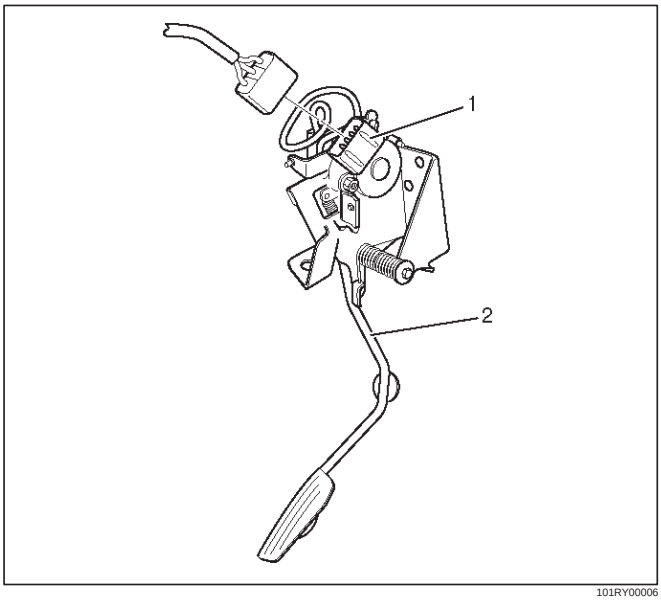
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Accelerator Pedal

Accelerator Pedal and Associated Parts



Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

Removal

1. Disconnect battery ground cable.
2. Disconnect Accelerator position (AP) sensor (1) connector from Accelerator pedal assembly.
3. Remove Accelerator pedal assembly (2).

Installation

1. Install Accelerator pedal assembly (2).
2. Connect AP sensor (1) harness connector.
3. Connect battery ground cable.

AXIOM

ENGINE

INDUCTION (6VE1 3.5L)

CONTENTS

Service Precaution 6J–1
Air Cleaner Element 6J–2
Removal 6J–2
Inspection 6J–2
Installation 6J–2

Service Precaution

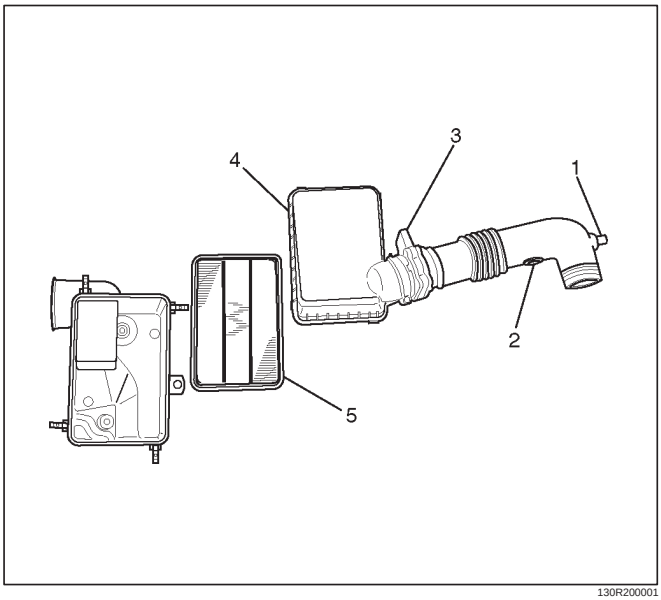
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Air Cleaner Element

Removal

1. Remove positive ventilation hose connector(1).
2. Remove intake air temperature sensor(2).
3. Remove air flow sensor(3).
4. Remove air cleaner duct assembly(4).
5. Remove air cleaner element(5).



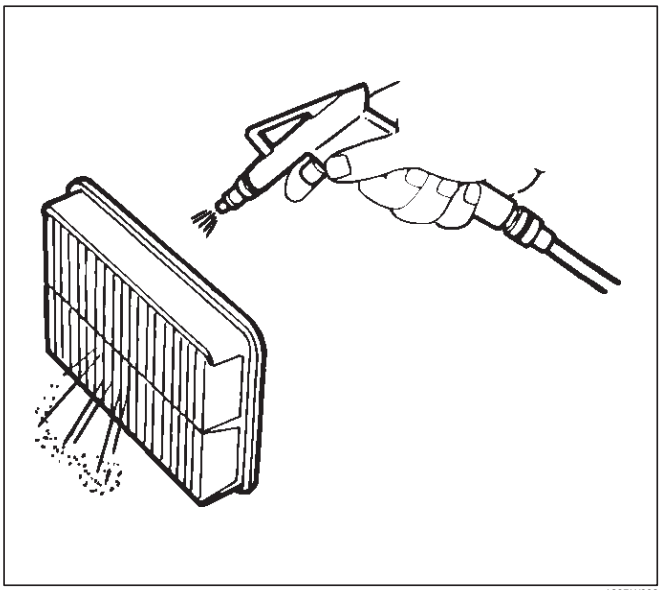
130R200001

Inspection

Check the air cleaner filter for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

Cleaning Method

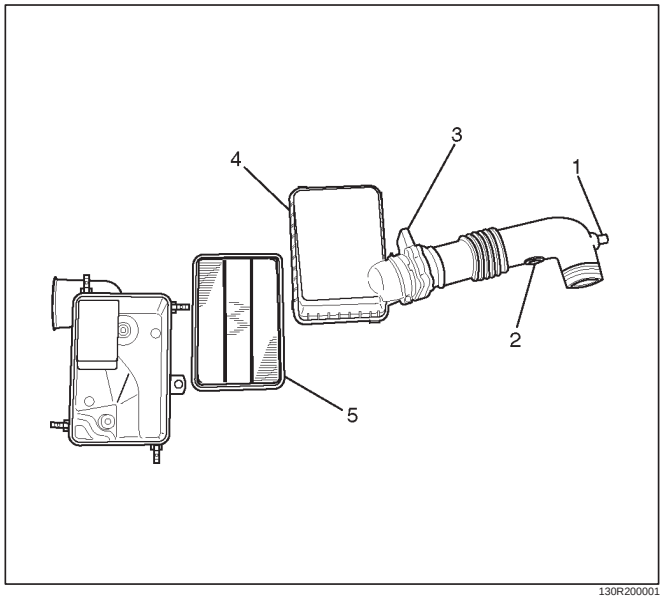
Tap the air cleaner filter gently so as not to damage the paper filter, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.



130RW002

Installation

1. Install air cleaner element(5).
2. Attach the mass air cleaner duct cover to the body completely, then clamp it with the clip(4).
3. Install air flow sensor(3).
4. Install air temprature sensor(2).
5. Install positive crankcase ventilation hose connector(1).



130R200001

AXIOM

TRANSMISSION

CONTENTS

Automatic Transmission (4L30–E) 7A
Transmission Control System (4L30–E) 7A1

AUTOMATIC TRANSMISSION (4L30–E)

CONTENTS

Service Precaution 7A–2
Construction 7A–3
Range Reference Chart 7A–4
Normal Operation Of 2002 4L30–E Transmission 7A–5
Diagnosis 7A–5
Driver Information 7A–5
General Diagnosis Procedure 7A–8
Preliminary Inspection Chart 7A–9
Checking Transmission Fluid Level and Condition 7A–10
Test Driving 7A–11
Mechanical / Hydraulic Diagnosis Check Trans Indicator Chart 7A–12
Mechanical / Hydraulic Diagnosis Symptoms Index 7A–13
Stall Test 7A–23
Line Pressure Test 7A–23
Shift Speed Chart 7A–24
Lockup Speed Chart 7A–26
Changing Transmission Fluid 7A–27
Selector Lever 7A–27
Inspection 7A–27
Removal 7A–27
Installation 7A–29
Select Cable 7A–29
Removal 7A–29
Installation 7A–32
Shift Lock Cable 7A–34
Removal 7A–34
Installation 7A–34
Mode Switch 7A–35
Removal 7A–35
Installation 7A–36
Transmission Assembly 7A–37
Transmission and Associated Parts 7A–37
Removal 7A–38
Installation 7A–43
Solenoid (Main Case Valve Body) 7A–47
Removal 7A–47
Installation 7A–47
Solenoid (Adapter Case Valve Body) 7A–48
Removal 7A–48
Installation 7A–48
Valve Body Assembly (Main Case) 7A–49
Removal 7A–49
Installation 7A–49
Valve Body Assembly (Adapter Case) 7A–50
Removal 7A–50
Installation 7A–50
Powertrain Control Module (PCM) 7A–50
Removal 7A–50
Installation 7A–50
Speed Sensor (Extension Assembly) 7A–51
Removal 7A–51
Installation 7A–51
Transmission Oil Temperature Sensor (Main Case) 7A–52
Removal 7A–52
Installation 7A–52
Front Oil Seal (Converter Housing) 7A–53
Removal 7A–53
Installation 7A–53
Rear Oil Seal (Extension Assembly) 7A–53
Removal 7A–53
Installation 7A–53
Transmission (4L30–E) 7A–54
Disassembly 7A–54
Reassembly 7A–58
Converter Housing And Oil Pump Assembly 7A–68
Disassembled View 7A–68
Disassembly 7A–68
Inspection And Repair 7A–68
Reassembly 7A–68
Oil Pump 7A–69
Disassembled View 7A–69
Disassembly 7A–69
Inspection And Repair 7A–70
Reassembly 7A–70

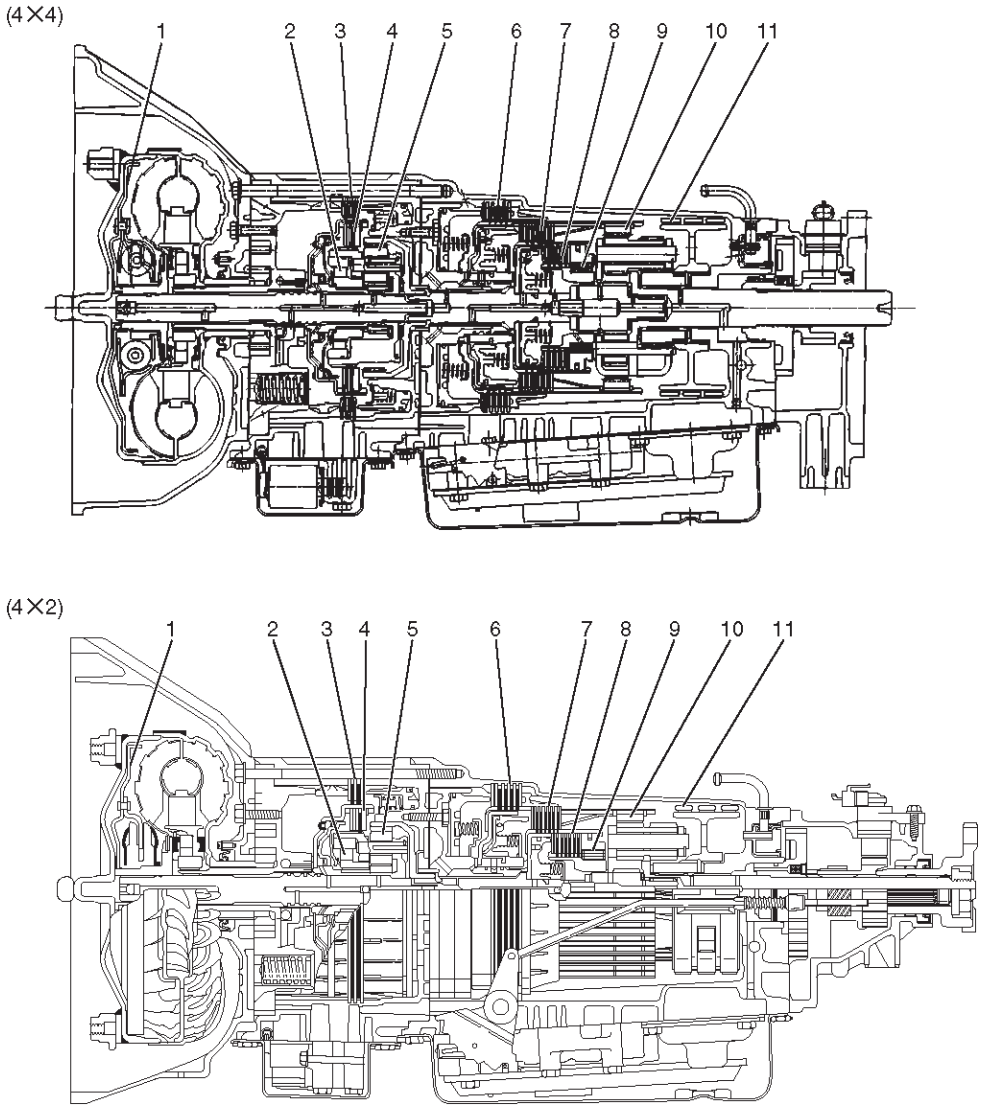
Main Case Valve Body 7A–71
Disassembled View 7A–71
Disassembly 7A–71
Inspection And Repair 7A–72
Reassembly 7A–72
Adapter Case Valve Body 7A–73
Disassembled View 7A–73
Disassembly 7A–73
Inspection And Repair 7A–73
Reassembly 7A–74
Third Clutch And Sprag Unit 7A–75
Disassembled View 7A–75
Disassembly 7A–75
Inspection And Repair 7A–75
Reassembly 7A–76
Third Clutch 7A–77
Disassembled View 7A–77
Disassemble 7A–77
Inspection And Repair 7A–77
Reassembly 7A–77
Sprag Unit 7A–79
Disassembled View 7A–79
Disassembly 7A–79
Inspection And Repair 7A–79
Reassembly 7A–79
Second Clutch 7A–80
Disassembled View 7A–80
Disassembly 7A–80
Inspection And Repair 7A–81
Reassembly 7A–81
3–4 Accumulator Piston 7A–82
Disassembled View 7A–82
Disassembly 7A–82
Inspection And Repair 7A–83
Reassembly 7A–83
Reverse Clutch Piston And Center Support . 7A–84
Disassembled View 7A–84
Disassembly 7A–84
Inspection And Repair 7A–85
Reassembly 7A–85
Overrun Clutch And Turbine Shaft 7A–86
Disassembled View 7A–86
Disassembly 7A–87
Inspection And Repair 7A–87
Reassembly 7A–87
Main Data And Specification 7A–89
General Specifications 7A–89
Torque Specifications 7A–90
Special Tools 7A–93
4L30–E Parts List 7A–96

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Construction

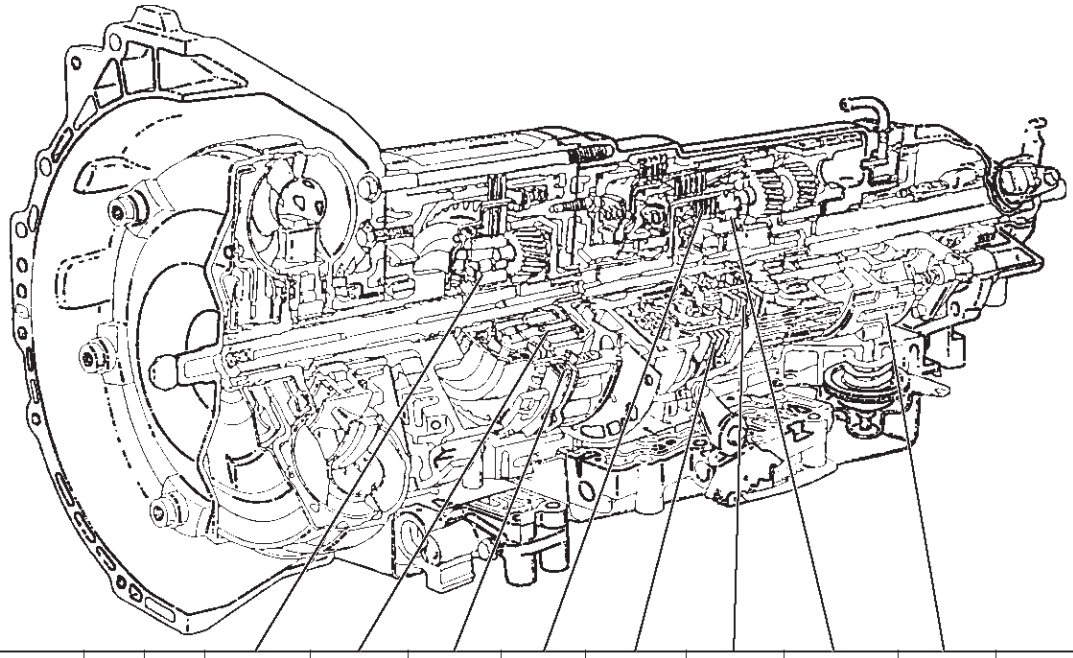


A07R100002

Legend

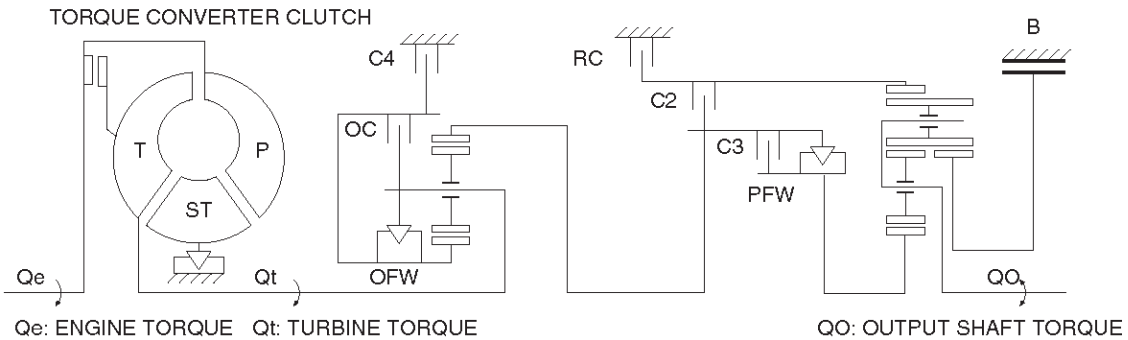
(1) Torque Converter Clutch (TCC)
(2) Overdrive Free Wheel (One Way Clutch) (OFW)
(3) Fourth Clutch (C4)
(4) Overrun Clutch (OC)
(5) Overdrive Unit
(6) Reverse Clutch (RC)
(7) Second Clutch (C2)
(8) Third Clutch (C3)
(9) Principle Sprag Assembly (One Way Clutch) (PFW)
(10) Ravigneaux Planetary Gear Set
(11) Brake Band (B)

Range Reference Chart



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE FREE WHEEL (OFW)	O/RUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASM (PFW)	BAND ASM (B)	ENGINE BRAKING	TORQUE CONV. CLUTCH
P-N		OFF	ON		APP							NO	NO
R	REVERSE	OFF	ON	LD	APP			APP		LD		NO	NO
D	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
	4TH	OFF	OFF	FW		APP	APP		APP	NE		YES	ECCC
3	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
2	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
L	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE APP : APPLIED



C07RY00032

Normal Operation Of 2002 4L30–E Transmission

Torque Converter Clutch (Electronically Controlled Capacity Clutch : ECCC) Application Conditions:

The clutch apply is controlled by moving the converter clutch control valve by commanding Torque Converter Clutch (TCC) solenoid using the PWM signal.
The TCC is normally applied in 2nd, 3rd and 4th gears only when all of the following conditions exist:

— The engine coolant temperature is above 70˚C (158˚F) and ATF temperature is above 18˚C (64.5˚F).

— The shift pattern requests TCC apply.

Moreover, TCC is always applied in 2nd, 3rd and 4th gears when the transmission oil temperature is above 135˚C (275˚F).
This mode should be canceled at 125˚C (257˚F).

ATF Warning Lamp

The ATF warning lamp will be constantly on (not flashing) if the transmission oil temperature is above 145˚C (293˚F).
The ATF warning lamp goes off again when the transmission oil temperature is below 125˚C (257˚F).

Reverse Lock Out

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 11 km/h (6.8 mph), thus preventing reverse engagement above this speed.

Diagnosis

Introduction

The systematic troubleshooting information covered by this Section offers a practical and systematic approach to diagnosing 4L30–E transmission, using information that can be obtained from road tests, electrical diagnosis, oil pressure checks or noise evaluation.
The key to correcting a complaint is to make use of all of the available symptoms and logically letting them direct you to the cause.
When dealing with automatic transmission complaints, it is best to gather as many symptoms as possible before making the decision to remove the transmission from the vehicle.
Frequently, the correction of the complaint does not require removal of the transmission from the vehicle.

Driver Information

To analyze the problem fill out a complete description of the owner’s complaint.
Please draw a circle around the right information and complete the following form. (The next page is an example of a completed form). You can draw a circle around many numbers if you are not sure.

A - Today's date :	Month :	Day :	Year : .....
B - End User Name, Address :			
C - Date of Problem :	Month :	Day :	Year : .....
D - Mileage : ..... Miles / Km	**E - With Ignition ON is CHECK TRANS Indicator :** 1- Flashing 2- Not Flashing	**F -Car load when problem occured :** 1 - Towing a trailer 2- ..... people OR ..... Kg	
G - Weather conditions when problem : 1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable 6-Any	**H - Weather Temperature when problem:** 1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable 6- Any	**I - Road Conditions when problem :** 1- Any 2- Inter City 3- Outside City 4- Highway 5 - Uphill 6- Downhill 7- Unpaved 8- Snow 9 - Others :	**J - Frequency of the Problem :** 1- Always 2- Occasional : ..... times/day, ... times/month 3- Only Once 4- Others :
K - Engine Condition : 1- Always 2- At Cold 3- During Warming up 4- After Warming or Hot 5- Others	**L - Engine Speed when the problem occured :** 1- Idling 2- Starting 3- Stalling 4- High RPM 5- Low RPM	**M - Transmission Condition when it occured :** 1- Any 2- Idling 3- Starting 4- Driving 5- Accelerating 6-Coasting 7- In corner 8- Shifting	

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz	2- Whine 3- Clunk 4- Rattle	5- Whistle // 6- light 7-medium 8- heavy
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments

P - Isuzu Vehicle Code :	.....	**Q - VIN Number**	.....
R - Date of Vehicle Registration	Month :	Day :	Year : .....
S - Trans. model :	.....	**T - A/T Serial Number :**	.....
U - Your name :	.....		

V - Dealer Name, Address, Phone

F07RT036

Example of form completed.

A - Today's date :	Month : April	Day : 13	Year : 1994
B - End User Name, Address :	Dave Smith 6584, Arlington road Plymouth MI 48170 USA		
C - Date of Problem :	Month : April	Day : 8	Year : 1994
D - Mileage : 12230 (Mile) / Km	E - With Ignition ON is CHECK TRANS Indicator : (1- Flashing) 2- Not Flashing	F - Car load when problem occured : 1 - Towing a trailer 2- 2 people OR ..... Kg	
G - Weather conditions when problem : 1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable (6- Any)	H - Weather Temperature when problem: 1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable (6- Any)	I - Road Conditions when problem : 1- Any 2- Inter City 3- Outside City (4- Highway) 5 - Uphill 6- Downhill 7- Unpaved (8- Snow) 9 - Others	J - Frequency of the Problem : 1- Always (2- Occasional : ..... times/day, 3 times/month 3- Only Once 4- Others :
K - Engine Condition : 1- Always 2- At Cold 3- During Warming up (4- After Warming or Hot) 5- Others	L - Engine Speed when the problem occured : 1- Idling 2- Starting 3- Stalling (4- High RPM) 5- Low RPM	M - Transmission Condition when it occured : 1- Any 2- Idling 3- Starting 4- Driving (5- Accelerating) (6- Coasting) 7- In corner (8- Shifting)	this means do not take this into account

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
(3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a (upshift : 1-2 / 2-3 / 3-4) or (downshift : 4-3) / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz	2- Whine 3- Clunk 4- Rattle	5- Whistle // 6- light 7-medium 8- heavy
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments :

(This is just an example). Shift shock very harsh overall during a downshift. Not sure if it's the 4-3 or 3-2.

P - Isuzu Vehicle Code :	94 UCR	Q - VIN Number	4S2CV58ZXM4324047
R - Date of Vehicle Registration	Month : November.	Day : 18	Year : 1993
S - Trans. model :	4L30-E	T - A/T Serial Number :	96 358 654
U - Your name :	Joe Spring		

V - Dealer Name, Address, Phone

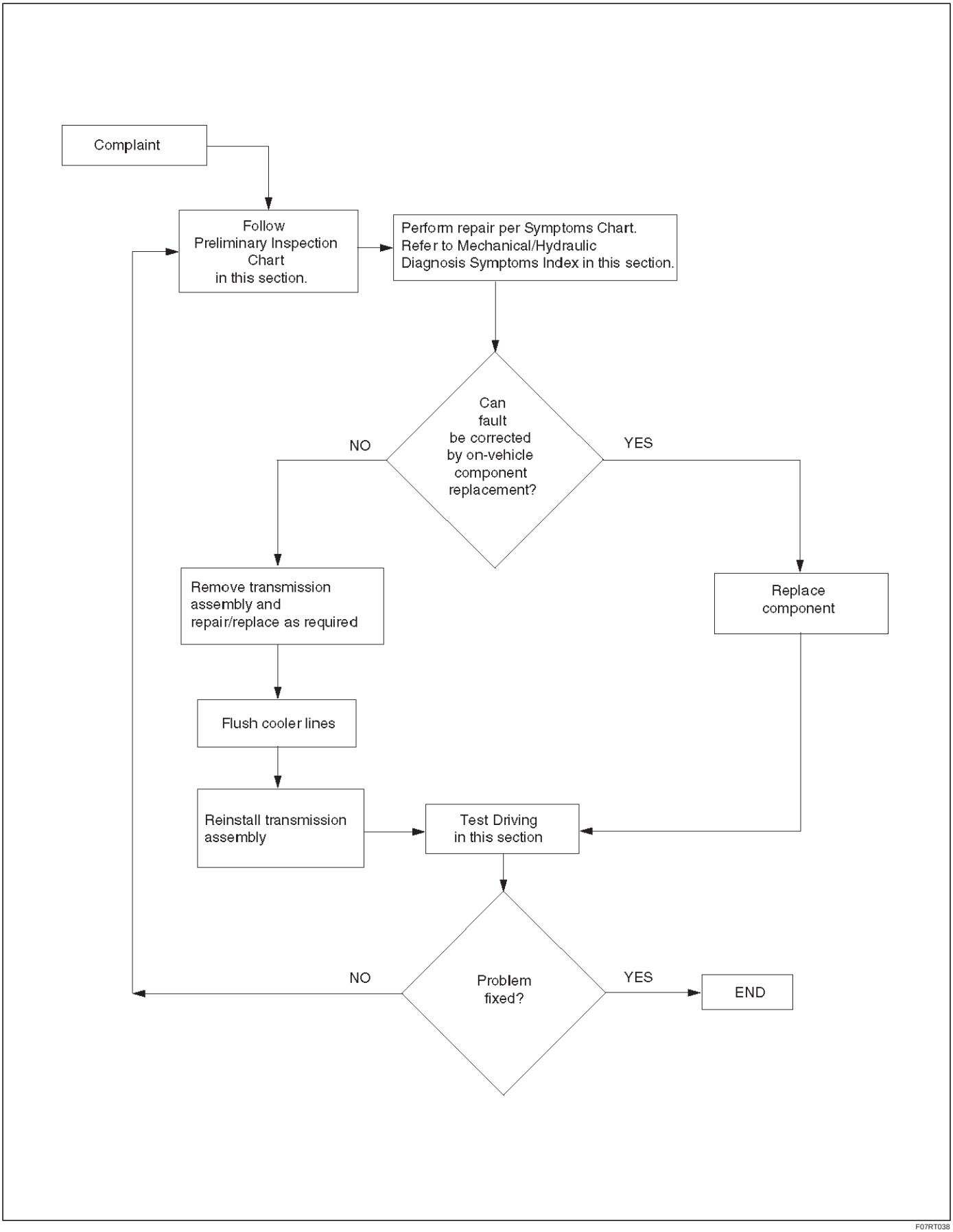
Kent Helfrich

Home-town ISUZU

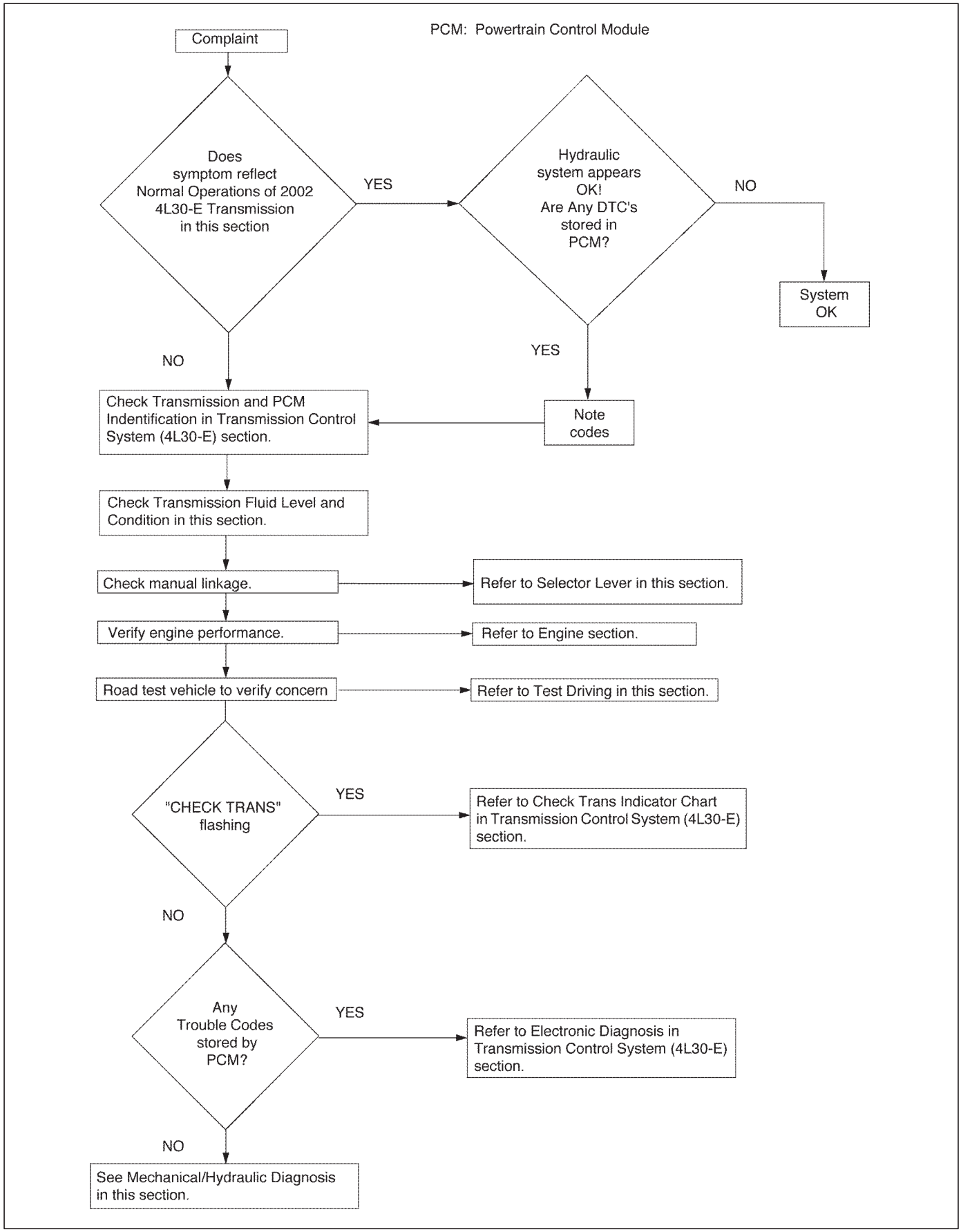
900 - 999 - 9999

F07RT037

General Diagnosis Procedure



Preliminary Inspection Chart



F07R200003

Checking Transmission Fluid Level and Condition

Checking fluid level and condition (color and odor) at regular intervals will provide early diagnosis information about the transmission. This information may be used to correct a condition that, if not detected early, could result in major transmission repairs.

IMPORTANT: When new, automatic transmission fluid is red in color. As the vehicle is driven, the transmission fluid will begin to look darker in color. The color may eventually appear light brown.

A dark brown color with burnt odor may indicate excessive fluid deterioration and signal a need for fluid change.

Fluid Level

When adding or changing fluid, use only DEXRON ®–III. Refer to *Maintenance and Lubrication in General Information section for maintenance information and servicing interval.*

CAUTION: DO NOT OVERFILL.
Overfilling will cause foaming, loss of fluid, abnormal shifting and possible damage to the transmission.

1. Park the vehicle on level ground and apply the parking brake firmly.
2. Check fluid level with engine running at idle.

NOTE: Be sure that transmission fluid temperature is below 30˚C (86˚F).

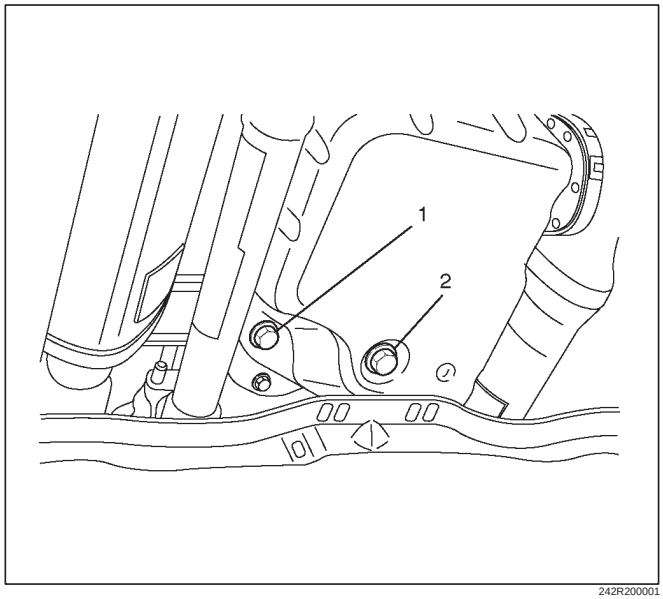
3. Move the selector lever through all gear ranges.
4. Move the selector lever to “Park”.
5. Let engine idle for 3 minutes and open the overfill screw (1).
6. Add released transmission fluid until it flows out over the overfill screw opening.
7. Let engine idle until a fluid temperature between 32˚C (90˚F) and 57˚C (135˚F) is reached, then close the overfill screw (1).

Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

Minimum fluid level → 57˚C (135˚F)
Maximum fluid level → 32˚C (90˚F)



242R200001

CAUTION: Do not open overfill screw with engine stopped.

CAUTION: DO NOT CHECK FLUID LEVEL UNDER THESE CONDITIONS:

- Immediately after driving at sustained highway speeds.
- In heavy city traffic during hot weather.
- If vehicle is towing a trailer.

If the vehicle has been operated under these conditions, shut the engine off and allow the vehicle to “cool” for thirty (30) minutes. After the cool down period, restart the vehicle and continue from step 2 above.

Fluid Condition

	FLUID CONDITION			
	NORMAL*		CONTAMINATED	
COLOR	RED OR LIGHT BROWN	BROWN	NON–TRANSPARENT / PINK	BROWN
DRAIN REQUIRED?	NO	YES	YES	YES
CONTAMINA–TION	NONE	Very small amount of foreign material in bottom of pan	Contamination by coolant or other source	Large pieces of metal or other foreign material in bottom of pan
CORRECT LEVEL AND CONDITION	1. LOW LEVEL: A. Add fluid to obtain proper level & check for external leaks. B. Correct cause of leak. 2. HIGH LEVEL: – Remove excess fluid	– Remove both pans – Change filter – Flush cooler – Add new fluid – Check level	– Repair/replace radiator cooler – Transmission overhaul required – Check for: ▼Damaged plates and seals ▼Contaminated solenoids – Flush cooler – Add new fluid – Check level	– Transmission overhaul required – Flush cooler and cooler lines – Add new fluid – Check level

*Fluid should be changed according to maintenance schedule.

Test Driving

Some 4L30–E automatic transmission complaints will require a test drive as a part of the diagnostic procedure. Some codes will not set unless the vehicle is moving. The purpose of the test drive is to duplicate the customer's complaint condition and set a current Powertrain Control Module (PCM) trouble code. Perform this procedure before each 4L30–E automatic transmission repair, and again after repairs are made.

IMPORTANT:

- ▼ Duplicate the condition under which the customer's complaint was observed.
- ▼ Depending on the complaint, the line pressure gauge and the scan tool may be required during the test drive.
- ▼ During the test drive, it is important to record all necessary data from the areas being monitored, for use in diagnosis. Also listen for and note any unusual noises.

The following procedure should be used to test drive 4L30–E automatic transmission complaint vehicles:

1. Turn the ignition ON without starting the engine. Check that the "CHECK TRANS" lamp comes on for approximately 2 seconds and then goes out and remains out.

   ▼If the lamp is flashing, GO TO **Check Trans Indicator** in Transmission Control System (4L30–E) section.

   ▼If no serial data is present, GO TO **OBD System Check.** Refer to *Driveability and Emissions in Engine section.*

   ▼If the lamp stays ON or stays OFF, GO TO **"Check Trans" Check** in Transmission Control System (4L30–E) section.

2. Drive the vehicle. During the test drive, be sure that the transmission achieves normal operating temperature (approx. 20 minutes).

   Allow the transmission to go through all of its gear ranges, checking shift timing and firmness. Duplicate the owner's complaint condition as closely as possible during the test drive.

3. If, during the test drive, the "CHECK TRANS" lamp comes on, use the scan tool to check for trouble codes.

4. If, during the test drive, a problem is felt, but the "CHECK TRANS" lamp does not come on and no trouble codes are present, drive the vehicle with the PCM disconnected (manually shifting the vehicle).

   ▼In Manual L, the vehicle operates in first gear.

   ▼In Manual 2, the vehicle operates in third gear.

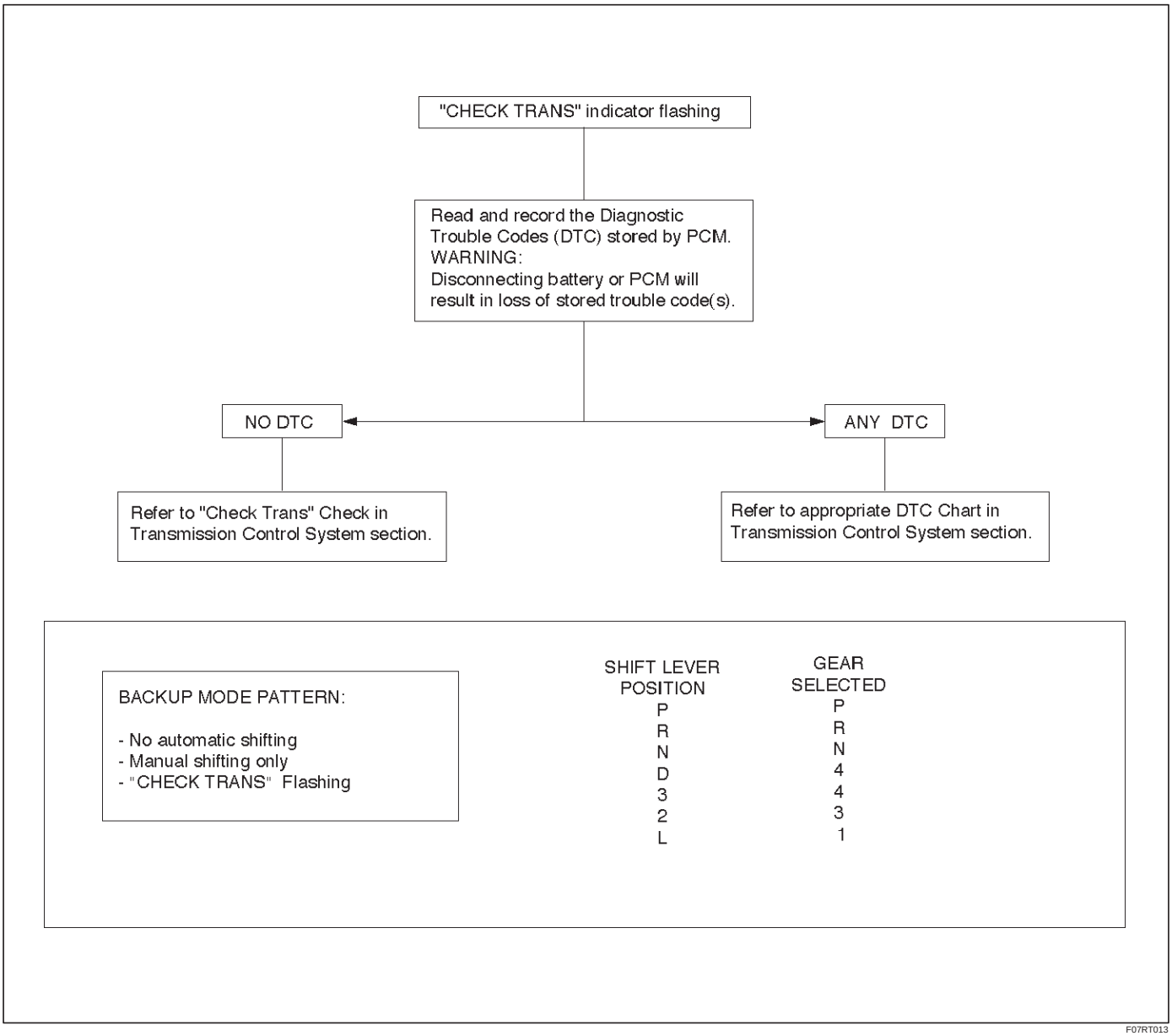
   ▼In Manual 3 or "D", the vehicle operates in fourth gear.

   If the problem still exists with the PCM disconnected, refer to *Mechanical/Hydraulic Diagnosis in this section.*

5. If no problem has been found at this point, check all underhood connections that supply power to the PCM and ignition fuses. Physically and visually inspect all the PCM harness connectors for loose or corroded terminals. Inspect the PCM ground points.

Mechanical / Hydraulic Diagnosis Check Trans Indicator Chart

Perform Preliminary Inspection First!



F07RT013

When the “CHECK TRANS” indicator is flashing, it indicates that a problem related to the transmission, the Powertrain Control Module (PCM), or the vehicle harness has occurred.
The system is now operating in a “BACKUP MODE” where the risk of further damaging the transmission has been reduced. The vehicle may be shifted manually.
If the initial problem is intermittent or seldom, switching the engine OFF/ON might allow normal operation again until the problem reoccurs.

Mechanical / Hydraulic Diagnosis Symptoms Index

Perform Preliminary Inspection First!

CHART	SYMPTOMS
1	NO ENGINE START IN NEUTRAL OR PARK
2	NO FORWARD GEARS IN ANY RANGE/NO REVERSE
3	NO ENGINE BRAKE IN ANY RANGE
4	POOR SHIFTING IN ALL GEARS (ALL HARSH OR ALL SOFT)
5a	DELAYS IN DRIVE AND REVERSE
5b	DELAYS IN REVERSE ONLY
6	DIAGNOSTIC TROUBLE CODE (DTC) P0730
7	HARSH 1–2 SHIFT
8	HARSH 3–4 SHIFT
9a	3–2 DOWNSHIFT COMPLAINT
9b	HARSH SHIFT WHEN SHIFTING INTO “D” OR ACCELERATING FROM STOP
9c	COASTDOWN HARSH SHIFT OR CLUNK AT 3–2 DOWNSHIFT
10	INTERMITTENT 4TH TO 2ND GEAR DOWNSHIFT AT STEADY SPEED
11	ENGINE FLARE AT SHIFTING DURING TURNING ONLY (USUALLY WITH WARM ENGINE)
12	ENGINE FLARE DURING 1–2 OR 2–3 SHIFT
13	SHUDDER ONLY DURING TORQUE CONVERTER CLUTCH (TCC) APPLYING
14	POSSIBLE CAUSES OF TRANSMISSION NOISE
15a	POSSIBLE CAUSES OF LOW LINE PRESSURE
15b	POSSIBLE CAUSES OF HIGH LINE PRESSURE
16	POSSIBLE CAUSES OF TRANSMISSION FLUID LEAKS

NOTE: Numbers with parenthesis on the following charts refer to *Parts List at end of this section.*

Chart 1: No Engine Start In Neutral Or Park

Step	Action	Yes	No
1	Does engine start when shift lever moved from drive to neutral mostly in hot condition?	Go to *Step 2*	Go to *Step 3*
2	Does engine start in park at any condition?	Re–test vehicle	Go to *Step 4*
3	Does engine also not start in neutral when shift lever moved from park to neutral?	Go to *Step 4*	Go to *Step 5*
4	Check mode switch (63) setting. Readjust if necessary. Problems fixed?	Re–test vehicle	Go to *Step 5*
5	Check start circuit of mode switch (63) open in neutral. Was open found?	Locate and repair open(s)	Replace mode switch (63)

Chart 2: No Forward Gears In Any Range/No Reverse

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check internal linkage: – Manual linkage (58) not moving manual valve (326). 2. Check for internal mechanical damage: – Turbine shaft (506) broken loose. – Overrun roller clutch (516) broken loose. Was the problem found?	Repair or replace	—

Chart 3: No Engine Brake In Any Range

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for overrun clutch leaks caused by: – Damaged piston lip (513) – Check ball defective (504) 2. Check for overrun lockout valve (705) stuck by foreign material. 3. Check for leaks at turbine shaft (506) caused by: – Teflon seal rings damaged (508) – Excessive wear of turbine shaft bearing surfaces. Was the problem found?	Repair or replace	—

Chart 4: Poor Shifting In All Gears (All Harsh Or All Soft)

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Go to *Step 3*
2	1. Check for these conditions which could affect clutch apply time: – Defective band apply solenoid (323). – Defective servo or/and accumulator piston. – Excessive clutch piston travel. 2. Check of possible causes of internal leaks: – Cut or damaged sealing ring(s) – Damaged sealing gasket(s) – Check ball missing or out of location in 2nd and 3rd clutch pistons. 3. Check for causes of burned clutch plates or band. Was the problem found?	Repair or replace	—
3	Was the line pressure high?	Go to *Step 4*	Use Chart 15a: Possible Causes of Low Line Pressure in this section
4	Does DTC P0705 set?	Diagnose those DTC(s) first	Use Chart 15b: Possible Causes of High Line Pressure in this section

Chart 5a: Delays In Drive And Reverse

NOTE: A short delay (less than 3 seconds) when first engaging drive or reverse after allowing vehicle to sit overnight is normal.

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	More than 3 second delay in drive and reverse with engine off 1 hour or less. Teflon seals (508) on turbine shaft damaged. Repair	Use Chart 15a: Possible Causes of Low Line Pressure in this section.

Chart 5b: Delays In Reverse Only

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	Main case valve body gasket (88) damaged. – Reverse check ball (85) in valve body (84) missing or out of location. – Check for restrictions at valve body transfer plate orifice. Was the problem found?	Repair	—

Chart 6: Diagnostic Trouble Code (DTC) P0730

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	1. 1st and 2nd gear missing or 3rd and 4th gear missing. Check appropriate shift valve. If OK replace solenoid. 2. No engine brake in any range (All ranges in Drive and Reverse are OK). Check for suspected conditions modifying delays to clutch apply: – Overrun clutch seal damaged. – Excessive overrun clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. 3. 1st and 4th gear missing or 2nd and 3rd gear missing. Shift solenoid A stuck. Replace shift solenoid A. 4. DTC P0730 is set in D range 1st gear above 3500 rpm. Go to *Step 3*. 5. DTC P0730 is set in D range 3rd gear between 55-80 mph. NOTE: Perform this test within safe and legal limits. Check for suspected conditions modifying delays to clutch apply: – 4th clutch seal damaged. – Excessive 4th clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—
3	Check 3rd gear in “D” in winter mode. Does vehicle move?	Shift solenoid A stuck. Replace shift solenoid A.	Go to *Step 4*
4	Check for suspected conditions modifying delays to clutch apply: – 2nd clutch seal damaged. – Excessive 2nd clutch piston travel. – Defective accumulator piston. – Causes of internal leaks. – Check ball missing or out of location in 2nd clutch. – Seals cut, damaged or missing. – Gaskets defective. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—

Chart 7: Harsh 1–2 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Check for 1–2 accumulator valve (320) stuck by foreign material in main case valve body.	Use Chart 15b: Possible Causes of High Line Pressure in this section.

Chart 8: Harsh 3–4 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	1. Check for 3–4 accumulator valve (407) stuck in adapter case valve body (401). 2. Check for 3–4 accumulator piston (18) stuck in adapter case (20). Was the problem found?	Repair or replace	—

Chart 9a: 3–2 Downshift Complaint

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 9b: Harsh Shift When Shifting Into “D” Or Accelerating From Stop

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 9c: Coastdown Harsh Shift Or Clunk At 3–2 Downshift

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 10: Intermittent 4TH TO 2ND Gear Downshift At Steady Speed

Step	Action	Yes	No
1	Check for consistent speed sensor reading with scan tool. Was the reading correct?	Replace mode switch for intermittent contact.	Go to *Step 2*
2	1. Check for wiring harness damage or short to ground. If OK, go to *(2)*. 2. Check transmission speed sensor connections. If OK, go to *(3)*. 3. Replace transmission speed sensor. Was the replacement complete?	—	Replace speed sensor.

Chart 11: Engine Flare At Shifting During Turning Only (Usually With Warm Engine)

Step	Action	Yes	No
1	Check for oil leaks at transmission. Was the problem found?	Replace transmission oil filter and gasket	—

Chart 12: Engine Flare During 1–2 Or 2–3 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to *Line Pressure Test in this section.* Was line pressure normal?	Go to *Step 2*	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for a stuck 1–2 accumulator valve (320). 2. Check for servo piston (106) leaks. 3. Check for a stuck band apply solenoid (323). Was line pressure normal?	Repair or replace	—

Chart 13: Shudder Only During Torque Converter Clutch (TCC) Applying

Step	Action	Yes	No
1	1. TCC shudder is one of the most commonly misdiagnosed conditions in an automatic transmission. The key to diagnosing TCC shudder is to note when it happens and under what conditions. Once the TCC has been fully applied, it is nearly impossible to make it shudder. TCC shudder (short burst of noise normally less than 1 second) will only occur during clutch applying. It is not a steady state condition. 2. Drive until whole drivetrain is at normal operating temperature. – On 4WD vehicles, the test must be performed with transfer case selector lever in “2H” position. – Shudder is a short burst of noise normally less than 1 second in duration, and can be induced by the following maneuver: 3. From coast condition at 50 mph in “D” range (Normal mode), depress the throttle to 1/4-1/3 throttle. If present, shudder will occur within 5 seconds together with TCC application.(The scan tool may be used to determine the exact time of TCC applying) Was the problem found?	Replace transmission fluid and filter (remove both pans) and flush cooler lines. Replace converter assembly and O-ring on turbine shaft	Perform mechanical inspection of other drivetrain components.

Chart 14: Possible Causes Of Transmission Noise

CAUTION: Before checking transmission for what is believed to be transmission noise, ensure presence and positioning of insulating plugs, pads etc. Also make sure that noise does not come from other drivetrain components.

Condition	Possible cause	Correction
Whine or Buzz	Oil level low	Fill with ATF, check for external leaks.
	Plugged or restricted oil filter	Inspect oil filter. Replace oil filter or ATF as necessary.
	Damaged oil filter gasket	Replace oil filter gasket.
Knocking noise from front of transmission.	Loose bolts (Converter to flex plate)	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Converter damaged	Replace converter.
Knocking noise while driving, mostly on acceleration.	Transmission mount loose or broken	Tighten mount bolts or replace transmission mount.
	Cooler line mounts loose or broken	Tighten or replace cooler line mounts.
	Cooler lines touching body or frame	Repair or replace as necessary.
Knocking noise when vehicle is stationary.	Loose flex plate mounting bolts	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Damaged converter	Replace converter.

Chart 15a: Possible Causes of Low Line Pressure

Step	Action	Yes	No
1	Check oil level. Was the problem found?	Fill with ATF	Go to *Step 2*
2	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor	Go to *Step 3*
3	Check for plugged, loose, or damaged oil filter (79). Was the problem found?	Inspect oil filter, tighten bolts or replace oil filter (79)	Go to *Step 4*
4	Check for a stuck force motor plunger (404). (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to *Step 5*
5	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace feed limit valve (412)	Go to *Step 6*
6	Check for loose converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to *Step 7*
7	Check for a stuck pressure regulator valve (217). (Oil pump) Was the problem found?	Replace pressure regulator valve (217)	Go to *Step 8*
8	Check for a stuck boost valve (213).(Oil pump) Was the problem found?	Replace boost valve (213)	Go to *Step 9*
9	Check for blocked intermediate oil passages to pressure regulator valve. (Oil pump) Was the problem found?	Replace oil pump	Go to *Step 10*
10	Check for defective oil pump (9, 201, 202 & 228). Was the problem found?	Replace oil pump	Go to *Step 11*
11	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or damaged – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

Chart 15b: Possible Causes Of High Line Pressure

NOTE: If transmission is operating in backup mode, high line pressure will be present.

Step	Action	Yes	No
1	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor.	Go to *Step 2*.
2	Check for a stuck force motor plunger (404). (Open circuit/intermittent) (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to *Step 3*
3	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace force motor plunger (412)	Go to *Step 4*
4	Check converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to *Step 5*
5	Check for a stuck pressure regulator valve (217). (Oil pump) Was the problem found?	Replace pressure regulator valve (217)	Go to *Step 6*
6	Check for a stuck boost valve (213). (Oil pump) Was the problem found?	Replace boost valve (213)	Go to *Step 7*
7	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or missing – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

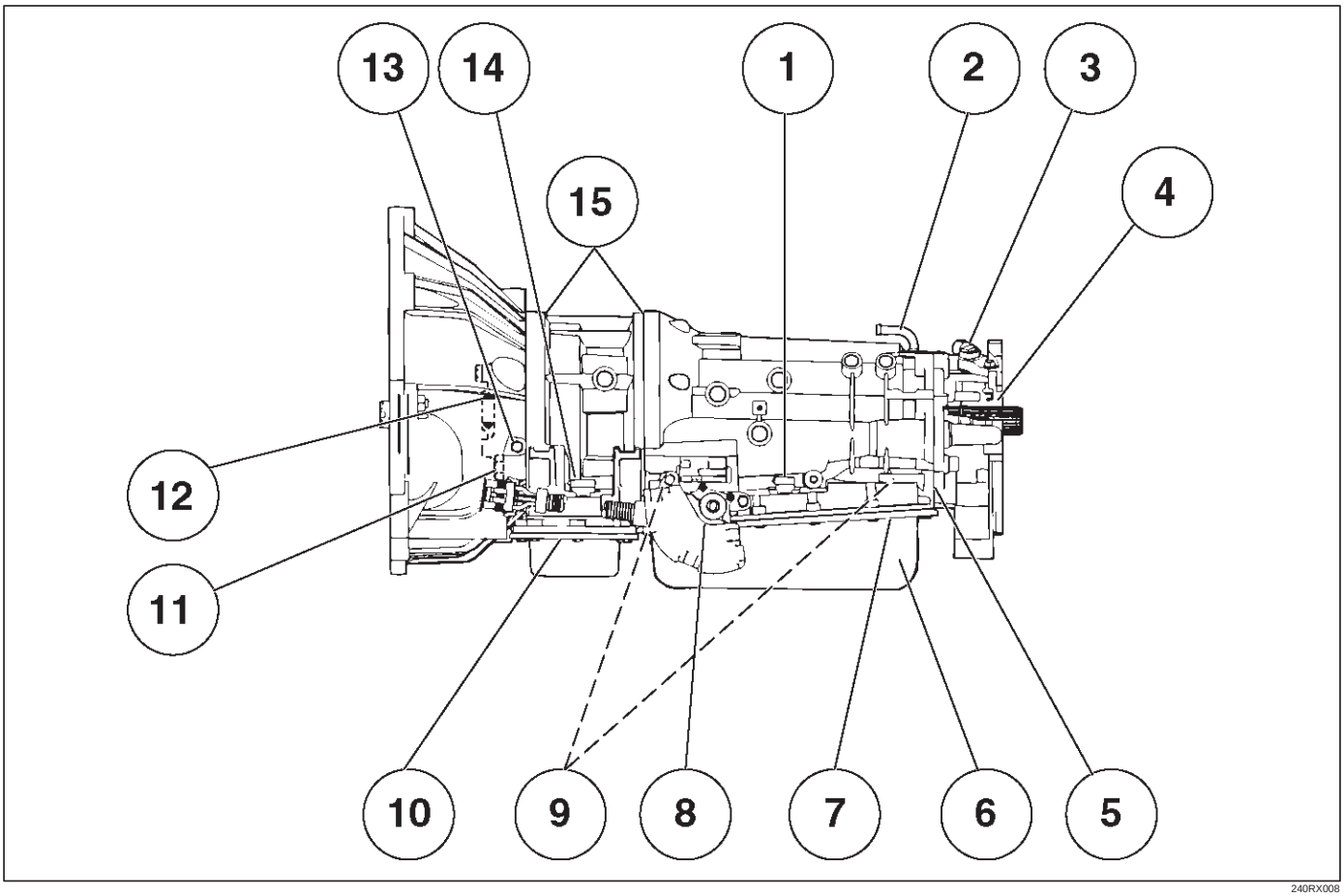
Chart 16: Possible Causes Of Transmission Fluid Leaks

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak may be difficult to determine due to “wind flow” around the engine and transmission.
The suspected area should be wiped clean before inspecting for the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the vehicle by the air stream. In determining the source of an oil leak, the following two checks should be made:

1. With the engine running, check for external line pressure leaks.
2. With the engine off, check for oil leaks due to the raised oil level caused by drainback of converter oil into the transmission.

Possible Causes Of Fluid Leaks Due To Sealing Malfunction



240RX008

Legend

(1) Electrical Connector (Main Case) Seal
(2) Transmission Vent (Breather)
(3) Speed Sensor O–Ring
(4) Extension (Adapter) Lip Seal
(5) Extension (Adapter) to Main Case Gasket
(6) Overfill and Oil Drain Screws Gasket
(7) Oil Pan Gasket (Main Case)
(8) Selector Shaft Seal
(9) Oil Cooler Connectors (2)
(10) Oil Pan Gasket (Adapter Case)
(11) Converter housing attaching bolts not correctly torqued
(12) Converter Housing Lip Seal
(13) Line Pressure Tap Plug
(14) Electrical Connector (Adapter Case) Seal
(15) Adapter Case Seal Rings (2)

Stall Test

The stall test allows you to check the transmission for internal abrasion and the one way clutch for slippage. Torque converter performance can also be evaluated.
The stall test results together with the road test results will identify transmission components requiring servicing or adjustment.

Stall Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if necessary.
2. Block the wheels and set the parking brake.
3. Connect a tachometer to the engine.
4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80˚C (158 – 176˚F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Gradually push the accelerator pedal to the floor.
   The throttle valve will be fully open.
   Note the engine speed at which the tachometer needle stabilizes.

   Stall Speed : 2,100 ±150 rpm

NOTE: Do not continuously run this test longer than 5 seconds.

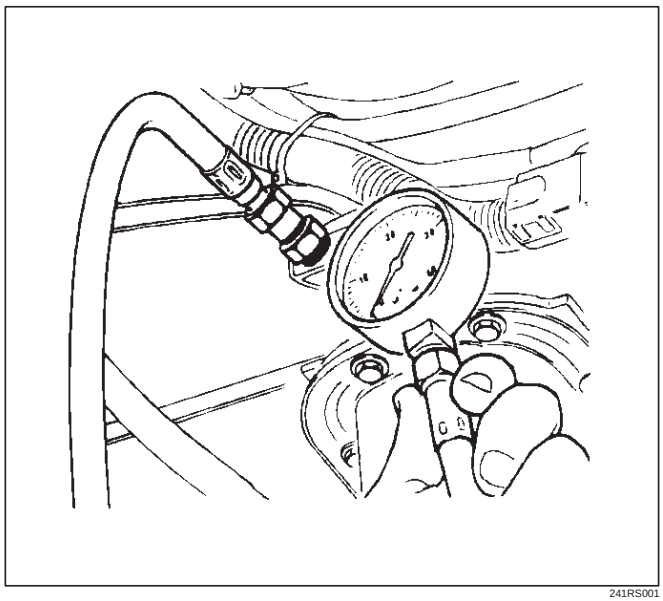
8. Release the accelerator pedal.
9. Place the selector in the “N” range.
10. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
11. Repeat Steps 7 – 10 for the “3”, “2”, “L” and “R” ranges.

Line Pressure Test

The line pressure test checks oil pump and control valve pressure regulator valve function. It will also detect oil leakage.

Line Pressure Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid.
   Replenish if required.
2. Block the wheels and set the parking brake.
3. Remove the pressure detection plug at the left side of the transmission case.
   Set J–29770–A pressure gauge and adapter to the pressure detection plug hole.


241RS001

4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80˚C (158 – 176˚F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Note the pressure gauge reading with the engine idling.
8. Gradually push the accelerator pedal to the floor. The throttle valve will be fully open.
   Note the pressure gauge reading with the accelerator pedal fully depressed.

NOTE: Do not continuously run this test longer than 5 seconds.

9. Release the accelerator pedal.
10. Place the selector in the “N” range.
11. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
12. Repeat Steps 7 – 11 for the “3”, “2”, “L”, and “R” ranges.
13. Install a pressure detection plug to the transmission case, applying recommended thread locking agent (LOCTITE 242) or its equivalent to thread of plug. Make sure that thread is cleaned before applying locking agents.
14. Tighten the pressure detection plug to the specified torque.

    Torque: 9 – 14N·m (7 – 10lb ft)

MODE	LEVER POSITION	ENGINE SPEED	LINE PRESSURE		FORCE MOTOR CURRENT (mA)
			kPa	PSI	
NORMAL/POWER	D,3,2,L	IDLE	590 – 730	86 – 106	680 – 720
WINTER	D	IDLE	300 – 390	44 – 57	1,020 – 1,060
NORMAL/POWER WINTER	REVERSE	IDLE	460 – 630	67 – 91	880 – 920
NORMAL/POWER	D, 3, 2, L	STALL SPEED	1,250 – 1,380	181 – 200	70 – 110
WINTER	D	STALL SPEED	1,250 – 1,380	181 – 200	70 – 110
NORMAL/POWER WINTER	REVERSE	STALL SPEED	1,400 – 1,580	203 – 229	340 – 380

Shift Speed Chart

Transfer gear ratio:	High: 1.000
Rear axle ratio:	4.300

“Normal mode”

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	166 ~ 172 (103 ~ 107)
	Half throttle	32 ~ 38 (20 ~ 24)	57 ~ 63 (35 ~ 39)	99 ~ 105 (61 ~ 65)
3 (Third)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	—
	Half throttle	32 ~ 38 (20 ~ 24)	57 ~ 63 (35 ~ 39)	—
2 (Second)	Fully opened	53 ~ 59 (33 ~ 37)	—	—
	Half throttle	32 ~ 38 (20 ~ 24)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	45 ~ 51 (28 ~ 32)	97 ~ 103 (60 ~ 64)	155 ~ 161 (96 ~ 100)
	Half throttle	14 ~ 20 (9 ~ 12)	33 ~ 39 (20 ~ 24)	64 ~ 70 (40 ~ 43)
	Fully closed	13 ~ 19 (8 ~ 12)	19 ~ 25 (12 ~ 16)	27 ~ 33 (17 ~ 21)
3 (Third)	Fully opened	45 ~ 51 (28 ~ 32)	97 ~ 103 (60 ~ 64)	—
	Half throttle	14 ~ 20 (9 ~ 12)	33 ~ 39 (20 ~ 24)	—
	Fully closed	13 ~ 19 (8 ~ 12)	19 ~ 25 (12 ~ 16)	—
2 (Second)	Fully opened	45 ~ 51 (28 ~ 32)	92 ~ 98 (57 ~ 61)	—
	Half throttle	14 ~ 20 (9 ~ 12)	92 ~ 98 (57 ~ 61)	—
	Fully closed	13 ~ 19 (8 ~ 12)	92 ~ 98 (57 ~ 61)	—
L (First)	—	48 ~ 54 (30 ~ 34)	—	—

“Power mode”

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	174 ~ 180 (108 ~ 112)
	Half throttle	41 ~ 47 (25 ~ 29)	84 ~ 90 (52 ~ 56)	136 ~ 142 (84 ~ 88)
3 (Third)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	—
	Half throttle	41 ~ 47 (25 ~ 29)	84 ~ 90 (52 ~ 56)	—
2 (Second)	Fully opened	53 ~ 59 (33 ~ 37)	—	—
	Half throttle	41 ~ 47 (25 ~ 29)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	45 ~ 51 (28 ~ 32)	104 ~ 110 (65 ~ 68)	163 ~ 169 (101 ~ 105)
	Half throttle	22 ~ 28 (14 ~ 17)	57 ~ 63 (35 ~ 39)	108 ~ 114 (67 ~ 71)
	Fully closed	13 ~ 19 (8 ~ 12)	23 ~ 29 (14 ~ 18)	46 ~ 52 (29 ~ 32)
3 (Third)	Fully opened	45 ~ 51 (28 ~ 32)	104 ~ 110 (65 ~ 68)	—
	Half throttle	22 ~ 28 (14 ~ 17)	57 ~ 63 (35 ~ 39)	—
	Fully closed	13 ~ 19 (8 ~ 12)	23 ~ 29 (14 ~ 18)	—
2 (Second)	Fully opened	45 ~ 51 (28 ~ 32)	92 ~ 98 (57 ~ 61)	—
	Half throttle	22 ~ 28 (14 ~ 17)	92 ~ 98 (57 ~ 61)	—
	Fully closed	13 ~ 19 (8 ~ 12)	92 ~ 98 (57 ~ 61)	—
L (First)	—	48 ~ 54 (30 ~ 34)	—	—

“Winter mode”

D range, winter mode ON → OFF	31 ~ 37 km/h (19 ~ 23 mph)

Lockup Speed Chart

Transfer gear ratio	High: 1.000
Rear axle ratio	4.300

D range Throttle opening 6%	Mode	ECCC Apply			ECCC Release		
		2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)	2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)
	Normal	57 ~ 63 (35 ~ 39)	42 ~ 48 (26 ~ 30)	43 ~ 49 (27 ~ 31)	52 ~ 58 (32 ~ 36)	32 ~ 38 (20 ~ 24)	41 ~ 47 (25 ~ 29)
	Power	57 ~ 63 (35 ~ 39)	67 ~ 73 (42 ~ 45)	57 ~ 63 (35 ~ 39)	52 ~ 58 (32 ~ 36)	32 ~ 38 (20 ~ 24)	49 ~ 55 (30 ~ 34)

Changing Transmission Fluid

There is no need to change the transmission fluid unless the transmission is used under one or more of the following heavy duty conditions.

A. Repeated short trips
B. Driving on rough roads
C. Driving on dusty roads
D. Towing a trailer

If the vehicle is used under these conditions, change the fluid every 20,000 miles (32,000 km).

1. Place a large drain pan under the oil pan.
2. Remove the transmission oil drain screw (2) and drain fluid.
3. Tighten drain screw (2).

   Torque: 38 N•m (28 lb ft)
4. Remove the transmission overfill screw (1) and fill transmission through overfill screw opening, using DEXRON®–III ATF.

NOTE: Add transmission fluid until it flows out over the overfill screw opening.

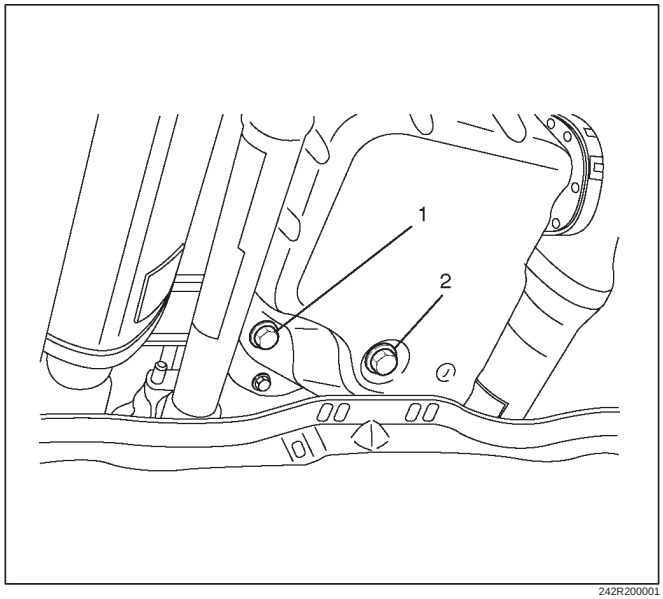
5. Let engine idle until a fluid temperature between 32˚C (90˚F) and 57˚C (135˚F) is reached.
6. Add transmission fluid until it flows out over the overfill screw opening, then close the overfill screw (1).

   Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

7. Reset “Oil Life Monitor” data by using Tech 2.
   Refer to *Tech 2 OBD II Connection in Transmission Control System (4L30-E) section.*

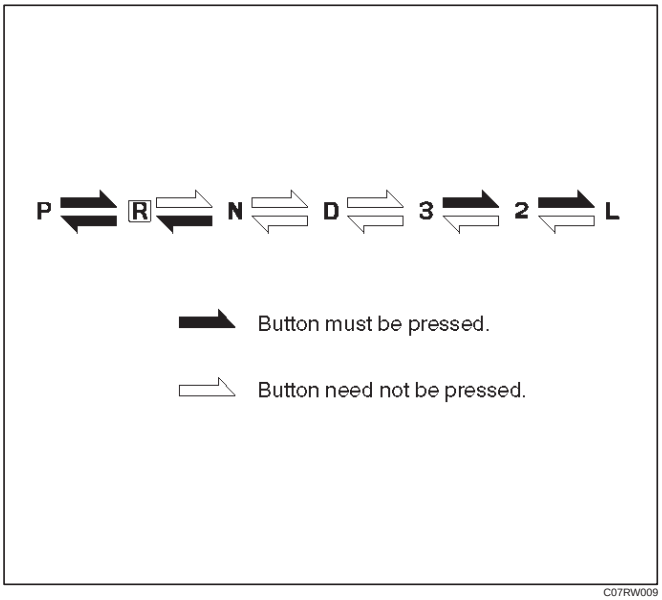


242R200001

Selector Lever

Inspection

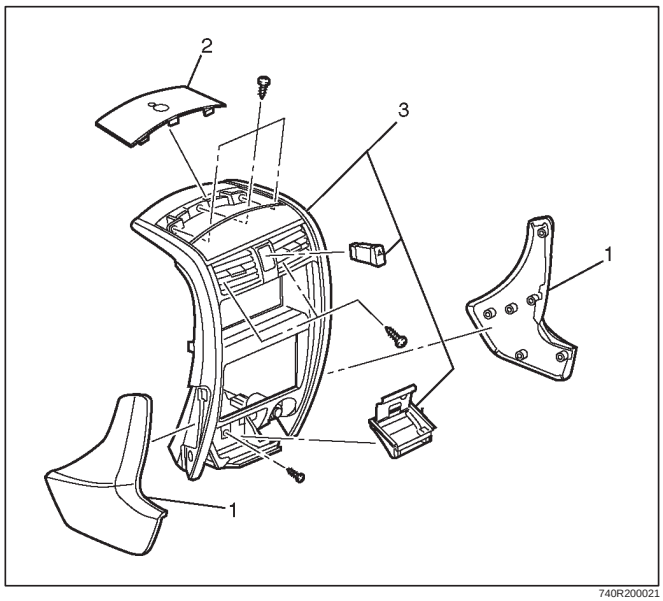
1. Make sure that when the selector lever is shifted from “P” to “L”, a “clicking” can be felt at each shift position. Make sure that the gear corresponds to that of the position plate indicator.
2. Check to see if the selector lever can be shifted as shown in illustration.



C07RW009

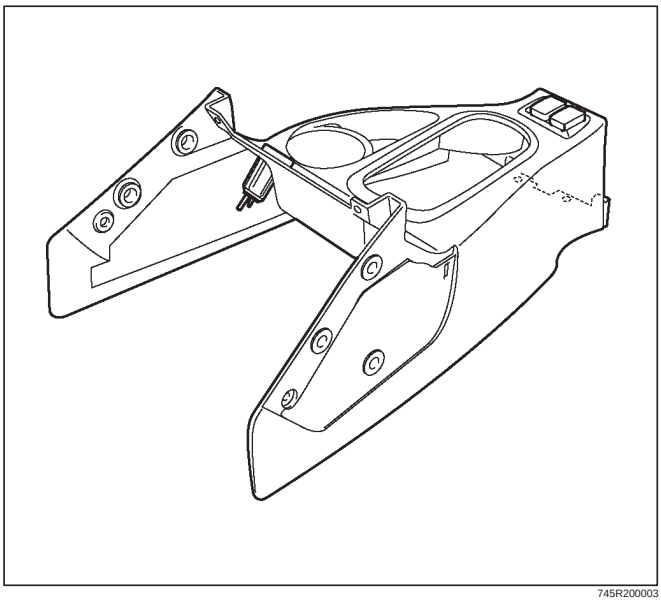
Removal

1. Disconnect battery ground cable.
2. Set ignition Key in “LOCK” position and selector lever in ”P” position.
3. Remove knee pads (1), cluster upper cover (2) and center cluster assembly (3).



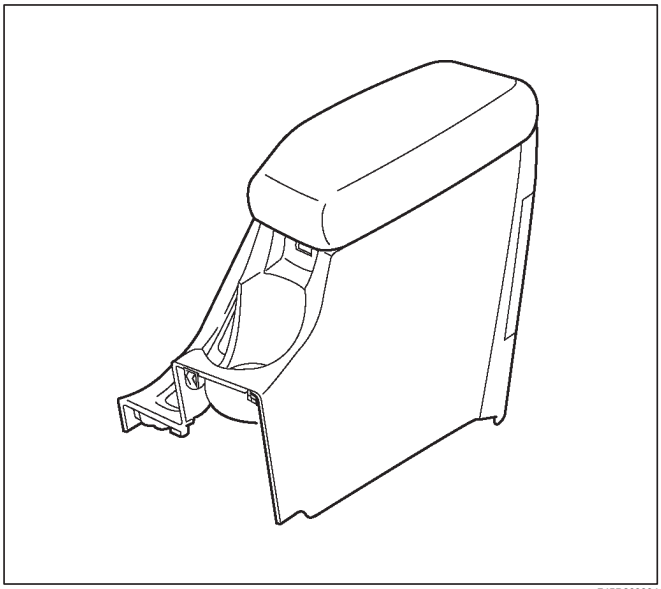
740R200021

4. Remove rear console.



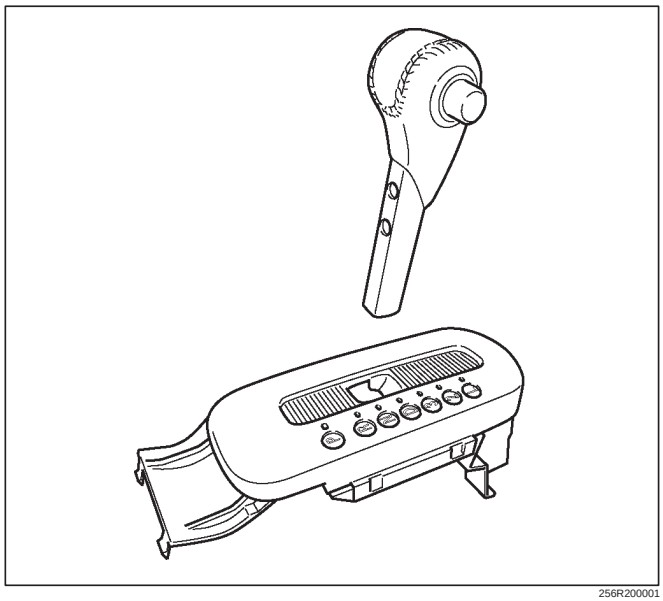
745R200003

5. Remove front console.



745R200004

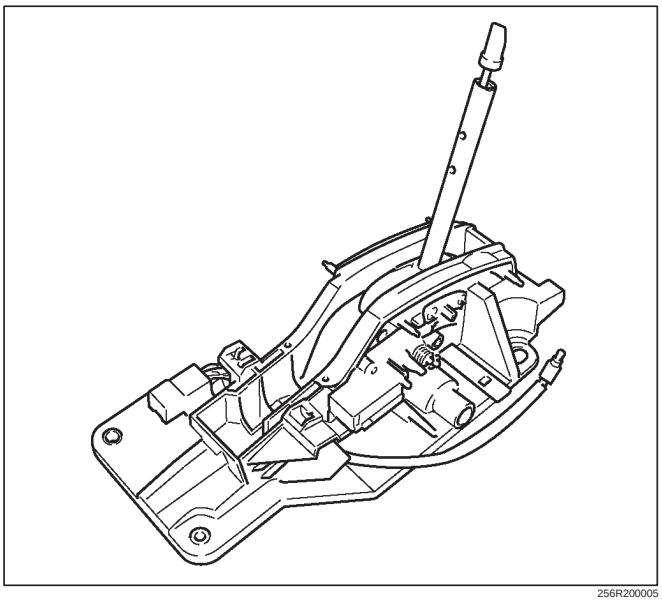
6. Remove selector lever knob and cover assembly.



256R200001

7. Disconnect select cable.
   ▼Refer to *Select Cable in this section.*
8. Disconnect shift lock cable.
   ▼Refer to *Shift Lock Cable in this section.*
9. Disconnect harness connector.

10. Remove selector lever subassembly.



256R200005

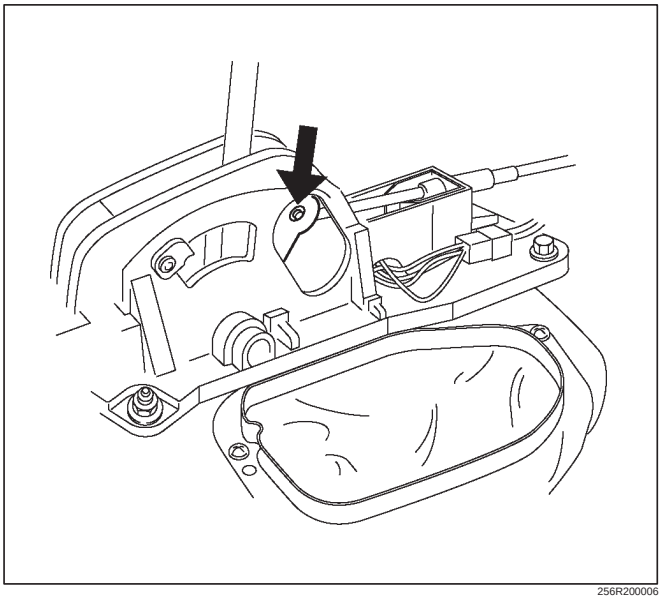
Installation

1. Install selector lever subassembly.
2. Connect harness connector.
3. Connect shift lock cable.
   ▼Refer to *Shift Lock Cable in this section.*
4. Connect select cable.
   ▼Refer to *Select Cable in this section.*
5. Install selector lever knob and cover assembly.
6. Install front console.
7. Install rear console.
8. Install center cluster assembly, cluster upper cover and knee pads.
9. Connect negative (–) battery cable.
10. After installation, make sure that the selector lever operates normally, and that each selector position is properly indicated. (The red mark shows through the window.)

Select Cable

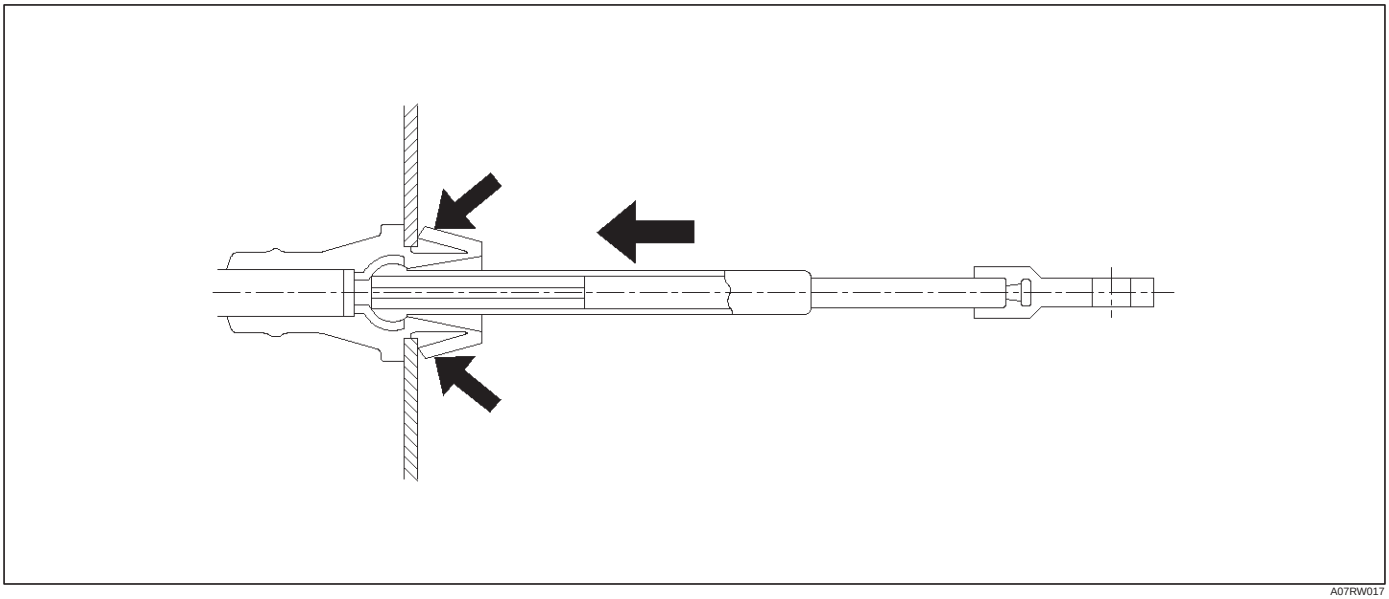
Removal

1. Set selector lever in “P” position.
2. Remove knee pads, cluster upper cover, center cluster assembly, rear console, front console, selector lever knob and cover assembly.
   ▼Refer to *Selector Lever in this section.*
3. Disconnect inner cable by pulling projection on pin.



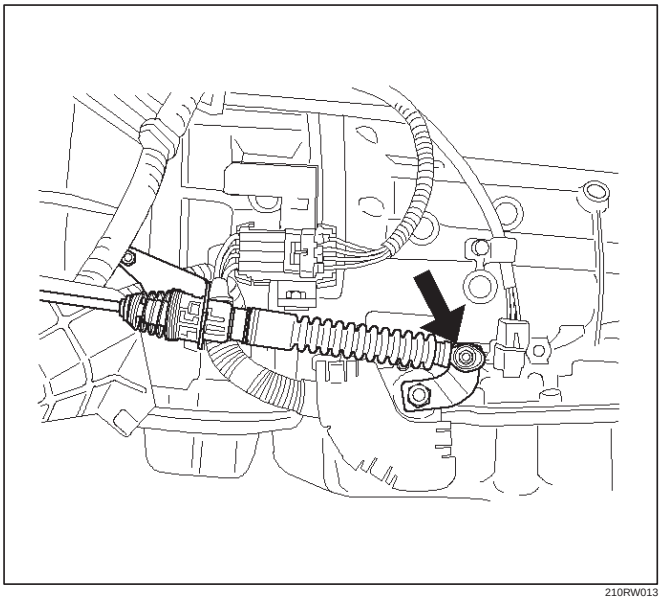
256R200006

4. Press down claws and disconnect cable assembly.



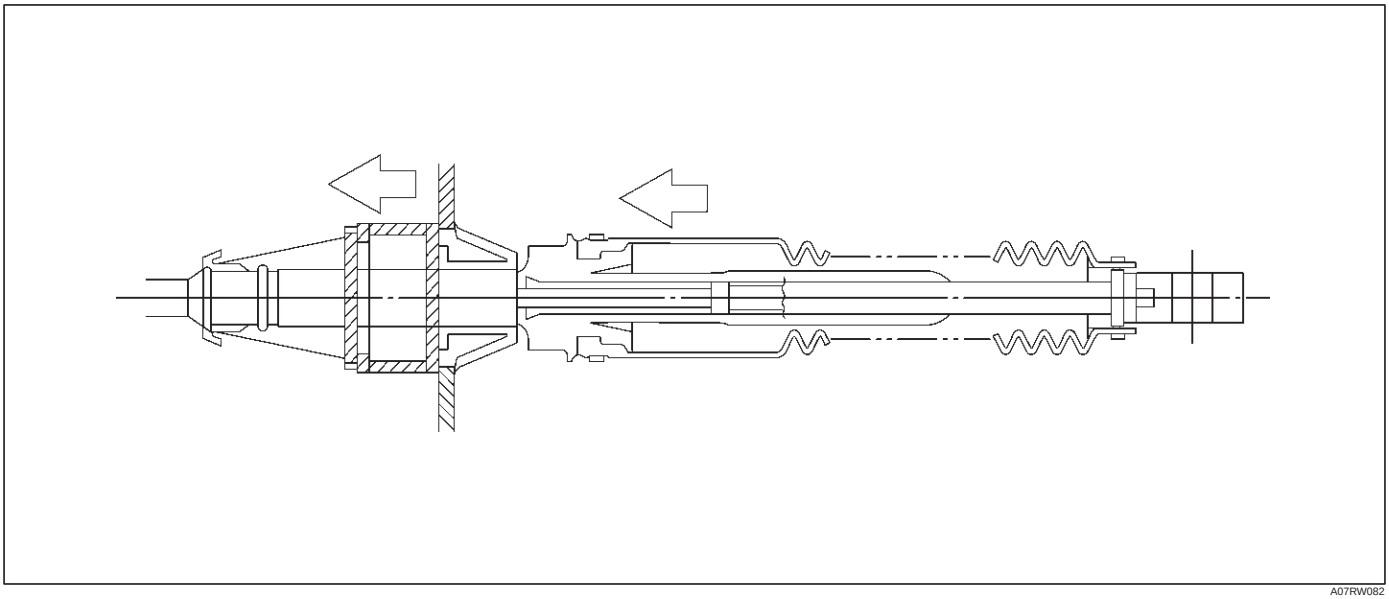
A07RW017

5. Remove nuts that fasten grommet in select cable assembly.
6. Disconnect inner cable.



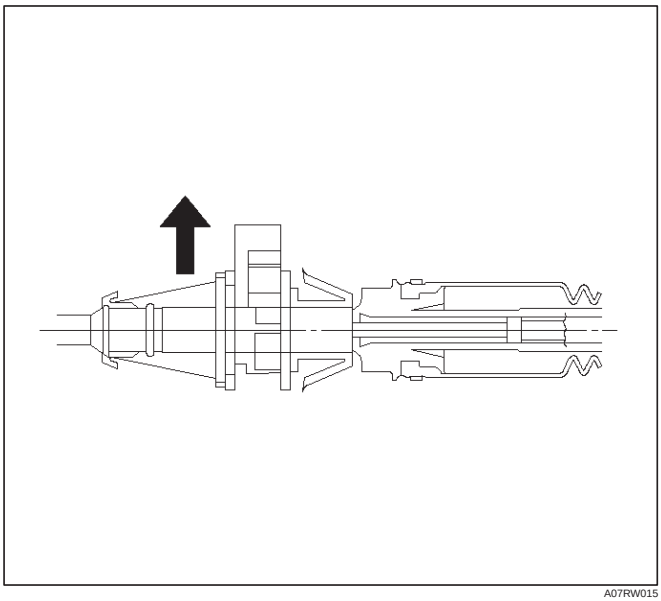
210RW013

7. Slide sleeve and disconnect cable assembly.



A07RW082

8. Pull lock.

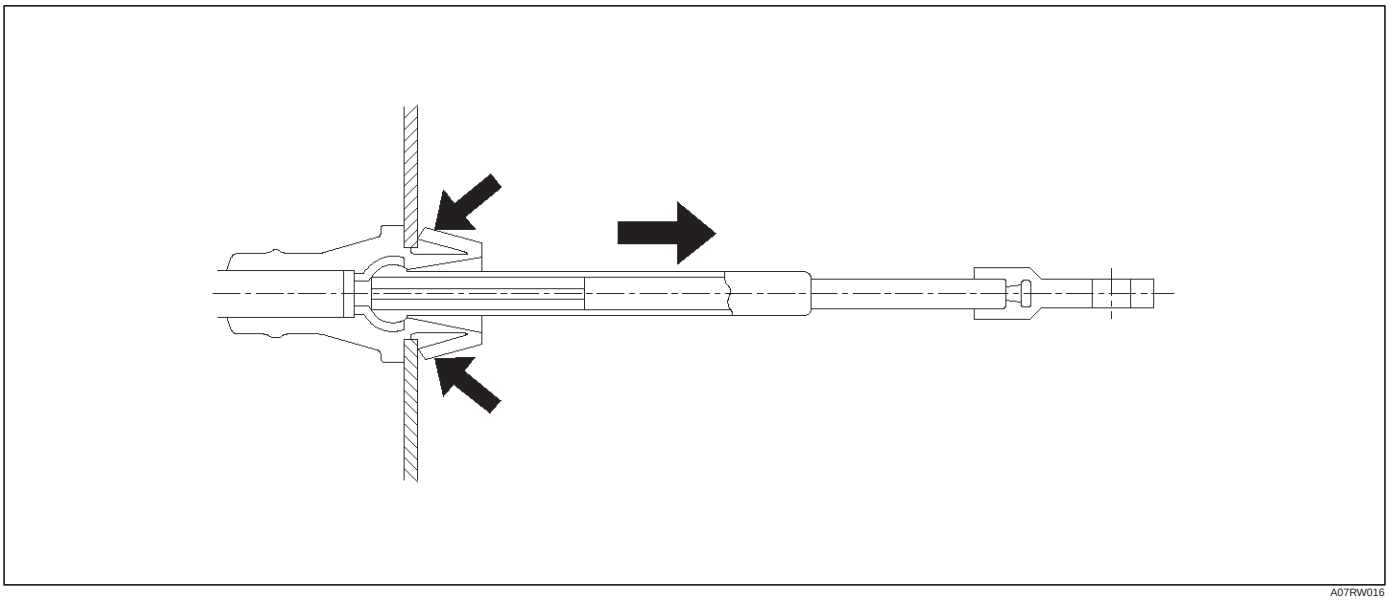


A07RW015

9. Draw select cable assembly into the interior side.

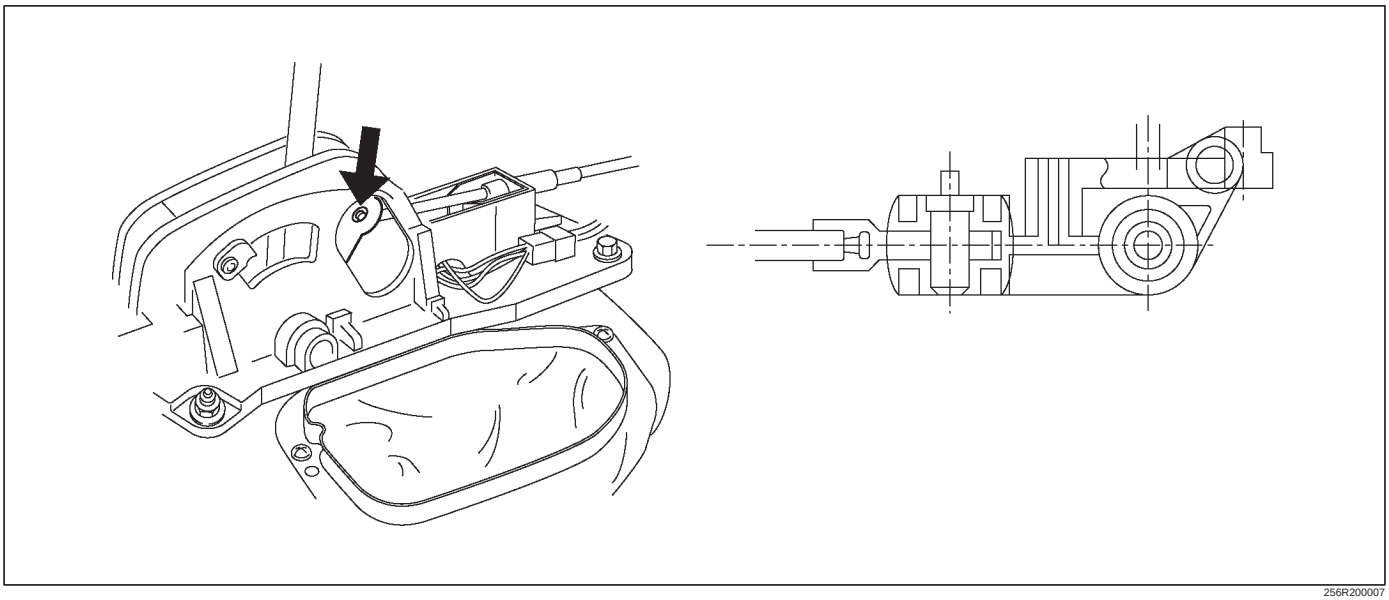
Installation

1. Set selector lever in “P” position.
2. Let out select cable transmission side end from floor hole.
3. Fit outer cable into bracket in selector lever assembly.



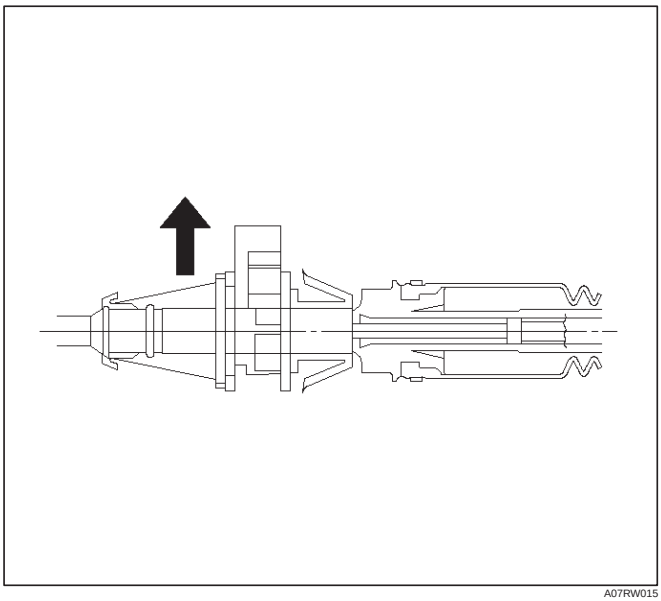
A07RW016

4. Set inner cable end in selector lever and push pin into selector lever hole and inner cable end.



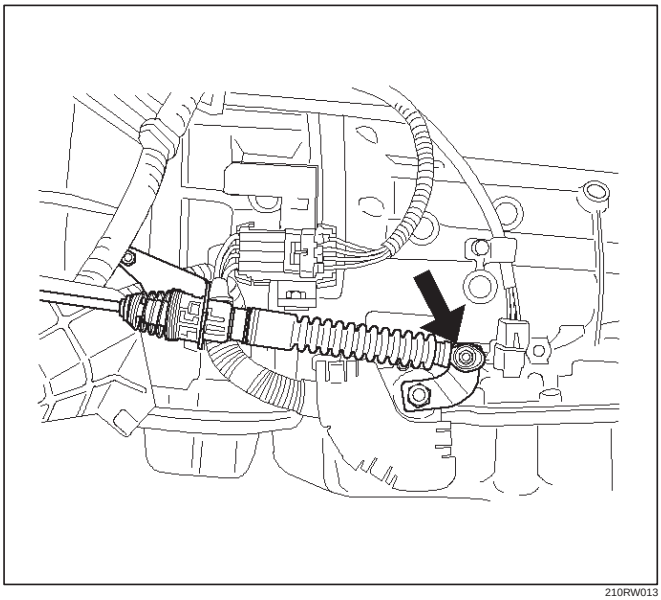
256R200007

5. Check that lock projects.



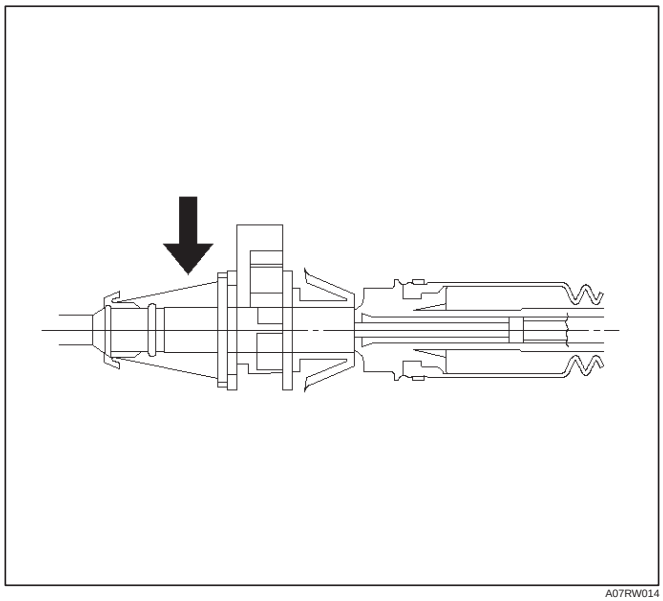
A07RW015

6. Connect adjust end fitting attachment to the bracket on transmission.
7. Set select lever “P” position and connect inner cable to select lever.



210RW013

8. Push lock into adjust end fitting attachment.



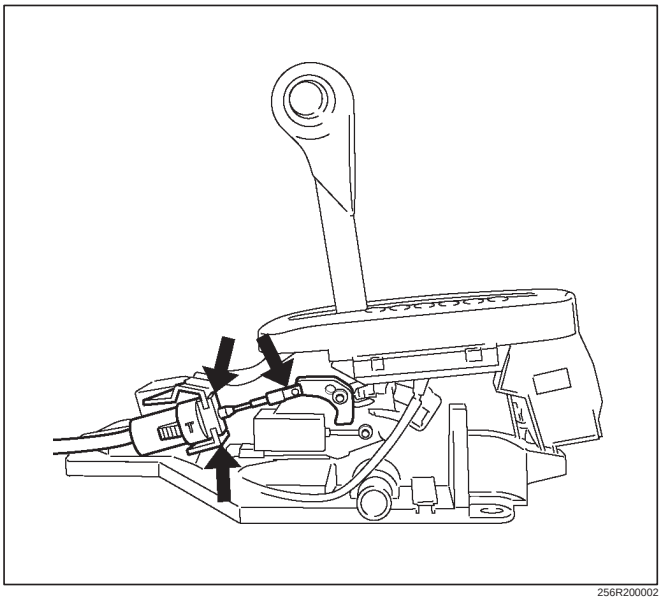
A07RW014

9. Install grommet.
10. About following installation steps, refer to *Selector Lever in this section.*

Shift Lock Cable

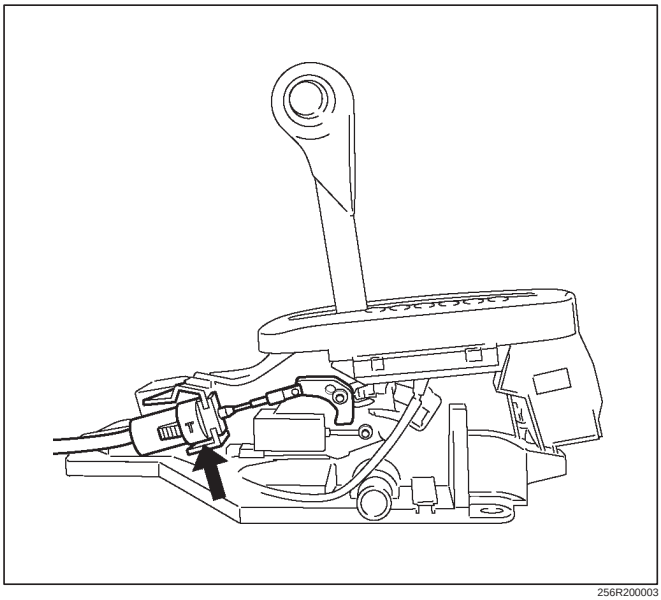
Removal

1. Set ignition key in “LOCK” position and selector lever in “P” position.
2. Remove knee pads, cluster upper cover, center cluster assembly, rear console, and front console.
   ▼Refer to *Selector Lever in this section.*
3. Disconnect inner cable from selector lever assembly then push claw and disconnect cable assembly.



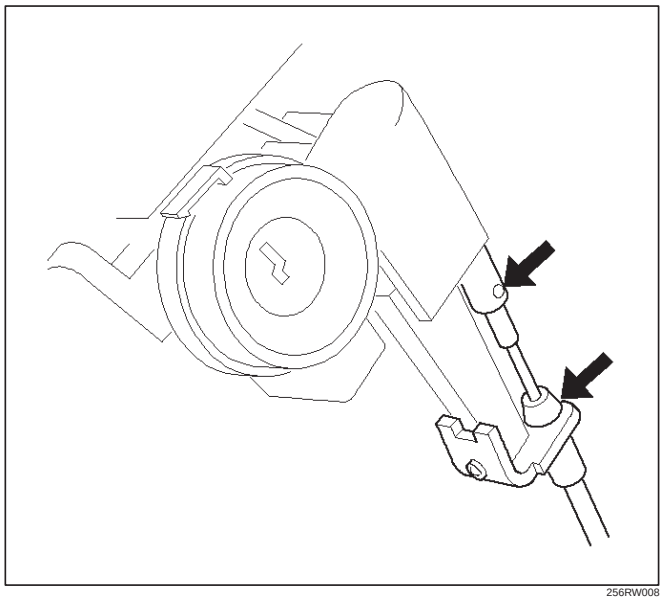
256R200002

4. Disconnect lock adjust.



256R200003

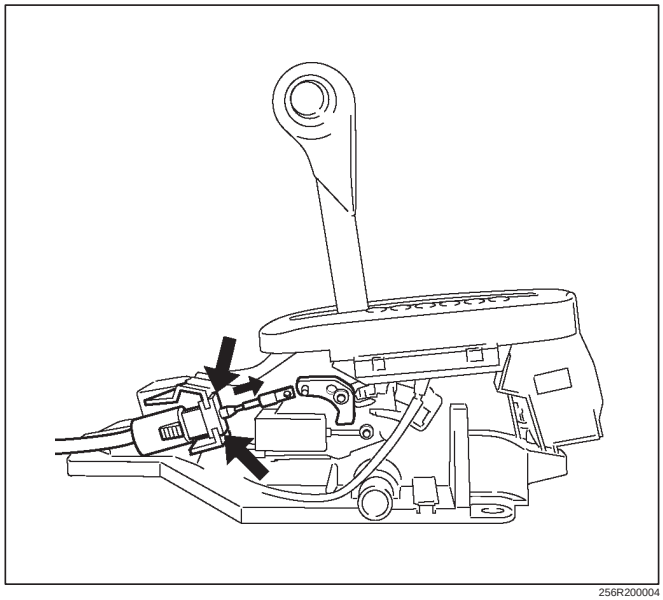
5. Remove instrument panel lower cover and steering column cover.
6. Remove spring pin and disconnect inner cable.
   ▼Disconnect outer cable from bracket.



256RW008

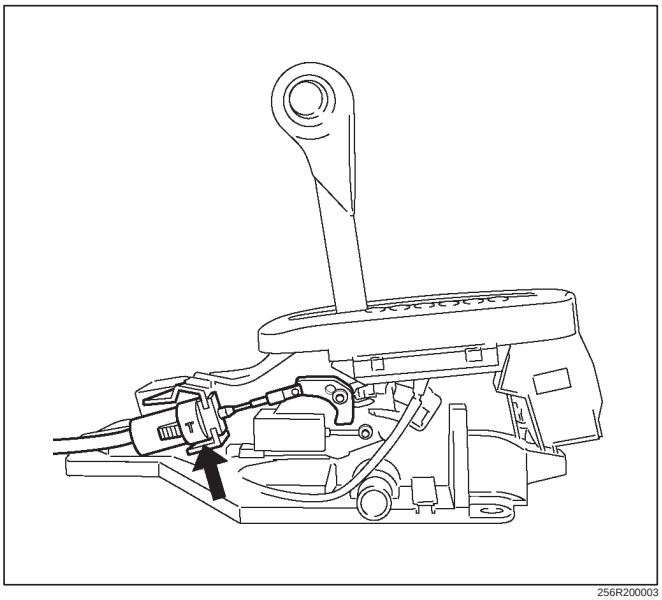
Installation

1. Set ignition key in “LOCK” position and selector lever in “P” position.
2. Connect outer cable to bracket near steering lock.
   ▼Connect inner cable to steering lock and install spring pin.
3. Install steering column cover and instrument lower cover.
4. Install adjust body of cable assembly to bracket in selector lever assembly.
   ▼Install inner cable to lever, pulling inner cable with outer cable.



256R200004

5. Check that cable moves smoothly, lightly pulling outer cable rearward.
6. Connect lock adjust, aligning “T” mark in the “Up” position.



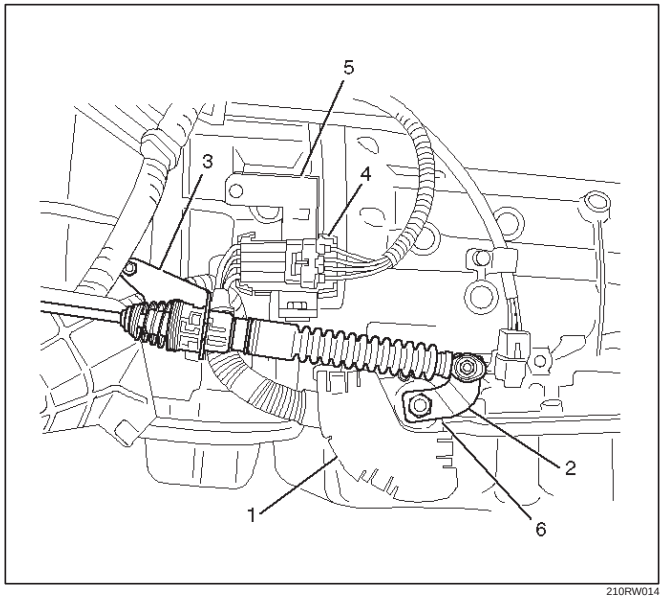
256R200003

7. About following installation steps, refer to *Selector Lever in this section.*
8. Check the shift lock operation:
   a. Selector lever should not be moved out of “P” position with ignition key in “Lock” position.
   b. Selector lever can be moved out of “P” position with ignition key in “ON”position only when brake pedal is depressed.
   c. ignition key can be turned to “LOCK” position only when selector lever is in “P” position (key can be pulled out).
9. If a. and c. fail, readjust cable. If b. fails, readjust connector wiring and brake pedal switch.

Mode Switch

Removal

1. Place selector lever in neutral.
2. Disconnect battery ground cable.
3. Remove mode switch cover (1) (V6).
4. Disconnect selector lever (2) from the mode switch.
5. Remove bracket with cable (3).
6. Disconnect transmission harness from the mode switch connector (4).
7. Remove bracket with mode switch connector from the transmission case.
8. Remove mode switch connector (4) from the bracket (5).
9. Remove two mode switch bolts and nut then remove mode switch (6).



210RW014

Installation

To install, follow the removal steps in the reverse order, noting the following points;

1. Torque

   Mode switch bolt: 13 N•m (113 lb in)

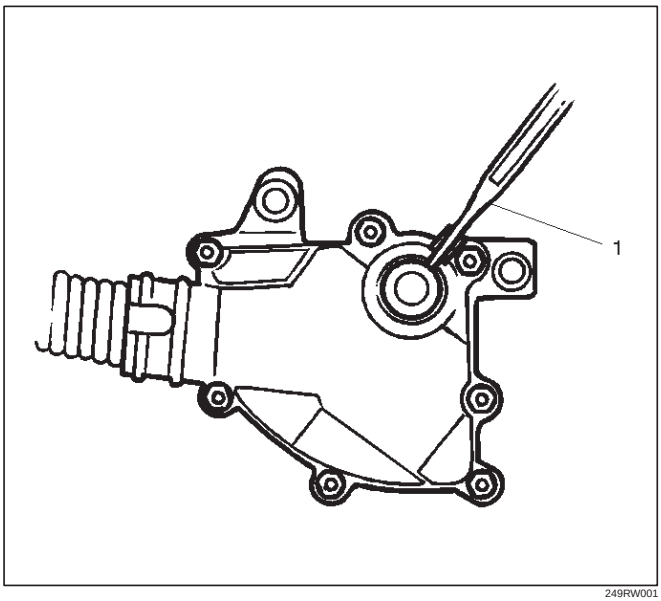
   Selector lever nut: 23 N•m (17 lb ft)

2. Mode switch setting procedure

   Perform either of the following adjustment procedures:

   Procedure 1

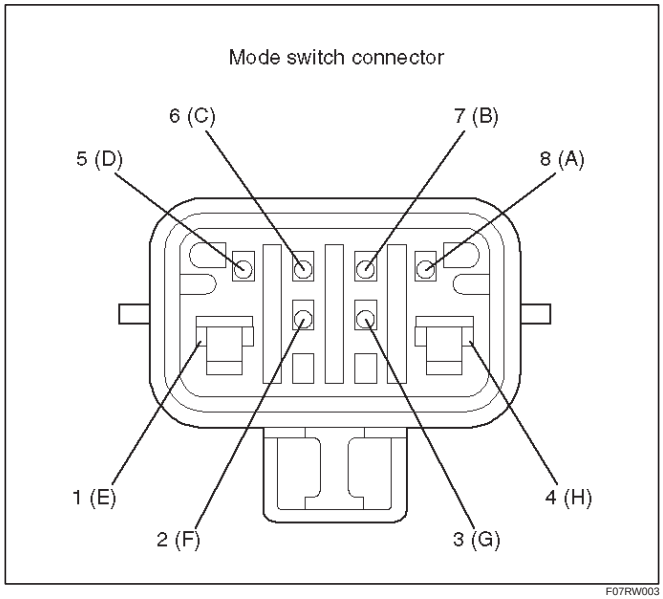
   a. Place selector lever in neutral.
   b. Remove selector lever from the mode switch.
   c. Remove the mode switch cover.
   d. Loosen the two 10 mm screws.
   e. Rotate the mode switch until the slot in the mode switch housing aligns with the selector shaft bushing, and insert a 3/32 in. (2.4 mm) drill bit or punch (1) into the slot.
   f. Tighten the screws to 13 N·m (113 lb in).
   g. After completing adjustment, snap the mode switch cover into place.
   h. Reinstall the selector lever.



249RW001

   Procedure 2

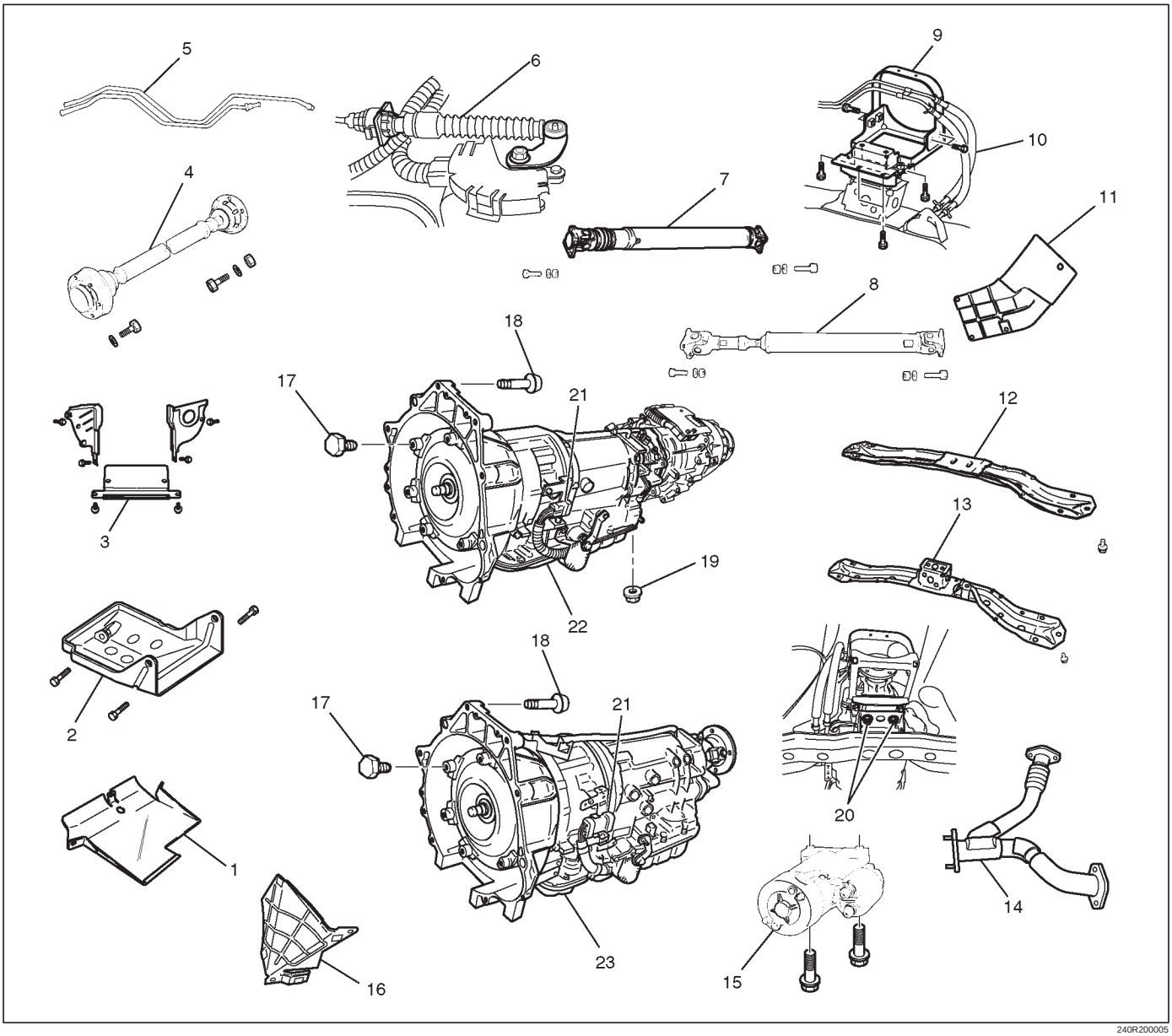
   a. Place selector lever in neutral.
   b. Disconnect transmission harness connector from mode switch connector.
   c. Remove mode switch connector with bracket from the transmission case.
   d. Connect multimeter (resistance mode) to terminals 1(E) and 4(H) on mode switch connector.
   e. Loosen two mounting screws.
   f. Rotate mode switch slightly in both directions to determine the range (approx. 5 degrees) of electrical contact.
   g. Position mode switch in middle of contact range.
   h. Tighten two mounting screws.
   i. Remove multimeter and install mode switch harness connector with bracket to the transmission case.
   j. Connect transmission harness connector to mode switch connector.



F07RW003

Transmission Assembly

Transmission and Associated Parts



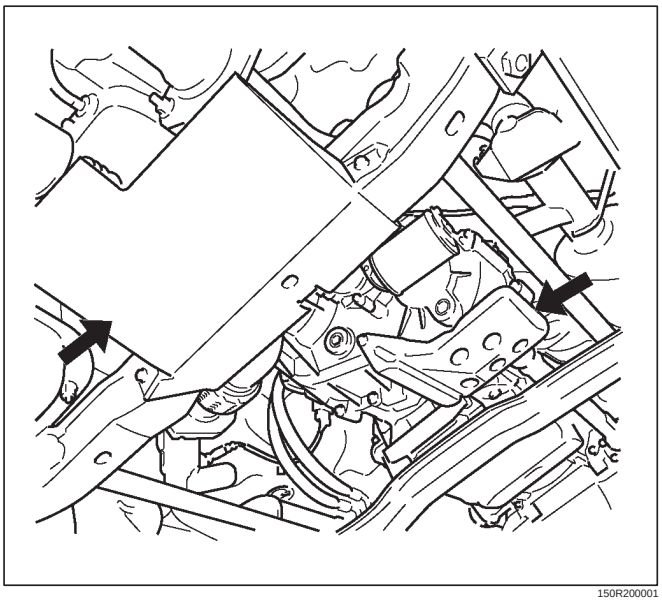
240R200005

Legend

(1) Fairing Plate
(2) Transfer Protector (4×4)
(3) Under Cover
(4) Front Propeller Shaft (4×4)
(5) Transmission Oil Cooler Pipe
(6) Select Cable
(7) Rear Propeller Shaft (4×2)
(8) Rear Propeller Shaft (4×4)
(9) Rear Mount Rubber and Propeller Protector Assembly (4×2)
(10) Fuel Pipe
(11) Fuel Pipe Heat Protector
(12) Third Crossmember (4×4)
(13) Third Crossmember (4×2)
(14) Center Exhaust Pipe (4×4)
(15) Starter
(16) Harness Heat Protector
(17) Torque Converter Bolt
(18) Engine-Transmission Bolt
(19) Rear Mount Nut (4×4)
(20) Rear Mount Nut (4×2)
(21) Harness Connector
(22) Transmission Assembly with Transfer Assembly (4×4)
(23) Transmission Assembly (4×2)

Removal

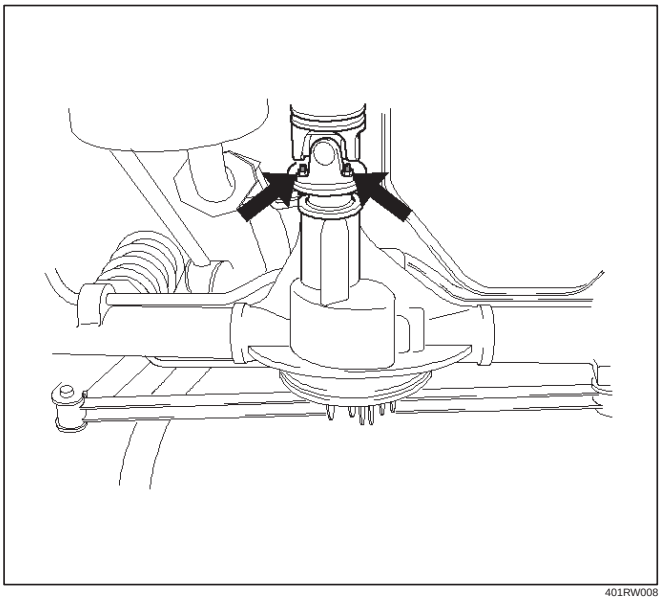
1. Disconnect battery ground cable.
2. Remove transfer protector (4×4) and fairing plate.



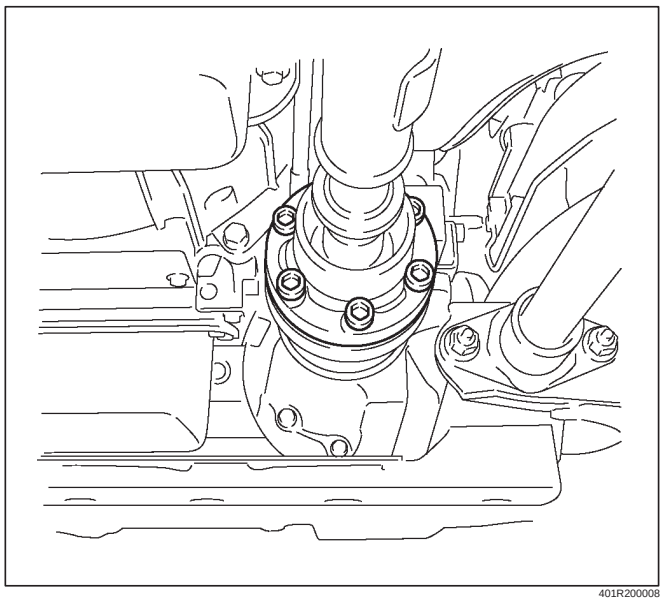
150R200001

3. Remove rear propeller shaft and front propeller shaft (4×4).

NOTE: Apply alignment marks on the flange at both front and rear sides.

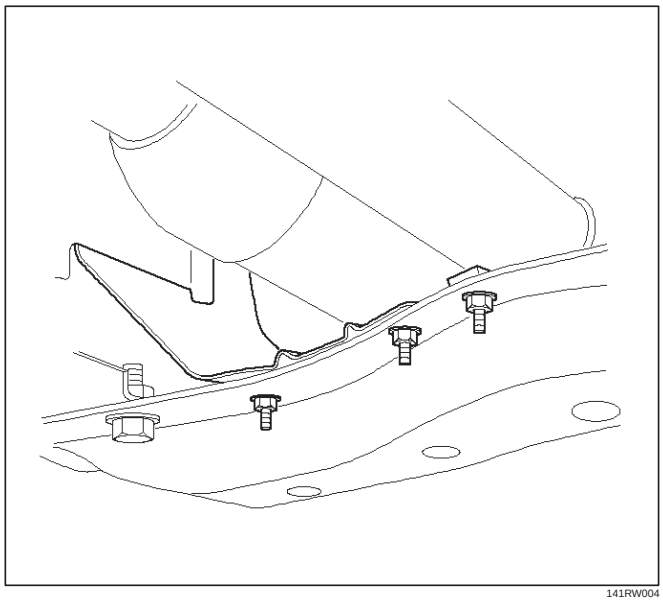


401RW008



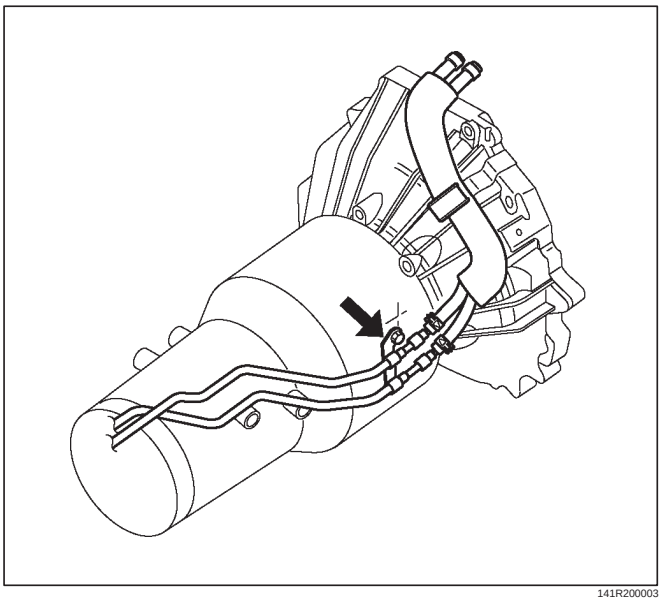
401R200008

4. Remove center exhaust pipe (4×4).
5. Remove fuel pipe heat protector and clip from third crossmember.
6. Disconnect fuel pipe bracket from third crossmember.



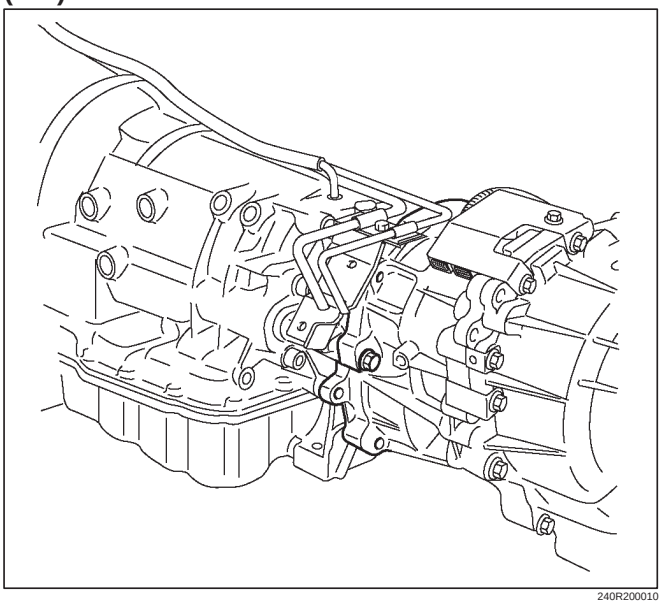
141RW004

7. Disconnect fuel pipe bracket from transmission side.



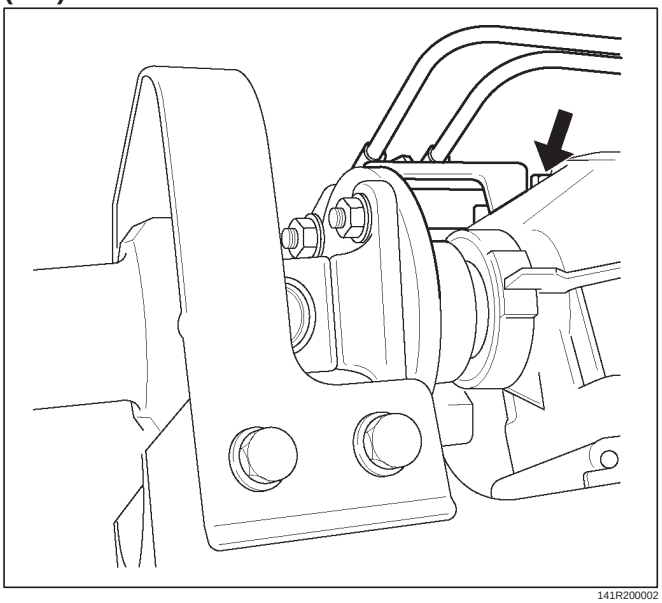
141R200003

(4×4)



240R200010

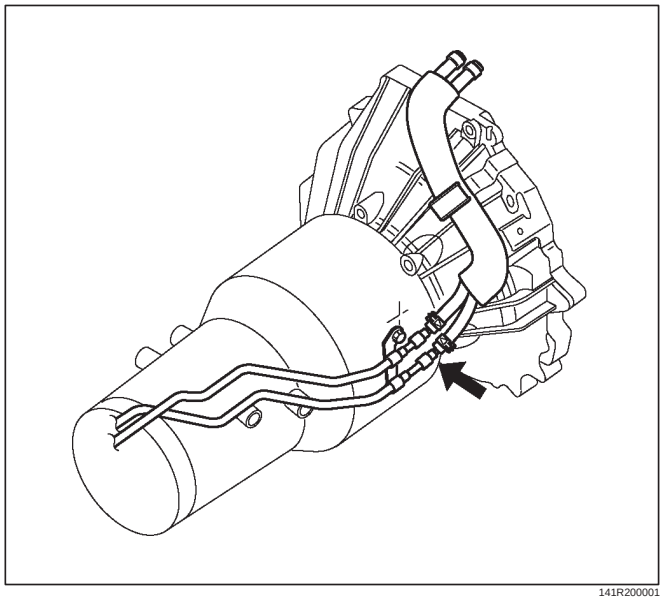
(4×2)



141R200002

Fuel hose connector removal procedure

If removal of the fuel hose connector is required for transmission servicing and/or replacement, follow the steps below.



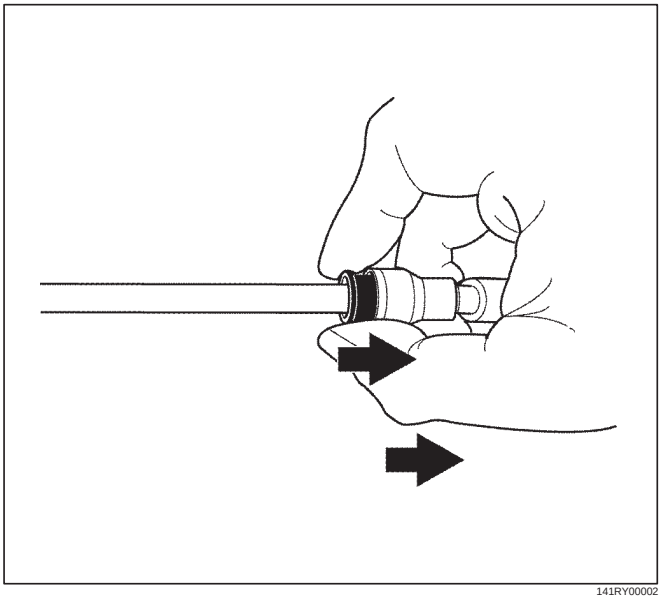
141R200001

NOTE:

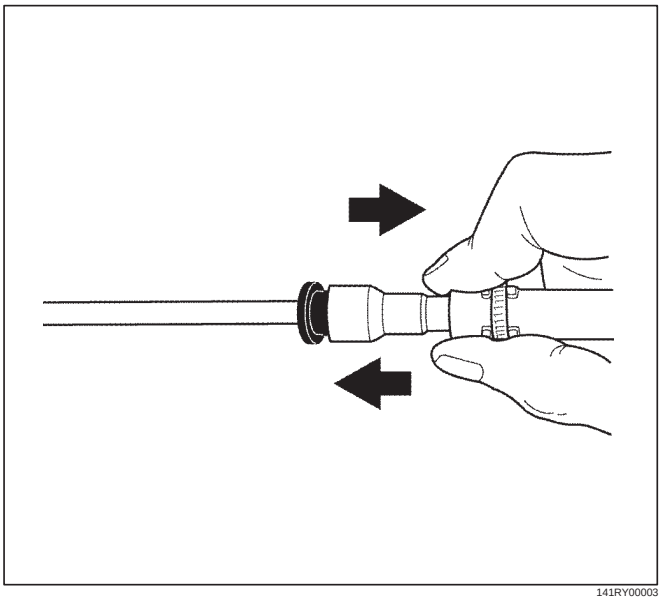
- ▼ An O-ring is used as a seal between the fuel pipe and the connector. Take care not to damage the contact surfaces during the removal procedure. Do not allow the surface to become contaminated with dirt or other foreign material.
- ▼ Perform the entire removal procedure with your hands. Do not use tools.

1. **Separating the connector and fuel pipe**
   1. Clean the fuel pipe and connector to remove mud and other dirt.
   2. Pull the black plastic piece toward the connector. Hold the piece near the connector. Pull the connector from the fuel pipe.

      If the connector and fuel pipe are stuck together, jiggle the connector back and forth to loosen the connector. Do not yank the connector from the fuel pipe.

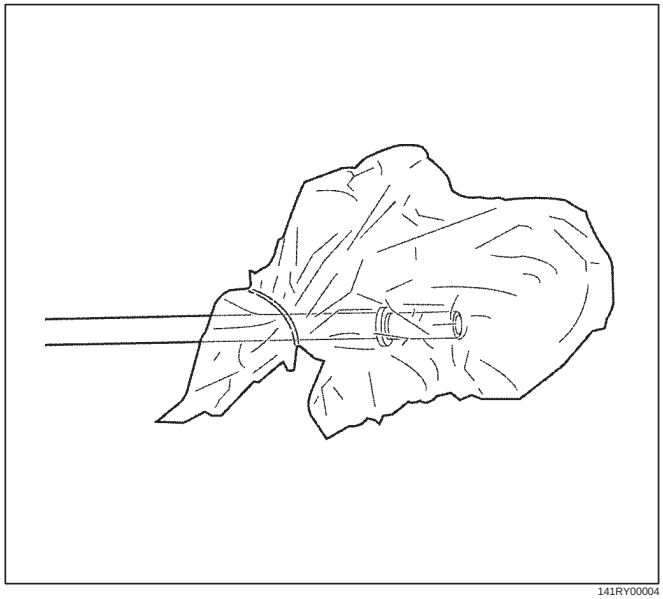


141RY00002



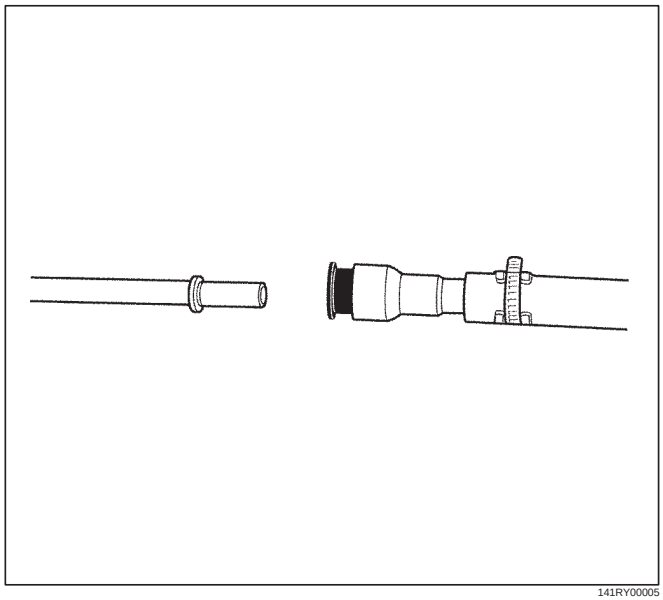
141RY00003

   3. Tie a vinyl bag around the connector and fuel pipe to protect them from dirt.



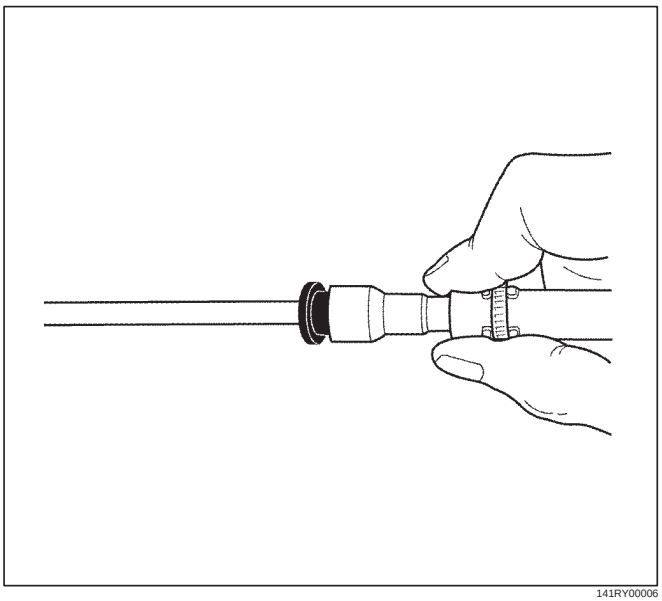
141RY00004

2. **Joining the connector and fuel hose**
   1. Remove the vinyl bag from the connector and fuel hose. Check that the contact surfaces are undamaged and free of dirt and other foreign material. Clean if necessary.
   2. Align the axis of the fuel pipe and connector. Push the connector into the fuel pipe until a distinct click is heard.



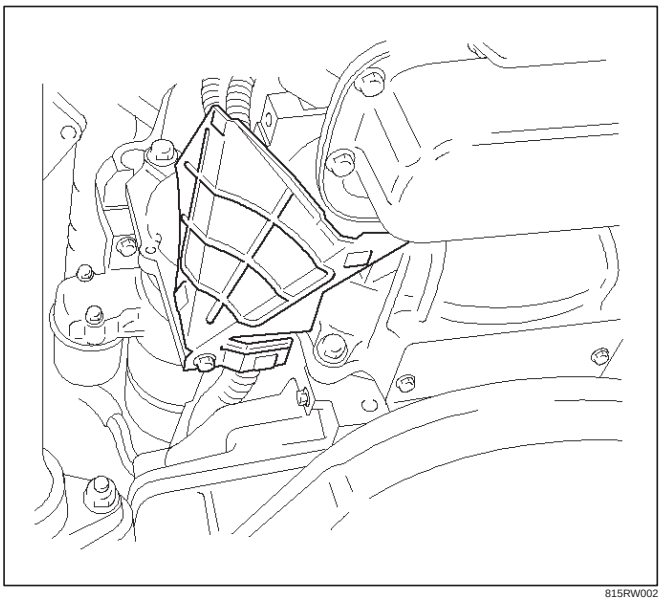
141RY00005

3. Gently pull on the connector to check that it is securely latched.



141RY00006

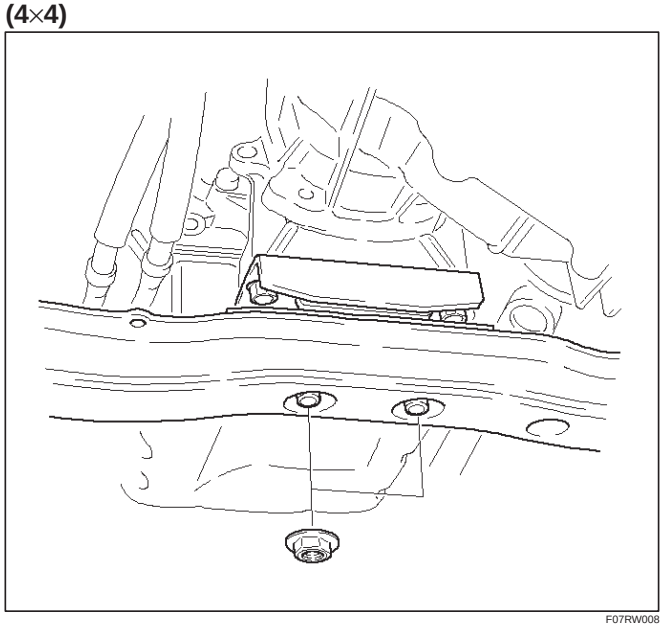
8. Disconnect transmission harness connector and clip.
   Connector : Adapter case, mode switch, main case, magnetic sensor, transfer switch (4×4), 2–4 actuator (4×4) and car speed sensor.
9. Remove harness heat protector.



815RW002

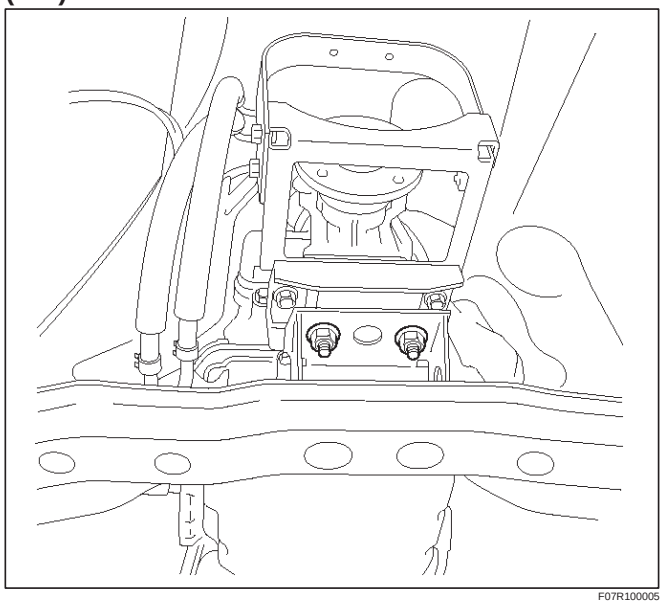
10. Support transmission with a jack.
    Remove rear mount nuts from third crossmember.

(4×4)



F07RW008

(4×2)

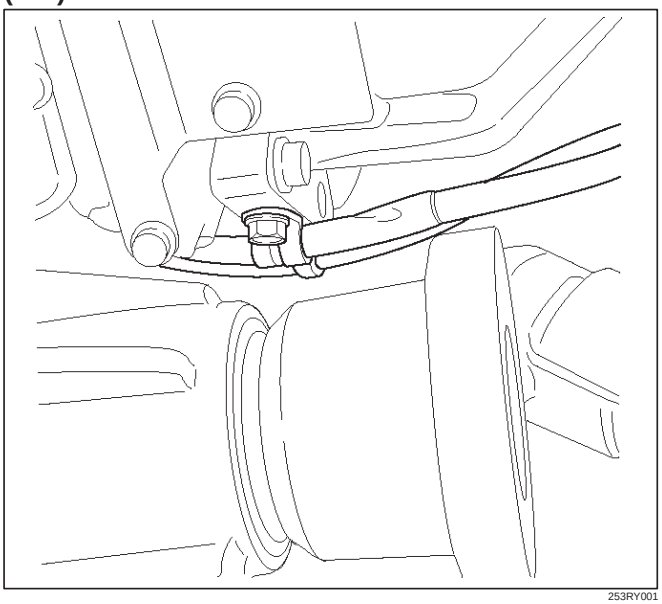


F07R100005

11. Remove third crossmember.
12. Disconnect transmission oil cooler pipes from A/T side.
13. Remove oil pipe clamp and bracket from the converter housing.

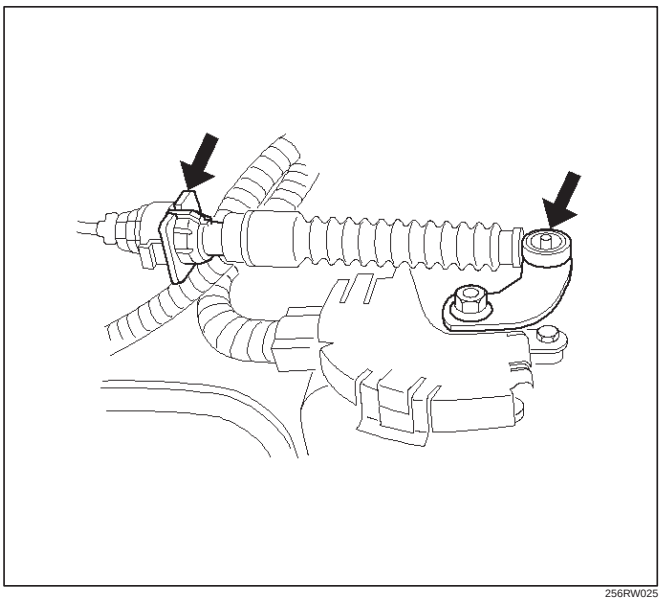
14. Loosen oil cooler pipe clamp bolt at the engine mount side.

(4×4)



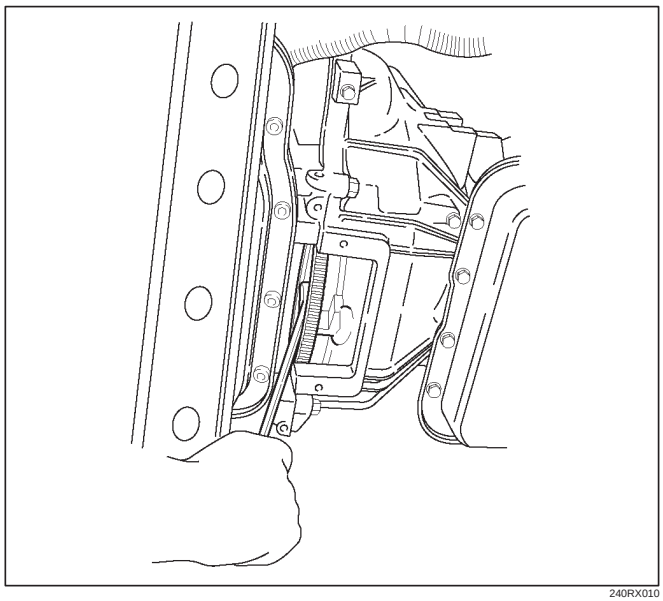
253RY001

15. Remove select cable by disconnecting inner cable from select lever and removing outer cable with bracket.



256RW025

16. Remove starter.
17. Remove under covers from the transmission and engine.
18. Remove flex plate torque converter fixing bolts (6 pieces) by turning crankshaft.

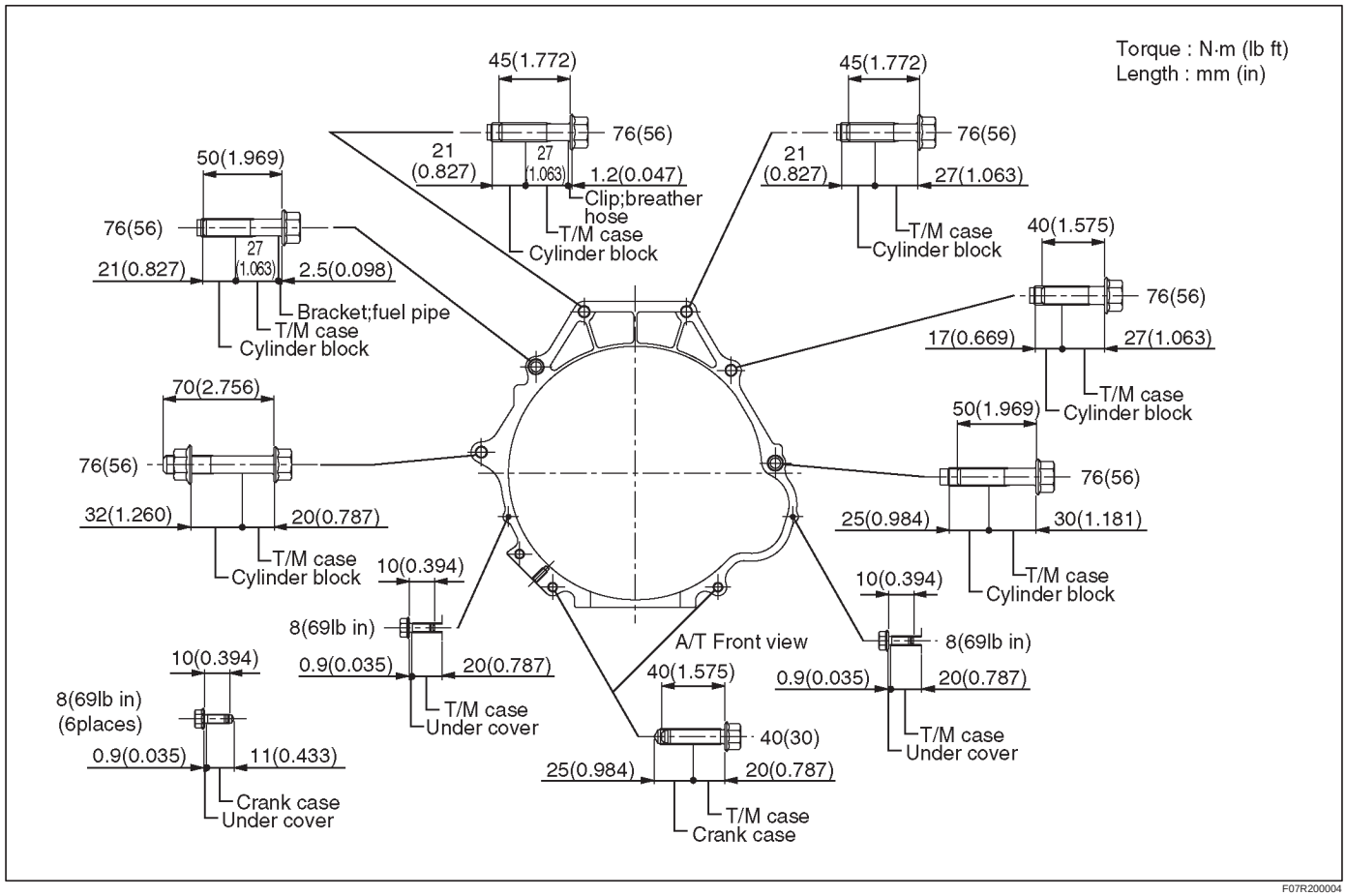


240RX010

19. Remove engine transmission fixing bolts.
20. Pull out transmission assembly from the engine.
21. Remove the rear mount rubber and propeller protector assembly if required (4×2).

Installation

1. Slowly raise transmission jack until front of the transmission assembly is aligned with rear of the engine. Attach the transmission assembly to the engine.
2. Tighten engine transmission bolts as shown in the figure.

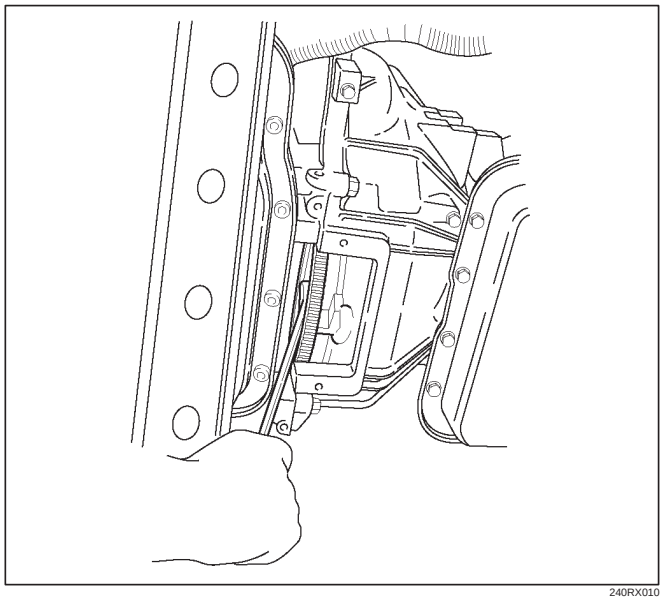


F07R200004

3. Align the flex plate torque converter bolt boss with flex plate hole by turning the torque converter. Install flex plate torque converter bolts (6 pieces) by turning the crankshaft.

Torque: 54 N•m (40 lb ft)

NOTE: Do not reuse the flex plate torque converter bolt.

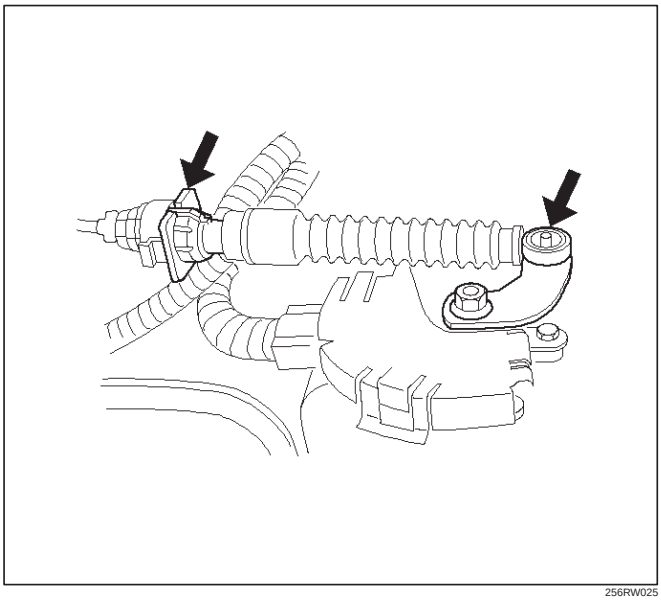


240RX010

4. Install under covers to the transmission and engine.
5. Install starter.

   Torque: 40 N•m (30 lb ft)

6. Install select cable by connecting inner cable to select lever and installing outer cable with bracket.



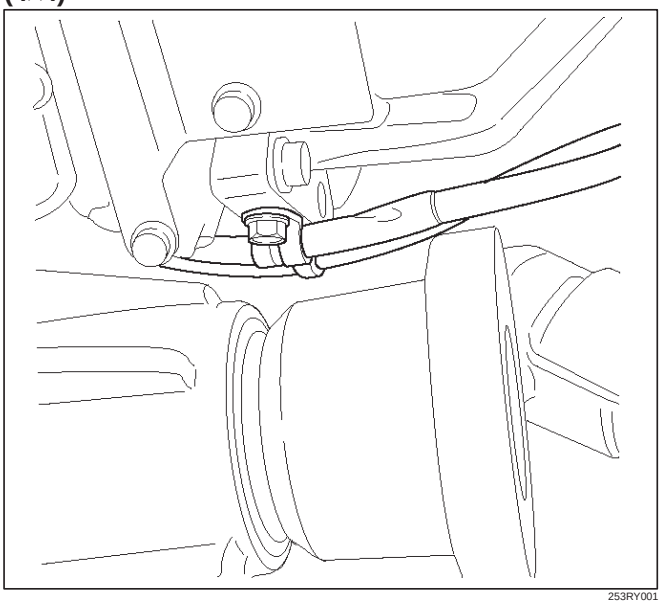
256RW025

7. Connect transmission oil cooler pipes to A/T.

   Torque: 44 N•m (33 lb ft)

8. Install oil cooler pipe clamp and bracket to the converter housing.

(4×4)



253RY001

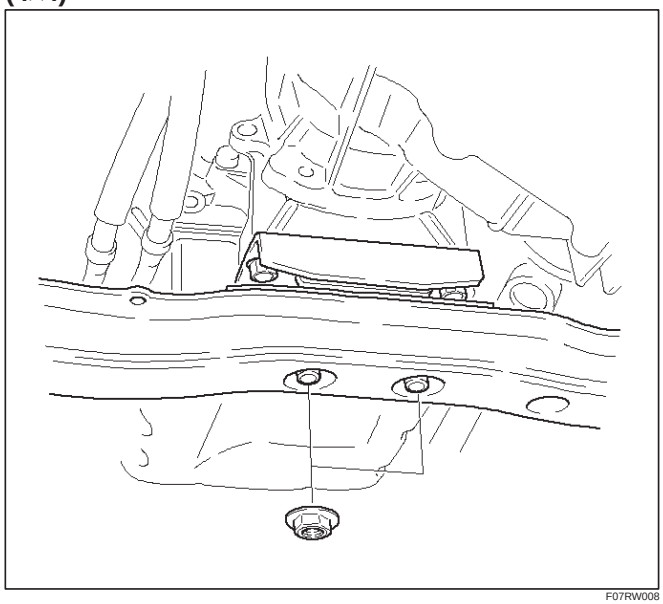
9. Tighten oil cooler pipe clamp bolt at the engine mount side.
10. Install third crossmember.

    Torque: 116 N•m (85 lb ft)

11. Install rear mount nuts.

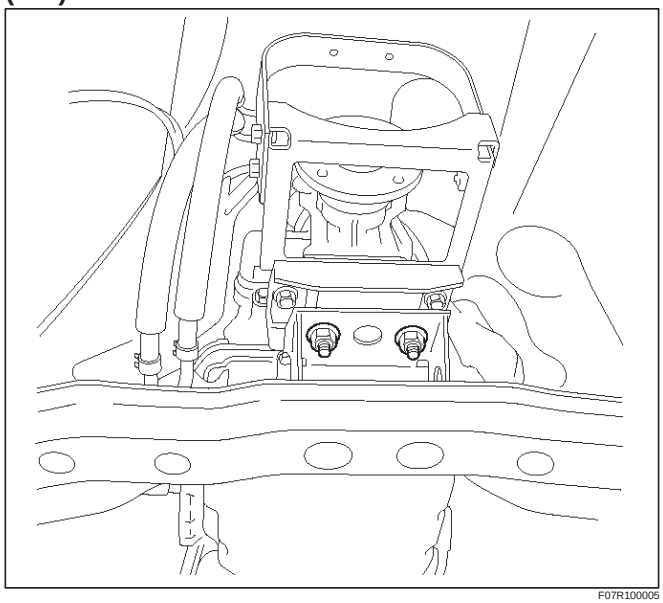
    Torque: 50 N•m (37 lb ft)

(4×4)



F07RW008

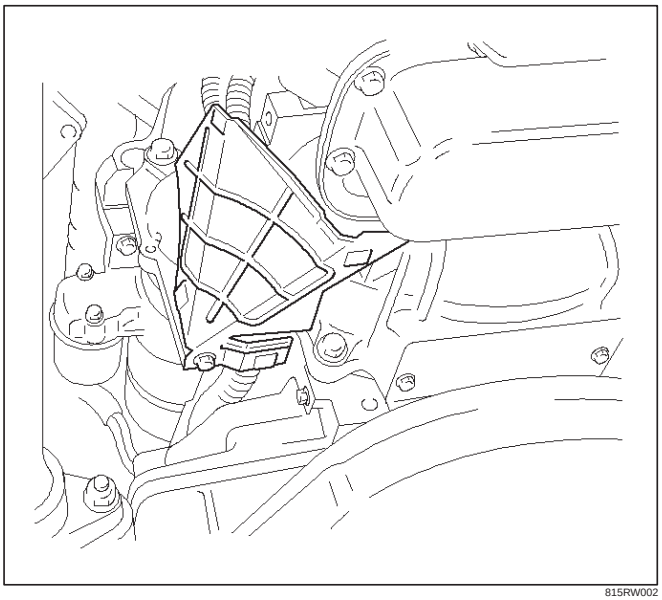
(4×2)



F07R100005

12. Install harness heat protector.

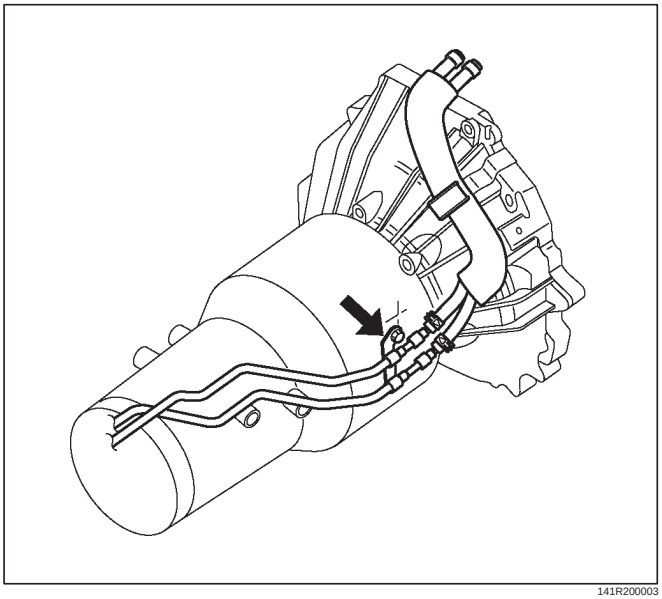
Torque: 6 N•m (52 lb in)



815RW002

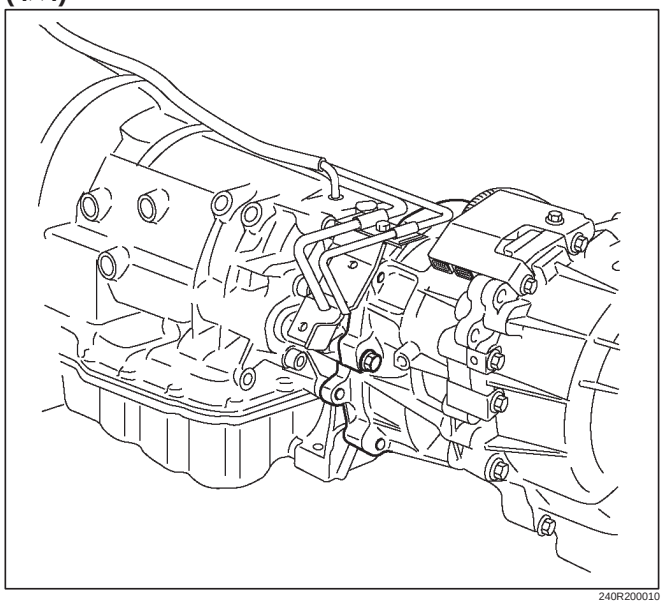
13. Connect transmission harness connector and clip.
    Connector : Adapter case, mode switch, main case, magnetic sensor, transfer connectors (4×4) and car speed sensor.
14. Connect fuel pipe bracket to transmission side.

NOTE: See “NOTE” of removal steps.



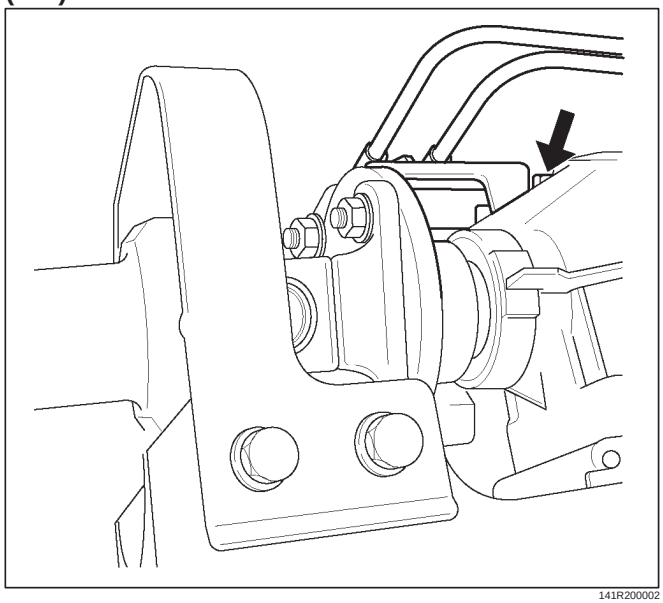
141R200003

(4×4)



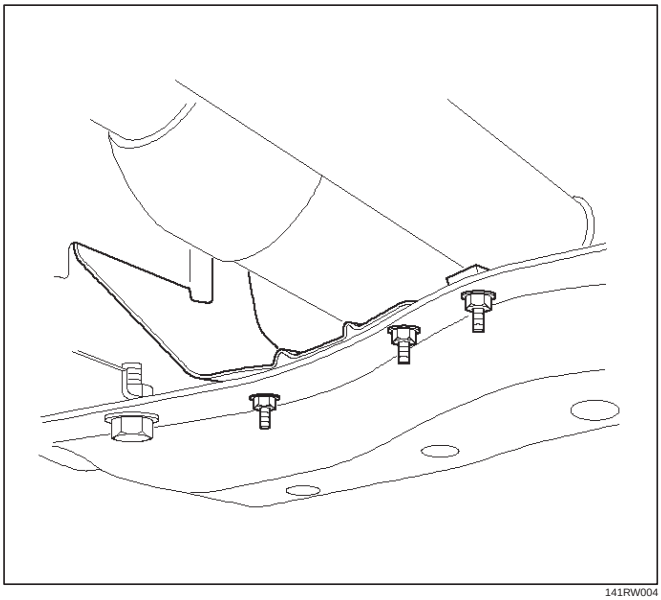
240R200010

(4×2)



141R200002

15. Install fuel pipe heat protector and clip.
16. Connector fuel pipe bracket to third crossmember.



141RW004

17. Install center exhaust pipe (4×4).

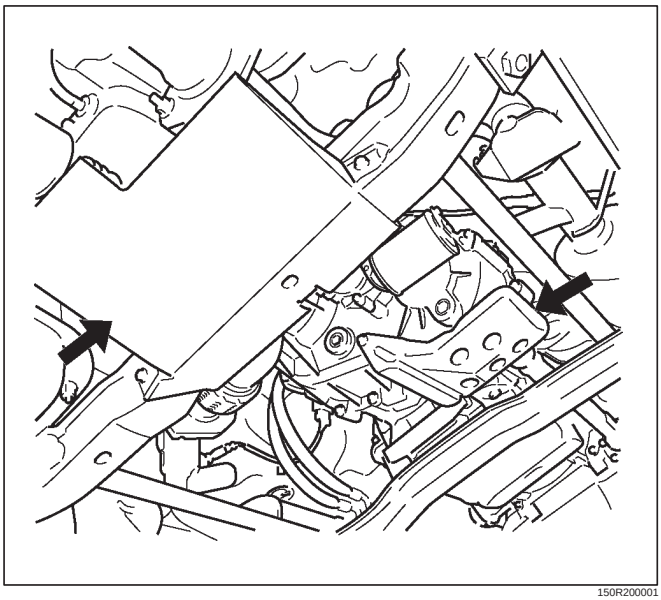
    Torque: 43 N•m (32 lb ft)

18. Install front propeller shaft (4×4) and rear propeller shaft.

    Torque: 63 N•m (46 lb ft)

19. Install transfer protector (4×4) and fairing plate.

    Torque (transfer protector bolt): 37 N•m (27 lb ft)

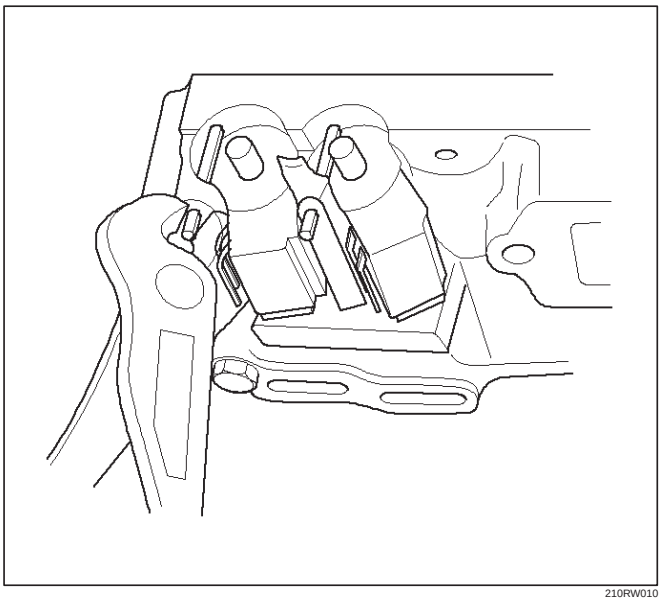


150R200001

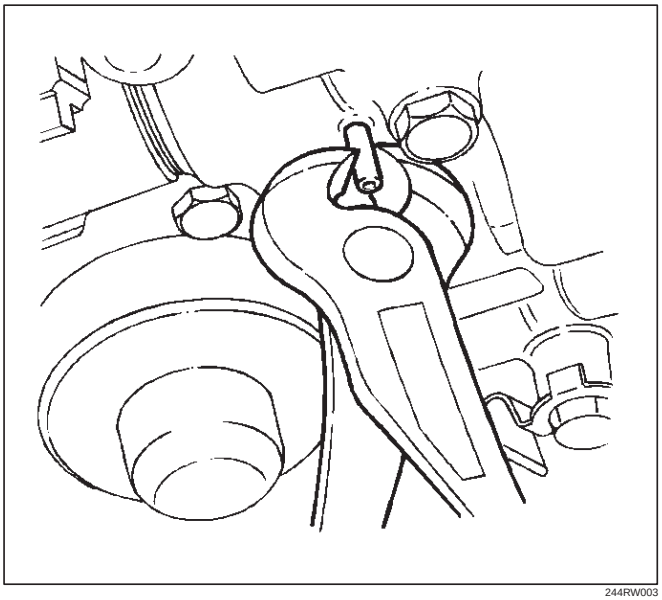
Solenoid (Main Case Valve Body)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer protector (4×4).
4. Drain fluid.
5. Support transfer case with a jack and remove third crossmember.
6. Remove sixteen 10 mm screws, main case oil pan, magnet, and gasket.
7. Remove three 13 mm screws, oil filter.
8. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
9. Remove spring pin for shift solenoid A, shift solenoid B, and band control solenoid respectively, using suitable pliers taking care not to damage solenoids.



210RW010

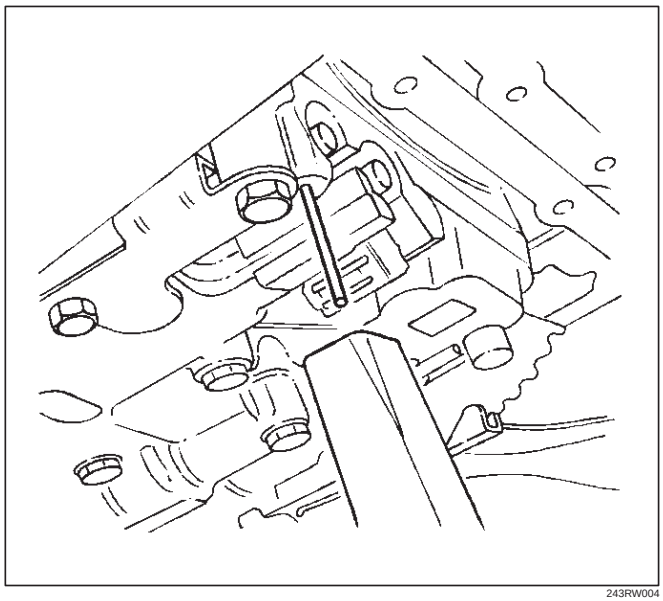


244RW003

10. Remove shift solenoid A, shift solenoid B, band control solenoid, and gaskets from main case valve body. Do not pull on wiring harness. Remove solenoids by grasping the metal tip.

Installation

1. Install shift solenoid A, shift solenoid B, band control solenoid with new gaskets to main case valve body respectively.
2. Carefully install spring pin with hammer to avoid damage to valve body, etc.



243RW004

3. Connect wiring harness to solenoids.
4. Install oil filter with a new gasket and the three 13 mm screws. Tighten the screws to the specified torque.

   Torque: 20 N•m (15 lb ft)

5. Install magnet, main case oil pan with new gasket, sixteen 10 mm screws. Tighten the screws to the specified torque.

   Torque: 11 N•m (96 lb in)

6. Install third crossmember and rear mount nuts. Tighten the nuts and bolts to the specified torque.

   Third crossmember bolt: 116 N•m (85 lb ft)

   Rear mount nut: 50 N•m (37 lb ft)

7. Install the transfer protector. Tighten the bolts to the specified torque (4×4).

   Torque: 37 N•m (27 lb ft)

8. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to *Changing Transmission Fluid in this section.*
9. Connect the battery ground cable.

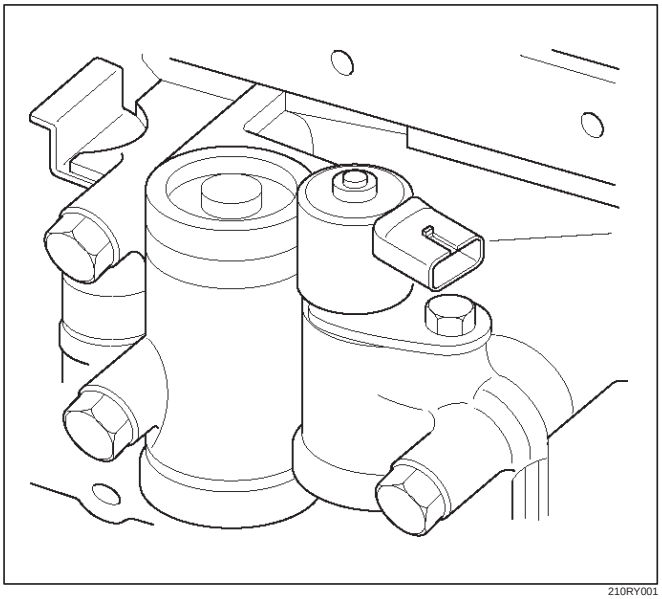
Solenoid (Adapter Case Valve Body)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove adapter case oil pan twelve fixing 10 mm screws, adapter case oil pan, and gasket.

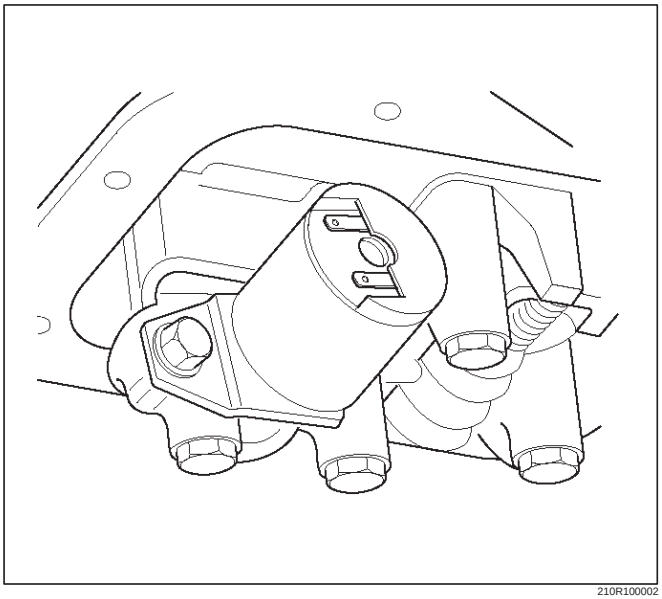
NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan and drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch PWM solenoid. Pull only on connectors, not on wiring harness.
6. Remove 11 mm bolt, bracket and converter clutch PWM solenoid with two O–rings.



210RY001

7. Remove 11 mm bolt, retainer, and force motor solenoid.



210R100002

Installation

1. Install force motor solenoid, retainer, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

   Torque: 10 N•m (87 lb in)

2. Install converter clutch PWM solenoid with two O–rings, bracket, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

   Torque : 10 N•m (87 lb in)

3. Connect wiring harness assembly to solenoids.
4. Install adapter case oil pan, new gasket, and twelve 10 mm screws. Tighten the screws to the specified torque.

   Torque : 11 N•m (96 lb in)

5. Fill transmission through overfill screw hole oil pan, using ATF DEXRON®–III. Refer to *Changing Transmission Fluid in this section.*
6. Connect battery ground cable.

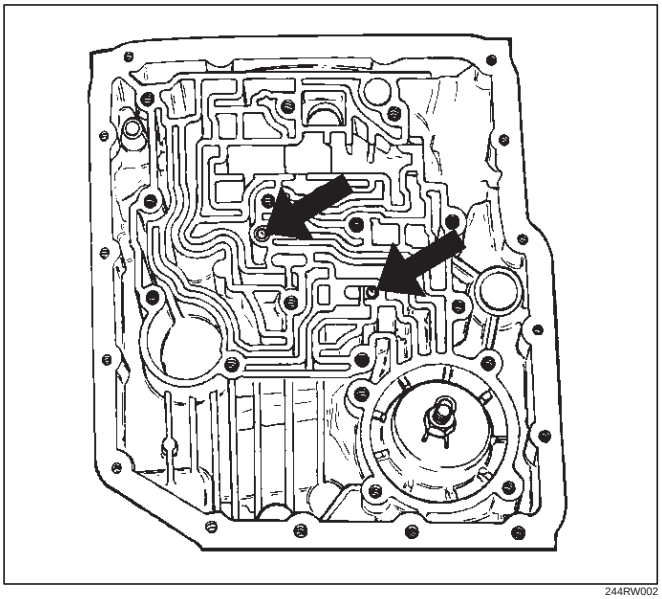
Valve Body Assembly (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer protector (4×4).
4. Drain fluid.
5. Support transfer case with a jack and remove third crossmember.
6. Remove sixteen 10 mm screws, main case oil pan, magnet and gasket.
7. Remove three 13 mm oil filter fixing screws, then remove oil filter.
8. Remove two 13 mm manual detent fixing screws, then remove roller and spring assembly.
9. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
10. Remove four 13 mm servo cover fixing screws, then remove servo cover and gasket.
11. Remove seven 13 mm valve body fixing screws.
12. Remove main case valve body with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
13. Remove transfer plate gasket from main case.
14. Remove two check balls from main case.

Installation

1. Install two check balls to main case.



244RW002

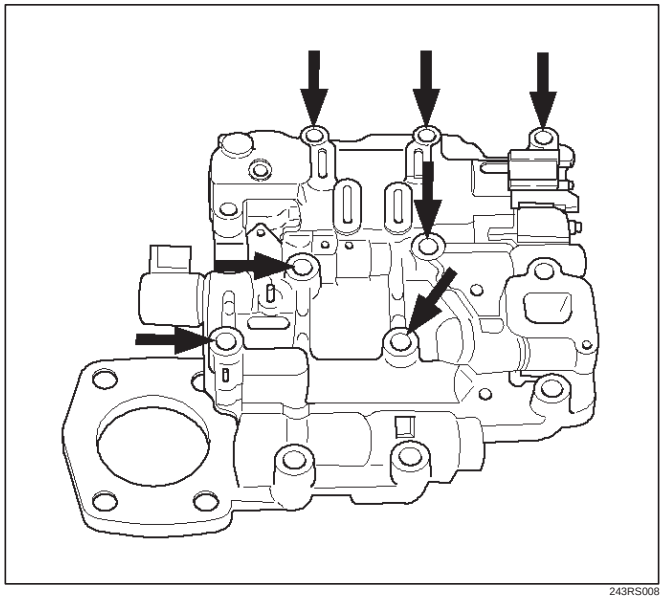
2. Inspect electrical 7 way connector and seal of main case. Replace if necessary.
3. Use two J–25025–B guide pin to install main case.

   ▼Install valve body assembly and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

4. Install seven 13 mm screws, and tighten them to the specified torque.

   Torque: 20 N•m (15 lb ft)



243RS008

5. Remove two guide pins from main case.
6. Install servo cover gasket, cover, and four 13 mm screws. Tighten the screws to the specified torque.

   Torque: 25 N•m (18 lb ft)

7. Connect wiring harness to band control and shift solenoids.
8. Install roller and spring assembly to manual detent.

   ▼Install two 13 mm screws, and tighten them to the specified torque.

   Torque: 20 N•m (15 lb ft)

9. Install oil filter and three 13 mm screws. Tighten the screws to the specified torque.

   Torque : 20 N•m (15 lb ft)

10. Install oil pan gasket, magnet, oil pan and sixteen 10 mm screws. Tighten the screws to the specified torque.

    Torque: 11 N•m (96 lb in)

11. Install third crossmember and rear mount. Tighten the bolts and nuts to the specified torque.

    Torque

    Third crossmember bolt: 116 N•m (85 lb ft)

    Rear mount nut: 50 N•m (37 lb ft)

12. Install transfer protector. Tighten the bolts to the specified torque (4×4).

    Torque: 37 N•m (27 lb ft)

13. Fill transmission through overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to *Changing Transmission Fluid in this section.*
14. Connect battery ground cable.

Valve Body Assembly (Adapter Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove twelve 10 mm adapter case oil pan fixing screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan.

Drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
6. Remove seven 13 mm screws from adapter case valve body assembly, then remove transfer plate, two gaskets, and adapter case valve body.

Installation

1. Inspect electrical 4 way connector and seal of adapter case. Replace if necessary.
2. Install gasket, transfer plate, and gasket.
3. Install adapter case valve body and seven 13 mm screws. Tighten the screws to the specified torque.

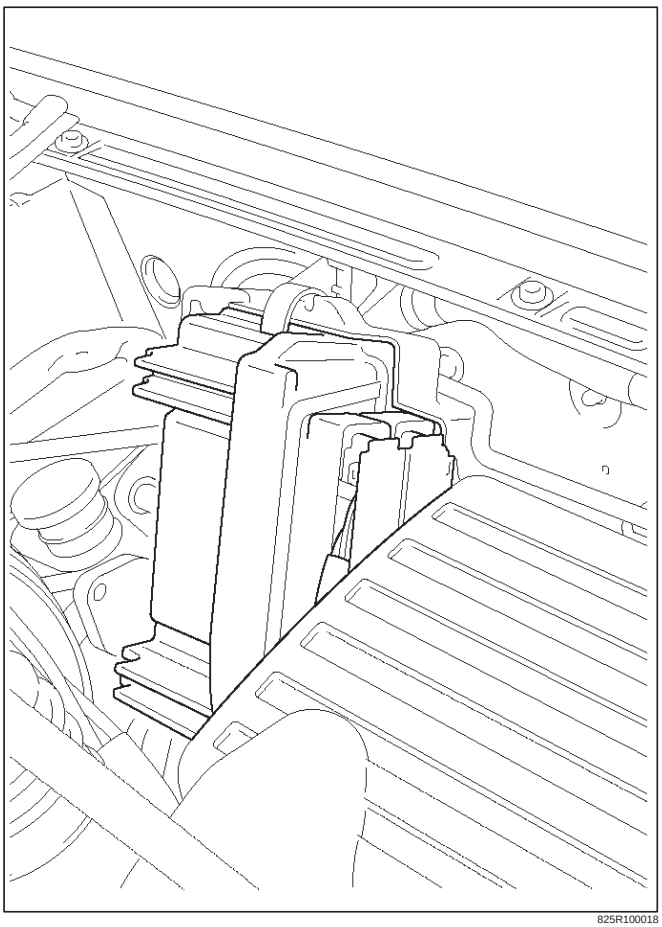
   Torque: 20 N•m (15 lb ft)
4. Connect wiring harness assembly to converter clutch solenoid and force motor.
5. Install oil pan gasket, oil pan, and twelve 10 mm screws. Tighten the screws to the specified torque.

   Torque: 11 N•m (96 lb in)
6. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to *Changing Transmission Fluid in this section.*
7. Connect battery ground cable.

Powertrain Control Module (PCM)

Removal

1. Disconnect battery ground cable.
2. Disconnect PCM wiring harness connectors from PCM.
3. Remove PCM from bracket.



825R100018

Installation

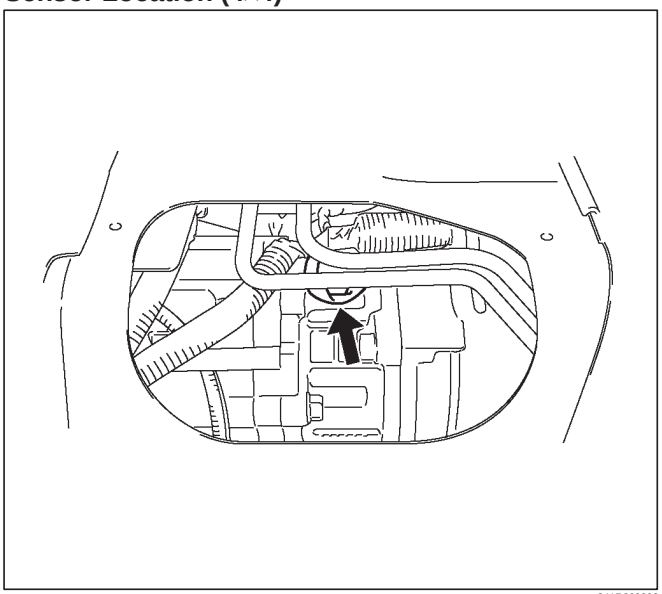
1. Install PCM to bracket.
2. Connect PCM wiring harness connectors to PCM.
3. Connect battery ground cable.

Speed Sensor (Extension Assembly)

Removal

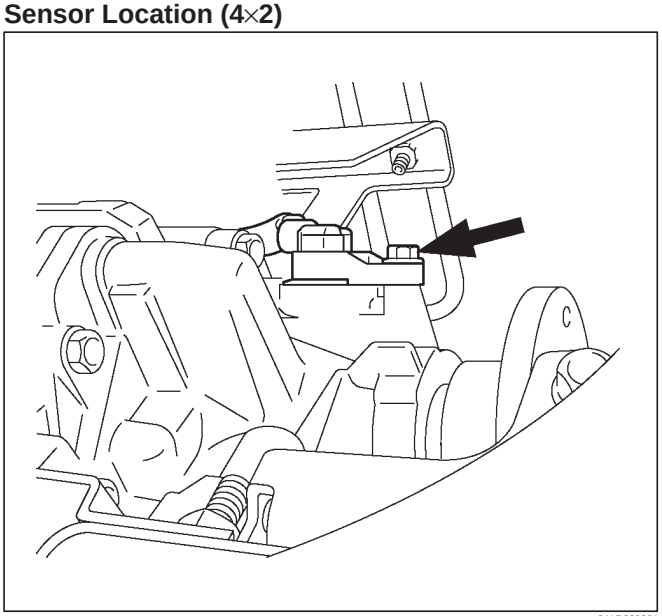
1. Raise the vehicle and support on jack stands.
2. Disconnect battery ground cable.
3. Disconnect speed sensor harness connector from speed sensor.
4. Remove one 10 mm screw and speed sensor with O–ring.

Sensor Location (4×4)



241R200002

Sensor Location (4×2)



241R200001

Installation

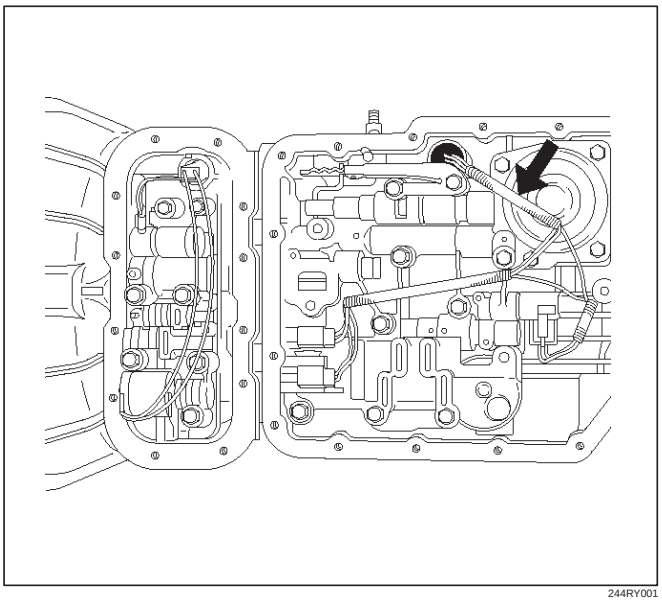
1. Inspect the speed sensor O–ring, and replace it if necessary.
2. Install speed sensor assembly and 10 mm screw.

   Torque: 9 N•m (78 lb in)
3. Connect speed sensor harness connector to speed sensor.
4. Connect battery ground cable.

Transmission Oil Temperature Sensor (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove sixteen 10 mm main case oil pan fixing screws, main case oil pan, and gasket.
5. Disconnect wiring harness from shift solenoids, band apply solenoid, and 7 way connector of main case. Pull only on connectors, not on wiring harness.
6. Remove wiring harness assembly with transmission oil temperature sensor.



244RY001

Installation

1. Install wiring harness assembly with transmission oil temperature sensor to band apply solenoid, shift solenoids, and 7 way connector of main case.
2. Install oil pan gasket, oil pan, and sixteen 10 mm fixing screws. Tighten the screws to the specified torque.

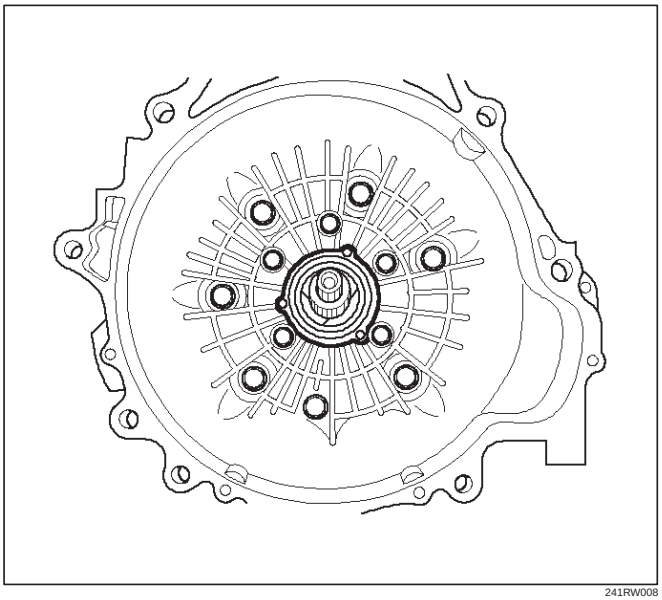
   Torque: 11 N•m (96 lb in)
3. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III.

   Refer to *Changing Transmission Fluid in this section.*
4. Connect battery ground cable.

Front Oil Seal (Converter Housing)

Removal

1. Remove transmission assembly from the vehicle. Refer to *Transmission Assembly in this section.*
2. Remove torque converter from converter housing.
3. Remove three screws and oil seal ring from converter housing.



241RW008

Installation

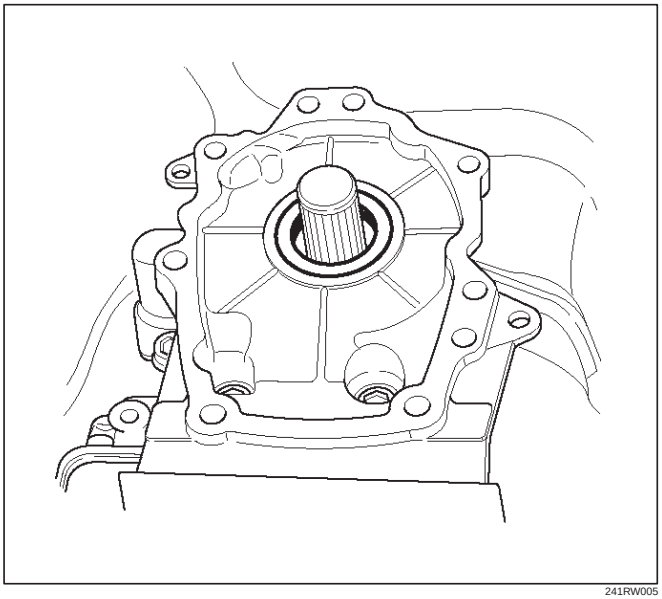
1. Apply clean ATF to the new oil seal ring lip.
2. ▼Install oil seal ring to converter housing. Tighten the screws to the specified torque.

   Torque: 3 N•m (26 lb in)
3. Install torque converter to converter housing.
4. Install transmission assembly to the vehicle. Refer to *Transmission Assembly in this section.*

Rear Oil Seal (Extension Assembly)

Removal

1. Remove transfer case assembly (4×4) or extension assembly (4×2) from the vehicle. Refer to *Transfer Case in Drive Line/Axle section (4×4).*
2. Remove rear oil seal from transmission extension assembly.



241RW005

Installation

1. Use J–36797 extension assembly oil seal installer, and install the rear oil seal to the transmission extension assembly.
2. Install the transfer case assembly (4×4) or extension assembly (4×2) to the vehicle. Refer to *Transfer Case in Drive Line/Axle section (4×4).*

Transmission (4L30–E)

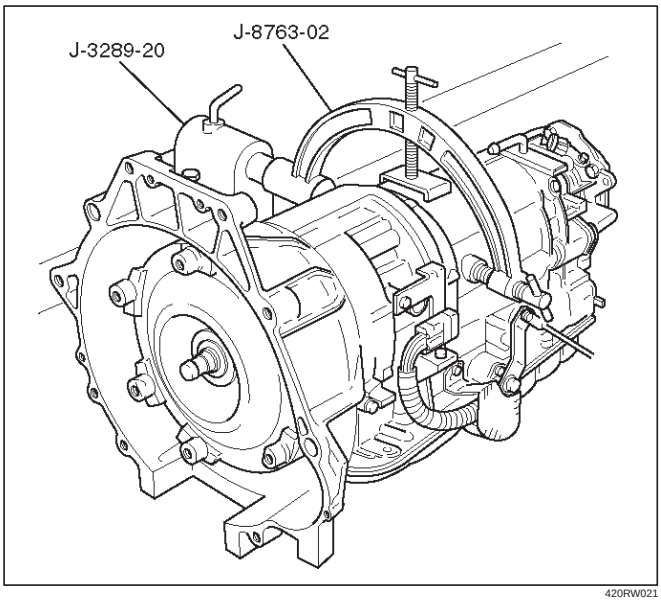
Disassembly

NOTE: During the disassembly and reassembly, perform the following:

- ▼Wash each part thoroughly, and blow air through each oil passage and groove to eliminate blockage.
- ▼Seal rings, roll pins, and gaskets should be replaced.
- ▼When assembling the components, apply DEXRON®–III Automatic Transmission Fluid (ATF) to each seal, rotating part, and sliding part.
- ▼Do not dip part facings, such as clutch or brake drive plates, in cleaner when washing it.
  Also, always coat parts with new ATF two or three times after cleaning with solvent.

1. Remove torque converter (1).
   - ▼Drain fluid from torque converter.
   - ▼Attach J–8763–02 holding fixture to the transmission and set it on J–3289–20 holding fixture base.

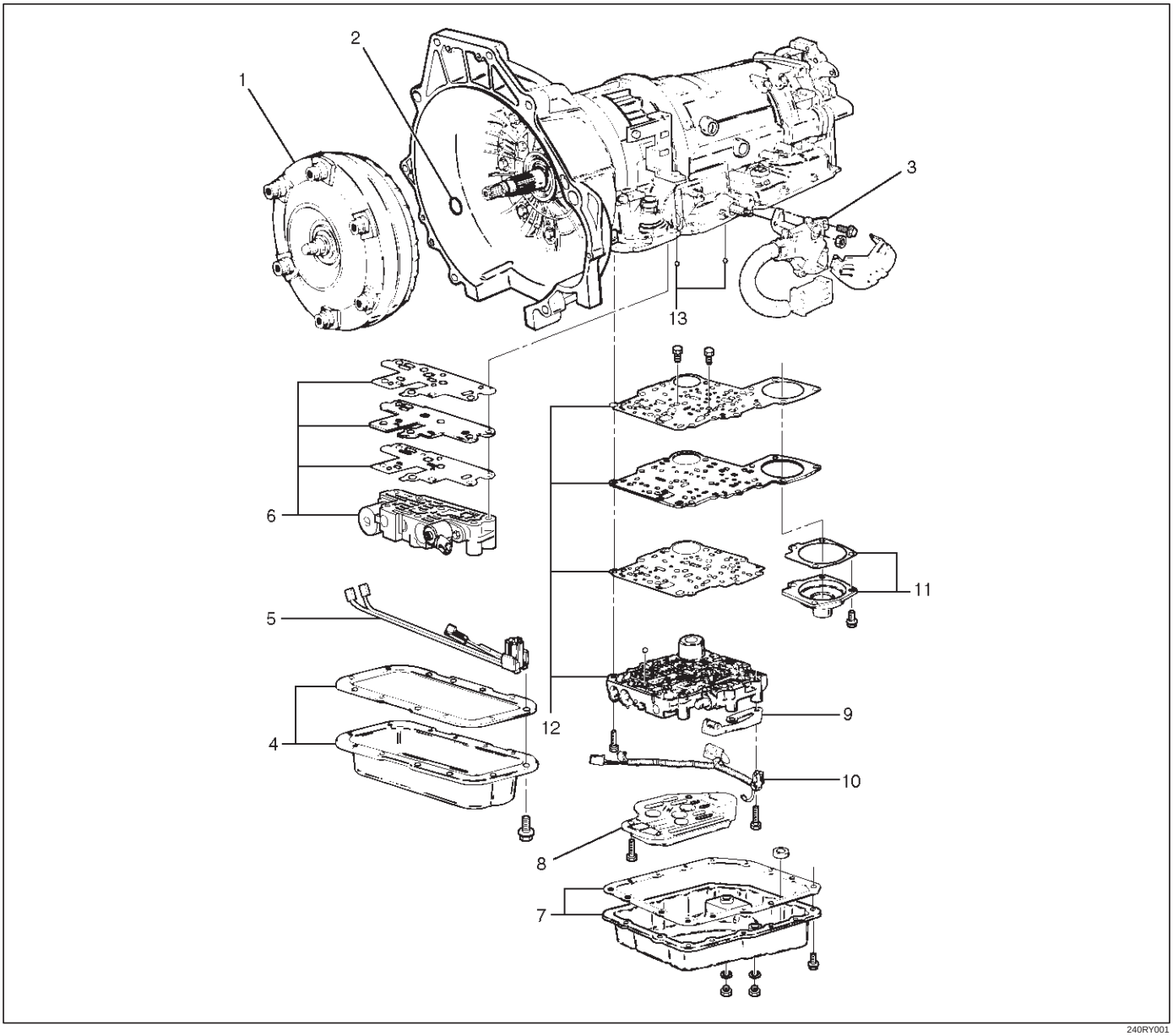
NOTE: Do not overtighten the tool, as case damage may result.



420RW021

2. Remove O–ring (2) from turbine shaft.
3. Remove two 10mm mode switch screws, selector lever nut, cover, and mode switch (3).
4. Remove twelve 10mm adapter case oil pan (4) fixing screws, adapter oil pan, and gasket.
5. Disconnect electrical wiring connections (5) from solenoids and 4 way connector of adapter case. Pull on connectors only, not on wiring harness.
6. Remove seven 13mm adapter case valve body (6) fixing screws, adapter case valve body assembly, transfer plate, and two gaskets.
   - ▼Remove wiring harness and 4 way connector.
7. Remove sixteen 10mm main case oil pan (7) fixing screws, main oil pan, magnet, and gasket.
8. Remove three 13mm oil filter (8) fixing screws and oil filter.
9. Remove two 13mm manual detent (9) fixing screws, roller and spring, and manual detent.
10. Disconnect wiring harness assembly (10) from band apply solenoid, shift solenoids, and main case 7 way connector.
    Pull on connectors only, not on wiring harness.
11. Remove four 13mm servo cover (11) fixing screws, servo cover, and gasket.
12. Remove seven 13mm valve body screws from main case.
    - ▼Remove wiring harness assembly (5) from the adapter case side.
    - ▼Remove main valve body assembly (12) with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
    - ▼Remove 7 way connector.
    - ▼Remove gasket transfer plate from main case.

13. Remove two check balls (13) from main case.



14. Turn transmission to vertical position to drain fluid.
    Return back to horizontal position when drained.

    ▼Install J–23075 servo piston spring compressor with offset to the rear of case.

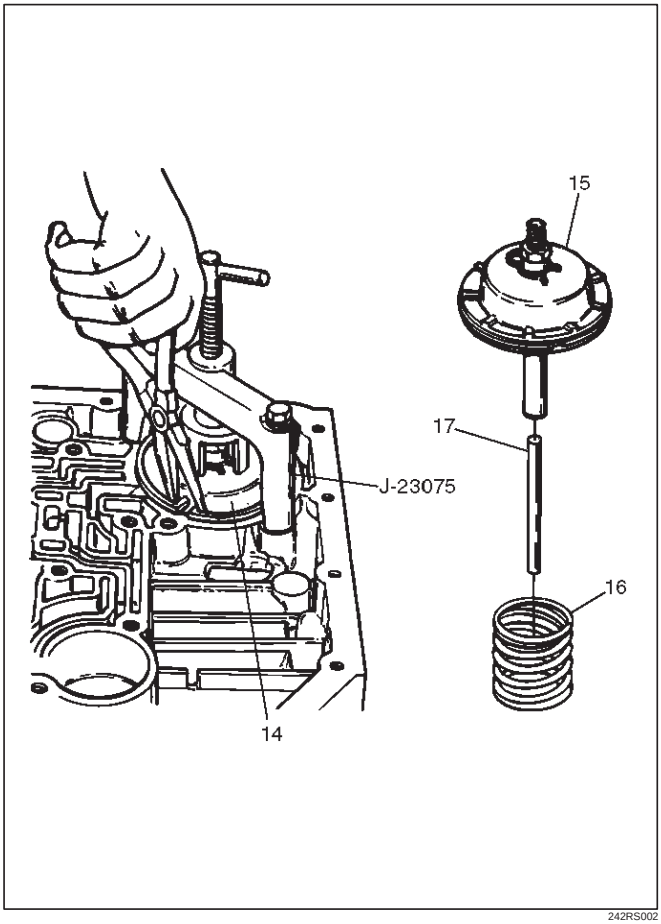
    ▼Compress servo piston assembly.

    ▼Remove servo piston retaining ring (14).

    ▼Slowly release servo piston assembly (15).

    ▼Remove tool.

15. Remove servo piston assembly (15), return spring (16), and servo apply rod (17).



16. Rotate transmission to horizontal position, pan side down.

▼Remove one 10mm screw, and speed sensor (18) with “O” ring.

17. Remove seven 8mm extension housing hexagon socket head screws, extension housing assembly (19), and gasket.

18. Remove retaining ring (20). (4×4)

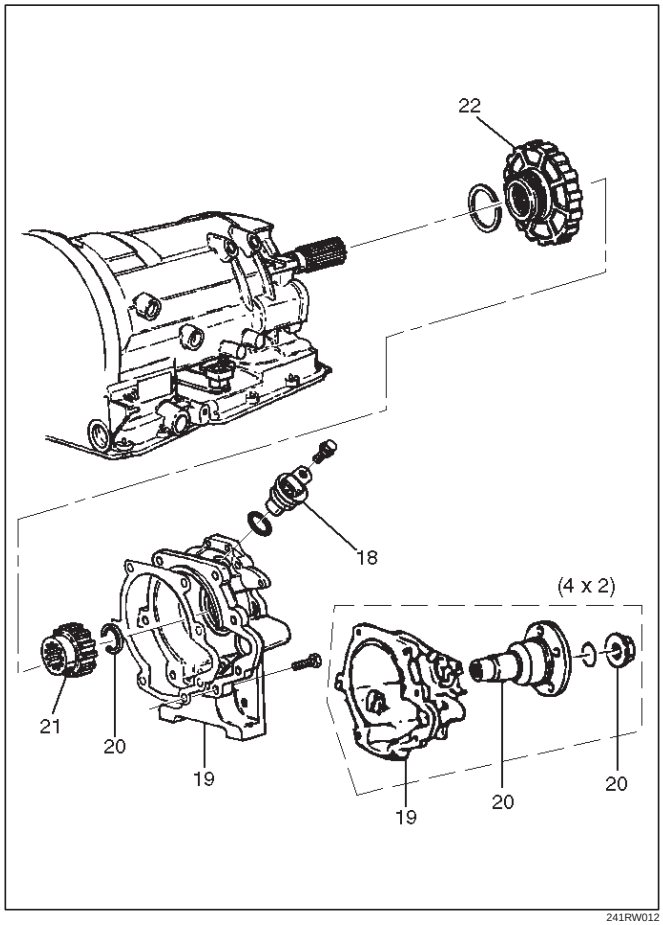
NOTE: Use extra long, needle- nose pliers.

▼ Remove flange nut (20). (4×4)

▼ Remove flange and O–ring (20). (4×2)

19. Remove speed wheel (21).

20. Remove wheel parking lock (with seal ring) (22).



21. Rotate transmission to vertical position, converter housing up.

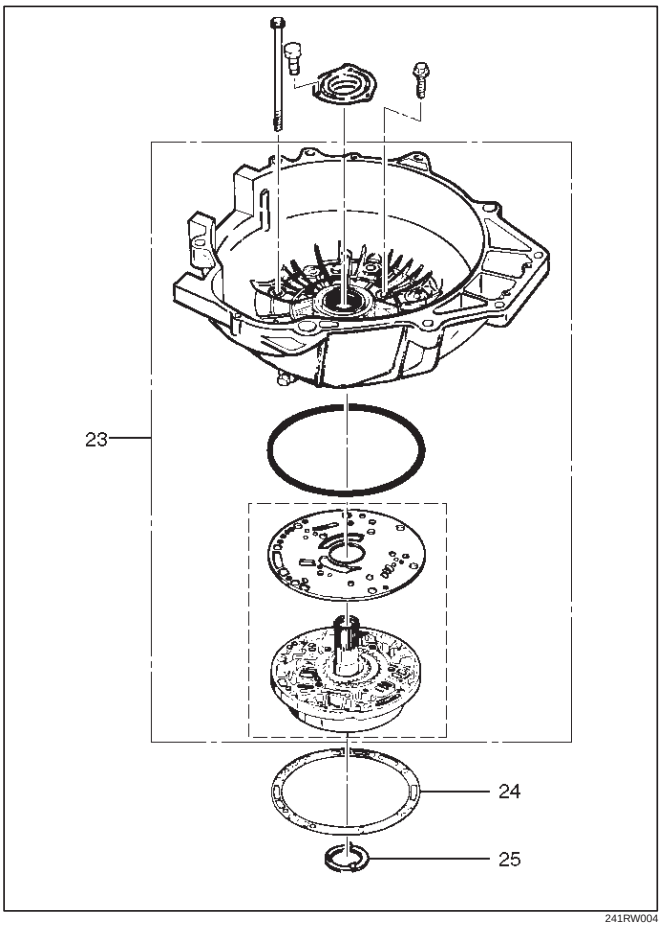
▼Loosen the converter housing and oil pump assembly fixing screws, but do not remove the five 13 mm inner screws if oil pump disassembly is required.

▼Remove seven outer screws.

▼Remove converter housing and oil pump assembly (23).

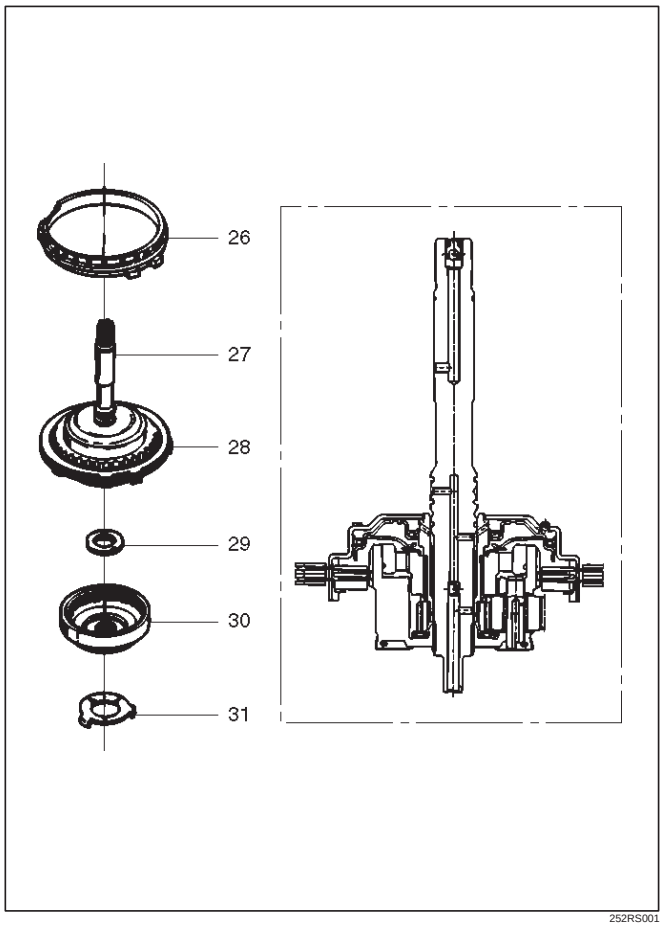
22. Remove gasket (24).

23. Remove selective thrust washer (25).



24. Remove fourth clutch retainer (26).
25. Grasp turbine shaft and lift out the overrun clutch housing assembly (27) and fourth clutch plates (28).
26. Remove thrust bearing assembly (29).
27. Remove overdrive internal gear (30).

28. Remove thrust washer (31).



29. Remove adapter case and center support assembly (with fourth clutch piston) (32).
30. Remove seal ring (33).
31. Remove selective thrust washer (34) and two O–ring seals (35) from main case.
32. Use J–23327 and J–23327–90 compressor to compress the fourth clutch spring retainer and springs (37).

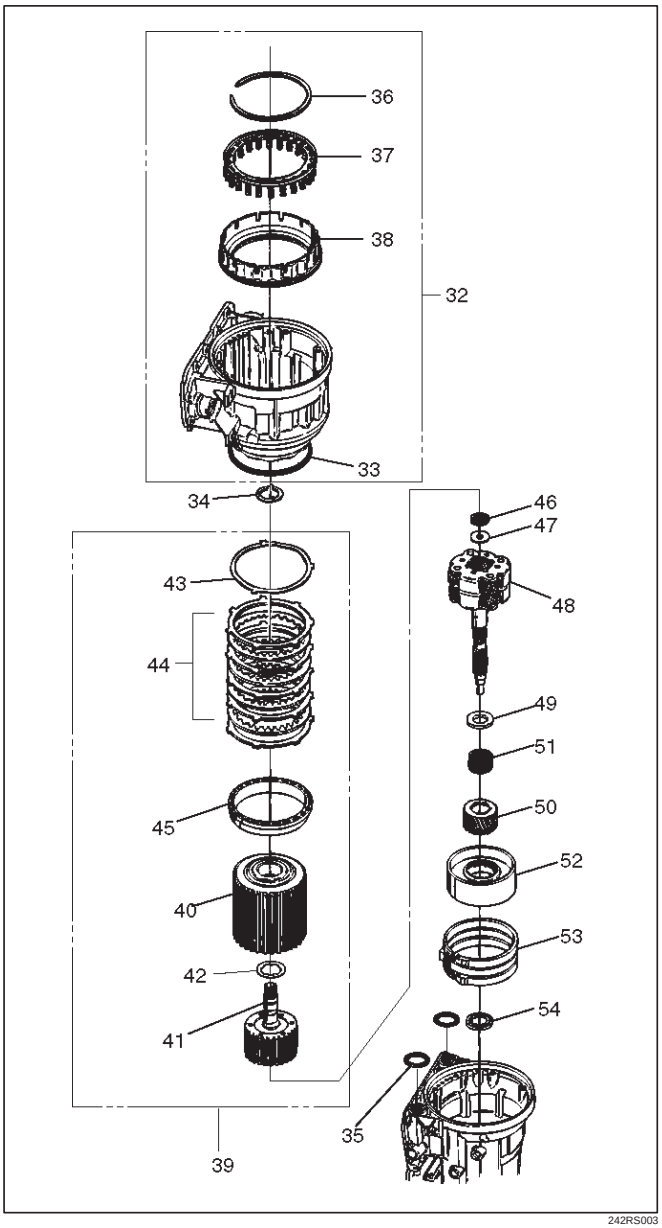
    ▼Release snap ring (36) from groove.

    ▼Remove clutch compressor and snap ring (36).
33. Remove retainer and spring assembly (37).
34. Insert two converter housing/main case screws to hold adapter case while pulling out fourth clutch piston (38).

    ▼Remove fourth clutch piston assembly (38) from the adapter case.

    ▼Remove converter housing/main case screws.
35. Grasp intermediate shaft, twist and pull out the second and third clutch drum assemblies with reverse clutch plates (39) while holding onto output shaft.

36. Separate second (40) and third clutch (41) assemblies.
37. Remove thrust washer (42).
38. Remove reverse clutch plates (43 and 44) and reverse clutch pressure plate (45).
39. Remove bearing (46) and washer (47).
40. Remove planetary carrier assembly (48).
41. Remove thrust bearing (49).
42. Remove reaction sun gear (50)
43. Remove needle bearing (51).
44. Remove brake drum (52).
45. Remove brake band (53).
46. Remove thrust bearing (54).



242RS003

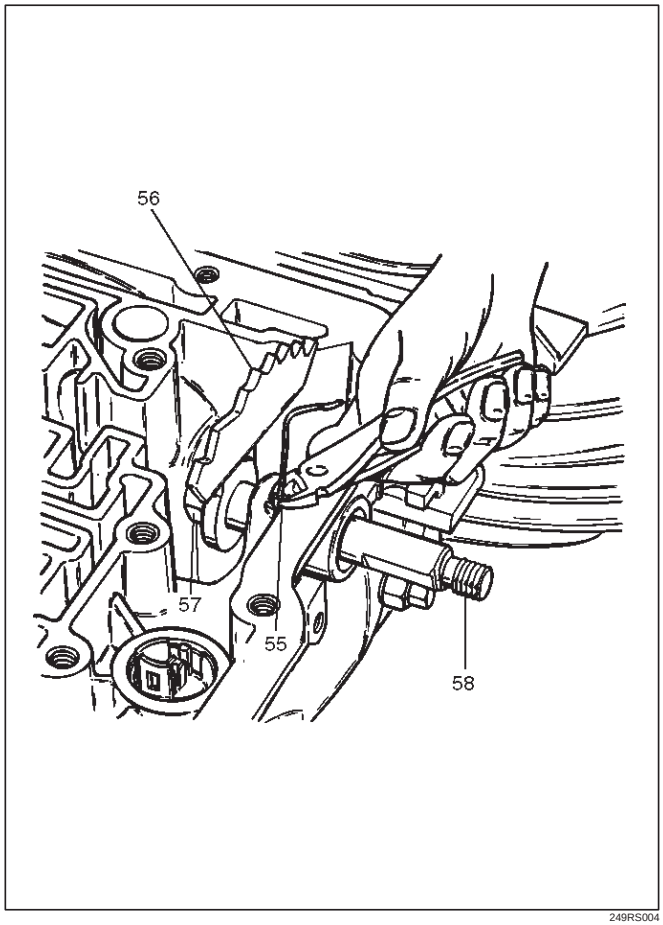
47. Rotate case to horizontal position, valve body side facing up.

▼Remove spring pin (55), using cutting pliers, then remove parking lock and selector lever assembly (56).

NOTE: Insert wire in the center of the spring pin to prevent it from collapsing during removal. Be aware of pin height. Protect machined face of main case.

48. Remove parking lock and range selector lever 17 mm nut (57).
49. Remove parking lock and range selector lever (56), and actuator assembly.
50. Remove selector shaft (58).

NOTE: Inspect the shaft for burrs before removing to prevent damaging seal. If necessary, remove burrs by lightly sanding with an oilstone.



249RS004

Reassembly

1. Inspect selector shaft seal, and replace it if necessary.

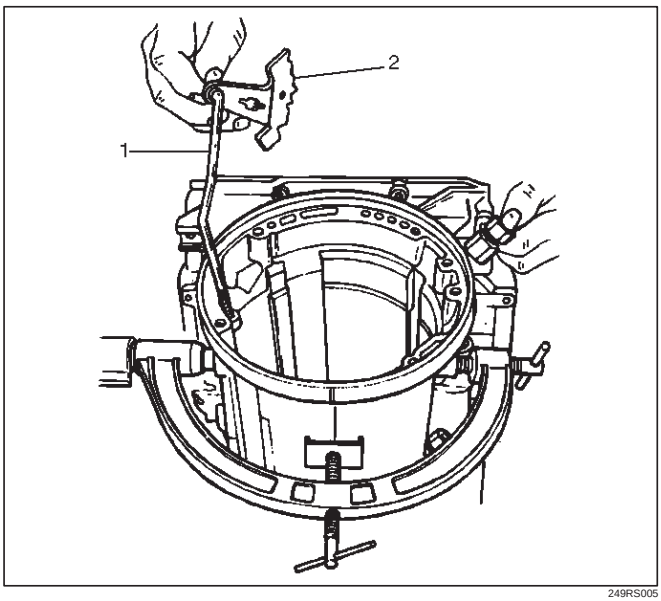
NOTE: Use a seal installer when replacing the seal.

▼Install selector shaft.

NOTE: Spring pin groove must be positioned inside the case.

2. Install spring pin. Be sure the selector shaft can move freely. Do not push the pin flush with the case surface. Leave enough height for removal.
3. Install actuator assembly (1).
4. Install parking lock and range selector lever (2) and new 17 mm nut. Tighten the nut to the specified torque.

Torque: 22 N•m (16 lb ft)



249RS005

5. Rotate main case to vertical position, extension end facing down.
   ▼Install brake band assembly (3).

NOTE: Be sure to align servo pin area with the servo hole.

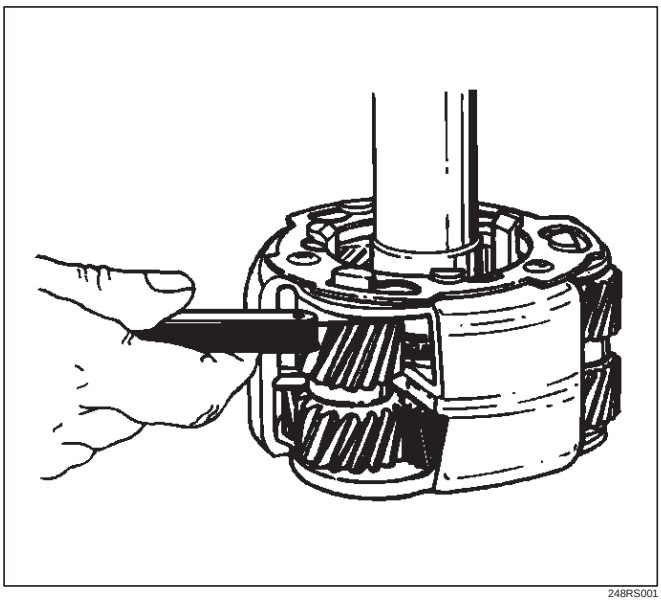
6. Install thrust bearing (4).

NOTE: The case bushing acts as a guide for the thrust bearing.

7. Install brake drum (5).
8. Install reaction sun gear (6).
9. Install needle bearing (7).
10. Inspect planetary carrier assembly (8) for wear and damage. If necessary replace it.
    ▼Measure pinion end play clearance with a feeler gauge.

    Clearance: 0.13mm–0.89mm (0.005 in–0.035 in)

    If clearance is outside specified value, replace the planetary carrier assembly.

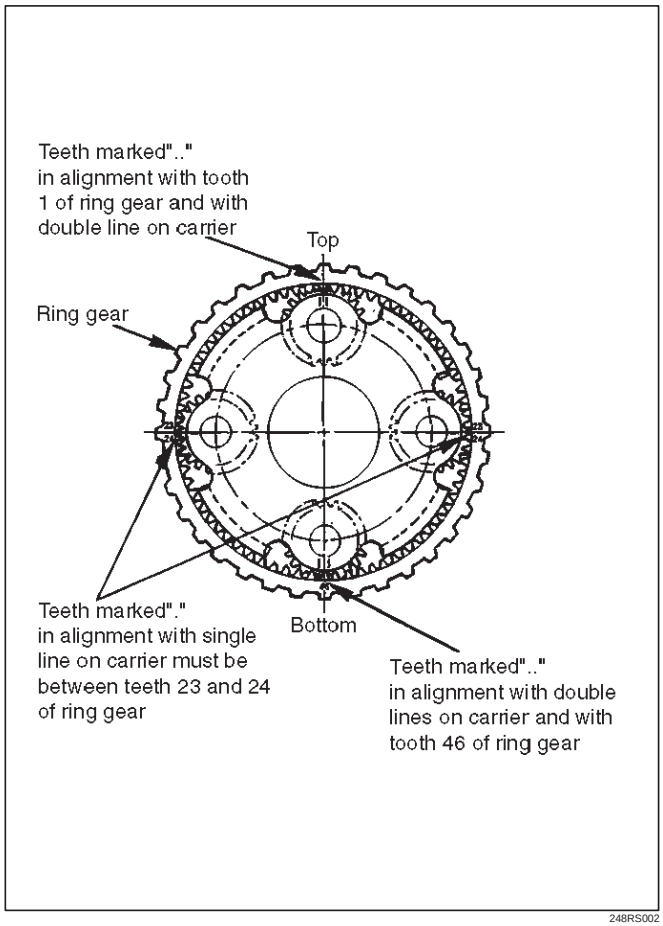

248RS001

11. Install the thrust bearing (9) on the output shaft.

NOTE: Use petroleum jelly to hold the thrust bearing in place.

12. Align planetary pinions. Each pinion is marked with double points to indicate the master tooth space and exactly opposite with a single point to indicate the master tooth. The markings on the planetary carrier consist of double lines which are to be lined up with the double points on two opposite pinions; the single lines are to be lined up with the single points on the other two pinions.
    ▼After all four pinions are lined up, slide on the third clutch assembly. Rotate third clutch and check mark alignment. Considering that the ring gear tooth between the double points of one planetary pinion is tooth number 1, count the teeth to check that the single points on the two adjacent pinions are between teeth 23 and 24 of the ring gear, and that the ring gear tooth between the double points of the opposite pinion is tooth number 46. If the ring gear and pinions are not lined up, remove, and realign them.
13. Install planetary carrier (8) with third clutch (12).

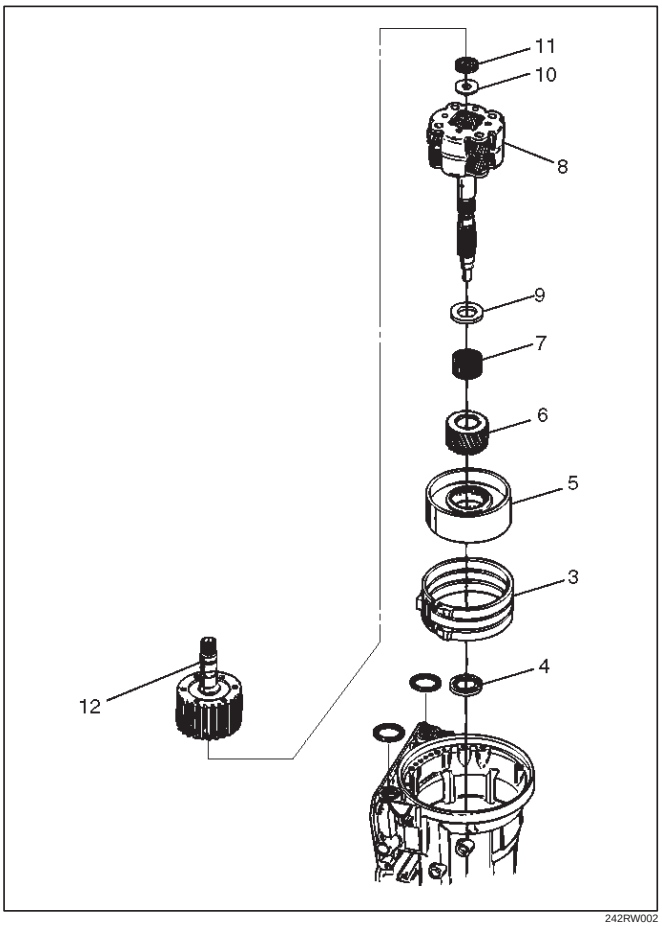
NOTE: Do not force. When properly aligned, the parts will fit together easily.



248RS002

14. Remove the third clutch (12).
15. Install bearing (11) and washer (10).

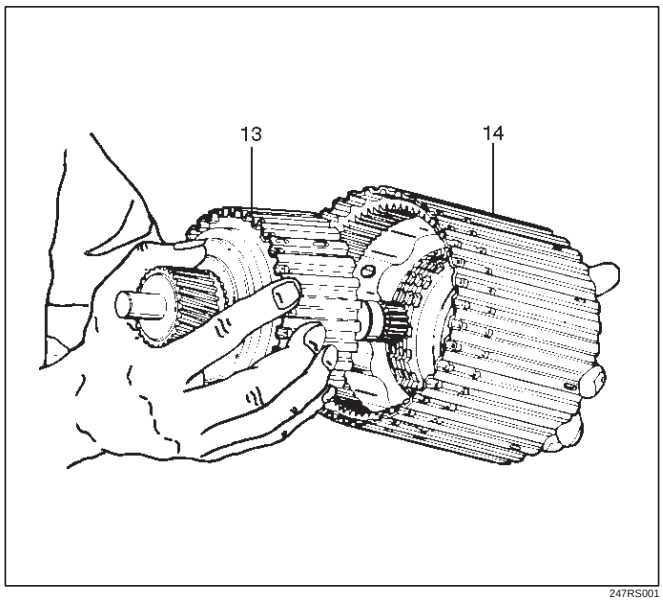
NOTE: Use petroleum jelly to hold the washer and bearing in place.



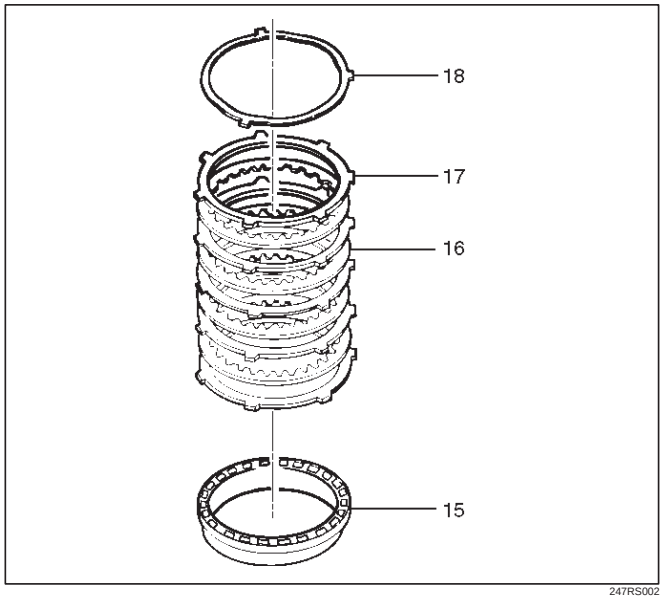
16. Carefully align the second clutch plate inner tangs.
    ▼Install thrust washer, tangs pointing downward, and locating tang positioned in slot on second clutch hub.

NOTE: Use petroleum jelly to hold thrust washer in place.

17. Install third clutch and intermediate shaft assembly (13) into the second clutch drum (14).
18. Install second and third clutch assemblies into the main case. Twist output shaft and clutch assemblies to ensure proper fit.

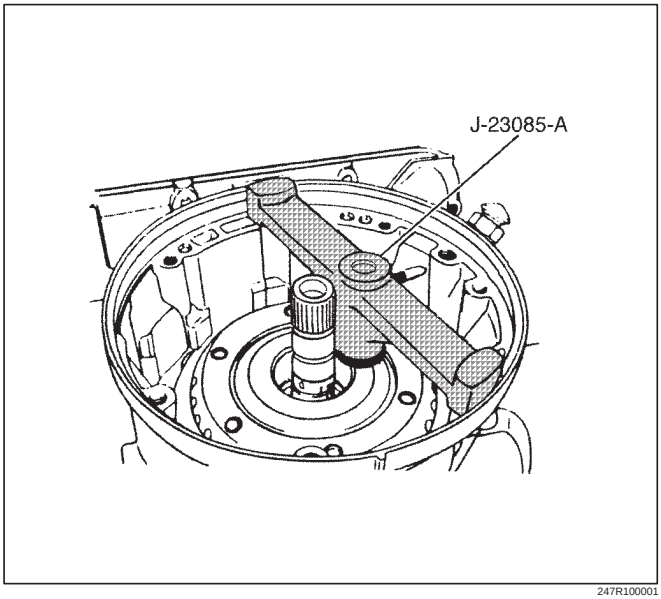


19. Install pressure plate (15) with lip side up, tang facing valve body face.
20. Install reverse clutch plates. Start with a steel plate (17) and alternate with a lined plate (16).
21. Install waved clutch plate (18) with center tang facing valve body side.

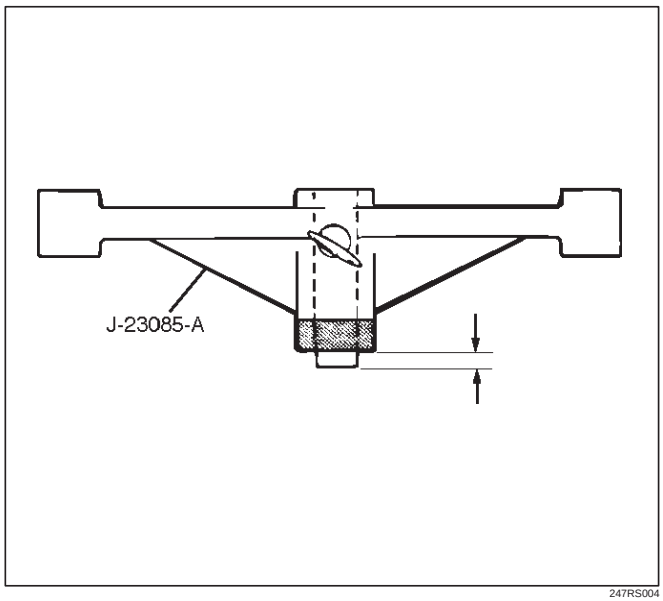


22. Second clutch end play measurement
    1. Install the J–23085–A Selective washer gauging tool (with spacer ring) on the case flange and against the intermediate shaft.
    2. Position the inner shaft of the gauging tool against the thrust surface of the second clutch hub.
    3. Tighten thumb screw. Remove the tool.
    4. Fit the spacer ring on the inner shaft of the tool.
    5. Measure the gap, and select the appropriate washer as shown in the chart.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.36 mm TO 0.79 mm (0.014 in TO 0.031 in)	

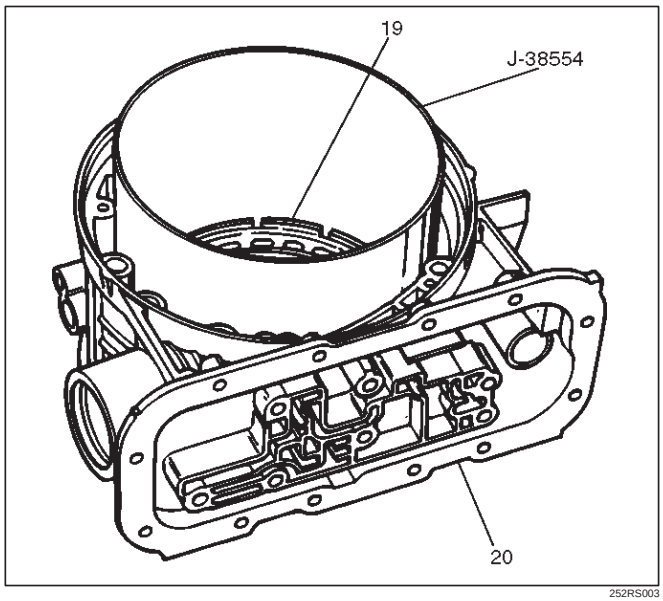


247R100001



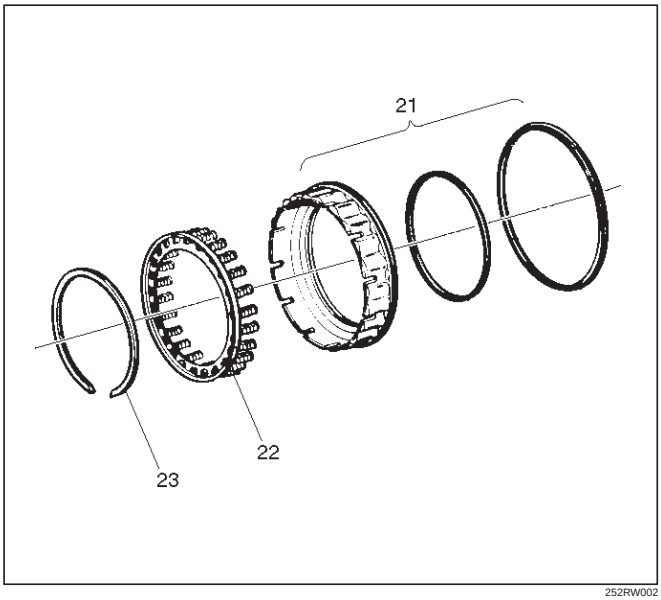
247RS004

23. Inspect fourth clutch piston seals and replace if necessary.
    - ▼Lubricate J–38554 fourth clutch piston fitter and install it on fourth clutch piston (19).
    - ▼Install fourth clutch piston (19) in adapter case (20).
    - ▼Remove fitter.

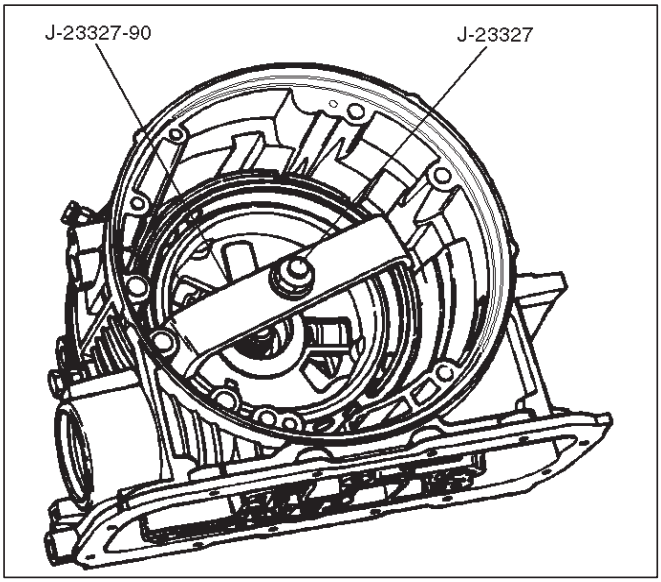


252RS003

24. Install retainer and spring assembly (22) into fourth clutch piston (21).
25. Install snap ring (23) in adapter case.
    ▼Install J–23327 and J–23327–90 fourth clutch spring compressor.
    ▼Seat snap ring in groove.
    ▼Remove compressor.

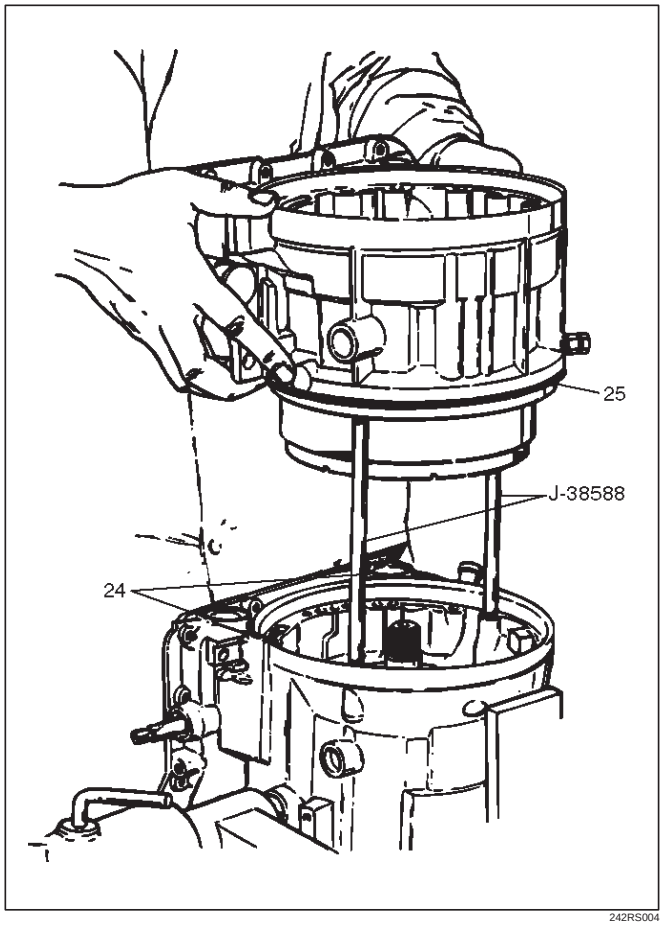


252RW002



252RS004

26. Install selective washer using petroleum jelly.
27. Install two O–ring seals (24) in main case and adapter case/main case seal ring (25).
28. Install J–38588 guide pins.
    ▼Install adapter case and center support assembly to main case.



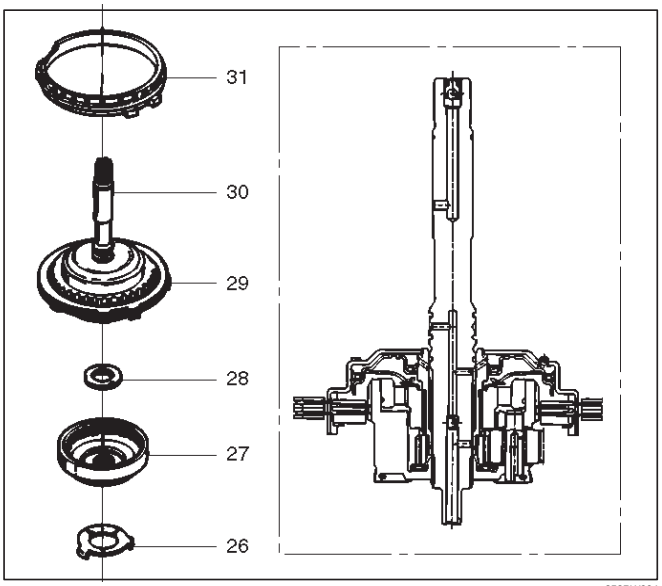
242RS004

29. Install thrust washer (26) into adapter case, with tangs pointing downwards.
30. Preassemble overdrive internal gear (27) and thrust bearing assembly (28) onto the turbine shaft and overrun clutch assembly.

NOTE: Install bearing assembly, black side up. Use petroleum jelly to keep assembly in place.

31. Install overdrive carrier (30) and internal gear assembly into adapter case.
32. Install fourth clutch plates (29) in the following order: Steel, Lined, Steel, Steel, Lined, Steel. Steel plates go in with short tang facing towards valve body surface.

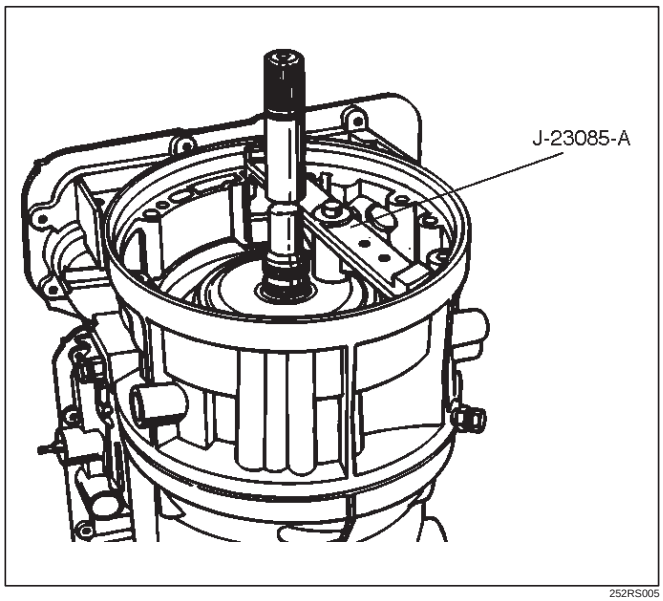
33. Install fourth clutch retainer (31) with the notch facing up and positioned towards valve body surface.



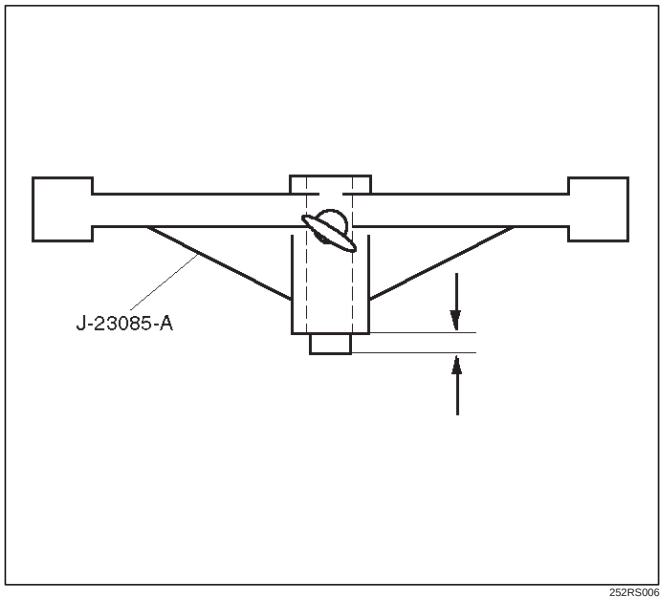
252RW004

34. Overdrive clutch end play measurement
    1. Install the J–23085–A selective washer gauging tool on the adapter case flange and against the input shaft.
    2. Position the inner shaft of the tool against the thrust surface of the overrun clutch housing.
    3. Tighten thumb screw. Remove the tool.
    4. Measure gap. Select appropriate size washer as shown in the chart.
    5. Set selective thrust washer aside.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.1 mm TO 0.8 mm (0.004 in TO 0.03 in)	



252RS005



252RS006

35. Install selective washer (32).

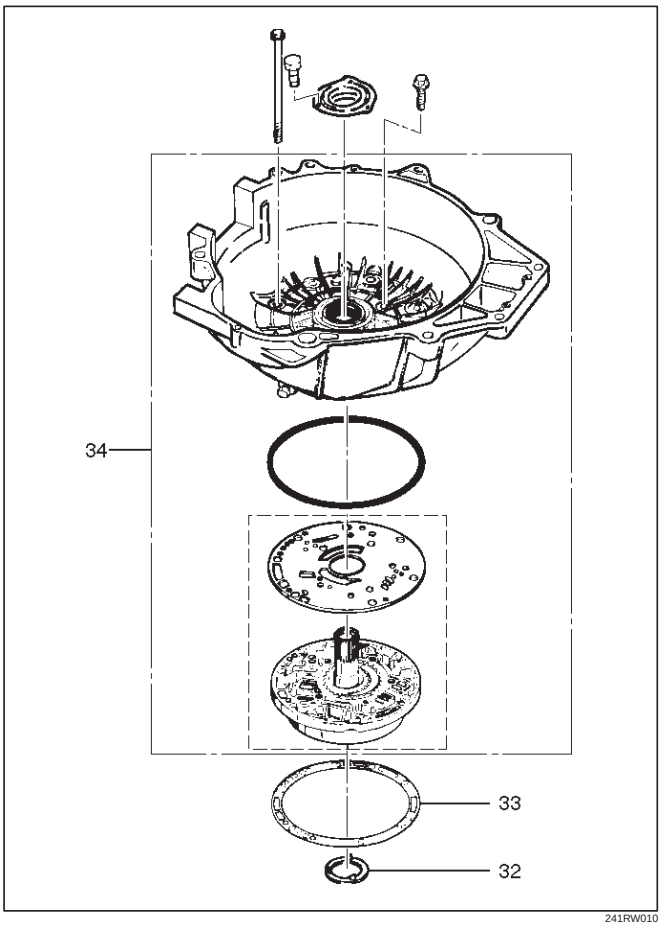
NOTE: Use petroleum jelly to hold selective washer in place.

36. Install gasket (33).
37. Install converter housing and oil pump assembly (34) to adapter case.

    ▼Fit and tighten seven outer 13 mm screws.

    Torque: 39 N•m (29 lb ft)

▼Ensure free rotation of oil pump using J–23082–01 oil pump rotation tool.

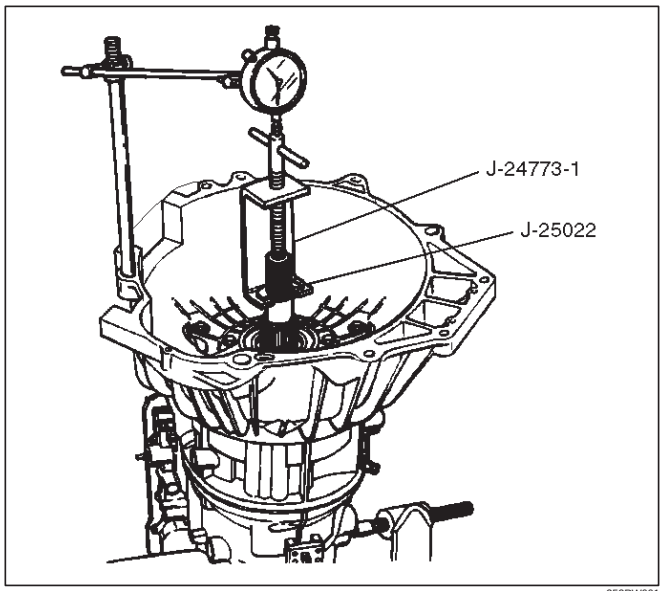


38. Overdrive clutch end play measurement
    1. Fit J–25022 and J–24773–1 turbine shaft puller on turbine shaft.
    2. Position axial play checking tool on converter housing mating face.
    3. Pull turbine shaft upwards with puller until first resistance is met. (due to weight of overdrive assembly).
    4. Maintain shaft in this position and set indicator to zero.
    5. Pull turbine shaft further upwards with puller. Read end play shown on indicator.

    End play: 0.1mm – 0.8mm (0.004 in – 0.031in)

    6. Remove axial play checking tool and puller.

NOTE: If end play is not correct, repeat selective washer selection.



39. Inspect extension housing oil seal and replace if necessary, using J–36797 extension housing oil seal installer.

    ▼Rotate transmission to horizontal position, with valve body side down.

    ▼Inspect parking wheel seal ring. Replace if necessary.

    ▼Install wheel parking lock assembly (35).

40. Install speed wheel (36) and snap ring (37). (4×4)

NOTE: Use extra long, needle-nose pliers.

41. Install flange, O–ring and nut. (4×2)
42. Install gasket onto extension assembly with a thin coating of oil.

    ▼Install extension housing assembly (38), and align parking pawl shaft.

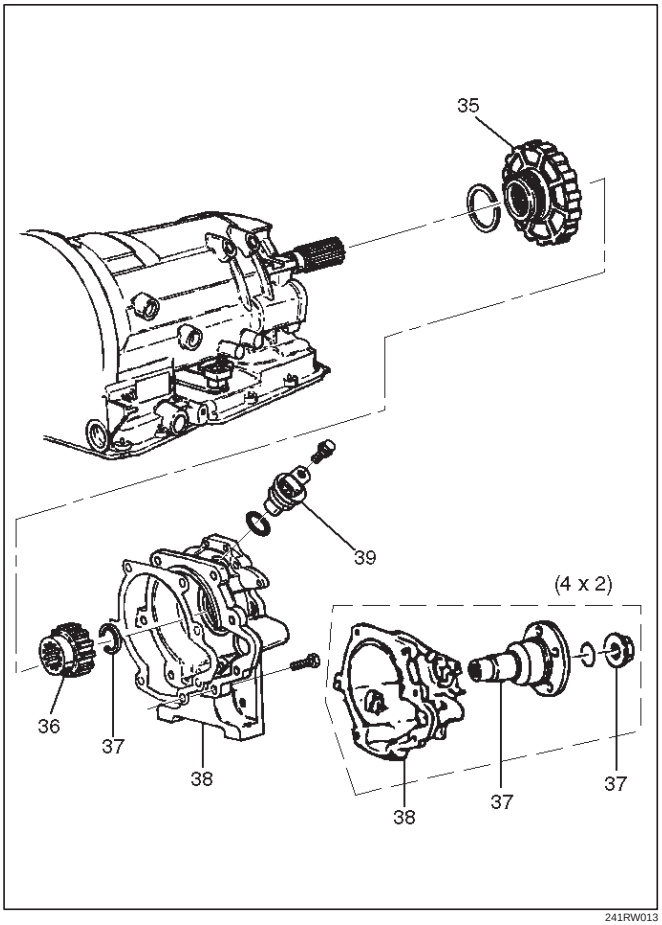
    ▼Install actuator assembly into extension assembly.

    ▼Install seven 8 mm hexagon socket head screws.

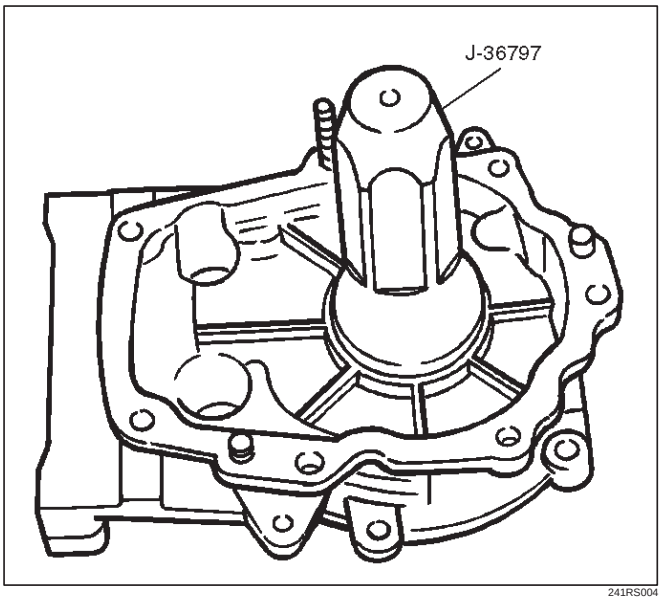
    Torque: 32 N•m (24 lb ft)

43. Inspect speed sensor O–ring. Replace if necessary.
    ▼Install speed sensor assembly (39) and 10 mm screw.

    Torque: 9 N•m (78 lb in)



241RW013

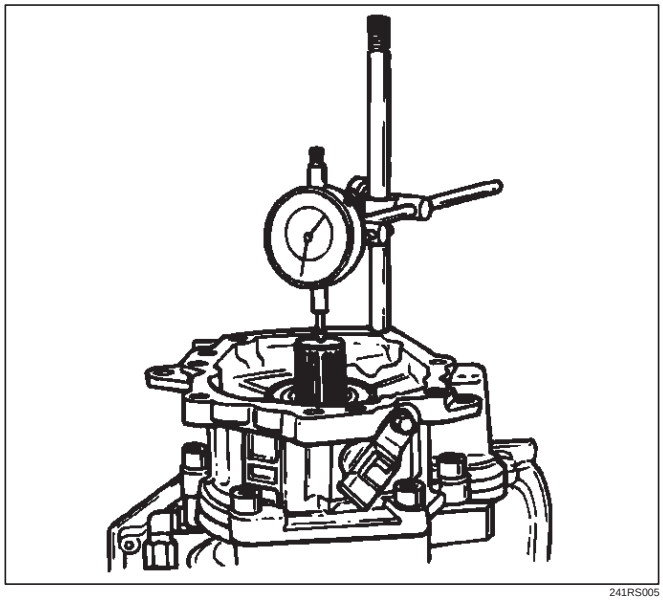


241RS004

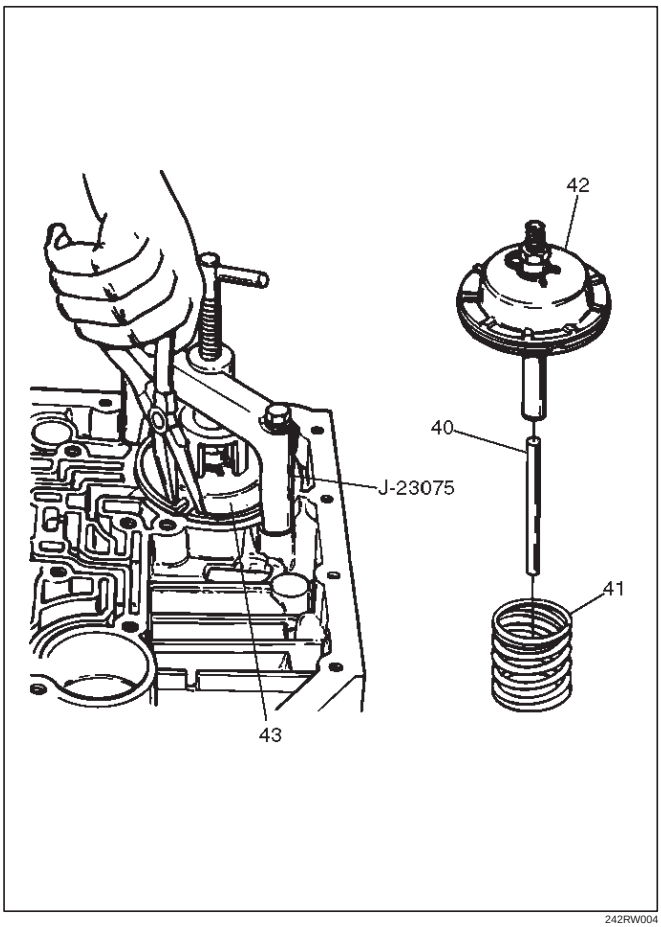
44. Main case end play measurement
    1. Attach axial play checking tool on the extension housing and set indicator to zero on output shaft.
    2. Manually push output shaft upwards.

    End play: 0.36mm – 0.80mm (0.014 in – 0.031in)

    3. Remove axial play checking tool.
    4. If end play is not correct, repeat selective washer selection.

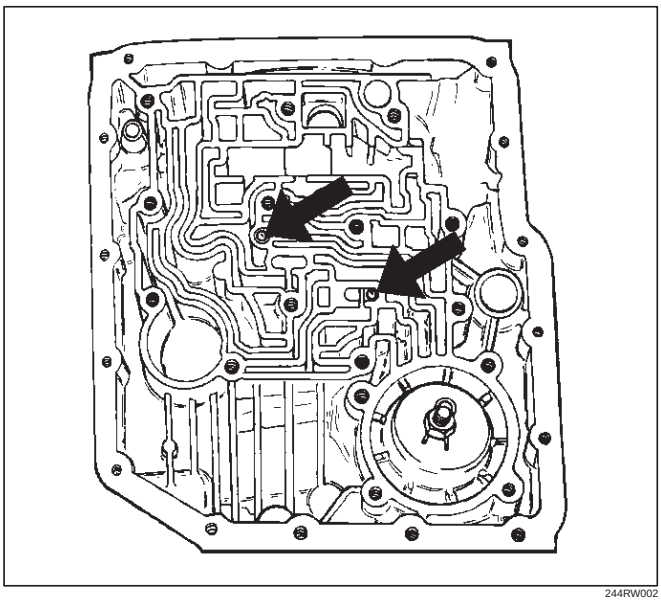

241RS005

45. Inspect servo piston seal ring. Replace if necessary.
    ▼Ensure brake band is correctly positioned. Rotate output shaft if necessary.
    ▼Install J–38428 servo piston fitter in servo bore.
    ▼Install apply rod (40), round end toward band, return spring (41) and piston assembly (42).
46. Install the J–23075 servo spring compressor with offset to rear of case.
    ▼Compress servo piston seal ring, using fitter while tightening the tool screw.
    ▼Install servo piston retaining ring (43).
    ▼Remove tool.
    ▼Adjust the brake band by tightening the servo adjusting screw to 4.5 N·m (39.8 lb in) torque. Be certain the lock nut is loose, then back–off the screw five turns exactly. Hold piston sleeve with wrench and tighten lock nut to 18.5 N·m (13.6 lb ft) torque. Be certain the adjusting screw does not turn.



242RW004

47. Install two check balls (44).



244RW002

48. Inspect main case electrical connector and seal, replace if necessary.
    ▼Install electrical 7 way connector/main case and wiring harness.
49. Install two J–25025–B guide pins into main case.
    ▼Install main case valve body complete assembly (45) and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

▼Install seven 13 mm screws.

Torque: 20 N•m (15 lb ft)

▼Remove two guide pins.

50. Install servo cover gasket, cover (46) and four 13 mm screws.

    Torque: 25 N•m (18 lb ft)

51. Connect wiring harness (47) to band control, shift solenoids, and main case 7 way connector.
52. Install manual detent roller and spring assembly (48) with clip.
    ▼Install two 13 mm screws.

    Torque: 20 N•m (15 lb ft)

53. Install oil filter (49), and three 13 mm screws.

    Torque: 20 N•m (15 lb ft)

54. Install oil pan gasket, magnet, main oil pan (50), and sixteen 10 mm screws.

    Torque: 11 N•m (96 lb in)

55. Inspect adapter case electrical connector and seal. Replace if necessary.
    ▼Install electrical 4 way connector and harness assembly (52) in bottom of adapter case.
56. Install gasket, transfer plate, and gasket.
    ▼Install adapter case valve body (51) and seven 13 mm screws.

    Torque: 20 N•m (15 lb ft)

57. Connect wiring harness harness assembly (52) to converter clutch PWM solenoid, force motor, and 4 way connector.
58. Install oil pan gasket, adapter case oil pan (53), and twelve 10 mm screws.

    Torque: 11 N•m (96 lb in)

    ▼Rotate transmission, with bottom pan facing down.
59. Install mode switch (54), two 10 mm screws, selector lever nut, and cover.

    10 mm screw

    Torque: 13 N•m (113 lb in)

    Nut

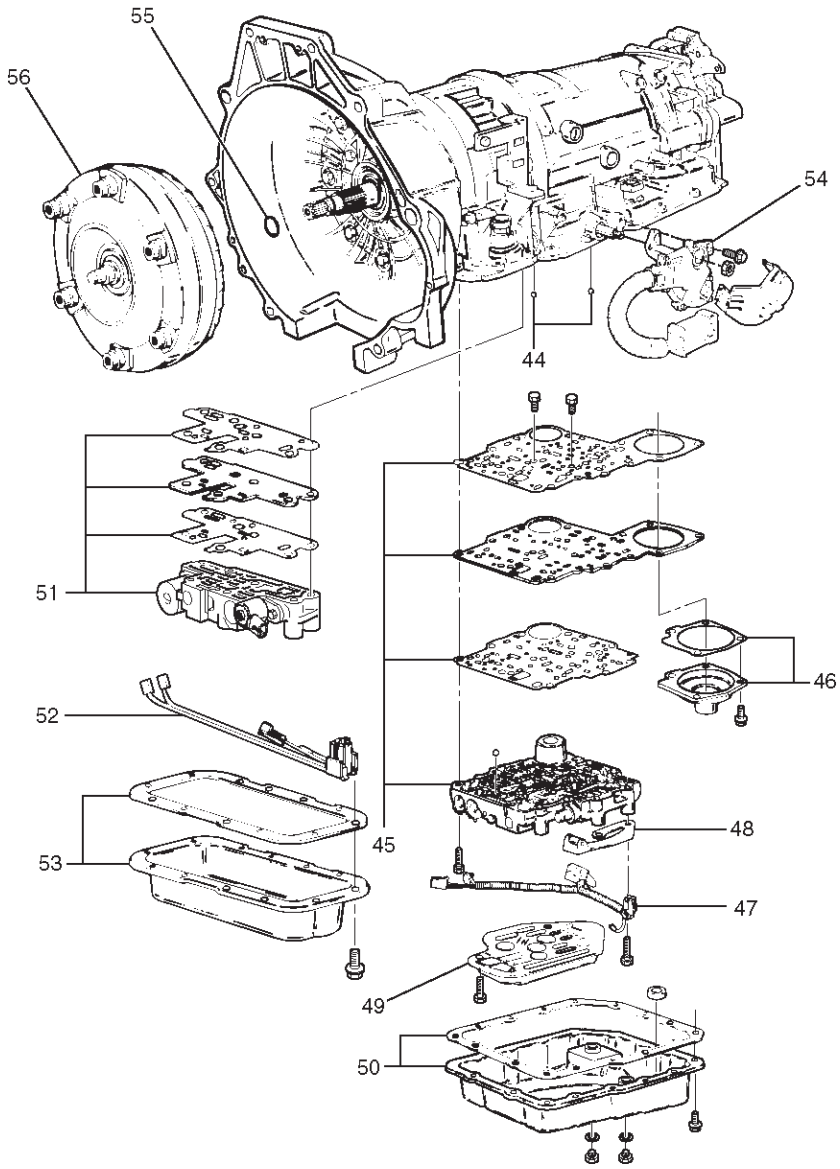
    Torque: 23 N•m (17 lb ft)

    ▼Adjust using setting tool, refer to *Mode Switch in this section.*
60. Install O–ring (55) on turbine shaft.
61. Install torque converter (56).
    The converter assembly must be replaced under any of the following conditions:
    a. Evidence of damage to the pump assembly.
    b. Metal particles are found after flushing the cooler lines.
    c. External leaks in hub weld area.
    d. Converter pilot broken, damaged, or poor fit into crankshaft.

e. Converter hub scored or damaged.
f. Internal failure in stator.
g. Contamination from engine coolant.
h. Excess end play.

▼Rotate transmission, bell housing up. Spin converter to insure proper fit.

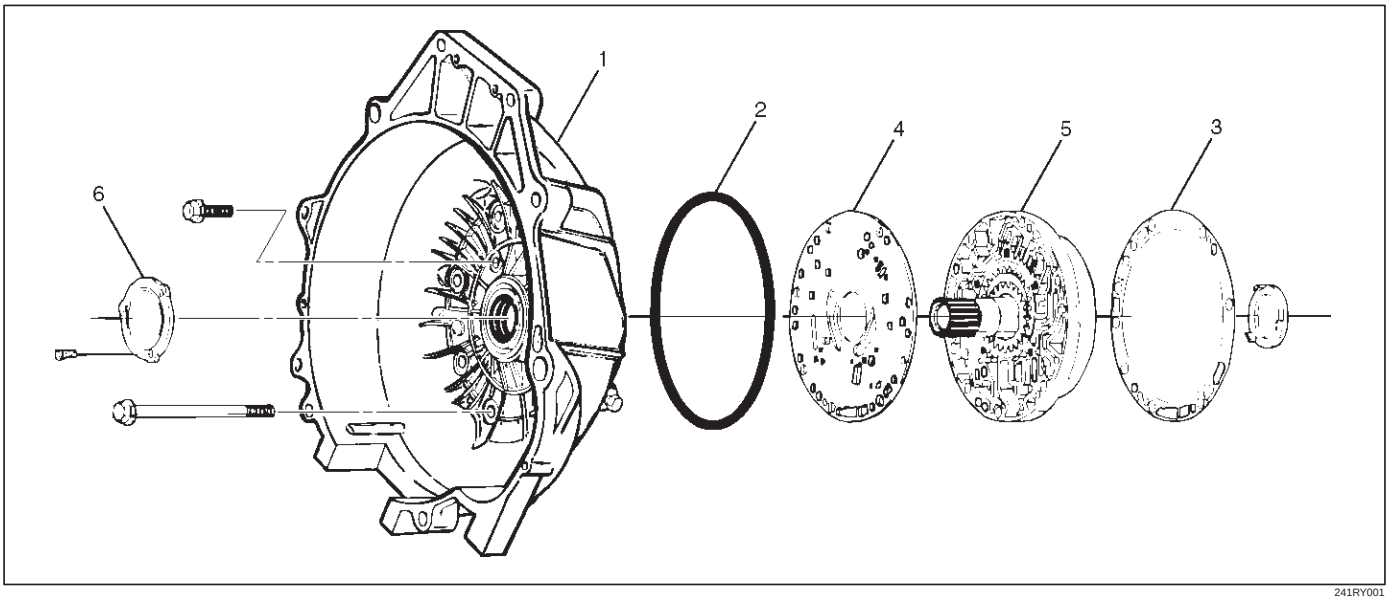
62. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to *Changing Transmission Fluid in this section.*



240RY002

Converter Housing And Oil Pump Assembly

Disassembled View



241RY001

Legend

(1) Converter Housing
(2) Outer Seal Ring
(3) Gasket
(4) Wear Plate
(5) Oil Pump Assembly
(6) Oil Seal Ring

Disassembly

1. Remove oil pump assembly from converter housing.
2. Remove outer seal ring.
3. Remove gasket.
4. Remove wear plate.
5. Remove oil seal ring.

Inspection And Repair

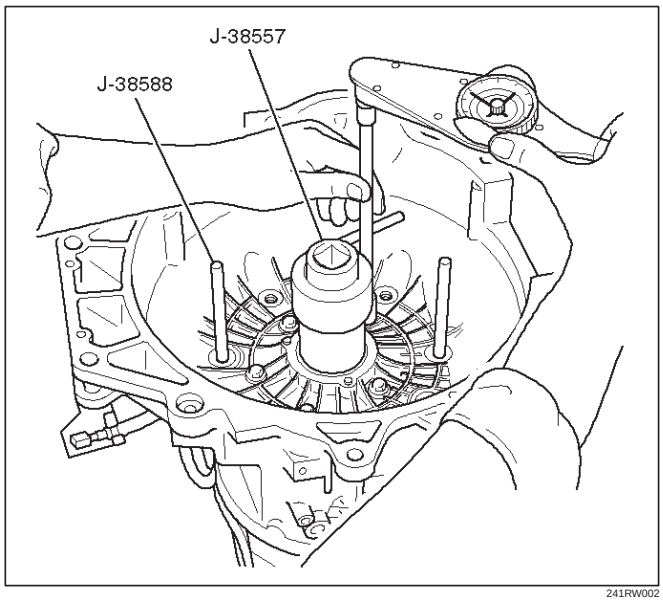
Visual Check:

If any damage, deformation, or local wear is found in a converter housing, outer seal ring, wear plate, or oil seal ring, replace it.

Reassembly

1. Install wear plate onto oil pump assembly.
2. Install converter housing onto complete oil pump assembly. Align with two short J–38588 guide pins on outer bolt holes.
   ▼Loosely install five 13mm bolts.
   ▼Center converter housing using J–38557 centering tool.
   ▼Tighten five inner 13mm bolts in an alternating pattern.

   Torque: 20 N•m (15 lb ft)



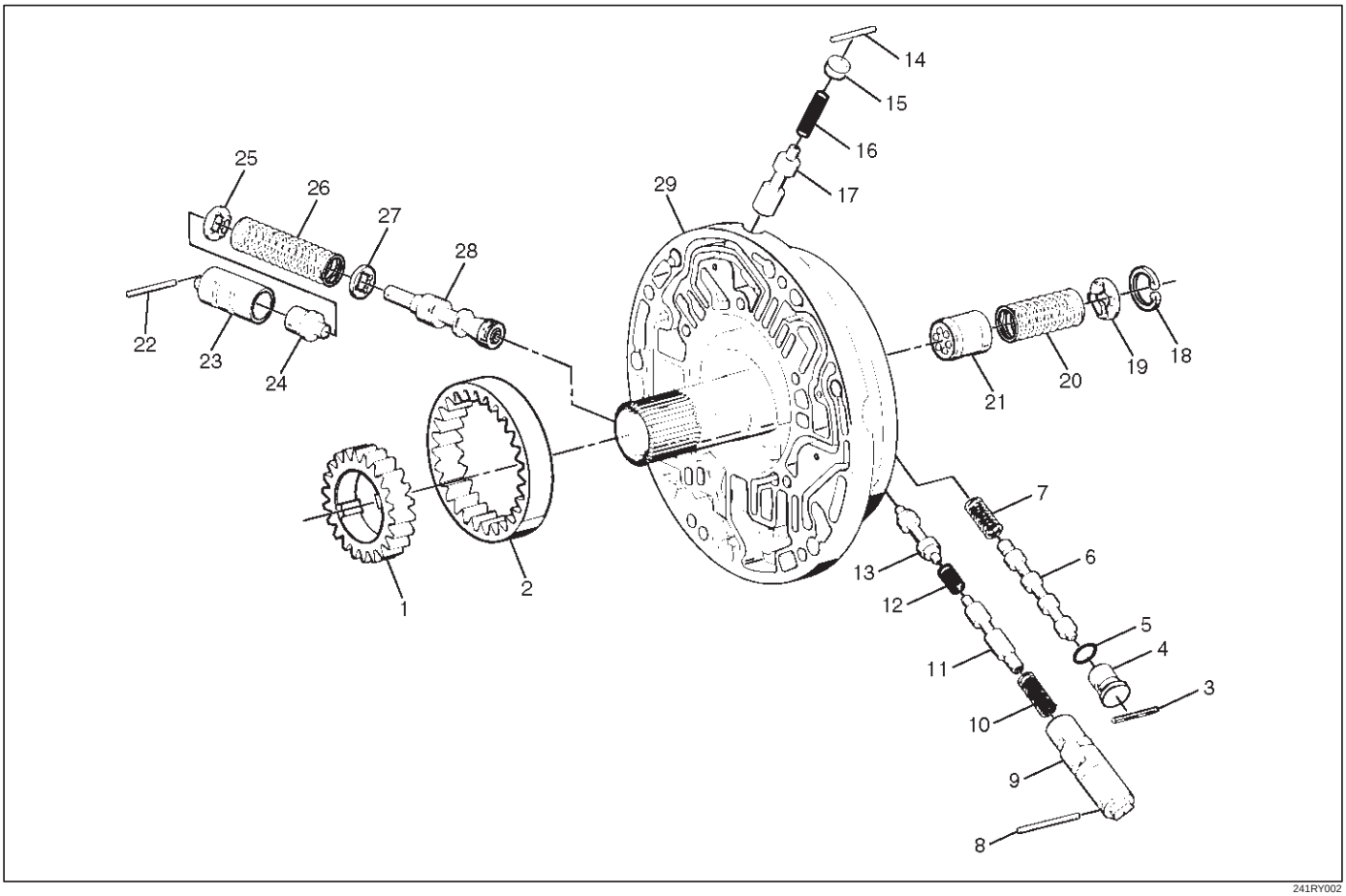
241RW002

3. Install oil seal ring (3 screws).

   Torque: 3 N•m (26 lb in)
4. Install gasket.
5. Install outer seal ring.

Oil Pump

Disassembled View



241RY002

Legend

(1) Oil Pump Drive Gear
(2) Oil Pump Driven Gear
(3) Pin
(4) Plug
(5) Seal Ring
(6) Torque Converter Clutch Control Valve
(7) Converter Clutch Control Valve Spring
(8) Pin
(9) Converter Clutch Regulator Sleeve
(10) Converter Clutch Regulator Spring
(11) Converter Clutch Regulator Valve
(12) Isolator Spring
(13) Isolator Valve
(14) Pin
(15) Enable Valve Spring Guide
(16) Enable Valve Spring
(17) Enable Valve
(18) Snap Ring
(19) Spring Seat
(20) Throttle Signal Accumulator Spring
(21) Throttle Signal Accumulator Piston
(22) Sleeve Pin
(23) Boost Valve Sleeve
(24) Boost Valve
(25) Spring Seat
(26) Pressure Regulator Valve Spring
(27) Spring Seat
(28) Pressure Regulator Valve
(29) Oil Pump Assembly

Disassembly

1. Remove oil pump drive gear (1) and driven gear (2).
2. Remove pin (3) from oil pump assembly (29).
3. Remove plug (4) and seal ring (5), torque converter clutch control valve (6) and spring (7).
4. Remove pin (8) from oil pump assembly (29).
5. Remove torque converter regulator sleeve (9), converter clutch regulator spring (10), converter clutch regulator valve (11), isolator spring (12) and isolator valve (13).
6. Remove pin (14) from oil pump assembly (29).
7. Remove enable valve spring (16), spring guide (15) and enable valve (17).
8. Remove snap ring (18) from oil pump assembly (29).

9. Remove spring seat (19), spring (20) and throttle signal accumulator piston (21).
10. Remove sleeve pin (22) from oil pump assembly (29).
11. Remove boost valve sleeve (23), boost valve (24), spring seat (25), valve spring (26), spring seat (27), and pressure regulator valve (28).

Inspection And Repair

Visual Check:

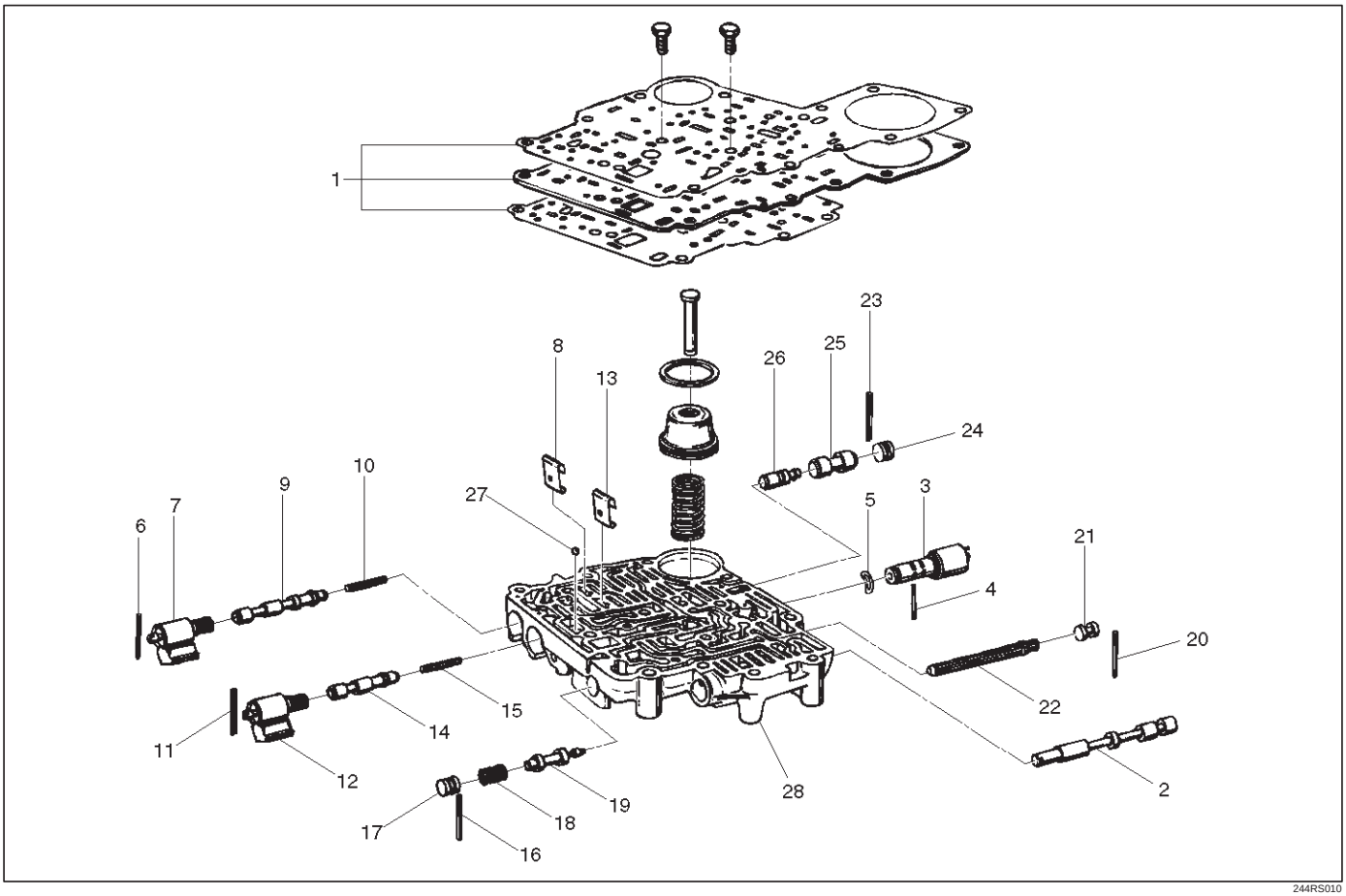
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Lubricate and preinstall pressure regulator spring seat (27) on valve (28), with the flat side against shoulder.
2. Install pressure regulator valve (28) and spring seat (27) assembly, valve spring (26), and spring seat (25) with the flat side away from spring to oil pump assembly (29).
3. Assemble boost valve (24) into sleeve (23).
4. Install boost valve and sleeve assembly, and sleeve pin (22) to oil pump assembly (29).
5. Install throttle signal accumulator piston (21), spring (20), and spring seat (19), with the flat side away from the spring, and snap ring (18) to oil pump assembly (29).
6. Install enable valve (17), spring guide (15), enable valve spring (16) and retainer pin (14) to oil pump assembly (29).
7. Assemble torque converter regulator spring (10) and torque converter regulator valve (11) into sleeve (9).
8. Install isolator valve (13), isolator valve spring (12) and the torque converter regulator sleeve and valve assembly into the oil pump assembly (29).
9. Install torque converter clutch control valve spring (7), torque converter clutch control valve (6), plug (4) and seal ring (5), and retainer pin (3) to oil pump assembly (29).
10. Install oil pump driven gear (2) and drive gear (1).

Main Case Valve Body

Disassembled View



244RS010

Legend

(1) Gaskets and Transfer Plate
(2) Manual Valve
(3) Band Control Solenoid
(4) Pin
(5) Waved Washer
(6) Spring Pin
(7) Solenoid A
(8) Retainer
(9) 1–2/3–4 Shift Valve
(10) Spring
(11) Spring Pin
(12) Solenoid B
(13) Retainer
(14) 2–3 Shift Valve
(15) Spring
(16) Spring Pin
(17) Plug
(18) Spring
(19) Low Pressure Control Valve
(20) Spring Pin
(21) Plug
(22) Band Control Screen Assembly
(23) Spring Pin
(24) Plug
(25) 1–2 Accumulator Valve
(26) 1–2 Accumulator Control Valve
(27) Check Ball
(28) Main Case Valve Body

Disassembly

1. Remove two 11mm bolts from valve body (28), then remove gaskets and transfer plate (1).
2. Remove manual valve (2).
3. Push in band control solenoid (3) to compress waved washer (5), and remove pin (4).
4. Remove band control solenoid (3) and waved washer (5).
5. Remove spring pin (6) with a 3 mm dia punch.
6. Remove solenoid A (7) by grasping the metal tip. Do not grasp the connector housing.
7. Remove retainer (8), 1–2/3–4 shift valve (9), and spring (10).
8. Remove spring pin (11) with a 3 mm dia punch.
9. Remove solenoid B (12) by grasping the metal tip. Do not grasp the connector housing.

10. Remove retainer (13), 2–3 shift valve (14), and spring (15).
11. Remove spring pin (16), plug (17), spring (18), and low pressure control valve (19).
12. Remove spring pin (20), plug (21), and band control screen assembly (22).
13. Remove spring pin (23), plug (24), 1–2 accumulator valve (25), and 1–2 accumulator control valve (26).
14. Remove check ball (27) from valve body (28).

Inspection And Repair

Inspect for the following, and replace any damaged or worn parts:

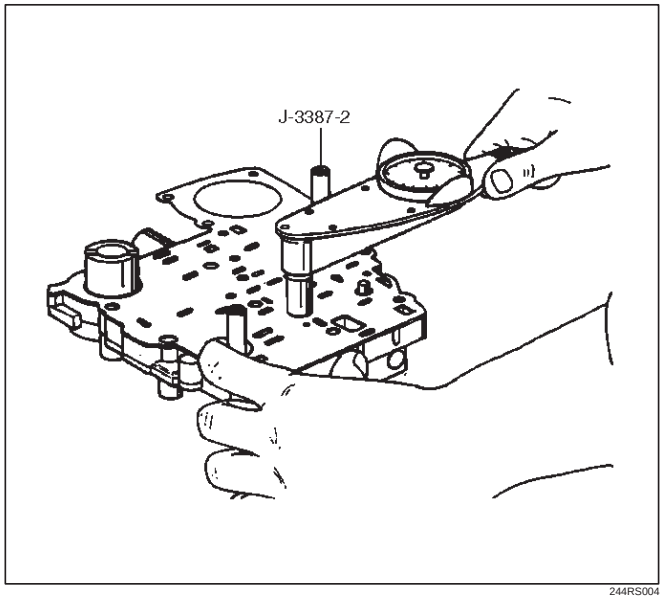
1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install 1–2 accumulator control valve (26), 1–2 accumulator valve (25), plug (24), and spring pin (23).
2. Install band control screen assembly (22), plug (21), and spring pin (20).
3. Install low pressure control valve (19), spring (18), plug (17), and spring pin (16).
4. Install spring (15), 2–3 shift valve (14), retainer (13), solenoid B (12), and spring pin (11).
5. Install spring (10), 1–2/3–4 shift valve (9), retainer (8), solenoid A (7), and spring pin (6).
6. Install waved washer (5), band control solenoid (3), and pin (4).
7. Install manual valve (2).
8. Install check ball (27) to valve body (28).
9. Install gasket (valve body/transfer plate) and transfer plate using two J–3387–2 guide pins.

▼Install two 11mm bolts.

Torque: 13 N•m (113 lb in)

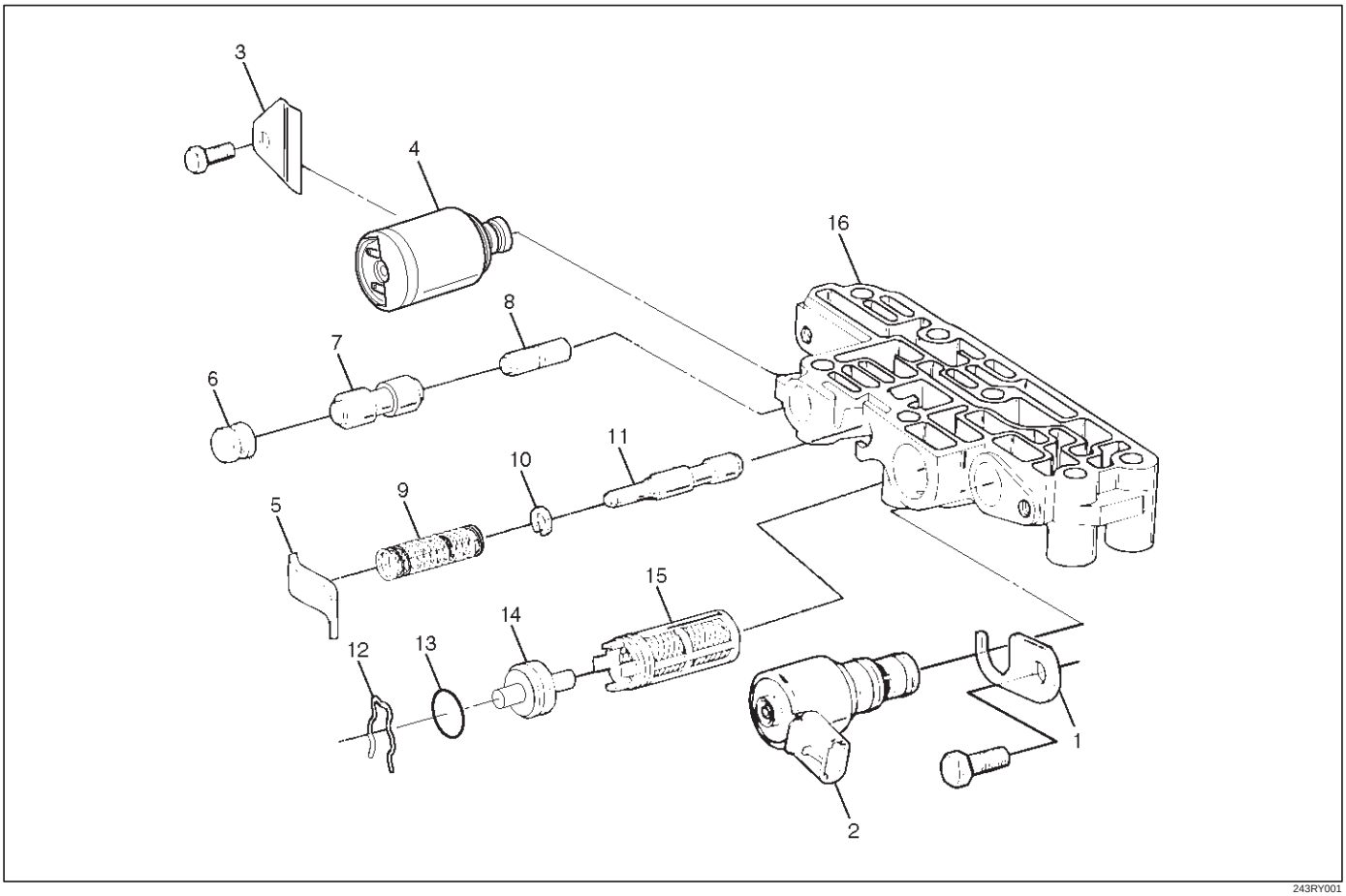


244RS004

▼Install gasket (transfer plate/main case).

Adapter Case Valve Body

Disassembled View



243RY001

Legend

(1) Bracket
(2) Converter Clutch PWM Solenoid
(3) Retainer
(4) Force Motor Solenoid
(5) Retainer
(6) Plug
(7) 3/4 Accumulator Valve
(8) 3/4 Accumulator Control Valve
(9) Spring
(10) Retaining Ring
(11) Feed Limit Valve
(12) Plug Retainer
(13) O–Ring
(14) Plug
(15) Force Motor Screen Assembly
(16) Adapter Case Valve Body

Disassembly

1. Remove 11mm bolt from valve body.
   ▼Remove bracket (1) and converter clutch PWM solenoid (2).
2. Remove 11mm bolt and retainer (3) from valve body.
   ▼Remove force motor solenoid (4).
3. Remove retainer (5), plug (6), 3/4 accumulator valve (7), and 3/4 accumulator control valve (8).
4. Remove spring (9), retaining ring (10), and feed limit valve (11).
5. Remove plug retainer (12), O–ring (13), plug (14), and force motor screen assembly (15).
   ▼Use 5 mm bolt to pull plug.

Inspection And Repair

Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install force motor screen assembly (15), plug (14), O–ring (13), and plug retainer (12).
2. Install feed limit valve (11), retaining ring (10), and spring (9).
3. Install 3/4 accumulator control valve (8), 3/4 accumulator valve (7), plug (6), and retainer (5).
4. Install force motor solenoid (4).

   ▼Place solenoid terminals pointing towards mating face.

   ▼Install retainer (3) and bolt.

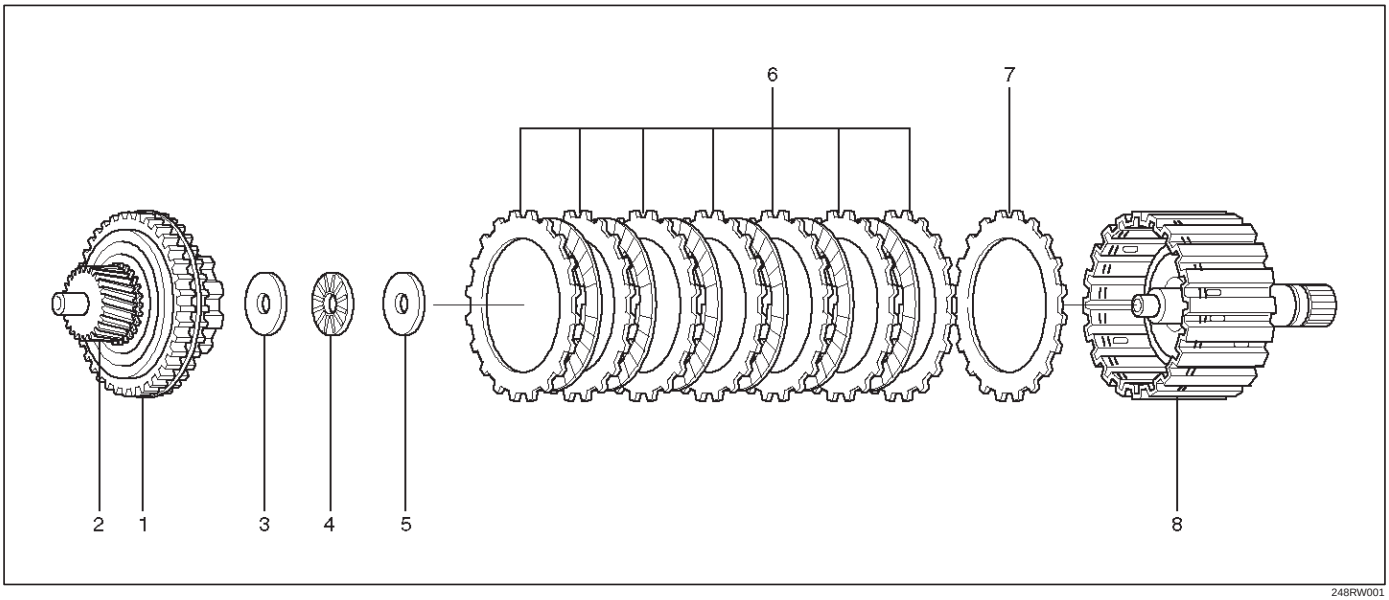
   Torque: 10 N•m (87 lb in)
5. Install converter clutch PWM solenoid (2) with two O–rings (2) and bracket (1) to valve body.

   ▼Install bolt.

   Torque: 10 N•m (87 lb in)

Third Clutch And Sprag Unit

Disassembled View



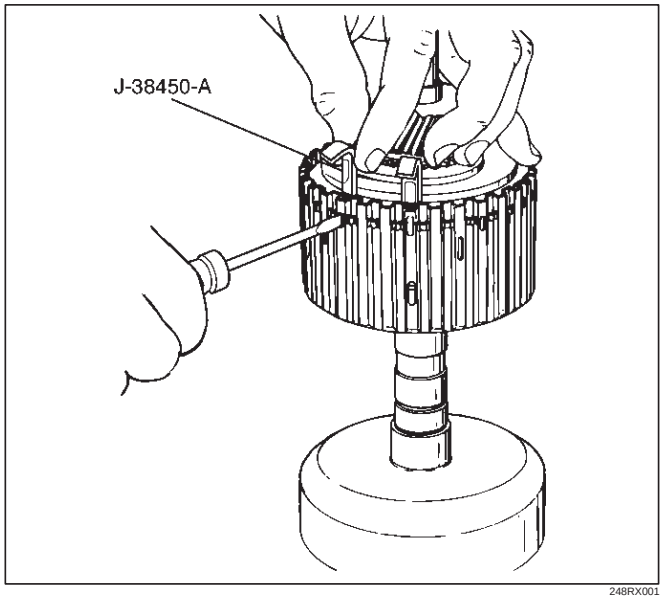
248RW001

Legend

(1) Retaining Ring
(2) Input Sun Gear and Sprag Unit Assembly
(3) Retaining Washer
(4) Bearing
(5) Thrust Washer
(6) Clutch Plates
(7) Third Clutch Spring Cushion Plate
(8) Third Clutch Drum Assembly

Disassembly

1. Place the third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Locate the ends of the retaining ring. Depress one end of the ring using a small screwdriver instead of the depressor handle provided with the tool J-38450-A. Slide one blade down between the third clutch drum and the retaining ring.
3. Remove a screwdriver and repeat this step for the other end of retaining ring.
4. Install the remaining four blades approximately (five) notches apart using a screwdriver to depress the retaining ring.
5. Pull up on input sun gear and sprag unit assembly (1 and 2) to release the retaining ring from third clutch drum assembly (8).
6. Remove the tool blades.



248RX001

7. Remove retaining washer (3), bearing (4), thrust washer (5), and clutch plates (6 and 7) from the third clutch drum assembly (8).

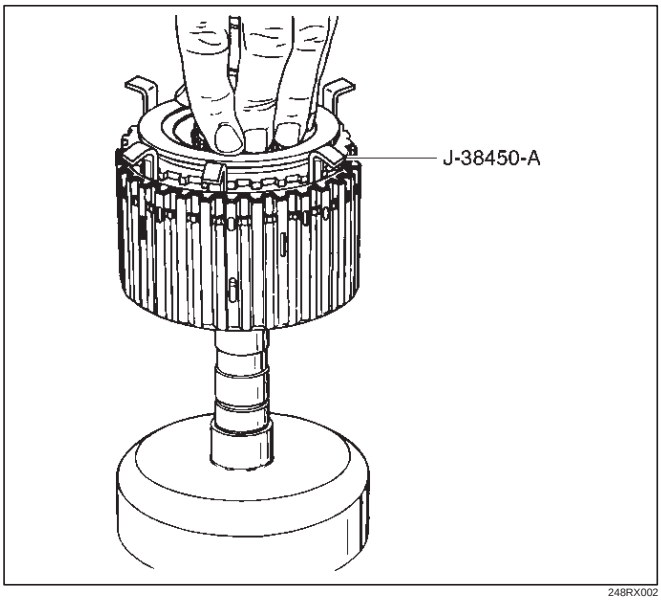
Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

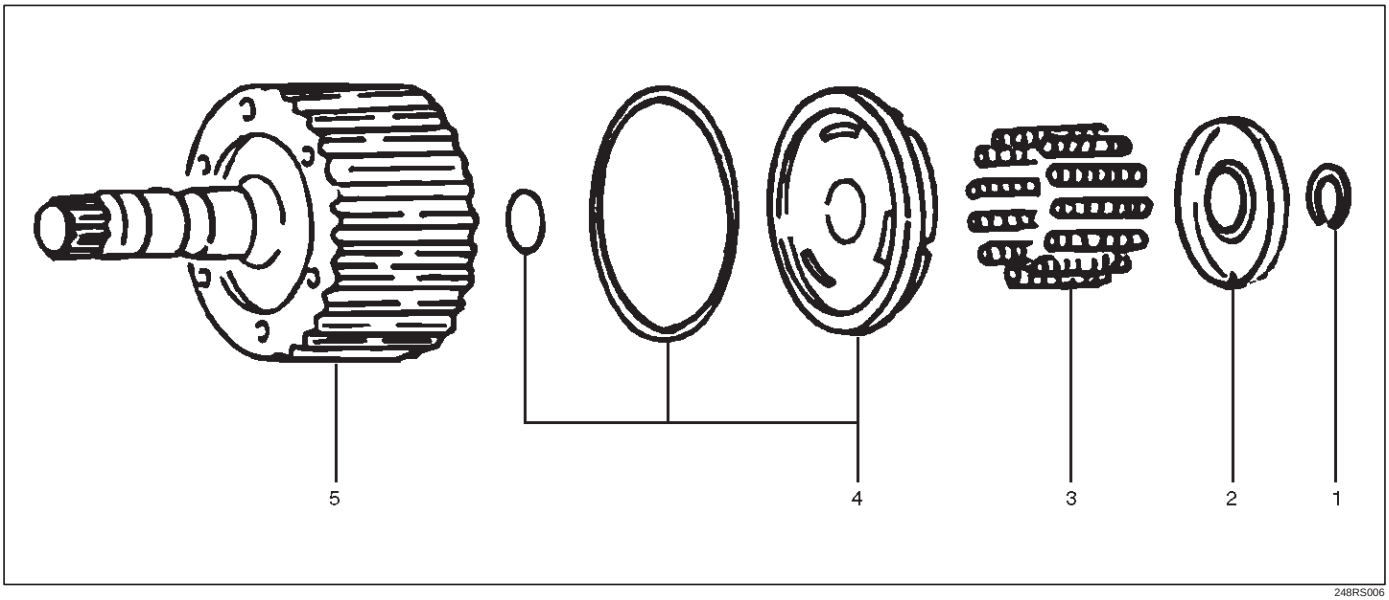
1. Place third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Install third clutch spring cushion plate (7), bevel face down.
3. Install third clutch plates (6) into third clutch drum assembly (8). Start with the steel clutch plate and alternate with lined plates.
4. Install thrust washer (5), bearing (4), and retaining washer (3).
5. Fully engage the hub splines of the input sun gear and sprag unit assembly (2) into the third clutch inner tangs.
   ▼Simultaneously rotate the outer sprag race to engage into the third clutch drum assembly (8).
6. Place J-38450-A blades between the retaining ring and the third clutch drum apporximately (five) notches apart, and one blade at each end of the retaining ring (1). Push down on sprag assembly until the assembly is seated into the third clutch drum assembly (8).
7. Remove the tool blades and engage retaining ring into groove of third clutch drum.



248RX002

Third Clutch

Disassembled View



248RS006

Legend

(1) Retaining Ring
(2) Spring Seat
(3) Springs
(4) Piston Assembly
(5) Third Clutch Drum

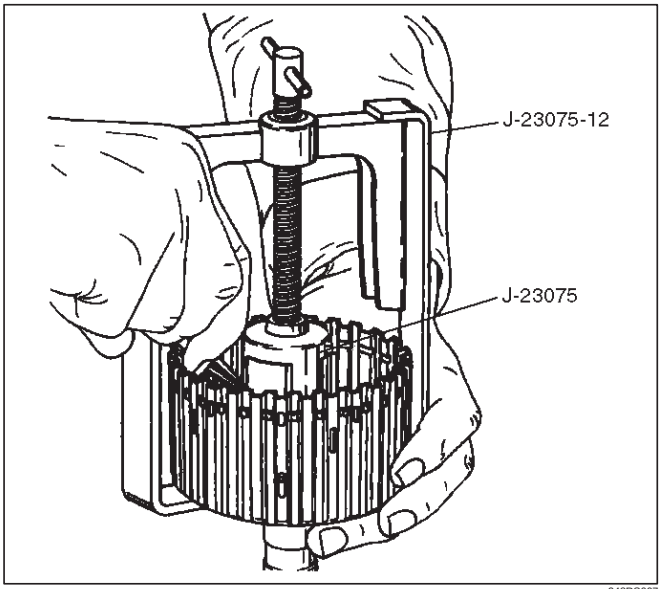
Disassemble

1. Compress spring seat using the J–23075 spring compressor and J–23075–12 adapter tool.

NOTE: Do not over–stress the springs and seat. This will cause damage to the spring seat.

▼Remove the tool.

▼Remove retaining ring (1).



248RS007

2. Release the spring seat (2).

NOTE: Do not let the spring seat catch in the ring groove.

▼Remove spring seat (2) and springs (3).

3. Remove piston assembly (4) from third clutch drum (5).

Inspection And Repair

Visual check:

If any damage, deformation or wear is found, replace the damaged part.

Operation check:

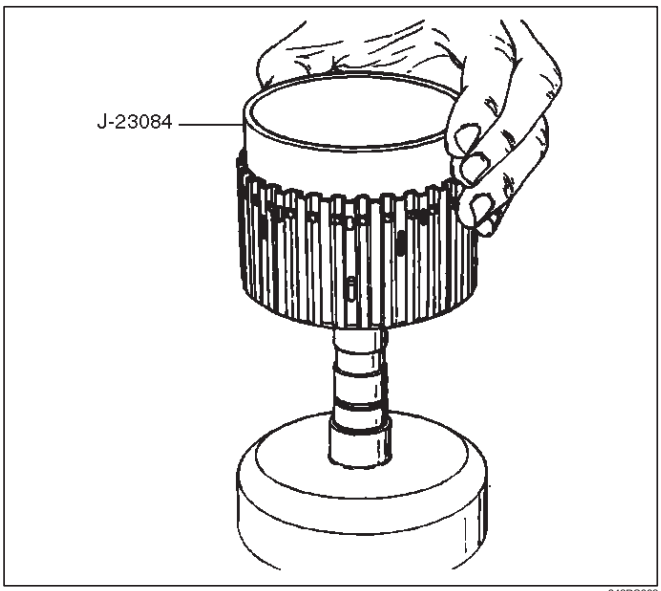
Shake the piston and listen for check ball movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. The lip of the piston seal must point toward the front of the transmission. Lubricate the seal lip with transmission fluid.

▼Install piston assembly (4) into the third clutch drum (5). Use the J–23084 third clutch piston installer to protect the outer seal during installation.

▼Remove the seal installer.



2. Install twelve springs (3) and spring seat (2).
3. Place retaining ring (1) onto spring seat.

▼Compress the piston springs, using the J–23075 piston spring compressor and J–23075–12 adapter.

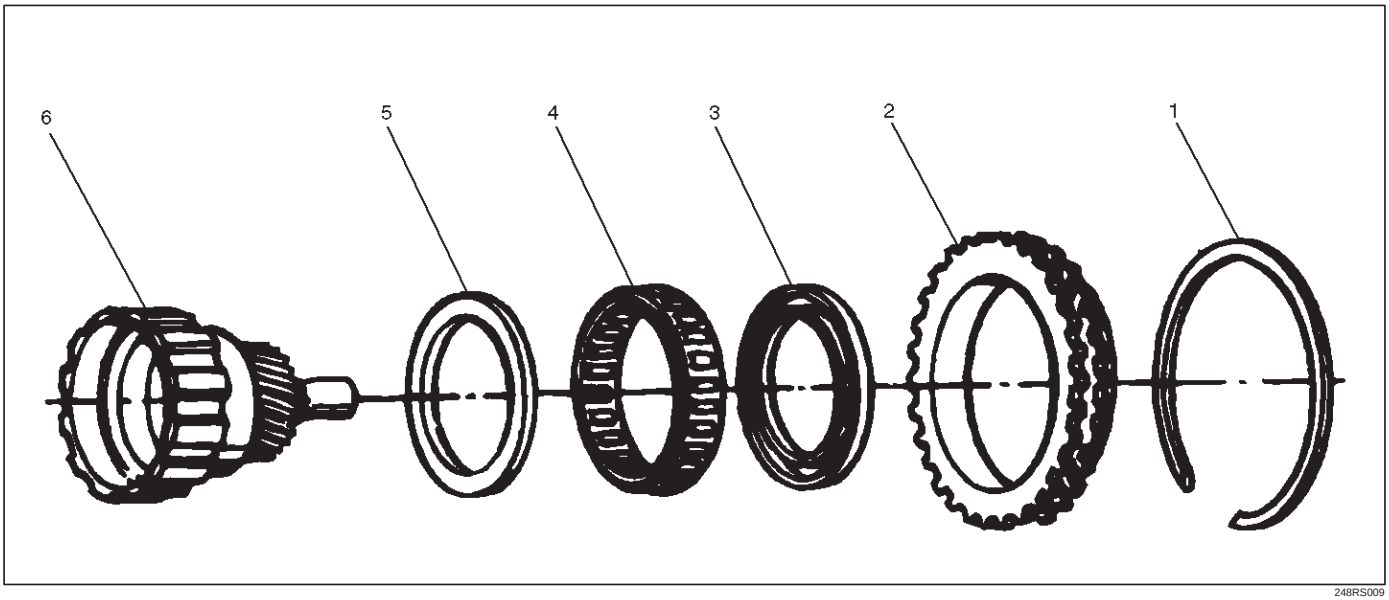
CAUTION: Do not over stress the springs and seat. Do not let the spring seat catch in the ring groove. This may cause damage to the spring seat.

▼Install spring seat retaining ring (1).

▼Remove the piston spring compressor and adapter.

Sprag Unit

Disassembled View



248RS009

Legend

(1) Retaining Ring
(2) Sprag Outer Race
(3) Ring
(4) Sprag Assembly
(5) Ring
(6) Third Clutch Hub and Sun Gear Assembly

Disassembly

1. Remove the sprag outer race, retaining ring, and sprag assembly from the third clutch hub and sun gear assembly.
2. Remove the rings and sprag assembly from the sprag outer race.

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

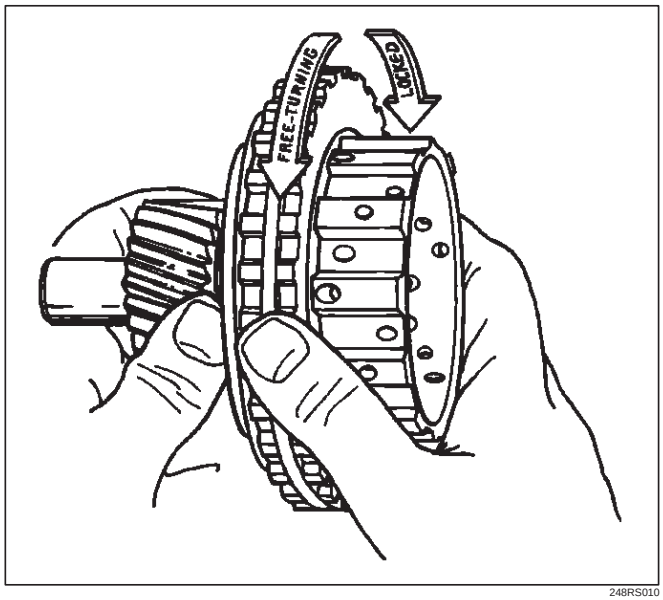
Reassembly

NOTE: Flared shoulder of the sprag cage faces the sun gear. This procedure must be followed exactly to be sure that the sprag assembly is installed properly.

1. Install rings and sprag assembly onto the third clutch hub and sun gear.
2. Install sprag outer race and retaining ring assembly over the sprag cage assembly.

▼Place third clutch hub and sun gear assembly on a flat surface, sun gear facing up. Place sprag outer race and sprag assembly over the sun gear assembly, push down and turn the input sun counterclockwise at the same time.

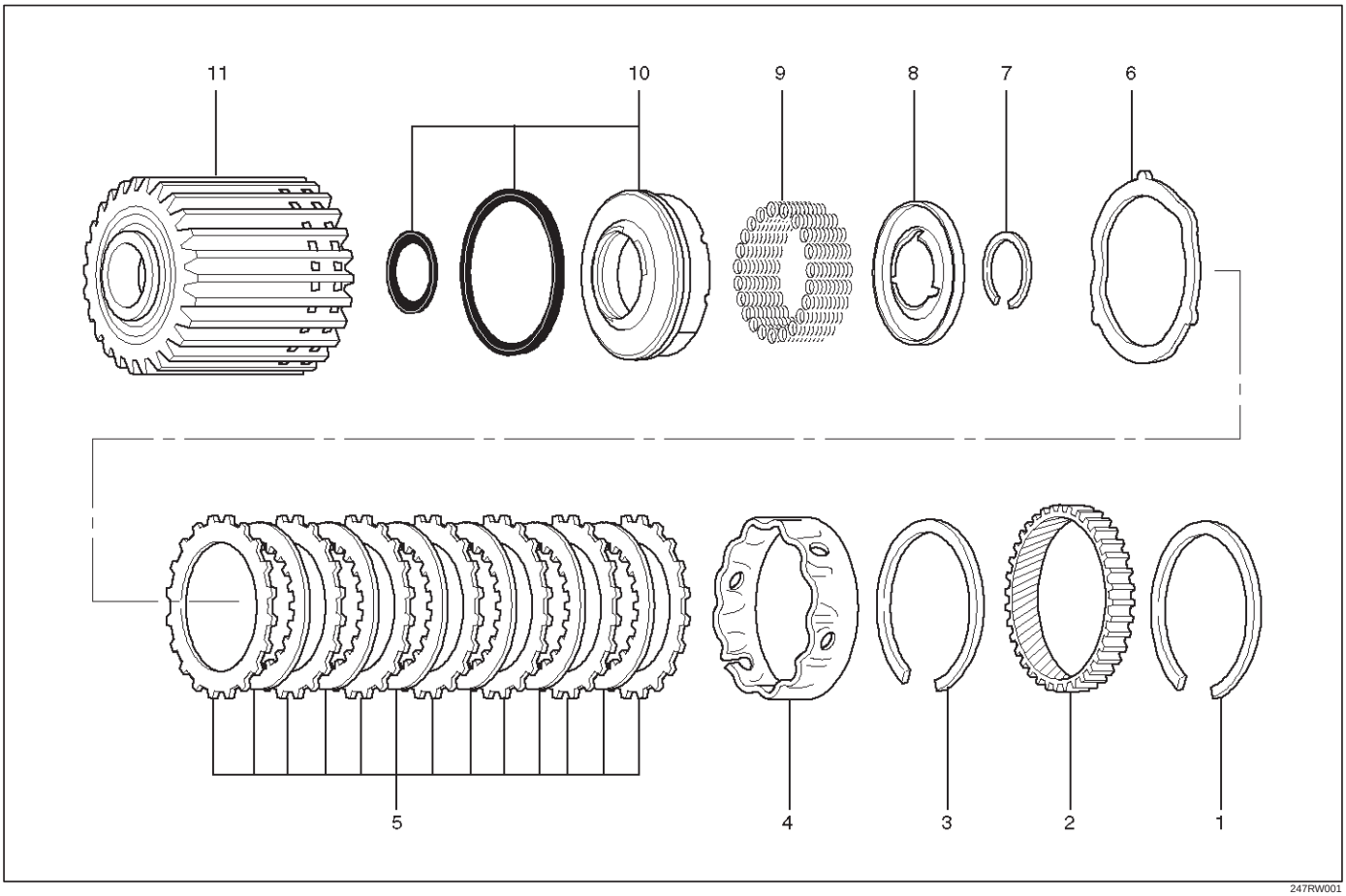
NOTE: Check correct rotation by holding the sun gear in your left hand and turning the outer race. The outer sprag race should turn freely towards you and should lock turning away from you.



248RS010

Second Clutch

Disassembled View



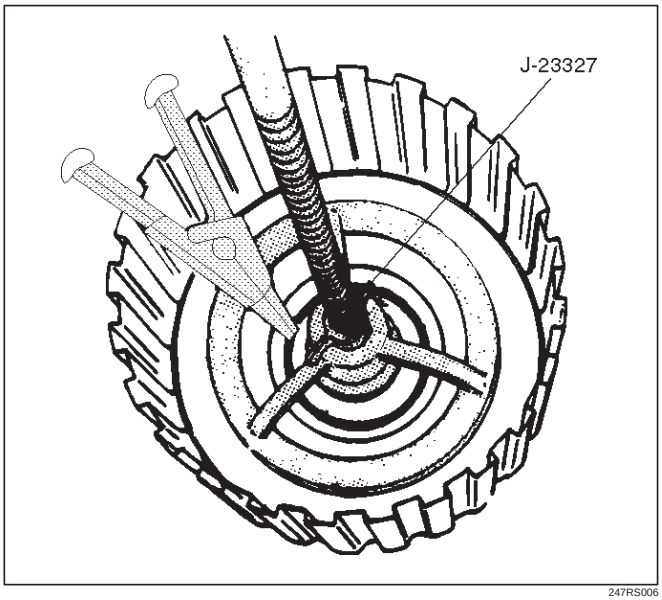
247RW001

Legend

(1) Retaining Ring
(2) Ring Gear
(3) Retaining Ring
(4) Spacer
(5) Clutch Plates
(6) Waved Washer
(7) Retaining Ring
(8) Spring Seat
(9) Springs
(10) Piston Assembly
(11) Second Clutch Drum

Disassembly

1. Remove retaining ring (1) from second clutch drum (11).
2. Remove ring gear (2), retaining ring (3), and spacer (4).
3. Remove clutch plates (5) and waved washer (6).
4. Remove retaining ring (7) using J–23327 compressor to compress the spring seat (8).
5. Remove spring seat (8), springs (9) and piston assembly (10) from second clutch drum (11).



247RS006

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Operation Check:

Shake the piston and listen for check ball movement. Movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

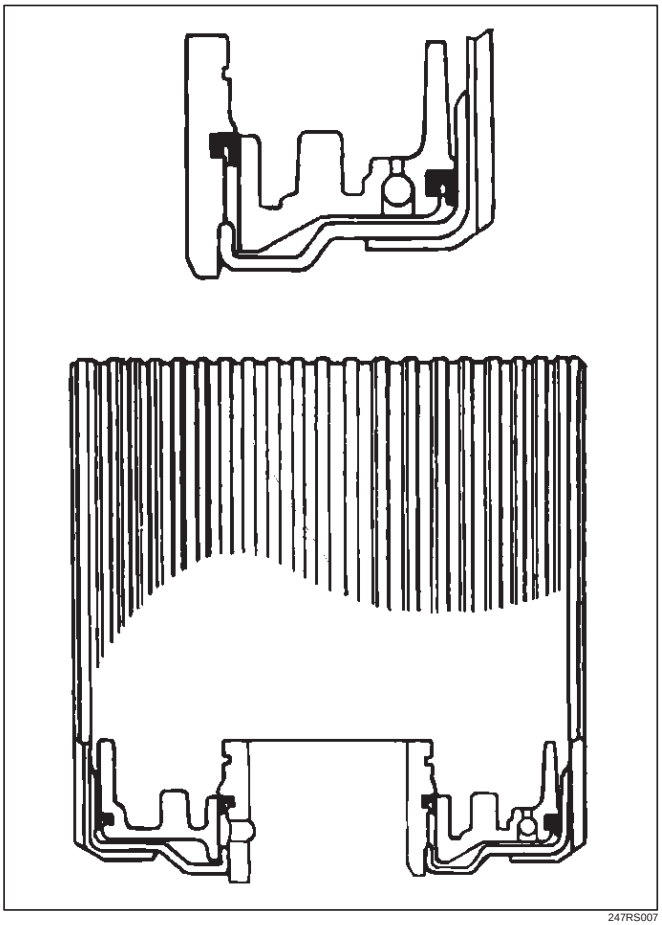
Reassembly

1. Install piston assembly (10) into the second clutch drum (11).

   ▼Lubricate the lip seal with transmission fluid. Use the J–23080–A second clutch piston installer to protect the outer piston lip seal.

NOTE: Lip of the seal should point toward front of transmission.

▼Remove the installer.



247RS007

2. Install twenty–two piston springs (9) and spring seat (8) on the second clutch piston (10). Place retaining ring (7) onto spring seat.

   ▼Use the J–23327 compressor to compress the piston springs.

NOTE: Do not let spring seat catch in ring groove.

▼Remove the compressor.

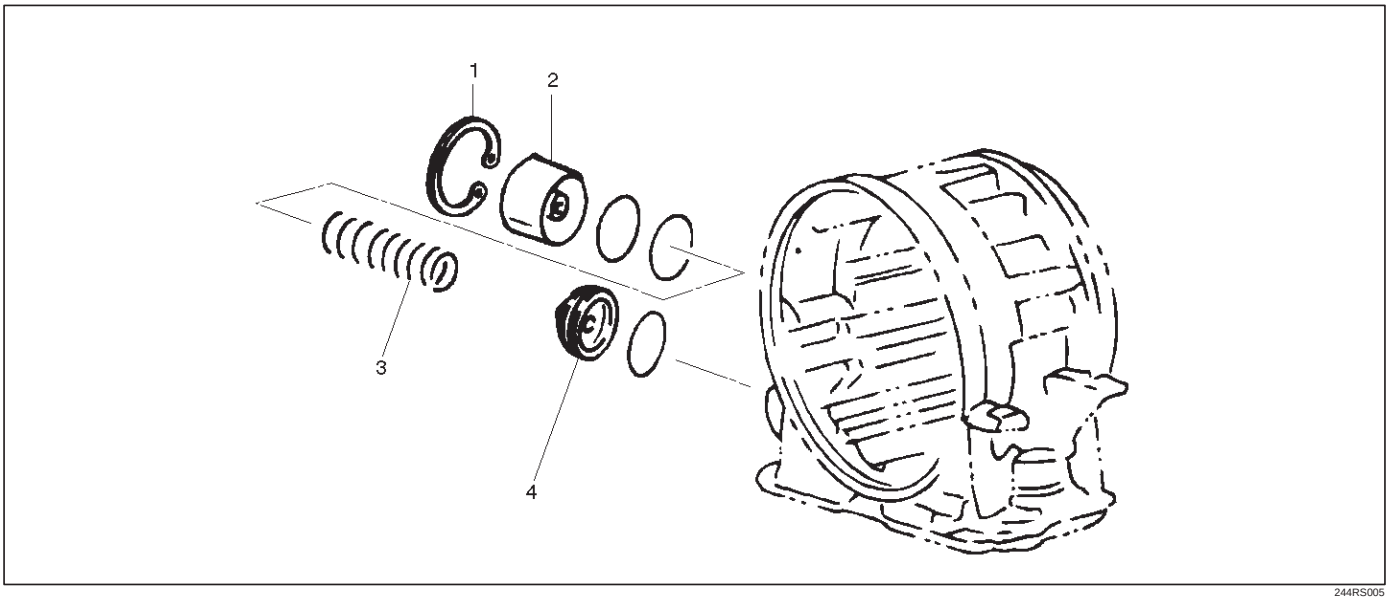
3. Install waved plate (6) and clutch plates (5). Start with a steel plate and alternate with lined plates.

   ▼Align second clutch inner tangs.

4. Install spacer (4), with the fluted end toward clutch plates.
5. Install retaining ring (3), ring gear (2) and retaining ring (1).

3–4 Accumulator Piston

Disassembled View

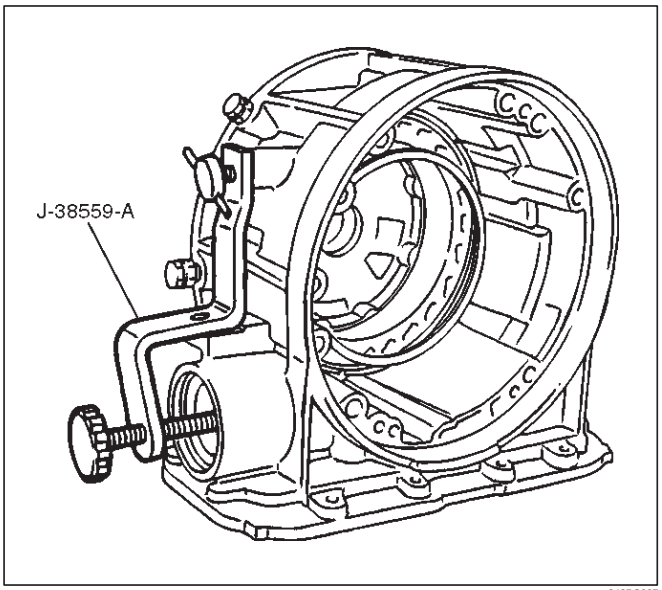


244RS005

Legend
(1) Snap Ring
(2) Cover
(3) Spring
(4) Piston Assembly

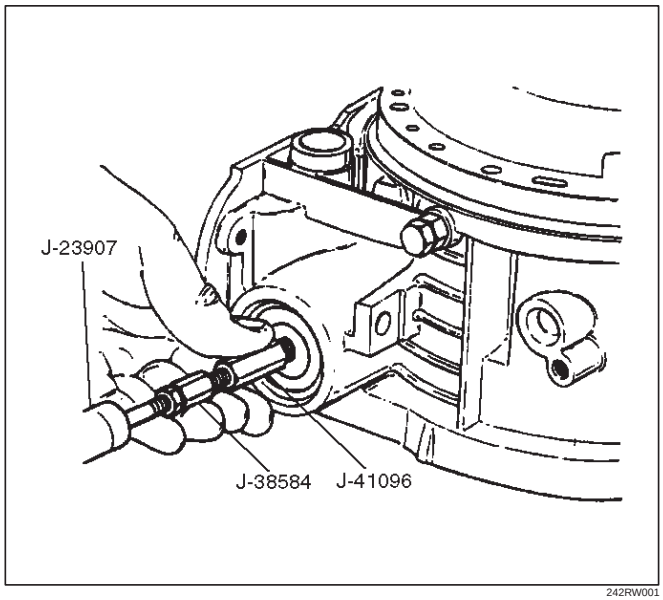
Disassembly

1. Install the J–38559–A cover compressor on adapter case.
   ▼Compress piston cover then remove snap ring.



242RS007

2. Install the J–41096 cover remover and J–38584 adapter to center hole of cover.
   ▼Use the J–23907 slide hammer to remove cover.
3. Remove spring and piston assembly.



242RW001

Inspection And Repair

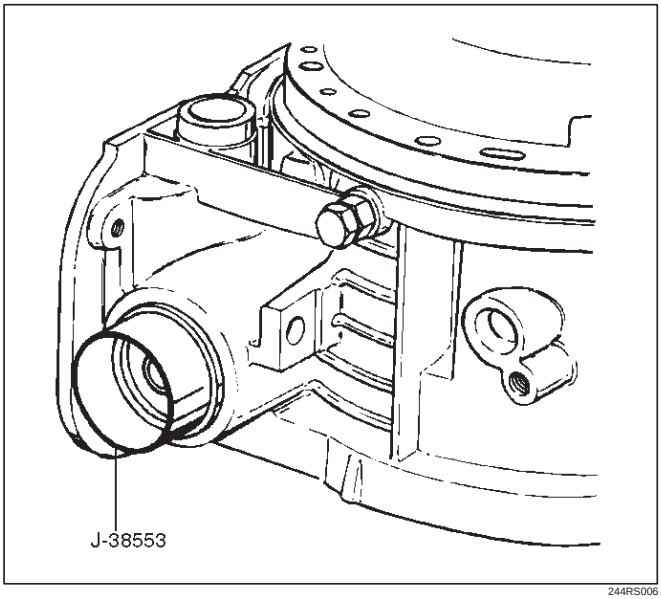
Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Place the J–38553 piston fitter into adaptor case and push the piston into position, using suitable diameter tube.

   ▼Remove the piston fitter.

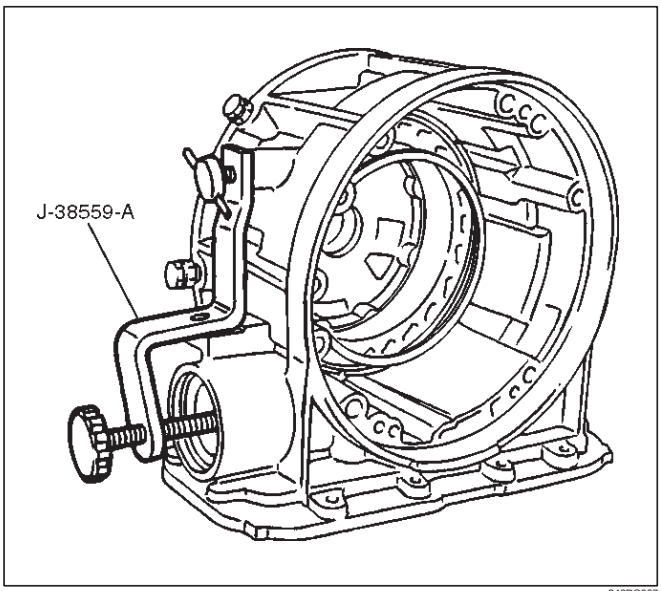


244RS006

2. Install spring and cover.
3. Install snap ring, using the J–38559–A compressor tool.

   ▼Install snap ring in groove.

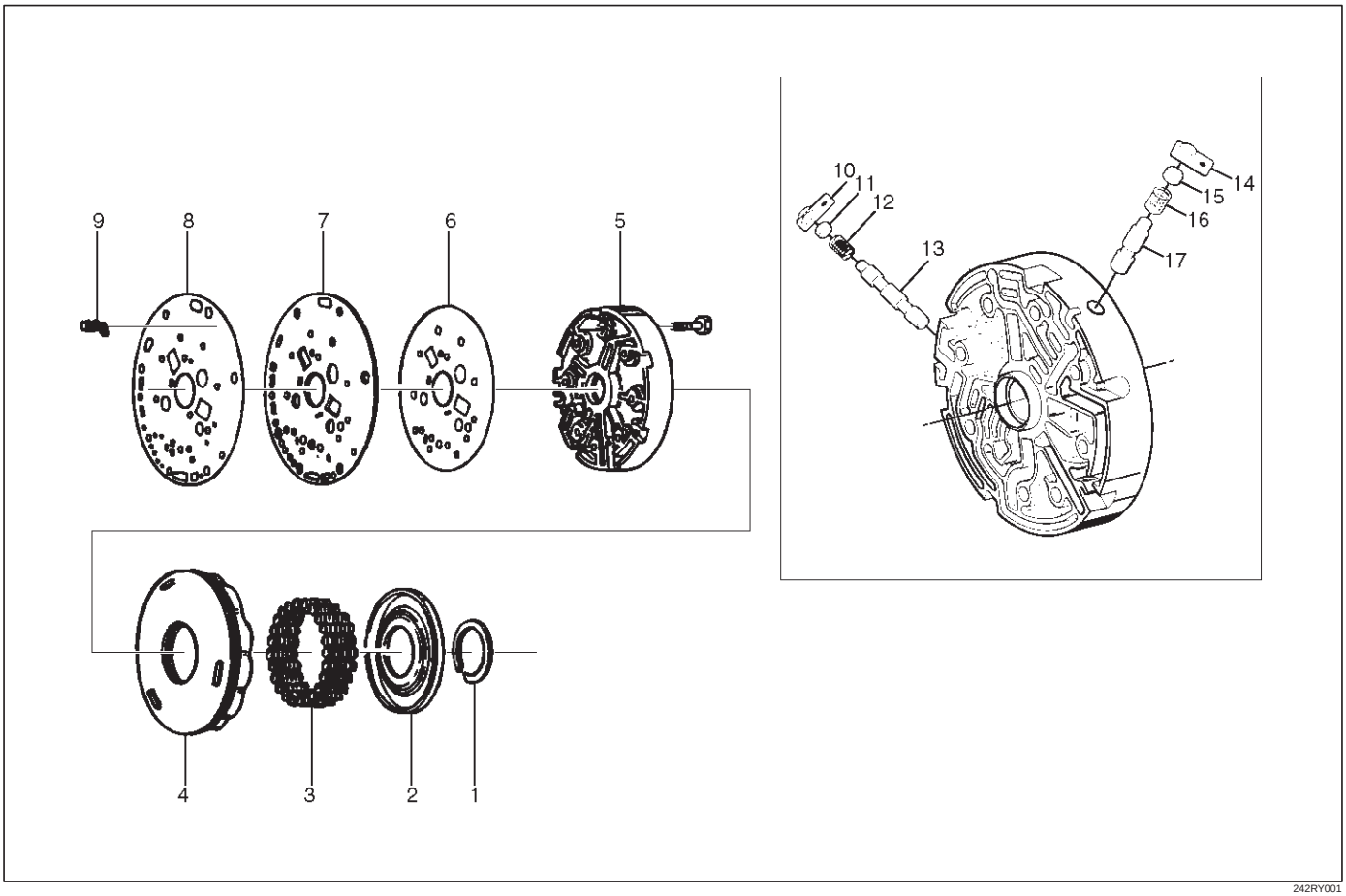
   ▼Remove the compressor tool.



242RS007

Reverse Clutch Piston And Center Support

Disassembled View



242RY001

Legend

(1) Retaining Ring
(2) Spring Seat
(3) Springs
(4) Piston Assembly
(5) Center Support
(6) Gasket
(7) Transfer Plate
(8) Gasket
(9) Restrictor
(10) Retainer Plate
(11) Plug
(12) Spring
(13) Overrun Lock Out Valve
(14) Retainer Plate
(15) Plug
(16) Spring
(17) Reverse Lock Out Control Valve

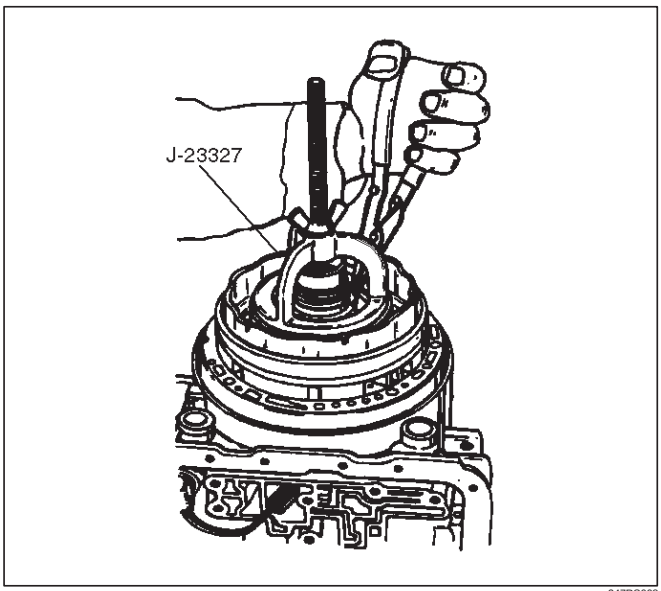
Disassembly

1. Install the J–23327 compressor tool on spring seat, then compress the spring seat.

▼Remove retaining ring (1).

NOTE: Do not over–stress the springs and seat, as this will cause damage to the spring seat.

▼Remove the compressor tool.



247RS008

2. Remove spring seat (2) and springs (3).
3. Remove piston assembly (4).
4. Remove 8 bolts from center support (5), then remove center support (5) from adapter case.
5. Remove gasket transfer plate/outer support (6), center support transfer plate (7), and gasket transfer plate/adapter case (8).
6. Remove restrictor (9) from adapter case housing.
7. Remove retainer plate (10), plug (11), spring (12), and overrun lock out valve (13) from center support (5).
8. Remove retainer plate (14), plug (15), spring (16) and reverse lock out valve (17) from center support (5).

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

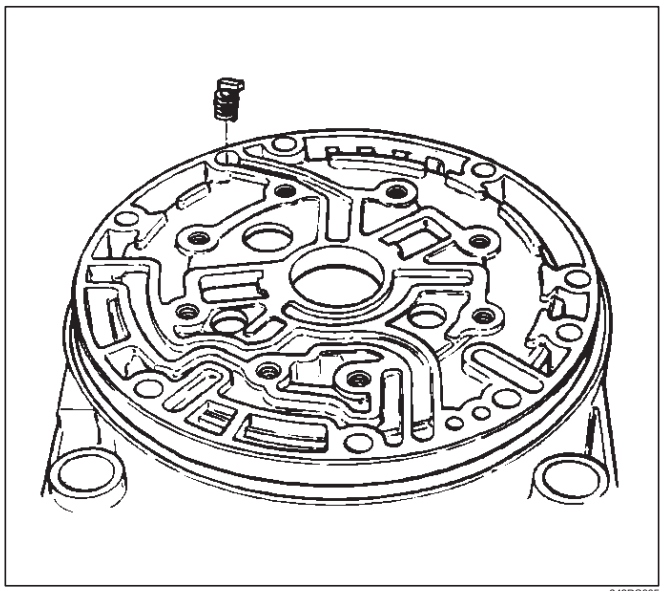
1. Install reverse lock out valve (17) and spring (16) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

2. Install plug (15) and retainer plate (14).
3. Install overrun lock out valve (13) and spring (12) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

4. Install plug (11) and retainer plate (10).
5. Place restrictor (9) in the lube overdrive channel in the adapter case housing.


242RS005

6. Install gasket transfer plate/adapter case (8), center support transfer plate (7), and gasket transfer plate/center support (6).
7. Install center support (5) with 8 bolts.

Torque : 25 N•m (18 lb ft)

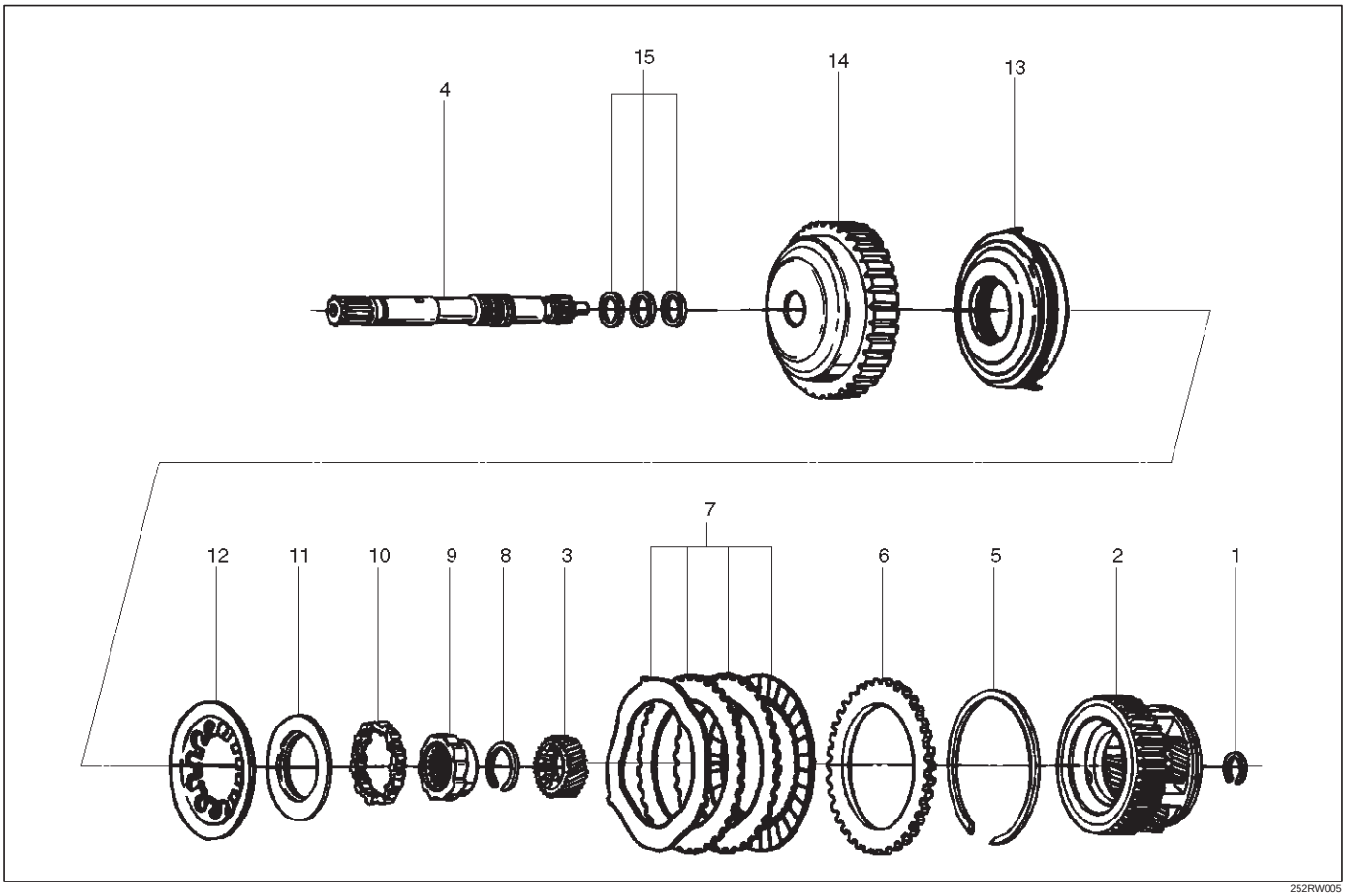
8. Install piston assembly (4) into center support (5).
9. Install twenty four springs (3), spring seat (2), and retaining ring (1).

▼Install the J–23327 compressor and compress spring seat (2) and springs (3), then seat snap ring (1) in groove.

▼Remove the tool.

Overrun Clutch And Turbine Shaft

Disassembled View



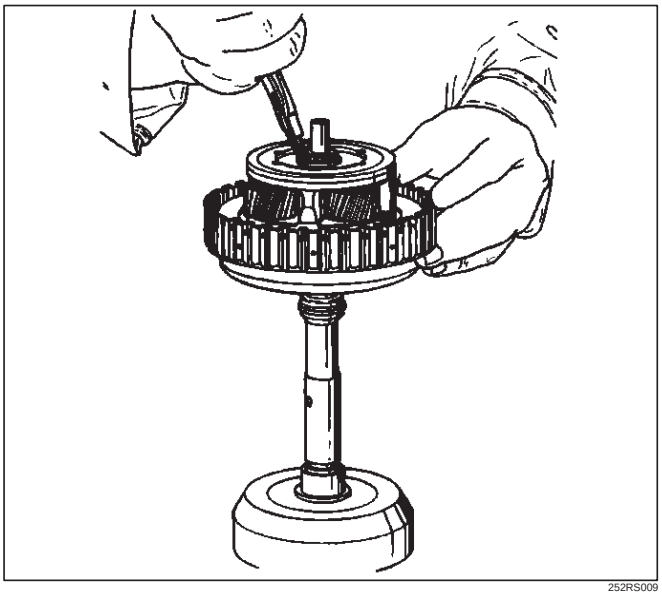
252RW005

Legend

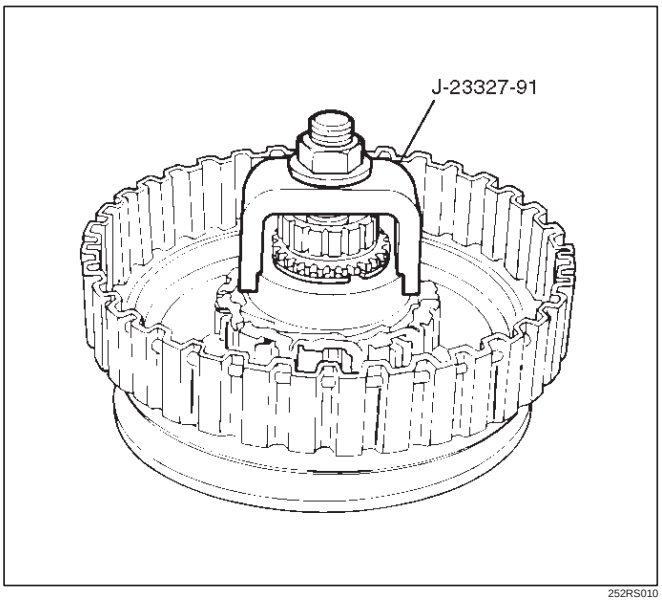
(1) Snap Ring
(2) Overdrive Carrier Assembly
(3) Sun Gear
(4) Turbine Shaft
(5) Snap Ring
(6) Backing Plate
(7) Clutch Plates
(8) Snap Ring
(9) Overrun Roller Clutch Cam
(10) Roller Clutch Assembly
(11) Overrun Clutch Release Spring Retainer
(12) Diaphragm Spring
(13) Piston Assembly
(14) Overrun Clutch Drum
(15) Turbine Shaft Seal Rings

Disassembly

1. Position overrun clutch assembly upright, using the overdrive internal gear as a support.
   ▼Remove snap ring (1).


252RS009

2. Remove overdrive carrier assembly (2), sun gear (3) and turbine shaft (4).
3. Remove snap ring (5), backing plate (6), and clutch plates (7).
4. Compress diaphragm spring with the J–23327–91 compressor, then remove snap ring (8).



252RS010

5. Remove overrun roller clutch cam (9) and roller clutch assembly (10).
6. Remove overrun clutch release spring retainer (11) and diaphragm spring (12).
7. Remove piston assembly (13) from overrun clutch drum (14).
8. Remove turbine shaft seal rings (15).

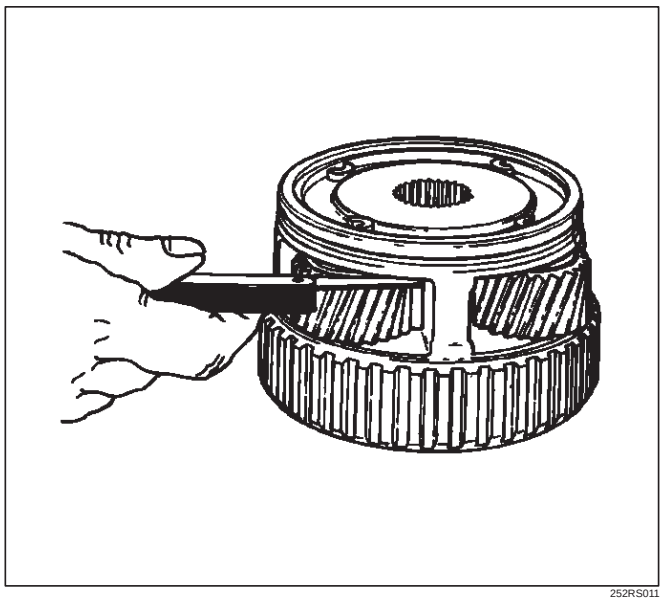
Inspection And Repair

Overdrive Carrier Check

▼Check pinion end play with a feeler gauge.

Clearance: 0.24mm–0.64mm (0.0094in–0.025in)

If clearance is outside specified value, replace overdrive carrier assembly.

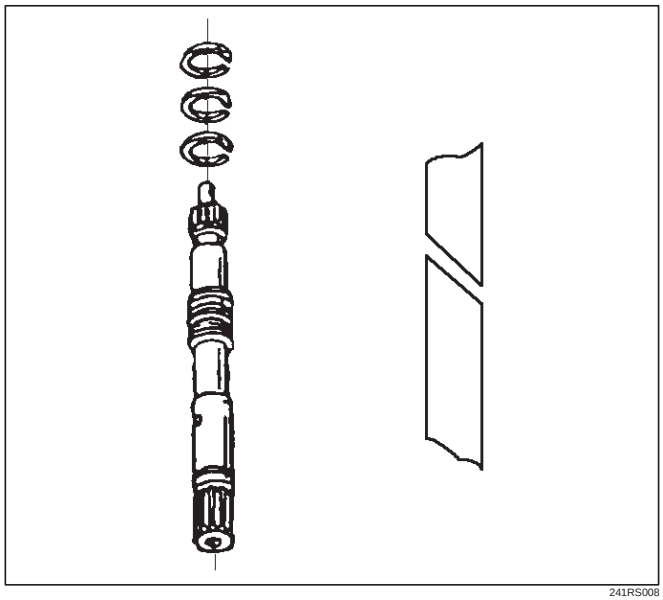

252RS011

Visual Check:

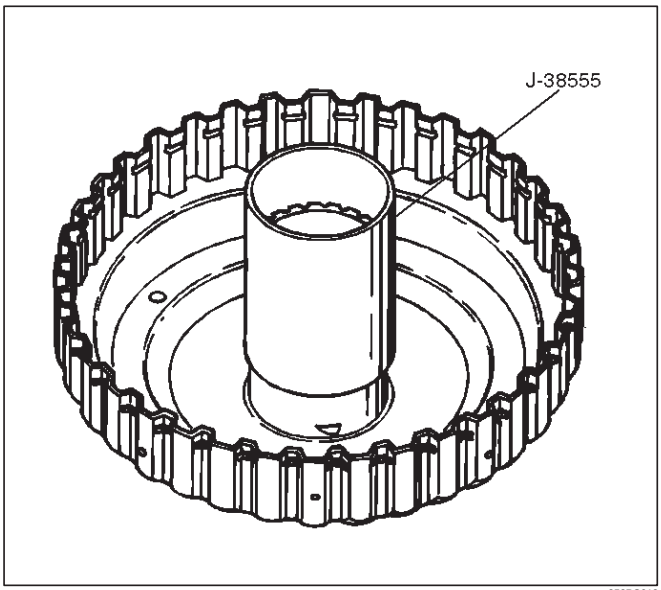
If any damage, deformation or local wear is found, replace the damaged part.

Reassembly

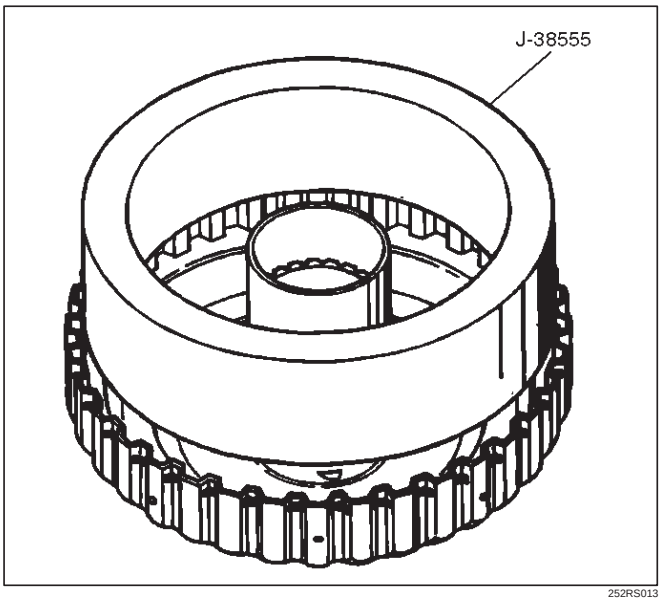
1. Install turbine shaft seal rings (15) with grease (petroleum jelly).


241RS008

2. Install the J–38555 inner installer on the drum (14).
   ▼Pre–install piston assembly into J–38555 outer installer.
   ▼Install overrun clutch piston assembly (13). Use the outer installer while pushing piston into drum (14).
   ▼Remove the installer.



252RS012



252RS013

3. Install diaphragm spring (12).
4. Install overrun clutch release spring retainer (11) (lip faces upwards), overrun roller clutch assembly (10), and cam (9).
5. Place snap ring loosely on spring retainer.
   ▼Hold the J–23327–91 compressor in a vise and compress piston return spring with compressor.
   ▼Set snap ring (8) in ring groove.
   ▼Remove the compressor.
6. Install clutch plates (7), start with steel plate and alternate with lined plates.
7. Install backing plate (6).
8. Install snap ring (5).
9. Install overdrive sun gear with countersink pointing downwards.
10. Install the overdrive carrier assembly (2).

NOTE: Turn the assembly in a counter–clockwise direction only until roller clutch enters the outer race. After installation, rotate the assembly and listen for loose rollers.

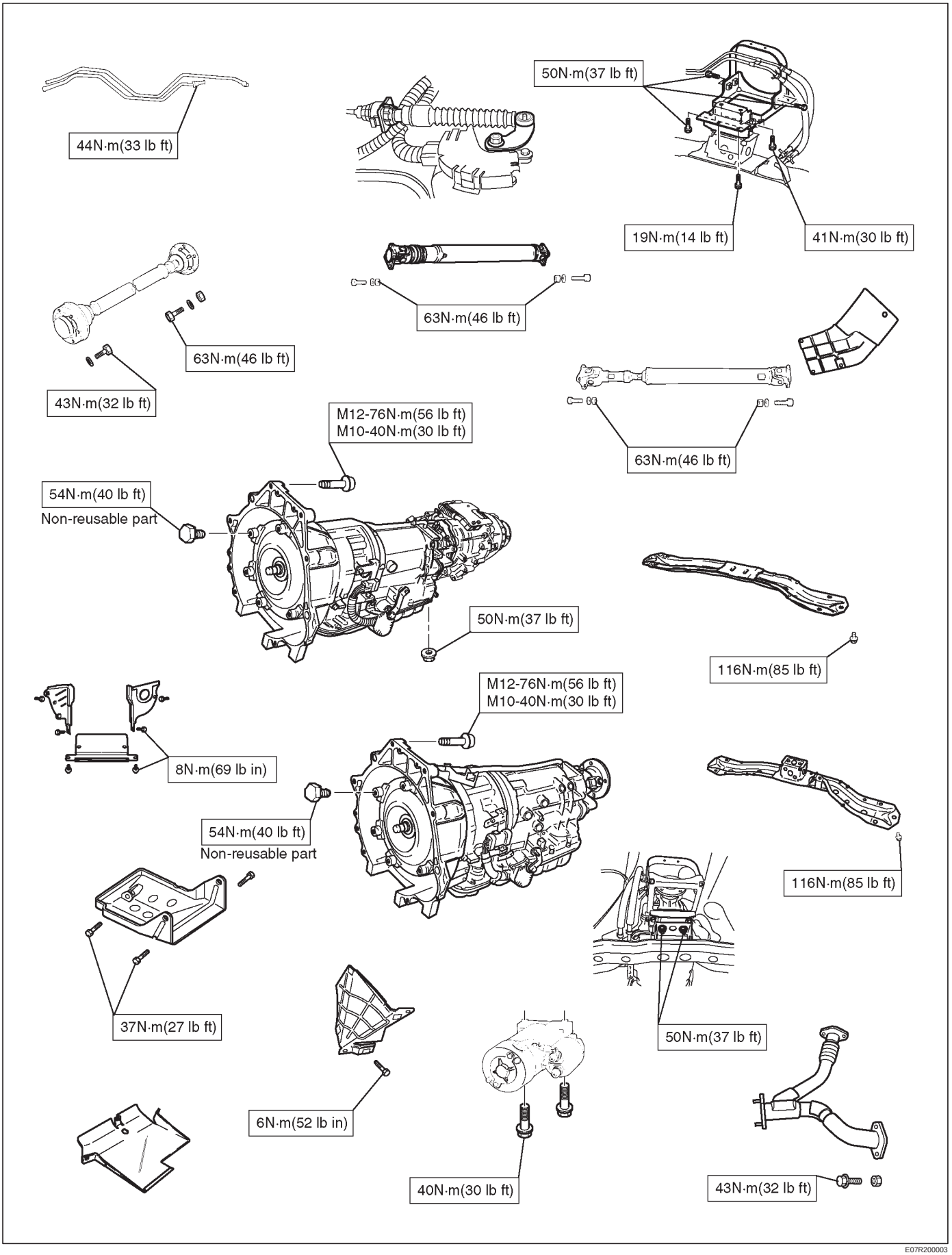
11. Install turbine shaft (4) and snap ring (1).

Main Data And Specification

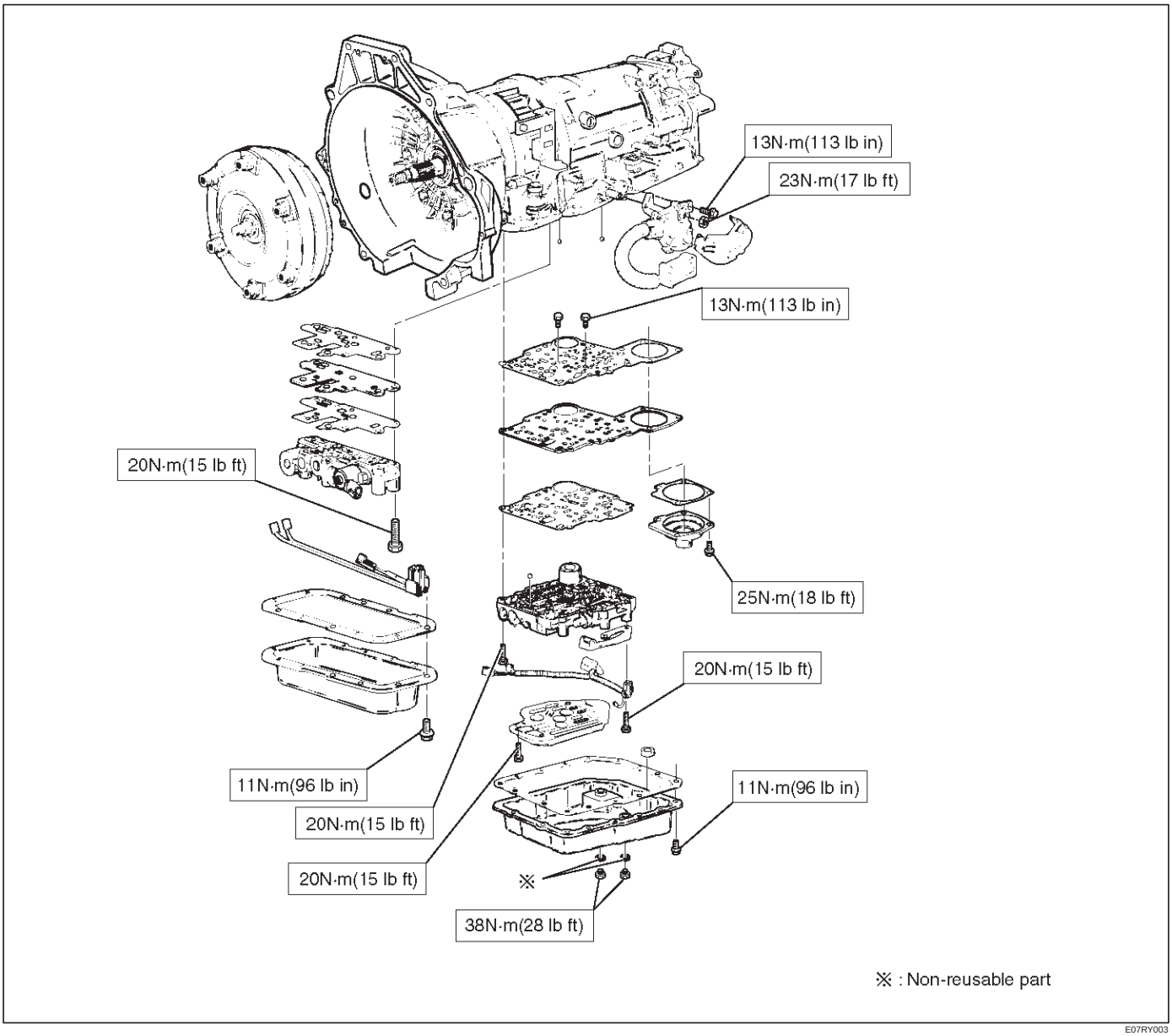
General Specifications

				Remarks
Model			THM 4L30–E	
Engine			V6 3.5L 6VE1	DOHC
Type			Automatic four speed overdrive in 4th gear lock–up clutch torque converter	
Control systems	Shift control		Hydraulic	
	Shift pattern		Electronic	
	Shift quality		Electronic	
	Lock–up clutch		Electronic	
Gear ratio	1st		2.856	
	2nd		1.618	
	3rd		1.000	
	4th (O/D)		0.723	
	Reverse		2.000	
Gear set			Noiseless, high torque capability	
Oil used	Name		ATF DEXRON®–III	
	Q’ty liter (qt)		8.6 (9.1)	
Torque converter			2,100 ± 150	Stall speed (rpm)
	Reverse clutch	RC	4	Number of discs
	Second clutch	C2	6	
	Third clutch	C3	6	
	Brake band		Double wrap	
	Fourth clutch	C4	2	Number of discs
	Overrun clutch	OC	1	
	Overdrive	OFW	10	Number of rollers
	Principal	PFW	26	Number of sprags
	Ravigneaux planetary gear set	Input sun gear	30	Number of teeth
		Pinion gear	19	
		Long pinion	23	
		Ring gear	90	
		Long pinion	19	
		Output sun gear	46	
	Overdrive planetary gear set	Sun gear	31	
		Pinion gear	24	
		Ring gear	81	

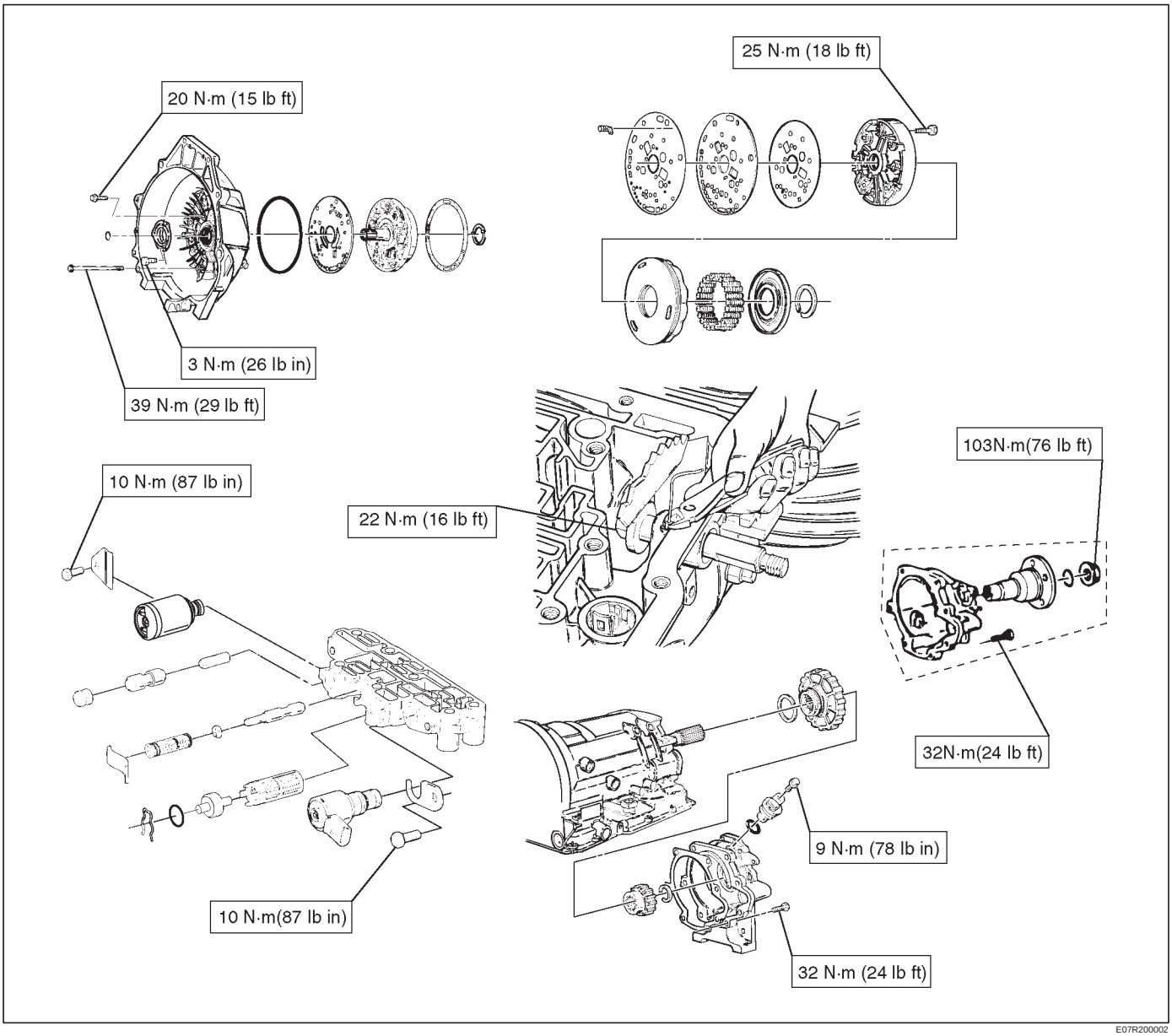
Torque Specifications



E07R200003


13N·m(113 lb in)
23N·m(17 lb ft)
13N·m(113 lb in)
20N·m(15 lb ft)
25N·m(18 lb ft)
20N·m(15 lb ft)
11N·m(96 lb in)
11N·m(96 lb in)
20N·m(15 lb ft)
20N·m(15 lb ft)
※
38N·m(28 lb ft)
※ : Non-reusable part

E07RY003


25 N·m (18 lb ft)
20 N·m (15 lb ft)
3 N·m (26 lb in)
39 N·m (29 lb ft)
10 N·m (87 lb in)
22 N·m (16 lb ft)
103N·m(76 lb ft)
32N·m(24 lb ft)
9 N·m (78 lb in)
10 N·m(87 lb in)
32 N·m (24 lb ft)

E07R200002

Special Tools

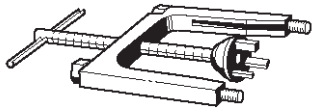
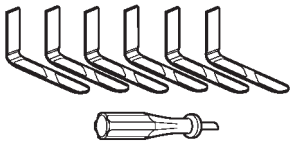
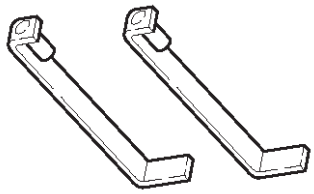
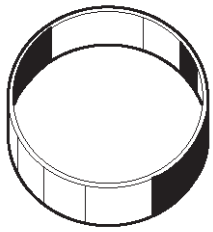
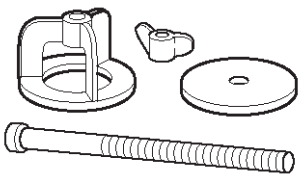
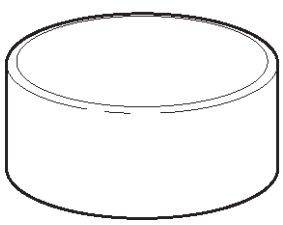
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT071	**J–23075** Spring compressor (For servo piston)
 901RX007	**J–38450–A** Third clutch snap ring compressor
 901RT073	**J–23075–12** Third clutch spring compressor adapter (Use with J–23075)
 901RT074	**J–23084** Third clutch piston installer
 901RT075	**J–23327** Third clutch spring compressor
 901RT076	**J–23080–A** Second clutch piston installer

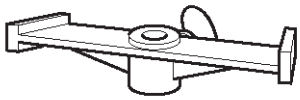
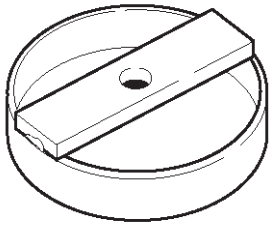
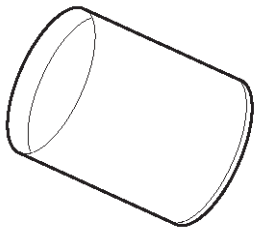
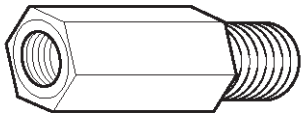
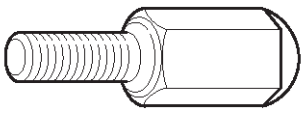
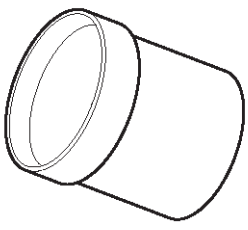
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT077	**J–23085–A** Selective washer gauging tool
 901RT078	**J–23327–90** Fourth clutch spring compressor (Use with J–23327)
 901RT079	**J–38553** 3/4 Accumulator piston fitter
 901RT080	**J–41096** Cover remover (Use with J–38584)
 901RT081	**J–38584** Slide hammer adapter (Use with J–23907)
 901RT082	**J–38554** Fourth clutch piston fitter

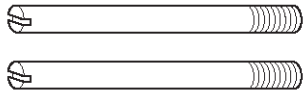
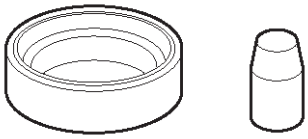
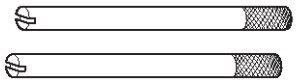
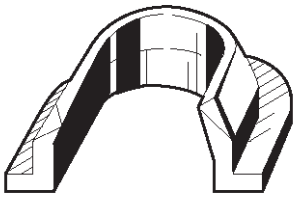
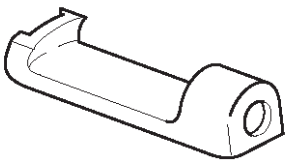
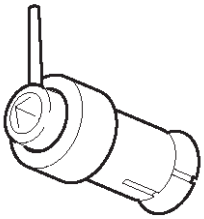
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT083	**J–38588** Guide pins; adapter case to main case
 901RT084	**J–38555** Overrun clutch piston seal installer set
 901RT085	**J–3387–2** Guide pins; gasket and transfer plate to valve body
 901RT086	**J–25022** Turbine shaft puller (Use with J–24773–1)
 901RT087	**J–23129** Oil seal remover (Use with J–23907 and J–38584)
 901RT088	**J–38557** Oil pump centering tool

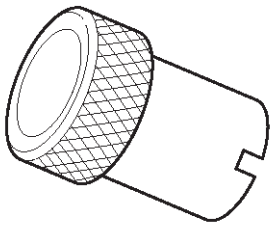
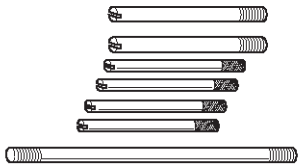
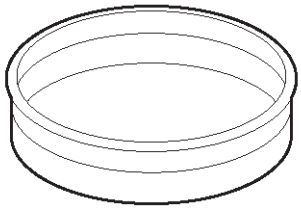
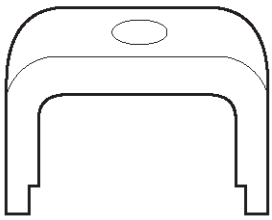
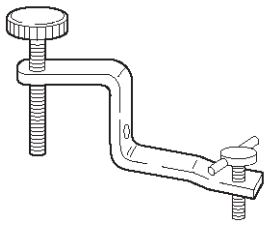
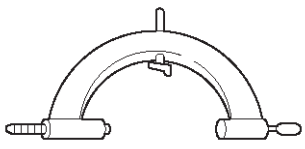
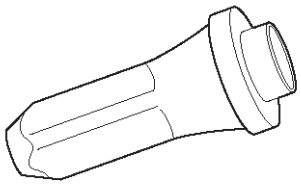
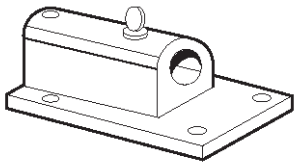
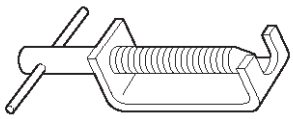
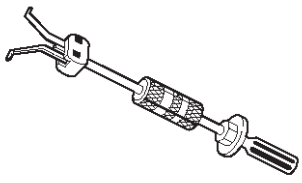
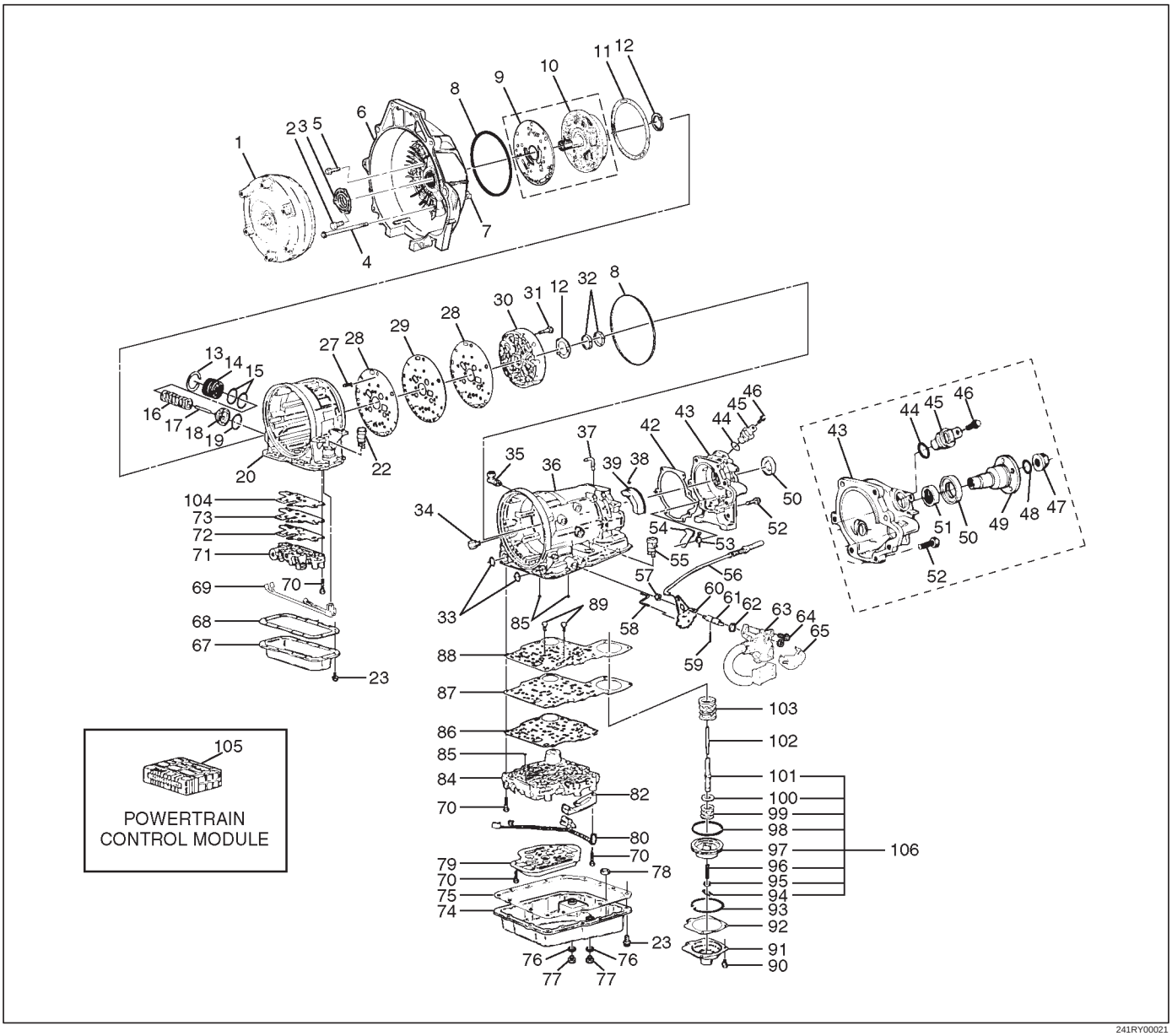
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT089	**J–23082–01** Oil pump rotation tool
 901RT090	**J–25025–B** Guide pins; valve body to main case
 901RT091	**J–38428** Servo piston fitter
 901RT092	**J–23327–91** Overrun clutch spring compressor
 901RT093	**J–38559–A** 3/4 Accumulator piston cover compressor
 901RT094	**J–8763–02** Holding fixture

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT095	**J–36797** A/T extension assembly oil seal installer (Inside)
 901RT096	**J–3289–20** Holding fixture base
 901RT097	**J–29770–A** Pressure gauge
 901RT098	**J–24773–1** End play fixture (Use with J–25022)
 901RT099	**J–23907** Slide hammer

4L30–E Parts List

Case And Associated Parts



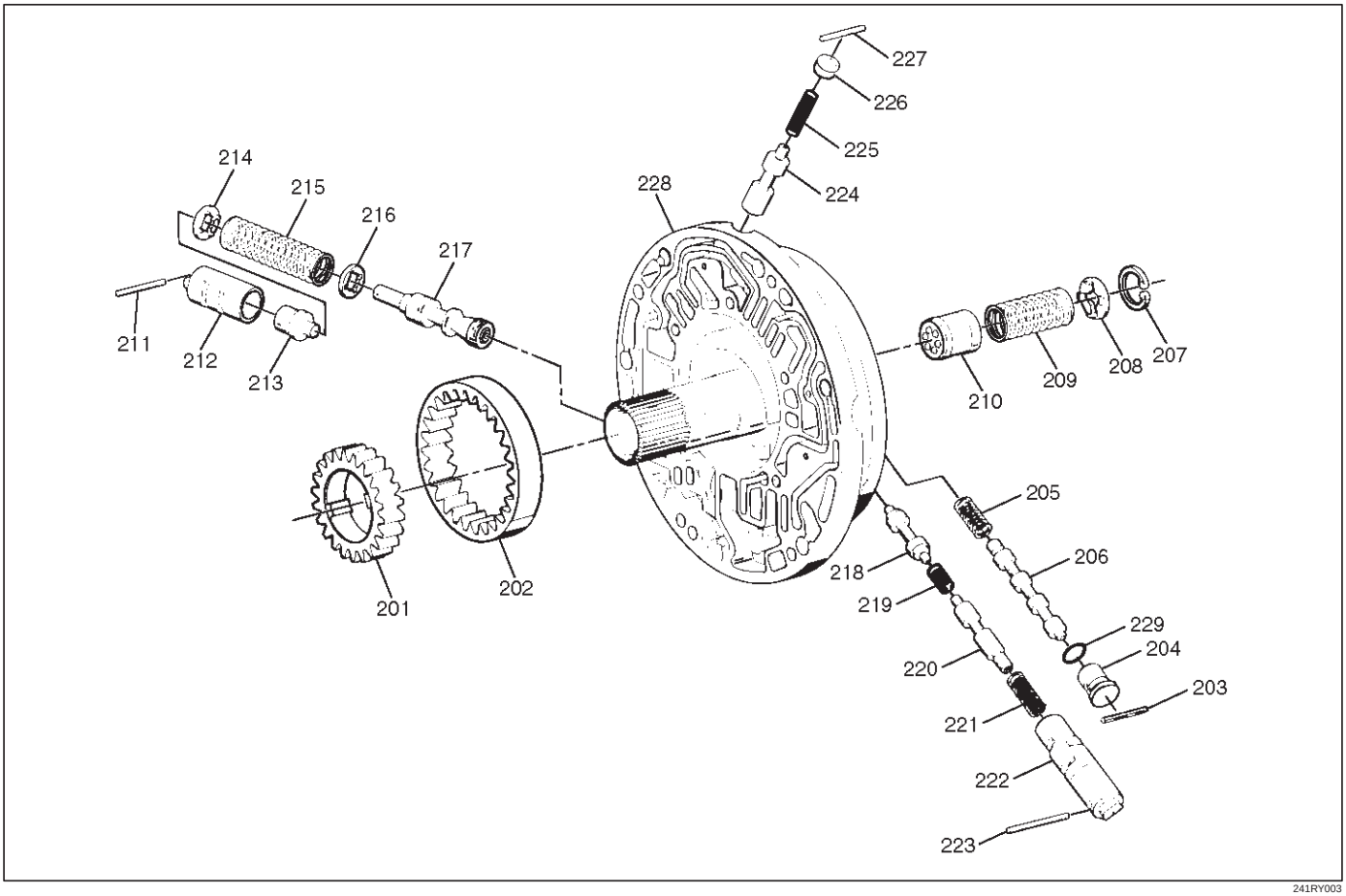
241RY00021

Legend

(1) Torque Converter
(2) Screw, Seal Ring Assembly
(3) Seal Ring Assembly, Converter Housing
(4) Screw, Converter Housing/Main Case
(5) Screw, Converter Housing/Oil Pump
(6) Housing, Converter
(7) Plug, Converter Housing
(8) Seal, O–Ring
(9) Wear Plate, Oil Pump Body
(10) Pump Assembly, Oil
(11) Gasket
(12) Washer, Thrust Selective
(13) Ring, Snap
(14) Cover, 3–4 Accumulator Piston
(15) Seal, O–Ring, 3–4 Accumulator
(16) Spring, 3–4 Accumulator Piston
(17) Pin, 3–4 Accumulator Piston
(18) Piston, 3–4 Accumulator
(19) Ring, 3–4, Accumulator Piston
(20) Case, Adapter
(22) Connector, Electrical/Adapter Case
(23) Screw, Pan
(27) Restrictor, Oil
(28) Gasket, Transfer Plate/Adapter
(29) Plate, Transfer Adapter/Center Support
(30) Support Assembly, Center
(31) Screw, Center Support
(32) Ring, Oil Seal
(33) Seal, O–Ring Main Case
(34) Fitting, Cooler
(35) Fitting Assembly, Cooler
(36) Case, Main
(37) Breather, Pipe

(38) Seal, O–Ring
(39) Reservoir
(42) Gasket, Extension Case
(43) Extension Assembly
(44) Seal, O–Ring/Speed Sensor
(45) Sensor Assembly, Speed
(46) Screw, Speed Sensor
(47) Nut, Output Shaft/Drive Flange
(48) Seal, O–Ring/Drive Flange
(49) Flange, Drive
(50) Seal, Extension Assembly
(52) Screw, Extension/Main Case
(53) Spring, Parking Pawl Lock
(54) Pawl, Parking Lock
(55) Connector, Electrical/Main Case
(56) Actuator Assembly, Parking Lock
(57) Nut, Parking Lock Lever
(58) Link, Manual Valve
(59) Pin, Spring
(60) Lever, Parking Lock and Range Selector
(61) Shaft, Selector
(62) Seal, Selector Shaft
(63) Mode Switch Assembly
(64) Screw and Conical Washer Assembly
(65) Shield, Mode Switch
(67) Pan, Bottom/Adapter Case
(68) Gasket, Bottom Pan/Adapter Case
(69) Harness Assembly, Adapter Case
(70) Screw, Valve Body
(71) Valve Body Assembly, Adapter Case
(72) Gasket, Adapter Valve Body
(73) Plate, Adapter Valve Body/Transfer
(74) Pan, Bottom/Main Case
(75) Gasket, Bottom Pan/Main Case
(76) Gasket, Oil Drain or Overfill Screw
(77) Screw, Oil Drain or Overfill
(78) Magnet, Chip Collector
(79) Filter Oil
(80) Harness Assembly, Main Case
(82) Roller and Spring Assembly, Manual Detent
(84) Valve Body Assembly, Main Case
(85) Ball, Check
(86) Gasket, Main V.B./Transfer Plate
(87) Plate, Main V.B./Transfer
(88) Gasket, Transfer/Main Case
(89) Screw, Transfer Plate on V.B.
(90) Screw, Servo Cover
(91) Cover, Servo Piston
(92) Gasket, Cover/Servo Piston
(93) Ring, Retaining Servo Piston
(94) Clip, Servo Piston
(95) Nut, Servo Screw
(96) Screw, Servo Piston
(97) Piston, Servo
(98) Seal, Ring/Servo Piston
(99) Spring, Cushion/Servo Piston
(100) Seat, Cushion Spring
(101) Sleeve, Servo Piston Adjust
(102) Rod, Apply/Servo Piston
(103) Spring, Return/Servo Piston
(104) Gasket, Adapter Case/Transfer Plate
(105) Powertrain Control Module
(106) Servo Piston Assembly

Pump Assembly

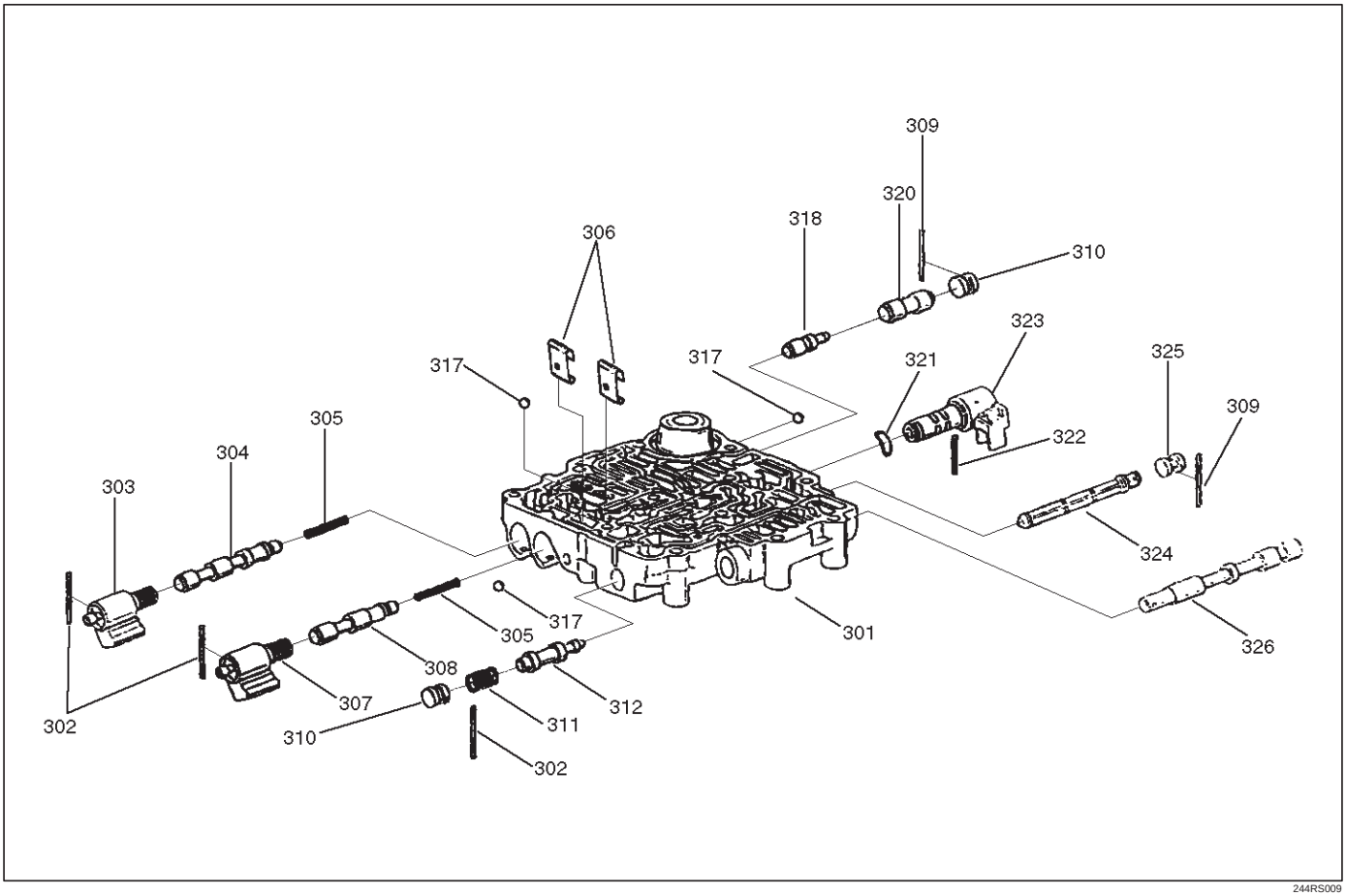


241RY003

Legend

(201) Gear, Oil Pump Drive
(202) Gear, Oil Pump Driven
(203) Pin, Plug Converter Clutch Control
(204) Plug, Converter Clutch Control Valve
(205) Spring, Converter Clutch Control Valve
(206) Valve, Converter Clutch Control
(207) Ring, Snap/Throttle Signal Accumulator
(208) Seat, Spring/Throttle Signal Accumulator
(209) Spring, Throttle Signal Accumulator
(210) Piston, Throttle Signal Accumulator
(211) Pin, Boost Valve Sleeve
(212) Sleeve, Boost Valve
(213) Valve, Boost
(214) Seat, Spring/Pressure Regulator Valve
(215) Spring, Pressure Regulator Valve
(216) Seat, Spring/Pressure Regulator Valve
(217) Valve, Pressure Regulator
(218) Isolator Valve
(219) Spring, Isolator
(220) Valve, Converter Clutch Regulator
(221) Spring, Converter Clutch Regulator
(222) Sleeve, Converter Clutch Regulator
(223) Pin, Retainer Sleeve
(224) Valve, Enable
(225) Spring, Enable Valve
(226) Spring Guide, Enable Valve
(227) Pin, Enable Valve
(228) Pump Assembly
(229) Seal Ring, Plug

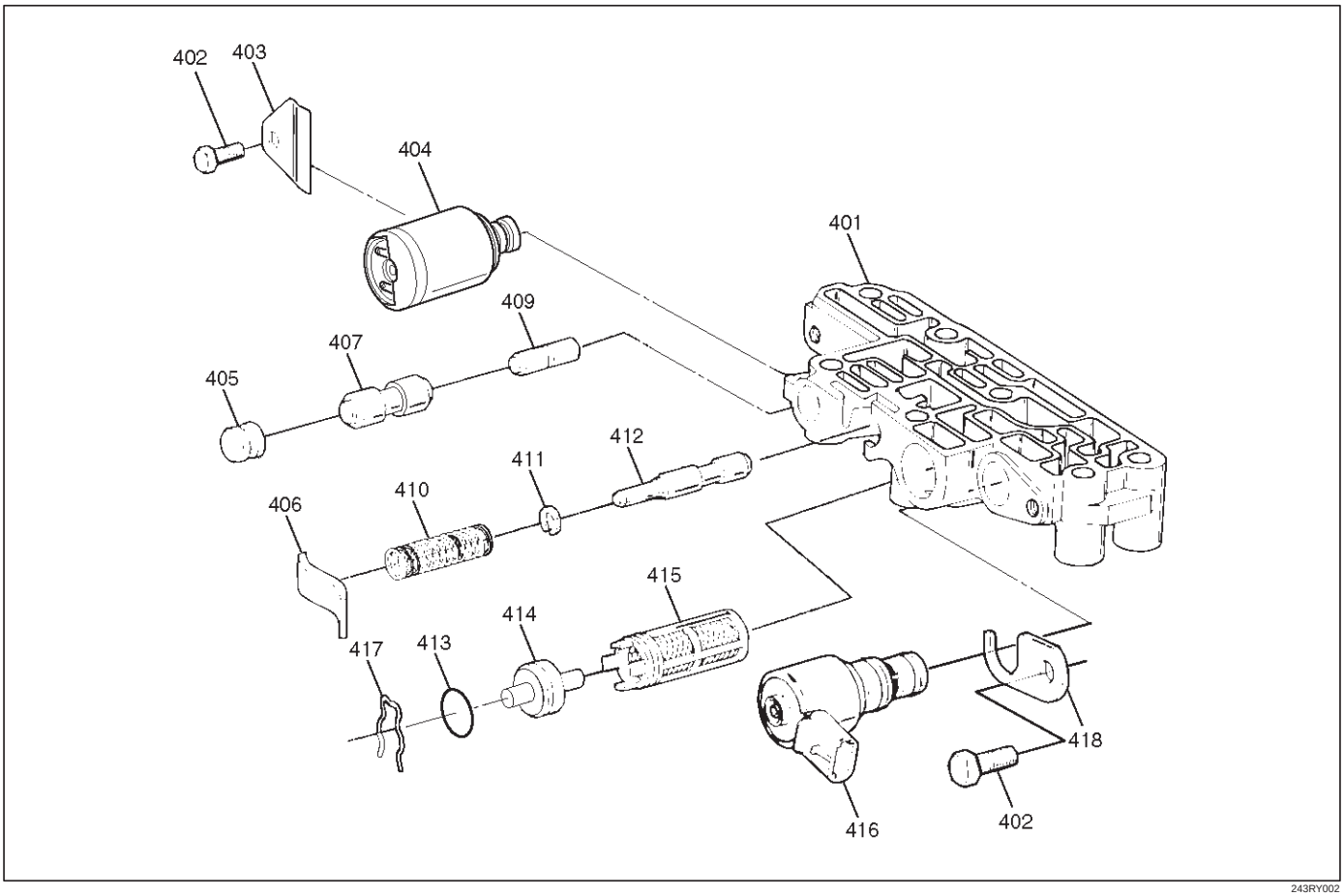
Valve Body Assemblies



244RS009

Legend

(301) Body, Valve Main Case
(302) Pin, Spring
(303) Solenoid Assembly, ON/OFF N.C.
(304) Valve, 1–2 and 3–4 Shift
(305) Spring, 1–2 and 3–4 (2–3) Shift
(306) Retainer, Valve
(307) Solenoid Assembly, ON/OFF N.O.
(308) Valve, 2–3 Shift
(309) Pin, Spring
(310) Plug, Valve Bore
(311) Spring, Valve Low Pressure Control
(312) Valve, Low Pressure Control
(317) Ball, Check
(318) Valve, 1–2 Accumulator Control
(320) Valve, 1–2 Accumulator
(321) Washer, Waved PWM Solenoid
(322) Pin, Solenoid PWM
(323) Solenoid Assembly, Band Control PWM
(324) Screen Assembly, PWM Solenoid
(325) Plug, Screen
(326) Valve, Manual

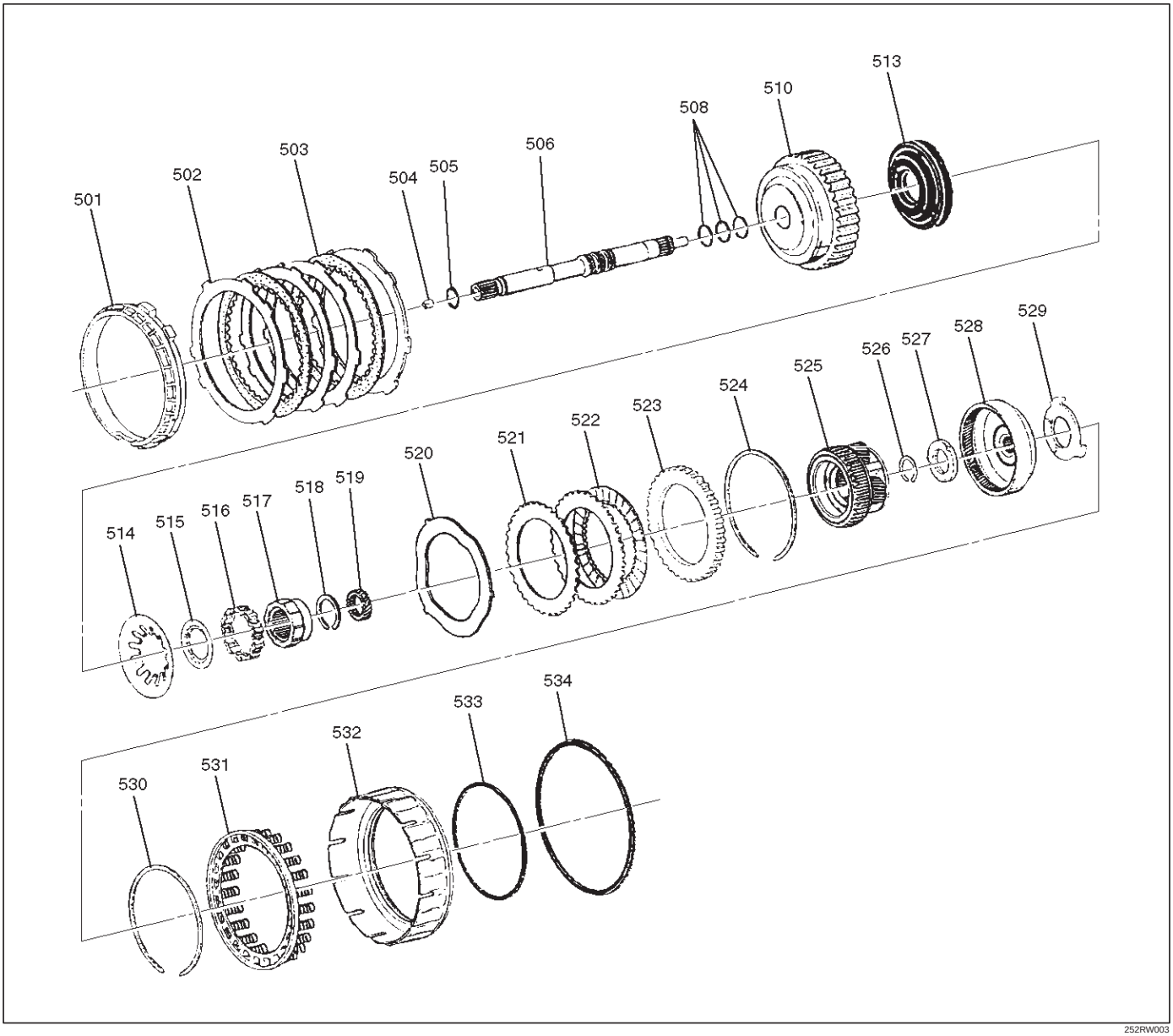


243RY002

Legend

(401) Body, Valve/Adapter Case
(402) Screw, Solenoid Force Motor
(403) Retainer, Force Motor
(404) Solenoid, Force Motor
(405) Plug, 3–4 Accumulator
(406) Plug and Spring Retainer
(407) Valve, 3–4 Accumulator
(409) Valve, 3–4 Accumulator Control
(410) Spring, Feed Limit Valve
(411) Ring, Retainer
(412) Valve, Feed Limit
(413) Seal, O–Ring Plug Filter
(414) Plug, Screen
(415) Screen Assembly, Force Motor
(416) Solenoid, Torque Converter Clutch, PWM
(417) Retainer, Screen Plug
(418) Bracket, PWM Solenoid

Overdrive Internal Components

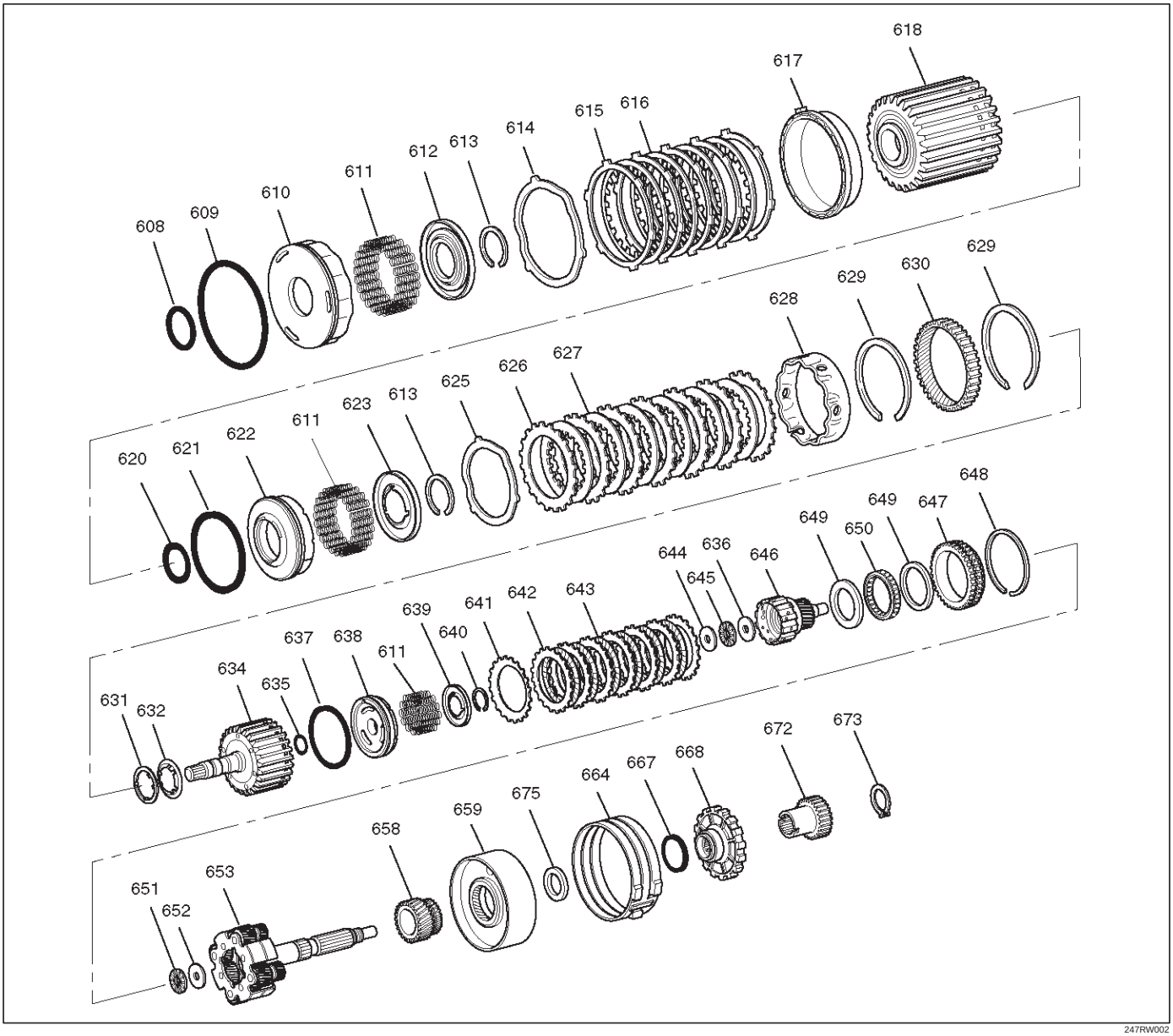


252RW003

Legend

(501) Retainer, 4th Clutch
(502) Plate, 4th Clutch (Steel)
(503) Plate Assembly, 4th Clutch (Lined)
(504) Retainer And Ball Assembly, Check Valve
(505) Seal, O–Ring/Turbine Shaft
(506) Shaft, Turbine
(508) Ring, Oil Seal/Turbine Shaft
(510) Housing, Overrun Clutch
(513) Piston, Overrun Clutch
(514) Spring, Overrun Clutch Release
(515) Retainer, Release Spring/Overrun Clutch
(516) Roller Assembly, Overdrive Clutch
(517) Cam, Overdrive Roller Clutch
(518) Ring, Snap/Overrun Clutch Hub
(519) Gear, Overdrive Sun
(520) Plate, Waved/Overrun Clutch
(521) Plate, Overrun Clutch (Steel)
(522) Plate Assembly, Overrun Clutch (Lined)
(523) Plate, Backing/Overrun Clutch
(524) Ring, Snap/Overrun Clutch Housing
(525) Carrier Assembly, Overdrive Complete
(526) Ring, Snap/Turbine Shaft/Carrier
(527) Bearing Assembly, Thrust
(528) Gear, Overdrive Internal
(529) Washer, Thrust/Internal Gear/Support
(530) Ring, Snap/Adapter/4th Clutch Spring
(531) Retainer and spring assembly, 4th clutch
(532) Piston, 4th Clutch
(533) Seal, 4th Clutch Piston (Inner)
(534) Seal, 4th Clutch Piston (outer)

Internal Components



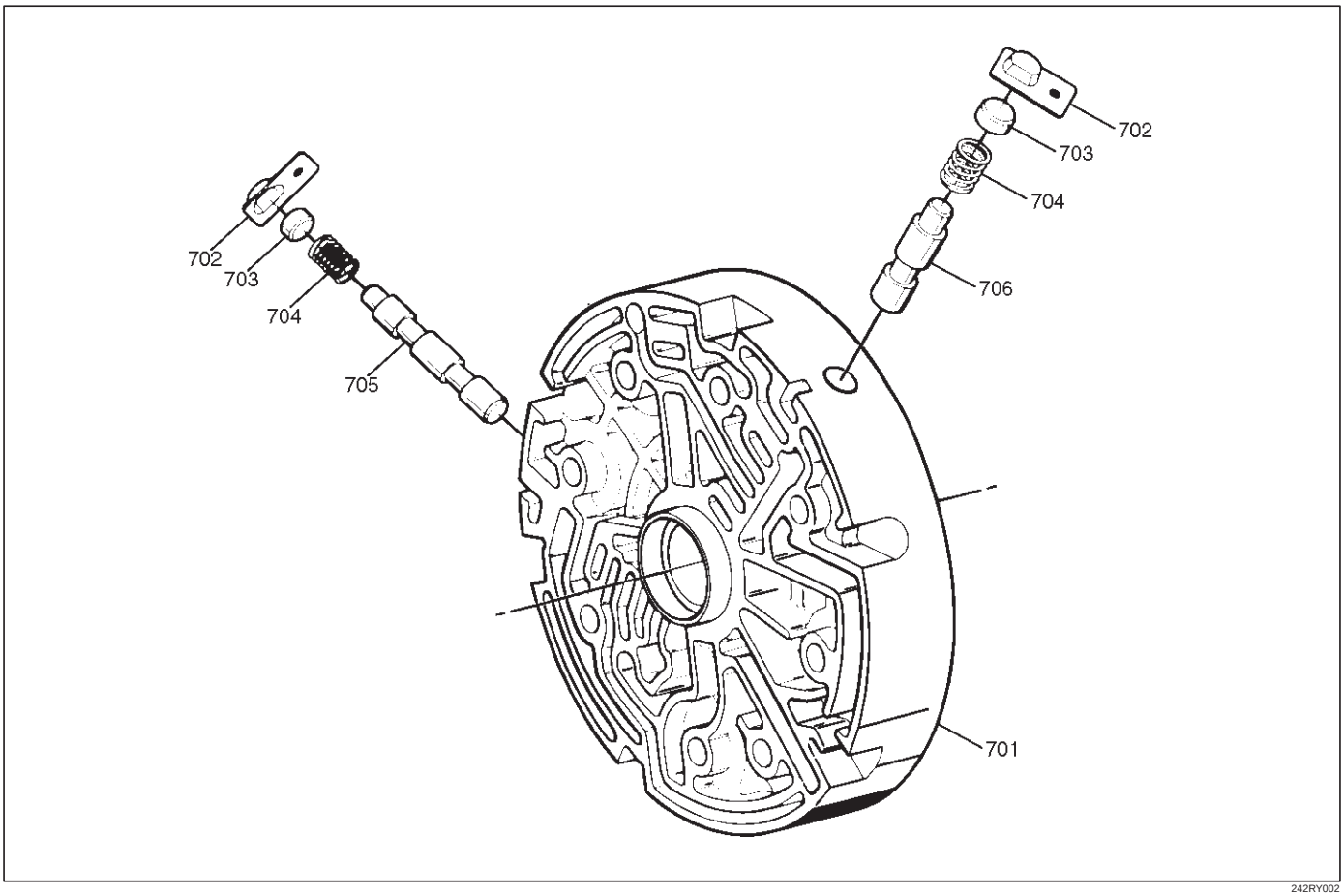
247RW002

Legend

(608) Seal, Reverse Clutch Piston (Inner)
(609) Seal, Reverse Clutch Piston (Outer)
(610) Piston, Reverse Clutch
(611) Spring, Piston Clutch
(612) Seat, Spring/Reverse Clutch
(613) Ring, Retaining
(614) Plate, Waved/Reverse Clutch
(615) Plate, Reverse Clutch (Steel)
(616) Plate Assembly, Reverse Clutch (Lined)
(617) Plate, Reverse Clutch Pressure/Selective
(618) Drum Assembly, 2nd Clutch
(620) Seal, 2nd Clutch Piston (Inner)
(621) Seal, 2nd Clutch Piston (Outer)
(622) Piston, 2nd Clutch
(623) Seat, Spring/2nd Clutch
(625) Plate, Waved/2nd Clutch
(626) Plate, 2nd Clutch (Steel)
(627) Plate Assembly, 2nd Clutch (Lined)
(628) Spacer, 2nd Clutch
(629) Ring, Retaining
(630) Gear, Ring
(631) Washer, Thrust/2nd Clutch/3rd Clutch
(632) Thrust Washer, Clutch Hub
(634) Drum Assembly, 3rd Clutch
(635) Seal, 3rd clutch piston (Inner)
(636) Washer, Retaining
(637) Seal, 3rd Clutch Piston (Outer)
(638) Piston 3rd Clutch
(639) Seat, Spring/3rd Clutch
(640) Ring, Retaining
(641) Plate, Spring Cushion/3rd Clutch
(642) Plate, 3rd Clutch (Steel)
(643) Plate Assembly, 3rd Clutch (Lined)
(644) Washer, Thrust/Input Sun
(645) Bearing, Input Shaft/Gear Assembly

(646) Gear Assembly, Input Sun
(647) Race Assembly, Sprag
(648) Ring, Retaining/Sprag
(649) Ring, Retaining
(650) Cage Assembly, Sprag
(651) Bearing, Output Shaft/Input Sun
(652) Washer, Output Shaft/Input Sun
(653) Carrier Assembly, Planetary
(658) Gear, Reaction Sun
(659) Drum, Reaction Sun
(664) Band Assembly, Brake
(667) Seal, Ring/Wheel Parking Lock
(668) Wheel, Parking Lock
(672) Wheel, Speed
(673) Ring, Retaining
(675) Bearing, Thrust Assembly

Center Support Assembly



242RY002

Legend
(701) Center Support
(702) Retainer Plate
(703) Plug, Lockout
(704) Spring, Lockout
(705) Valve, Overrun Lockout
(706) Valve, Reverse Lockout Control

AXIOM

TRANSMISSION

TRANSMISSION CONTROL SYSTEM (4L30–E)

CONTENTS

Service Precaution 7A1–2
General Description 7A1–2
Electronic Control Diagram 7A1–3
Powertrain Control Module (PCM) 7A1–4
Control System Diagram 7A1–5
Shift Control 7A1–6
Band Apply Control 7A1–6
Torque Converter Clutch Control (Electronically Controlled Capacity Clutch = ECCC) 7A1–6
Line Pressure Control 7A1–6
On–Board Diagnostic System 7A1–6
Fail Safe Mechanism 7A1–6
Torque Management Control 7A1–6
ATF Warning Control 7A1–6
Reverse Lock Out Control 7A1–6
Downhill Control 7A1–6
Uphill Control 7A1–6
Shift Mode Control 7A1–7
Gear Shift Control 7A1–8
Winter Drive Mode 7A1–9
Backup Mode 7A1–9
Functions of Input / Output Components . . 7A1–10
Diagnosis 7A1–11
Electronic Diagnosis 7A1–11
Check Trans Indicator 7A1–11
Diagnostic Check 7A1–11
“Check Trans” Check 7A1–12
Tech 2 OBD II Connection 7A1–13
Transmission Data 7A1–18
OBD II Diagnostic Management System . . 7A1–19
16 – Terminal Data Link Connector (DLC) . 7A1–20
Malfunction Indicator Lamp (MIL) 7A1–21
DTC Types 7A1–21
Clear DTC 7A1–22
DTC Check 7A1–22
PCM Precaution 7A1–22
Information On PCM 7A1–22
Intermittent Conditions 7A1–23
Transmission And PCM Identification 7A1–23
Diagnostic Trouble Code (DTC) Identification 7A1–24
DTC P0218 Transmission Fluid Over Temperature 7A1–25
DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position 7A1–27
DTC P0706 Transmission Range Switch (Mode Switch) Performance 7A1–30
DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance 7A1–33
DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input 7A1–36
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input 7A1–39
DTC P0719 Brake Switch Circuit Low (Stuck On) 7A1–42
DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input 7A1–45
DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent 7A1–48
DTC P0724 Brake Switch Circuit High (Stuck Off) 7A1–51
DTC P0730 Gear Error Without Input Speed 7A1–53
DTC P0742 Torque Converter Clutch (TCC) System Stuck On 7A1–56
DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical 7A1–58
DTC P0751 Shift Solenoid A Performance (Stuck Off) 7A1–60
DTC P0752 Shift Solenoid A Performance (Stuck On) 7A1–62
DTC P0753 Shift Solenoid A Electrical 7A1–64
DTC P0756 Shift Solenoid B Performance (Stuck Off) 7A1–67
DTC P0757 Shift Solenoid B Performance (Stuck On) 7A1–69
DTC P0758 Shift Solenoid B Electrical 7A1–71
DTC P1850 Brake Band Apply Solenoid Malfunction 7A1–75
DTC P1860 TCC PWM Solenoid Electrical . 7A1–79
DTC P1870 Transmission Component Slipping (TCC Stuck Off) 7A1–82
Circuit Diagram 7A1–84
Parts Location 7A1–86
Harness Connector Faces 7A1–87
Transmission Fluid Temperature (TFT) Sensor Specifications 7A1–89

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The 4L30–E is a 4–speed fully automatic transmission. It uses a microcomputer as a control unit to judge running conditions including throttle opening rate and vehicle speed, then it sets the shifting point in the optimum timing so that best driving performance can be achieved.
In addition, the built–in shift mode select function can select three shift modes according to the driver's preference:

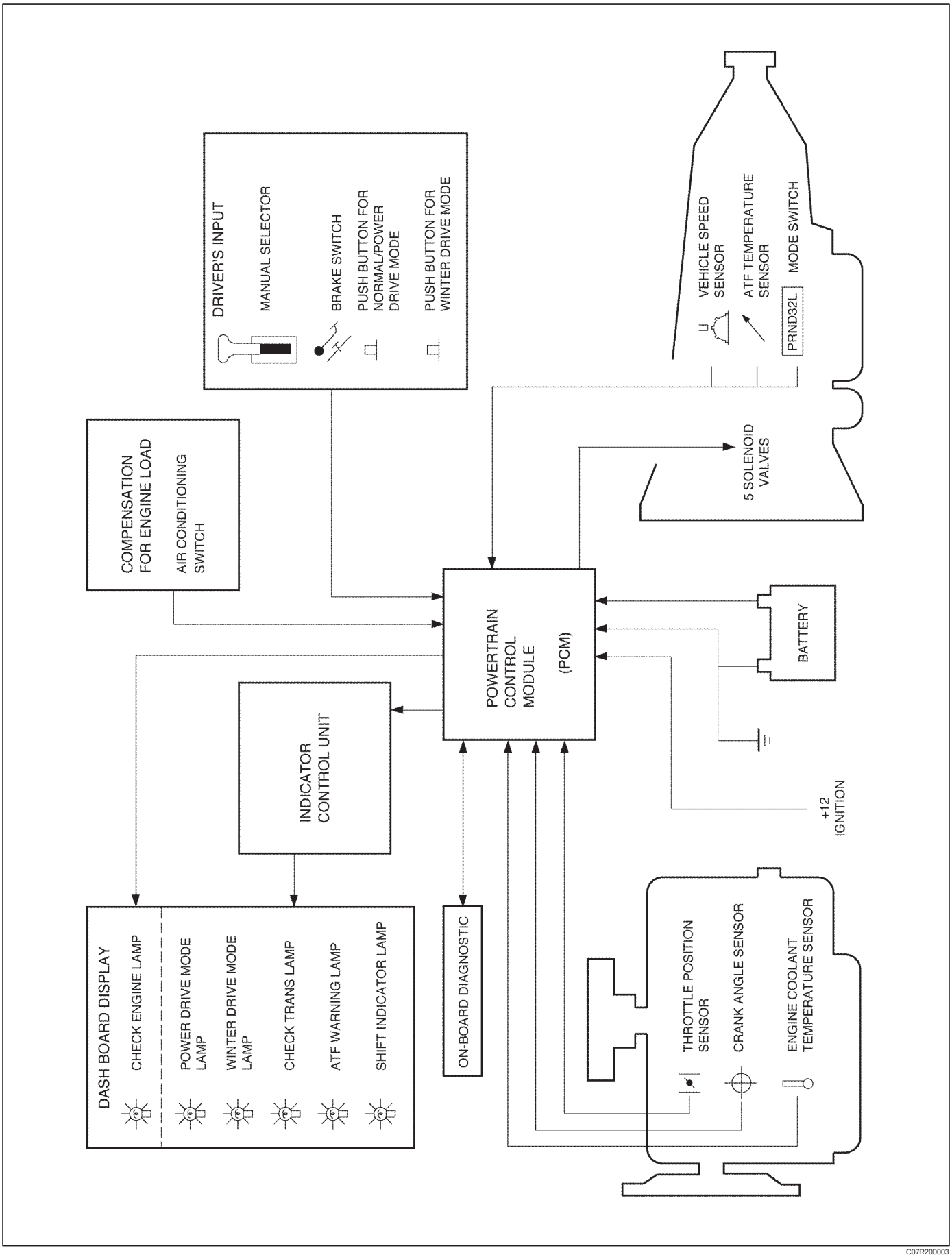
- Normal mode –Normal shift pattern.
- Winter mode –Starts in 3rd gear to reduce slippage on ice or snow.
- Power mode has a delayed upshift when more powerful acceleration is required.

Also, the built–in fail safe function ("backup mode") assures driving performance even if the vehicle speed sensor, throttle signal or any solenoid fails.
Further, the self–diagnostic function conducts diagnosis in a short time when the control system fails, thus improving serviceability.
The major features of 4L30–E are as follows:

- A compact structure consisting of 2 sets of planetary gears and flat torque converter.
- Electronic control selects the optimum shift mode according to the driving conditions.
- Electronic control maintains the optimum hydraulic pressure for clutch, band brake as well as transmission so that shift feeling is improved.
- Two sets of planetary gears reduce friction of power train.

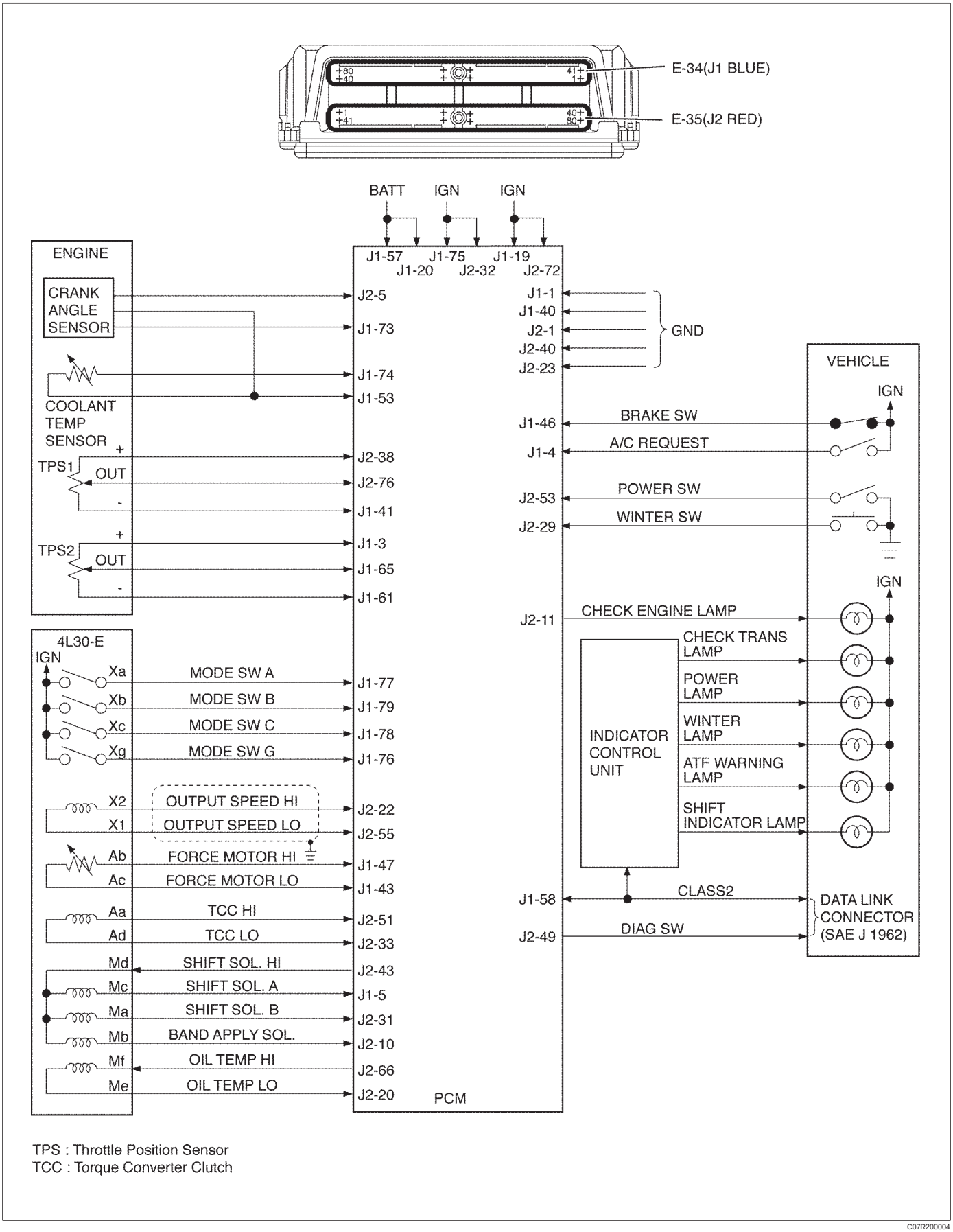
  Also, a lockup mechanism in the torque converter reduces fuel consumption.
- Wide gear ratio and high torque rate of torque converter provide excellent starting performance.

Electronic Control Diagram



C07R200003

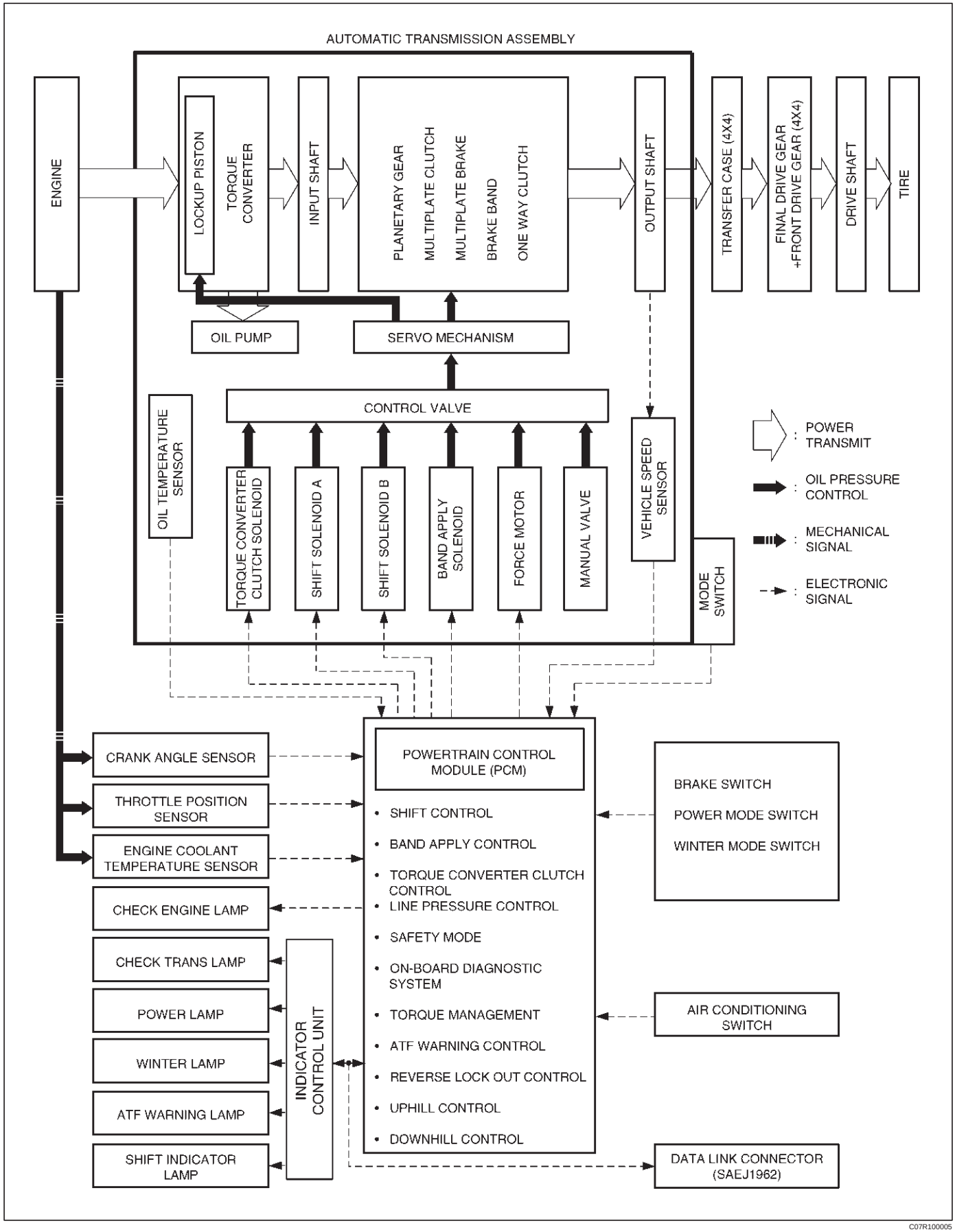
Powertrain Control Module (PCM)



TPS : Throttle Position Sensor
TCC : Torque Converter Clutch

C07R200004

Control System Diagram



C07R100005

Shift Control

The transmission gear is shifted according to the shift pattern selected by the driver. In shifting gears, the gear ratio is controlled by the ON/ OFF signal using the shift solenoid A and the shift solenoid B.

Band Apply Control

The band apply is controlled when in the 3–2 downshift (engine overrun prevention) and the garage shift (shock control).
The band apply solenoid is controlled by the signal from the Pulse Width Modulation (PWM) to regulate the flow of the oil.

Torque Converter Clutch Control (Electronically Controlled Capacity Clutch = ECCC)

The clutch apply is controlled by moving the converter clutch valve by commanding Torque Converter Clutch (TCC) solenoid using the PWM signal.

Line Pressure Control

The throttle signal allows the current signal to be sent to the force motor. After receiving the current signal, the force motor activates the pressure regulator valve to regulate the line pressure.

On–Board Diagnostic System

Several malfunction displays can be stored in the Powertrain Control Module (PCM) memory, and read out of it afterward.
The serial data lines, which are required for the testing of the final assembly and the coupling to other electronic modules, can be regulated by this function.

Fail Safe Mechanism

If there is a problem in the transmission system, the PCM will go into a “backup” mode.
The vehicle can still be driven, but the driver must use the select lever to shift gears.

Torque Management Control

The transmission control side sends the absolute spark advance signal to the engine control side while the transmission is being shifted. This controls the engine spark timing in compliance with the vehicle running condition to reduce the shocks caused by the change of speed.

ATF Warning Control

The oil temperature sensor detects the ATF oil temperature to control the oil temperature warning, TCC, and the winter mode.

Reverse Lock Out Control

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 11 km/h (6.8 mph), thus preventing reverse engagement above this speed.

Downhill Control

This mode is automatically activated from “NORMAL” mode only when downhill conditions are recognized.
The shift pattern is identical to “NORMAL” mode except 3-4 and 4-3 shift lines at low throttle modified to get engine braking on a larger speed range.
ECCC lines unchanged compared to “NORMAL” mode.

Uphill Control

When Uphill condition are recognized the 2-3 and 3-4 shift and TCC apply take place only when the engine torque is sufficient in order to avoid shift hunting.

Shift Mode Control

① Mode Type

Mode Type	Select lever position
Normal drive mode (NOR)	Entire range (excluding "R")
Power drive mode (PWR)	Entire range (excluding "R")
Winter drive mode	"D" range only

② Mode selection

	SWITCH (SW)		LAMP	
Mode Type	POW/NOR. SW	WINTER SW	POWER DRIVE LAMP	WINTER DRIVE LAMP
Normal drive mode (NOR)	OFF	OFF	OFF	OFF
Power drive mode (PWR)	ON	OFF	ON	OFF
Winter drive mode	ON/OFF	ON	OFF	ON

However, the winter switch prevails over the PWR/NOR switch.
The mode becomes normal drive mode when the winter switch is operated from ON to OFF.

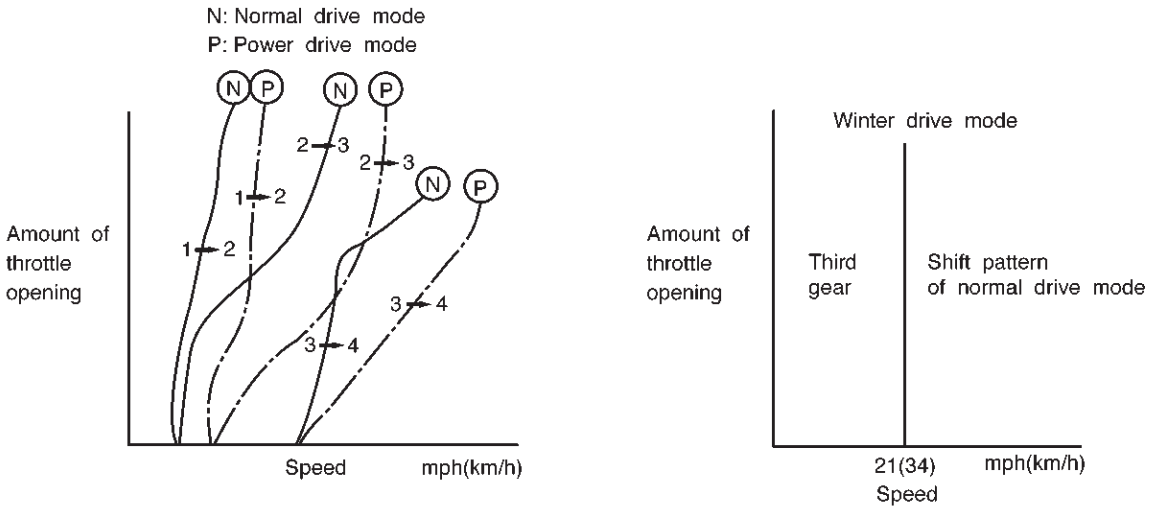
③ Comparison of mode

(1) The normal drive mode is set at the normal shift points.

(2) The shift points of the power drive mode are shifted to the higher speed side, compared to the normal drive mode.

(3) The winter drive mode is a special mode used exclusively for starting in third gear.

Shift diagram



F07RX001

Gear Shift Control

① Shift pattern

SELECT LEVER RANGE	SHIFT PATTERN
D (Drive)	1⇄2TCC ⇄3TCC ⇄4TCC
3 (Third)	1⇄2TCC ⇄3TCC ←4TCC
2 (Second)	1⇄2TCC ←3TCC
L (First)	1←2

TCC = Torque Converter Clutch

② Gear position

The gear is selected by ON/OFF of two solenoids.

Gear \ SOL	A	B
4 (Fourth)	×	×
3 (Third)	○	×
2 (Second)	○	○
1 (First)	×	○
P (park) R (Reverse) N (Neutral)	×	○

○ = ON

× = OFF

Shift solenoid A (Normally closed) ON → PRESSURE TO SHIFT VALVE

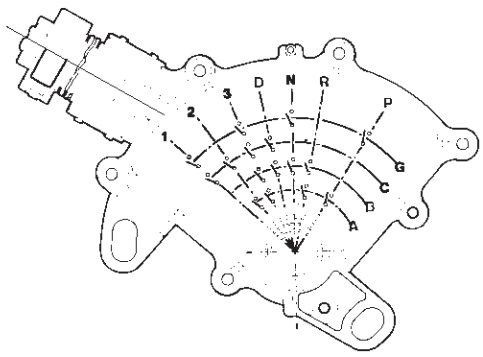
Shift solenoid B (Normally open) OFF → PRESSURE TO SHIFT VALVE

③ Selecting gear pisition

Seven types of positions can be selected according to 5 signals from the mode switch as below.

	MODE SW TERMINALS				
SELECT LEVER RANGE	5(D)	8(A)	7(B)	6(C)	3(G)
P (park)	•	•			•
R (Reverse)	•	•	•		
N (Neutral)	•		•		•
D (Drive)	•		•	•	
3 (Third)	•	•	•	•	•
2 (Second)	•	•		•	
L (First)	•			•	•

• = Continuity



F07RT034

Winter Drive Mode

1. **Operation**
   The winter switch will operate when switched on after all of the following conditions are present:

   Conditions:

   a. The select lever position is “D” range only.
   b. Vehicle speed is 7 mph (11 km/h) or less.
   c. Transmission oil temperature is 130˚C (266˚F) or less.
   d. Accelerator opening is at 8% or less.

2. **Cancel Release**
   1. Cancellation by driver
      a. Turning off the winter drive mode switch
      b. Shifting select position to “3”, “2”, or “L” (winter drive mode is not canceled by selecting “N”, “R”, or “P”).
      c. Ignition key is turned off.
   2. Automatic cancellation
      a. When vehicle runs at 21mph (34 km/h) or more for 1 second or more
      b. When transmission oil temperature reaches 130˚C (266˚F) or above

NOTE: The mode returns to normal drive mode or power drive mode after the winter drive mode is canceled.

Backup Mode

If a major system failure occurs which could affect safety or damage the transmission under normal vehicle operation, the diagnostic system detects the fault and overrides the Powertrain Control Module (PCM).
The “CHECK TRANS” light flashes to alert the driver, and the transmission must be manually shifted as follows:

Select lever position	Gear Ratio Selected
D	4 (Fourth)
Manual 3	4 (Fourth)
Manual 2	3 (Third)
Manual L	1 (First)
R	Reverse

Shifts are firmer to prevent clutch slip and consequent wear. The fault should be corrected as soon as possible.

Functions of Input / Output Components

Components			Function
INPUT SIGNAL	Speed sensor (fixed to transmission)		Senses rotation of output shaft and feeds the data to Powertrain Control Module (PCM).
	Throttle position sensor (TPS) (fixed to engine)		Senses the extent of throttle valve opening and the speed of the throttle valve lever motion to open the valve. Feeds the data to PCM.
	Brake switch (fixed to brake pedal)		Senses whether the driver has pressed the brake pedal or not and feeds the information to PCM.
	Mode switch (fixed to transmission)		Senses the select lever position, and feeds the information to PCM.
	Power drive switch (fixed to front console)		Senses whether the driver has selected the power mode, and feeds the information to PCM.
	T/M oil temperature sensor		Senses the T/M oil temperature and feeds the data to PCM
	Engine coolant temperature sensor		Senses the engine coolant temperature, and feeds the data to PCM.
	Engine speed signal		Feeds the signals monitoring engine speed to PCM from crank angle sensor.
	Air conditioning information		Senses whether the air conditioner has been switched on or not, and feeds the information to PCM.
	Winter switch (fixed to front console)		Senses whether the driver has selected the winter mode, and feeds the information to PCM.
	Cruise controller (Overdrive OFF signal)		Downshift takes place when overdrive OFF signal is received from auto cruise controller integrated in PCM.
OUTPUT SIGNAL	SOLENOID	Shift solenoid A, B	Selects shift point and gear position suited to the vehicle running condition on the basis of PCM output.
		Band apply solenoid	Controls oil flow suited to the vehicle running condition on the basis of PCM output.
		Torque Converter Clutch PWM solenoid	Controls clutch apply suited to the vehicle running condition on the basis of PCM output.
		Force motor (Pressure regulator valve)	Adjusts the oil pump delivery pressure to line pressure suited to the vehicle running condition on the basis of PCM output.

Diagnosis

Electronic Diagnosis

How To Diagnose The Problem

1. To avoid incorrect diagnostics, this book needs to be followed accurately. Unless stated, do not jump directly to a section that could contain the solution. Some important information may be missed.
2. The sections in CAPITALS and bold are the main sections that can be found in the contents.
3. The GO TO **"SECTION"** means to continue to check going to the "section".
4. The GO THROUGH **"SECTION"** means to go through the "section" and then to go back to the place the GO THROUGH was written.
5. BASIC ELECTRIC CIRCUITS:
   You should understand the basic theory of electricity. This includes the meaning of voltage, amps, ohms, and what happens in a circuit with an open or shorted wire. You should also be able to read and understand wiring diagrams.

Check Trans Indicator

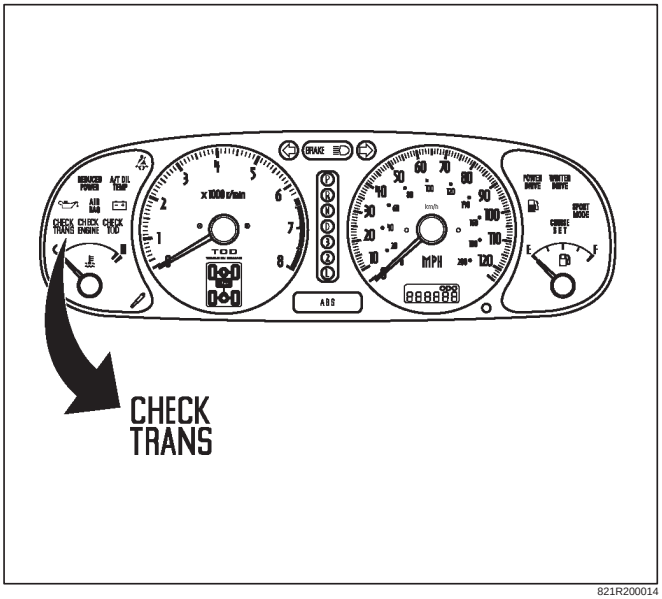
Find CHECK TRANS indicator and verify if it is

A. Flashing: GO TO **DIAGNOSTIC CHECK.**

B. Staying on: GO THROUGH **CHECK TRANS CHECK**.

C. Is never ON when the ignition key is turned on: GO THROUGH **CHECK TRANS CHECK**

D. Is ON during 2 seconds at ignition but OFF after: Normal operation. No DTC or malfunction.



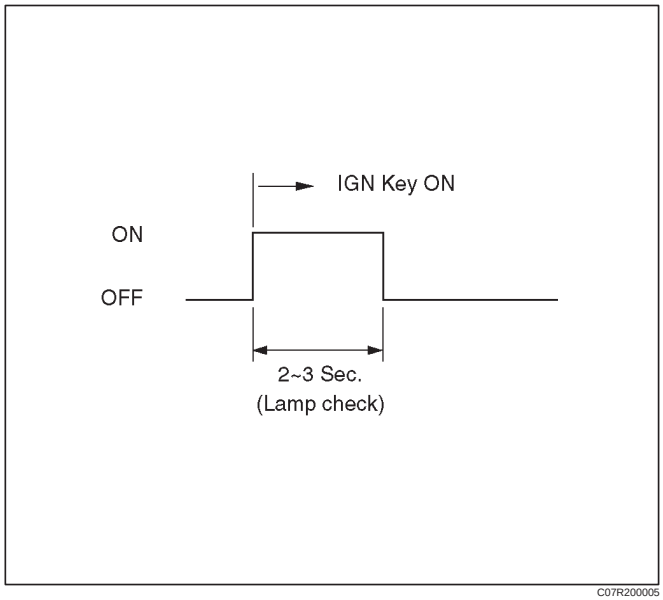
821R200014

Diagnostic Check

This test determines if the transmission or its input or output connections or sensors are failing.

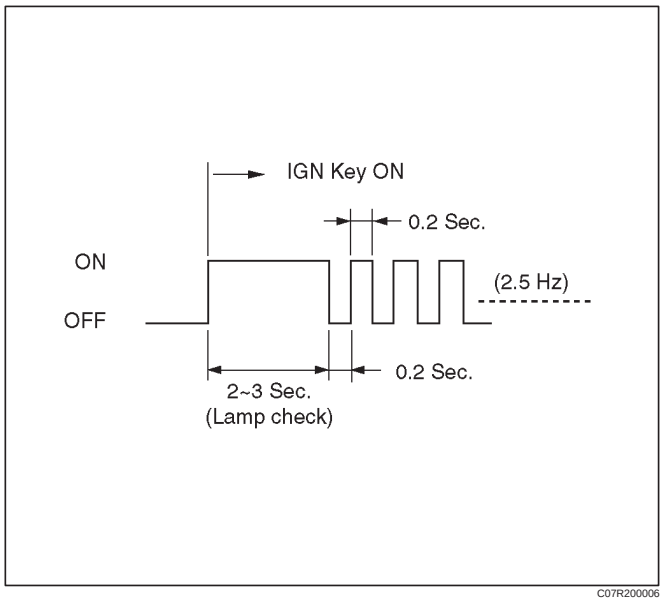
1. Connect the Tech 2: GO THROUGH **Tech 2 OBD II CONNECTION**.
2. Turn on the ignition but not the engine.
3. Push "F0" on Tech 2 to see the Diagnostic Trouble Code (DTC):
4. Do you have a DTC?
   YES: write down all code numbers and do the **DTC CHECK**
   NO: the DTC can not help you finding the problem.
   1. GO THROUGH **"CHECK TRANS" CHECK**
   2. If it is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF, this means that you should have a DTC stored. Please recheck GO TO **DIAGNOSTIC CHECK** and if you find the same problem, replace the Powertrain Control Module (PCM).

Normal



C07R200005

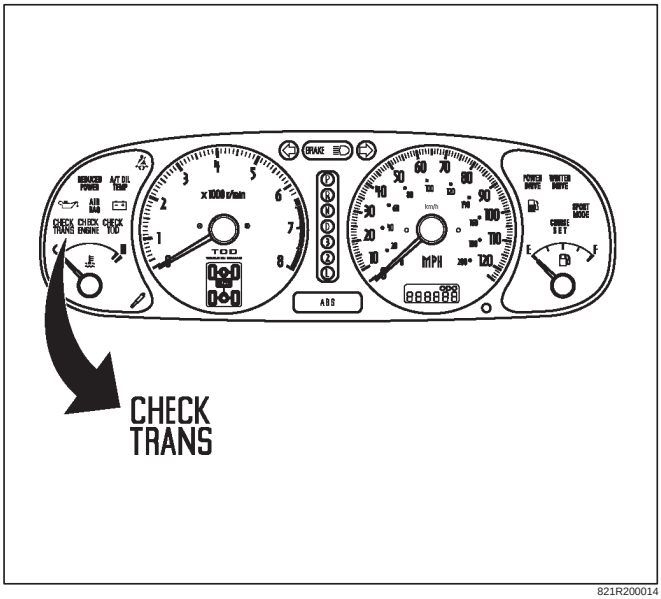
Abnormal



C07R200006

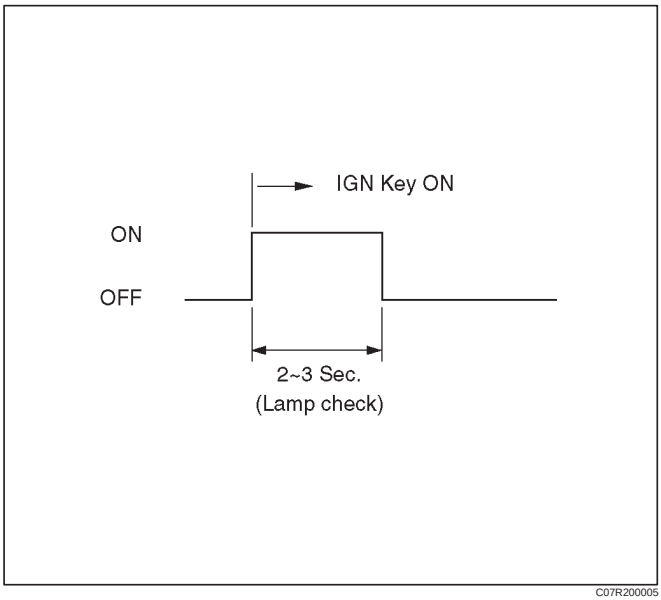
“Check Trans” Check

1. Indicator is ON during 2~3 seconds at ignition (or when the engine is cranked) but it is OFF after the engine starts. The indicator is working normally GO TO **DIAGNOSTIC CHECK**.



821R200014

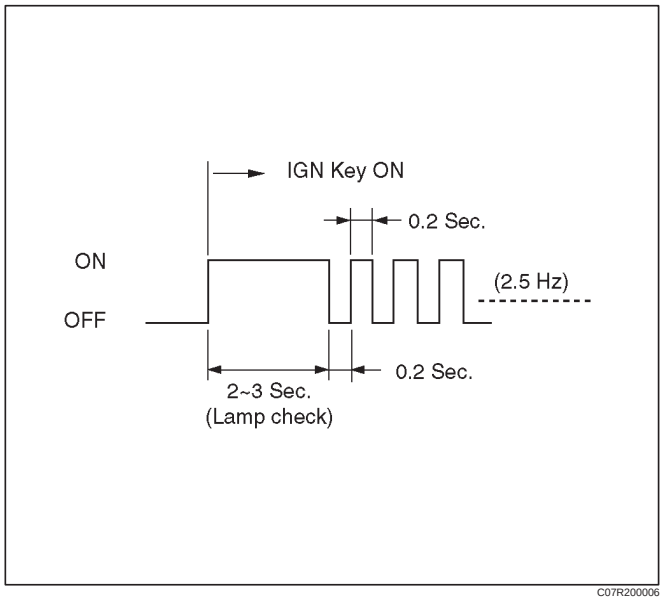
Normal



C07R200005

2. Indicator is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF always when ignition is on (engine cranked or not). This means that there is a malfunction. GO TO **DIAGNOSTIC CHECK**.

Abnormal



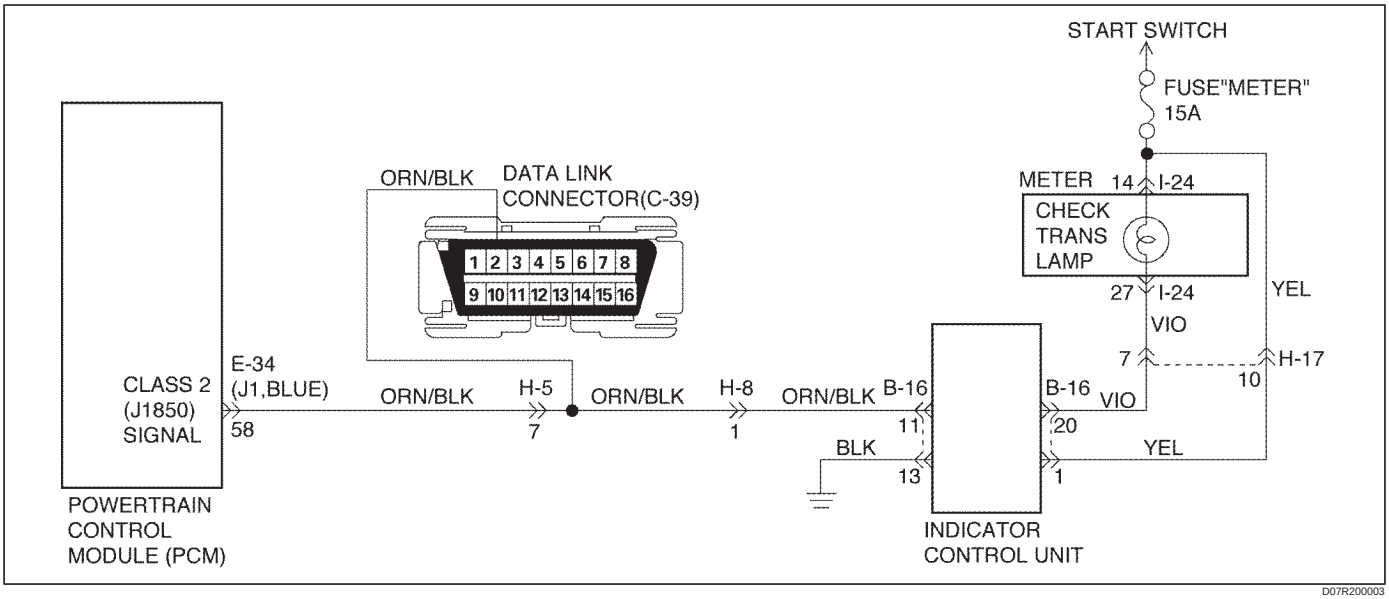
C07R200006

3. Indicator is staying ON always when Ignition is ON.
   1. This means that connection between the lamp and the indicator control unit is shorted to ground.
   2. Verify if instrument panel terminal 27 of connector I–24 is shorted to ground.
   3. Verify if the indicator control unit connector B–16 terminal 20 is shorted to ground.
   4. Verify that the instrument panel terminal 14 of connector I–24 is connected to battery.
   5. If problem solved: GO TO **CHECK TRANS INDICATOR**.

   NO:Replace Powertrain Control Module (PCM).
4. Indicator is staying OFF with the ignition ON (engine OFF).
   1. This means that connection between the lamp and the indicator control unit is shorted to battery or opened.
   2. Verify if instrument panel terminal 27 of connector I–24 is shorted to battery or open.
   3. Verify if the indicator control unit connector B–16 terminal 20 is shorted to battery or open.
   4. Verify that the instrument panel terminal 14 of connector I–24 is connected to battery. If not, check the fuses and the connections (terminal 7 of connector H–17) voltage.

5. If problem solved: GO TO **CHECK TRANS INDICATOR**.

NO: Replace Powertrain Control Module (PCM).

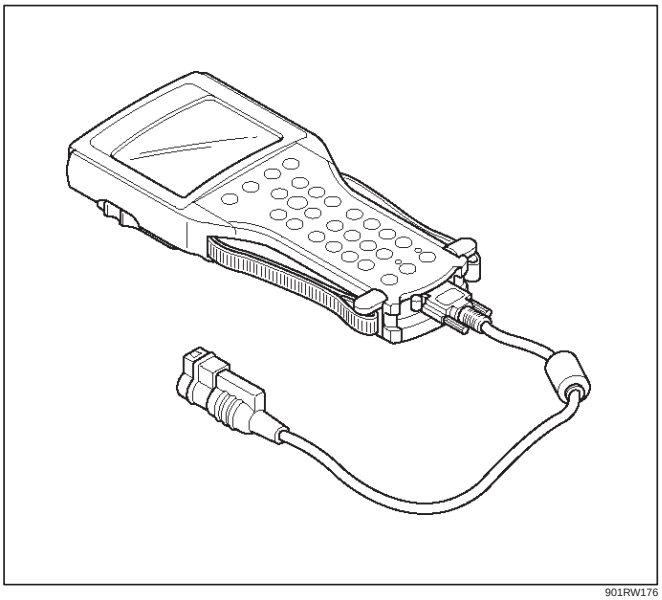


D07R200003

Tech 2 OBD II Connection

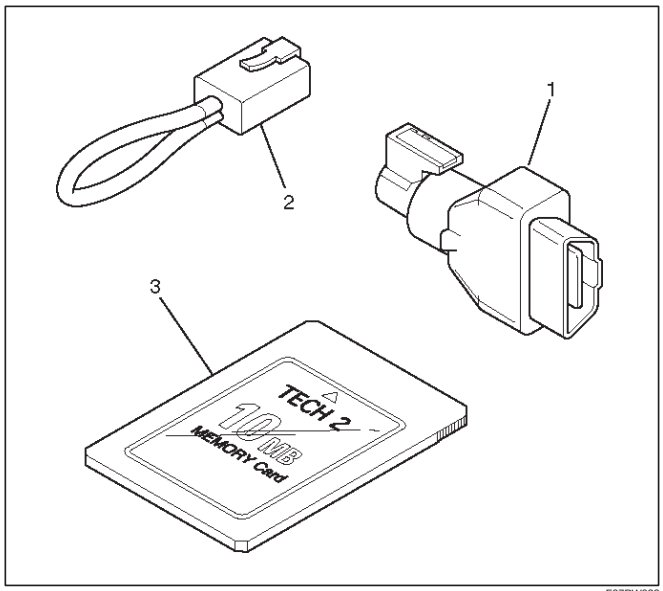
In order to access OBD II Powertrain Control Module (PCM) data, use of the Tech 2 scan tool kit (7000086) is required.

1. The electronic diagnosis equipment is composed of:
   1. Tech 2 hand held scan tool unit (7000057) and DLC cable (3000095).



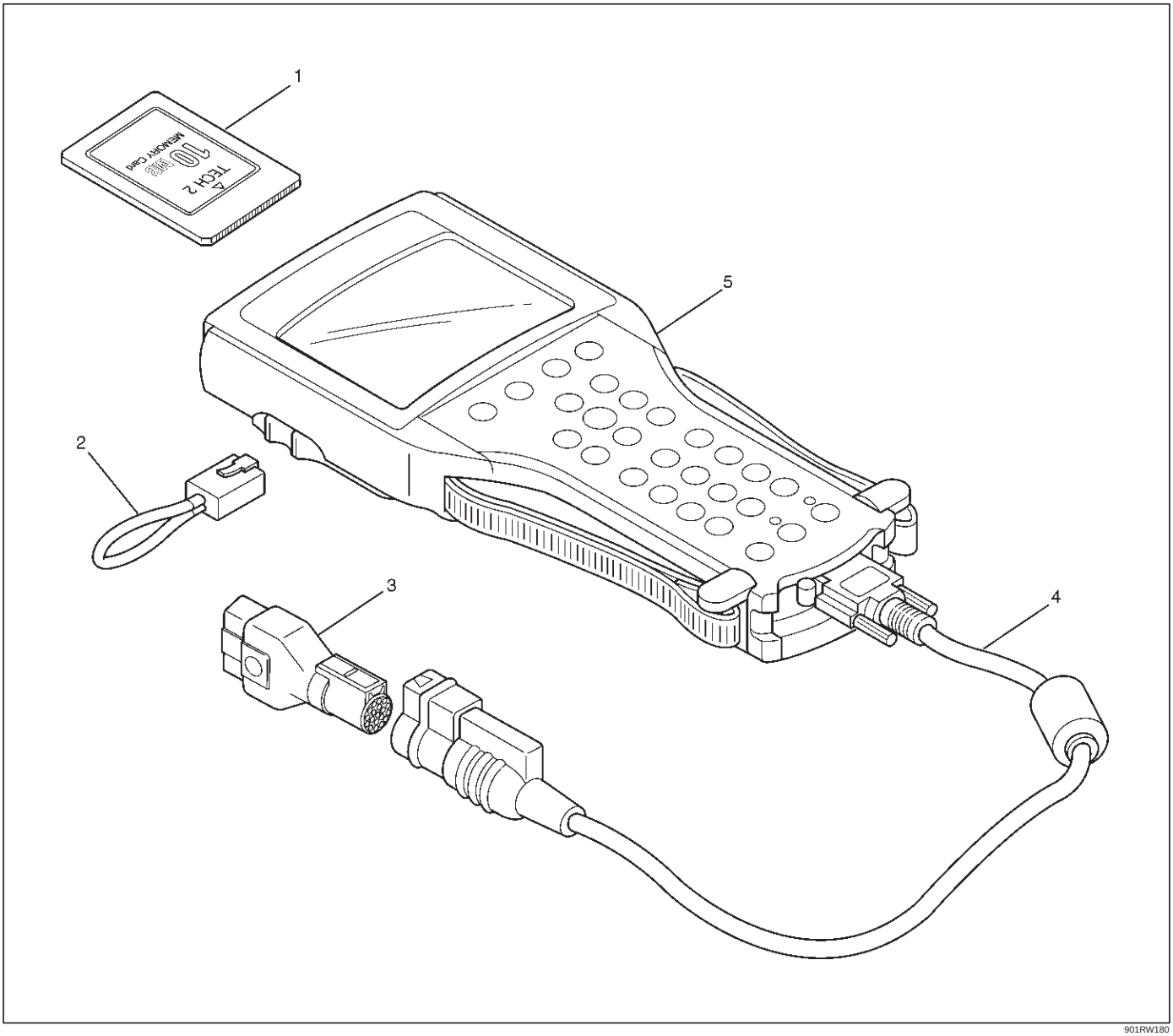
901RW176

2. SAE 16/19 adaptor (3000098) (1), RS 232 loop back connector (3000112) (2), and PCMCIA card (3000117) (3).



F07RW033

2. Connecting the TECH2



901RW180

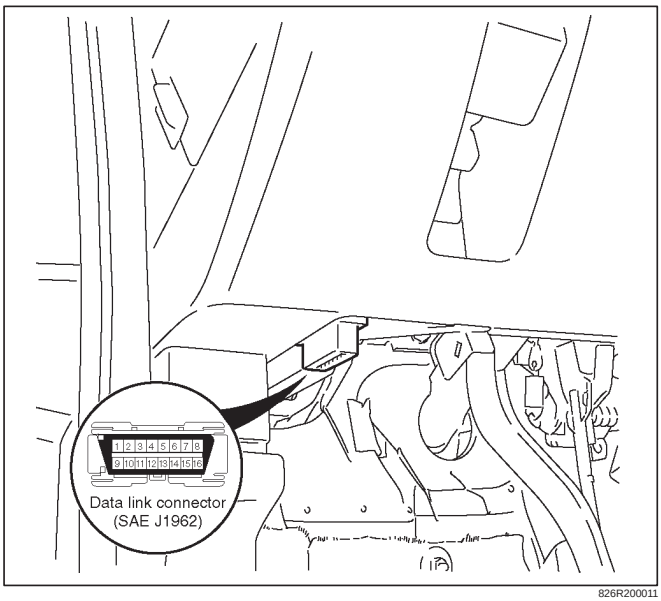
Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adapter
(4) DLC Cable
(5) Tech 2

▼Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2002 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.

5. Connect the Tech 2 SAE 16/19 adaptor to the vehicle DLC.



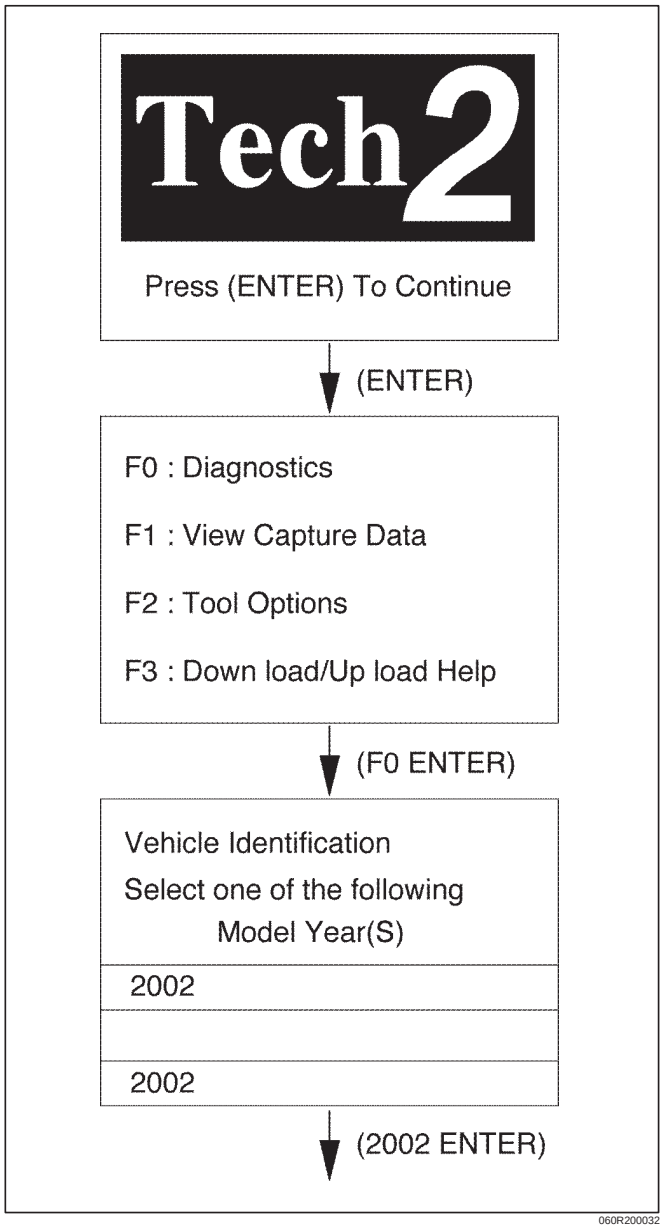
826R200011

6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

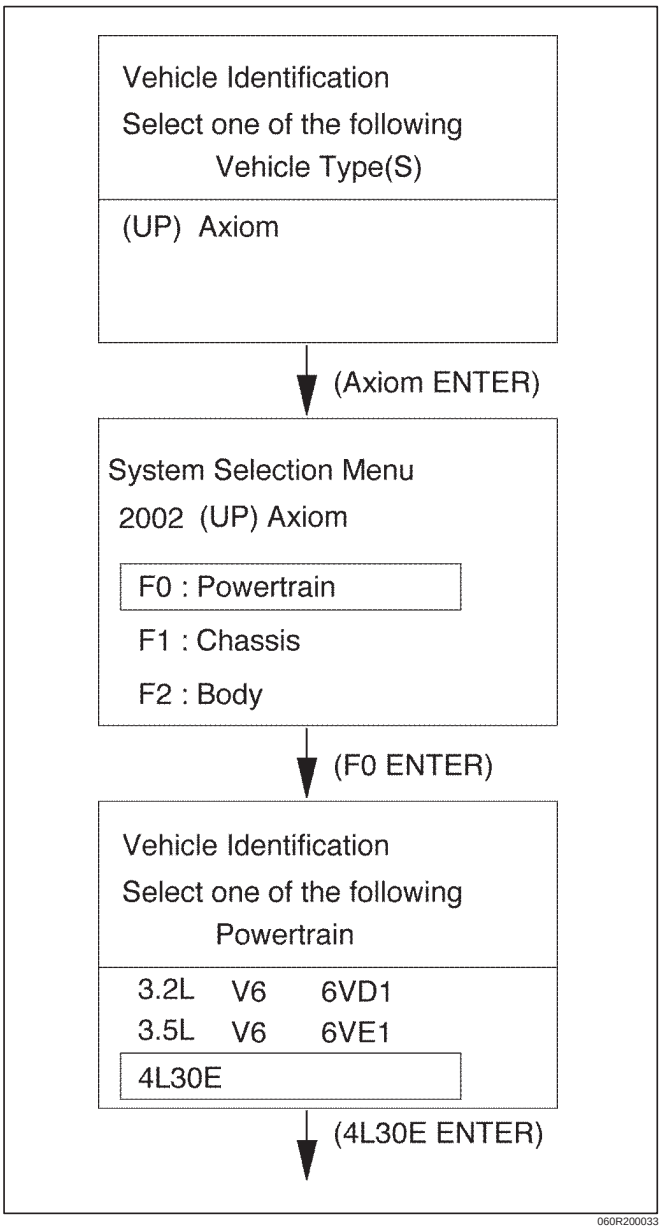
060RW009

NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to *user guide of the Tech 2.*

8. The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060R200032



Once the test vehicle has been identified an “Application (Powertrain) Menu” screen appears. Please select the appropriate application.
The following table shows, which functions are used for the available equipment versions.

- F0: Diagnostic Trouble Codes
  - F0: Read DTC Info Ordered By Priority
  - F1: Clear DTC Information
  - F2: DTC Information
- F1: Data Display
  - F0: Transmission Data
- F2: Snap Shot
- F3: Actuator Tests
  - F0: Lamps
    - F0: Check Light
    - F1: Winter Drive Lamp
    - F2: Power Drive Lamp
    - F3: AT Oil Temperature Lamp
  - F1: Solenoids
    - F0: Solenoid 1-2/3-4 Test
    - F1: Solenoid 2-3 Test
    - F2: TCC Solenoid
    - F3: Band Apply Solenoid
    - F4: Pressure Control Solenoid (PCS)
- F4: Function Tests
  - F0: Reset Oil Life Monitor

Diagnostic Trouble Codes

The purpose of the "Diagnostic Trouble Codes" mode is to display stored PCM trouble codes.
When "Diagnostic Trouble Codes" is selected an "Application Menu" screen appears.

Clear DTC Information

The purpose of the "Clear DTC Information" mode is to command the clearing of stored PCM trouble codes.
When "Clear DTC Information" is selected, a "Clear DTC Information", warning screen appears. This screen informs you that by cleaning DTC's, "all stored DTC information in controller will be erased".
Do you want to clear DTC's (Yes/No).
Press either the Yes or No key when answering.
After clearing codes, confirm system operation by test driving the vehicle.
Allow the vehicle to shift through all four forward gears in a manner which attempts to repeat the failure condition.

NOTE: When the trouble has not been repaired and the trouble code cannot be erased, check the vehicle again.

DTC Information

When "DTC Information" is selected, an "Application Menu" appears with a list of DTC information function keys addressing DTC specifics and their origins.
Function key selections may vary for particular vehicle and/or system.

Data Display

The purpose of the "Data Display" mode is to continuously monitor data parameters.
The current actual values of all important sensors and signals in the system are display through F1 mode.
When "Data Display" is selected an "Application Menu" appears. Please select either "Engine" or "Transmission Data Display".
See "Transmission Data" on next page.

Snapshot

When "Snapshot" is selected an "Application Menu" appears.
When "Transmission Snapshot" application is selected from the "Application Menu", a "Snapshot Menu" appears, displaying several options. "Snapshot" options may vary from one system to another.
"Snapshot" allows a recording of all vehicle parameters. There parameters may then be replayed at a future point in time.
This action allows you to focus on making the condition occur, rather than trying to view all of the data in anticipation of the fault. The snapshot will collect parameter information around a trigger point that you select.
When a snapshot is taken. It is recorded onto the PCMCIA memory card. When the Tech 2 is powered down. Snapshots are not lost.

Actuator Tests

The purpose of "Actuator Tests" mode is to check for correct operation of electronic system actuators.

Lamps

You can operate the lamps by pressing the ON and OFF buttons.
Preconditions: none

Solenoid

Solenoid 1-2/3-4, Solenoid 2-3, TCC Solenoid
You can operate the solenoids by pressing the ON and OFF buttons.
Preconditions: P–N position, no vehicle speed, no engine speed

Band Apply Solenoid
You can operate the solenoid by pressing the ON and OFF buttons.
Preconditions: P-N position, idle engine speed, no vehicle speed.

Pressure Control Solenoid (PCS)
You can set desired PCS Current using the "Increment" (+25) and "Decrement" (–25) button. The PC Solenoid Data informs about PCS Current, Pressure and Duty Cycle.
Preconditions: P–N position, no engine speed, no vehicle speed

Reset Oil Life Monitor

Displays parameter "Oil Life Monitor" and resets to 100% if Yes-button is pressed on Reset-question. "No" leaves test.
Preconditions: no vehicle speed, no engine speed

NOTE:

Freeze Frame (Powertrain DTC A/B Type)

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Frame Data* for more detailed information.

Failure Records (Powertrain DTC C/D Type)

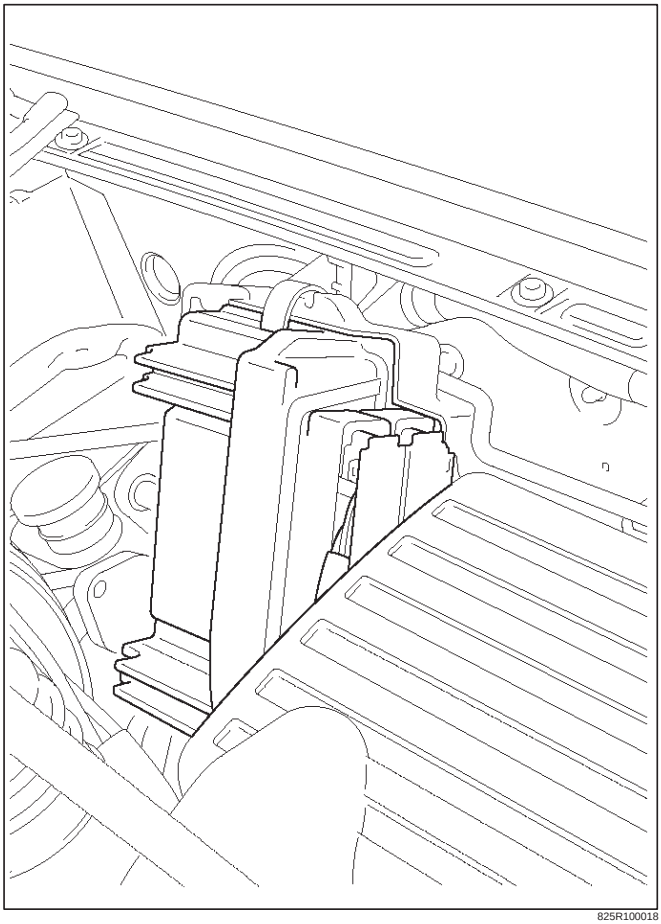
Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

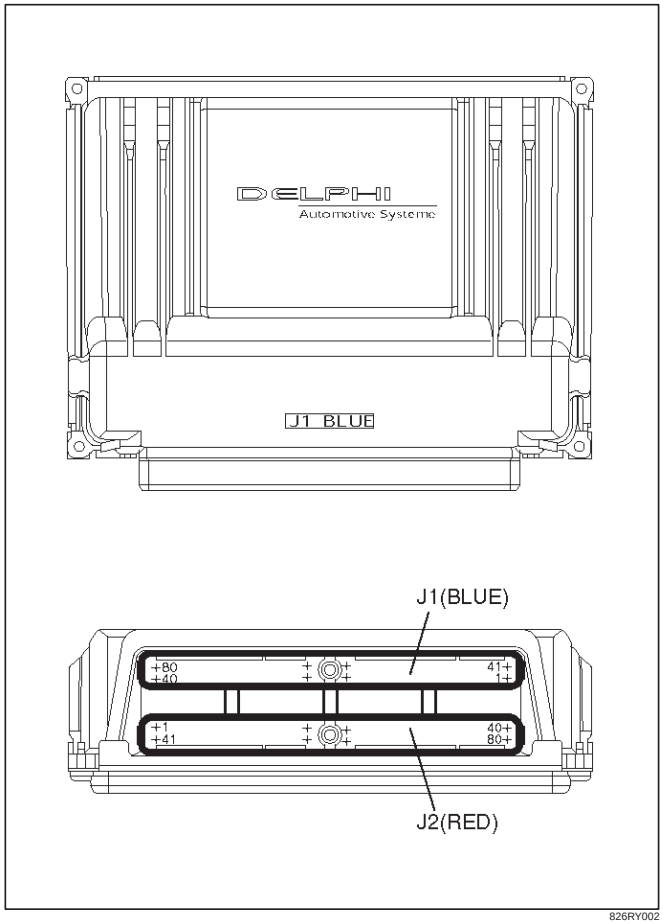
Transmission Data

Tech 2 string	Unit	Engine running at idle
Ignition Voltage	V	12.8 ~ 14.1 V
Engine Speed	RPM	750 ~ 900 RPM
Vehicle Speed	km/h, MPH	0 MPH
AT Output Speed (Automatic Transmission)	RPM	0 RPM
AT Input Speed Ratio (Automatic Transmission)		0.0
Throttle Position	%	0 %
AT Oil Temperature (Automatic Transmission)	˚C, ˚F	70 ~ 80˚C (158 ~ 176˚F)
Transmission Temperature	˚C, ˚F	75 ~ 110˚C (167 ~ 230˚F)
AT Oil Temperature Lamp (Automatic Transmission)	On/Off	Off
AT Oil Life Monitor (Automatic Transmission)	%	100 %
AT Oil Life Lamp (Automatic Transmission)	On/Off	(Not used)
Commanded Gear		1
Current Gear		1
Mode Switch A	Inactive/Active	Active
Mode Switch B	Inactive/Active	Inactive
Mode Switch C	Inactive/Active	Inactive
Mode Switch G	Inactive/Active	Active
Selector Position		Park
1–2 Shift Solenoid A	On/Off	Off
2–3 Shift Solenoid B	On/Off	On
Solenoid Brake Band	On/Off	Off
TCC Slip Speed	RPM	750 ~ 900 RPM
TCC Solenoid	On/Off	Off
TCC Duty Cycle	%	0 %
PCS Current (Pressure Control Solenoid)	A	approx. 1.0 A
PCS Duty Cycle (Pressure Control Solenoid)	%	approx. 45 ~ 60 %
Desired PCS Pressure (Pressure Control Solenoid)	kPa	43 ~ 52 kPa
Shift Pressure	kPa	43 ~ 52 kPa
Brake Switch	On/Off	On
Winter Switch	On/Off	Off
Winter Drive Lamp	On/Off	Off
Power Switch	Normal	Normal
Power Drive Lamp	Off/On	Off
Emergency Mode	Inactive/Active	Inactive
ABS Status	On/Off	(Not used)

OBD II Diagnostic Management System

Powertrain Control Module (PCM) Location





Class 2 Serial Data Bus

OBD II technology requires a much more sophisticated PCM than does OBD I technology. The OBD II PCM diagnostic management system not only monitors systems and components that can impact emissions, but they also run active tests on these systems and components. The decision making functions of OBD II PCMs have also greatly increased. To accommodate this expansion in diagnostic complexity, Isuzu engineers have designed the Class 2 serial data bus, which meets SAE J1850 recommended practice for serial data.

"Serial Data" refers to information which is transferred in a linear fashion – over a single line, one bit at a time. A "Data Bus" is an electronic pathway through which serial data travels.

AXIOM previously used a 5 volt data bus called UART, which is an acronym for "Universal Asynchronous Receive and Transmit". When neither the vehicle's control module nor the diagnostic tool, such as a Tech 2, are "talking," the voltage level of the bus at rest is 5 volts. The two computers talk to each other at a rate of 8,192 bits per second, by toggling or switching the voltage on the data bus from 5 volts to ground.

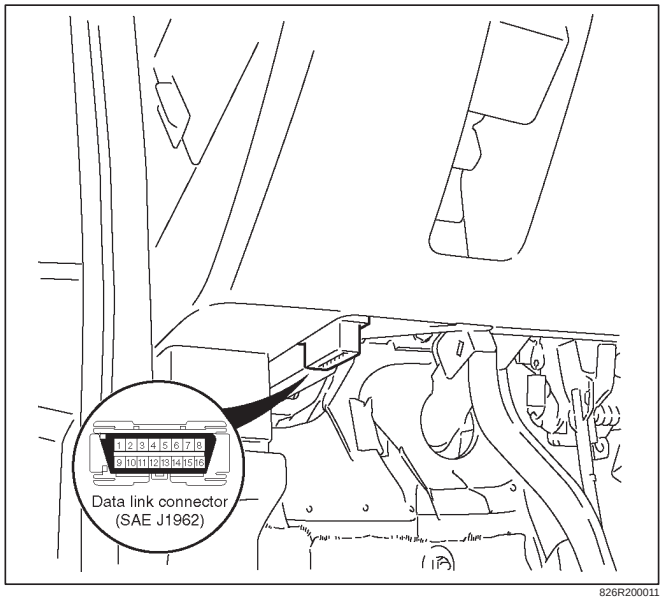
Class 2 data, which is used on OBD II vehicles, is quite different. Data is transferred at a rate of 10.4 kilobits per second, and the voltage is toggled between zero and 7 volts.

C07RT006

Class 2 data is also pulse width modulated. Each bit of information can have one of two lengths: long or short. On the other hand, UART data bits come in only one length (short). The pulse width modulation of Class 2 data allows better utilization of the data line.

The message carried on Class 2 data streams are also prioritized. This means that if two devices try to communicate on the data line at the same time, only the higher priority message will continue. The device with the lower priority message must wait.

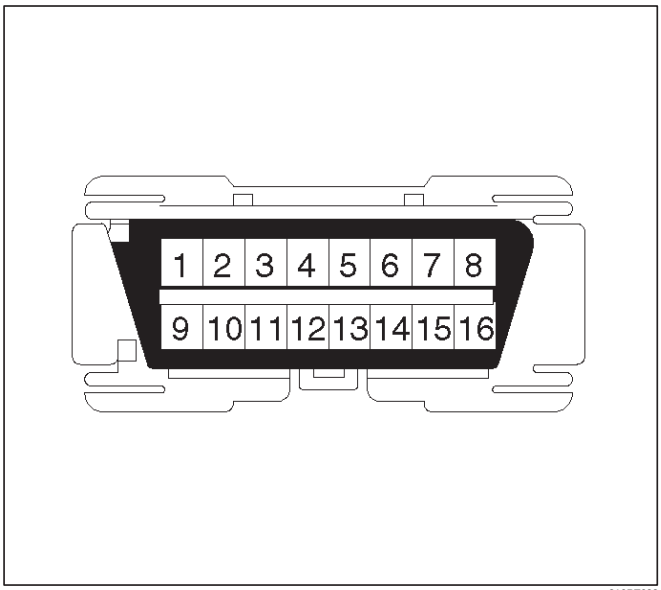
NOTE: The Class 2 data wire is always terminal 2 of the new 16–terminal Data Link Connector (DLC).



826R200011

16 – Terminal Data Link Connector (DLC)

OBD II standardizes Data Link Connector (DLC) configurations. The DLC, formerly referred to as the ALDL, will be a 16–terminal connector found on the lower left side of the driver's side instrument panel. All manufacturers must conform to this 16–terminal standard.



PIN 1 – DIAG. SW
PIN 2 – J1850 Bus + L line on 2–wire systems, or single wire (Class 2)
PIN 3 – Active suspension diagnostic enable
PIN 4 – Chassis ground pin
PIN 5 – Signal ground pin
PIN 6 – (Not used)
PIN 7 – TOD diagnostic enable
PIN 8 – TOD diagnostic enable
PIN 9 – Primary UART
PIN 10 – (Not used)
PIN 11 – (Not used)
PIN 12 – ABS diagnostic or CCM diagnostic enable
PIN 13 – SIR diagnostic enable
PIN 14 – (Not used)
PIN 15 – (Not used)
PIN 16 – Battery power from vehicle unswitched (4 AMP MAX.)

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (“CHECK ENGINE” lamp). However, OBD II requires for it illuminate under a strict set of guidelines. Basically, the MIL is turned on when the PCM detects a DTC that will impact the vehicle’s emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if a component or system which has an impact on vehicle emissions indicates a malfunction or fails to pass an emissions–related diagnostic test. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions–related faults.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty) (DTC Information for 6VE1 engine)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - “Armed” after one (1) trip with a fail
  - “Disarmed” after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty) (DTC Information for 6VE1 engine)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non-Emissions related
  - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails
- Type D
  - Non-Emissions related
  - Not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Clear DTC

NOTE: If you clear the DTC (Diagnostic Trouble Codes) you will not be able to read any codes recorded during the last occurrence.

NOTE: To use the DTC again to identify a problem, you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. If you have a Tech 2:
   1. Connect the Tech 2 if it is still not connected GO THROUGH **Tech 2 OBD II CONNECTION.**
   2. Push "F1: Clear DTC Information" in the Application Menu and answer "Yes" to the question "Do you want to clear DTC's?"
      a. When a malfunction still exists and the Tech 2 displays "4L30E CODES NOT CLEARED". This means that the problem is still there or that the recovery was not done. Please **GO TO DTC CHECK.**
      b. When a malfunction has been repaired and the recovery is done. The Tech 2 displays "4L30E CODES CLEARED".
2. If you have no Tech 2:
   Disconnect the PCM battery feed as necessary.

DTC Check

1. Diagnostic Trouble Codes (DTC) have been identified by Tech 2.
2. You have written the list of the DTCs. The order of the malfunctions has no meanings for this PCM. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTCs are sorted by number. Refer to *Diagnostic Trouble Code (DTC) Identification in this section.*

PCM Precaution

The PCM can be damaged by:

1. Electrostatic discharge
2. The short circuit of some terminals to voltage or to ground.

Electrostatic Discharge Damage Description:

1. Electronic components used to control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
2. There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges for the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: **To prevent possible electrostatic discharge damage:**

1. Do not touch the PCM connector pins or soldered components on the PCM circuit board.
2. Be sure to follow the guidelines listed below if servicing any of these electronic components:
3. Do not open the replacement part package until it is time to install the part.
4. Avoid touching electrical terminals of the part.
5. Before removing the part from its package, ground the package to a known good ground on the vehicle.
6. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position or while walking some distance.

Information On PCM

1. The Powertrain Control Module (PCM) is located in the center console and is the control center of the electronic transmission control system.
2. The PCM must be maintained at a temperature below 85˚ (185˚F) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85˚C (185˚F). Therefore, it is recommended that the PCM be removed or that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature process.
3. The PCM is designed to process the various inputs and then respond by sending the appropriate electrical signals to control transmission upshift, downshift, shift feel and torque converter clutch engagement.
4. The PCM constantly interprets information from the various sensors, and controls the systems that affect transmission and vehicle performance. By analyzing operational problems, the PCM is able to perform a diagnostic function by displaying DTC(s) and aid the technician in making repairs.

Intermittent Conditions

If the Tech 2 displays a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present, the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the PCM.

Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:
   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro–Magnetic Interference (EMI):
   HINT: Check that all wires are properly routed away from coil, and generator. Also check for improperly installed electrical options, such as lights, 2–way radios, etc.

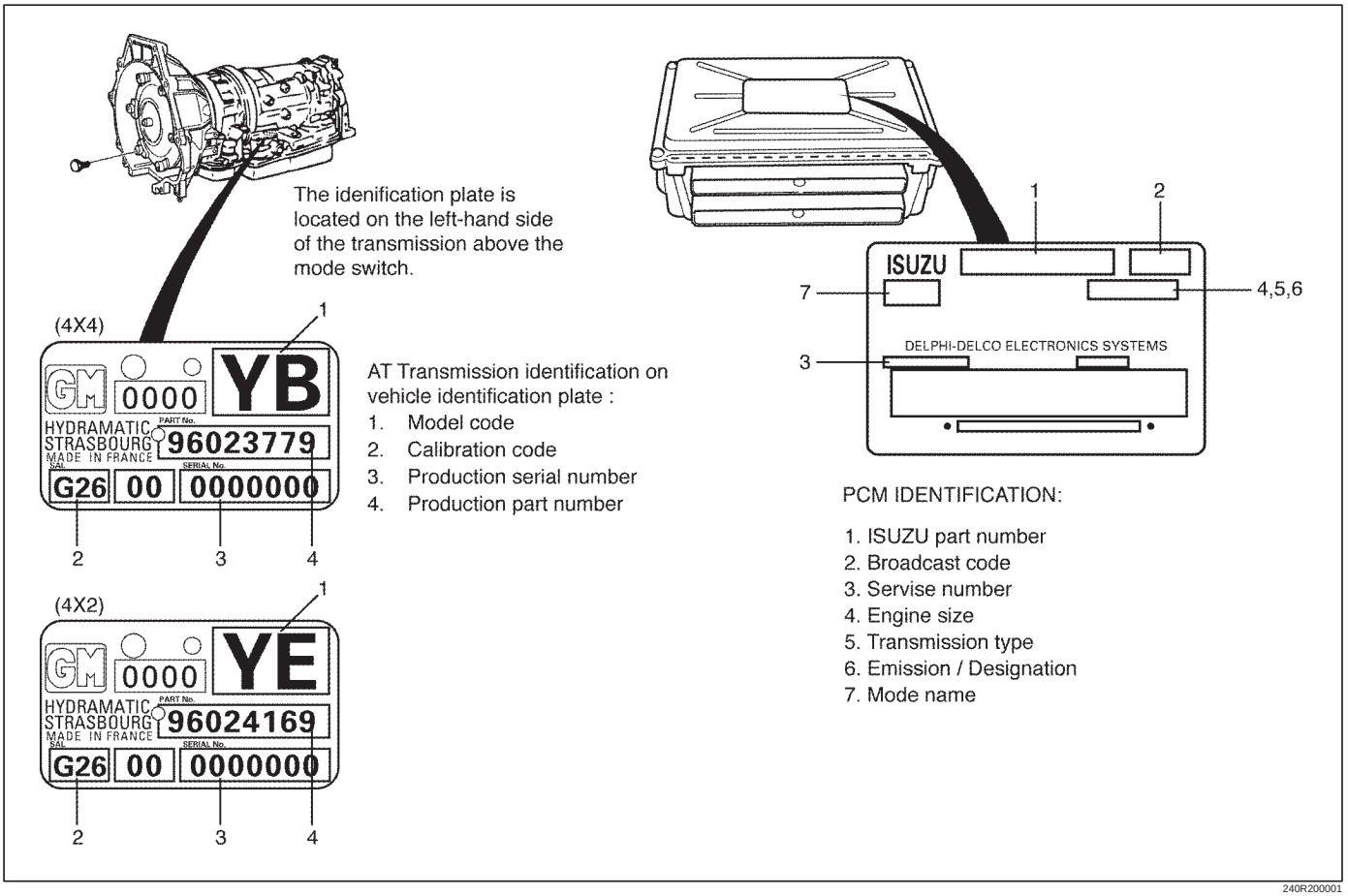
Use the F2: SNAPSHOT mode of the Tech 2 to help isolate the cause of an intermittent fault. The snapshot mode will record information before and after the problem occurs. Set the snapshot to “trigger” on the suspect DTC. If you notice the reported symptom during the test drive, trigger the snapshot manually.

After the snapshot has been triggered, command the Tech 2 to play back the flow of data recorded from each of the various sensors. Signs of an intermittent fault in a sensor circuit are sudden unexplainable jump in data values out of the normal range.

Transmission And PCM Identification

The chart below contains a list of all important information concerning rear axle ratio, Powertrain Control Module (PCM), and transmission identification.

VEHICLE		Rr axle Ratio	PCM	TRANSMISSION		
Type	Engine		ISUZU Parts No.	Calibration Code	Isuzu Part No.	Model Code
Isuzu / Axiom	3.5L V6	4.300	8–97287–830–0 8–09389–969–0	G26	8–96023–779–0	YB (4×4)
				G26	8–96024–169–0	YE (4×2)



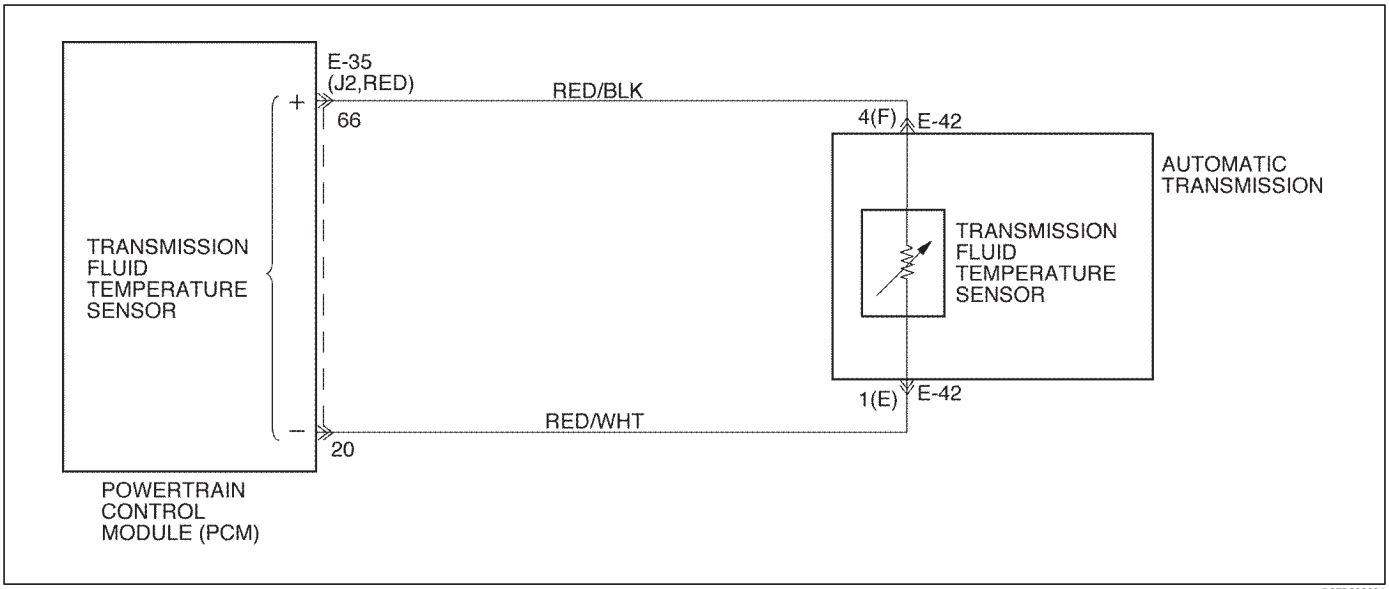
240R200001

Diagnostic Trouble Code (DTC) Identification

DTC NUMBER	DTC NAME	DTC TYPE	MIL "CHECK ENGINE"	"CHECK TRANS"
P0218	Transmission Fluid Over Temperature	D		
P0705	Transmission Range Switch (Mode Switch) Illegal Position	D		
P0706	Transmission Range Switch (Mode Switch) Performance	D		
P0711	Transmission Fluid Temperature (TFT) Sensor Performance	D		
P0712	Transmission Fluid Temperature (TFT) Sensor Circuit Low Input	D		
P0713	Transmission Fluid Temperature (TFT) Sensor Circuit High Input	D		
P0719	Brake Switch Circuit Low (Stuck On)	D		
P0722	Automatic Transmission Output Speed Sensor (OSS) Low Input	B	ON	Flash
P0723	Automatic Transmission Output Speed Sensor (OSS) Intermittent	B	ON	Flash
P0724	Brake Switch Circuit High (Stuck Off)	D		
P0730	Gear Error Without Input Speed	C		Flash
P0742	Torque Converter Clutch (TCC) System Stuck On	B	ON	Flash
P0748	Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical	C		Flash
P0751	Shift Solenoid A Performance (Stuck Off)	B	ON	Flash
P0752	Shift Solenoid A Performance (Stuck On)	B	ON	Flash
P0753	Shift Solenoid A Electrical	B	ON	Flash
P0756	Shift Solenoid B Performance (Stuck Off)	B	ON	Flash
P0757	Shift Solenoid B Performance (Stuck On)	B	ON	Flash
P0758	Shift Solenoid B Electrical	B	ON	Flash
P1850	Brake Band Apply Solenoid Malfunction	D		
P1860	TCC Solenoid Electrical	B	ON	Flash
P1870	Transmission Component Slipping (TCC Stuck Off)	B	ON	Flash

DTC TYPE	DEFINITION
B	Emission related, turn on MIL (Check Engine) and flashing Check Trans after 2 consecutive trips (Removal to confirmed)
C	Non–emission related, flashing Check Trans on 1st failure
D	Non–emission related, no lamps

DTC P0218 Transmission Fluid Over Temperature



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the fluid temperature warms to a normal transmission operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.
This DTC detects a high transmission temperature for a long period of time. This is a type “D” DTC.

Conditions For Setting The DTC

- ▼ No TFT DTCs P0712 or P0713.
- ▼ TFT is greater than 135˚C (275˚F).
- ▼ All conditions met for 21 seconds.

Action Taken When The DTC Sets

- ▼ Hot mode TCC Shift Pattern.
- ▼ The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- ▼ ATF Lamp ON. (TFT is greater than 145˚C (293˚F))
- ▼ Disable E–side TCC OFF request.

Conditions For Clearing The DTC

- ▼ The DTC can be cleared from the PCM history by using a scan tool.
- ▼ The DTC will be cleared from history when the vehicle has achieved 40 warm–up cycles without a failure reported.
- ▼ The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- ▼ Inspect the wiring for poor electrical connections at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- ▼ When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- ▼ Check harness routing for a potential short to ground in circuit RED/BLK.
- ▼ Scan tool TFT sensor temperature should rise steadily to about 100˚C (212˚F), then stabilize.
- ▼ Check for a “skewed” (mis–scaled) sensor by comparing the TFT sensor temperature to the ambient temperature after a vehicle cold soak. A “skewed” sensor can cause delayed garage shifts or TCC complaints.
- ▼ Check for a possible torque converter stator problem.
- ▼ Verify customer driving habits, trailer towing, etc.

Test Description

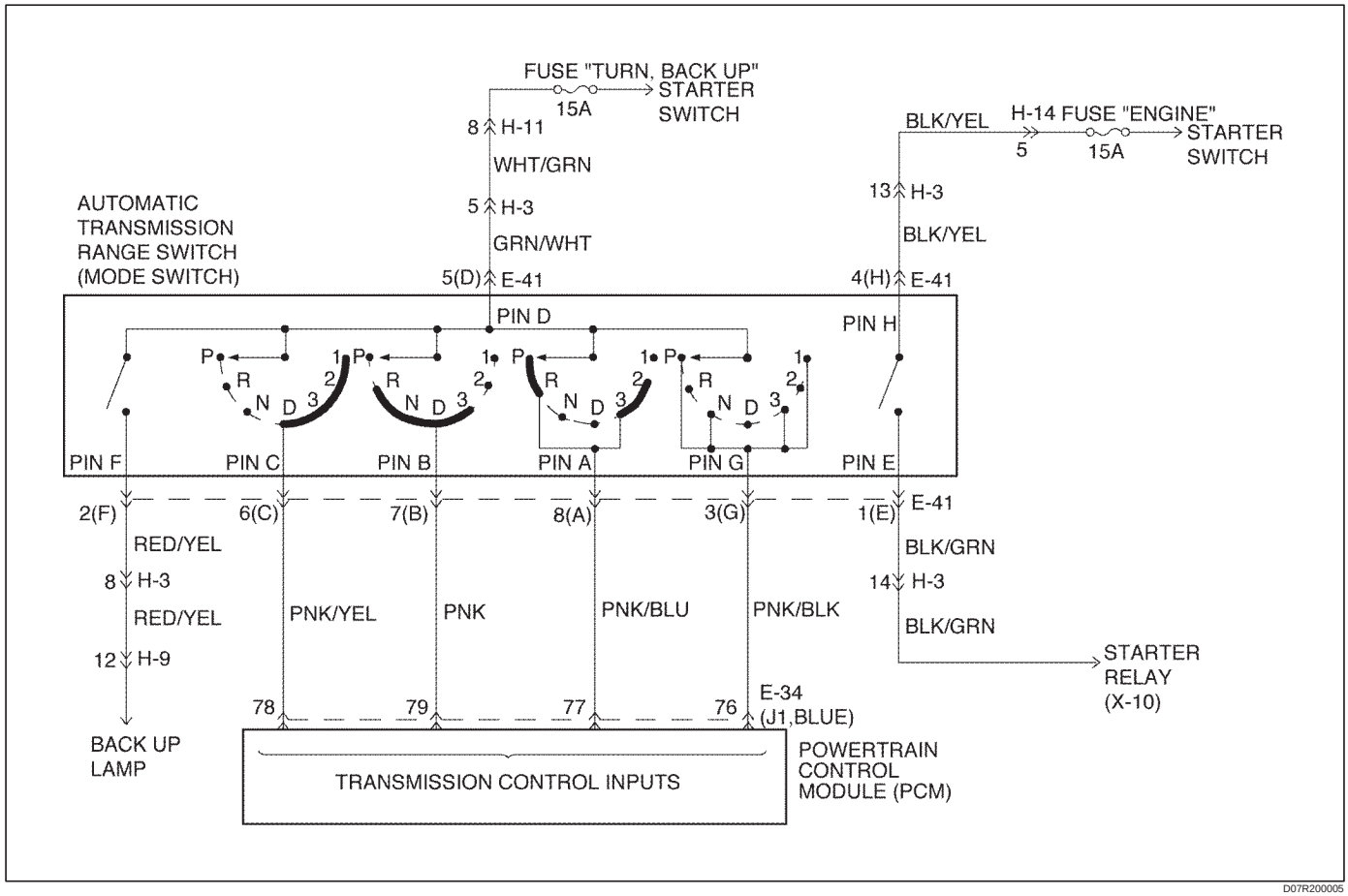
The numbers below refer to *the step numbers on the diagnostic chart.*

3. This test checks for a “skewed” sensor or shorted circuit.
4. This test simulates a TFT DTC P0713.

DTC P0218 Transmission Fluid Over Temperature

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	Perform the following checks: ▼ Check for possible engine system problems. ▼ Transmission fluid checking procedure. Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) Section.* Were the checks performed?	Go to *Step 3*	—
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when “Clear Info” function is used. 3. Record the DTC “Failure Records”. Is the TFT sensor signal voltage less than 1.54 volts?	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–42 (additional DTCs may set). 3. With the engine “off”, turn the ignition switch “on”. Is the TFT sensor signal voltage greater than 4.92 volts?	Go to *Internal Wiring Harness Check*	Go to *Step 5*
5	Inspect/repair circuit RED/BLK for a short to ground. Was a problem found?	Go to *Step 7*	Go to *Step 6*
6	1. Inspect the PCM for poor connections. 2. Replace the PCM if no poor connections were found. Is the replacement complete?	Go to *Step 7*	—
7	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: TFT is less than 125˚C (257˚F) for at least 10 seconds. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position



D07R200005

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector E–41 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is the reason why the range switch is supplied through a 15A fuse (TURN, BACK UP). This fuse can burn due to a short circuit in the back up lamp.

This DTC detects when a fuse is open or the range switch circuit does not work. This is a type “D” DTC.

Conditions For Setting The DTC

- Range switch illegal positions met for 5 seconds.

Action Taken When The DTC Sets

- Default to D position.
- Inhibit torque management.
- Maximum line pressure.
- Turn Force Motor OFF.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to *accompanying chart for the normal range signals and the illegal combinations.*
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the *“Range Switch Logic Table” for further information.*

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

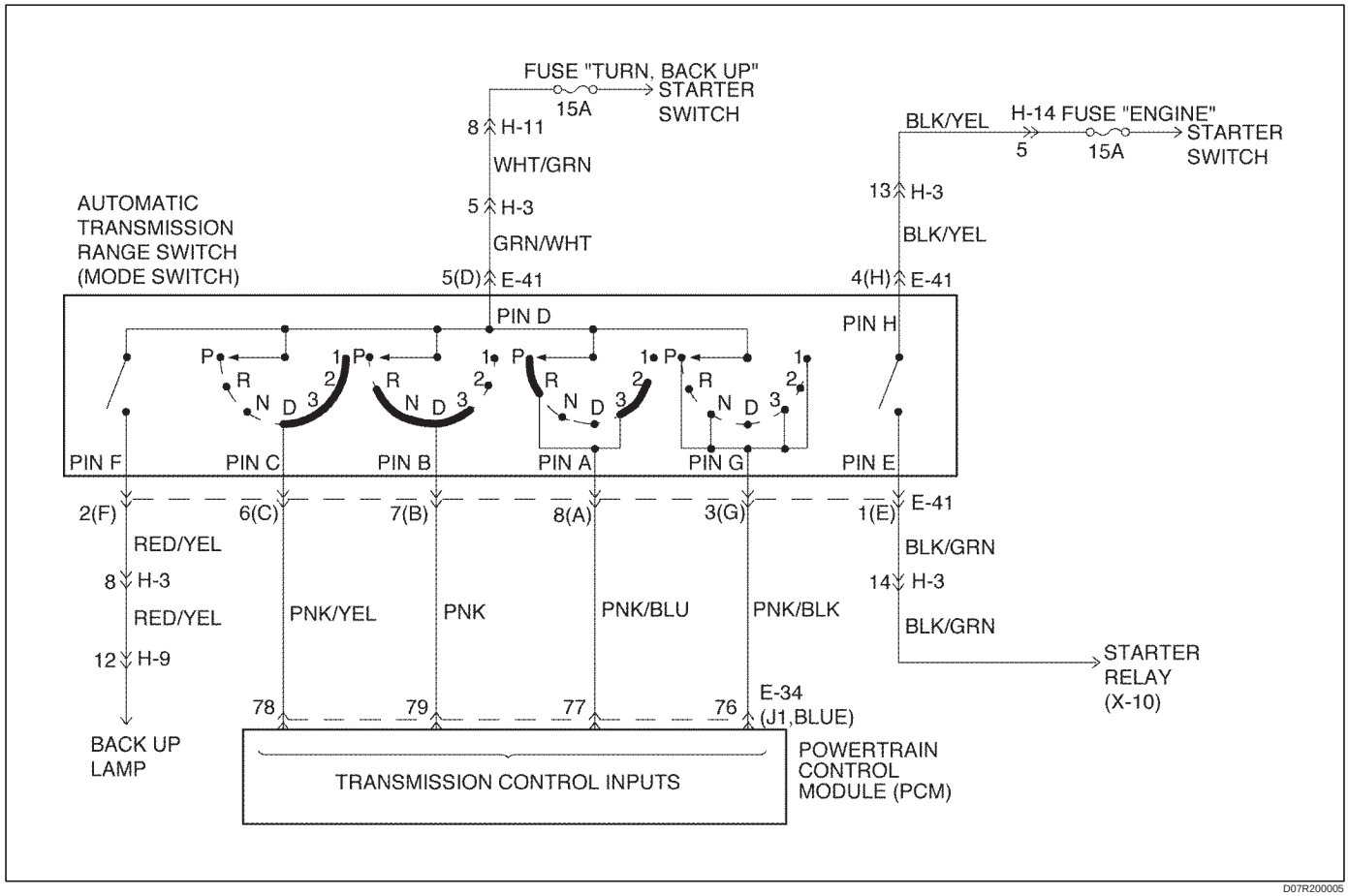
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	Perform the following checks: ▼ The transmission linkage from the select lever to the manual valve is adjusted properly. ▼ Diagnostic circuit check. Were the checks performed?	Go to *Step 3*	—
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Select each transmission range: DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to *Diagnostic Aids*	Go to *Step 4*
4	Are all range switch pin displays incorrect?	Go to *Step 5*	Go to *Step 6*
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to *Mode Switch in Automatic Transmission (4L30–E) section.* If no problem was found, replace the range switch. Is the replacement complete?	Go to *Step 9*	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to *Step 7*	Go to *Step 8*
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to *Step 9*	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to *Step 9*	—
9	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0706 Transmission Range Switch (Mode Switch) Performance



D07R200005

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector E–41 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the back up lamp power in reverse. This is the reason why the mode switch is supplied through a 15A fuse (TURN, BACK UP). This fuse can burn due to a short circuit in the back up lamp.
- This DTC detects an invalid state of the range switch or the range switch circuit by deciphering the range switch inputs. This is a type “D” DTC.

Conditions For Setting The DTC

This DTC will set if any of the following conditions occurs:

Condition 1 (“R” bad position):

- Engine is running.
- No output speed DTCP0722, P0723.
- Output speed greater than 3,200 RPM.
- Range switch indicates “R”.
- All conditions met for 4 seconds.

Condition 2 (“P” or “N” bad position):

- Engine is running.
- No TPS codes.
- Engine speed is less than 3,000 RPM.
- TP angle is greater than 20%.
- Range switch indicates “P” or “N”.
- All conditions met for 4 seconds.

Action Taken When The DTC Sets

- Default to “D” position.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to *the accompanying chart for the normal range signals and the illegal combinations.*
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the *"Range Switch Logic Table" for further information.*

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

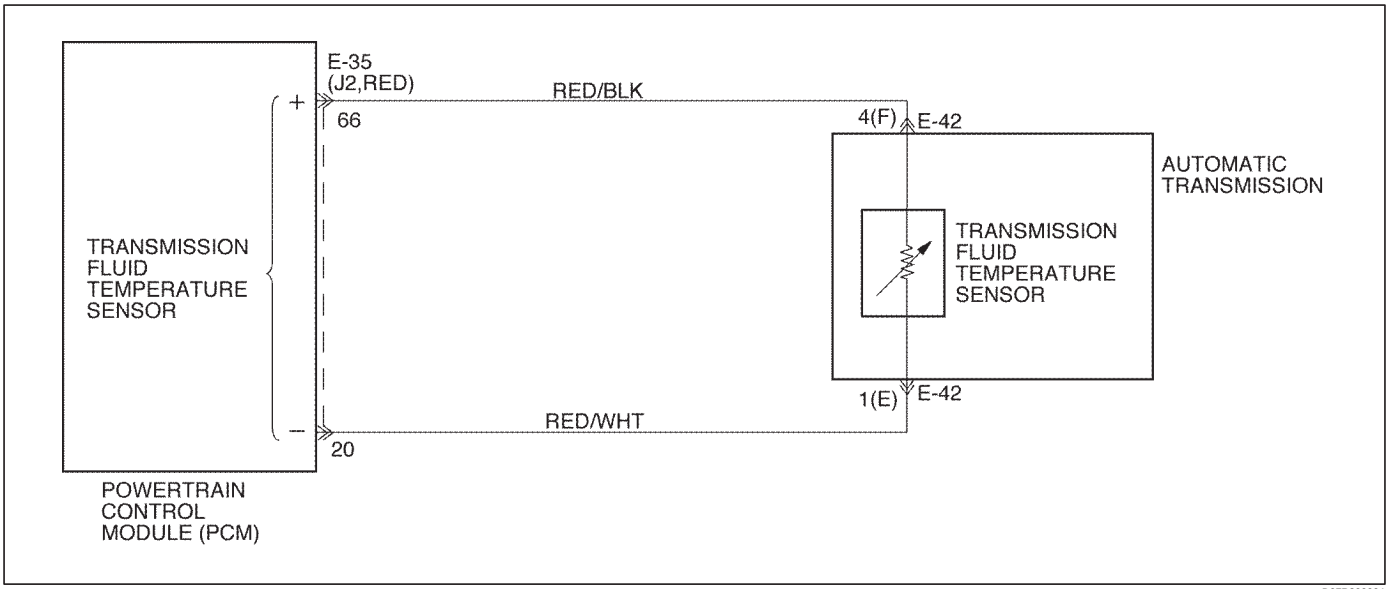
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0706 Transmission Range Switch (Mode Switch) Performance

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	Perform the following checks: ▼ The transmission linkage from the select lever to the manual valve is adjusted properly. ▼ Diagnostic circuit check. Were the checks performed?	Go to *Step 3*	—
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Select each transmission range: DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to *Diagnostic Aids*	Go to *Step 4*
4	Are all range switch pin displays incorrect?	Go to *Step 5*	Go to *Step 6*
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to *Mode Switch in Automatic Transmission (4L30–E) section.* If no problem was found, replace the range switch. Is the replacement complete?	Go to *Step 9*	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to *Step 7*	Go to *Step 8*
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to *Step 9*	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to *Step 9*	—
9	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance



Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5 volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the transmission fluid temperature increases to normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts.

When the PCM detects a TFT sensor that remains at the startup value, or a sensor that has a change delta of greater than 20˚C (36˚F) less than 1 second, DTC P0711 sets. DTC P0711 is a type D.

Conditions For Setting The DTC

- No VSS DTCs P0722 or P0723.
- No Transmission Component Slipping DTC P1870.
- Engine is running.
- TFT is between 20 A/D (Analog/Digital) counts and 248 A/D counts.
- TFT is between –40˚C (–40˚F) and +21˚C (69.8˚F) at engine startup.
- Engine coolant temperature is greater than 70˚C (150˚F).
- Engine coolant temperature has changed by greater than 50˚C (90˚F) since engine startup.
- Vehicle speed has been greater than 5 mph for greater than 410 seconds since engine startup (cumulative timer).
- TCC slip speed has been greater than 120 rpm for greater than 410 seconds since engine startup (cumulative timer).
- Battery voltage is between 10 and 16 volts.

All of the above is true and either of the following occurs:

- If the sensor is stuck, the TFT has not changed for greater than 2 counts (from startup temperature) for greater than 410 seconds.
- If the sensor shows an unrealistic change, the TFT exhibits a change delta of greater than 20˚C (36˚F), greater than 14 times in 7 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Inspect the wiring for poor electrical connections at the transmission 7-way connector. Look for the following conditions:
  a. A bent terminal
  b. A backed out terminal
  c. A damaged terminal
  d. Poor terminal tension
  e. A chafed wire
  f. A broken wire inside the insulation

▼When diagnosing for an intermittent short or open connection, move the wiring harness while watching the test equipment for a change.

▼First diagnose and clear any engine DTCs or TP Sensor codes. Then inspect for any transmission DTCs that may have reset.

Test Description

The number below refers to the step number on the diagnostic chart:

3. This test checks PCM and associated wiring up to the 7–way connector. If the voltage increases to match chart the problem is isolated to the transmission wiring.

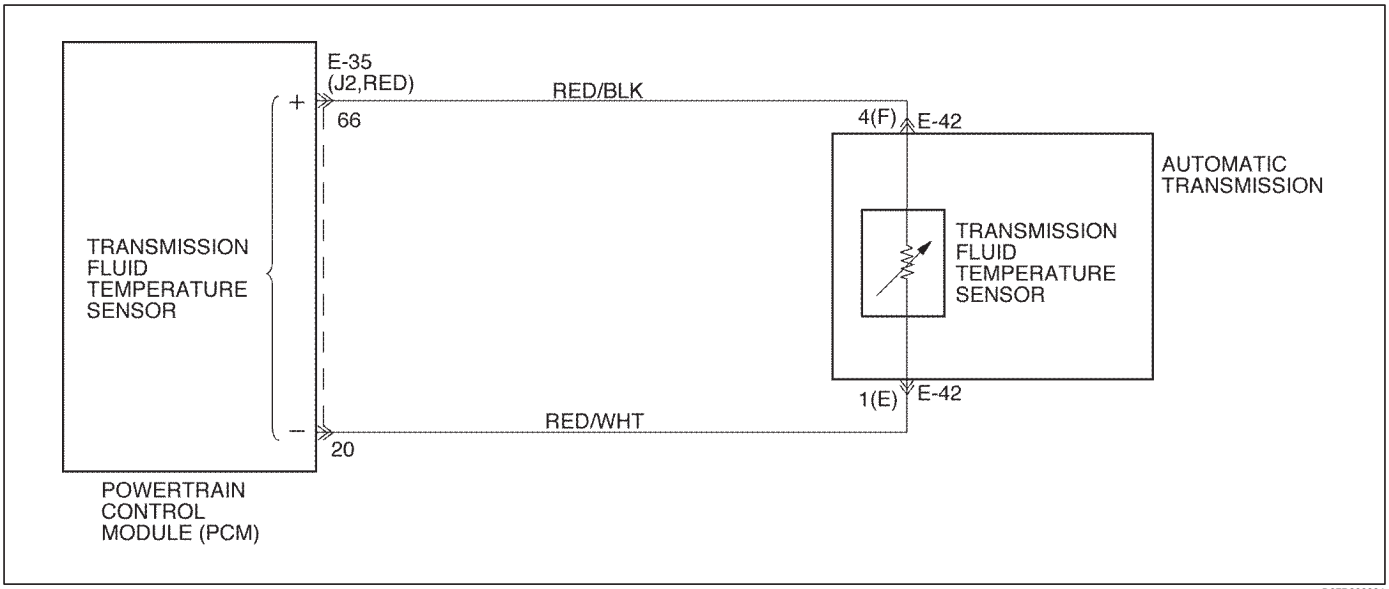
DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	Perform the transmission fluid checking procedure. Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section.* Did you perform the fluid checking procedure?	Go to *Step 3*	Go to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section*
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch to the “on” position. NOTE: Before clearing DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data. 3. Record the DTC Freeze Frame and Failure Records. 4. Select TFT on the scan tool. 5. While observing the scan tool display, move or massage the engine wiring harness from PCM connectors E35–66 and E35–20 to the transmission 7–way connector E–42. Does the TFT change by more than ±20˚C (36˚F)?	Go to *Step 6*	Go to *Step 4*
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–42. 3. Install Jumper Harness on the transmission side of the 7–way connector E–42. 4. Using the J39200 DVOM and J35616 Connector Test Adapter Kit, connect the DVOM leads from terminal E42–4(F) to terminal E42–1(E). 5. Set the DVOM on MIN/MAX to measure resistance. 6. Record the TFT sensor resistance. 7. Move or massage the automatic transmission wiring harness assembly from the PCM to the TFT sensor connector. (See Transmission Fluid Temperature (TFT) Sensor Specifications.) Does the DVOM MAX display a resistance greater than the value recorded in Action item 6 of this step?	Go to *Step 7*	Go to *Step 5*
5	Does the DVOM MIN display a resistance less than the value recorded in Action item 6 of step 4?	Go to *Step 8*	—
6	Inspect circuit RED/BLK and RED/WHT of the engine wiring harness for an intermittent open or short condition. Repair the circuits if necessary. Did you find a problem?	Go to *Step 12*	Go to *Step 11*

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance (Cont'd)

Step	Action	Yes	No
7	Inspect the automatic transmission wiring harness assembly for an intermittent open in circuits RED/BLK and RED/WHT. Did you find a problem?	Go to *Step 9*	Go to *Step 10*
8	Inspect the automatic transmission wiring harness assembly for an intermittent shorted condition in circuits RED/BLK and RED/WHT. Did you find a problem?	Go to *Step 9*	Go to *Step 10*
9	Replace the automatic transmission wiring harness assembly. Is the replacement complete?	Go to *Step 12*	—
10	Replace TFT Sensor. Refer to *Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 12*	—
11	Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 12*	—
12	In order to verify your repair, perform the following procedure. 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle and ensure the following conditions are met: ▼The TFT changes by more than 2.25˚C (4.05˚F) for 11 seconds since startup. ▼The TFT does not change by more than 20˚C (36˚F) within 0.200 second for a period of at least 11 seconds. 4. Select Specific DTC. 5. Enter DTC P0711. Has the test run and passed?	System OK	Begin the diagnosis again Go to *Step 1*

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input



Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high. The PCM detects high signal voltage. As the transmission fluid temperature increases to the normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts. With transmission fluid over temperature and DTC P0218 also set, check the transmission cooling system.

This DTC detects a continuous short to ground in the TFT signal circuit or the TFT sensor. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is “on”.
- TFT sensor indicating a voltage less than 0.4 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Check harness routing for a potential short to ground in circuit RED/BLK. Scan tool TFT display should rise steadily to about 100˚C (212˚F), then stabilize.
- Inspect the wiring for poor electrical connection at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- The temperature to resistance value scale may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a “skewed” (mis–scaled) sensor.

  A “skewed” sensor could result in delayed garage shifts or TCC complaints.
- Verify customer driving habits, trailer towing, etc.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for a short to ground or a “skewed” sensor.
4. This test checks for an internal fault within the transmission by creating an open.

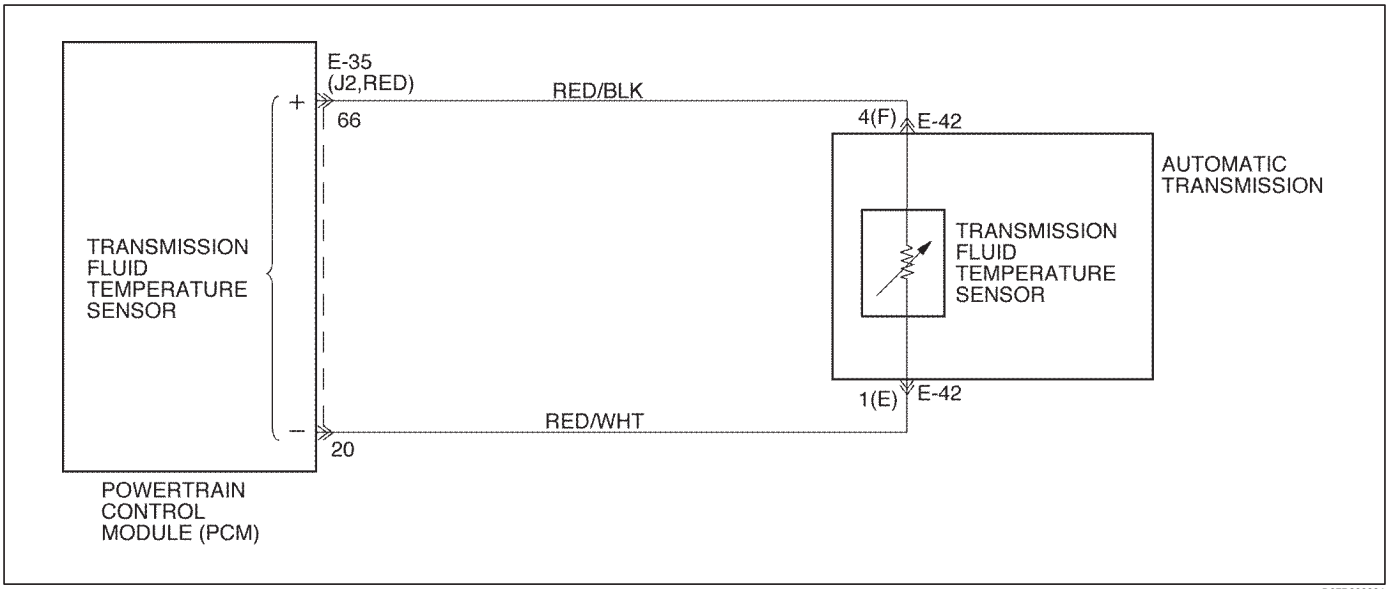
DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	Perform the transmission fluid checking procedure. Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section* Was the fluid checking procedure performed?	Go to *Step 3*	Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section*
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Does the scan tool display a TFT sensor signal voltage less than 0.4 volts?	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–42. 3. Turn the ignition “on”. Does the TFT signal voltage change to match the voltage 4.92 volts?	Go to *Step 5*	Go to *Step 10*
5	Using the J39200 DVOM, measure the resistance between terminals E42–4(F) and E42–1(E). Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 6*
6	1. Disconnect the transmission 7–way connector E–42. 2. Using the J39200 DVOM, measure the resistance between terminals E42–4(F) and E42–1(E). Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 7*
7	1. Remove the transmission oil pan. Refer to *Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section.* 2. Check the internal wiring harness for a short to ground. Was a problem found?	Go to *Step 9*	Go to *Step 8*
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 9*
9	Replace the TFT Sensor. Is the replacement complete?	Go to *Step 13*	—
10	Check circuit RED/BLK for a short to ground. Was a problem found?	Go to *Step 13*	Go to *Step 11*

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (Cont'd)

Step	Action	Yes	No
11	Check the PCM for faulty connections. Was a problem found?	Go to *Step 13*	Go to *Step 12*
12	Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 13*	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT sensor indicates a voltage greater than 0.33 volts for 2 seconds. 2. Review the scan tool "DTC info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input



D07R200004

Circuit Description

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the transmission fluid temperature warms to the normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to about 1.5 to 2 volts.

This DTC detects a continuous open or short to power in the TFT signal circuit or the TFT sensor. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is “on”.
- TFT sensor indicating a voltage greater than 4.86 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100˚C (212˚F), then stabilize.
- The temperature to resistance value scale may be used to check the TFT sensor at the various temperature levels to evaluate the possibility of a “skewed” (mis–scaled) sensor.

  A “skewed” sensor could result in hard shifts or TCC complaints.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This check verifies problem in the TFT sensor circuit.
4. This test simulates a TFT sensor DTC P0712. If the PCM recognizes the low signal voltage (high temperature), and the scan tool displays 146˚C (295˚F) or greater, the PCM and wiring are OK.
5. This test checks the TFT sensor and internal wiring harness.

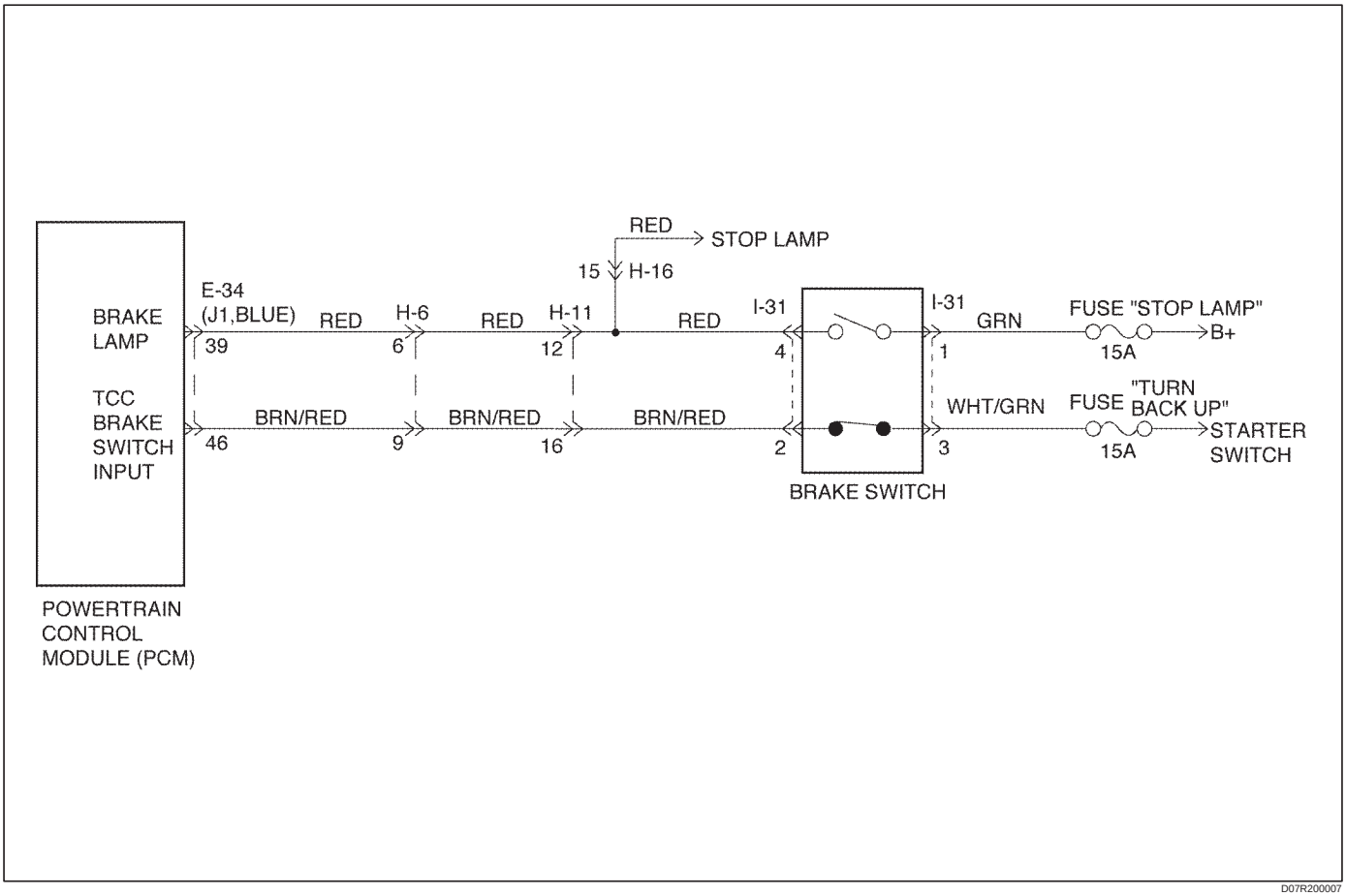
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	Perform the transmission fluid checking procedure. Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section.* Was the fluid checking procedure performed?	Go to *Step 3*	Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section*
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Does the scan tool display a TFT sensor signal voltage greater than 4.86 volts?	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–42. 3. Install a fused jumper wire from terminal E42–4(F) to E42–1(E) on the engine harness. 4. Turn the ignition “on”. Does the TFT signal voltage drop to less than 0.4 volts?	Go to *Step 5*	Go to *Step 10*
5	1. Turn the ignition “off”. 2. Using the J39200 DVOM, measure the resistance between terminals E42–4(F) and E42–1(E). Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 6*
6	1. Disconnect the transmission 7–way connector E–42. 2. Using the J39200 DVOM, measure the resistance between terminals E42–4(F) and E42–1(E). Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 7*
7	1. Remove the transmission oil pan. 2. Check the internal wiring harness for an open. Refer to *Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section.* Was a problem found and corrected?	Go to *Step 14*	Go to *Step 8*
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Transmission Fluid Temperature (TFT) Sensor Specifications.)	Go to *Diagnostic Aids*	Go to *Step 9*
9	Replace TFT sensor. Refer to *Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 14*	—

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (Cont'd)

Step	Action	Yes	No
10	Check circuit RED/BLK for an open or short to B+. Was a problem found?	Go to *Step 14*	Go to *Step 11*
11	Check circuit RED/WHT for an open. Was a problem found?	Go to *Step 14*	Go to *Step 12*
12	Check the PCM for faulty or intermittent connections. Was a problem found?	Go to *Step 14*	Go to *Step 13*
13	Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 14*	—
14	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: 2. TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0719 Brake Switch Circuit Low (Stuck On)



D07R200007

Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit BRN/RED to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to *Diagnostic Aids*).

When the PCM detects an open brake switch circuit (0 volts, low input) during accelerations, then DTC P0719 sets. DTC P0719 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects an open brake switch or circuit (0 volts) for 15 minutes without changing for 2 seconds, and the following events occur seven consecutive times.
  - The vehicle speed is less than 8 km/h (5 mph).
  - then the vehicle speed is 8–32 km/h (5–20 mph) for 4 seconds.
  - then the vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0719 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

Test Description

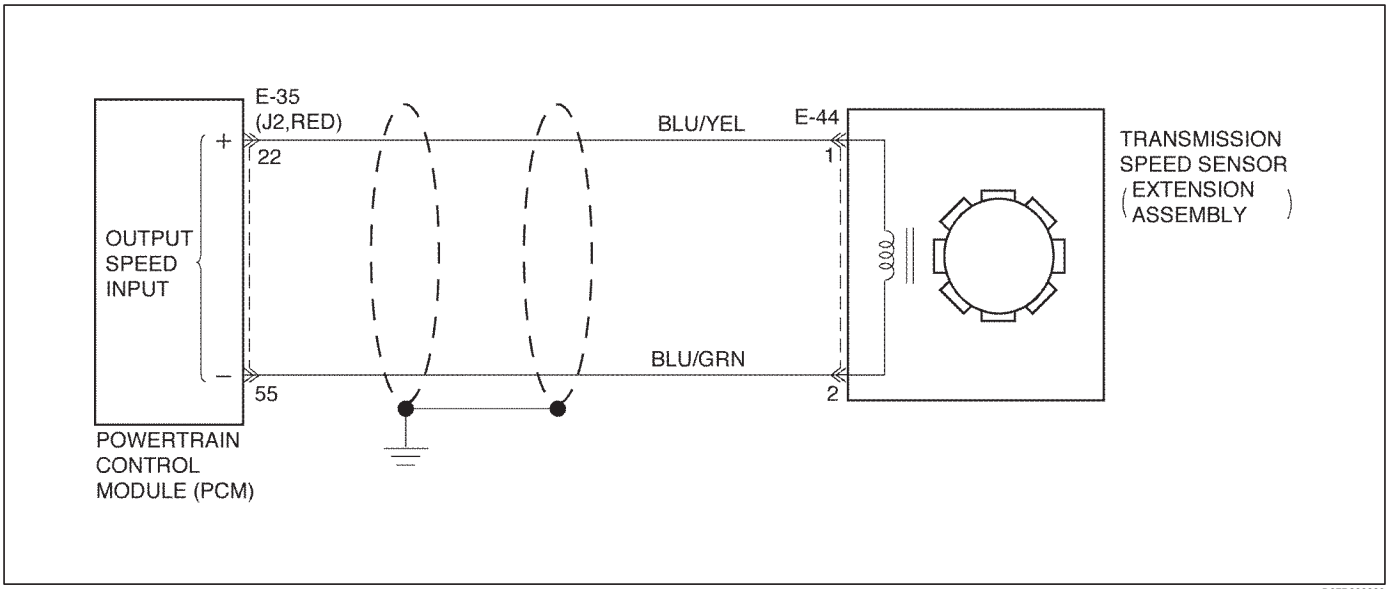
The numbers below refer to the step numbers on the diagnostic chart:

3. This step isolates the brake switch as a source for setting the DTC.

DTC P0719 Brake Switch Circuit Low (Stuck On)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to *Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the scan tool. 2. With the engine “off,” turn the ignition switch to the “on” position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the “Failure Records” for reference. Using the “Clear Info” function will erase the stored “Failure Records” from the PCM. 3. Record the “DTC Failure Records”, then clear the DTC(s). 4. Select “TCC Brake Switch” on the scan tool. 5. Disconnect the brake switch connector from the brake switch. 6. Connect a test lamp from cavity I31–3 of the brake switch connector to a known good ground. Is the test lamp ON?	Go to *Step 3*	Go to *Step 4*
3	Install a J 36169–A Fused Jumper Wire from terminal I31–2 to terminal I31–3 of the brake switch connector. Did the TCC Brake Switch status change from Open to Closed?	Go to *Step 7*	Go to *Step 9*
4	1. Remove the fuse “TURN, BACK UP”. 2. Inspect the fuse for an open. Is the fuse open?	Go to *Step 5*	Go to *Step 8*
5	Inspect circuit WHT/GRN for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to *Step 11*	Go to *Step 6*
6	Inspect circuit BRN/RED for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to *Step 11*	Go to *Step 10*
7	Replace the brake switch. Is the replacement complete?	Go to *Step 11*	—
8	Inspect circuit WHT/GRN for an open condition. Repair the circuit if necessary. Did you find and correct an open condition?	Go to *Step 11*	—
9	Inspect circuit BRN/RED for an open. Did you find an open condition?	Go to *Step 11*	Go to *Step 10*
10	Replace the PCM. Is the replacement complete?	Go to *Step 11*	—
11	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. With the engine “off,” turn the ignition switch to the “on” position. 4. Do not depress the brake pedal. 5. Verify that the Brake Switch status indicates “Closed” (12 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0719. Has the test run and passed?	System OK	Begin the diagnosis again. Go to *Step 1*

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input



D07R200006

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

- No MAP DTCs P0107 or P0108, P0106, P1106, P1107.
- No TPS DTCs P0122 or P0123.
- Not in Park or Neutral.
- TP angle is greater than 10%.
- Engine vacuum is between 0 and 70kPa.
- Engine speed is between 3000 and 7000 rpm.
- Transmission output speed is less than 0 rpm.
- All conditions met for 5 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool. The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- An OSS DTC P0722 will set when no output speed is at detected at start off.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

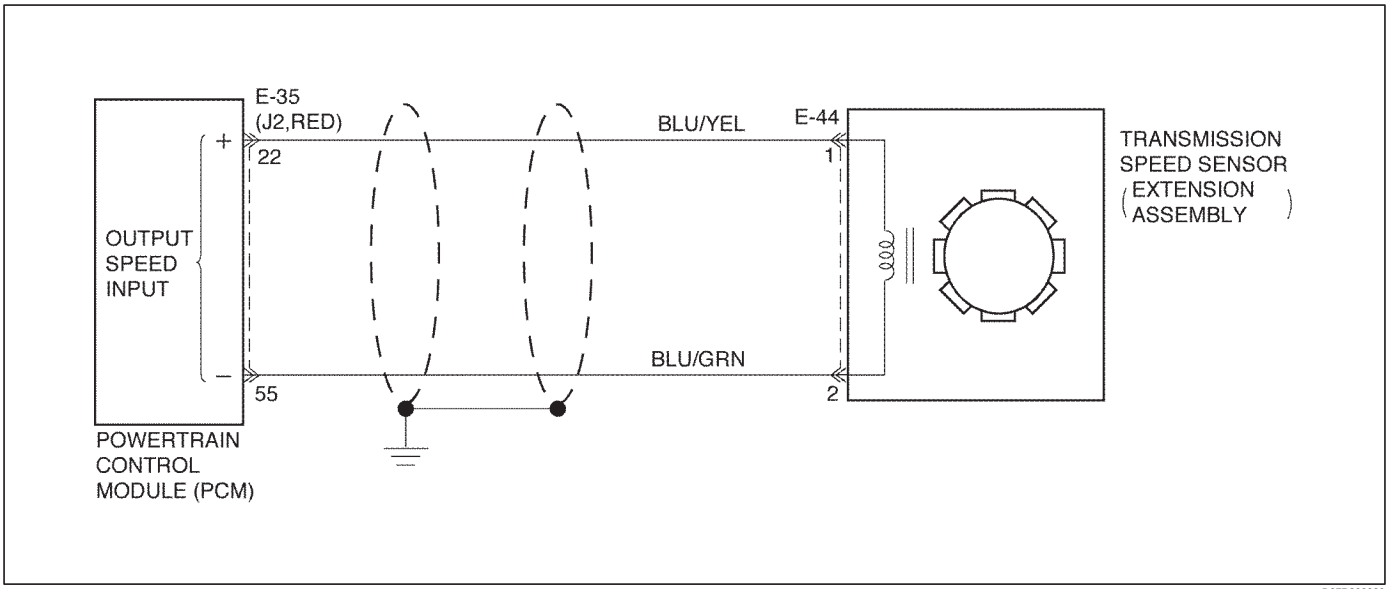
DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the “Trans Output Speed” increase with the drive wheel speed?	Go to *Diagnostic Aids*	Go to *Step 3*
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to *Step 16*	Go to *Step 4*
4	1. Turn the ignition “off”. 2. Disconnect the E35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals E35–22 and E35–55. Is the reading 3000 ohms?	Go to *Step 5*	Go to *Step 6*
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to *Step 7*	Go to *Step 8*
6	Inspect circuits BLU/YEL and BLU/GRN for a poor connection or an open circuit. Was a problem found?	Go to *Step 17*	Go to *Step 8*
7	1. Reconnect the E35 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine “off”, turn the ignition “on”. 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals E44–1 and E44–2. Is the reading between 4.0 to 5.1 volts?	Go to *Step 16*	Go to *Step 10*
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to *Speed Sensor (Extension Assembly) in Automatic Transmission (4L30–E) section.* Was a problem found?	Go to *Step 17*	Go to *Step 9*
9	Replace the OSS. Is the replacement complete?	Go to *Step 17*	—
10	Was the reading in step 7 less than 4.0 volts?	Go to *Step 12*	Go to *Step 11*
11	Was the reading in Step 7 greater than 5.1 volts?	Go to *Step 15*	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit BLU/YEL. Is the reading between 4.0 to 5.1 volts?	Go to *Step 13*	Go to *Step 14*

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit BLU/GRN. Is the repair complete?	Go to *Step 17*	—
14	Check circuit BLU/YEL for a short to ground or open. Was a problem found and corrected?	Go to *Step 17*	Go to *Step 16*
15	Repair the short to B+ in circuit BLU/YEL. Is the repair complete?	Go to *Step 17*	—
16	Replace the PCM. Refer to *Powertrain Control Module (PCM) in automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 17*	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent



Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a fast decrease of output speed when engine running in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

Drive range

- Engine running time is greater than 5 seconds.
- Output speed is greater than 1300 rpm for 2 second.
- NORAW–NOLAST < 200 rpm for 2 seconds.
  - NORAW: Latest raw data of output shaft speed.
  - NOLAST: Fitered previous data of output speed.
- Transmission negative output speed change is greater than 1300 rpm.
- Conditions met for 3 seconds.

Action During Detection Time

- Output speed value is frozen

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- A OSS DTC P0723 will set when output speed has been detected and is lost.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

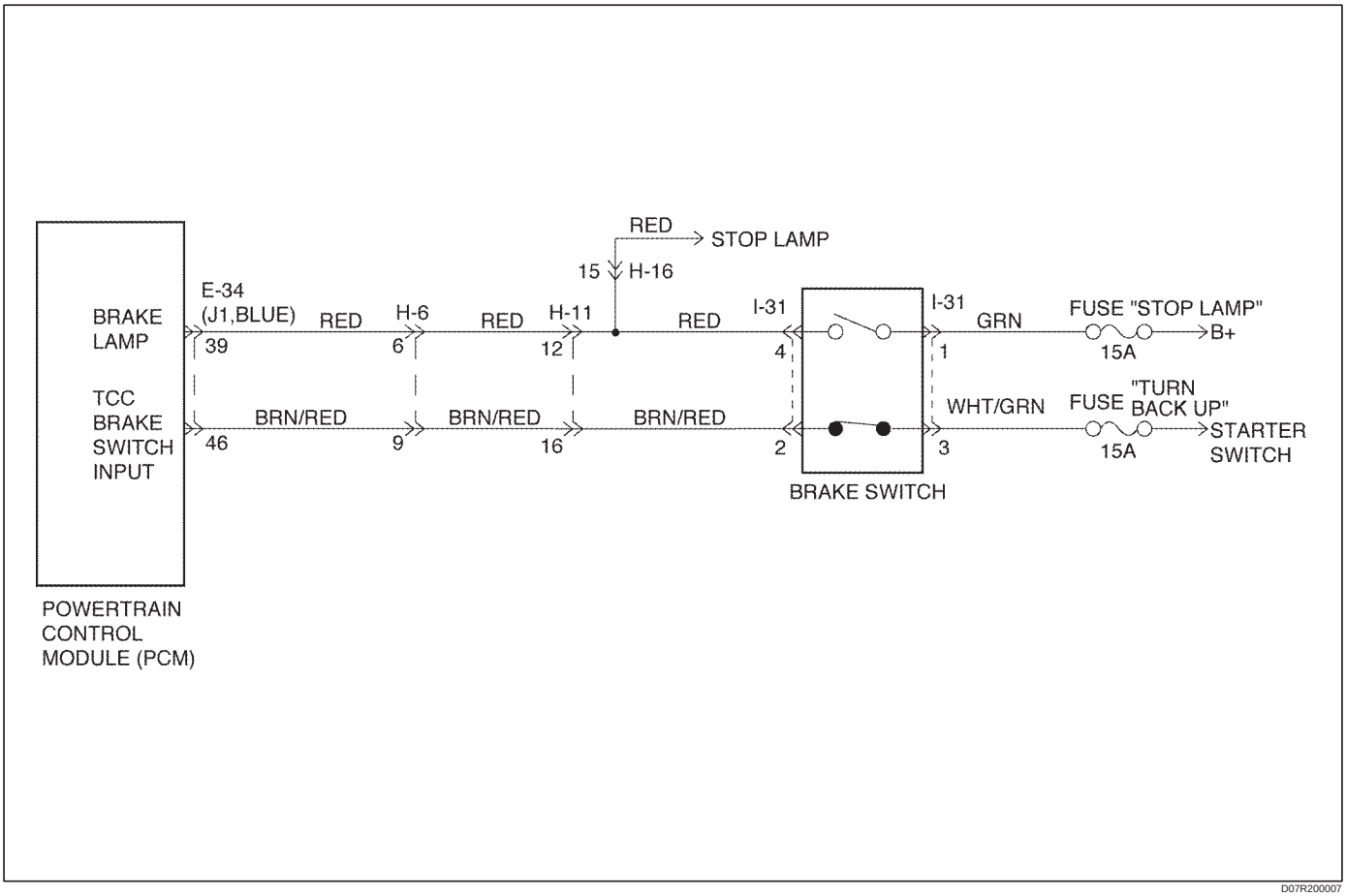
DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the “Trans Output Speed” increase with the drive wheel speed?	Go to *Diagnostic Aids*	Go to *Step 3*
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to *Step 16*	Go to *Step 4*
4	1. Turn the ignition “off”. 2. Disconnect the E35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals E35–22 and E35–55. Is the reading 3,000 ohms?	Go to *Step 5*	Go to *Step 6*
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to *Step 7*	Go to *Step 8*
6	Inspect circuits BLU/YEL and BLU/GRN for a poor connection or an open circuit. Was a problem found?	Go to *Step 17*	Go to *Step 8*
7	1. Reconnect the E35 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine “off”, turn the ignition “on”. 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals E44–1 and E44–2. Is the reading between 4.0 to 5.1 volts?	Go to *Step 16*	Go to *Step 10*
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to *Speed Sensor (Extension Assembly) in Automatic Transmission (4L30–E) section.* Was a problem found?	Go to *Step 17*	Go to *Step 9*
9	Replace the OSS. Is the replacement complete?	Go to *Step 17*	—
10	Was the reading in step 7 less than 4.0 volts?	Go to *Step 12*	Go to *Step 11*
11	Was the reading in Step 7 greater than 5.1 volts?	Go to *Step 15*	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit BLU/YEL. Is the reading between 4.0 to 5.1 volts?	Go to *Step 13*	Go to *Step 14*

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit BLU/GRN. Is the repair complete?	Go to *Step 17*	—
14	Check circuit BLU/YEL for a short to ground or open. Was a problem found and corrected?	Go to *Step 17*	Go to *Step 16*
15	Repair the short to B+ in circuit BLU/YEL. Is the repair complete?	Go to *Step 17*	—
16	Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 17*	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0724 Brake Switch Circuit High (Stuck Off)



D07R200007

Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit BRN/RED to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to *Diagnostic Aids*).

When the PCM detects a closed brake switch circuit (12 volts, high input) during decelerations, then DTC P0724 sets. DTC P0724 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects a closed brake switch circuit (12 volts) without changing and the following events occur seven consecutive times.
  - The vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.
  - then the vehicle speed is between 8–32 km/h (5–20 mph) for 4 seconds.
  - then the vehicle speed is less than 8 km/h (5 mph).

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0724 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go, expressway).
- Check brake switch for proper mounting and adjustment.

Test Description

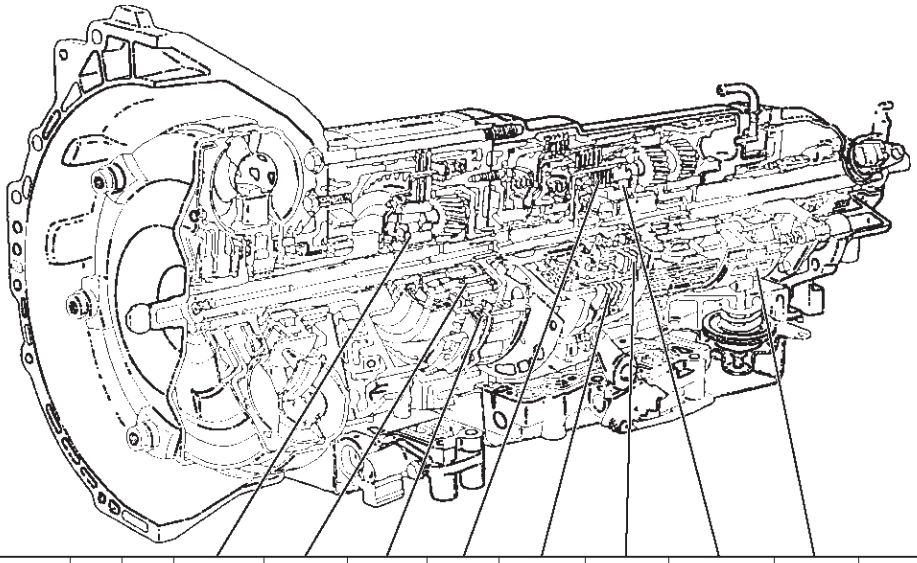
The numbers below refer to the step numbers on the diagnostic chart:

2. This step isolates the brake switch as a source for setting the DTC.

DTC P0724 Brake Switch Circuit High (Stuck Off)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to *Step 2*	Go to *Powertrain OBD System Check*
2	1. Install the scan tool. 2. With the engine "off," turn the ignition switch to the "on" position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the "Failure Records" for reference. Using the "Clear Info" function will erase the stored "Failure Records" from the PCM. 3. Record the DTC Failure Records, then clear the DTC(s). 4. Select "Brake Switch" on the scan tool. 5. Disconnect the brake switch connector from the brake switch. Did the TCC brake switch status change from "Closed" to "Open"?	Go to *Step 3*	Go to *Step 4*
3	Replace the brake switch. Is the replacement complete?	Go to *Step 6*	—
4	Inspect circuit BRN/RED for a short to B+ condition. Repair the circuit if necessary. Did you find a short to B+ condition?	Go to *Step 6*	Go to *Step 5*
5	Replace the PCM. Is the replacement complete?	Go to *Step 6*	—
6	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select "Clear Info". 3. With the engine "off" turn the ignition switch to the "on" position. 4. Apply the brake pedal. 5. Verify that the brake switch status indicates "Open" (0 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0724. Has the test run and passed?	System OK	Begin the diagnosis again. Go to *Step 1*

DTC P0730 Gear Error Without Input Speed



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE FREE WHEEL (OFW)	O/RUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASM (PFW)	BAND ASM (B)	ENGINE BRAKING	TORQUE CONV. CLUTCH
P-N		OFF	ON		APP							NO	NO
R	REVERSE	OFF	ON	LD	APP			APP		LD		NO	NO
D	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
	4TH	OFF	OFF	FW		APP	APP		APP	NE		YES	ECCC
3	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
2	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
L	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE APP : APPLIED

D07RY00055

Circuit Description

- The Powertrain Control Module (PCM) calculates the slippage of the converter and transmission based upon the engine speed, the output speed, and the current gear ratio.
- The slippage of the converter at a high enough engine speed is low. The transmission should not slip more than a given value when there is no shift.
- This DTC detects a slip at each gear. This is a type “C” DTC.

Conditions For Setting The DTC

- No Output Speed Sensor DTC(s) P0722, P0723.
- Not in Park, Neutral, or Reverse.
- Engine speed is greater than 3,500 rpm.
- 3 seconds since upshift.
- No Transmission Range Switch DTC(s) P0705, P0706.
- 3 seconds since downshift.
- 3 seconds since garage shift (N→D).
- And one of the following conditions occur:
  - Slip is greater than 508 rpm in 1st gear.
  - Slip is greater than 468 rpm in 2nd gear.
  - Slip is greater than 449 rpm on 3rd gear.
  - Slip is greater than 440 rpm on 4th gear.
- All conditions met for 5.5 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

▼ The PCM will illuminate the CHECK TRANS Lamp.
▼ Turn force motor OFF.

Conditions For Clearing The DTC/CHECK TRANS Lamp

▼ The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
▼ The DTC can be cleared from PCM memory by using a scan tool.
▼ The DTC can also be cleared from memory when the vehicle has made 40 warmup cycles without a failure reported.
▼ The PCM will cancel the DTC Actions Taken items when the fault conditions no longer exist and the ignition is cycles “off” long enough to power down the PCM.

Diagnostic Aids

▼ Check for intermittent output speed sensor circuit problems.
▼ Check for possible incorrect calibration. (PCM part No., tire specification, and rear axle ratio)

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This step checks for possible low fluid level causing slipping resulting in an undefined gear ratio.
4. This step checks for correct gear ratios for commanded gears.
5. This step checks for low line pressure.

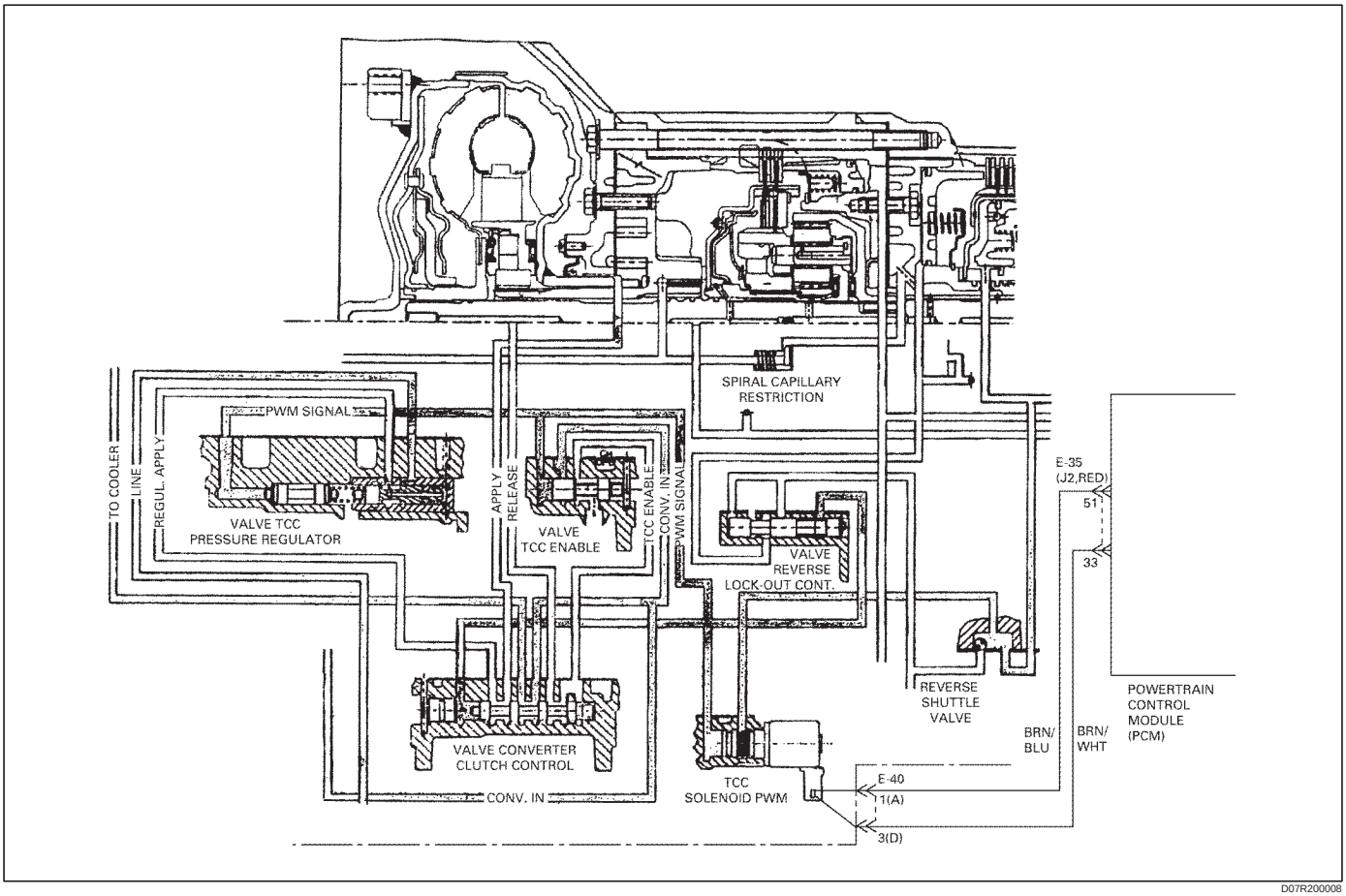
DTC P0730 Gear Error Without Input Speed

Step	Action	Yes	No
1	Were you sent here from the “On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	Visually inspect the transmission cooling system for fluid leaks. ▼ Refer to *Chart 16: Possible Causes of Transmission Fluid Leaks of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section* Was condition found and corrected?	Go to *Step 7*	Go to *Step 3*
3	Refer to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section.* Has transmission fluid checking procedure been performed?	Go to *Step 4*	Go to *Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section*
4	1. Install the scan tool. 2. Turn the ignition switch to the “on” position. 3. Engine not running. NOTE: Before clearing DTC(s) use the scan tool to record the “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 4. Record the Failure Record data. 5. Use the scan tool snapshot mode to record transmission gear ratios. 6. Drive vehicle in transmission gear ranges L, 2, 3, and D with the engine speed is greater than 3,500 rpm for 5.5 seconds. 7. Record each transmission gear. 1st:2.73 – 2.99 2nd:1.54 – 1.71 3rd:0.93 – 1.05 4th:0.66 – 0.78 Does commanded gear ratio match ranges as shown?	Refer to *Diagnostic Aids*	Go to *Step 5*

DTC P0730 Gear Error Without Input Speed (Cont'd)

Step	Action	Yes	No
5	Perform line pressure check. ▼Refer to *Line Pressure Test in Automatic Transmission (4L30–E) section.* Was condition found and corrected?	Go to *Step 7*	Go to *Step 6*
6	Check for possible clutch slippage. ▼Refer to *Chart 6: Diagnostic Trouble Code (DTC) P0730 of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section.* Was condition found and corrected?	Go to *Step 7*	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear info" function. 2. Operate the vehicle under the following conditions: ▼Drive the vehicle in D4 with the engine speed greater than 3,500 rpm to obtain anyone of the following gear ratios for seven seconds. 1st 1:2.73 – 1:2.99 2nd 1:1.54 – 1:1.71 3rd 1:0.93 – 1:1.05 4th 1:0.66 – 1:0.78 Has the last test failed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0742 Torque Converter Clutch (TCC) System Stuck On



D07R200008

Circuit Description

The PCM energizes the TCC solenoid by creating an ignition voltage on circuit BRN/BLU. When ignition voltage is energized by the PCM, the TCC solenoid stops converter signal oil from exhausting. This causes converter signal oil pressure to increase and move the TCC valve. The TCC solenoid will deenergize when the PCM no longer provides ignition voltage. When the TCC solenoid is deenergized, it will exhaust fluid and release the TCC.

This DTC detects low torque converter slip when the TCC is commanded “off”. This is a type “B” DTC.

Conditions For Setting The DTC

The following conditions occur once per TCC cycle, three consecutive times:

- ▼ No TPS DTCs P0122 or P0123.
- ▼ No OSS DTCs P0722 or P0723.
- ▼ No TCC solenoid DTC P1860.
- ▼ TP angle is greater than 20%.
- ▼ Engine speed is greater than 500 rpm and less than 3,000 rpm.
- ▼ Engine vacuum is between 0 and 70 kPa.
- ▼ Commanded gear is not 1st.
- ▼ Gear range is D4.
- ▼ TCC is commanded “off”.
- ▼ No TCC Stuck off DTC P1870.
- ▼ TCC slip speed is between –20 and 40 rpm for 2 seconds.
- ▼ Vehicle speed is greater than 25 km/h (15 mph) and less than 120 km/h (75 mph).
- ▼ Speed ratio is greater than 0.9 and less than 2.0.

Action Taken When The DTC Sets

- ▼ For lamp illuminate refer to *DTC type definition (type B).*
- ▼ Inhibit TCC engagement.

Conditions For Clearing The MIL/DTC

- ▼ The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- ▼ The DTC can be cleared from the PCM history by using a scan tool.
- ▼ The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- ▼ The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

▼ If the TCC is mechanically stuck “on” with the parking brake applied and any gear range selected, the TCC fluid will mechanically apply the TCC, possibly causing an engine stall.

Test Description

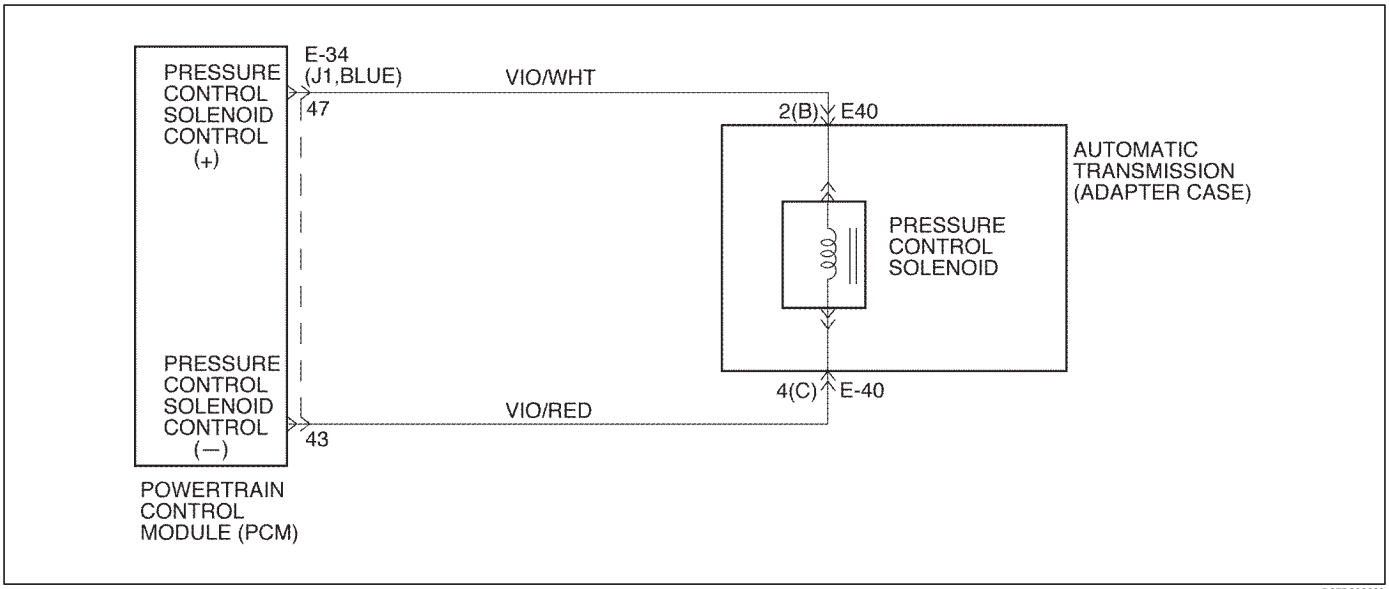
The number below refers to the step number on the diagnostic chart:

3. This test checks the mechanical state of the TCC. (When the PCM commands the TCC solenoid “off”, the slip speed should increase).

DTC P0742 Torque Converter Clutch (TCC) System Stuck On

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Using the scan tool, verify the “TP Sensor” operation. Are the “TP Sensor” values within 0.6 – 5.0 volts?	Go to *Step 3*	Go to *Diagnostic Aids*
3	Drive the vehicle in the D4 drive range in fourth gear under steady acceleration, with a TP angle greater than 20%. Does the scan tool display “TCC Slip Speed” between –30 and +30 rpm, while the displayed TCC solenoid state is “off”?	Go to *Step 4*	Go to *Diagnostic Aids*
4	The TCC is mechanically stuck “on”. Check the following items: ▼ Clogged exhaust orifice in the TCC solenoid. ▼ Converter clutch apply valve stuck in the apply position. ▼ Misaligned or damaged valve body gasket. ▼ Restricted release passage. Was a problem found and corrected?	Go to *Step 5*	—
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: TCC slip speed must be between 200 and 2,500 rpm for 4 seconds. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical



D07R200009

Circuit Description

The PCS is a PCM–controlled device used to regulate transmission line pressure. The PCM compares TPS voltage, engine rpm, and other inputs to determine the line pressure appropriate for a given load. The PCM will regulate the pressure by applying a varying amperage to the PCS. The applied amperage can vary from 70 to 1060 milliampere (mA), and is monitored by the PCM.
This DTC detects a continuous open or short to ground in the PCS circuit or the PCS. This is a type “C” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- The PCM detects that the different between commanded and actual current is 200 milliampere (mA) for over 1 second.
- Engine speed is greater than 300 rpm.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- Maximum line pressure.
- The PCM will illuminate the CHECK TRANS Lamp.
- Turn Force Motor OFF (Durability).

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM history by using a scan tool.
- The DTC will be cleared from memory when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 4–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

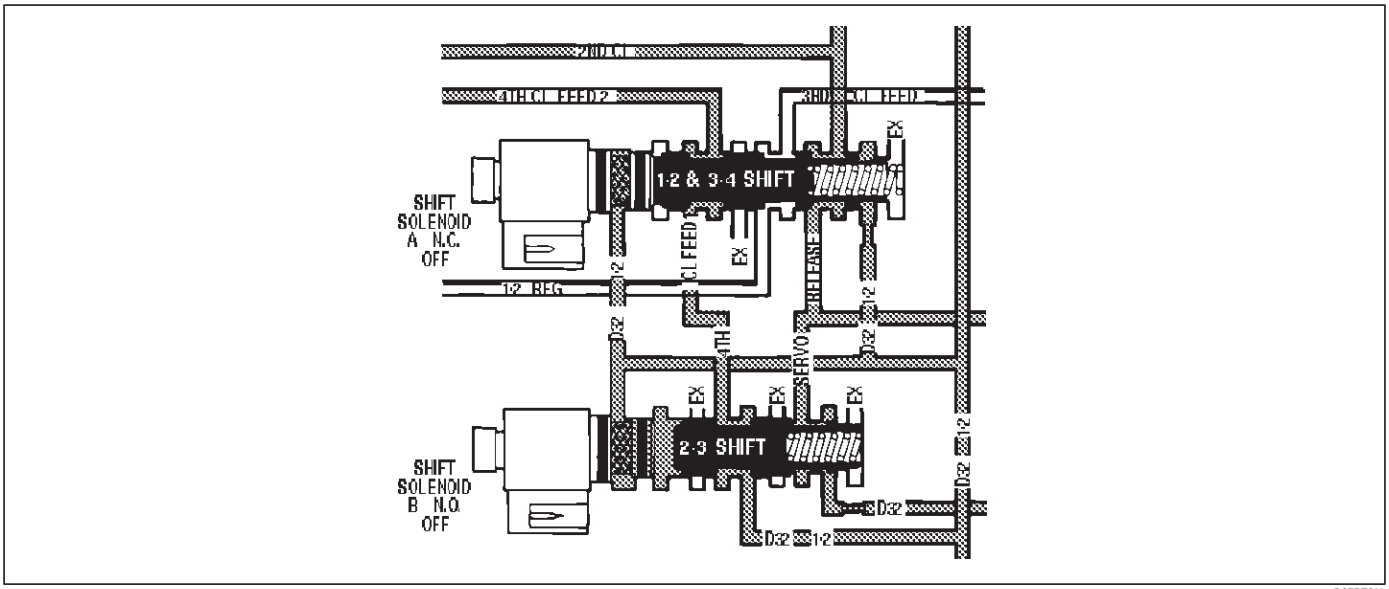
The numbers below refer to the *step numbers on the diagnostic chart:*

2. This test checks the ability of the PCM to command the PCS.
3. This test checks the PCS and internal wiring harness for incorrect resistance.

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Failure Records”. 4. While the engine is operating, put the transmission in Park. 5. Using the scan tool, apply 70 through 1060 milliampere (mA) while observing “PC Ref. Current” and “PC Act. Current”. Is the “PC Act. Current” reading always within 160 mA?	Go to *Diagnostic Aids*	Go to *Step 3*
3	1. Turn the ignition “off”. 2. Disconnect the transmission 4–way connector E–40. 3. Using the J39200 DVOM, measure the resistance between terminals E40–2(B) and E40–4(C). Is the resistance within 3–7 ohms?	Go to *Step 7*	Go to *Step 4*
4	1. Remove the transmission oil pan. Refer to *Solenoid (Adapter Case Valve Body) in Automatic Transmission (4L30–E) section.* 2. Disconnect the internal wiring harness at the PCS. 3. Measure the resistance of the PCS. Is the resistance within 3–7 ohms?	Go to *Step 6*	Go to *Step 5*
5	Replace the PCS. Is the replacement complete?	Go to *Step 10*	—
6	Repair the internal wiring harness for an open. Is the repair complete?	Go to *Step 10*	—
7	Inspect/repair circuits VIO/WHT and VIO/RED. Was a problem found?	Go to *Step 10*	Go to *Step 8*
8	Inspect/repair circuits VIO/WHT and VIO/RED for a short to ground or poor connections. Was a problem found?	Go to *Step 10*	Go to *Step 9*
9	Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 10*	—
10	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: The PCS duty cycle is not at its electrical high or low limit. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0751 Shift Solenoid A Performance (Stuck Off)



D07RT011

Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.
The DTC detects when there is only a 1–1–4–4 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTCs P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Transmission temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- Output speed is greater than 375 rpm.
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of conditions 1, 2 occur two consecutive times.

Condition 1:

- 2nd gear is commanded for ≥ 1 second.
- 40 ≤ Engine Torque ≤ 400 N·m
- Speed ratio ≥ 0.6
- Throttle position ≥ 10 %
- 800 ≤ TCC Slip ≤ 4000 rpm
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 1 second.

Condition 2:

- 3rd gear is commanded for ≥ 1 second.
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- –8000 ≤ TCC Slip ≤ 8000 rpm
- Speed ratio ≥ 0.45
- 0.62 ≤ Modeled Ratio ≤ 0.92 for 3 second.

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to *DTC type definition (type B).*
- Turn Force Motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

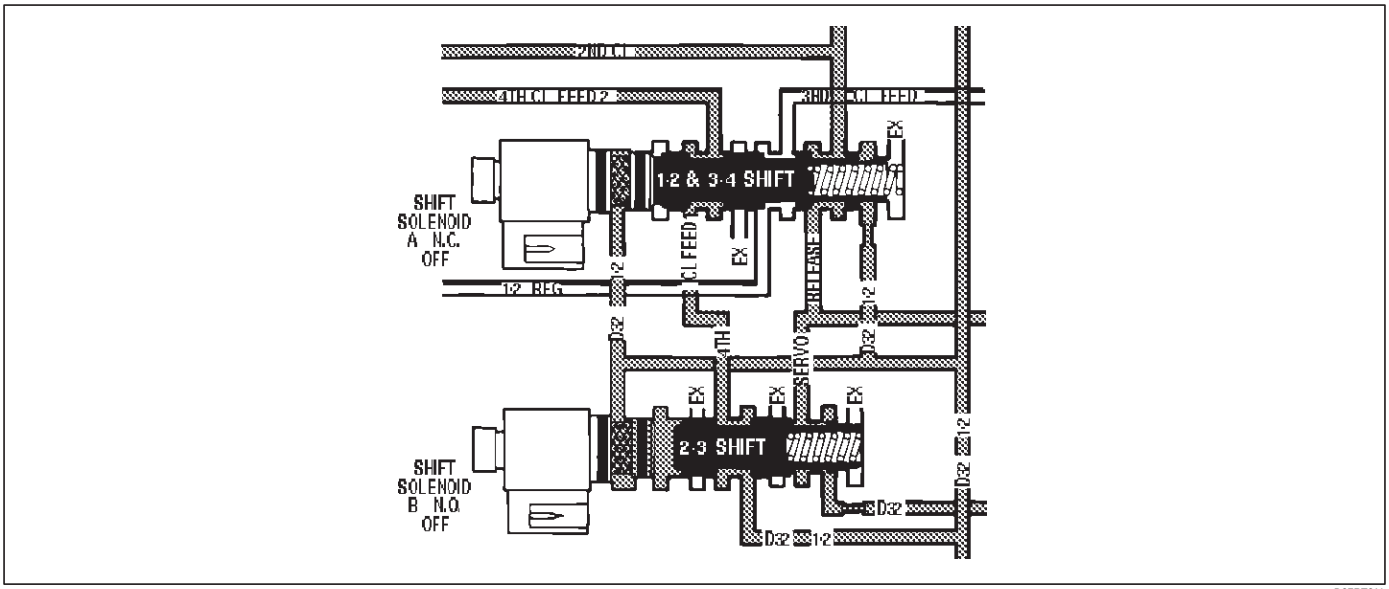
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0751 Shift Solenoid A Performance (Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to *Step 3*	Go to *“Range Switch Logic Table”*
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 1–1–4–4 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to *Step 4*	Go to *Diagnostic Aids*
4	Check the shift solenoid/hydraulic circuit for: ▼ One or both of the shift solenoids for an internal malfunction. ▼ Contamination or sediment in one or both of the shift solenoids. ▼ Damaged seals on one or both of the shift solenoids. Refer to *Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section.* Was a problem found and corrected?	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0752 Shift Solenoid A Performance (Stuck On)



Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.
The DTC detects when there is only a 2–2–3–3 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.3
- 1.5 ≤ Modeled Ratio ≤ 2.4 for 0.687 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 sec.
- 40 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 7 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to *DTC type definition (type B).*
- Turn Force Motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

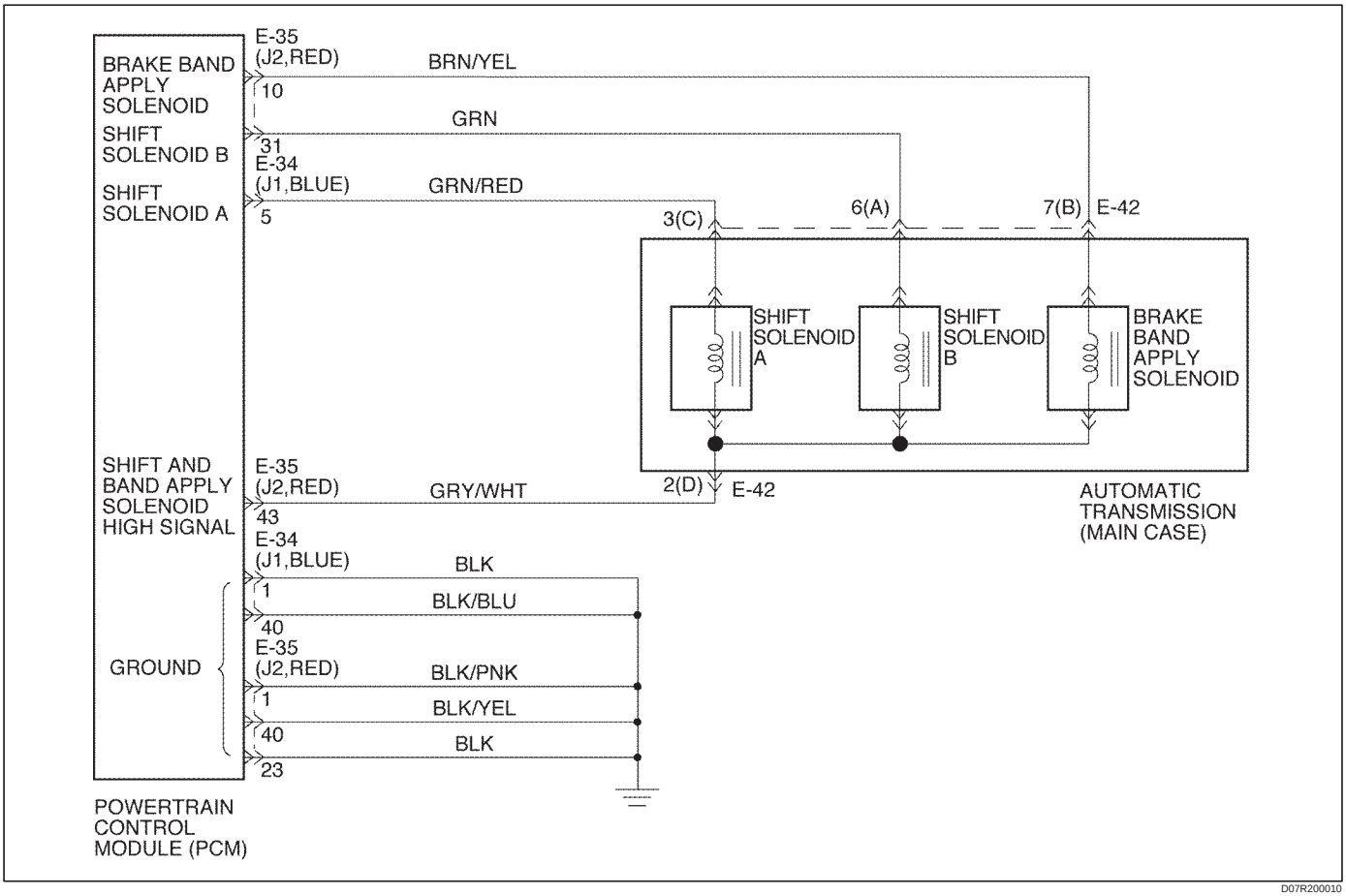
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0752 Shift Solenoid A Performance (Stuck On)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to *Step 3*	Go to *“Range Switch Logic Table”*
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 2–2–3–3 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to *Step 4*	Go to *Diagnostic Aids*
4	Check the shift solenoid/hydraulic circuit for: ▼ One or both of the shift solenoids for an internal malfunction. ▼ Contamination or sediment in one or both of the shift solenoids. ▼ Damaged seals on one or both of the shift solenoids. Refer to *Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section.* Was a problem found and corrected?	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0753 Shift Solenoid A Electrical



D07R200010

Circuit Description

- The shift solenoid A is a simple on/off solenoid located in the main case valve body. The solenoid is the normally closed type. In second or third gear the Powertrain Control Module (PCM) energizes the solenoid to open a fluid inlet port. When the port is open, fluid pressure actuates the shift valve.
- The solenoid is activated by a current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage, except in BACKUP MODE or when ignition is off the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid A circuit or the shift solenoid A. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+), or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 – 1.0 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- ▼When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- ▼An open ignition feed circuit can cause multiple DTCs to set.
- ▼A shift solenoid B DTC P0758 could also set with a shift solenoid A electrical failure.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the shift solenoid A from the ignition through the PCM.
5. This test measures the resistance of the component.
8. This test checks the function of the shift solenoid A and the transmission internal wiring harness.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

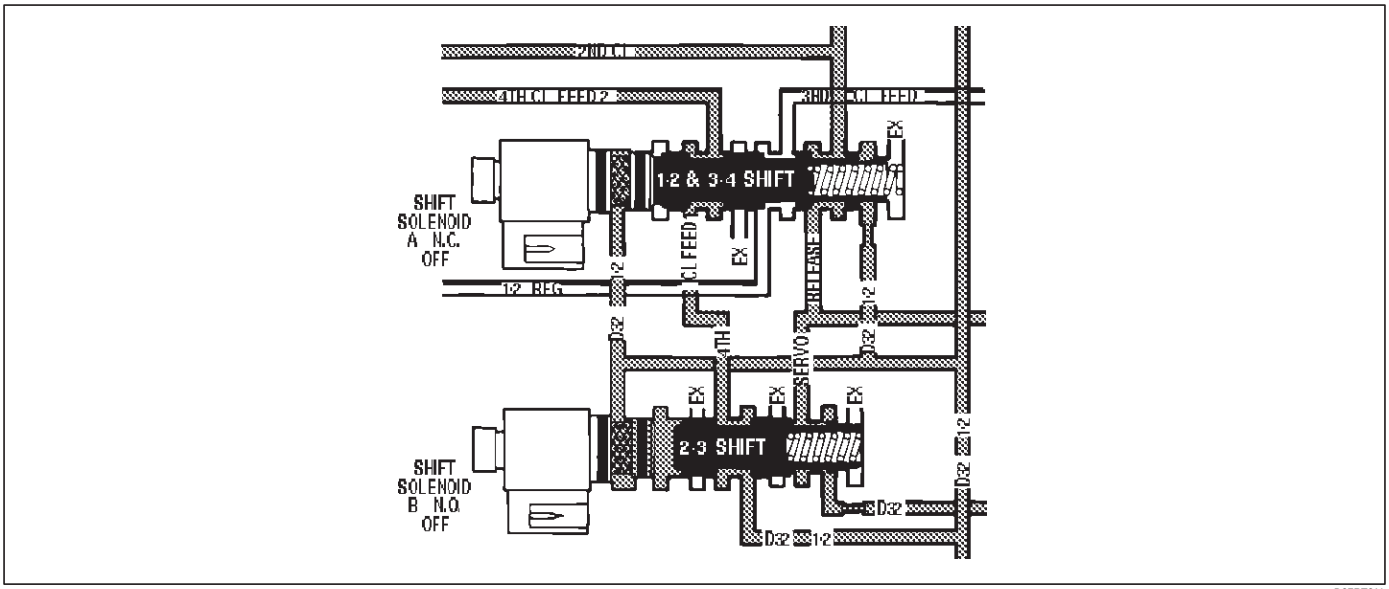
DTC P0753 Shift Solenoid A Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758, P1860 set?	Go to *Step 3*	Go to *Diagnostic Aids*
3	1. Turn the ignition “on”. 2. Using the J39200 DVOM, measure the voltage between PCM connector terminals E35–43 and E34–1 (GND). Is the voltage within 10–12 volts?	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connector. 3. Turn the ignition “on”. 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals E34–5 and ground. Is the voltage within 10 – 12 volts?	Go to *Step 10*	Go to *Step 5*
5	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals E35–43 and E34–5. Is the resistance within 18 – 20 ohms?	Go to *Step 6*	Go to *Step 8*
6	1. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connectors. 2. Using the J39200 DVOM, check a continuity between PCM terminals E34–5 and ground. Is there a continuity?	Go to *Step 11*	Go to *Step 7*
7	Using the J39200 DVOM, check a continuity between E-35 (RED) PCM terminal 43 and ground. Is there a continuity?	Go to *Step 12*	Go to *Step 9*

DTC P0753 Shift Solenoid A Electrical (Cont'd)

Step	Action	Yes	No
8	1. Disconnect the transmission main case 7–way connector E–42. 2. Using the J39200 DVOM, measure the resistance between terminals E42–2(D) and E42–3(C). Is the resistance within 18–20 ohms?	Go to *Step 13*	Go to *Step 14*
9	Check every connection at the PCM connector. Was a problem found?	Go to *Step 16*	Go to *Step 15*
10	The wiring harness between PCM connector terminals E34–5 and transmission harness terminal E42–3(C) is shorted to voltage. Was a problem found and corrected?	Go to *Step 17*	—
11	The wiring harness between PCM connector terminal E34–5 and transmission harness terminal E42–3(C) is shorted to ground. Was a problem found and corrected?	Go to *Step 17*	—
12	The wiring harness between PCM connector terminals E35–43 and transmission harness terminal E42–2(D) is shorted to ground. Was a problem found and corrected?	Go to *Step 17*	—
13	The wiring harness between PCM connector E-34 or E-35 and transmission 7–way connector E42 is open or poor connection. Was a problem found and corrected?	Go to *Step 17*	—
14	The shift solenoid A is faulty. Replace the shift solenoid A. Refer to *Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 17*	—
15	The PCM may be faulty. Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 17*	—
16	Repair the PCM connector connection. Was a problem found and corrected?	Go to *Step 17*	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: ▼The shift solenoid A is commanded "on" and the voltage drops to zero. ▼The shift solenoid A is commanded "off" and the voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0756 Shift Solenoid B Performance (Stuck Off)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.
This DTC detects when there is only a 4-3-3-4 shift pattern depending on the state of the mechanical failure instead of a 1-2-3-4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTCs P0742, P1860, P1870.
- No shift solenoid DTCs P0753, P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and influed cut-off (to be confirmed).

  All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- –2300 ≤ TCC Slip ≤ 200 rpm.
- Transmission output speed ≥ 400 rpm
- Speed ratio ≥ 0.3
- 0.60 ≤ Modeled Ratio ≤ 1.49 for 1 second.

Condition 2:

- 2nd gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- –8000 ≤ TCC Slip ≤ 8000 rpm.
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 0.687 second.

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to *DTC type definition (type B).*
- Turn Force Motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may allow more than one shift to occur.

Test Description

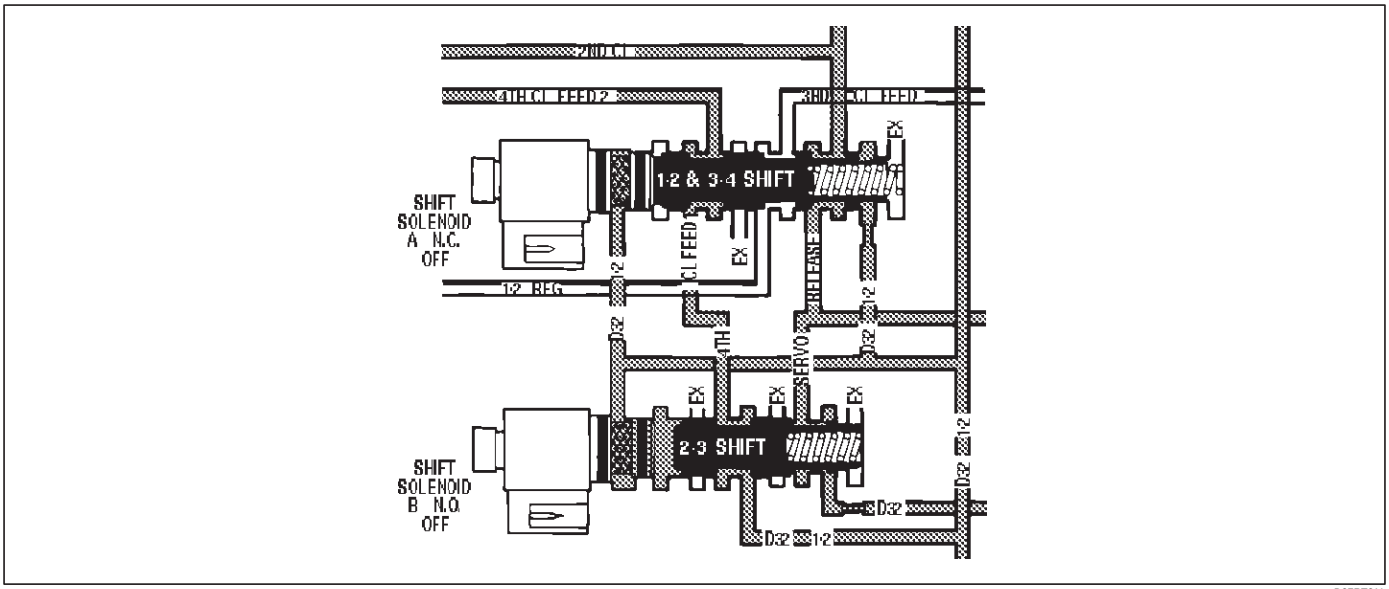
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0756 Shift Solenoid B Performance (Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to *Step 3*	Go to *“Range Switch Logic Table”*
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was a 4–3–3–4 shift pattern detected? (Road testing the vehicle may be necessary.)	Go to *Step 4*	Go to *Diagnostic Aids*
4	Check the shift solenoid/hydraulic circuit for: ▼One or both of the shift solenoids for an internal malfunction. ▼Contamination or sediment in one or both of the shift solenoids. ▼Damaged seals on the one or both of the shift solenoids. Refer to *Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section.* Was a problem found and corrected?	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0757 Shift Solenoid B Performance (Stuck On)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.

This DTC detects when there is only a 1–2–2–1 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTCs P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All of the above conditions have been met and the combination of condition 1,2 occur two consecutive times.

Condition 1:

- 3rd gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.6
- 1.44 ≤ Modeled Ratio ≤ 2.4 for 4 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 second
- 15 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 2 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to *DTC type definition (type B).*
- Turn Force Motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

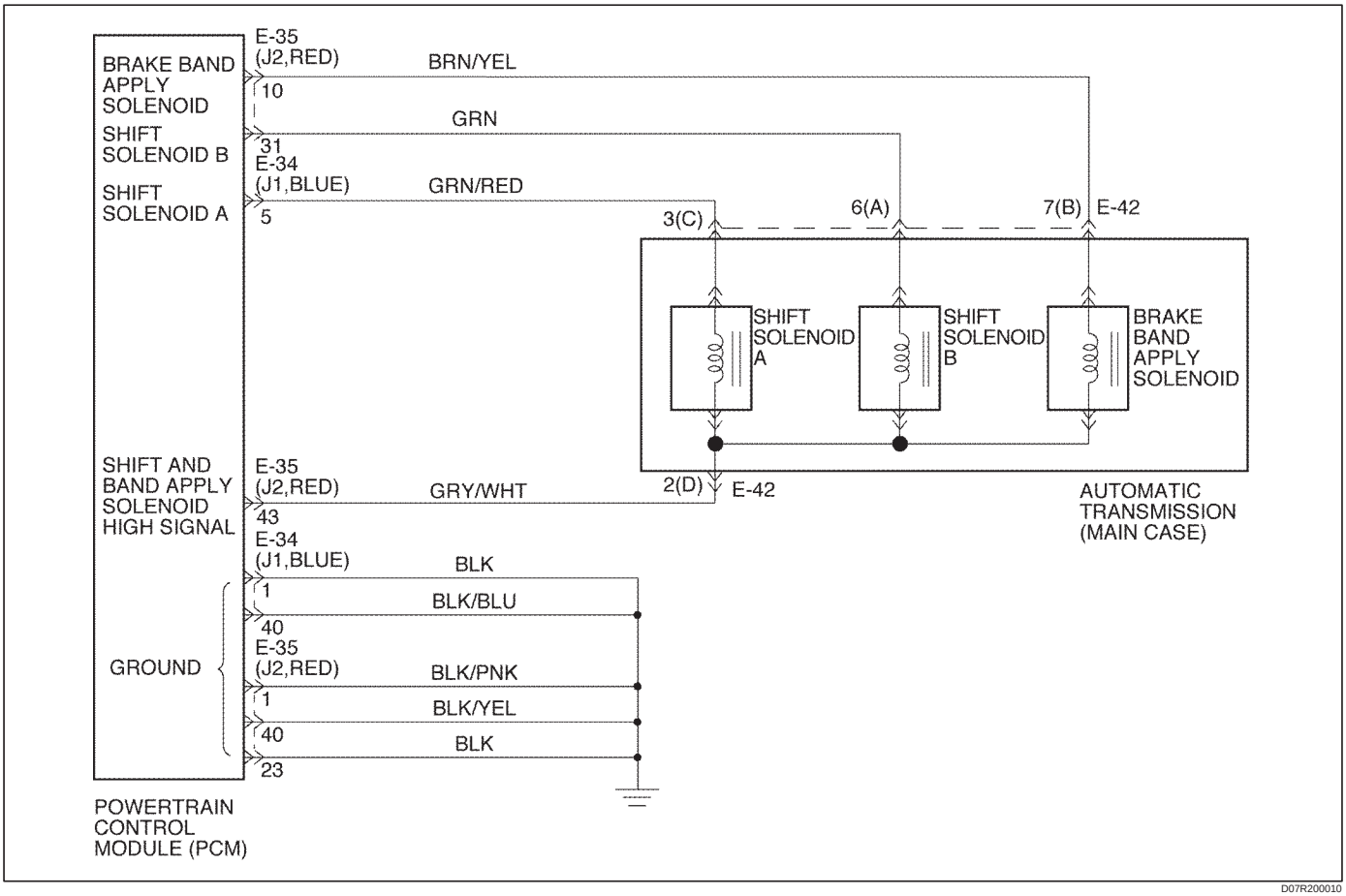
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0757 Shift Solenoid B Performance (Stuck On)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to *Step 3*	Go to *“Range Switch Logic Table”*
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was a 4–3–3–4 shift pattern detected? (Road testing the vehicle may be necessary.)	Go to *Step 4*	Go to *Diagnostic Aids*
4	Check the shift solenoid/hydraulic circuit for: ▼ One or both of the shift solenoids for an internal malfunction. ▼ Contamination or sediment in one or both of the shift solenoids. ▼ Damaged seals on the one or both of the shift solenoids. Refer to *Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section.* Was a problem found and corrected?	Go to *Step 5*	Go to *Diagnostic Aids*
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P0758 Shift Solenoid B Electrical



D07R200010

Circuit Description

- The shift solenoid B is a simple on/off solenoid located in the main case valve body. It is normally open. When the port is open, fluid pressure actuates the shift valve. In first or second gear, the Powertrain Control Module (PCM) energizes the solenoid to close a fluid inlet port.
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. In BACKUP MODE or when the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid B circuit or shift solenoid B. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+), or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 ~ 1.0 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

▼When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the *step numbers on the diagnostic chart:*

5. This test measures the resistance of the component.
6. This test checks the function of the shift solenoid B and the transmission internal wiring harness.
9. This test checks for power to the shift solenoid B from the ignition through the PCM.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

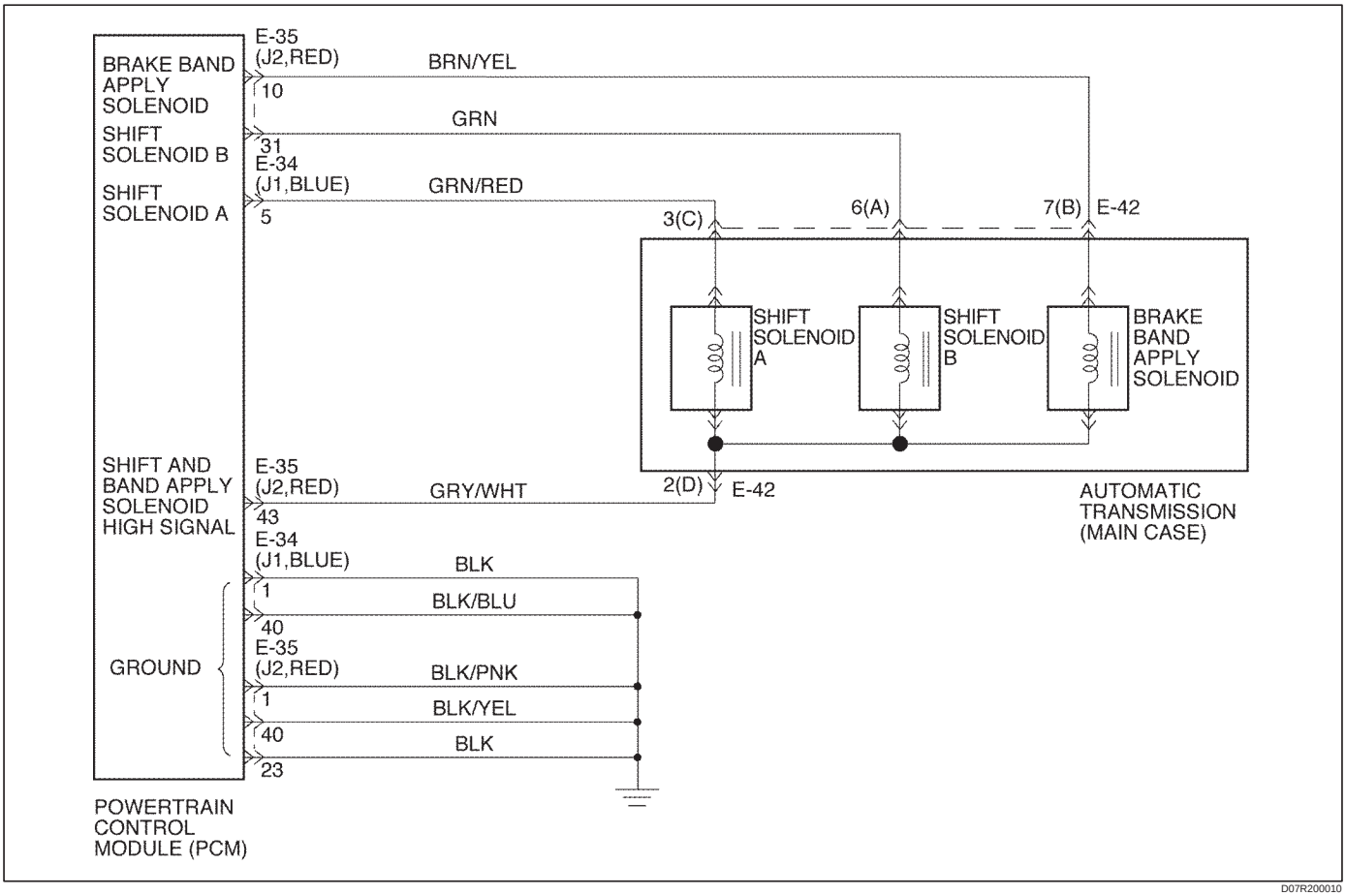
DTC P0758 Shift Solenoid B Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758, P1860 set?	Go to *Step 4*	Go to *Step 3*
3	1. The engine “on”. 2. Apply brake pedal and select transmission range “D”. 3. Press and hold down the winter switch and select transmission mode “winter”. Does the scan tool display DTC P0758 at 3rd gear?	Go to *Step 7*	Go to *Diagnostic Aids*
4	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connectors. 3. Turn the ignition “on”. 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals E35–31 and E35–1. Is the voltage within 10 – 12 volts?	Go to *Step 13*	Go to *Step 5*
5	1. Turn the ignition “off”. 2. Using the J39200 DVOM, measure the resistance between PCM connector terminals E35–31 and E35–43. Is the resistance within 18 – 20 ohms?	Go to *Step 14*	Go to *Step 6*
6	1. Disconnect the transmission main case connector E–42. 2. Using the J39200 DVOM, measure the resistance between terminals E42–6(A) and E42–2(D). Is the resistance within 18 – 20 ohms?	Go to *Step 15*	Go to *Step 16*
7	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connectors. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals E35–31 and E35–43. Is the resistance within 18 – 20 ohms?	Go to *Step 8*	Go to *Step 10*
8	Using the J39200 DVOM, check a continuity between PCM connector terminal E35–31 and ground. Is there a continuity?	Go to *Step 17*	Go to *Step 9*
9	Using the J39200 DVOM, check a continuity between PCM connector terminal E35–43 and ground. Is there a continuity?	Go to *Step 18*	Go to *Step 11*
10	1. Disconnect the transmission main case connector E-42. 2. Using the J39200 DVOM, measure the resistance between terminals E42–6(A) and E42–2(D). Is the resistance within 18 – 20 ohms?	Go to *Step 19*	Go to *Step 20*

DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
11	Check every connection of the PCM. Was a problem found and corrected?	Go to *Step 22*	Go to *Step 12*
12	1. Connect the E-34 (BLUE) and E-35 (RED) PCM connectors to the PCM. 2. Turn the ignition "on", the engine "on". 3. Repeat Step 3. Does the scan tool display DTC P0758 at 3rd gear?	Go to *Step 21*	Go to *Diagnostic Aids*
13	The wiring harness between PCM connector terminal E35–31 and transmission main case terminal E42–6(A) is shorted to voltage. Was a problem found and corrected?	Go to *Step 22*	—
14	The PCM internal terminal E35–31 is shorted to voltage. Replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 22*	—
15	The wiring harness between PCM connector and transmission main case 7-way connector is shorted. Was a problem found and corrected?	Go to *Step 22*	—
16	The shift solenoid B is faulty, or the internal wiring harness from the shift solenoid B is shorted. Was a problem found and corrected?	Go to *Step 22*	—
17	The wiring harness between PCM connector terminal E35–31 and transmission main case connector terminal E42–6(A) is shorted to ground. Was a problem found and corrected?	Go to *Step 22*	—
18	The wiring harness between PCM connector terminal E35–43 and transmission main case connector terminal E42–2(D) is shorted to ground. Was a problem found and corrected?	Go to *Step 22*	—
19	The wiring harness between PCM connector terminal E35–31 and transmission main case connector terminal E42–6(A), or between PCM connector terminal E35–43 and main case connector terminal E42–2(D) is open. Was a problem found and corrected?	Go to *Step 22*	—
20	The internal wiring harness from the shift solenoid B is open, or the shift solenoid B is faulty. Was a problem found and corrected?	Go to *Step 22*	—
21	Replace the PCM. Is the replacement complete?	Go to *Step 22*	—
22	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: ▼The shift solenoid B is commanded "on" and voltage drops to zero. ▼The shift solenoid B is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P1850 Brake Band Apply Solenoid Malfunction



D07R200010

Circuit Description

- The brake band apply solenoid is a normally open solenoid which controls the flow of fluid for brake band application. The Powertrain Control Module (PCM) uses Pulse Width Modulation (PWM) and changes the duty cycle to control the solenoid. The PCM turns the solenoid on (energized) and off (deenergized) at a constant frequency. The length of time the solenoid is energized during each on/off cycle is called the pulse width. By varying or "modulating" the pulse width, the solenoid output pressure is changed. Since the solenoid is normally open, increasing the pulse width increases the duty cycle and decreases the output pressure. PWM control provides smooth band application without an accumulator. The band is only applied in first and second gears.
- In the event of an electrical failure (open), the solenoid regulates at the maximum oil flow (0% duty cycle).
- The solenoid is activated by a current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. When the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the brake band apply solenoid circuit or the brake band apply solenoid. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on", Engine "run".
- The PCM commands the solenoid "on" and the voltage remains high (B+), or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met in 1.34 ~ 1.56 seconds.

Action Taken When The DTC Sets

- Inhibit brake band apply solenoid.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- ▼ Inspect the wiring for poor electrical connection at the PCM and at the transmission 7–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- ▼ When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the brake band apply solenoid from the ignition through the PCM.
4. This test checks the resistance of the transmission internal wiring harness and brake band apply solenoid.
5. This test checks the ability of the PCM and wiring to control the ground circuit.

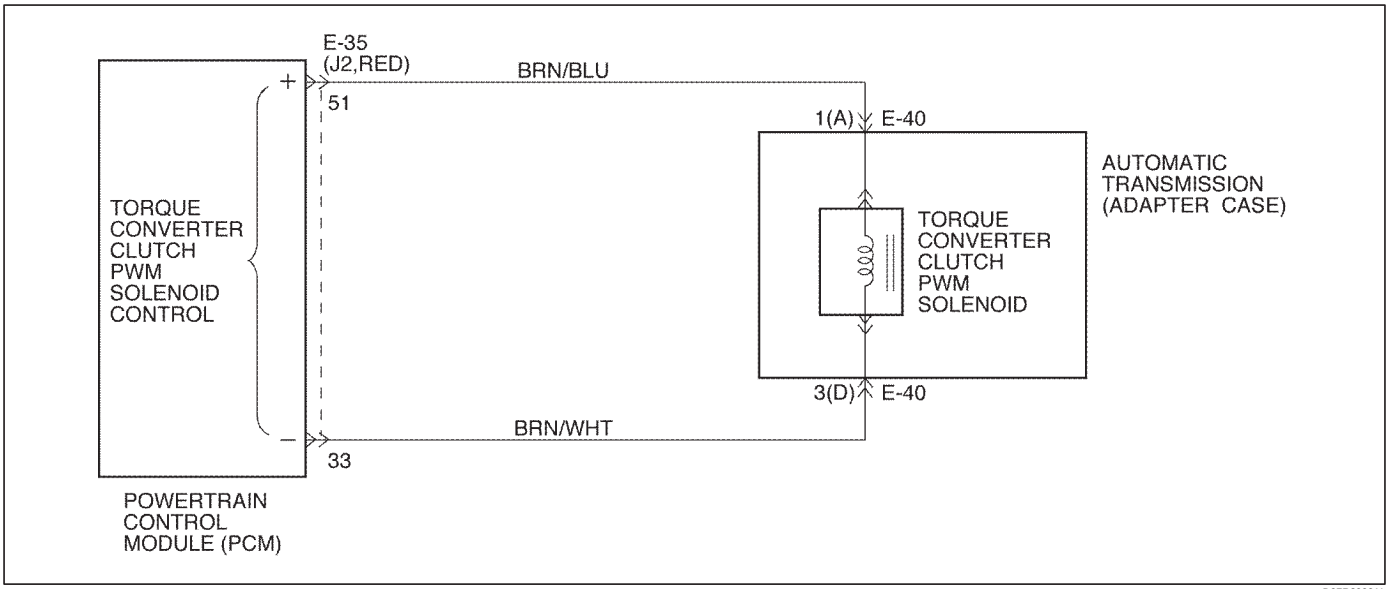
DTC P1850 Brake Band Apply Solenoid Malfunction

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758 set?	Go to *Step 3*	Go to *Step 4*
3	Using the J39200 DVOM, back probe between PCM connector terminals E35–43 and E35–1. Is the voltage between 10 to 12 volts?	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals E35–43 and E35–10. Is the resistance within 10–12 ohms?	Go to *Step 10*	Go to *Step 11*
5	Using the J39200 DVOM, back probe between PCM connector terminals E35–10 and E35–1. Is the voltage between 10 to 12 volts?	Go to *Step 19*	Go to *Step 4*
6	1. Turn the ignition “off”. 2. Disconnect the E-34 (BLUE) and E-35 (RED) PCM connector. 3. Using the J39200 DVOM, check continuity between PCM terminal E35–43 and ground. Is there a continuity?	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the transmission main case connector E-42. 2. Using the J39200 DVOM, check continuity between the terminal E42–7(B) and ground. Is there continuity?	Go to *Step 13*	Go to *Step 14*
8	1. Disconnect the E-34 (BLUE) and E-35 (RED) PCM Connector. 2. Using the J39200 DVOM, measure the resistance between the PCM connector terminals E35–43 and E35–10. Is the resistance within 10–12 ohms?	Go to *Step 19*	Go to *Step 9*
9	1. Disconnect the transmission main case connector E-42. 2. Using the J39200 DVOM, measure the resistance between the terminals E42–7(B) and E42–2(D). Is the resistance within 10–12 ohms?	Go to *Step 15*	Go to *Step 16*
10	Using the J39200 DVOM, check continuity between PCM terminal E35–10 and ground. Is there continuity?	Go to *Step 12*	Go to *Step 19*
11	1. Disconnect the transmission main case connector E-42. 2. Using the J39200 DVOM, measure the resistance between the terminals E42-7(B) and E42-2(D). Is the resistance within 10–12 ohms?	Go to *Step 18*	Go to *Step 16*

DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)

Step	Action	Yes	No
12	1. Disconnect the transmission main case connector E-42. 2. Using the J39200 DVOM, check continuity between the terminals E42–7(B) and ground. Is there a continuity?	Go to *Step 13*	Go to *Step 17*
13	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is shorted to ground. Was a problem found and corrected?	Go to *Step 20*	—
14	The wiring harness between the PCM connector terminal E35–43 and the transmission main case connector terminal E42–2(D) is shorted to ground. Was a problem found and corrected?	Go to *Step 20*	—
15	The wiring harness between the PCM connector terminal E35–43 and the transmission main case connector terminal E42–2(D) is open. Was a problem found and corrected?	Go to *Step 20*	—
16	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is open. Was a problem found and corrected?	Go to *Step 20*	—
17	The wiring harness between the PCM connector terminal E35–10 and the transmission main case connector terminal E42–7(B) is shorted to ground. Was a problem found and corrected?	Go to *Step 20*	—
18	The wiring harness between the PCM connector terminal E35–10 and the transmission main case connector terminal E42–7(B) is open. Was a problem found and corrected?	Go to *Step 20*	—
19	Check every connection at the PCM. If OK, replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 20*	—
20	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: ▼The brake band apply solenoid is commanded "on" and the volts drop to zero. ▼The brake band apply solenoid is commanded "off" and the volts increase to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P1860 TCC PWM Solenoid Electrical



Circuit Description

The PCM allows current to flow through the solenoid coil according to the duty cycle (percentage of “on” and “off” time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows 2–3 drive fluid to feed to TCC signal circuit.The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift control valve. When the TCC shift valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch. The TCC PWM solenoid is used in conjunction with the TCC PWM solenoid to regulate fluid to the torque converter. The TCC PWM solenoid is attached to the valve body within the transmission.

This DTC detects a continuous open or short to ground or ignition in the TCC circuit or the TCC PWM solenoid. This is a type “B” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- Ignition is “on”, Engine “run”.
- The PCM commands the solenoid “on” and the voltage remains low (zero volts).
- The PCM commands the solenoid “off” and the voltage remains high (B+).
- All conditions met for 0.875 ~ 1.25 seconds.

Action Taken When The DTC Sets

- Inhibit TCC engagement.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart*:*

3. This test checks for voltage to the solenoid.
4. This test checks the ability of the PCM and wiring to control the ignition circuit.
9. This test checks the resistance of the TCC solenoid and the internal wiring harness.

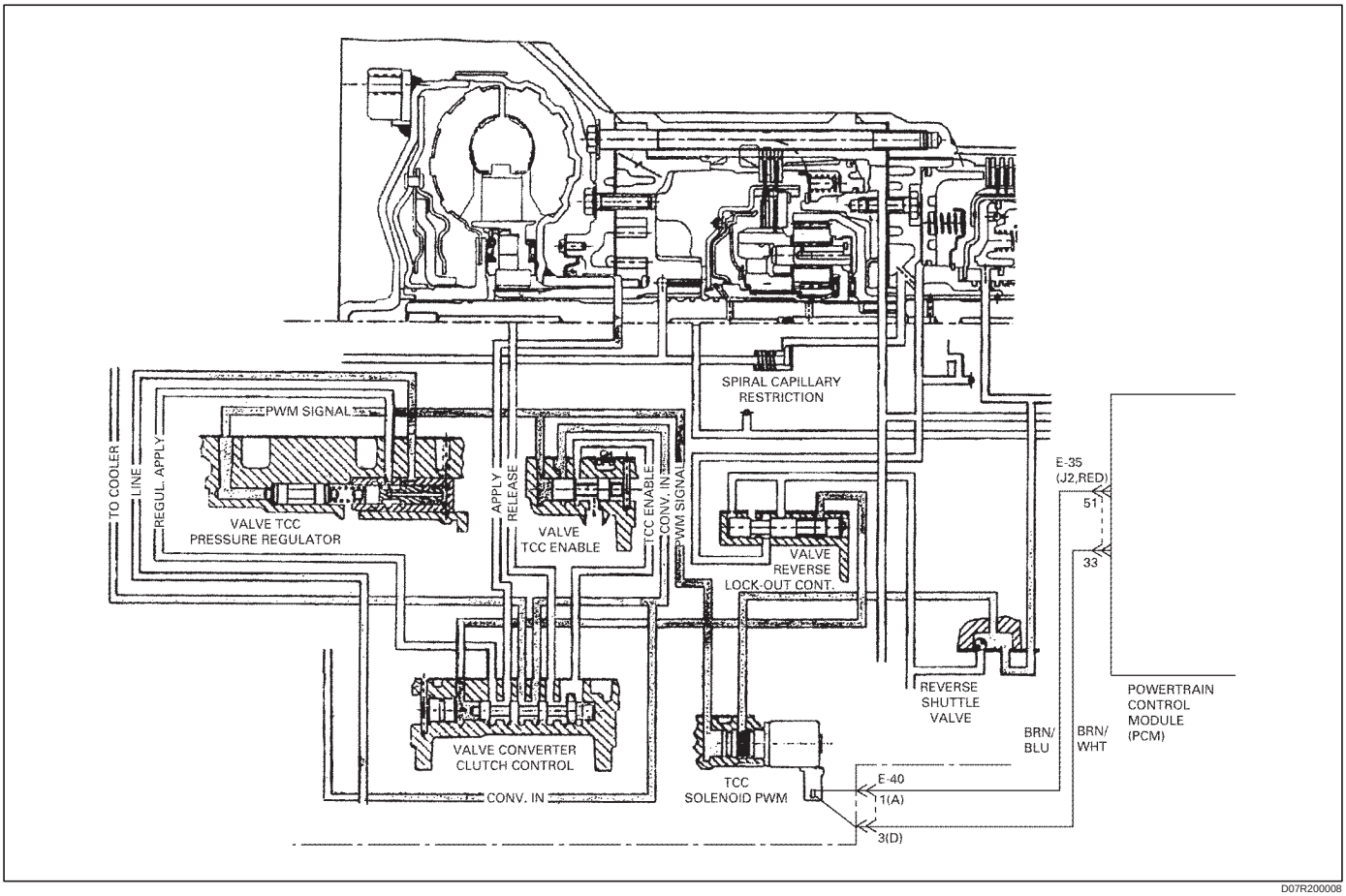
DTC P1860 TCC PWM Solenoid Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emission in Engine section*
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the“Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Was DTC P1860 set?	Go to *Step 3*	Go to *Step 4*
3	Using the J39200 DVOM, back probe between PCM connector terminals E35–51 and E35–33. Is the voltage 0?	Go to *Step 5*	Go to *Step 6*
4	1. Apply brake pedal and select transmission range “D”. 2. Do a test drive, and increase the vehicle speed to TCC “on” at 4th. Does the scan tool display DTC P1860 at TCC “ON”?	Go to *Step 9*	Go to *Diagnostic Aids*
5	1. Turn the ignition “off”. 2. Disconnect the E-35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals E35–51 and E35–33. Is the resistance within 18 – 20 ohms?	Go to *Step 7*	Go to *Step 8*
6	The wiring harness between PCM connector terminal E35–51 and transmission adapter case connector terminal E40–1(A) is shorted to voltage. Was a problem found and corrected?	Go to *Step 15*	Go to *Step 16*
7	Intermittent condition. Check the wiring harness and terminals between PCM connector J2 and transmission adapter case connector E–40. Was a problem found and corrected?	Go to *Step 15*	Go to *Step 16*
8	1. Disconnect the transmission adapter case connector E–40. 2. Using the J39200 DVOM, measure the resistance between terminal E40–1(A) and ground. Is the resistance within 18 – 20 ohms?	Go to *Step 13*	Go to *Step 14*
9	1. Turn the ignition “off”. 2. Disconnect the E-35 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between terminals E35–51 and E35–33. Is the resistance within 18 – 20 ohms?	Go to *Step 15*	Go to *Step 10*
10	1. Disconnect the transmission adapter case connector E–40. 2. Using the J39200 DVOM, measure the resistance between terminal E40–1(A) and ground. Is the resistance within 18–20 ohms?	Go to *Step 11*	Go to *Step 12*
11	The wiring harness between PCM connector E-35 and adapter case connector E-40 is shorted to ground. Was a problem found and corrected?	Go to *Step 17*	—

DTC P1860 TCC PWM Solenoid Electrical (Cont'd)

Step	Action	Yes	No
12	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is shorted to ground. Was a problem found and corrected?	Go to *Step 17*	—
13	The wiring harness between PCM connector terminal E35–51 and adapter case terminal E40–1(A) is open. Was a problem found and corrected?	Go to *Step 17*	—
14	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is open. Was a problem found and corrected?	Go to *Step 17*	—
15	Check every connection at the PCM. If OK, replace the PCM. Refer to *Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section.* Is the replacement complete?	Go to *Step 17*	—
16	Check the PCM connector terminal E35–51, and transmission adapter case connector terminal E40–1(A). Was a problem found and corrected?	Go to *Step 17*	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: ▼The TCC solenoid is commanded "on" and the volts increase to B+. ▼The TCC solenoid is commanded "off" and the volts drop to zero. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to *Step 1*	Repair verified Exit DTC table

DTC P1870 Transmission Component Slipping (TCC Stuck Off)



D07R200008

Circuit Description

The PCM monitors the difference in engine speed and transmission output speed. For example in D3 drive range with the ECCC commanded, the engine speed should closely match transmission output speed.
This DTC detects excessive TCC slip when the ECCC is engaged. This is a type “B” DTC.

Conditions For Setting The DTC

The following conditions are met for three TCC cycles with reported excessive TCC slip conditions.

- No OSS DTCs P0722 or P0723.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- No TCC solenoid DTCs P0742 or P1860 or P1870.
- Engine speed is between 1,000 and 3,500 rpm for 0.5 seconds.
- Gear range is D4.
- 13% < TPS < 99%
- 50 < Engine Torque < 300 N·m
- TFT is between 20˚ and 150˚C (68˚ and 302˚F).
- TCC slip speed is between 250 rpm and 800 rpm for 3 times 7 seconds.
- Vehicle speed is between 25 km/h (15 mph) and 225 km/h (158 mph).
- Speed ratio is between 0.6 and 0.95.
- ECCC is “ON”.
- Low (0.8) < TCC Capacity < hi (0.99) for 5 seconds

Action Taken When The DTC Sets

- Only stored in memory.
- For lamp illuminate refer to *DTC type definition (type B).*

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exist and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Range switch malfunction could set a DTC P1870.
- A mechanical failure of the shift solenoids, TCC solenoid, or TCC PWM solenoid could set a DTC P1870.
- Internal transmission failures may set a DTC P1870.
- An intermittent or incorrect engine speed signal may set a DTC P1870.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the indicated range signal to the actual selected range. A faulty switch could set a DTC P1870.
3. This test checks the torque converter for slippage while in a commanded lockup state.

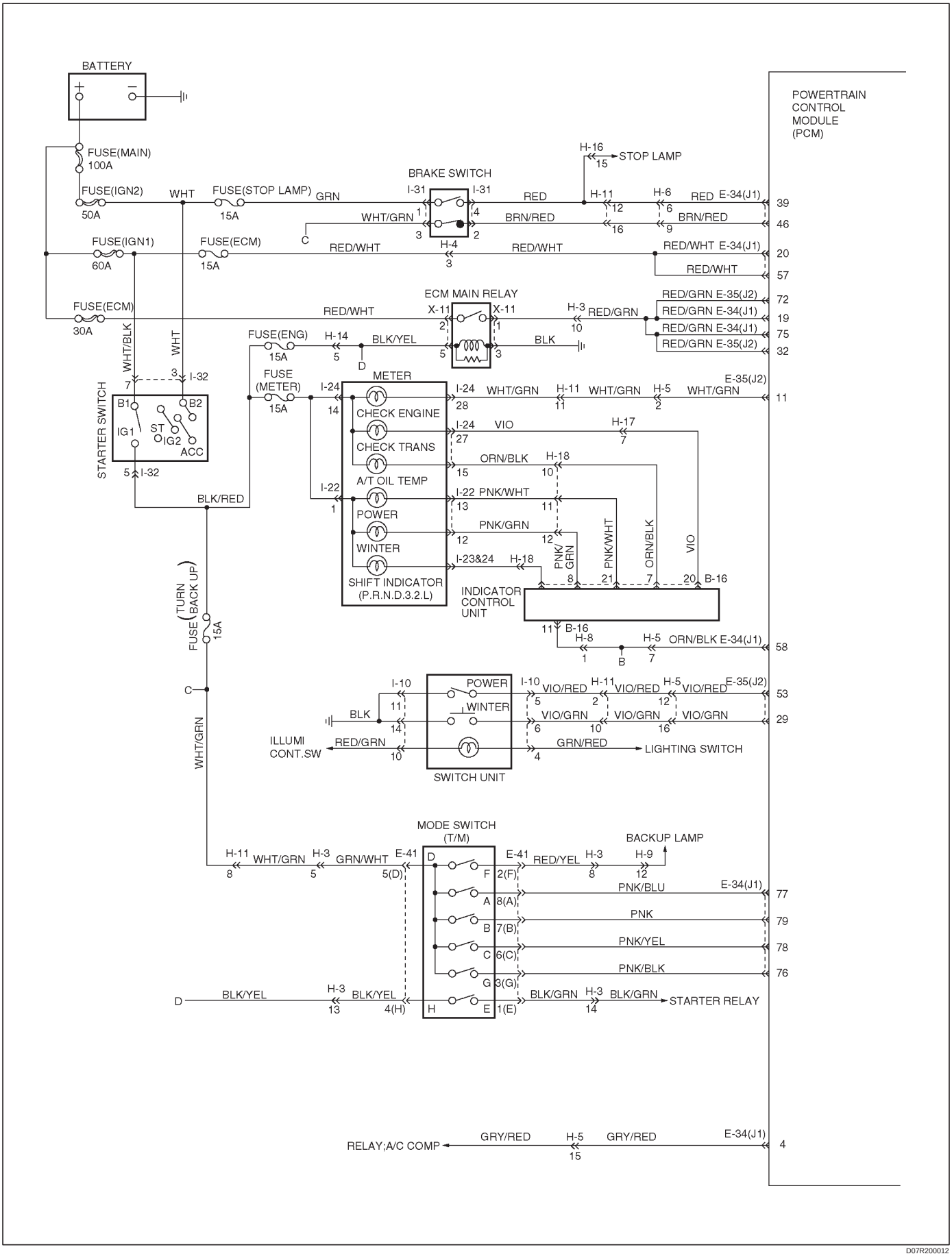
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

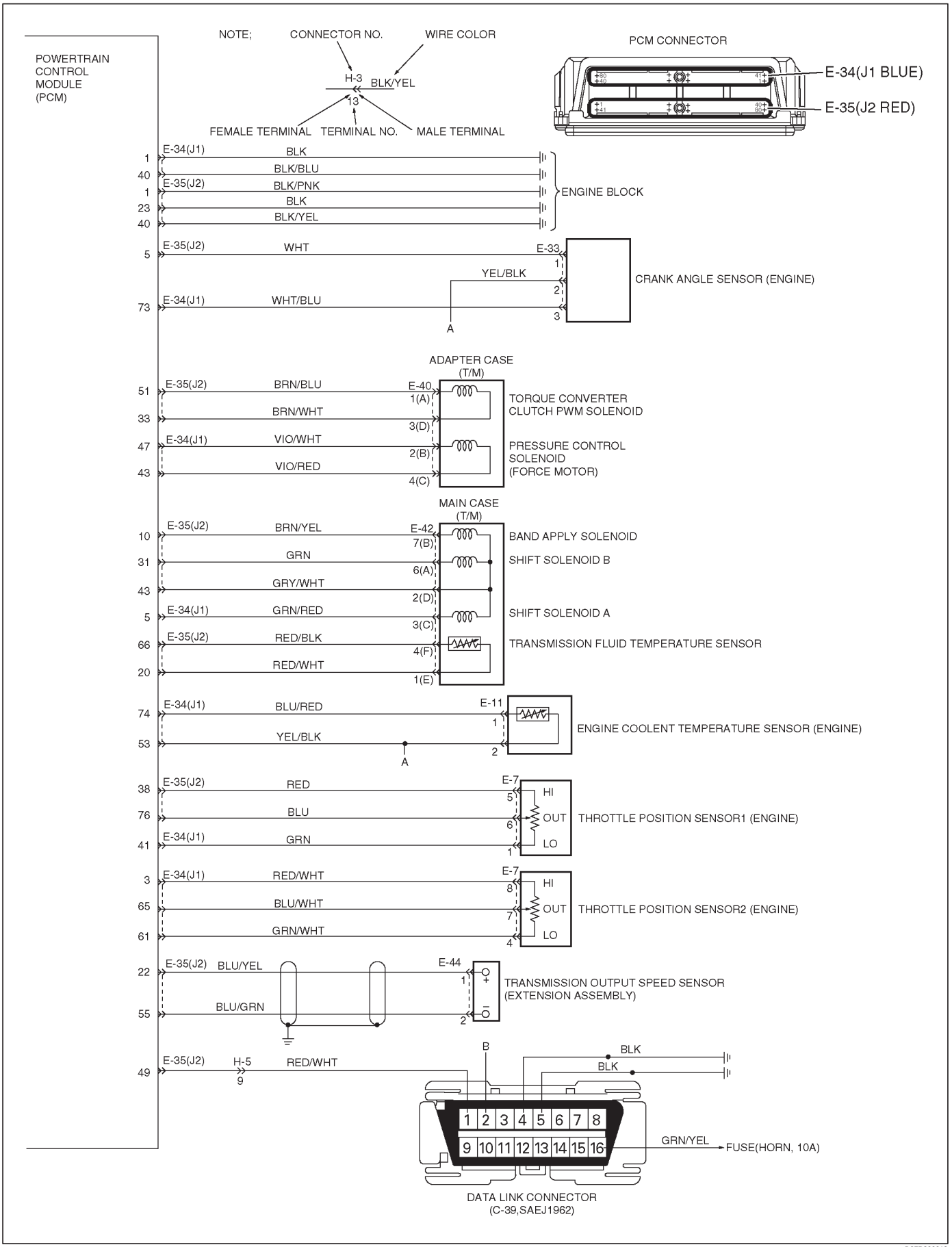
DTC P1870 Transmission Component Slipping (TCC Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to *Step 2*	Go to *OBD System Check* Refer to *Driveability and Emissions in Engine section*
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Apply the brake pedal. 5. Select each transmission range: DL, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “TR Switch” display?	Go to *Step 3*	Go to *“Range Switch Logic Table”*
3	Drive the vehicle in 4th gear while the TCC is engaged. At any time is the “TCC Slip Speed” greater than 130 rpm for 8 seconds while the TCC is engaged?	Go to *System Diagnosis Charts*	Go to *Diagnostic Aids*

Circuit Diagram

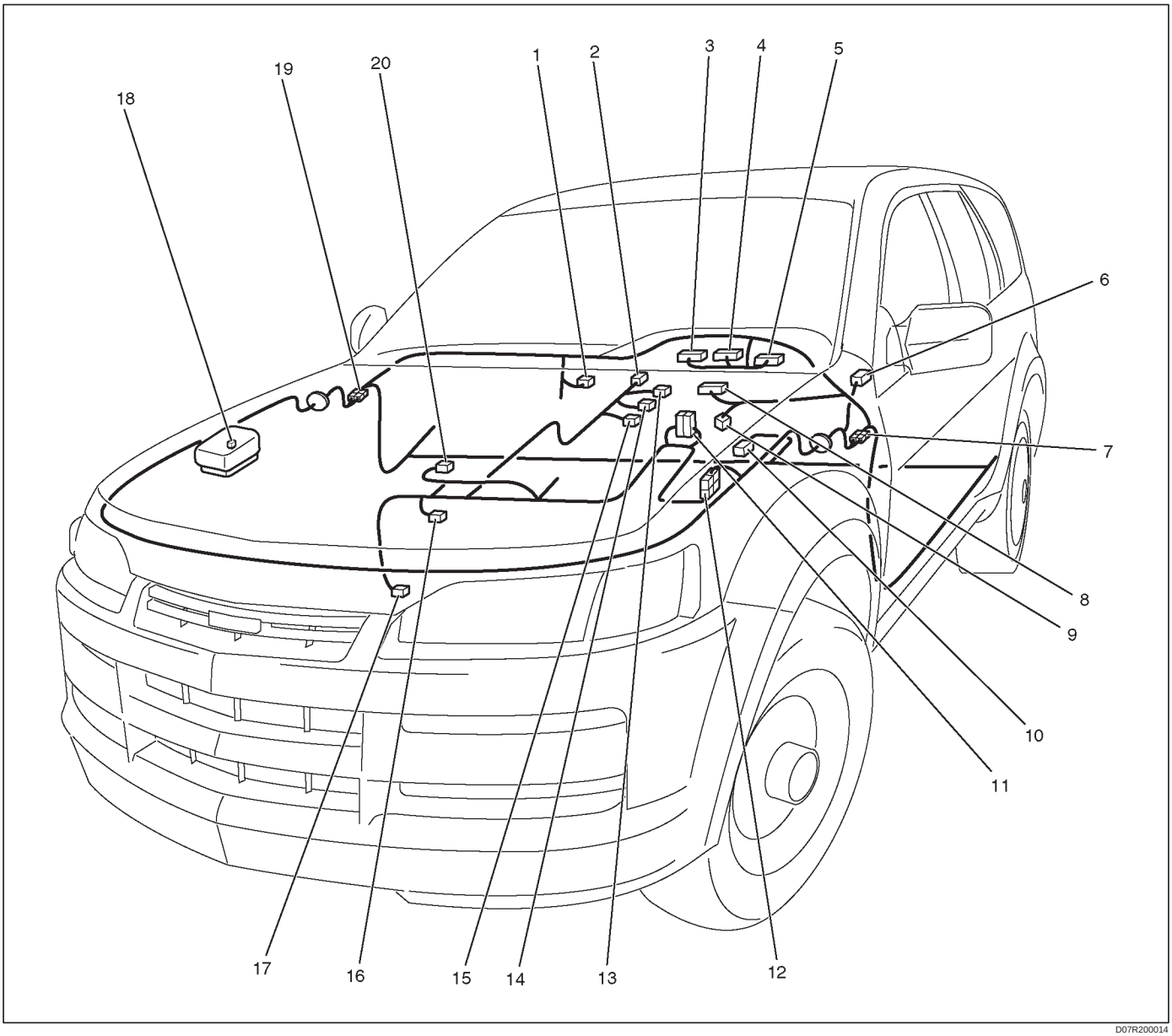


D07R200012


POWERTRAIN CONTROL MODULE (PCM)
NOTE;
CONNECTOR NO.
WIRE COLOR
H-3
BLK/YEL
13
FEMALE TERMINAL
TERMINAL NO.
MALE TERMINAL
PCM CONNECTOR
E-34(J1 BLUE)
E-35(J2 RED)
E-34(J1)
E-35(J2)
BLK
BLK/BLU
BLK/PNK
BLK
BLK/YEL
ENGINE BLOCK
WHT
YEL/BLK
WHT/BLU
E-33
CRANK ANGLE SENSOR (ENGINE)
ADAPTER CASE (T/M)
BRN/BLU
BRN/WHT
VIO/WHT
VIO/RED
E-40
TORQUE CONVERTER CLUTCH PWM SOLENOID
PRESSURE CONTROL SOLENOID (FORCE MOTOR)
MAIN CASE (T/M)
BRN/YEL
GRN
GRY/WHT
GRN/RED
RED/BLK
RED/WHT
E-42
BAND APPLY SOLENOID
SHIFT SOLENOID B
SHIFT SOLENOID A
TRANSMISSION FLUID TEMPERATURE SENSOR
BLU/RED
YEL/BLK
E-11
ENGINE COOLENT TEMPERATURE SENSOR (ENGINE)
RED
BLU
GRN
E-7
HI
OUT
LO
THROTTLE POSITION SENSOR1 (ENGINE)
RED/WHT
BLU/WHT
GRN/WHT
THROTTLE POSITION SENSOR2 (ENGINE)
BLU/YEL
BLU/GRN
E-44
TRANSMISSION OUTPUT SPEED SENSOR (EXTENSION ASSEMBLY)
H-5
RED/WHT
B
BLK
GRN/YEL
FUSE(HORN, 10A)
DATA LINK CONNECTOR (C-39,SAEJ1962)

D07R200013

Parts Location

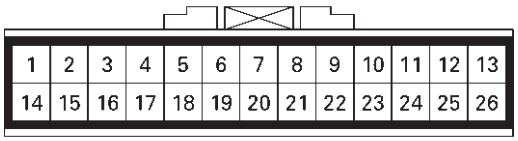
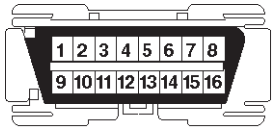
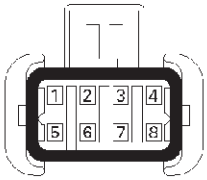
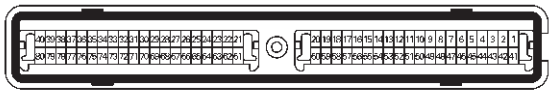
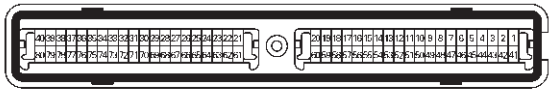
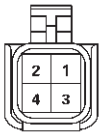
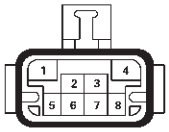


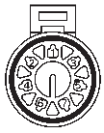
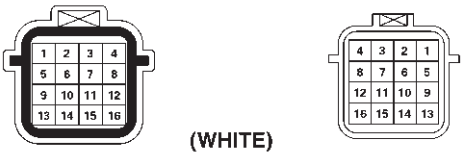
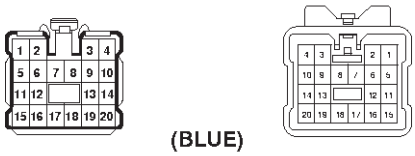
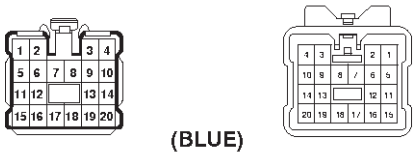
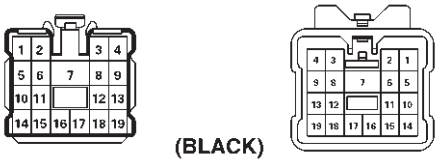
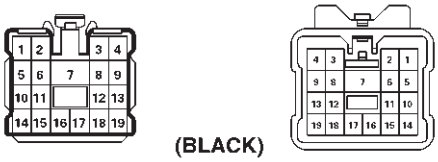
D07R200014

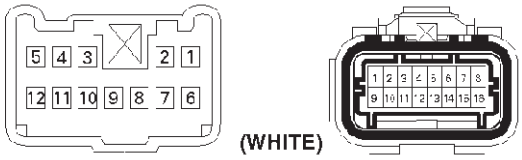
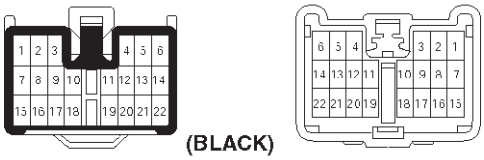
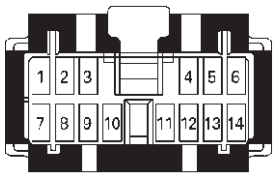
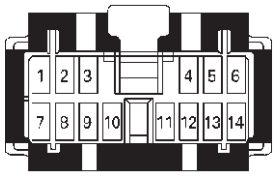
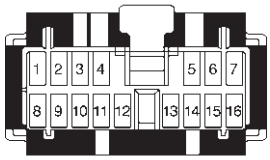
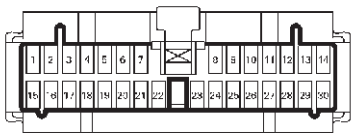
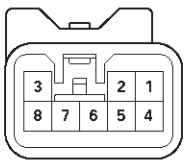
Legend

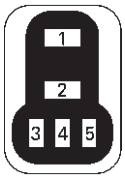
(1) Connector I–10
(2) Connector E–44
(3) Connector I–22
(4) Connector I–23
(5) Connector I–24
(6) Data Link Connector C–39
(7) Connector H–9, H–11, H–16
(8) Connector I–32
(9) Connector I–31
(10) Connector B–16
(11) Powertrain Control Module (PCM) Connector E–34, E–35
(12) Connector H–3, H–5, H–6
(13) Connector E–42
(14) Connector E–41
(15) Connector E–40
(16) Connector E–11
(17) Connector E–33
(18) Connector X–11
(19) Connector H–8, H–14, H–17, H–18
(20) Connector E–7

Harness Connector Faces

No.	Connector face
B-16	
C-39	
E-7	
E-11	
E-33	
E-34 (J1)	 (BLUE)
E-35 (J2)	 (RED)
E-40	 (GRAY)
E-41	 (BLACK)

No.	Connector face
E-42	 (BLACK)
E-44	
H-3	 (WHITE)
H-5	(GREEN)
H-6	(BLUE)
H-8	 (BLUE)
H-9	 (BLUE)
H-11	 (BLACK)
H-14	 (BLACK)

No.	Connector face
H-16	(WHITE)
H-17	 (WHITE)
H-18	 (BLACK)
I-10	
I-22	
I-23	
I-24	
I-31	
I-32	

No.	Connector face
X-11	

Transmission Fluid Temperature (TFT) Sensor Specifications

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance	Signal
˚F	˚C	Ω	Ω	Ω	Volts
-40	-40	600500	664200	731100	5.00
-22	-30	319800	350400	382400	4.65
-4	-20	177400	192700	208600	4.41
14	-10	102200	110100	118300	4.00
32	0	60870	65110	69450	3.52
50	10	37410	39750	42120	2.98
68	20	23660	24980	26300	2.40
86	30	15270	16120	16970	1.85
104	40	10040	10660	11290	1.43
122	50	6758	7211	7673	4.29
140	60	4645	4980	5324	4.04
158	70	3255	3506	3765	3.69
176	80	2323	2513	2710	3.34
194	90	1685	1831	1982	3.04
212	100	1242	1355	1472	2.58
230	110	929	1017	1109	2.24
248	120	704	773	846	1.97
266	130	540	595	653	1.67
284	140	419	464	511	1.42
302	150	329	365	403	1.16

AXIOM

BODY AND ACCESSORIES

CONTENTS

Lighting System 8A
Wiper / Washer System 8B
Entertainment 8C
Wiring System 8D
Meter and Gauge 8E
Body Structure 8F
Seats 8G
Security and Locks 8H
Sunroof / Convertible Top 8I
Exterior / Interior Trim 8J

LIGHTING SYSTEM

CONTENTS

Service Precaution 8A–2
Headlight Bulb 8A–3
Removal 8A–3
Installation 8A–3
Headlight Assembly 8A–4
Removal 8A–4
Installation 8A–4
Headlight Adjustment 8A–4
Side Marker Light Bulb 8A–6
Removal 8A–6
Installation 8A–6
Taillight Bulb 8A–7
Removal 8A–7
Installation 8A–7
License Plate Light Bulb 8A–8
Removal 8A–8
Installation 8A–8
Stoplight Bulb 8A–8
Removal and Installation 8A–8
High Mounted Stoplight Assembly 8A–9
Removal 8A–9
Installation 8A–9
High Mounted Stoplight Bulb 8A–9
Removal 8A–9
Installation 8A–9
Backup Light Bulb 8A–10
Removal 8A–10
Installation 8A–10
Front Turn Signal Light Bulb 8A–10
Removal and Installation 8A–10
Rear Turn Signal Light Bulb 8A–11
Removal 8A–11
Installation 8A–11
Dome Light Bulb 8A–11
Removal 8A–11
Installation 8A–11
Map Light Bulb 8A–12
Removal 8A–12
Installation 8A–12
Courtesy Light Bulb 8A–12
Removal 8A–12
Installation 8A–12
Luggage Room Light Bulb 8A–13
Removal 8A–13
Installation 8A–13
Shift Lever Illumination Light Bulb (A/T) 8A–13
Removal 8A–13
Installation 8A–13
Vanity Mirror Illumination Light Bulb 8A–14
Removal 8A–14
Installation 8A–14
Switch Unit Assembly Illumination Light Bulb (Power/Winter & Intelligent Suspension Switch) 8A–14
Removal 8A–14
Installation 8A–14
TOD Switch Illumination Light Bulb 8A–15
Removal 8A–15
Installation 8A–15
Cruise Control Main Switch Illumination Light Bulb 8A–15
Removal 8A–15
Installation 8A–15
Rear Wiper and Washer Switch Illumination Light Bulb 8A–16
Removal 8A–16
Installation 8A–16
Seat Heater Switch Illumination Light Bulb 8A–16
Removal 8A–16
Installation 8A–16
Starter Switch 8A–17
Removal and Installation 8A–17
Lighting Switch (Combination Switch) 8A–17

Removal and Installation 8A–17
Dimmer·Passing Switch (Combination Switch) 8A–17
Removal and Installation 8A–17
Front Door Switch 8A–17
Removal 8A–17
Installation 8A–17
Rear Door Switch 8A–18
Removal 8A–18
Installation 8A–18
Tailgate Lock Switch 8A–18
Removal 8A–18
Installation 8A–18
Key Remind Switch (Starter Switch) 8A–19
Removal and Installation 8A–19
Hazard Warning Light Switch 8A–19
Removal 8A–19
Installation 8A–19
Stoplight Switch 8A–20
Removal and Installation 8A–20
Turn Signal Light Switch (Combination Switch) 8A–20
Removal and Installation 8A–20
Illumination Controller 8A–20
Removal 8A–20
Installation 8A–20
Main Data and Specifications 8A–21

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

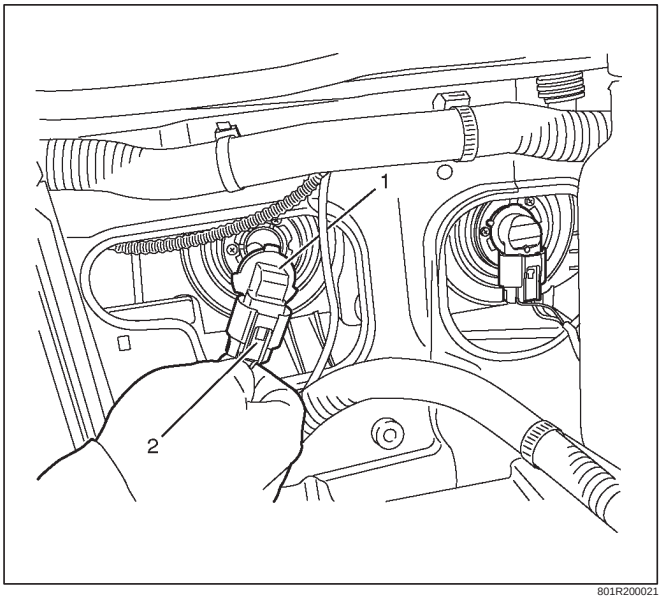
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Headlight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the headlight bulb.
   ▼Disconnect the connector (2).
   ▼Remove the socket (1) by turning it counterclockwise.

CAUTION: Do not touch the headlight bulb with your fingers. The oil on your fingers will leave a residue which will shorten the life of the halogen bulb. In order to prevent this problem, clean the bulb lens before installing the headlight bulb.



801R200021

Installation

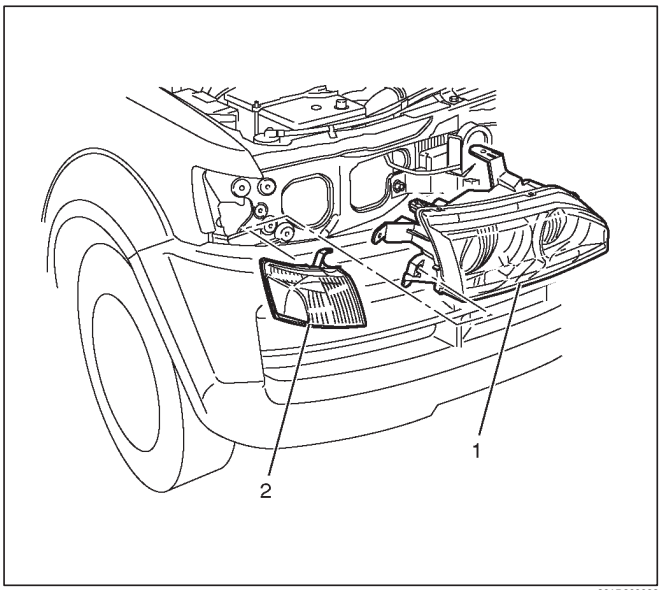
To install, follow the removal steps in the reverse order. noting the following point:

1. Make sure to set the retaining ring and the bulb cover. If the set is incomplete, there is a possibility that the water comes in the light.

Headlight Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the front combination light (2).
   ▼Remove the screw.
   ▼Disconnect the connector.
3. Remove the headlight assembly (1).
   ▼Disconnect the connector.
   ▼Remove four screws.



801R200022

Installation

To install, follow the removal steps in the reverse order. noting the following point:

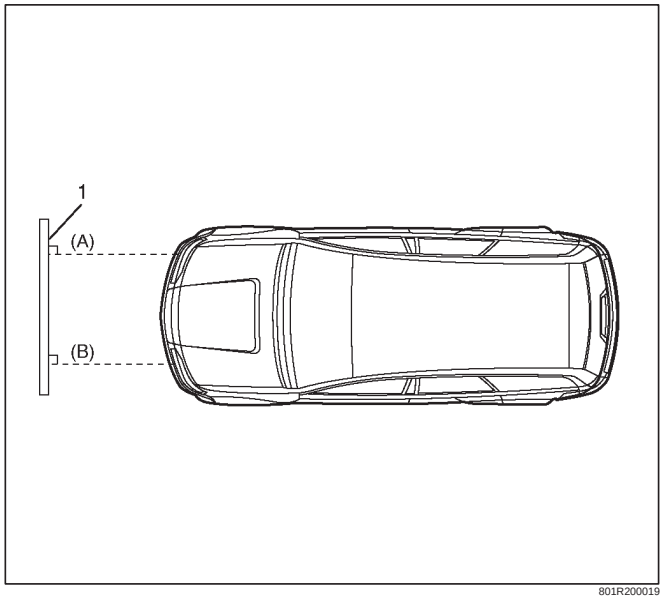
1. After installing the headlight, be sure to adjust the headlight aim.

Headlight Adjustment

Preparation

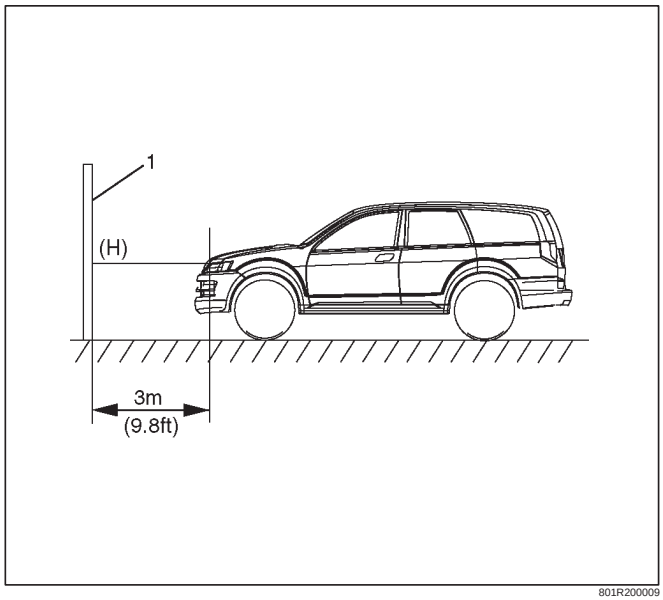
Place the vehicle with 1 person in driver seat on a level surface and check to see if the inflation pressure of the tires is correct, the lenses are clean, the battery is sufficiently charged, and adjust to place vehicle by using the screen.

1. Set a vertical screen on a level surface.
2. Toward the screen (1) from the bulb center mark of the headlight, extend parallel lines to the floor. Mark point (A) and (B) on the screen at the intersection of parallel line and the screen.
3. Draw vertical lines through point (A) and (B) on the screen.



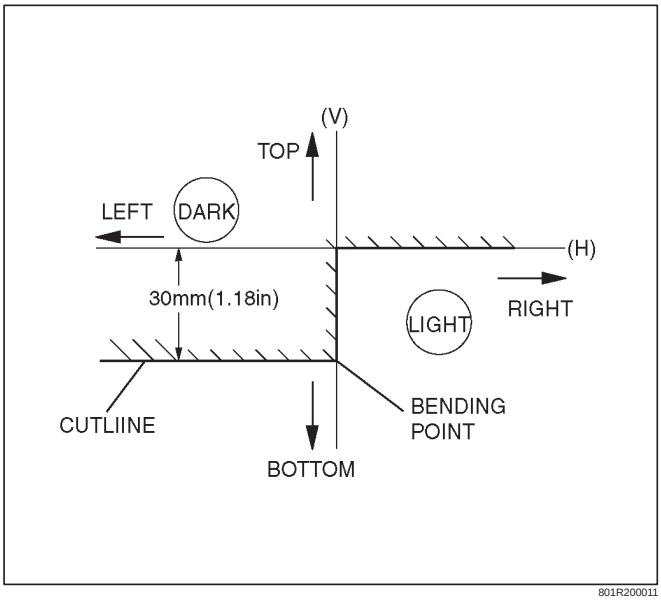
801R200019

4. Keep the vehicle (2) 3m (9.8 ft) apart from the screen (1).
5. Draw a horizontal line through point (A) and (B) on the screen (1).



801R200009

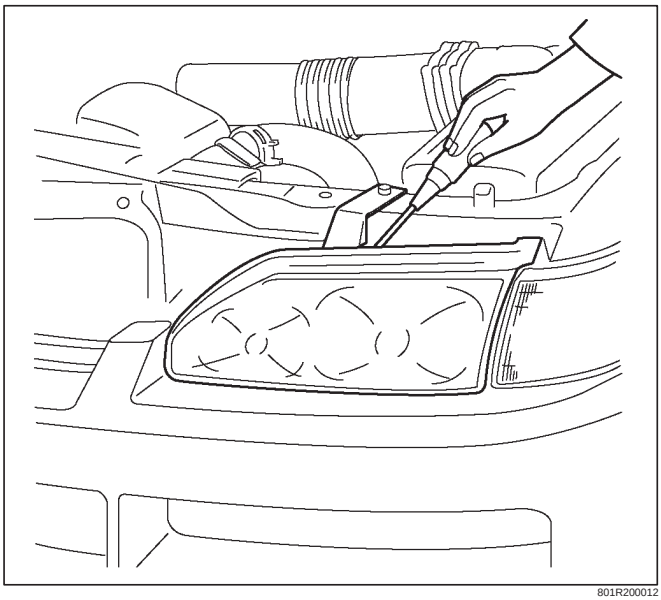
6. Turn the headlight low beam on.
7. Adjust the CUTLINE 30 mm (1.18 in) below the horizontal line (H).



801R200011

Vertical Adjustment

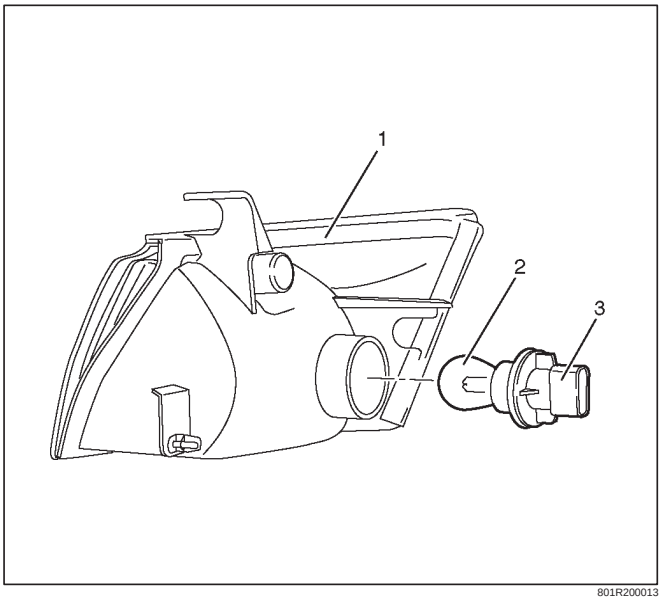
Use a screwdriver for vertical adjustment.


801R200012

Side Marker Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the front combination light (1).
   ▼Remove the screw.
3. Remove the bulb (2).
   ▼Remove the side marker light socket (3) by turning it counterclockwise.
   ▼Remove the bulb by turning it counterclockwise while pushing it at the same time.



801R200013

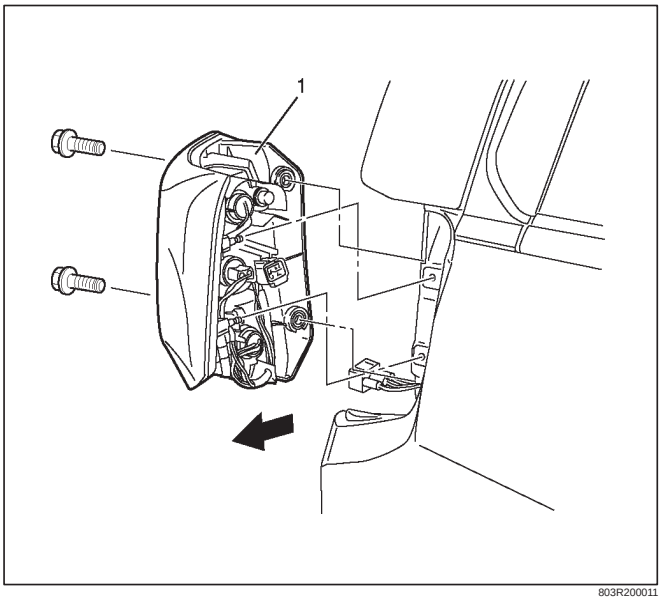
Installation

To install, follow the removal steps in the reverse order.

Taillight Bulb

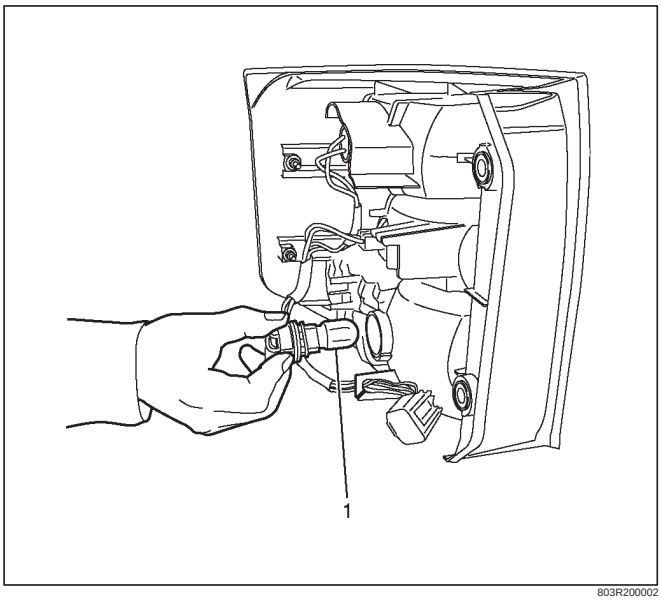
Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly (1).
   ▼Remove two screws.
   ▼Pull out the rear combination light assembly outside.



803R200011

3. Remove the bulb (1).
   ▼Remove the taillight socket by turning it counterclockwise.
   ▼Remove the bulb by turning it counterclockwise while pushing it at the same time.



803R200002

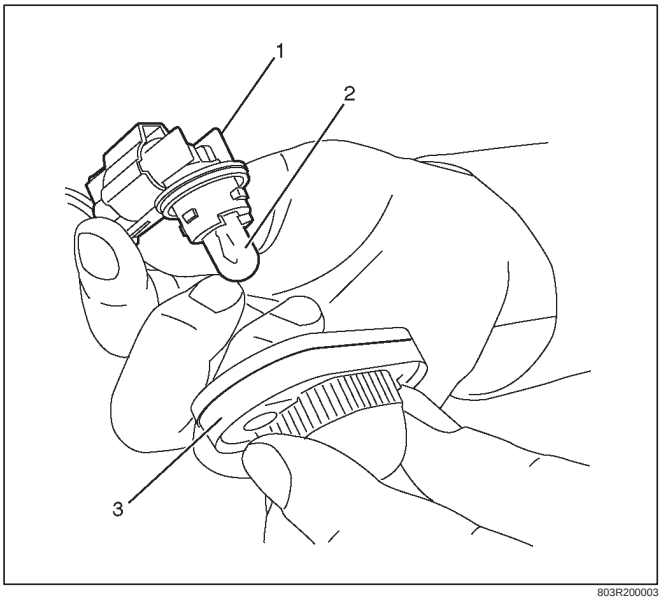
Installation

To install, follow the removal steps in the reverse order.

License Plate Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the license plate light garnish.
   ▼Remove the three screws.
3. Remove the lens cover (3).
   ▼Remove two screws.
4. Remove the license plate light socket by turning it counterclockwise.
5. Remove the bulb (2).
   ▼Pull out the bulb from the socket (1).



803R200003

Installation

To install, follow the removal steps in the reverse order.

Stoplight Bulb

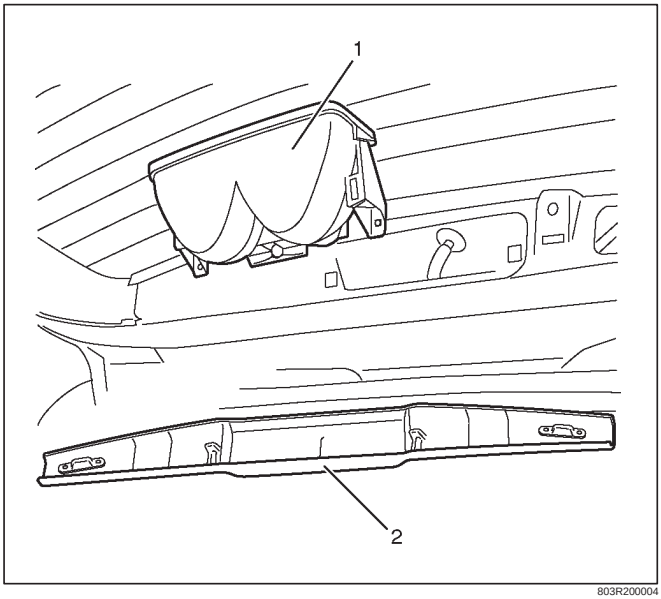
Removal and Installation

Refer to *Taillight Bulb* in this section.

High Mounted Stoplight Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the high mounted stoplight assembly (1).
   ▼Remove the cover (2).
   ▼Remove two screws.
   ▼Disconnect the connector.



803R200004

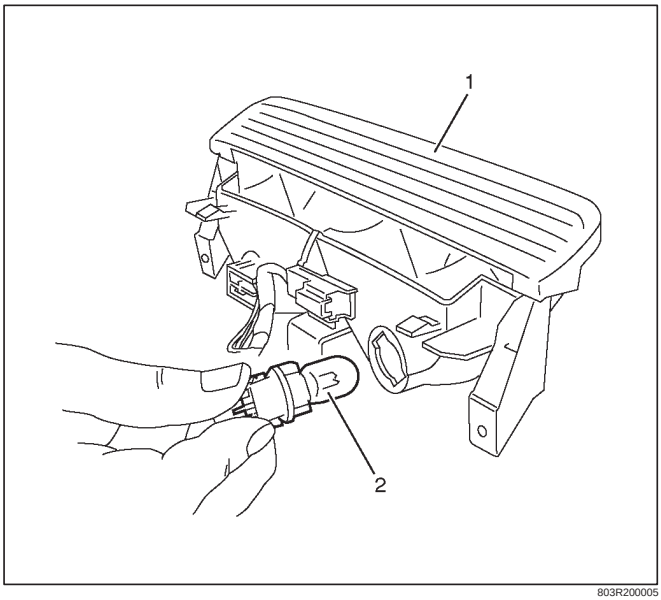
Installation

To install, follow the removal steps in the reverse order.

High Mounted Stoplight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the cover.
3. Remove the high mounted stoplight assembly (1).
   ▼Remove two screw.
4. Remove the bulb (2).
   ▼Remove the socket by turning it counterclockwise.



803R200005

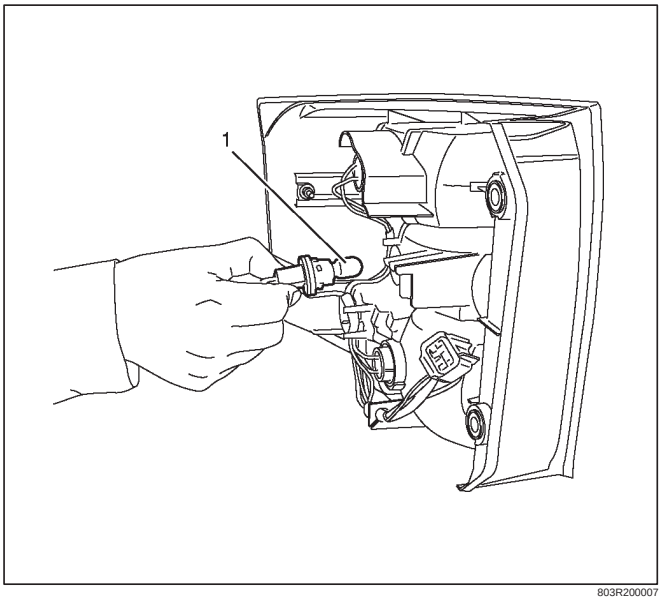
Installation

To install, follow the removal steps in the reverse order.

Backup Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly.
   ▼Refer to *Taillight Bulb* in this section.
3. Remove the bulb (1).
   ▼Remove the backup light socket by turning it counterclockwise.
   ▼Pull out the bulb from the socket.



803R200007

Installation

To install, follow the removal steps in the reverse order.

Front Turn Signal Light Bulb

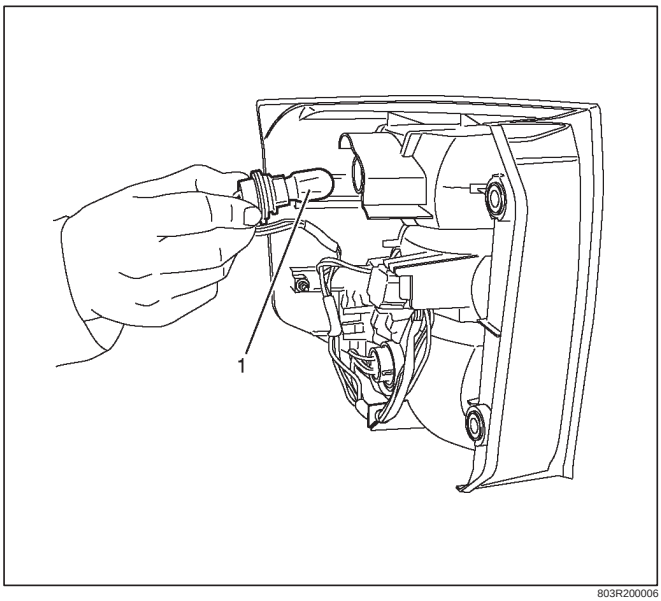
Removal and Installation

Refer to *Side Marker Light Bulb* in this section.

Rear Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly.
   ▼Refer to *Taillight Bulb* in this section.
3. Remove the bulb (1).
   ▼Remove the rear turn signal light socket by turning it counterclockwise.
   ▼Remove the bulb by turning it counterclockwise while pushing it at the same time.



803R200006

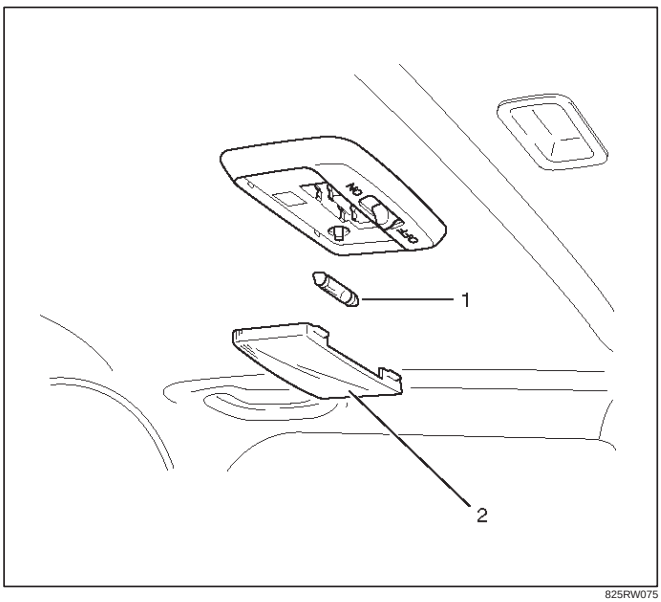
Installation

To install, follow the removal steps in the reverse order.

Dome Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   ▼Pull out the bulb.



825RW075

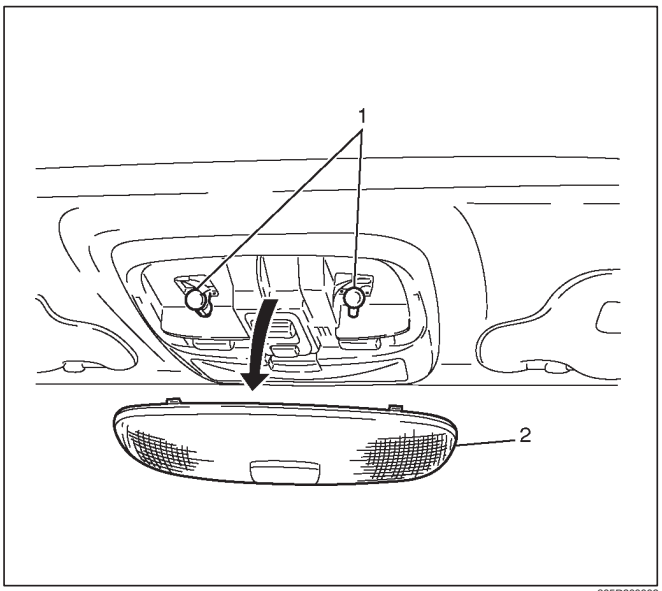
Installation

To install, follow the removal steps in the reverse order.

Map Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   ▼Pull out the bulb.



805R200002

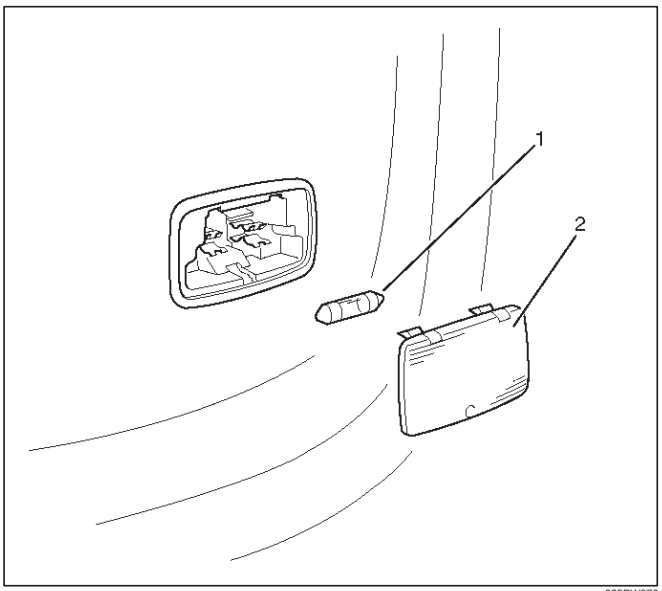
Installation

To install, follow the removal steps in the reverse order.

Courtesy Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   ▼Pull out the bulb.



825RW076

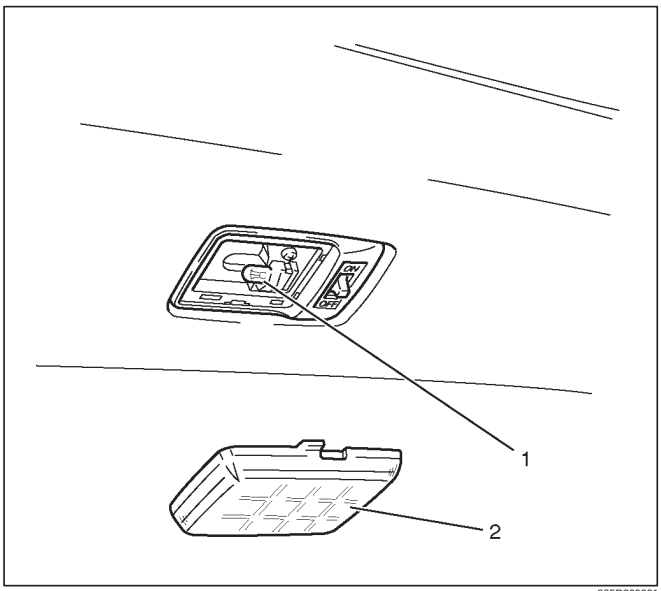
Installation

To install, follow the removal steps in the reverse order.

Luggage Room Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   ▼Pull out the bulb.



805R200001

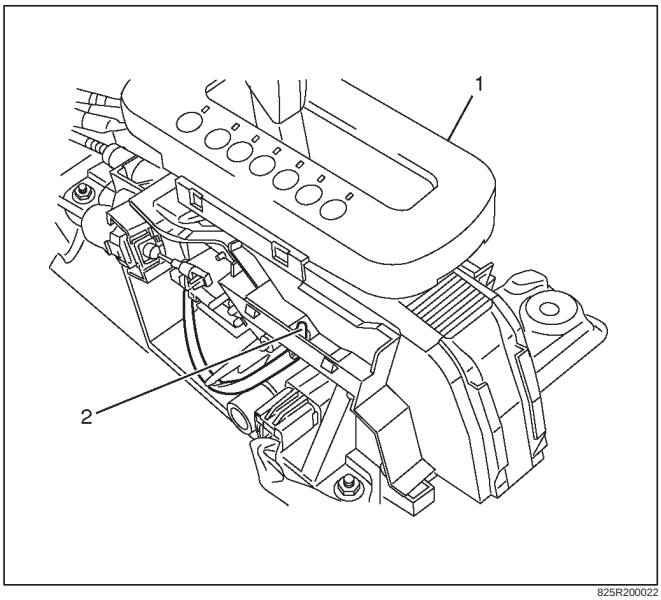
Installation

To install, follow the removal steps in the reverse order.

Shift Lever Illumination Light Bulb (A/T)

Removal

1. Disconnect the battery ground cable.
2. Remove the console assembly.
   ▼Refer to *Consol in Body Structure* section.
3. Remove the indicator cover (1).
4. Remove the bulb (2).
   ▼Turn the bulb socket counterclockwise.
   ▼Pull out the bulb from the socket.



825R200022

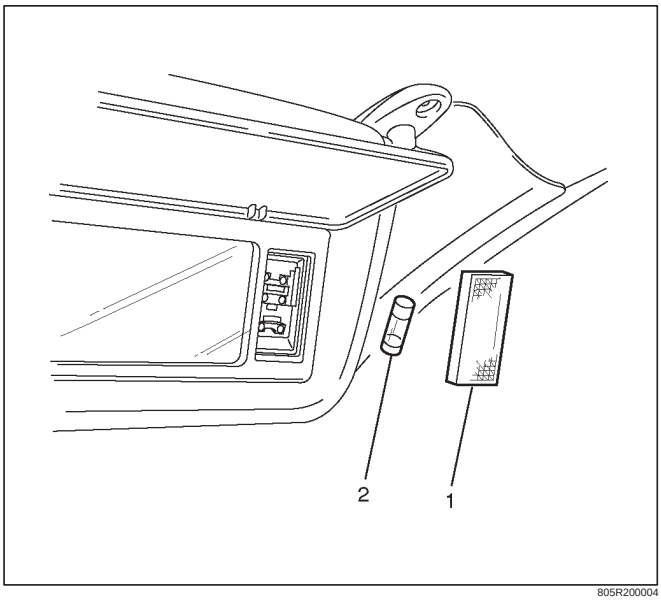
Installation

To install, follow the removal steps in the reverse order.

Vanity Mirror Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (1).
3. Remove the bulb (2).



805R200004

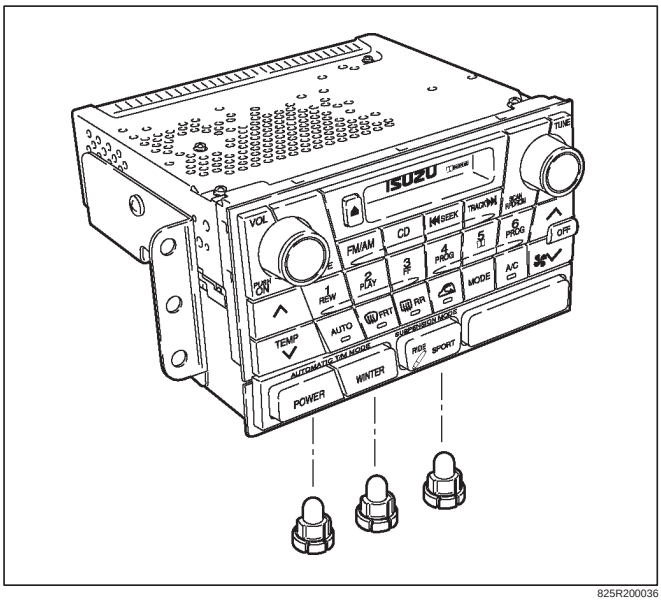
Installation

To install, follow the removal steps in the reverse order.

Switch Unit Assembly Illumination Light Bulb (Power/Winter & Intelligent Suspension Switch)

Removal

1. Disconnect the battery ground cable.
2. Remove the center cluster assembly.
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
3. Remove the audio.
   ▼Refer to *Audio in Entertainment* section.
4. Remove the illumination light bulb.



825R200036

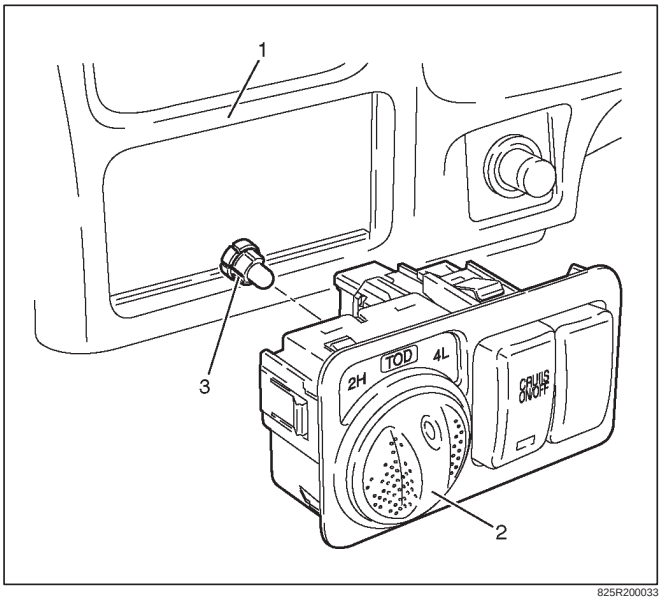
Installation

To install, follow the removal steps in the reverse order.

TOD Switch Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster (1).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
3. Remove the bulb (3).
   ▼Disconnect the TOD switch connector and cruise control main switch connector.
   ▼Remove the TOD switch (2).



825R200033

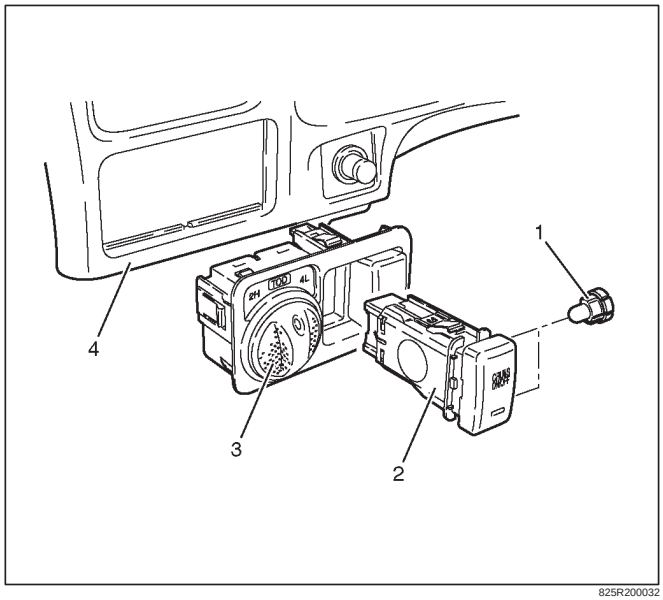
Installation

To install, follow the removal steps in the reverse order.

Cruise Control Main Switch Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster panel (4).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
3. Remove the bulb (1).
   ▼Disconnect the TOD switch connector and cruise control main switch connector.
   ▼Remove the TOD switch (3).
   ▼Remove the cruise main switch (2).



825R200032

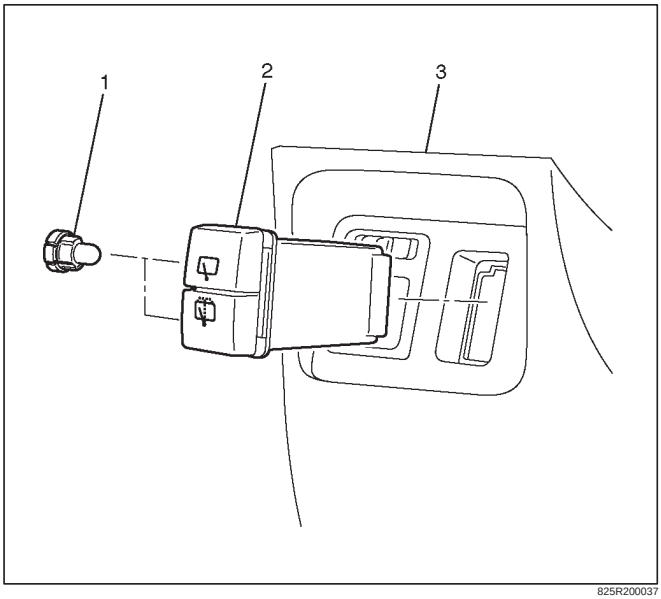
Installation

To install, follow the removal steps in the reverse order.

Rear Wiper and Washer Switch Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lower cover assembly (3).
   ▼Remove the dash side trim cover.
3. Remove the bulb (1).
   ▼Disconnect the connector.
   ▼Remove the rear wiper and washer switch (2).



825R200037

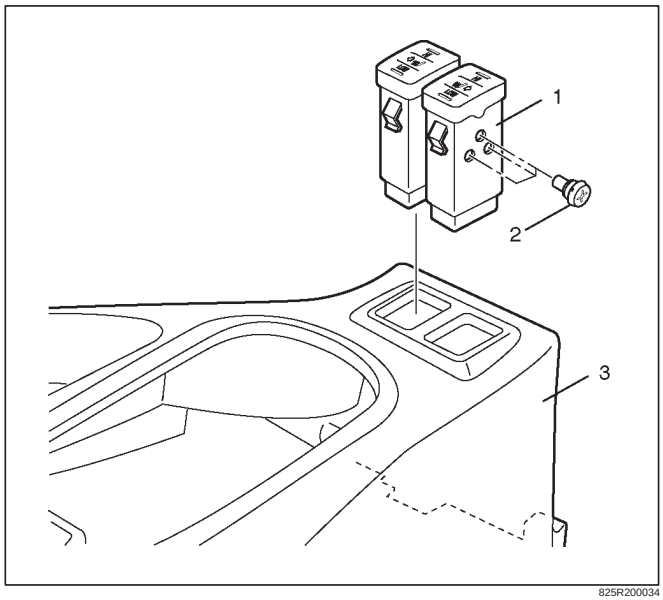
Installation

To install, follow the removal steps in the reverse order.

Seat Heater Switch Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the center consol assembly (3).
   ▼Refer to *Consol in Body Structure* section.
3. Remove the bulb (2).
   ▼Disconnect the seat heater switch connector.
   ▼Remove the seat heater switch (1).



825R200034

Installation

To install, follow the removal steps in the reverse order.

Starter Switch

Removal and Installation

Refer to *Lock Cylinder in Steering* section.

Lighting Switch (Combination Switch)

Removal and Installation

Refer to *Combination Switch in Steering* section.

Dimmer·Passing Switch (Combination Switch)

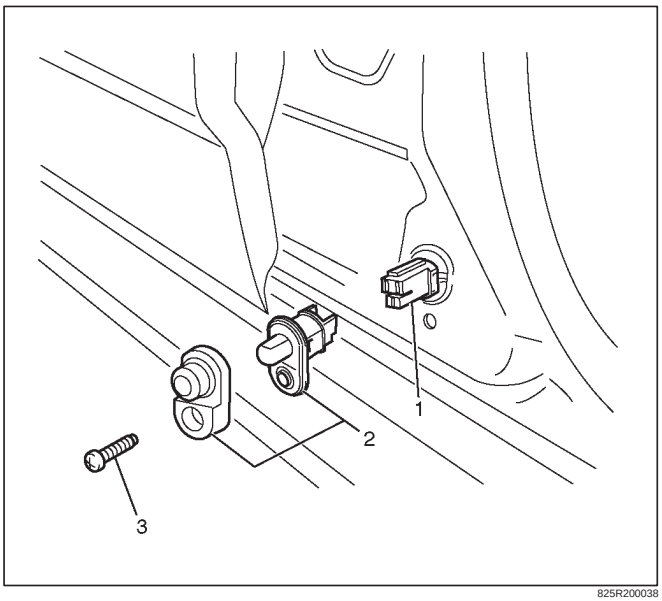
Removal and Installation

Refer to *Combination Switch in Steering* section.

Front Door Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the door switch (2).
   ▼Remove the screw (3).
   ▼Disconnect the connector (1).



825R200038

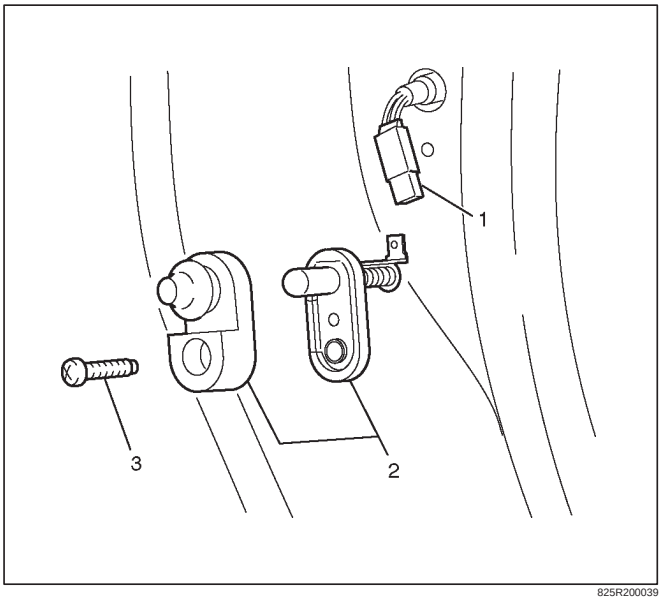
Installation

To install, follow the removal steps in the reverse order.

Rear Door Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the door switch (2).
   ▼Remove the screw (3).
   ▼Disconnect the connector (1).



825R200039

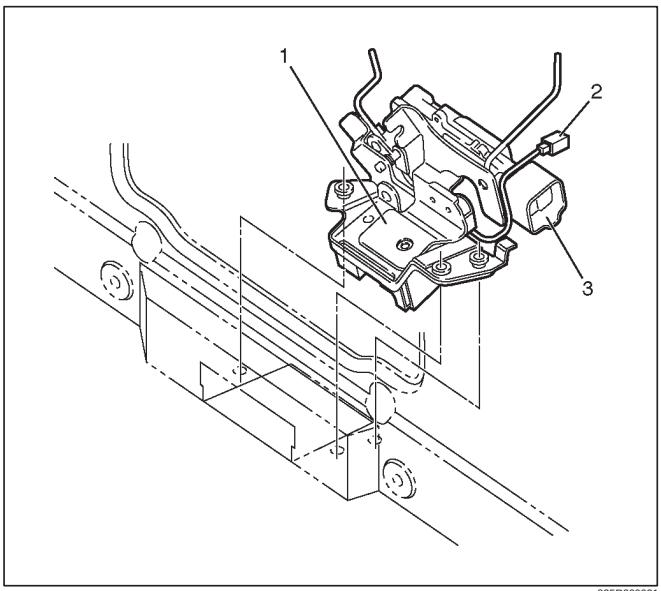
Installation

To install, follow the removal steps in the reverse order.

Tailgate Lock Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate outside handle.
   ▼Refer to *Tail Gate Outside Handle in Security and Locks* section.
3. Remove the tail gate lock switch (1).
   ▼Disconnect the switch connector (2) and lock actuator connectors (3).



825R200031

Installation

To install, follow the removal steps in the reverse order.

Key Remind Switch (Starter Switch)

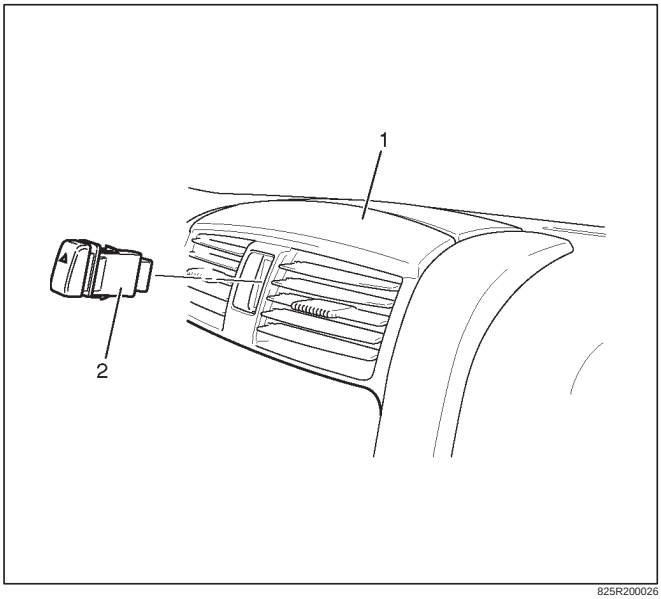
Removal and Installation

Refer to *Lock Cylinder in Steering* section.

Hazard Warning Light Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the center cluster assembly (1).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
3. Remove the hazard warning switch (2).
   ▼Disconnect the switch connector.
   ▼To remove the switch, push the lock from the back side of the center cluster assembly.



825R200026

Installation

To install, follow the removal steps in the reverse order.

Stoplight Switch

Removal and Installation

Refer to *Stoplight Switch in Brake* section.

Turn Signal Light Switch (Combination Switch)

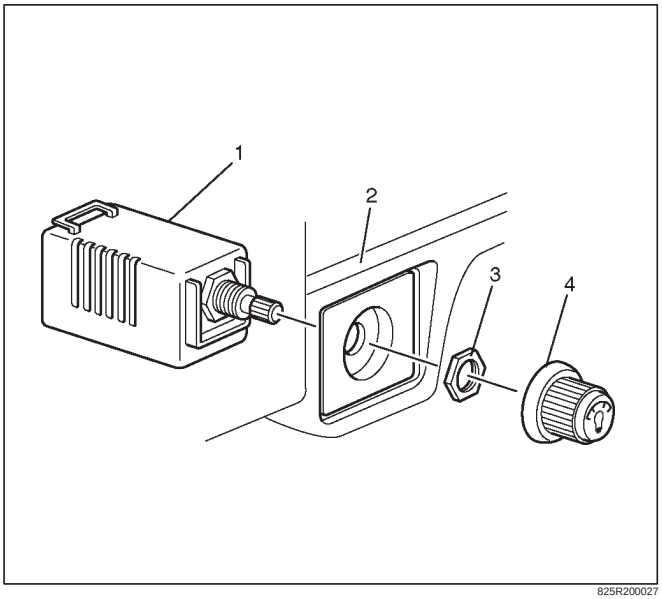
Removal and Installation

Refer to *Combination Switch in Steering* section.

Illumination Controller

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster panel cover assembly (2).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
3. Remove the illumination controller (1).
   ▼Disconnect the controller connector.
   ▼Remove the controller knob (4).
   ▼Remove the nut (3).
   ▼Remove the controller from the back side of the meter cluster panel assembly.



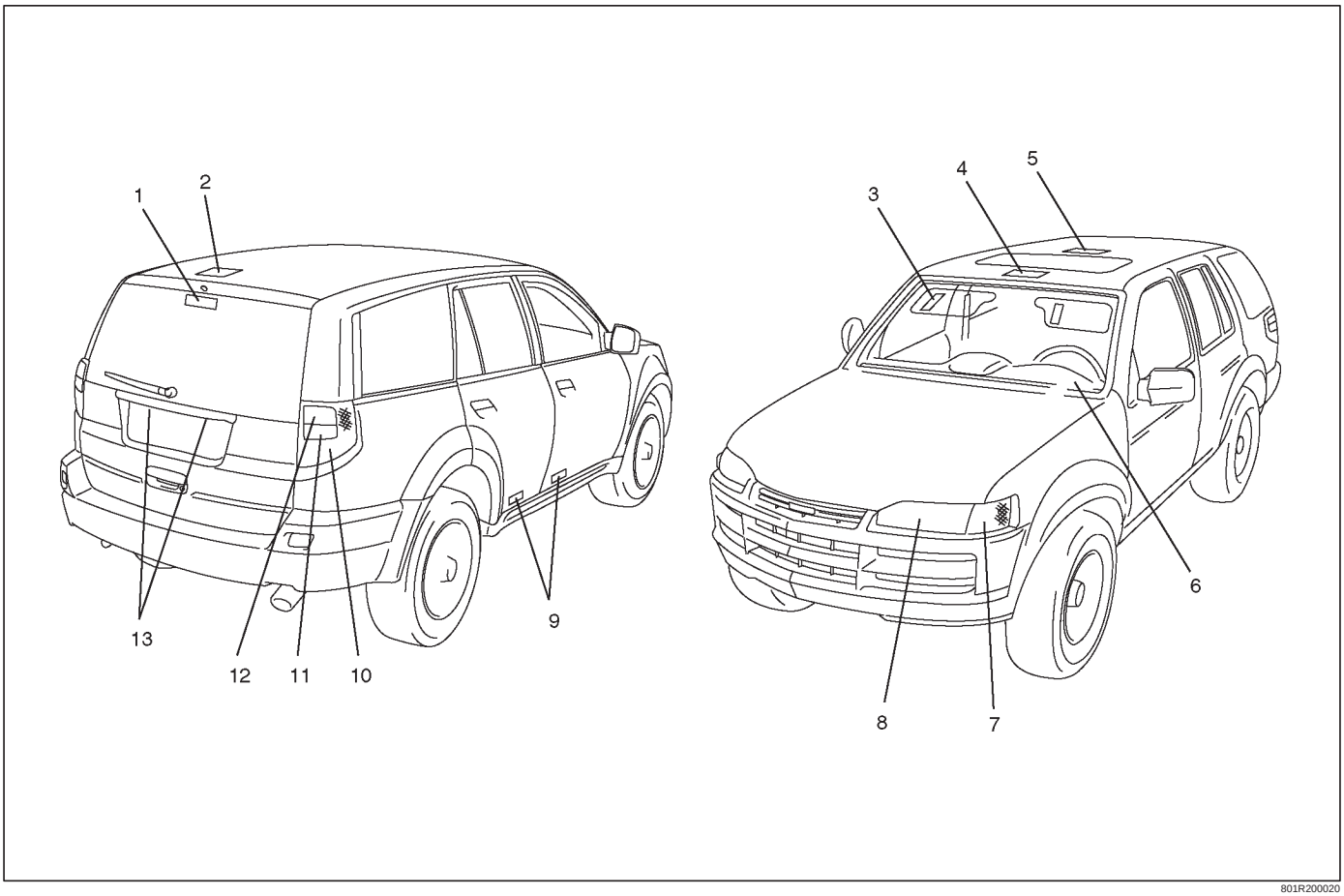
825R200027

Installation

To install, follow the removal steps in the reverse order.

Main Data and Specifications

Light and Bulb Specifications



801R200020

Legend
(1) High Mounted Stoplight
(2) Luggage Room Light
(3) Vanity Mirror Illumination Light
(4) Map Light
(5) Dome Light
(6) Meter
(7) Front Turn Signal Light/Front Side Marker Light/Parking Light
(8) Headlight
(9) Courtesy Light
(10) Taillight/Stoplight
(11) Backup Light
(12) Rear Turn Signal Light
(13) License Plate Light

Light Name		Bulb No.	Rated Power	Number of Bulbs	Lens Color	Remarks
Headlight		9005/9006	60w/51w	2	White	Halogen
Front Turn signal Light/ Front Side Marker Light/Parking Light		1157NA	27w/8w	2	Amber	
Rear Turn Signal Light		7440	21w	2	Amber	
Backup Light		921	18w	2	White	
Taillight/Stoplight		7443	21w/5w	2	Red	
High Mounted Stoplight		921	18w	2	Red	
License Plate Light (Tailgate type)		168	5w	2	White	
Map Light		—	8w	2	White	
Dome Light		—	10w	1	White	
Luggage Room Light		—	5w	1	White	
Courtesy Light		—	3.4w	4	White	
Indicator/Warning Light	Check Trans	—	1.4w	1	Red	Meter
	A/T Oil Temp	—	1.4w	1	Red	Meter
	Cruise Set	—	1.4w	1	Green	Meter
	Power Drive	—	1.4w	1	Amber	Meter
	Winter Drive	—	1.4w	1	Green	Meter
	Turn Signal	—	1.4w	2	Green	Meter
	Check TOD	—	1.4w	1	Red	Meter
	High Beam	—	1.4w	1	Blue	Meter
	ABS	—	1.4w	1	Amber	Meter
	Seat Belt	—	2w	1	Red	Meter
	Malfunction Indicator (Check Engine)	—	1.4w	1	Amber	Meter
	Low Fuel	—	1.4w	1	Amber	Meter
	Reduced Power	—	1.4w	1	Amber	Meter
	Sports Mode	—	1.4w	1	Green	Meter
	TOD Front	—	1.1w	1	Green	Meter
	TOD Auto	—	1.1w	1	Green	Meter
	TOD Rear	—	1.1w	1	Green	Meter
	Oil Pressure	—	1.4w	1	Red	Meter
	Brake System	—	1.4w	1	Red	Meter
	Charge	—	1.4w	1	Red	Meter
	A/T Shift Position	—	1.1w	7	P,N,D,3,2,L :Green R: Amber	Meter
	Air Bag	—	2w	1	Red	Meter
Illumination Light	Meter	—	3.4w	4		Meter
	Shift lever	—	1.4w	1	White	Shift lever
	Vanity Mirror	—	2w	2	White	Sun Visor
	Cigarette Lighter	—	1.4w	1	White	Cigarette Lighter
	Ashtray	—	1.4w	1	White	Ashtray

AXIOM

BODY AND ACCESSORIES

WIPER / WASHER SYSTEM

CONTENTS

Service Precaution 8B–1
Windshield Wiper/Washer System 8B–2
General Description 8B–2
Windshield Wiper And Washer Switch 8B–2
Removal and Installation 8B–2
Windshield Wiper Motor 8B–2
Removal 8B–2
Installation 8B–2
Windshield Washer Motor 8B–3
Removal 8B–3
Installation 8B–3
Windshield Washer Spray Pattern 8B–4
Windshield Wiper Linkage 8B–5
Windshield Wiper Linkage and Associated Parts 8B–5
Removal 8B–5
Installation 8B–5
Windshield Wiper Arm/Blade 8B–6
Removal 8B–6
Installation 8B–6
Windshield Wiper Blade Rubber 8B–7
Removal 8B–7
Installation 8B–7
Rear Wiper/Washer System 8B–8
General Description 8B–8
Rear Wiper and Washer Switch 8B–8
Removal 8B–8
Installation 8B–8
Rear Wiper Motor 8B–9
Removal 8B–9
Installation 8B–9
Rear Washer Motor 8B–10
Removal 8B–10
Installation 8B–10
Alarm and Relay Control Unit 8B–11
Removal 8B–11
Installation 8B–11
Rear Wiper Arm/Blade 8B–11
Removal 8B–11
Installation 8B–11
Rear Washer Nozzle 8B–12
Removal 8B–12
Installation 8B–12
Rear Washer Spray Pattern 8B–12
Rear Wiper Blade Rubber 8B–13
Removal 8B–13
Installation 8B–13
Main Data and Specifications 8B–14

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Windshield Wiper/Washer System

General Description

The circuit consists of the starter switch, windshield wiper & washer switch, windshield wiper motor, windshield washer motor and alarm & relay control unit.
When the windshield wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.
The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The alarm & relay control unit relay is used to control motion of the wiper.

Windshield Wiper And Washer Switch

Removal and Installation

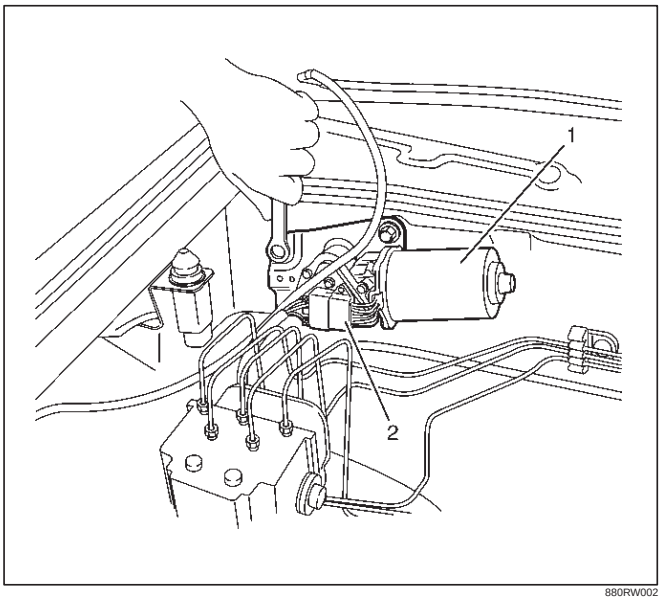
Refer to *Combination Switch in Steering* section.

Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector(2).
3. Remove 4 mounting bolts.
4. Remove the nut of the wiper motor shaft, and disconnect the linkage.
5. Remove the windshield wiper motor(1).

CAUTION: To facilitate the removal of the nuts, be sure to put out the tip portion of the linkage sufficiently through the mounting hole of the motor by sliding the linkage slowly.



880RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the wiper motor shaft nut to the specified torque.

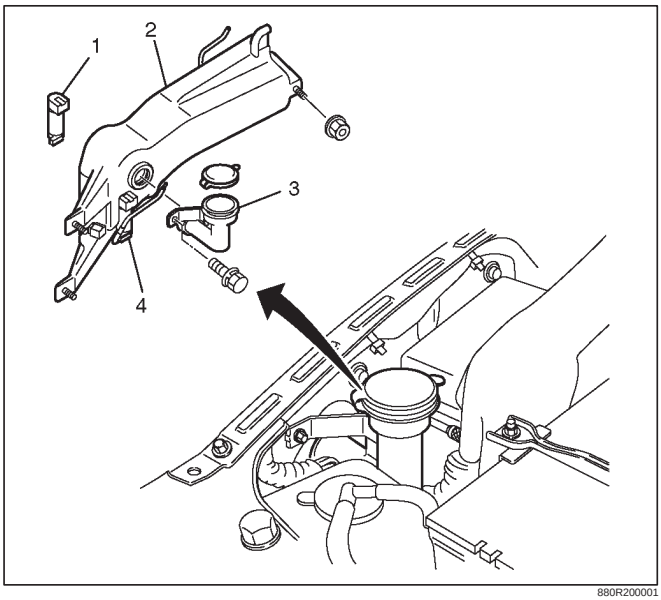
   Torque: 14 N·m (122 lb in)

2. Remove the wiper arms on both sides, and rotate the wiper motor until it gets to the autostop position to secure windshield wiper correct operation.

Windshield Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender panel (right side).
   ▼Refer to *Fender Panel in Body Structure* section.
3. Disconnect the windshield washer motor connector and the rear washer motor connector.
4. Disconnect the windshield washer hose connector and the rear washer hose connector.
5. Remove the filler neck (3).
   ▼Remove the bolt.
6. Remove the washer tank (2).
   ▼Remove the three nuts.
7. Remove the windshield washer motor (4).
   ▼Pull out the motor from the washer tank.

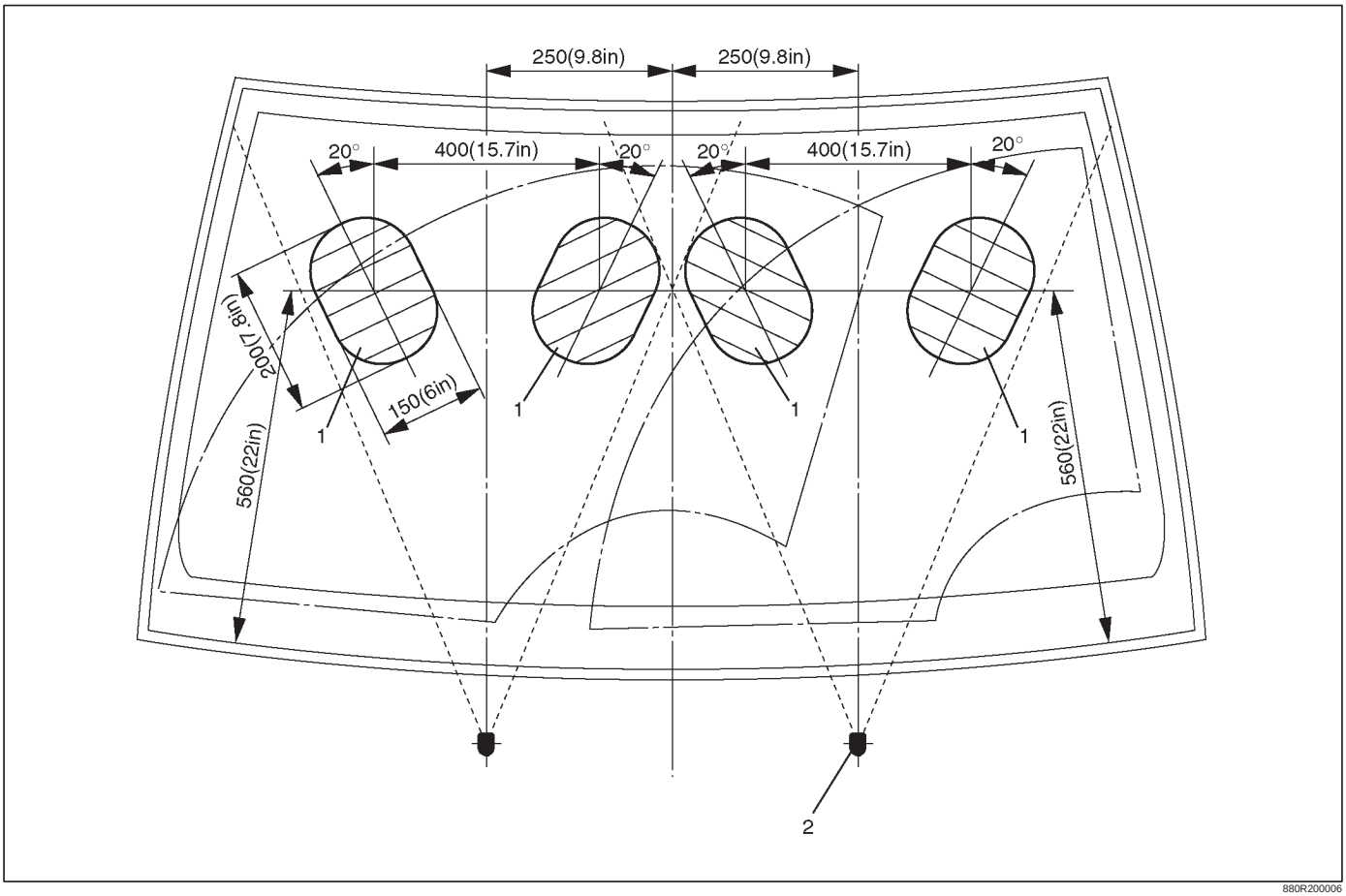


880R200001

Installation

To install, follow the removal steps in the reverse order.

Windshield Washer Spray Pattern

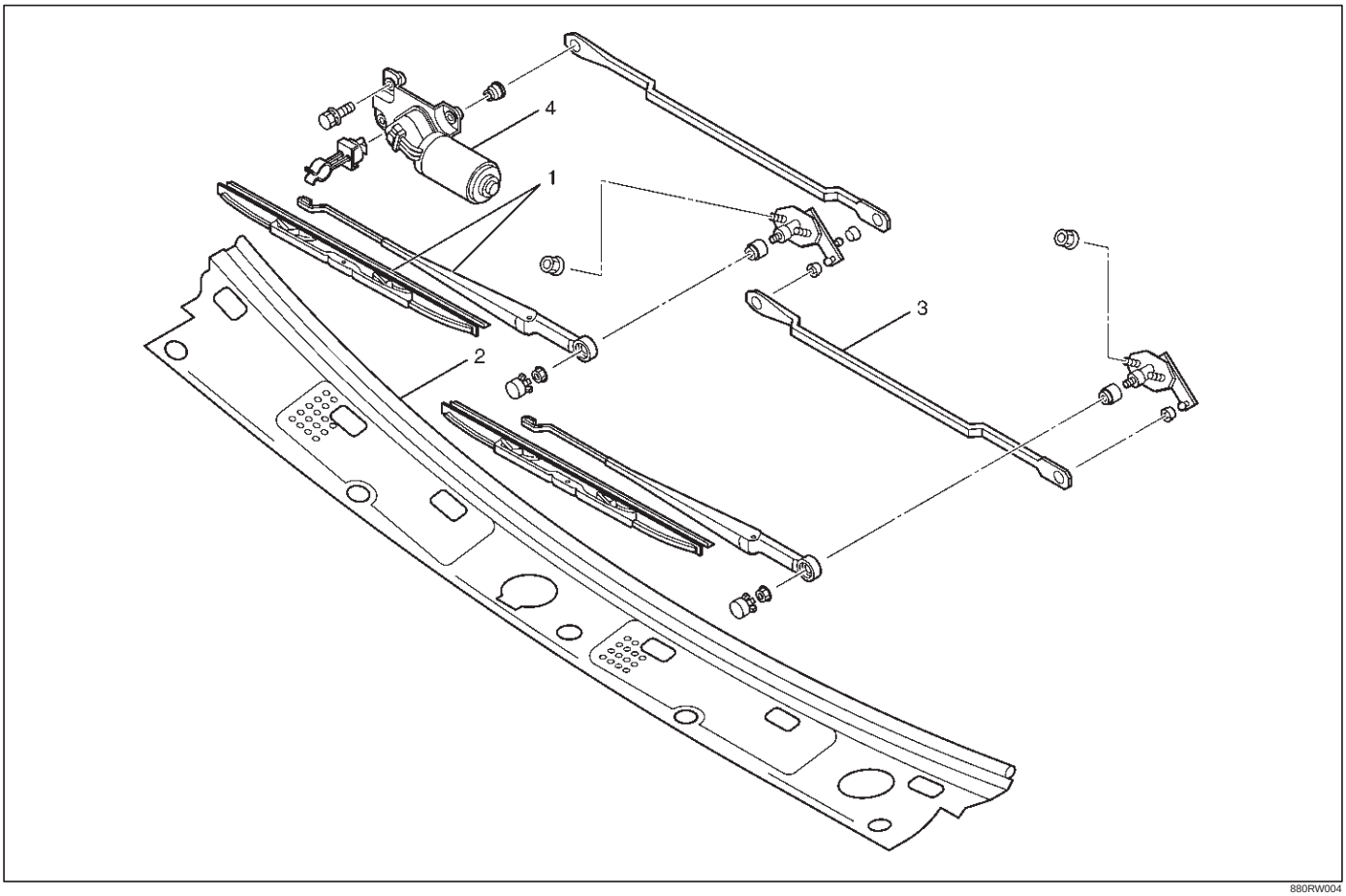


Legend

(1) Spray Target
(2) Washer Nozzle

Windshield Wiper Linkage

Windshield Wiper Linkage and Associated Parts



880RW004

Legend

(1) Windshield Wiper Arm/Blade
(2) Vent Cowl Cover
(3) Windshield Wiper Linkage Assembly
(4) Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the windshield wiper arm/blade.
3. Remove the vent cowl cover.
4. Remove the windshield wiper motor.
5. Remove the pivot assembly mounting nuts.
6. Take out the windshield wiper linkage assembly from the opening of the cowl.

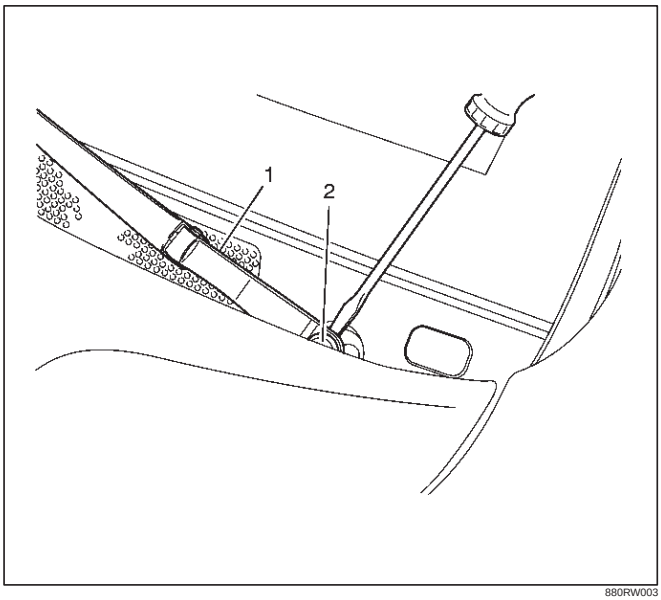
Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper Arm/Blade

Removal

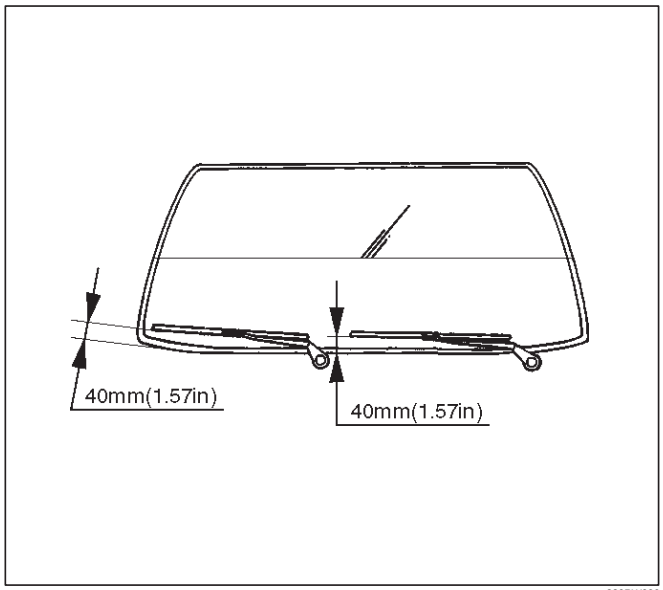
1. Pry the cap(2) off with the tip of a screwdriver.
2. Remove the nut.
3. Remove the wiper arm/blade(1).



880RW003

Installation

To install, follow the removal steps in the reverse order, noting the following points:



880RW006

1. Before installing the wiper arm/blade to the shaft, confirm that the motor stops at the autostop position.
2. Set the wiper arm/blade so that the tips of both blades are positioned about 40 mm (1.57 in) from the upper edge of the cowl cover as shown in the figure.
3. Tighten the nuts to the specified torque.

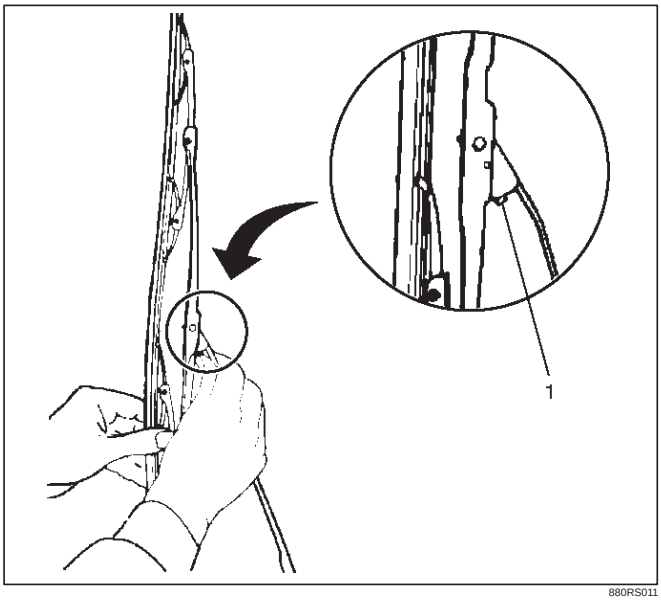
Torque: 23 N·m (17 lb ft)

Windshield Wiper Blade Rubber

Removal

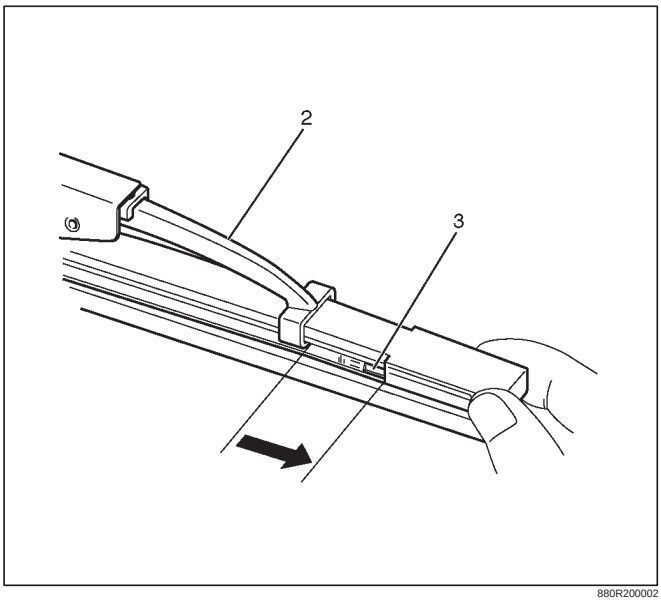
1. Push the wiper blade lock(1) while pulling the wiper blade in the arrow direction as shown in the figure.

CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



880RS011

2. Pull the end of rubber and remove the concavity (3) from the click of the blade stay (2).



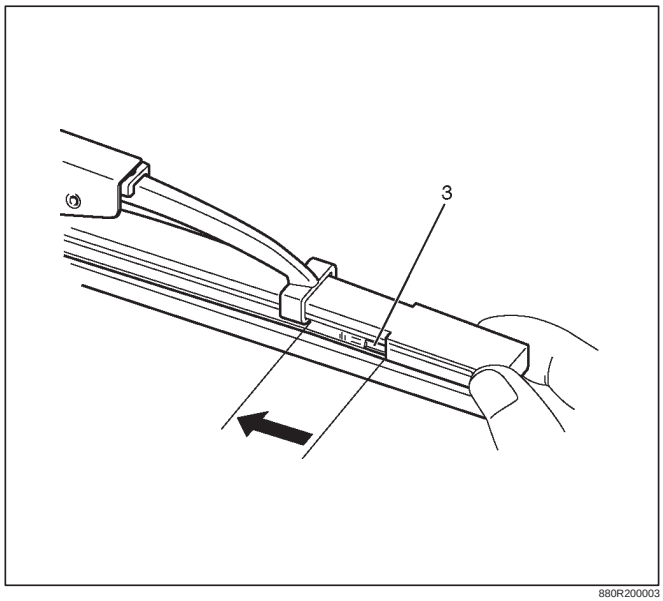
880R200002

3. Pull the rubber out in the same direction.

Installation

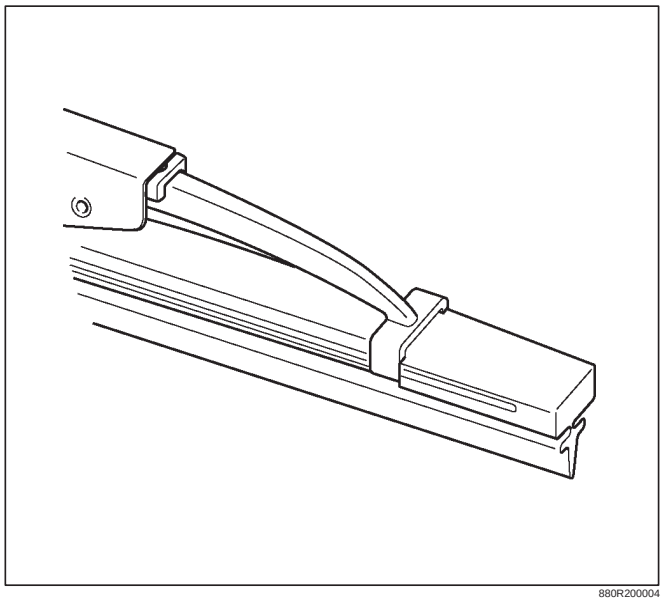
To install, follow the removal steps in the reverse order, noting the following points:

1. Install the click of the blade stay in the groove of the new rubber and slide it in. Complete wiper blade installation by pushing the click in the concavity (3).



880R200003

2. Finally, check that the click of the stay has caught in the hole of the rubber.



880R200004

Rear Wiper/Washer System

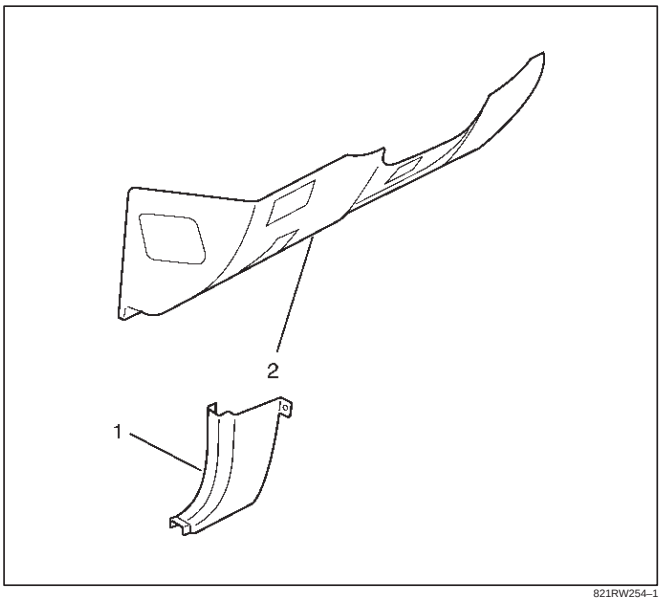
General Description

The circuit consists of the starter switch, rear wiper & washer switch, rear wiper motor, rear washer motor and Alarm & relay control unit.
When the rear wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.
The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The alarm & relay control unit is used to control motion of the wiper.

Rear Wiper and Washer Switch

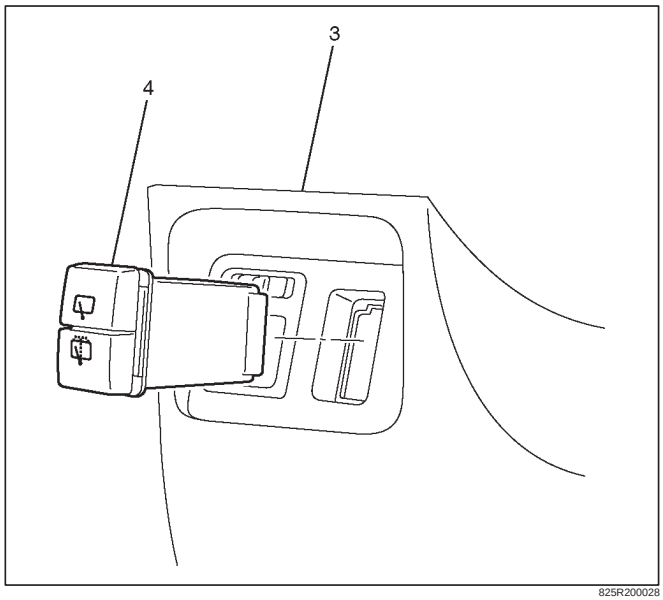
Removal

1. Disconnect the battery ground cable.
2. Remove the dash side trim panel(1).
3. Remove the lower cover assembly(2).



821RW254–1

4. Remove the rear wiper & washer switch (4).
   ▼Disconnect the connector.
   ▼Push the lock from the back side of the lower cover assembly (3).



825R200028

Installation

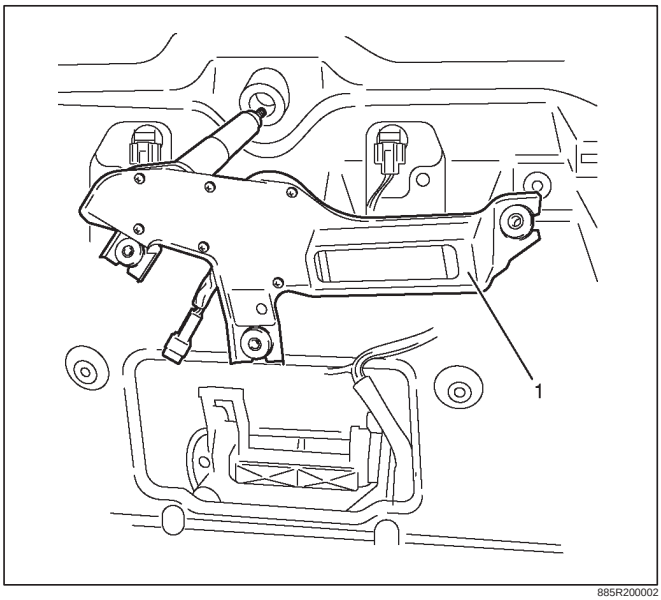
To install, follow the removal steps in the reverse order, noting the following point:

1. Push the switch with your fingers until it locks securely.

Rear Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad.
   ▼Refer to *Tailgate Trim Pad in Body Structure* section.
3. Remove the wiper arm/blade.
   Refer to *Rear Wiper Arm/Blade* in this section.
4. Remove the rear wiper motor (1).
   ▼Disconnect the connector.
   ▼Remove the rear wiper motor fixing screws.

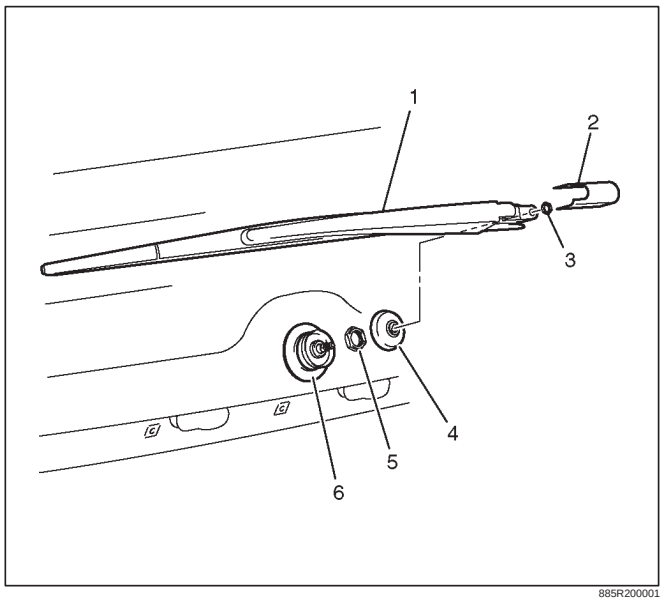


885R200002

Installation

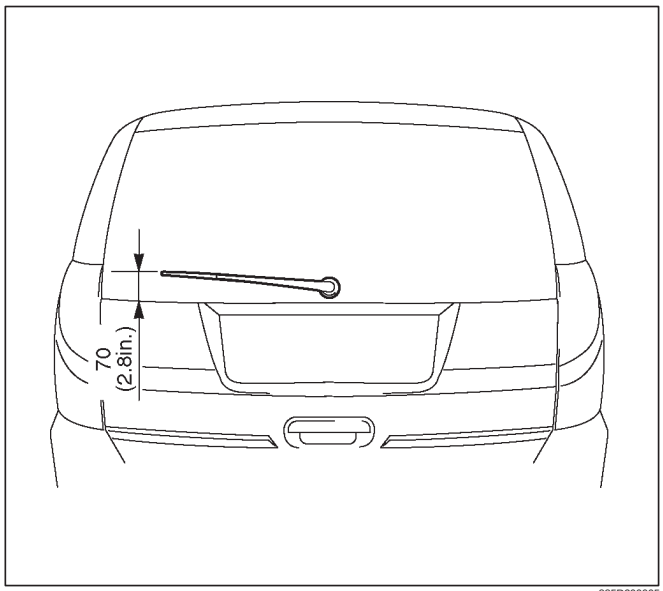
To install, follow the removal steps in the reverse order, noting the following points:

1. Before installing the wiper arm/blade (1) to the motor shaft (6), confirm that the motor stops at the autostop position.
2. Tighten the motor shaft nut (5) to the specified torque.
   Torque: 10 N·m (87 lb in)
3. Tighten the wiper arm nut (3) to the specified torque.
   Torque: 9 N·m (78 lb in)



885R200001

4. Install the wiper arm/blade so that the wiper arm contact as shown in the figure.

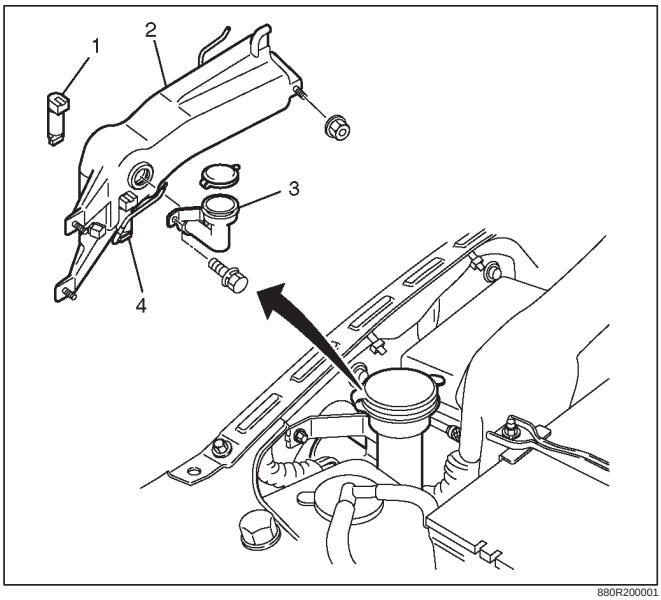


885R200005

Rear Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender panel (right side).
   ▼Refer to *Fender Panel in Body Structure* section.
3. Disconnect the windshield washer motor connector and the rear washer motor connector.
4. Disconnect the windshield washer hose connector and the rear washer hose connector.
5. Remove the filler neck (3).
   ▼Remove the bolt.
6. Remove the washer tank (2).
   ▼Remove the three nuts.
7. Remove the rear washer motor (1).
   ▼Pull out the motor from the washer tank.



880R200001

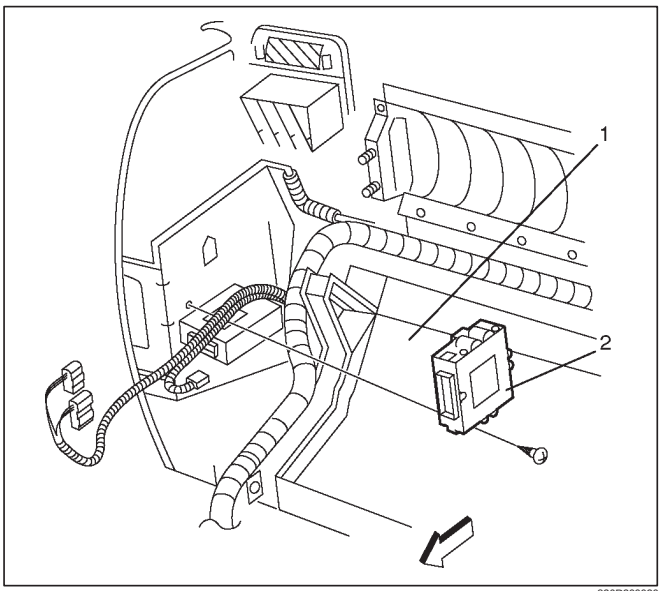
Installation

To install, follow the removal steps in the reverse order.

Alarm and Relay Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the grove box (1).
3. Remove the alarm and relay control unit (2). Disconnect the connector.



826R200020

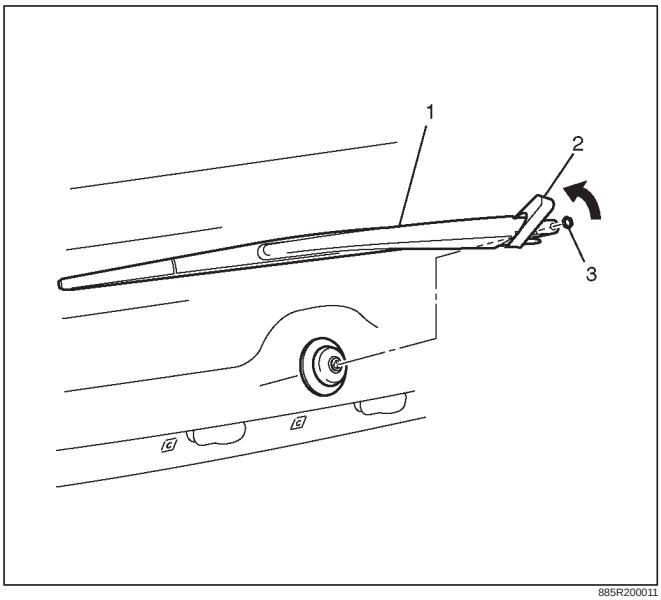
Installation

To install, follow the removal steps in the reverse order.

Rear Wiper Arm/Blade

Removal

1. Open the cap (2).
2. Remove the arm nut (3).
3. Remove the wiper arm/blade (1).



885R200011

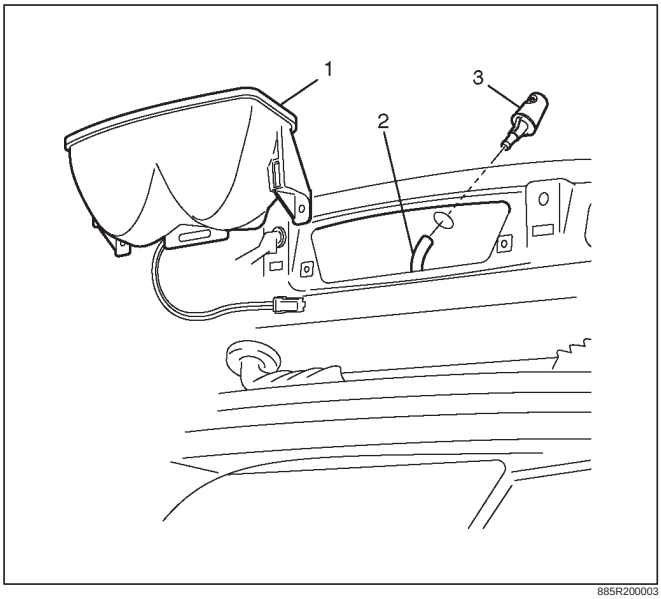
Installation

Refer to *Rear Wiper Motor* in this section.

Rear Washer Nozzle

Removal

1. Disconnect the battery ground cable.
2. Remove the high mounted stoplight (1).
   ▼Refer to *High Mounted Stoplight in Lighting System* section.
3. Remove the washer nozzle(3).
   ▼Pull out the washer nozzle from the washer hose (2).

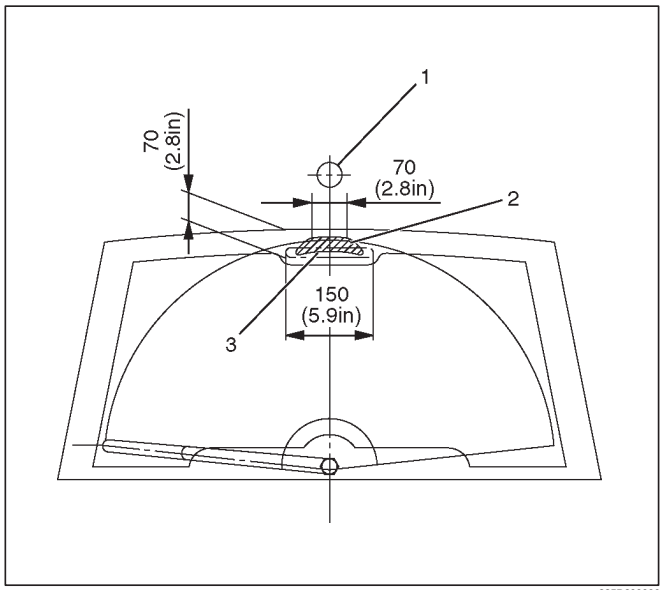


885R200003

Installation

To install, follow the removal steps in the reverse order.

Rear Washer Spray Pattern



885R200006

Legend

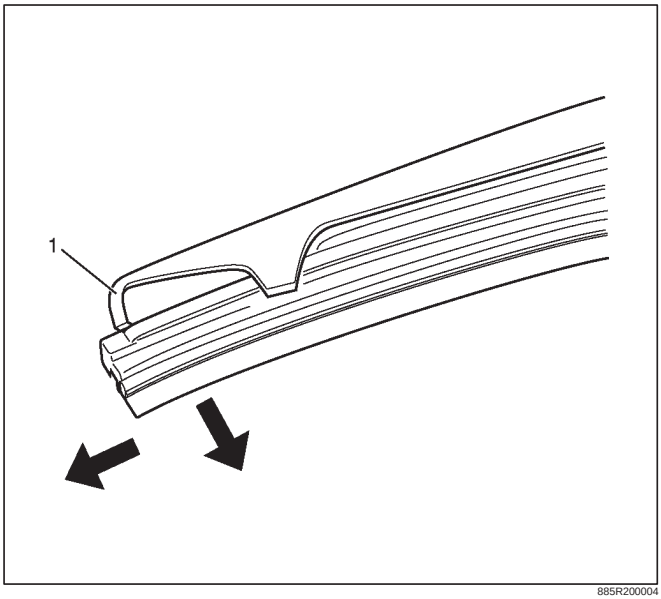
(1) Washer Nozzle
(2) Spray Target
(3) High Mounted Stoplight

Rear Wiper Blade Rubber

Removal

1. Remove the wiper blade from the wiper arm.
2. Press and hold the wiper rubber under the wiper blade hook (1).
3. Pull the wiper rubber out from wiper blade.

CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.

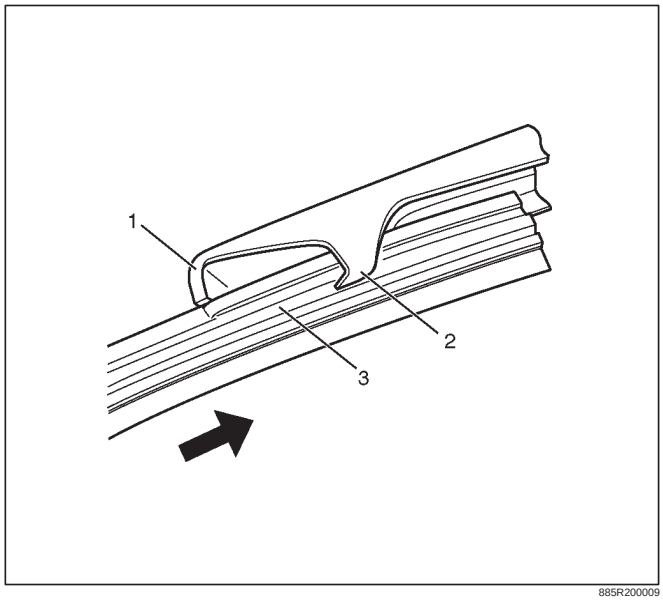


885R200004

Installation

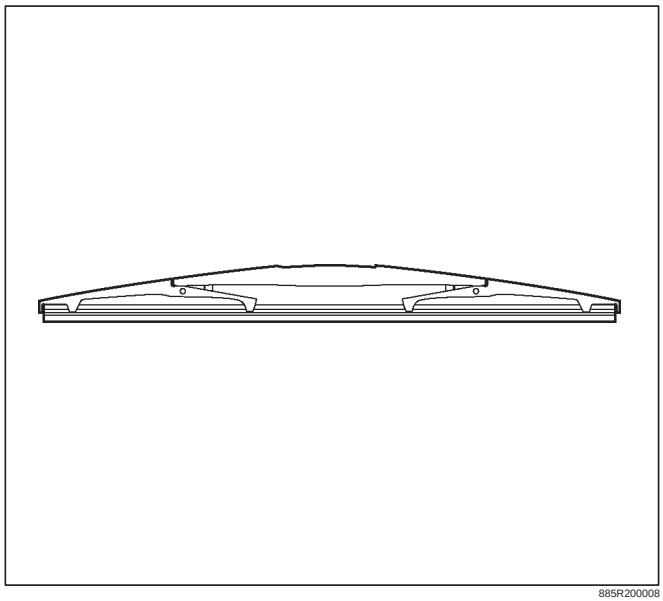
1. Install the wiper blade rubber.

▼Matching the grove of the wiper rubber (3) and the guide (2) of the wiper blade (1), insert the wiper rubber to the wiper blade.



885R200009

▼Check that the wiper rubber is set between the right hook and left hook of the wiper blade.



885R200008

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Windshield Wiper Motor Shaft Nut	14	—	122
Windshield Wiper Arm Nuts	23	17	—
Rear Wiper Motor Shaft Nut	10	—	87
Rear Wiper Arm Nut	9	—	78

AXIOM

BODY AND ACCESSORIES

ENTERTAINMENT

CONTENTS

Service Precaution 8C–1
Cigarette Lighter 8C–2
General Description 8C–2
Removal 8C–2
Installation 8C–2
Rod Type Antenna 8C–3
Removal 8C–3
Installation 8C–3
Accessory Socket 8C–4
Front Accessory Socket 8C–4
Removal 8C–4
Installation 8C–4
Rear Accessory Socket 8C–4
Removal 8C–4
Installation 8C–4
Audio 8C–5
Removal 8C–5
Installation 8C–5
Speaker 8C–6
Front Speaker 8C–6
Removal 8C–6
Installation 8C–6
Front Tweeter Assembly 8C–6
Removal 8C–6
Installation 8C–6
Rear Door Speaker 8C–6
Removal 8C–6
Installation 8C–7
Rear Tweeter Assembly 8C–7
Removal 8C–7
Installation 8C–7
Horn 8C–8
Removal 8C–8
Installation 8C–8
Display (MID) 8C–8
Removal 8C–8
Installation 8C–8
MID Control Unit 8C–9
Removal 8C–9
Installation 8C–9
GPS Control Unit 8C–10
Removal 8C–10
Installation 8C–10
Self-Diagnosis 8C–11
Self-Diagnosis Flow Chart–1 . . . . . 8C–11
Self-Diagnosis Flow Chart–2 (Audio) 8C–12
Self-Diagnosis Flow Chart–3 (Display) . . . 8C–13
Self-Diagnosis Flow Chart–4 (MID) 8C–14
Audio Self-Diagnosis 8C–15
Display Self-Diagnosis 8C–16
MID Self-Diagnosis 8C–17
Symptom Diagnosis 8C–18
MID Not Appears 8C–18
No COMPASS, CLOCK, FUEL CONSUMPTION, or SERVICE Display . . 8C–19
No COMPASS Display 8C–20
No SERVICE Display 8C–20
Other Trouble Symptom 8C–21
MID Circuit 8C–22
Harness Connector Faces 8C–23

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

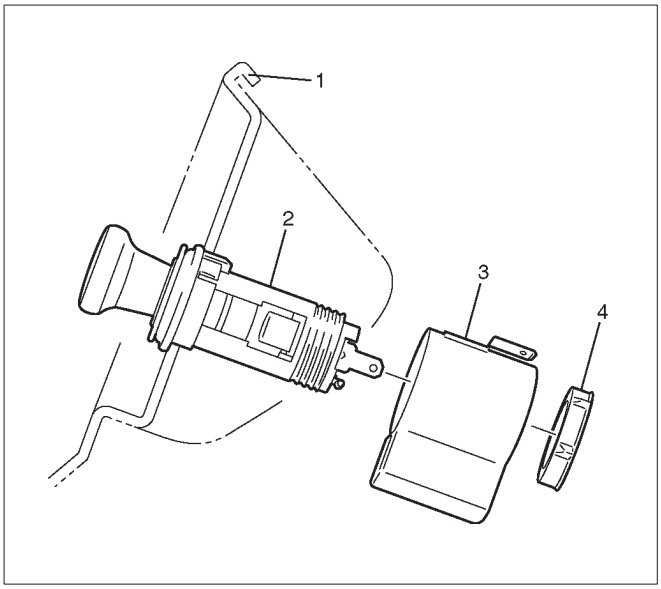
Cigarette Lighter

General Description

When the cigarette lighter is pushed in with the starter switch at either “ACC” or “ON” position, a circuit is formed in the cigarette lighter case to heat the lighter coil.
The cigarette lighter springs back to its original position after the lighter coil is heated.

Removal

1. Disconnect the battery ground cable.
2. Remove the center cluster assembly (1).
   ▼Refer to *Instrument Panel Assembly in Body Structure section.*
3. Remove the cigarette lighter assembly (2).
   ▼Disconnect the connectors.
   ▼Remove the socket (3) and nut (4).



826R200012

Installation

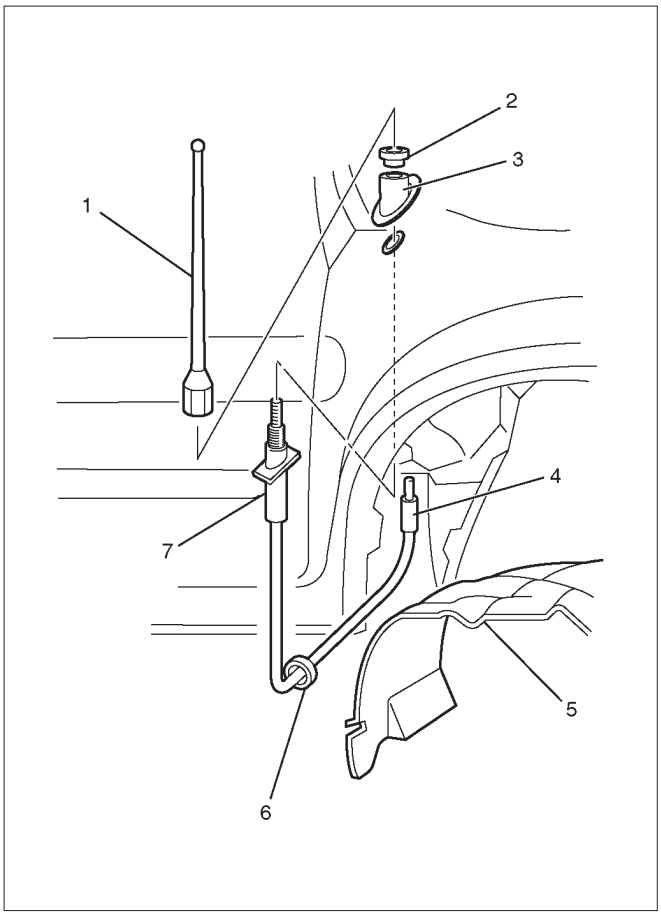
To install, follow the removal steps in the reverse order, noting the following point:

1. When installing the bezel, align the projected portion of the socket with the notch of the bezel.

Rod Type Antenna

Removal

1. Disconnect the battery ground cable.
2. Turn the antenna rod (1) counterclockwise to remove it.
3. Remove three screws and nine clips to remove the fender inner liner (5).
4. Disconnect the feeder cable connector (4) at the inside of the vehicle.
5. Turning the lock nut (2) counterclockwise removes it together with the base mold (3).
6. Pull down and remove the housing (7) from the panel.
7. Pull and remove the cable with the grommet (6).



890R200040

Installation

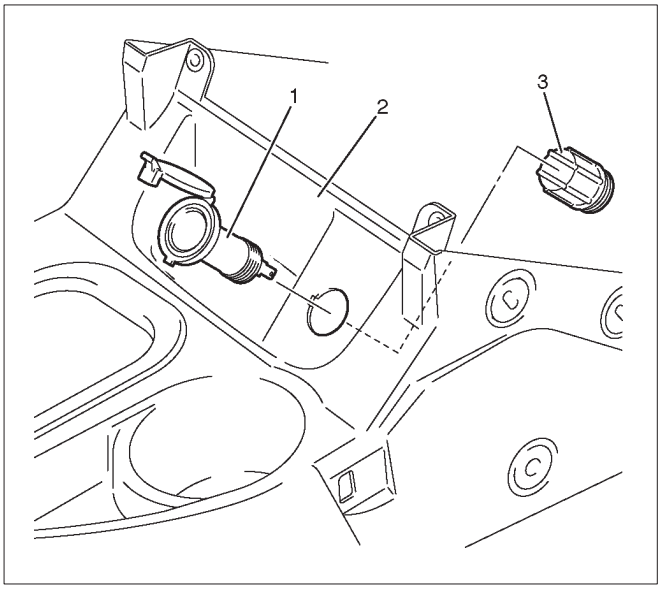
To install, follow the removal steps in the reverse order.

Accessory Socket

Front Accessory Socket

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (2).
   ▼Refer to *Instrument Panel Assembly in Body Structure section.*
3. Remove the front accessory socket (1).
   ▼Disconnect the connectors.
   ▼Remove the holdernut (3).



826R200013

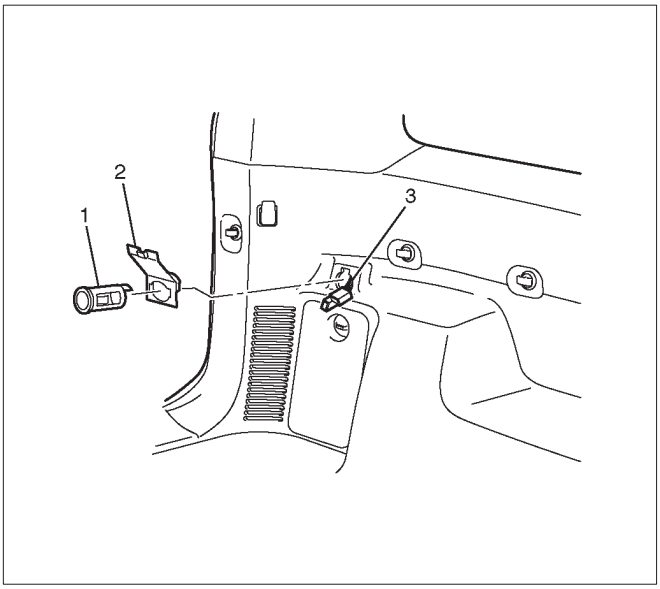
Installation

To install, follow the removal steps in the reverse order.

Rear Accessory Socket

Removal

1. Disconnect the battery ground cable.
2. Remove the quarter trim lower cover.
3. Remove the rear accessory socket (1).
   ▼Disconnect the connectors (3).
   ▼Pull out the rear accessory socket from the socket cover (2).



826R200014

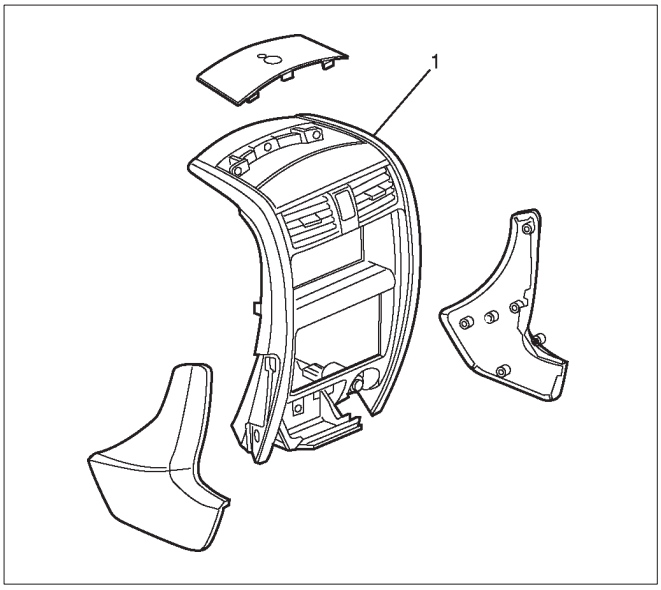
Installation

To install, follow the removal steps in the reverse order.

Audio

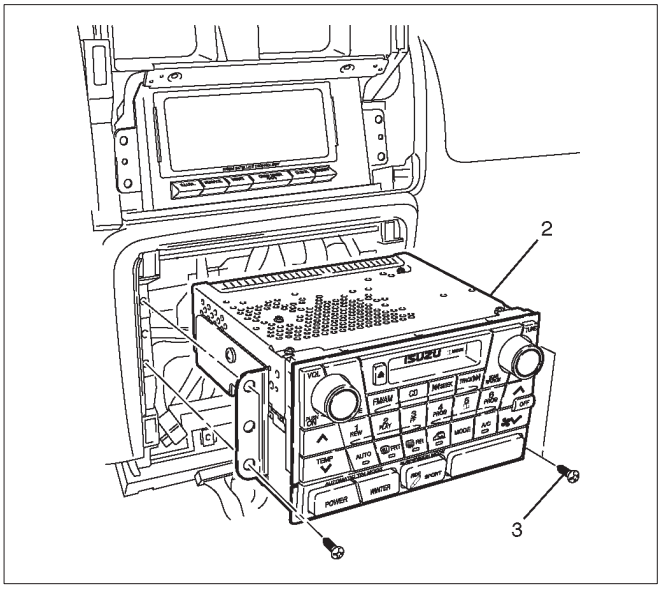
Removal

1. Disconnect the battery ground cable.
2. Remove the center cluster assembly (1).
   ▼Refer to *Instrument Panel Assembly in Body Structure section.*



890R200032

3. Remove the audio (2).
   ▼Remove the two fixing screws (3).
   ▼Disconnect the connector and the antenna cable.



890R200033

Installation

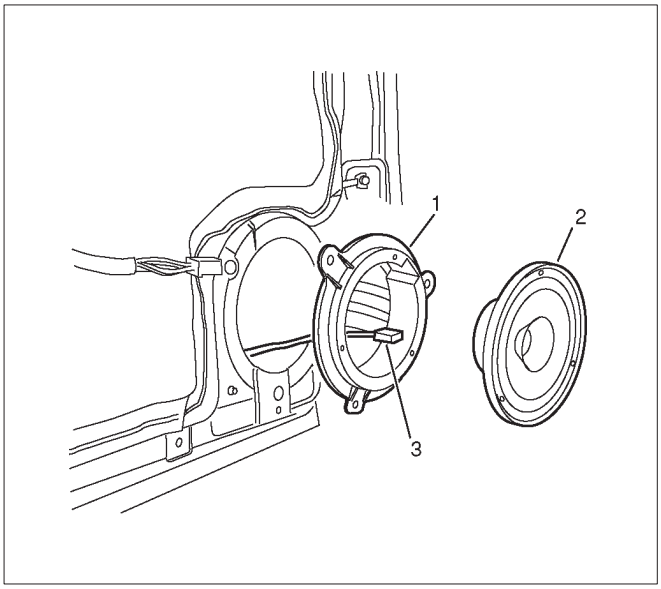
To install, follow the removal steps in the reverse order.

Speaker

Front Speaker

Removal

1. Disconnect the battery ground cable.
2. Remove the front door trim pad.
   ▼Refer to *Front Door in Body Structure section.*
3. Remove the front speaker (2).
   ▼Remove the three screws and the speaker spacer (1).
   ▼Disconnect the connector (3).



890R200028

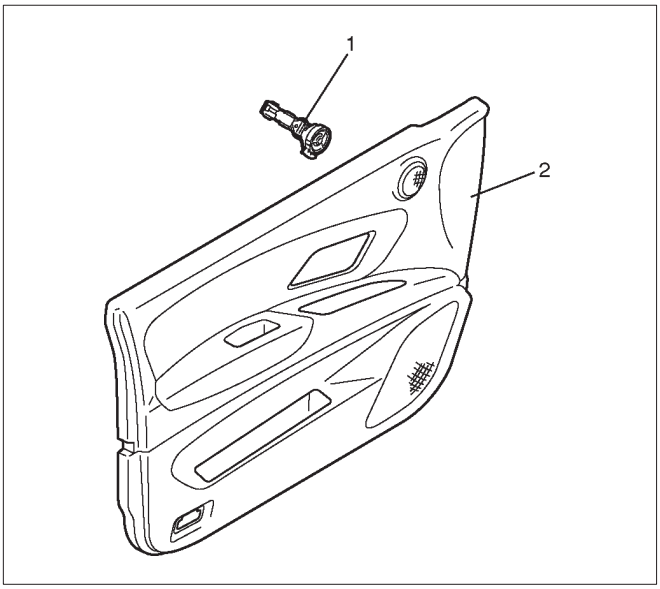
Installation

To install, follow the removal steps in the reverse order.

Front Tweeter Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the front door trim pad (2).
   ▼Refer to *Front Door in Body Structure section.*
3. Remove the tweeter (1).
   ▼Disconnect the connector.



890R200030

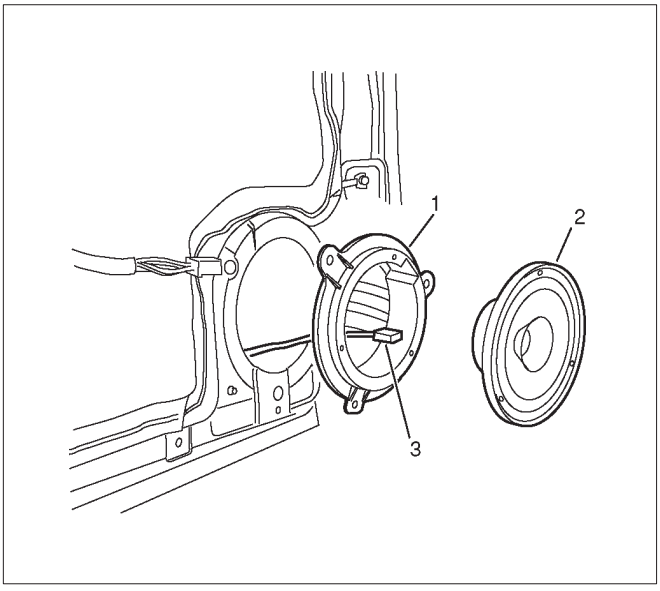
Installation

To install, follow the removal steps in the reverse order.

Rear Door Speaker

Removal

1. Disconnect the battery ground cable.
2. Remove the rear door trim pad.
   ▼Refer to *Rear Door in Body Structure* section.
3. Remove the rear speaker (2).
   ▼Remove the three screws and the speaker spacer (1).
   ▼Disconnect the connector (3).



890R200028

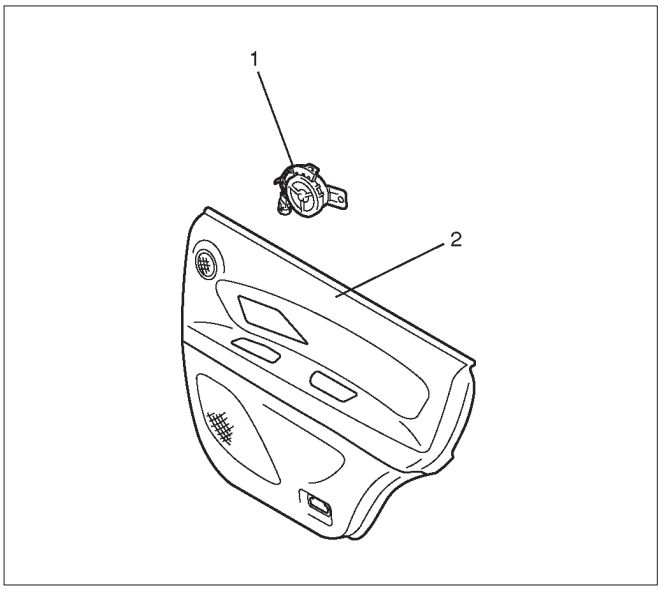
Installation

To install, follow the removal steps in the reverse order.

Rear Tweeter Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the rear door trim pad (2).
   ▼Refer to *Rear Door in Body Structure section.*
3. Remove the tweeter (1).
   ▼Disconnect the connector.



890R200031

Installation

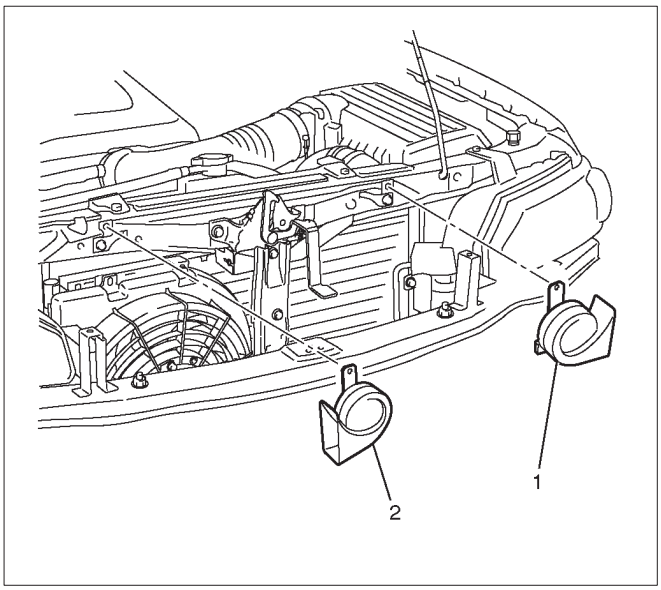
To install, follow the removal steps in the reverse order.

Horn

Removal

1. Disconnect the battery ground cable.
2. Remove the horn.
   ▼Disconnect the connector.
   ▼Remove the horn mounting bolt.

NOTE: High (1), Low (2)



828R200003

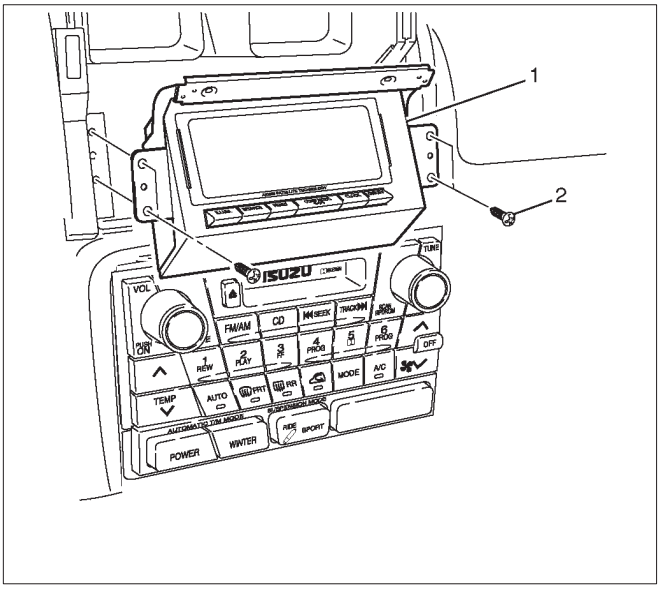
Installation

To install, follow the removal steps in the reverse order.

Display (MID)

Removal

1. Disconnect the battery ground cable.
2. Remove the cluster upper cover.
   ▼Disconnect the sun sensor connector and the GPS control unit connector.
3. Remove the center cluster.
   ▼Refer to *Instrument Panel Assembly in Body Structure.*
4. Remove the Display (1).
   ▼Remove the screws (2).
   ▼Disconnect the Display connector and MID control unit connector.



890R200036

Installation

To install, follow the removal steps in the reverse order.

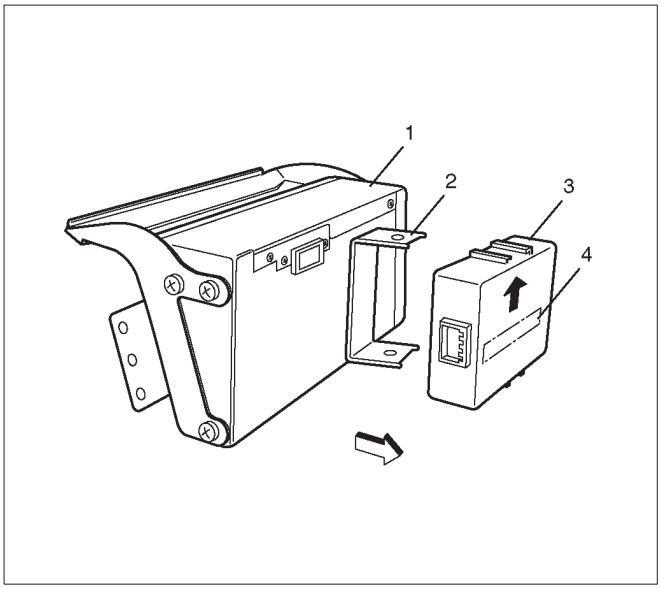
MID Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the MID control unit (3).
   ▼Refer to *MID (1) in this section.*
   ▼Remove the control unit (3) from the bracket (2).

CAUTION: When the battery is disconnected, the MID control unit directional data is lost (the control unit returns to its start-up condition). When the battery is reconnected, the display will be erroneous until the control unit receives a clear GPS satellite signal and resets its directional data.

After reconnecting the battery, wait until the satellite mark indicator turns on. Select an area where there are no high buildings or other obstacles to electromagnetic waves. Drive the vehicle in a straight line at a speed exceeding 32 km/h (20 mph) for at least 20 seconds.



D08R200055

Installation

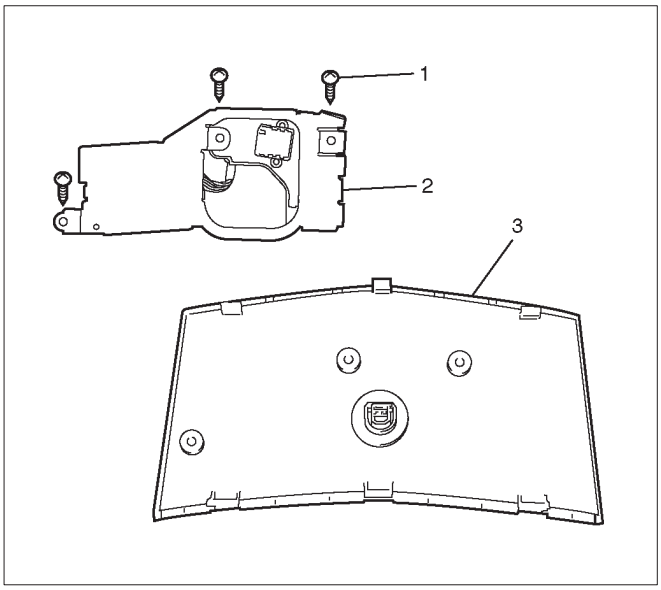
To install, follow the removal steps in the reverse order.

CAUTION: When installing the MID control unit, turn the face with part number (4) stamped on the MID control unit toward the front of vehicle.

GPS Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the cluster upper cover (3).
   ▼Disconnect the sun sensor connector and the GPS control unit connector.
3. Remove the GPS control unit (2).
   ▼Remove the screws (1).



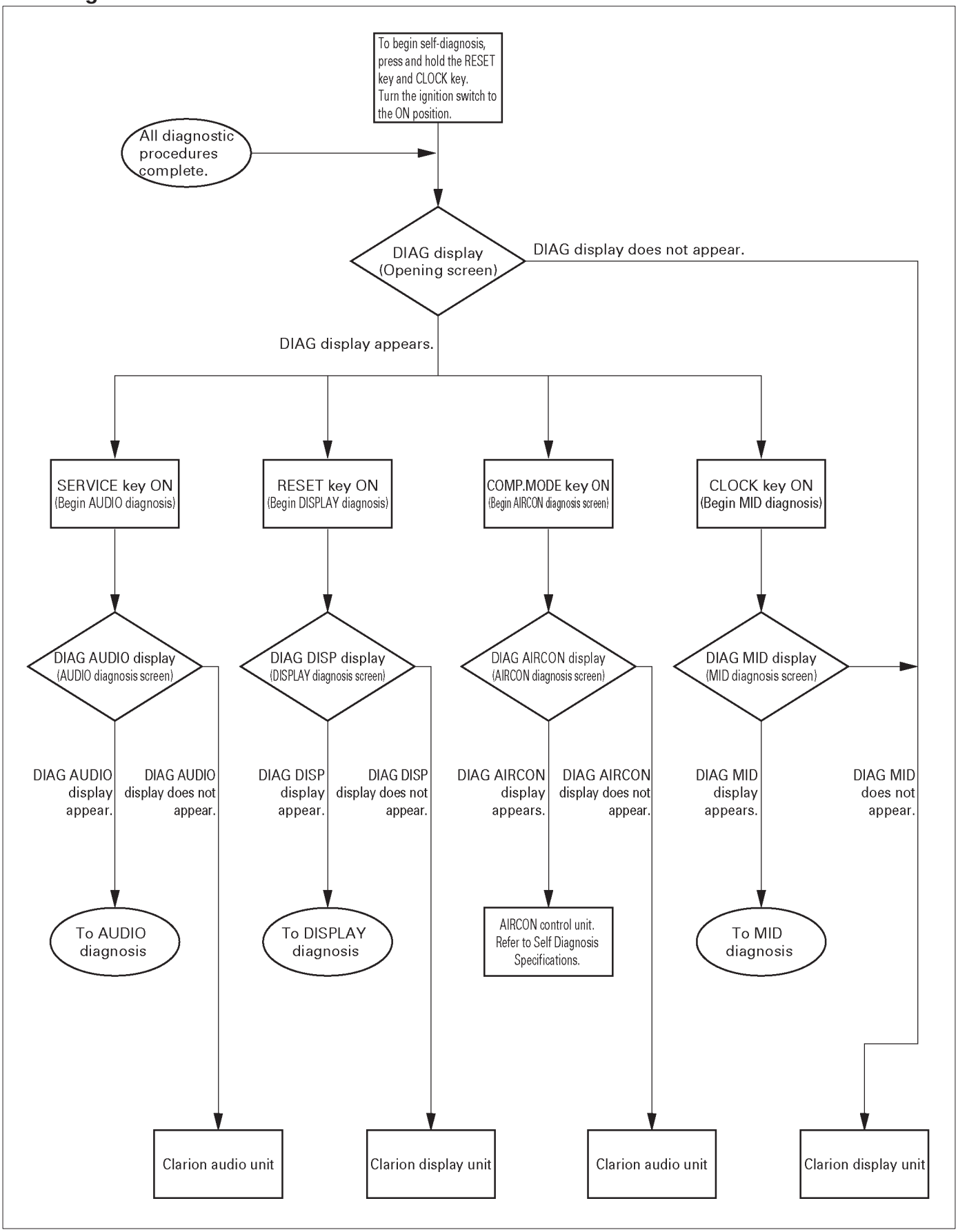
890R200035

Installation

To install, follow the removal steps in the reverse order.

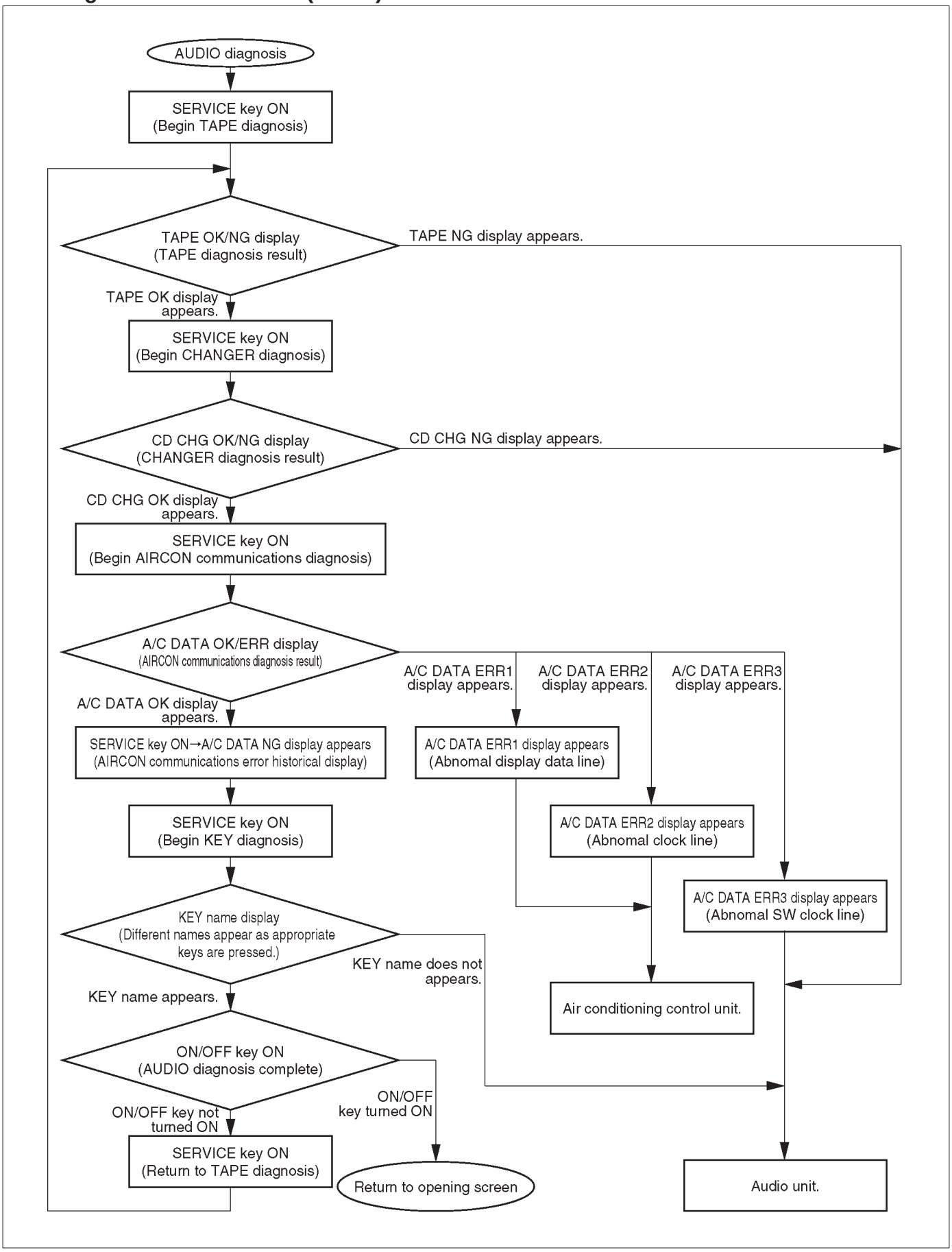
Self-Diagnosis

Self-Diagnosis Flow Chart–1



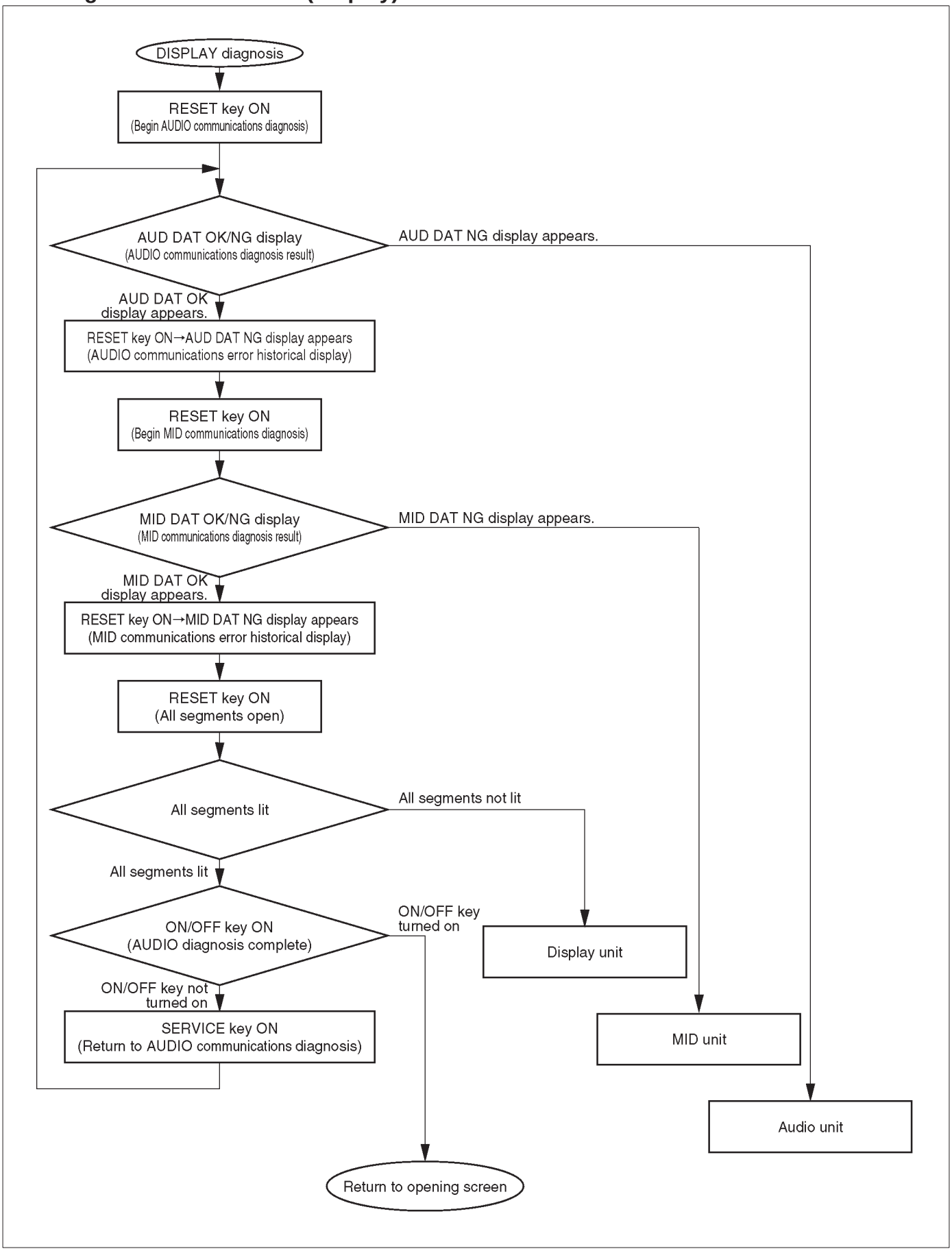
826R200015

Self-Diagnosis Flow Chart–2 (Audio)



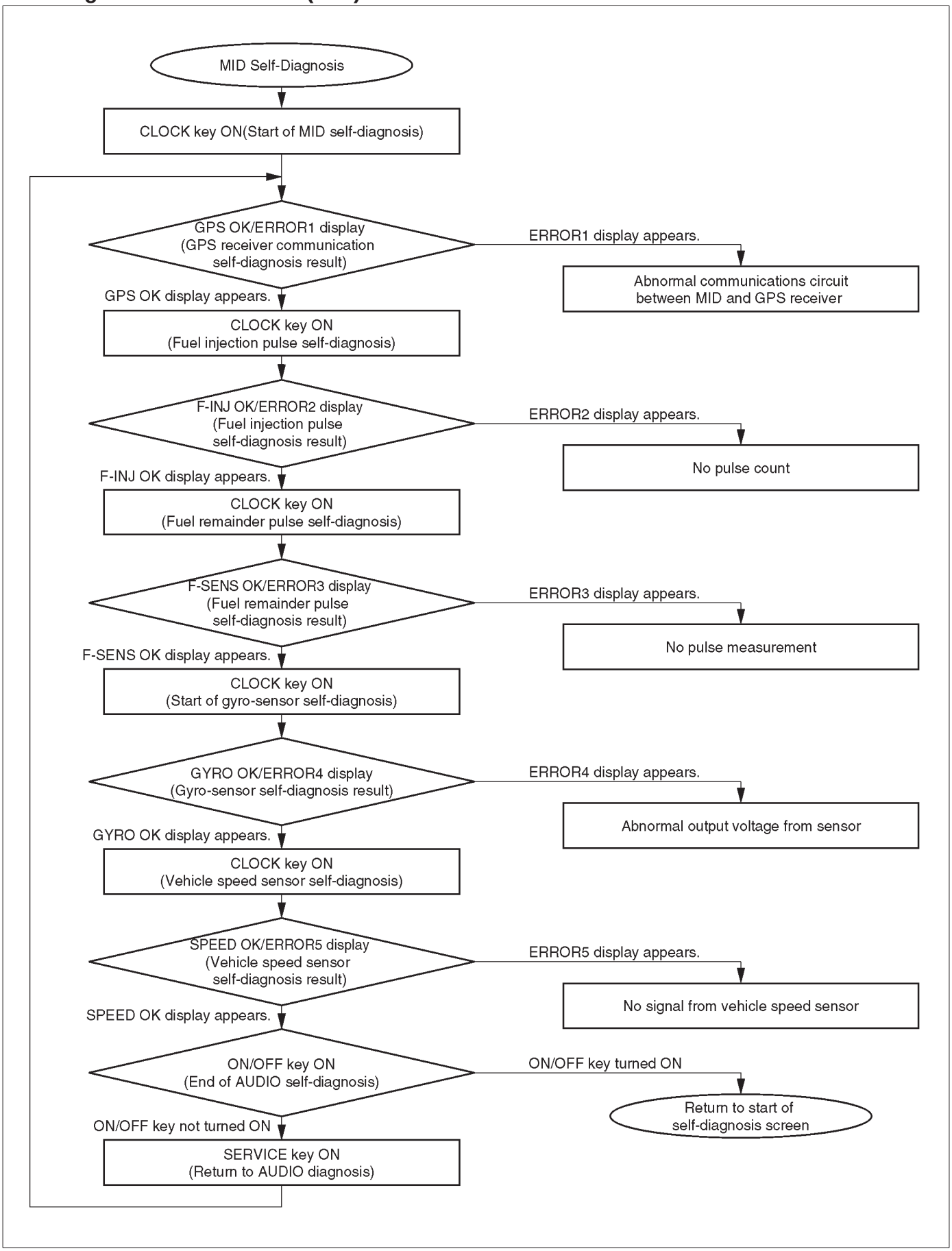
826R200021

Self-Diagnosis Flow Chart–3 (Display)



826R200022

Self-Diagnosis Flow Chart–4 (MID)



826R200023

Audio Self-Diagnosis

Step	Action	Value(s)	Yes	No
1	1. Simultaneously press and hold the RESET key and the CLOCK key (on the display panel). 2. Turn the ignition switch to the ON position. Does DIAG appear on the display screen?	—	Go to *Step 2*	Check power supply and component connections. Start self-diagnosis again.
2	Press and release the SERVICE key (1 time only). Does DIAG AUDIO appear on the display?	—	Go to *Step 3*	Go to Step 11
3	Press and release the SERVICE key (1 time only) to check tape connections. Does TAPE OK appear on the display?	—	Go to *Step 4*	On NG display, Go to *Step 11*
4	Press and release the SERVICE key (1 time only) to check CD changer connections. Does CD CHG OK appear on the display?	—	Go to *Step 5*	On NG display, Go to *Step 11*
5	Press and release the SERVICE key (1 time only) to check communication with A/C unit. Does A/C DATA OK appear on the display?	—	Go to *Step 9*	On NG display, Go to *Step 6*
6	Is A/C DATA ERR1(abnormal display data line) displayed?	—	Refer to *A/C self-diagnosis*	Go to *Step 7*
7	Is A/C DATA ERR2 (abnormal CLOCK data line) displayed?	—	Refer to *A/C self-diagnosis*	Go to *Step 8*
8	Is A/C DATA ER3 (abnormal SW data line) displayed?	—	Go to *Step 11*	—
9	Press and release the SERVICE key (1 time only) to display the A/C unit error history. Is the action complete?	—	Go to *Step 10*	—
10	1. Press and release the SERVICE key (1 time only) to change to the key diagnosis mode. 2. Press and release each key. NOTE: As a key is pressed, its name should appear on the display. The A/C LED should blink at 1–second intervals. Did the events described in Step 2 occur?	—	Go to *Step 12*	Go to *Step 11*
11	Replace the audio unit. Is the action complete?	—	Go to *Step 1*	—
12	Press and release the ON/OFF key. Is the action complete?	—	Go to *Step 1*	Go to *Step 13*
13	Press and release the SERVICE key (1 time only). Is the action complete?	—	Go to *Step 3*	—

Display Self-Diagnosis

Step	Action	Value(s)	Yes	No
1	1. Simultaneously press and hold the RESET key and the CLOCK key (on the display panel). 2. Turn the ignition switch to the ON position. Does DIAG appear on the display screen?	—	Go to *Step 2*	Check power supply and component connections. Start self-diagnosis again.
2	Press and release the RESET key (1 time only). Does DIAG DISP appear on the display?	—	Go to *Step 3*	Go to *Step 10*
3	Press and release the RESET key (1 time only) to start audio communications diagnosis. Does AUD DAT OK appear on the display?	—	Go to *Step 5*	On NG display, Go to *Step 4*
4	Replace the audio unit. Is the action complete?	—	Go to *Step 1*	—
5	1. Press and release the RESET key (1 time only). 2. Confirm that the trouble history is displayed on the screen. Is the trouble history displayed?	—	Go to *Step 6*	—
6	Press and release the RESET key (1 time only) to start MID communications diagnosis. Does MID DATA OK appear on the display?	—	Go to *Step 8*	On NG display, Go to *Step 7*
7	Replace the MID unit. Is the action complete?	—	Go to *Step 1*	—
8	1. Press and release the RESET key (1 time only) to display MID communications error history. 2. Confirm that the error history is displayed on the screen. Is the error history displayed?	—	Go to *Step 9*	—
9	Press and release the RESET key (1 time only) to open all segments. Do all segments light?	—	Go to *Step 11*	Go to *Step 10*
10	Replace the display unit. Is the action complete?	—	Go to *Step 1*	—
11	Press and release the ON/OFF key to complete display self-diagnosis. Is the action complete?	—	Go to *Step 1*	Go to *Step 12*
12	Press and release the SERVICE key. Is the action complete?	—	Go to *Step 3*	—

MID Self-Diagnosis

Step	Action	Value(s)	Yes	No
1	1. Simultaneously press and hold the RESET key and the CLOCK key (on the display panel). 2. Turn the ignition switch to the ON position. Does DIAG appear on the display screen?	—	Go to *Step 2*	Check power supply and components connections. Start self-diagnosis again.
2	Press and release the CLOCK key (1 time only). Does DIAG MID appear on the display?	—	Go to *Step 3*	—
3	Press and release the CLOCK key (1 time only) to begin GPS communications diagnosis. Does GPS OK appear on the display?	—	Go to *Step 5*	On ERROR1, Go to *Step 4*
4	Repair open circuit between MID and GPS receiver (I-13–2 ~ I-16–5). Is the action complete?	—	Go to *Step 1*	—
5	Press and release the CLOCK key (1 time only) to begin fuel injection pulse diagnosis. Does F-INJ OK appear on the display?	—	Go to *Step 7*	On ERROR2, Go to *Step 6*
6	Repair open fuel injection pulse circuit (I-13–5 ~ E35–8). Is the action complete?	—	Go to *Step 1*	—
7	Press and release the CLOCK key (1 time only) to begin fuel remainder pulse diagnosis. Does F-SENS OK appear on the display?	—	Go to *Step 9*	On ERROR3, Go to *Step 9*
8	Repair open fuel remainder pulse circuit (I-13–6 ~ E35–48). Is the action complete?	—	Go to *Step 1*	—
9	Press and release the CLOCK key (1 time only) to begin gyro-sensor diagnosis. Does GYRO OK appear on the display?	—	Go to *Step 11*	On ERROR4, Go to *Step 10*
10	Replace the MID control unit. Is the action complete?	—	Go to *Step 1*	—
11	1. Press and release the CLOCK key (1 time only) to begin vehicle speed sensor diagnosis. 2. Drive vehicle. Does SPEED OK appear on the display?	—	Go to *Step 13*	On ERROR5, Go to *Step 12*
12	Repair open vehicle speed sensor circuit (I-13–15 ~ E43–3). Is the action complete?	—	Go to *Step 1*	—
13	Press and release ON/OFF key to return to start of diagnosis screen. Is the action complete?	—	Go to *Step 1*	Go to *Step 14*
14	Press and release the SERVICE key. Is the action complete?	—	Go to *Step 2*	—

Symptom Diagnosis

MID Not Appears

Step	Action	Value(s)	Yes	No
1	Is fuse (AUDIO 20A) normal?	—	Go to *Step 2*	Replace fuse
2	Remove connectors at display unit. Is there battery voltage across terminal No. I-12–16 (display unit harness connector)?	12V	Go to *Step 4*	Go to *Step 3*
3	Repair open circuit between terminal No. I-12–16 (display unit harness connector) and the battery. Is the action complete?	—	Go to *Step 2*	—
4	Move the ignition switch to the ACC position. Is there battery voltage across terminal No. I-12–7 (display unit harness connector)?	12V	Go to *Step 6*	Go to *Step 5*
5	Repair open circuit between terminal No. I-12–7 (display unit harness connector) and the battery. Is the action complete?	—	Go to *Step 4*	—
6	Move the starter switch to the IGN position. Is there battery voltage across terminal No. I-12–14 (display unit harness connector)?	12V	Go to *Step 8*	Go to *Step 7*
7	Repair open circuit between terminal No. I-12–14 (display unit harness connector) and the battery. Is the action complete?	—	Go to *Step 6*	—
8	Replace the display unit. Is the action complete?	—	Go to *Step 1*	—

No COMPASS, CLOCK, FUEL CONSUMPTION, or SERVICE Display

Step	Action	Value(s)	Yes	No
1	1. Remove the connectors from the display unit. 2. Turn the ignition switch to the ON position. Is there approximately 5 volts across terminal No. I-12–1 (display unit harness connector)?	5V	Go to *Step 2*	Go to *Step 5*
2	Remove the connectors form the display unit. Is there battery voltage between the No. I-12–7 terminal and the No. I-12–16 terminal (display unit harness connector)?	12V	Go to *Step 4*	Go to *Step 3*
3	Repair open circuit between terminal No. I-12–7 and terminal No. I-12–16. Is the action complete?	—	Go to *Step 2*	—
4	Replace the display unit. Is the action complete?	—	Go to *Step 1*	—
5	Remove the MID connectors. Is there battery voltage between the No. I-13–7 terminal, the No. I-13–8 terminal, and the No. I-13–16 terminal (display unit harness connector)?	12V	Go to *Step 7*	Go to *Step 6*
6	Repair open circuit between terminal No. I-13–7, terminal No. I-13–8, and terminal No. I-13–16. Is the action complete?	—	Go to *Step 5*	—
7	Replace the MID Is the action complete?	—	Go to *Step 1*	—

No COMPASS Display

Step	Action	Value(s)	Yes	No
1	Does "—" appear on the display?	—	Go to *Step 2*	Go to *Step 3*
2	Use the self-diagnosis mode to perform MID self-diagnosis followed by GPS receiver and gyro-sensor self-diagnosis. Is the action complete?	—	Go to *Step 1*	—
3	Replace the MID and/or DISPLAY. Is the action complete?	—	Go to *Step 1*	—

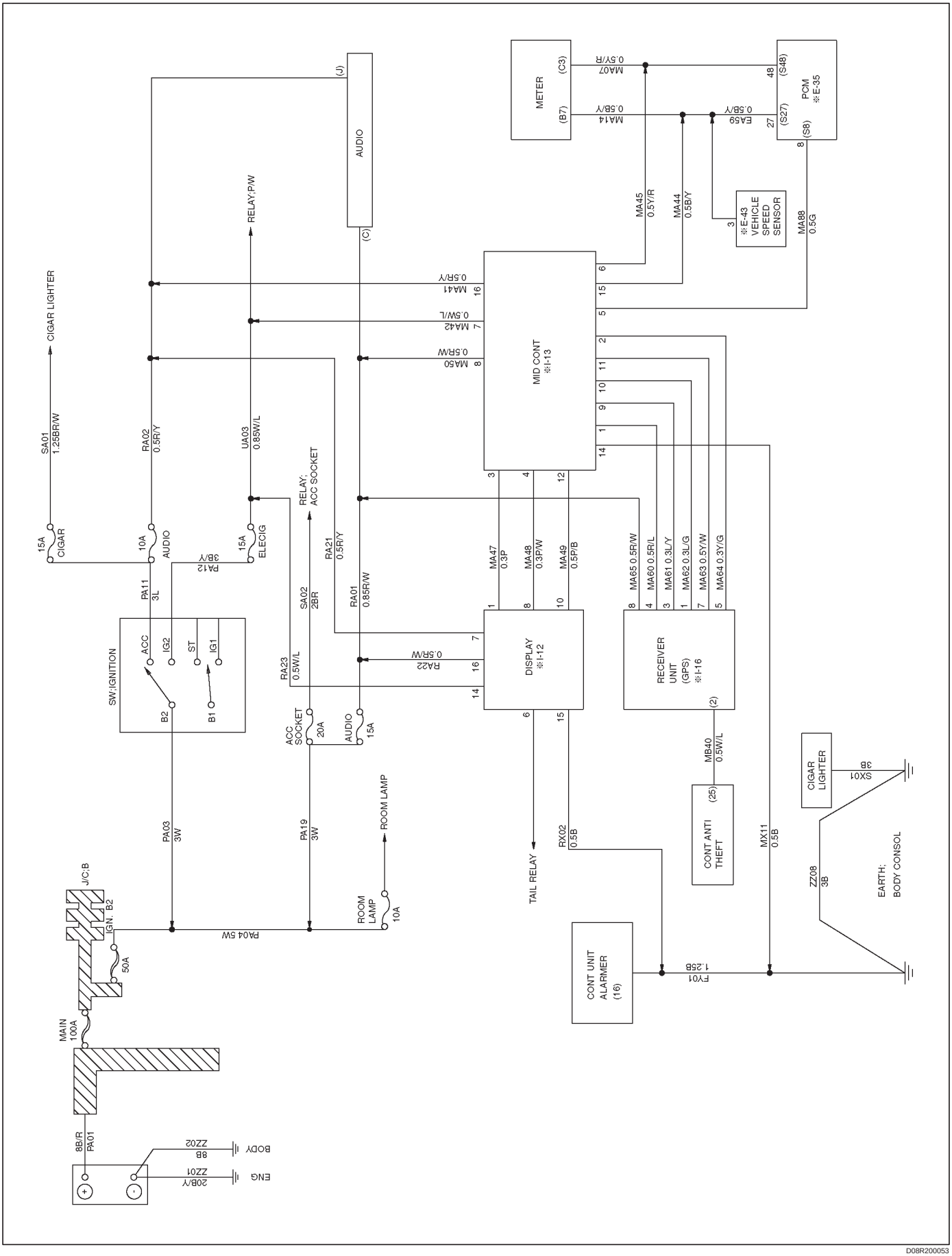
No SERVICE Display

Step	Action	Value(s)	Yes	No
1	Is SERVICE displayed?	—	Go to *Step 3*	Go to *Step 2*
2	Replace the MID and/or display. Is the action complete?	—	Go to *Step 1*	—
3	Does SERVICE display change?	—	Go to *Step 4*	Go to *Step 5*
4	CALENDER does not display MID self-diagnosis followed by GPS receiver self-diagnosis	—	Refer to *self-diagnosis items*	—
5	MID self-diagnosis followed by GPS receiver self-diagnosis	—	Refer to *self-diagnosis items*	—

Other Trouble Symptom

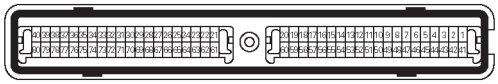
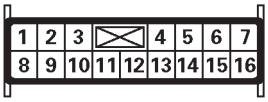
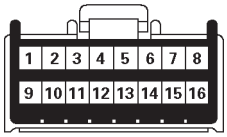
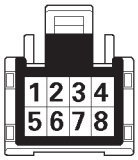
Condition	Possible cause	Correction
Elapsed time does not display	An open circuit between GPS receiver and MID control unit.	Repair an open circuit.
Fuel consumption does not display	MID control unit and/or DISPLAY not functioning.	Replace the MID control unit and/or DISPLAY.
Possible turning distance does not change	An open circuit between MID control unit No.I-13–6 terminal and PCM No.E35–48 terminal.	Repair an open circuit.
Average fuel consumption does not display	An open circuit between MID control unit No.I-13–5 terminal and PCM No.E35–8 or MID control unit NO.I-13–15 terminal and vehicle speed sensor terminal No.E43–3.	Repair an open circuit.
Current fuel consumption does not display	Refer to average fuel consumption items.	Repair an open circuit.
Compass does not change	An open circuit between MID control unit and GPS receiver or insufficient signal output of gyro sensor.	Repair an open circuit and/or replace gyro sensor.
CALENDER does not display	MID control unit and/or display not functioning.	Replace the MID control unit and/or DISPLAY.
SERVICE does not change	An open circuit of the vehicle speed sensor.	Repair an open circuit.
Units cannot be changed	MID not functioning.	Replace the MID control unit.

MID Circuit



D08R200053

Harness Connector Faces

No.	Connector face
E-35	
E-43	
I-12	
I-13	
I-16	

AXIOM

BODY AND ACCESSORIES

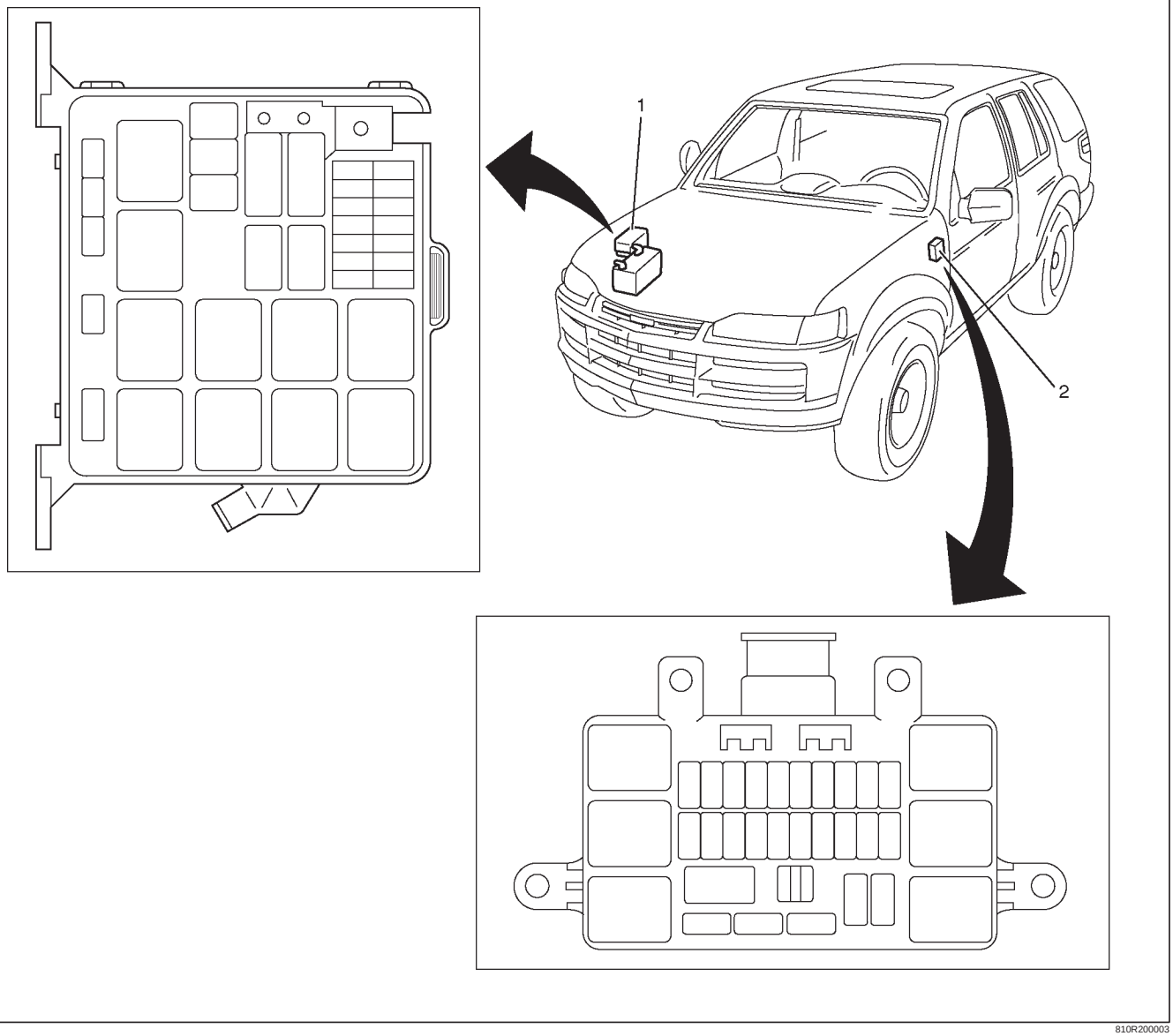
WIRING SYSTEM

CONTENTS

Fuse, Relay and Diode 8D–2
Relay / Fuse Box Location 8D–2
Relay / Fuse Box (Instrument Panel) 8D–3
Relay / Fuse Box (Engine Room) 8D–4
Circuit Diagram 8D–5
Fuse Block Circuit 8D–5
Ground Location (Engine Room) 8D–6
Ground Location (Cabin) 8D–7
Starter and Generator 8D–8
PCM–1 . . . . . 8D–9
PCM–2 . . . . . 8D–10
Headlight and Fog Light 8D–11
Turn, Hazard, Stop, Back Up, Horn and A/T Shift Lock 8D–12
Dome Light, Luggage Room Light, Courtesy Light, Spot Light, and Warning Buzzer . . . 8D–13
Power Window and Door Lock 8D–14
Alarm and Relay Control Unit 8D–15
Rear Wiper/Washer and Rear Defogger . . 8D–16
Audio, Clock, Cigarette Lighter and ACC Socket 8D–17
MID 8D–18
Door Mirror 8D–19
Meter 8D–20
Anti-theft with Keyless Entry 8D–21
Air Conditioning 8D–22
ABS 8D–23
SRS–Air Bag 8D–24
Intelligent Suspension 8D–25
T.O.D 8D–26
Sunroof 8D–27
Illumination Light 8D–28
Windshield Wiper and Washer 8D–29
Power Seat 8D–30
Seat Heater 8D–31

Fuse, Relay and Diode

Relay / Fuse Box Location

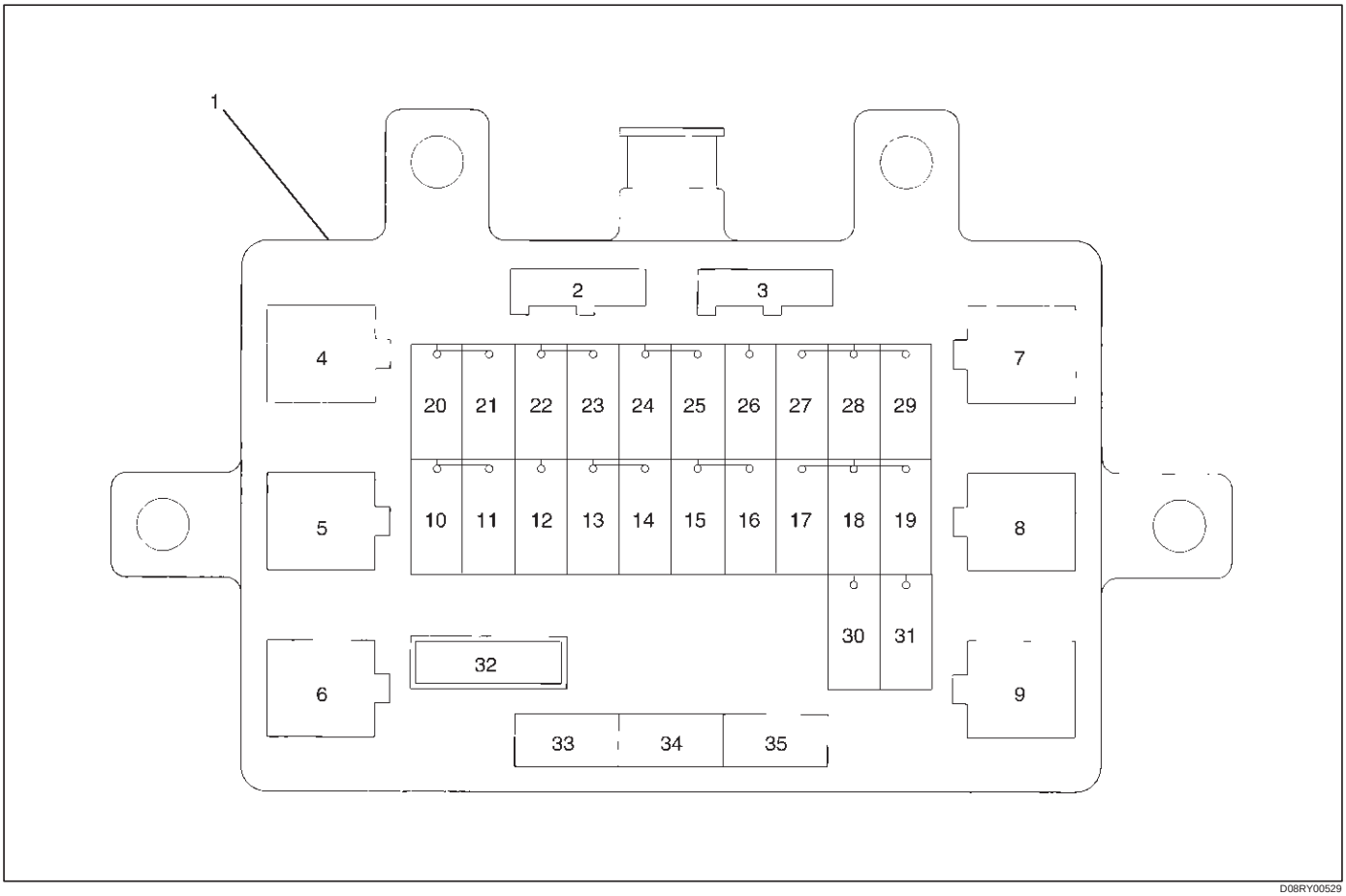


810R200003

Legend

(1) Relay/Fuse Box (Engine Room)
(2) Relay/Fuse Box (Instrument Panel)

Relay / Fuse Box (Instrument Panel)

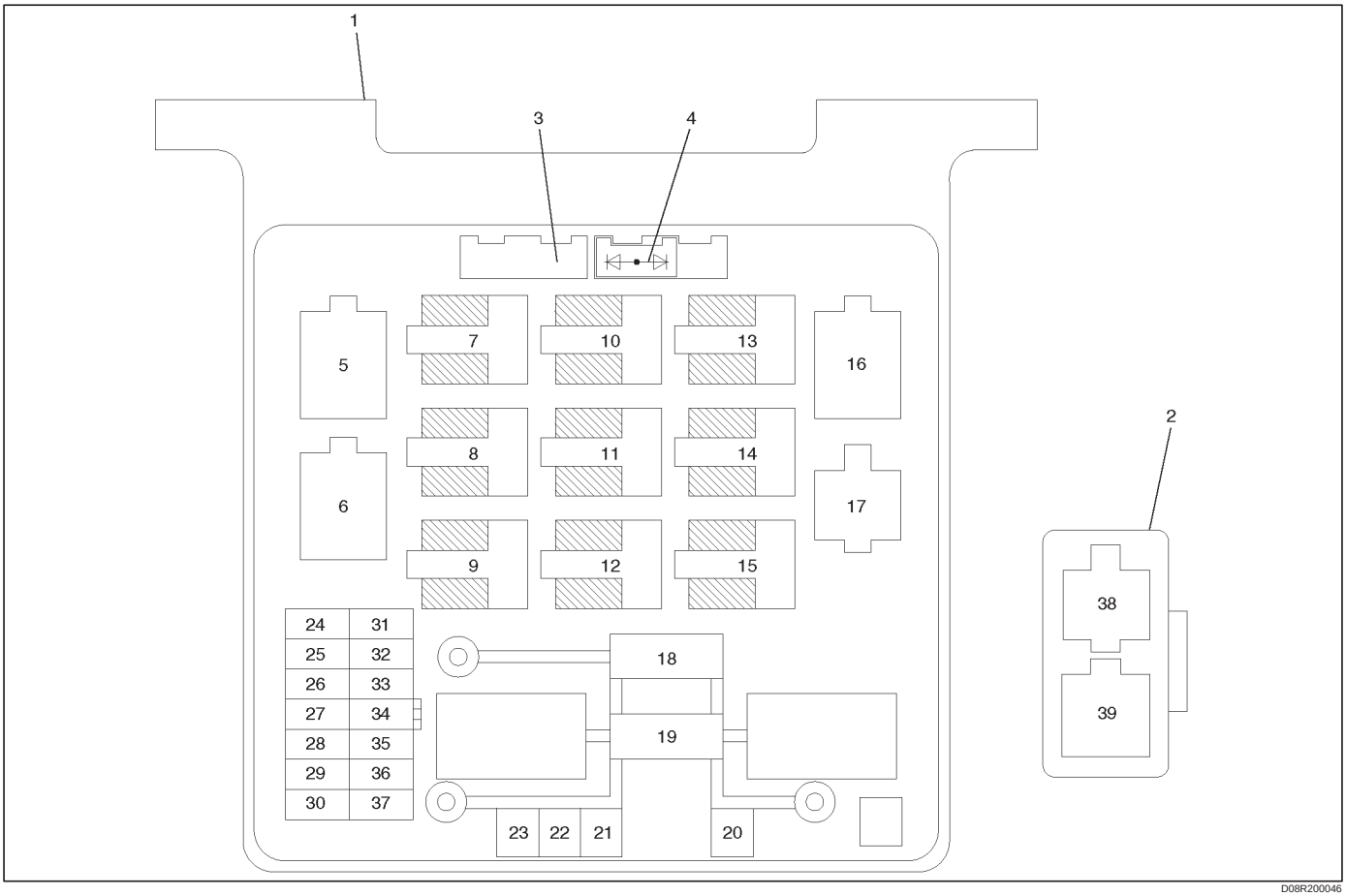


D08RY00529

Legend

(1) Fuse/Relay Box
(2) Diode
(3) Diode
(4) Tail Relay
(5) Not Used
(6) ACC Socket Relay
(7) Power Window Relay
(8) Not Used
(9) Rear Defogger Relay
(10) Fuse ACC Socket (15A)
(11) Fuse Audio (+B) (15A)
(12) Fuse Starter (10A)
(13) Fuse Tail (15A)
(14) Fuse Room Lamp (10A)
(15) Fuse Stop Lamp (15A)
(16) Fuse Door Lock (20A)
(17) Fuse Mirror Defogger (10A)
(18) Fuse Rear Defogger (15A)
(19) Fuse Rear Defogger (15A)
(20) Fuse Meter (15A)
(21) Fuse ENG. (15A)
(22) Fuse IG. Coil (15A)
(23) Fuse Back Up (15A)
(24) Fuse ELEC. IG. (15A)
(25) Fuse RR Wiper (10A)
(26) Fuse FRT Wiper (20A)
(27) Fuse Audio (ACC) (10A)
(28) Fuse Cigar Lighter (15A)
(29) Fuse Anti-theft (10A)
(30) Fuse SRS (10A)
(31) Fuse (Not Used)
(32) Circuit Breaker Power Window (30A)
(33) Spare Fuse (20A)
(34) Spare Fuse (15A)
(35) Spare Fuse (10A)

Relay / Fuse Box (Engine Room)



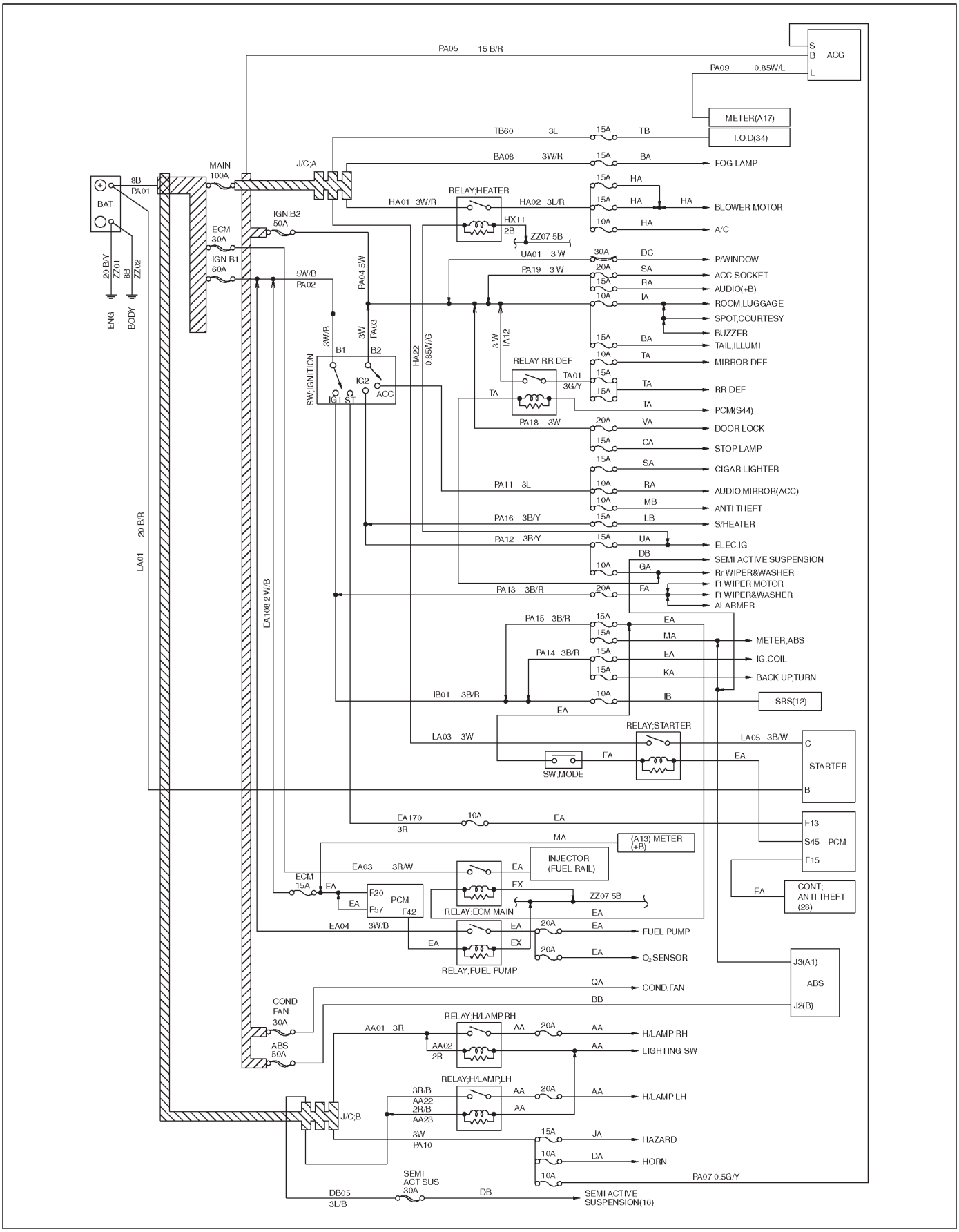
D08R200046

Legend

(1) Fuse/Relay Box
(2) Option Box
(3) Diode (Not Used)
(4) Diode
(5) Heater Relay
(6) A/C Compressor Relay
(7) Headlamp Relay RH
(8) Not Used
(9) Fog Lamp Relay
(10) Not Used
(11) Not Used
(12) Thermo Relay
(13) Headlamp Relay LH
(14) Starter Relay
(15) ECM Main
(16) Fuel Pump Relay
(17) Not Used
(18) IG.1 (+B.1 60A)
(19) Main (100A)
(20) ECM (30A)
(21) ABS (50A)
(22) IG.2 (+B.2 50A)
(23) Condenser Fan (30A)
(24) Hazard (15A)
(25) Horn (10A)
(26) ACG–S (10A)
(27) Seat Heater (15A)
(28) Blower (15A)
(29) Blower (15A)
(30) A/C (10A)
(31) Headlamp–LH (20A)
(32) Headlamp–RH (20A)
(33) Fog Lamp (15A)
(34) O_2 Sensor (20A)
(35) Fuel Pump (20A)
(36) ECM (15A)
(37) TOD (15A)
(38) Intelligent Suspension Relay (30A)
(39) Condenser Fan Relay

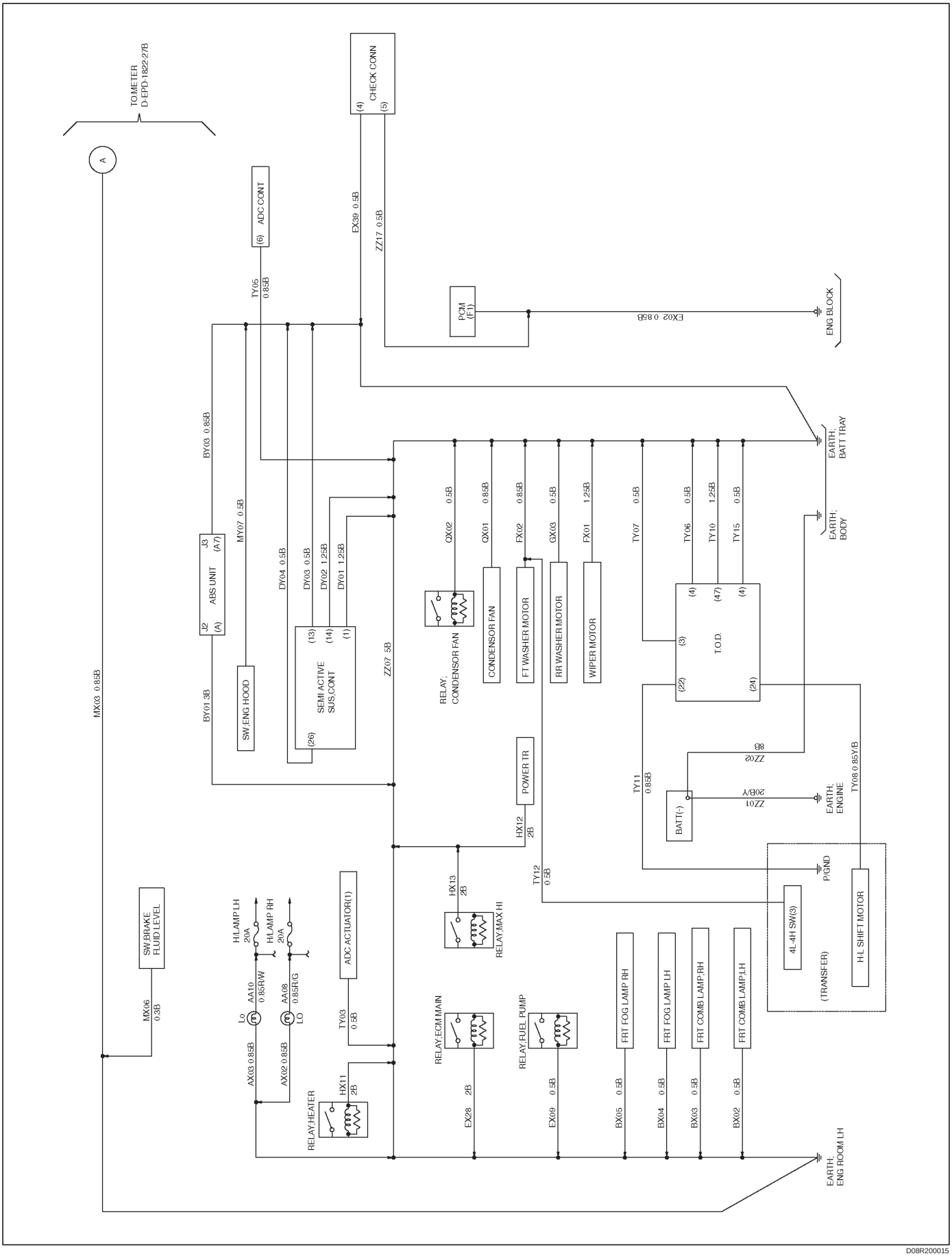
Circuit Diagram

Fuse Block Circuit



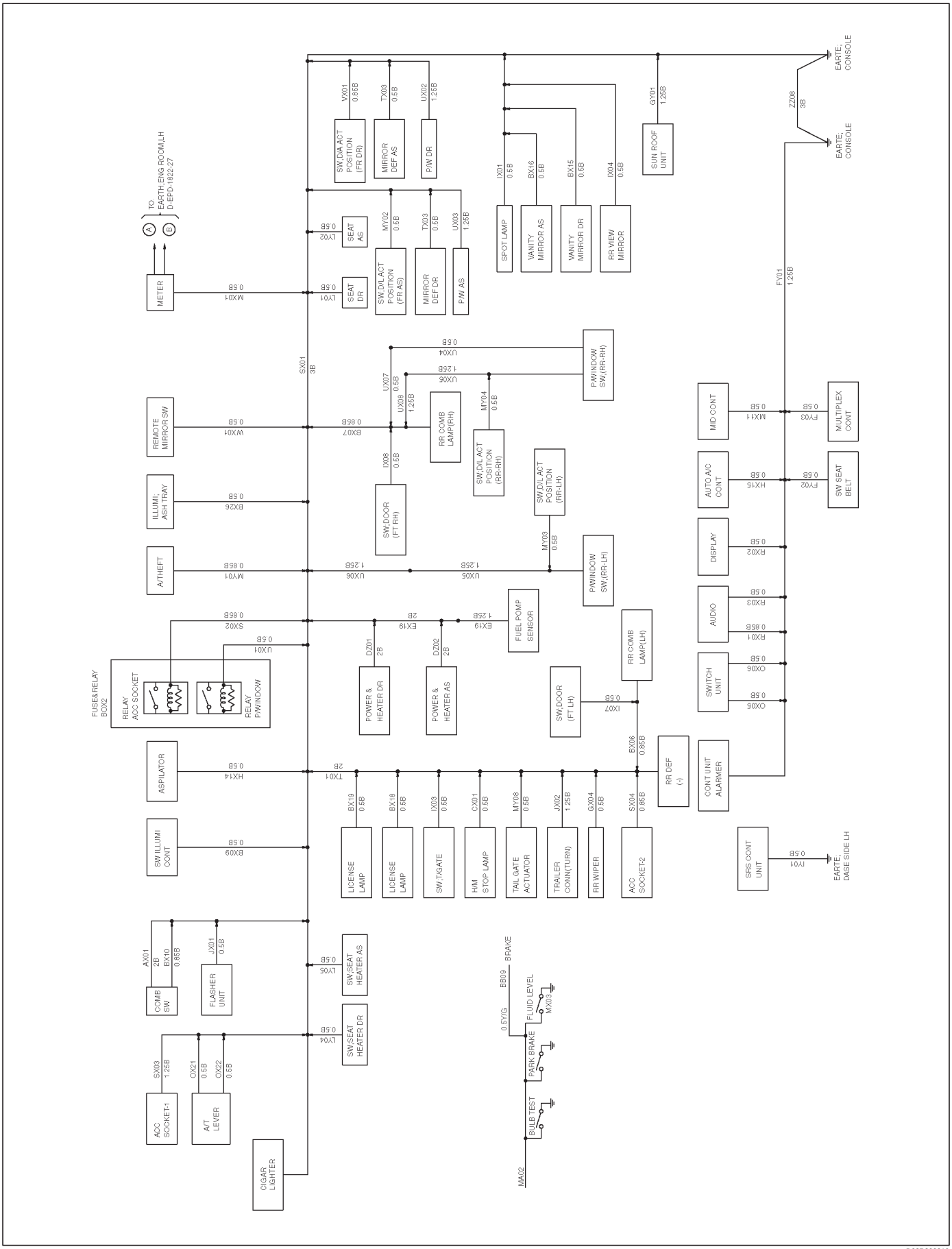
D08R200017

Ground Location (Engine Room)



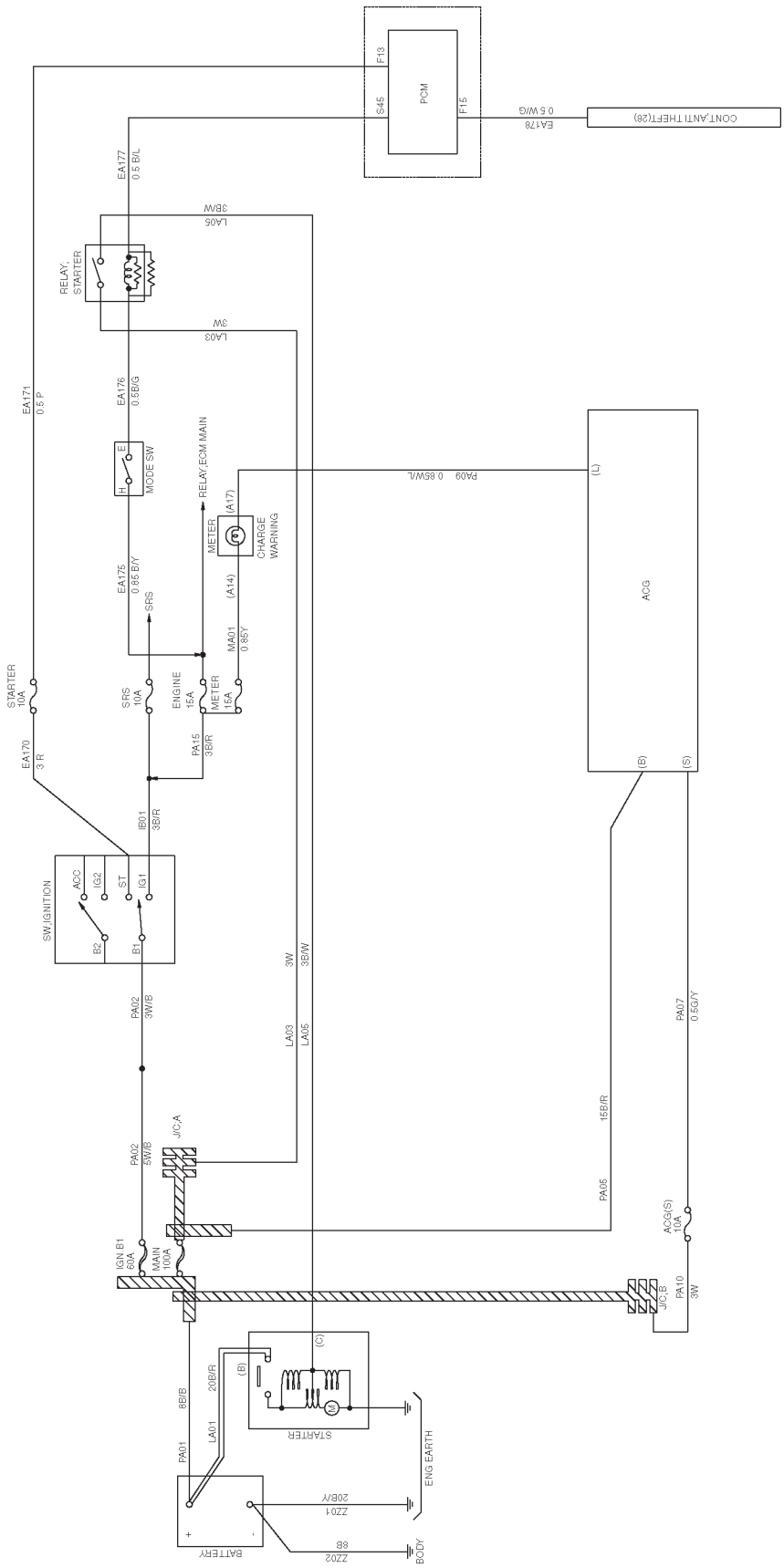
D08R200015

Ground Location (Cabin)



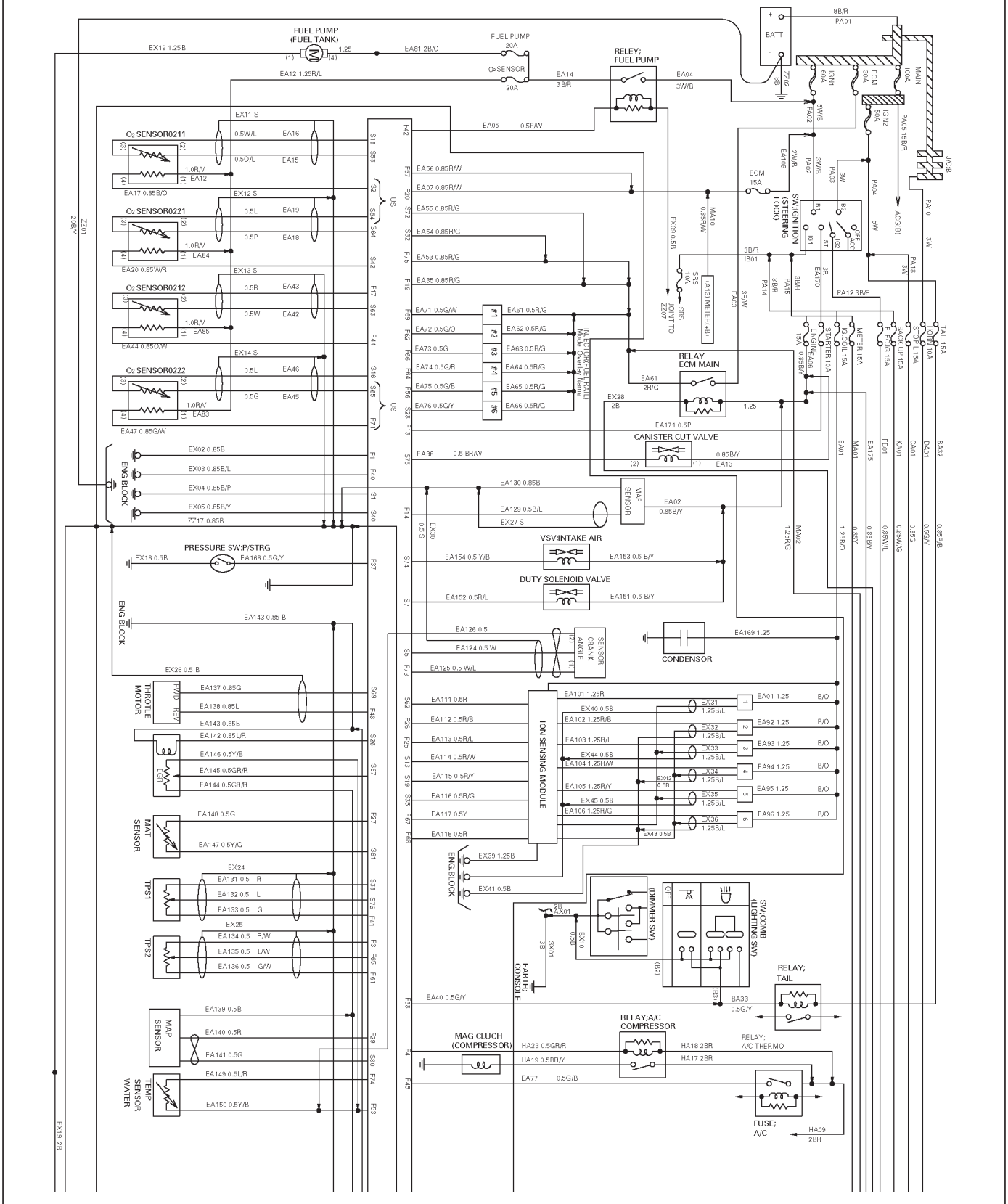
D08R200016

Starter and Generator

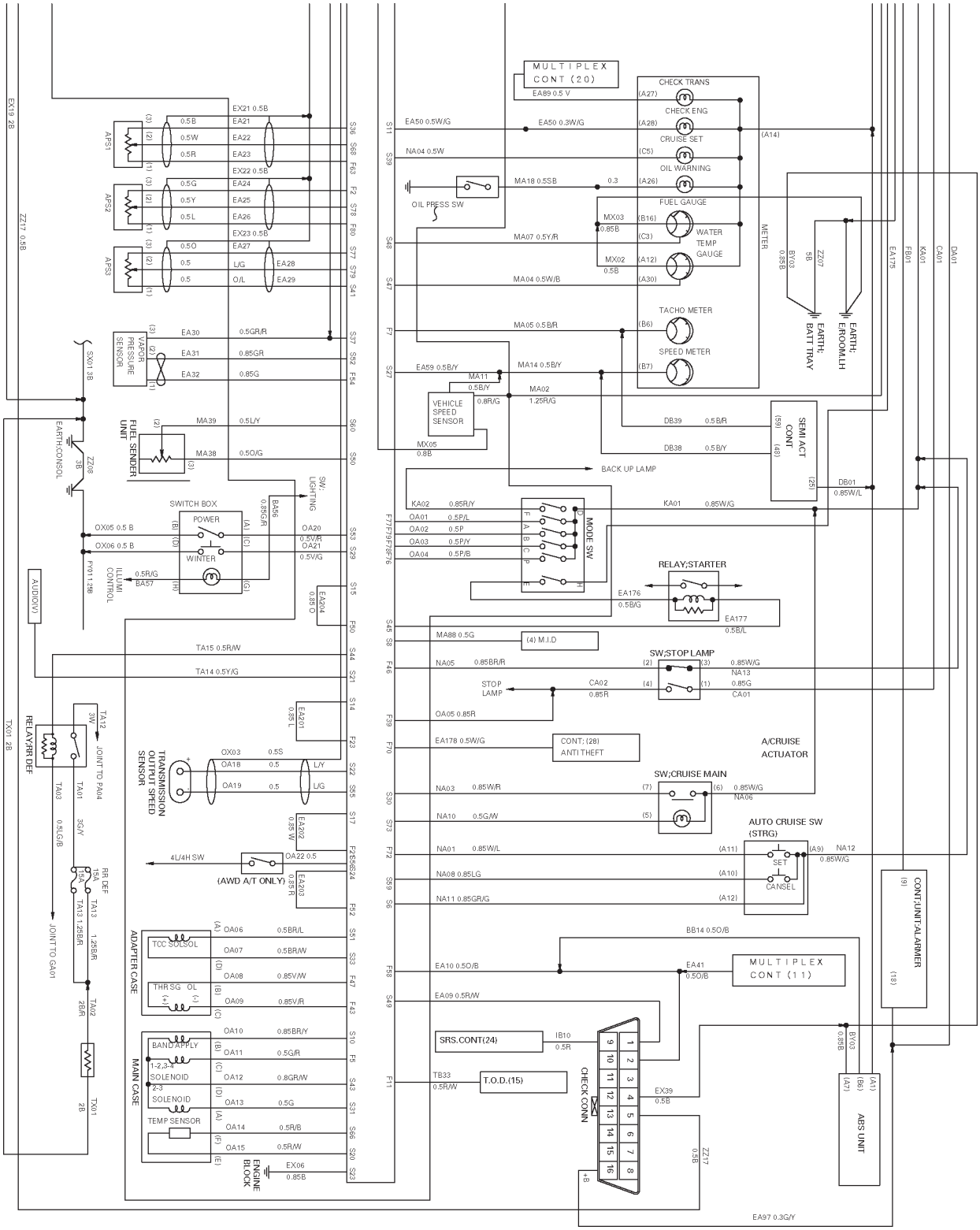


D08R200019

PCM–1

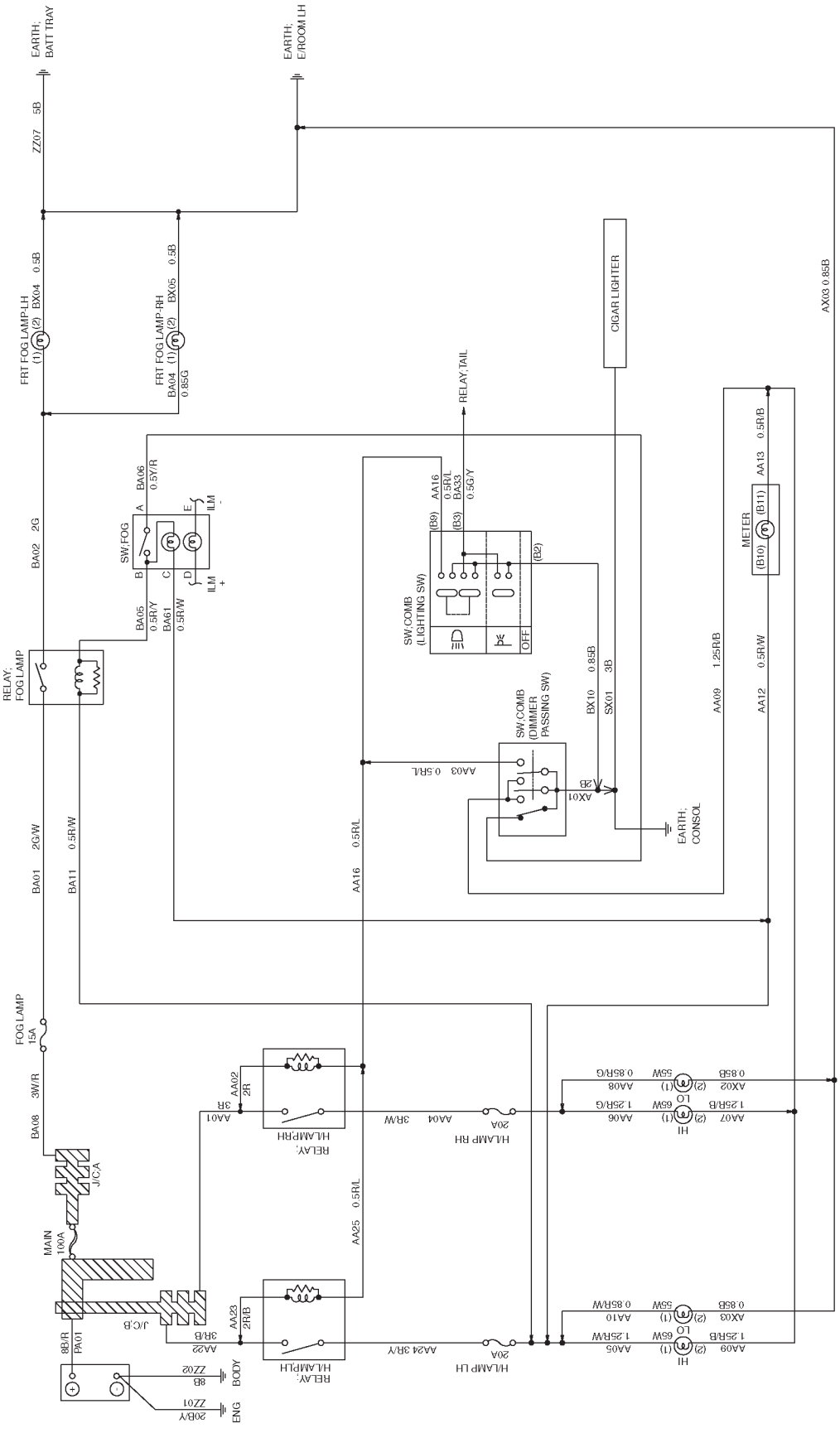

FUEL PUMP (FUEL TANK)
FUEL PUMP 20A
RELEY; FUEL PUMP
BATT
O2 SENSOR
O2 SENSOR0211
O2 SENSOR0221
O2 SENSOR0212
O2 SENSOR0222
ECM 15A
SW;IGNITION (STEERING LOCK)
RELAY ECM MAIN
CANISTER CUT VALVE
VSV;INTAKE AIR
DUTY SOLENOID VALVE
CONDENSOR
PRESSURE SW;P/STRG
ION SENSING MODULE
SW;COMB (LIGHTING SW)
RELAY; TAIL
RELAY;A/C COMPRESSOR
MAG CLUCH (COMPRESSOR)
RELAY; A/C THERMO
FUSE; A/C
THROTLE MOTOR
EGR
MAT SENSOR
TPS1
TPS2
MAP SENSOR
TEMP SENSOR WATER
ENG BLOCK
EARTH; CONSOLE
MAF SENSOR
SENSOR; CRANK ANGLE
METER 15A
ENGINE 15A
STARTER 10A
IG COIL 15A
ELECTRIC 15A
BACK UP 15A
STOP 15A
HORN 10A
TAIL 15A
MAIN 100A
ECM 30A
IGN1 60A
IGN2 50A
JUNCTION BLOCK (INJECTOR(REAR), FUEL PUMP, ECM, IGN1, IGN2)
JUNCTION BLOCK (A13; METER(+B))
JUNCTION BLOCK ZZ07
JUNCTION BLOCK ZZ01
JUNCTION BLOCK ZZ02
JUNCTION BLOCK (B2)
JUNCTION BLOCK (B3)
JUNCTION BLOCK (A6)
JUNCTION BLOCK (A5)
JUNCTION BLOCK (A3)
JUNCTION BLOCK (A2)
JUNCTION BLOCK (A1)
JUNCTION BLOCK (A4)
JUNCTION BLOCK (A7)
JUNCTION BLOCK (A8)
JUNCTION BLOCK (A9)
JUNCTION BLOCK (A10)
JUNCTION BLOCK (A11)
JUNCTION BLOCK (A12)
JUNCTION BLOCK (A13)
JUNCTION BLOCK (A14)
JUNCTION BLOCK (A15)
JUNCTION BLOCK (A16)
JUNCTION BLOCK (A17)
JUNCTION BLOCK (A18)
JUNCTION BLOCK (A19)
JUNCTION BLOCK

PCM–2



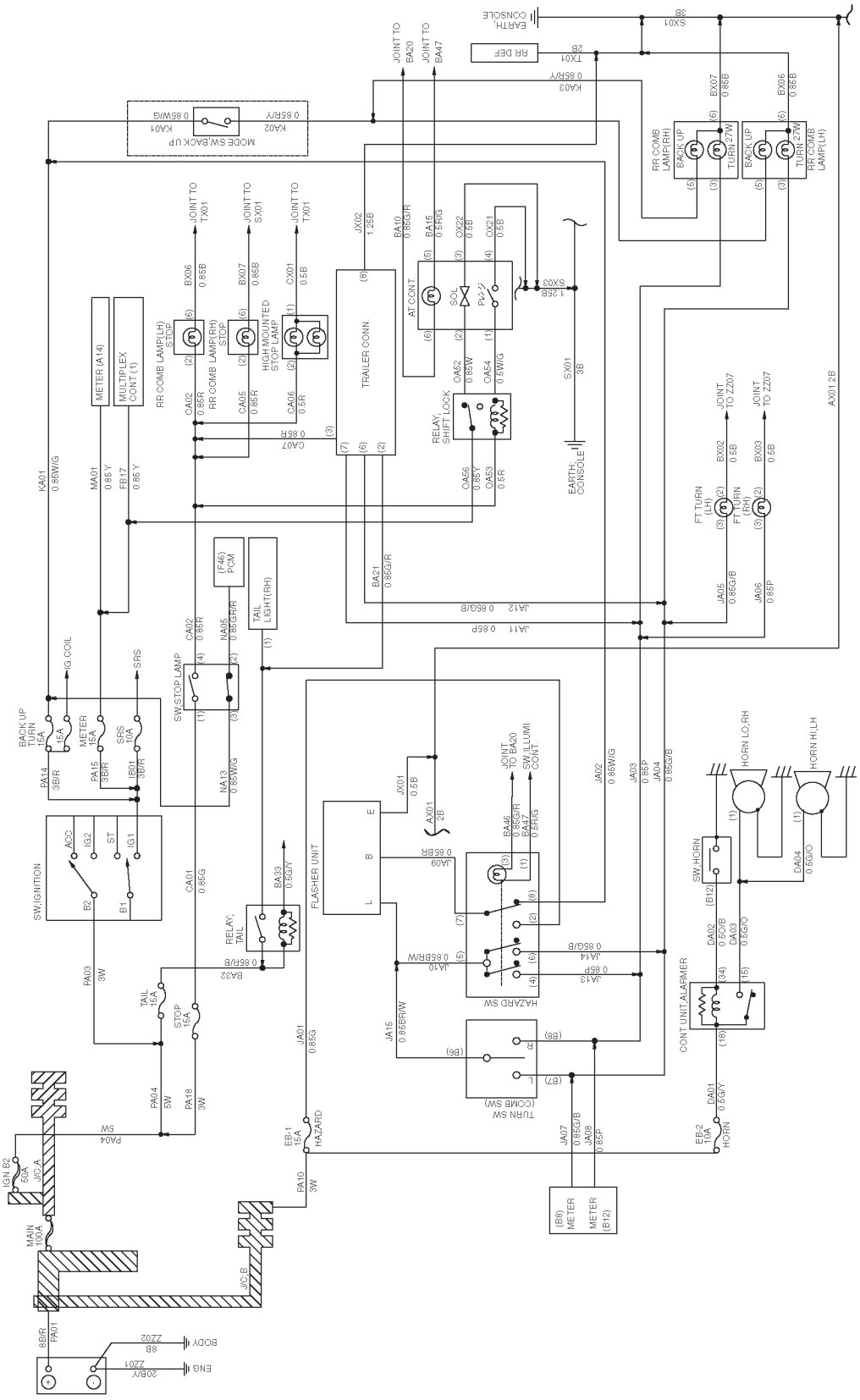
D08R200040

Headlight and Fog Light



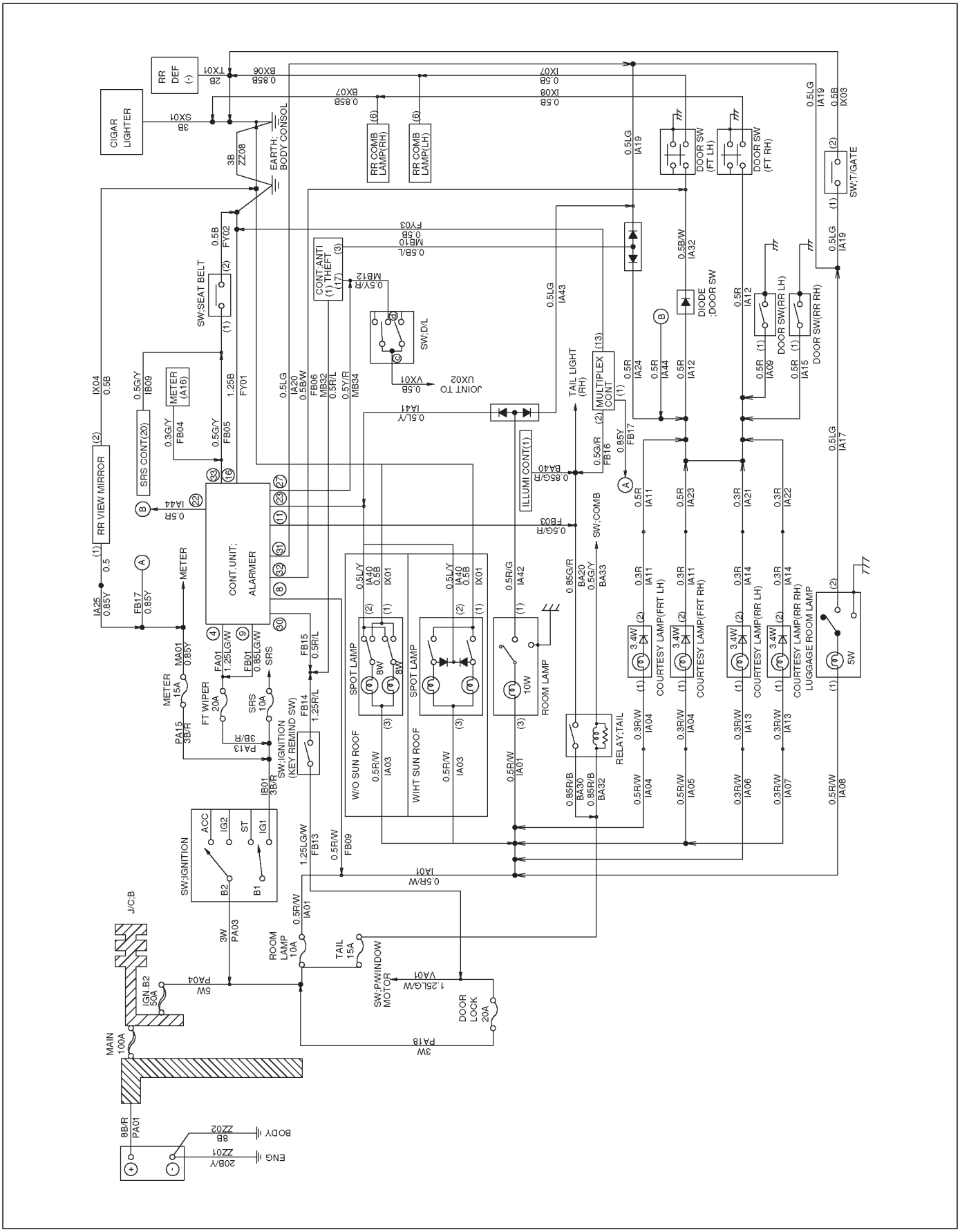
D08R200020

Turn, Hazard, Stop, Back Up, Horn and A/T Shift Lock



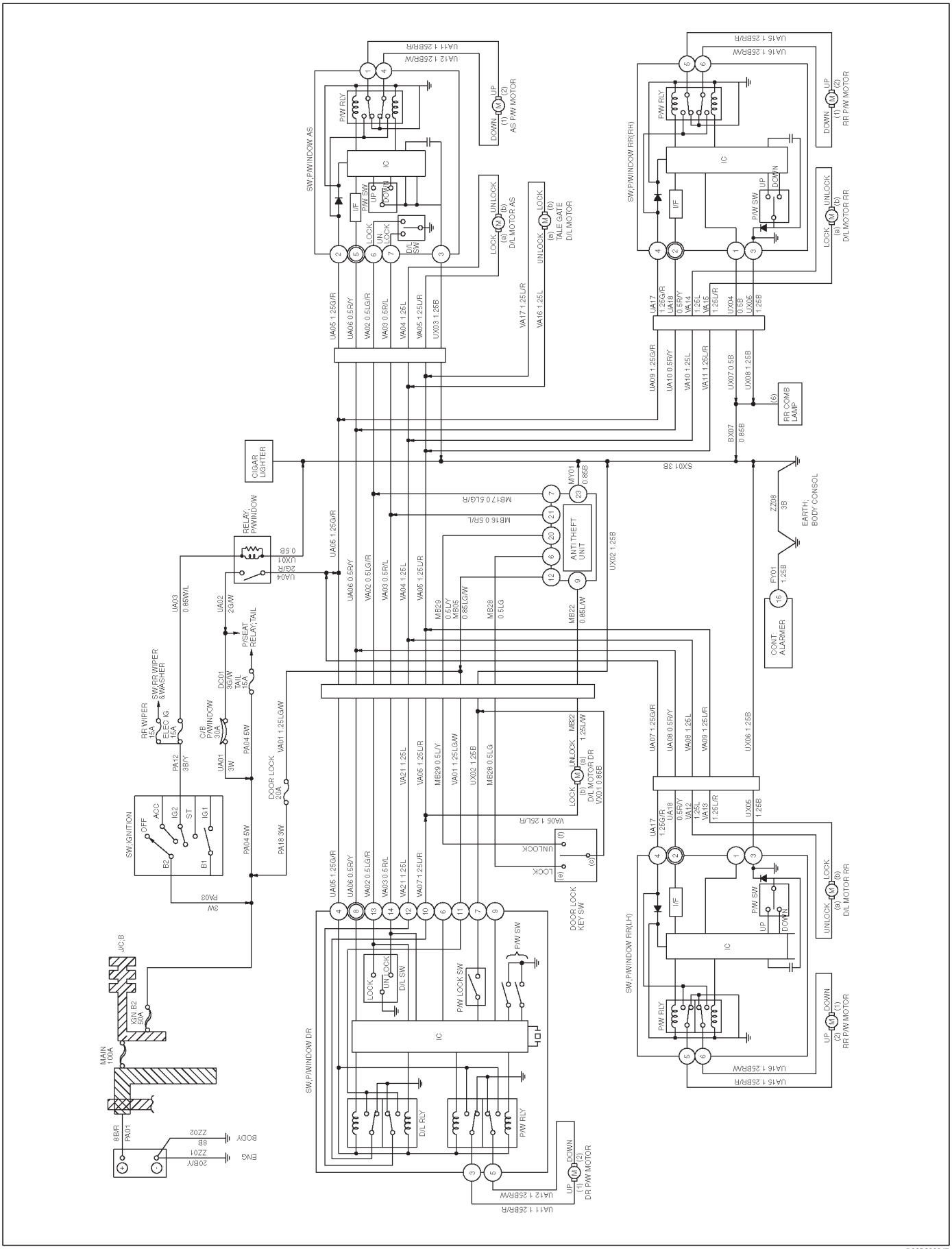
D08R200003

Dome Light, Luggage Room Light, Courtesy Light, Spot Light, and Warning Buzzer

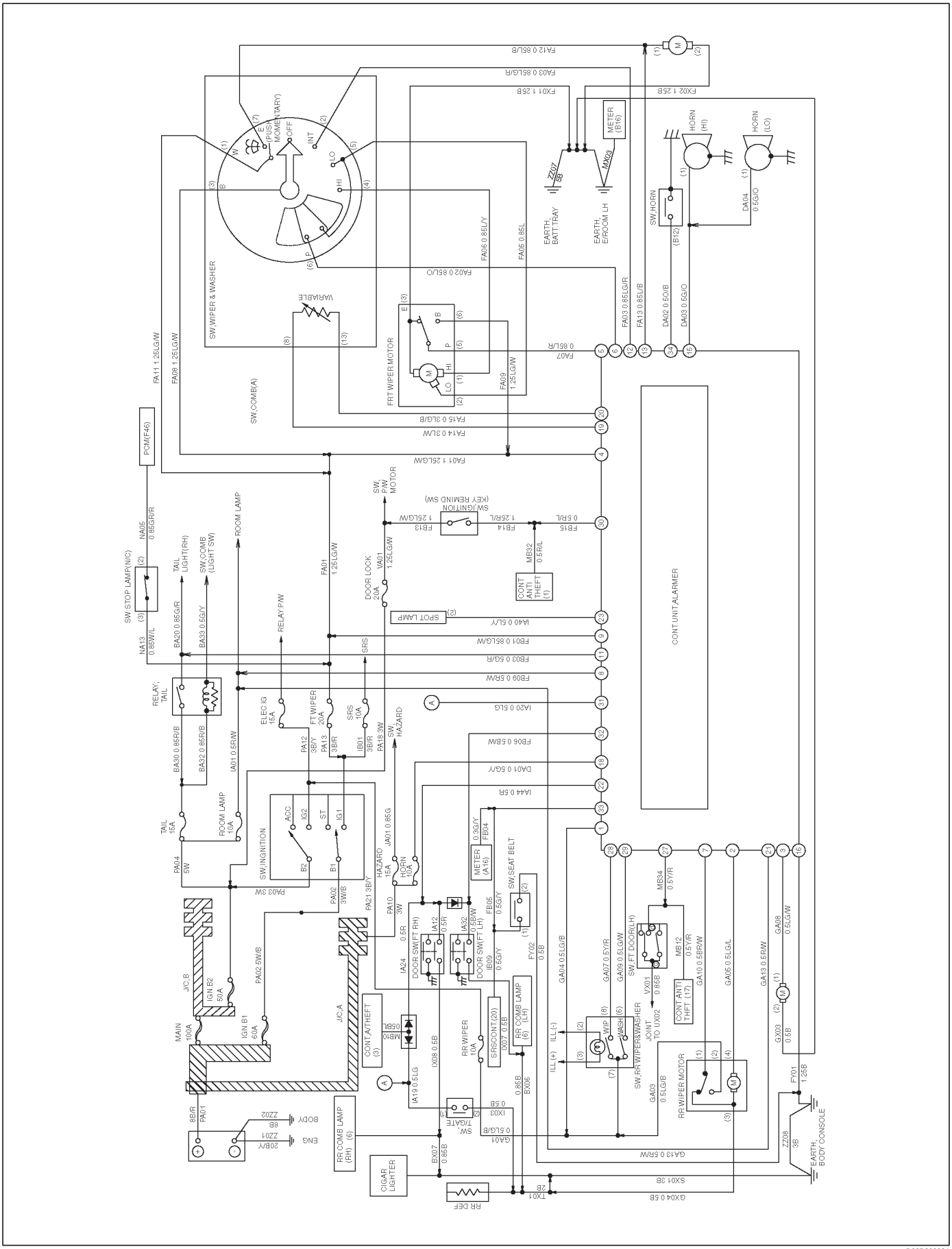


D08R200057

Power Window and Door Lock

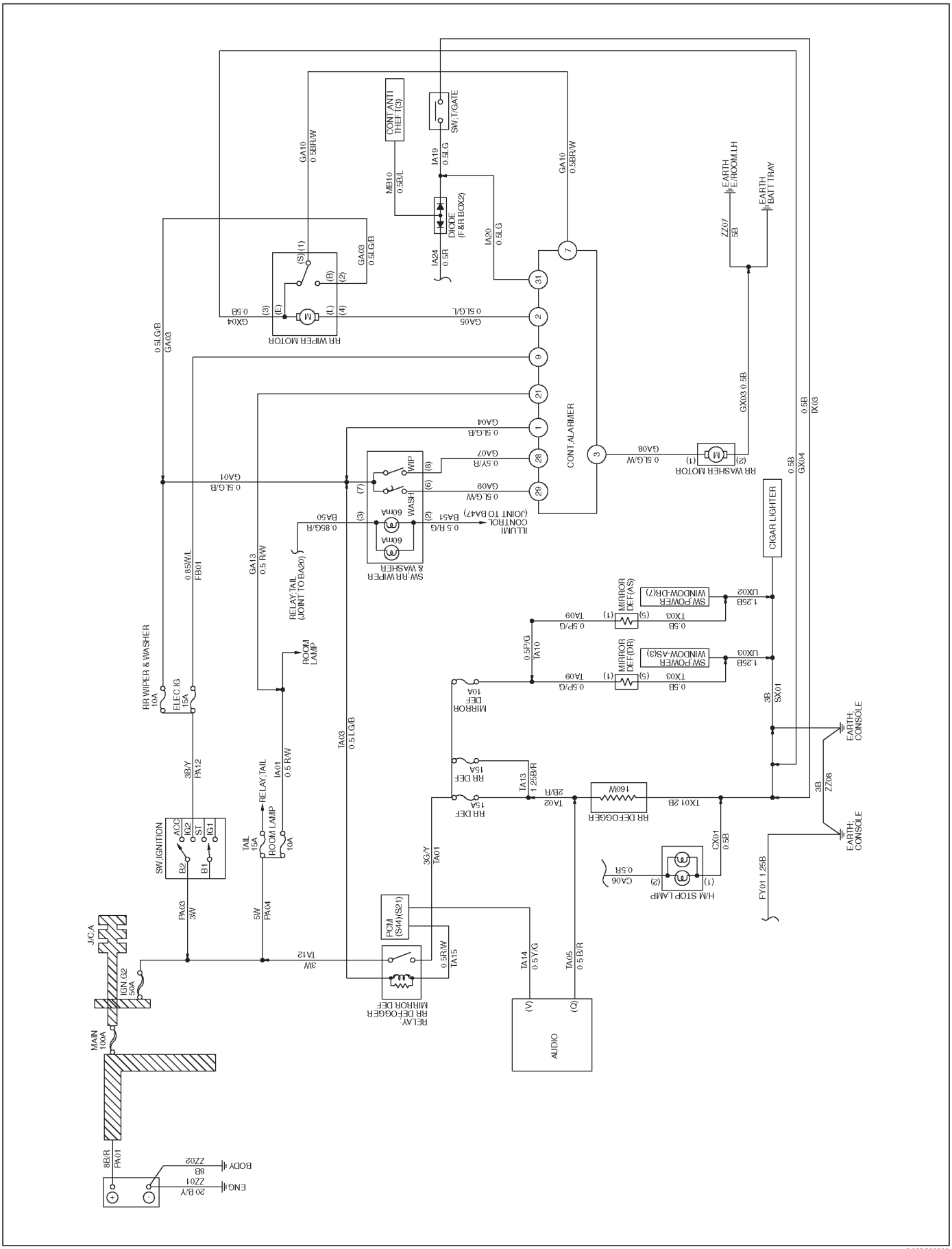


Alarm and Relay Control Unit



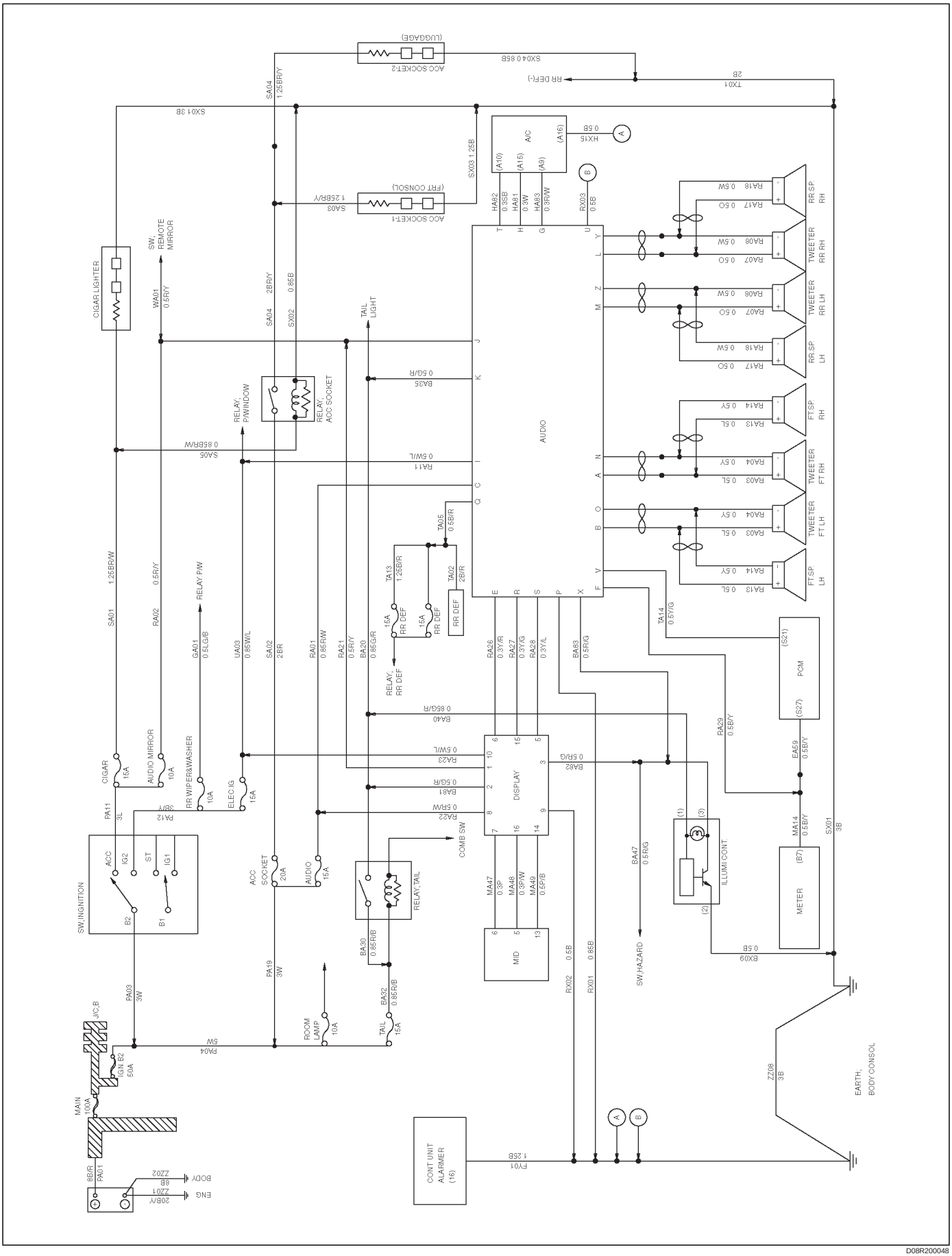
D08R200024

Rear Wiper/Washer and Rear Defogger



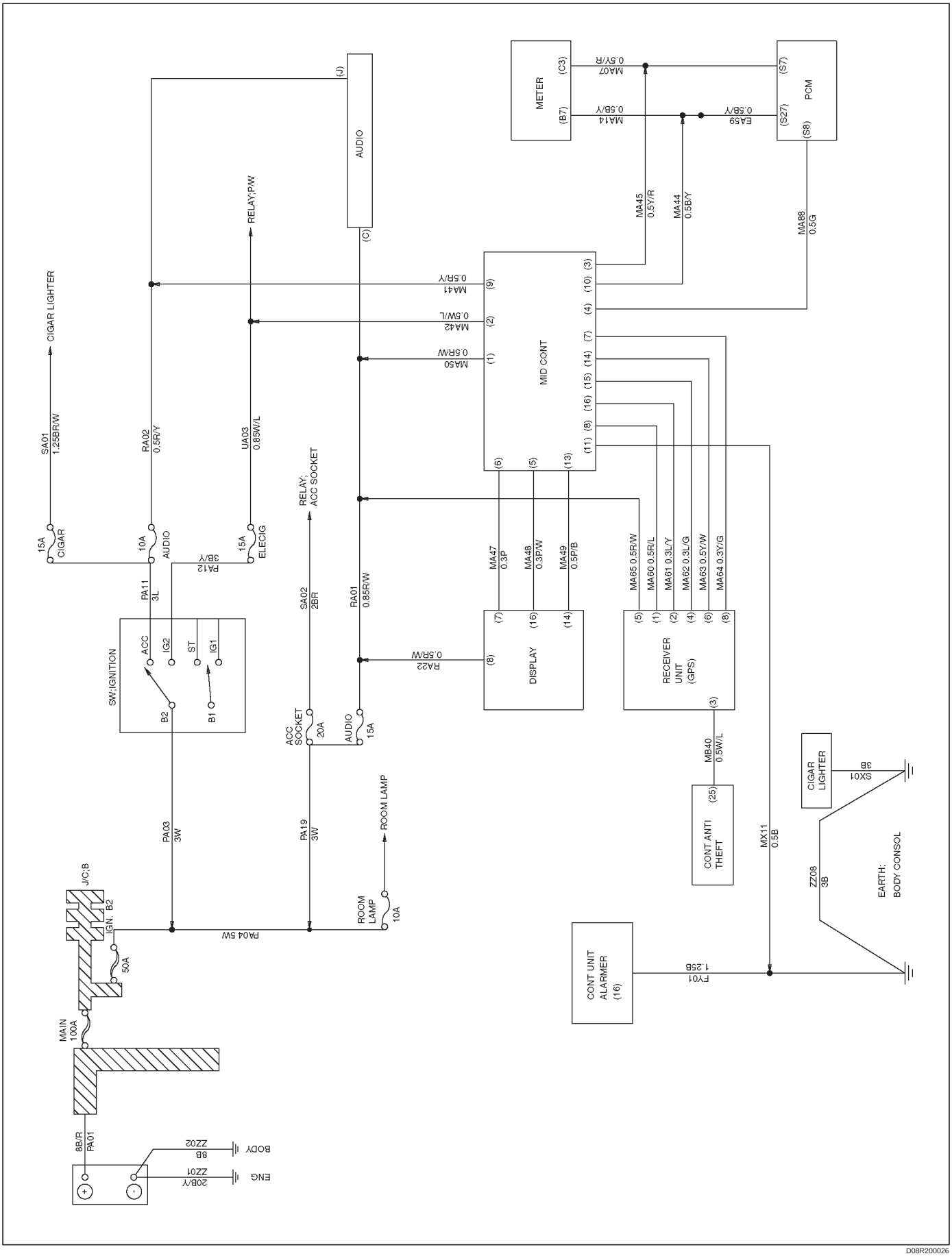
D08R200006

Audio, Clock, Cigarette Lighter and ACC Socket



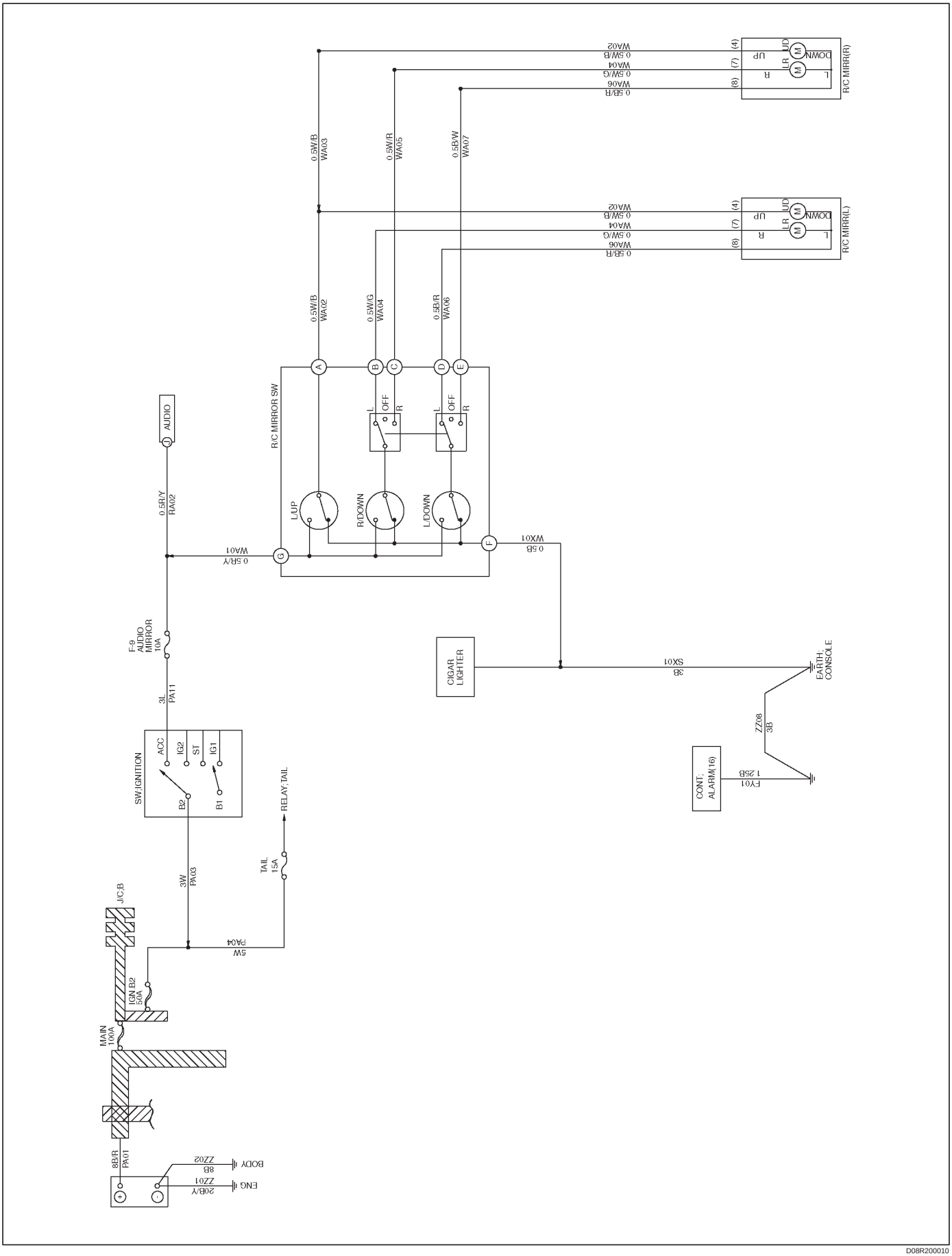
D08R200048

MID



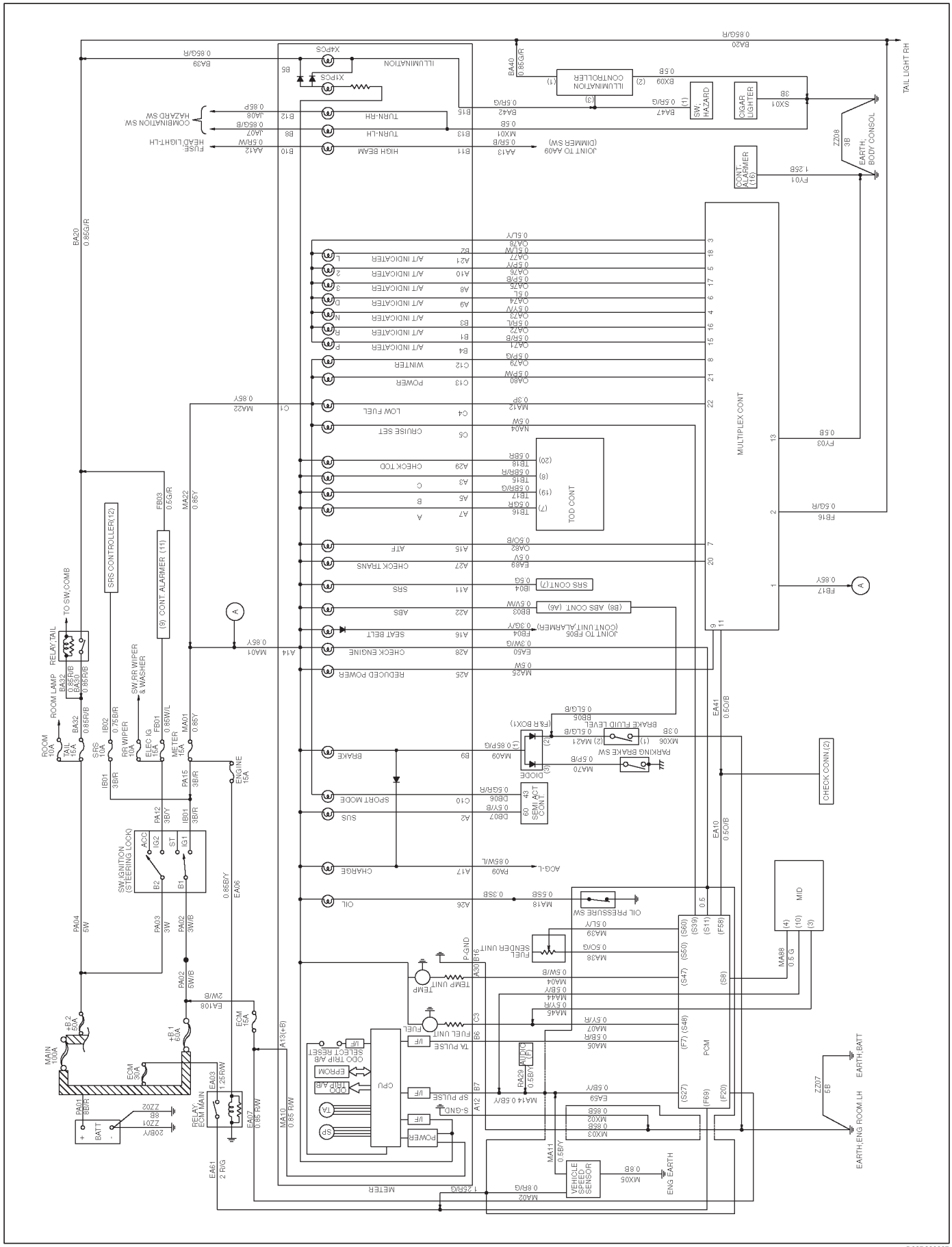
D08R200026

Door Mirror

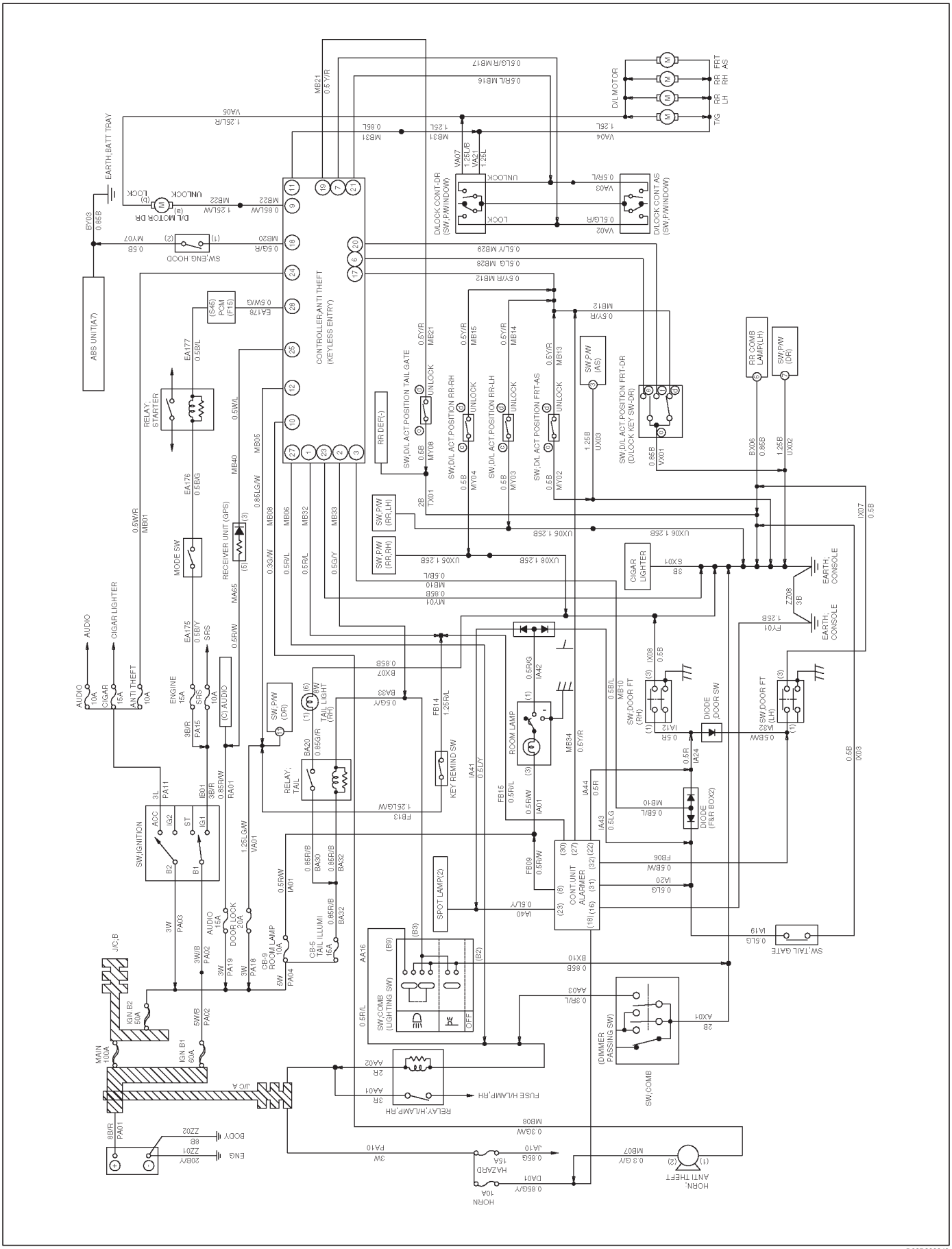


D08R200010

Meter

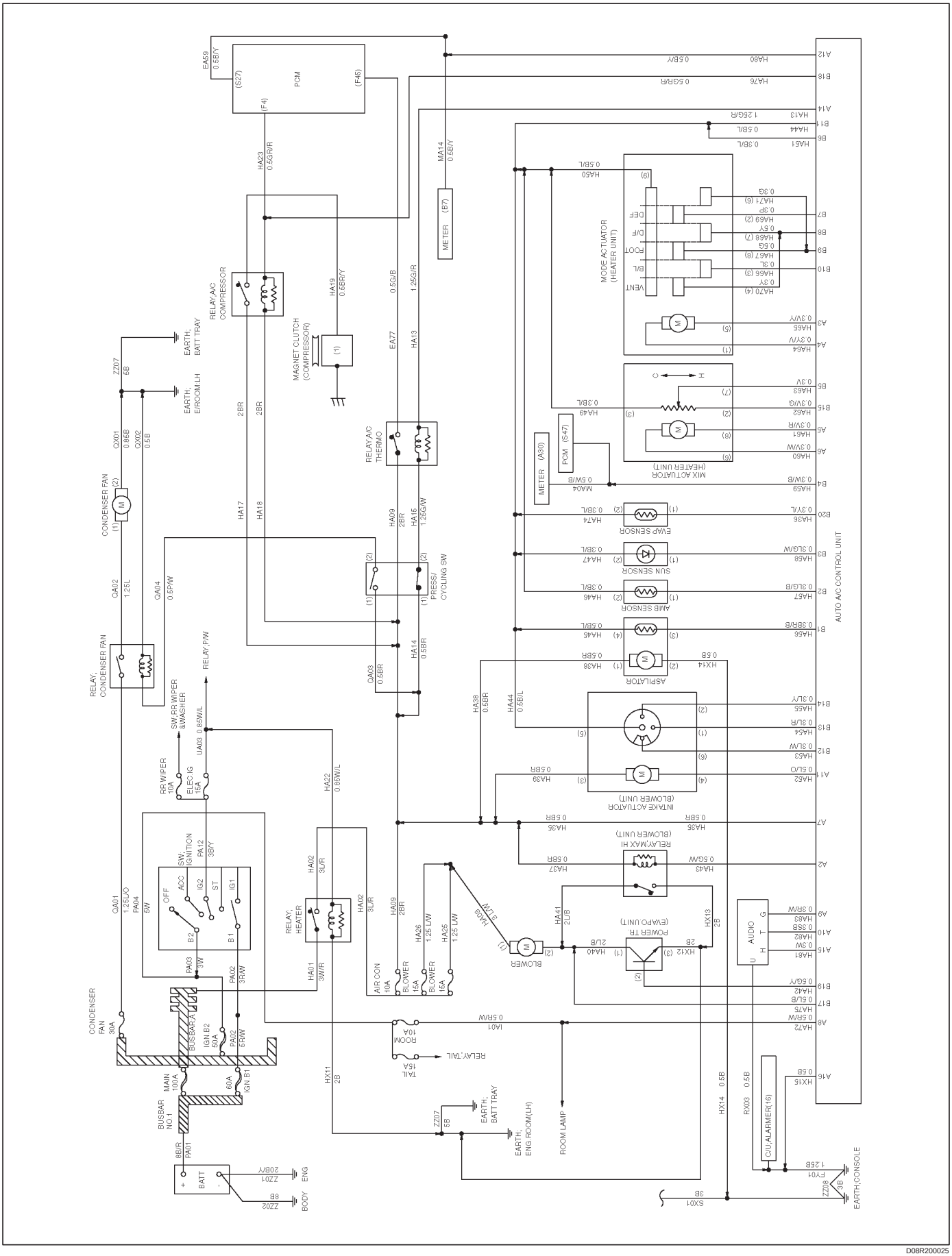

MULTIPLEX CONT
TOD CONT
SRS CONTROLLER(12)
(9) CONT ALARMER (11)
TO SW,COMB
RELAY,TAIL
ROOM LAMP
SW,RR WIPER & WASHER
SW,IGNITION (STEERING LOCK)
MAIN 100A
ECM 80A
+B,2 50A
+B,1 60A
ECM 15A
ENGINE 15A
METER 15A
ROOM 10A
TAIL 15A
SRS 10A
RR WIPER 10A
ELEC IG 15A
BATT
RELAY, ECM MAIN
COMBINATION SW
HAZARD SW
HEAD LIGHT-LH
TURN-RH
TURN-LH
HIGH BEAM
ILLUMINATION
ILLUMINATION CONTROLLER
SW, HAZARD
CIGAR LIGHTER
CONT ALARMER (16)
TAIL LIGHT RH
EARTH, BODY CONSOL
EARTH,BATT
EARTH,ENG ROOM LH
LOW FUEL
CRUISE SET
POWER
WINTER
A/T INDICATER
CHECK TOD
SRS
ABS
SEAT BELT
CHECK TRANS
CHECK ENGINE
REDUCED POWER
ATF
SPORT MODE
CHARGE
OIL
BRAKE
PARKING BRAKE SW
BRAKE FLUID LEVEL
OIL PRESSURE SW
FUEL SENDER UNIT
TEMP UNIT
FUEL UNIT
TA PULSE
SP PULSE
S-GND
POWER
CPU
OBD TRIP A/B
SELECT RESET
EPROM
TRIP A/B
VEHICLE SPEED SENSOR
ENG EARTH
PCM
MID
CHECK CONN.(2)
DIODE
SEMI A/T CONT
ABS CONT
SRS CONT
JOINT TO A409 (DIMMER SW)
JOINT TO F806 (CONT UNIT,ALARMER)
JOINT TO F804
D08R200007

Anti-theft with Keyless Entry



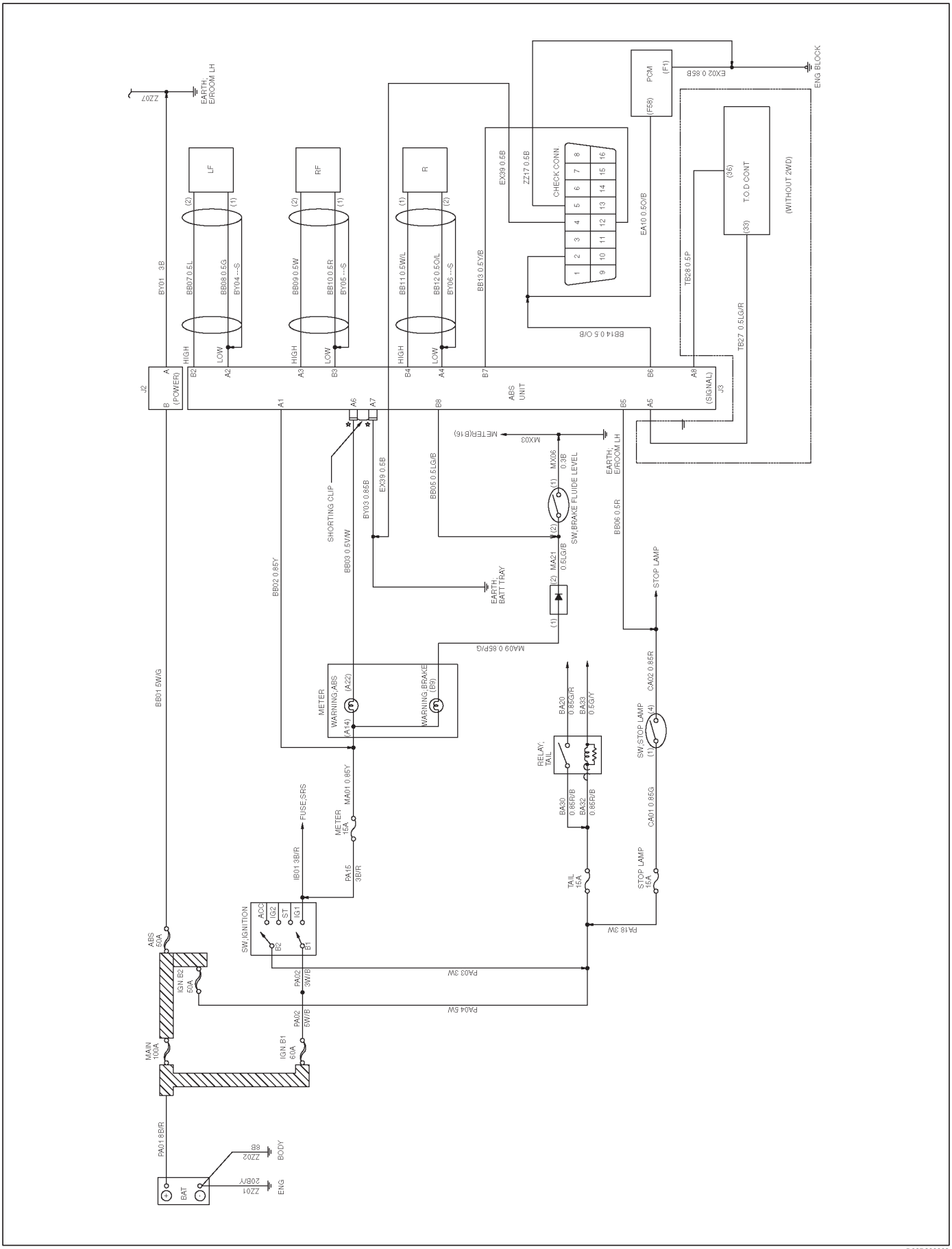
D08R200049

Air Conditioning



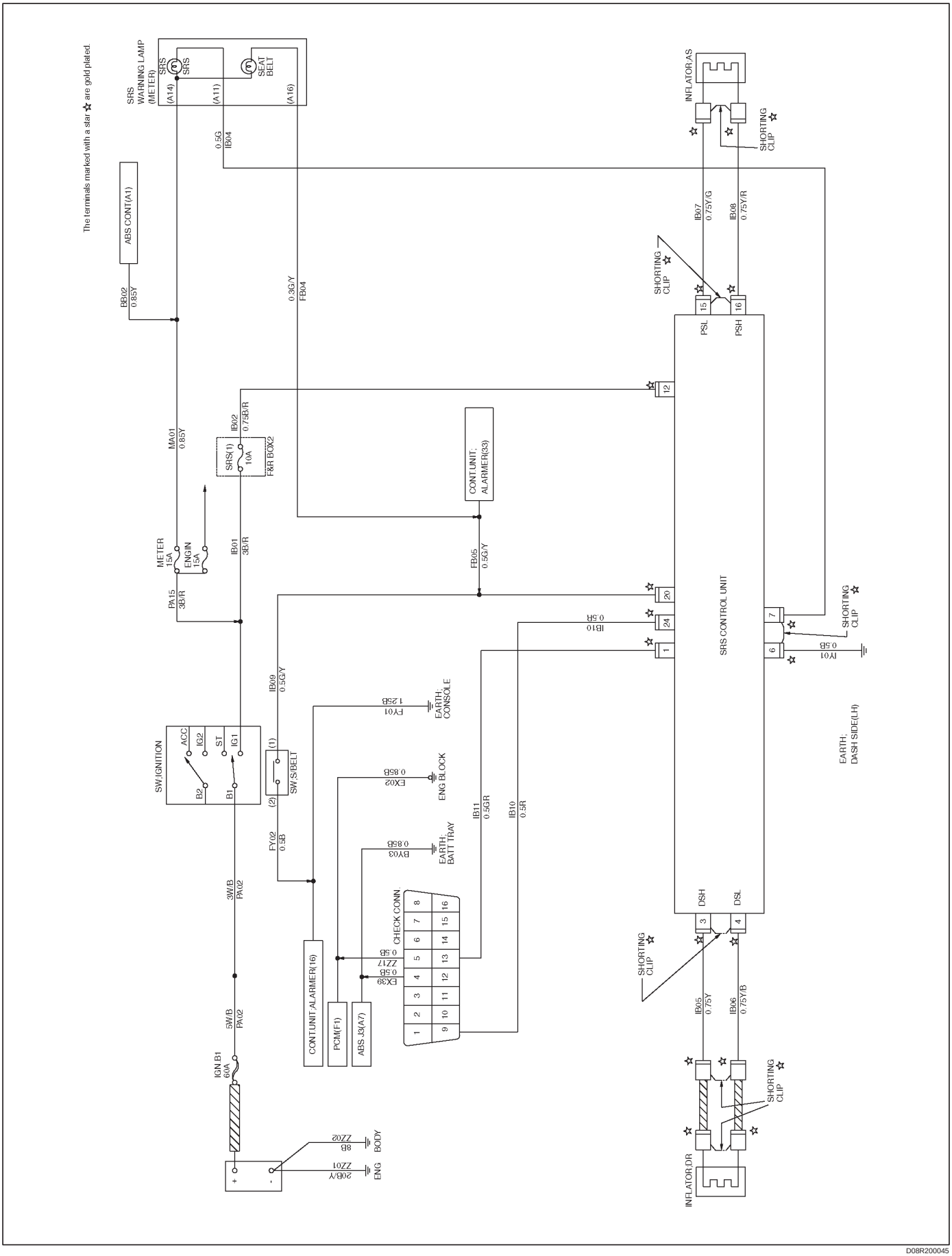
D08R200025

ABS



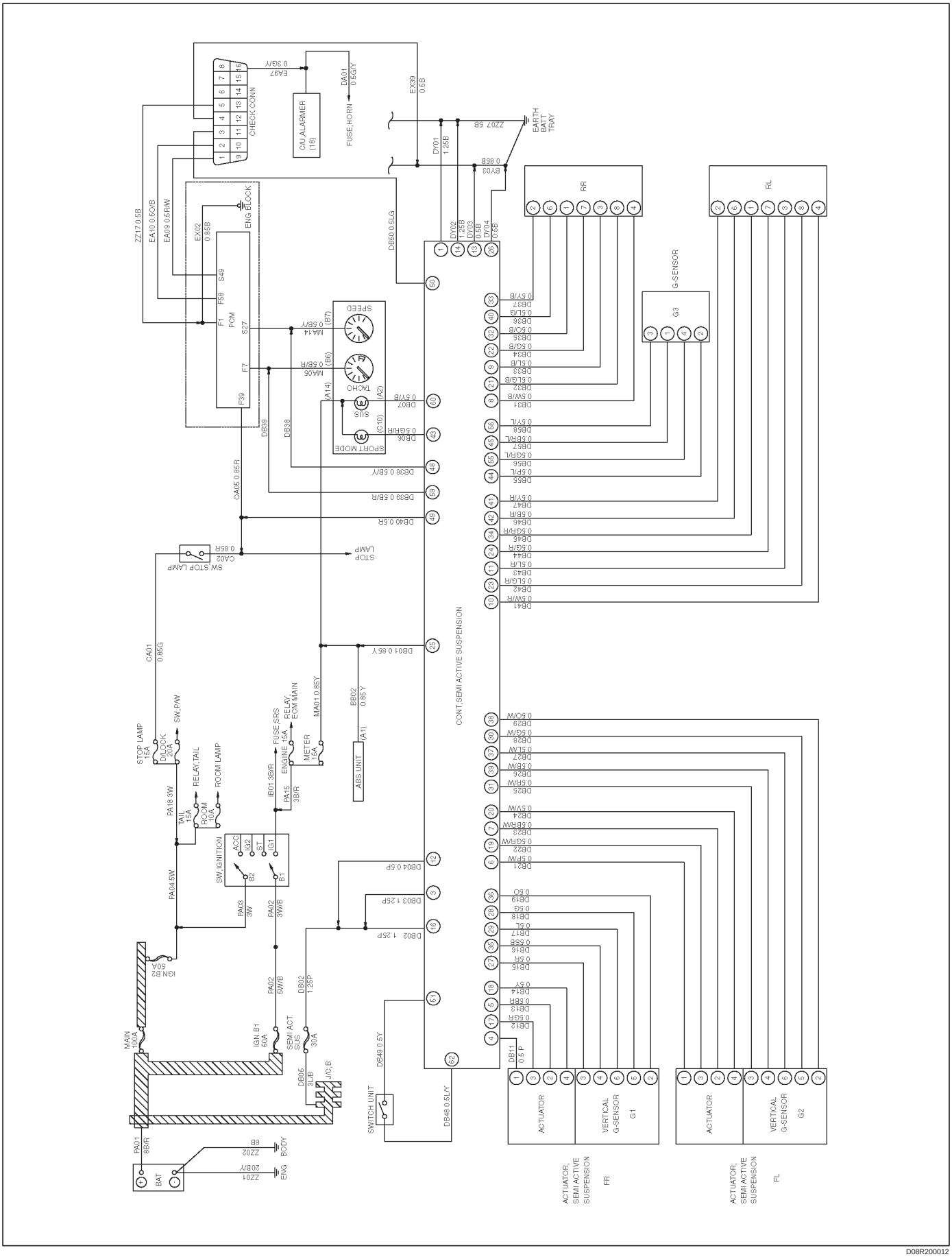
D08R200008

SRS–Air Bag



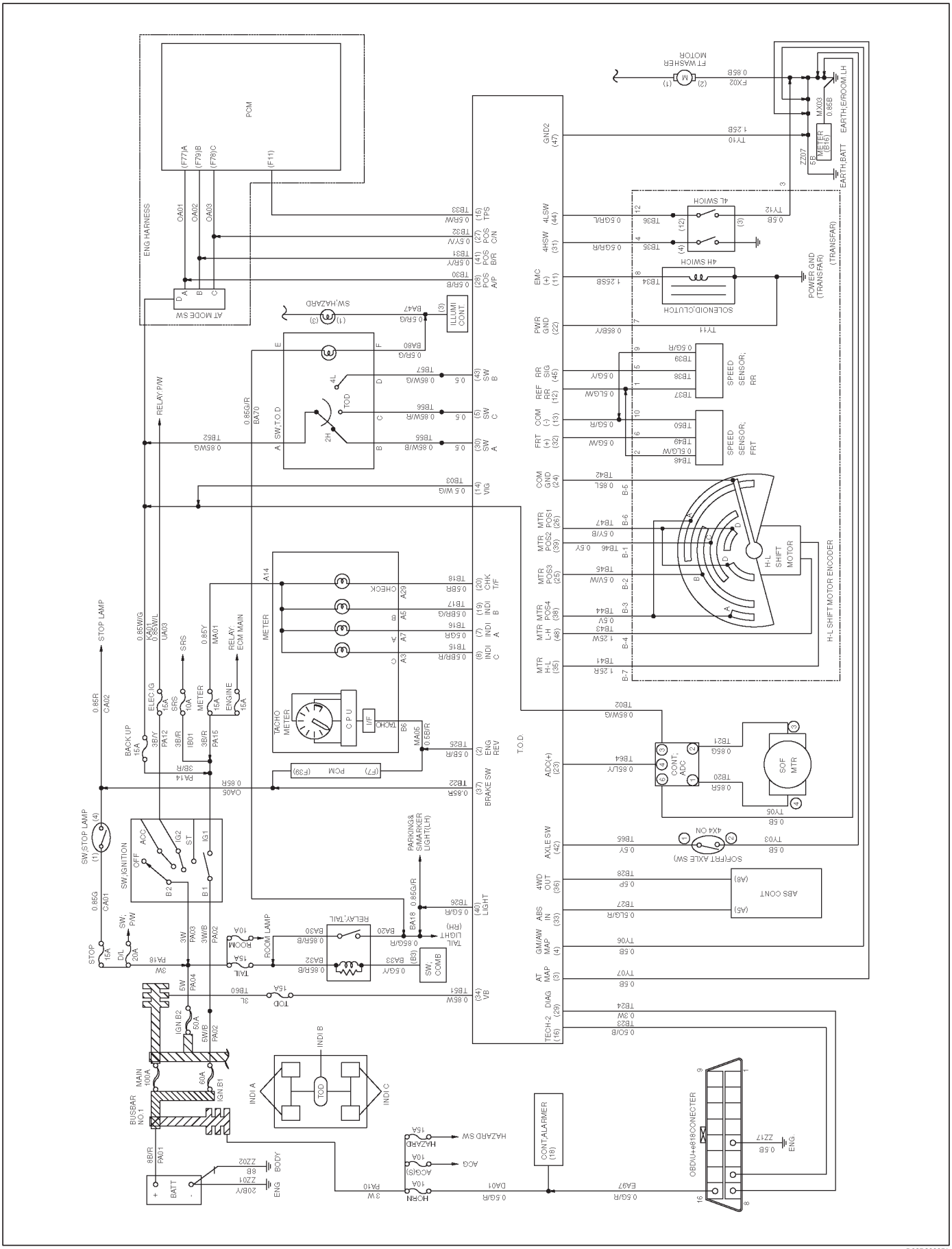
D08R200045

Intelligent Suspension



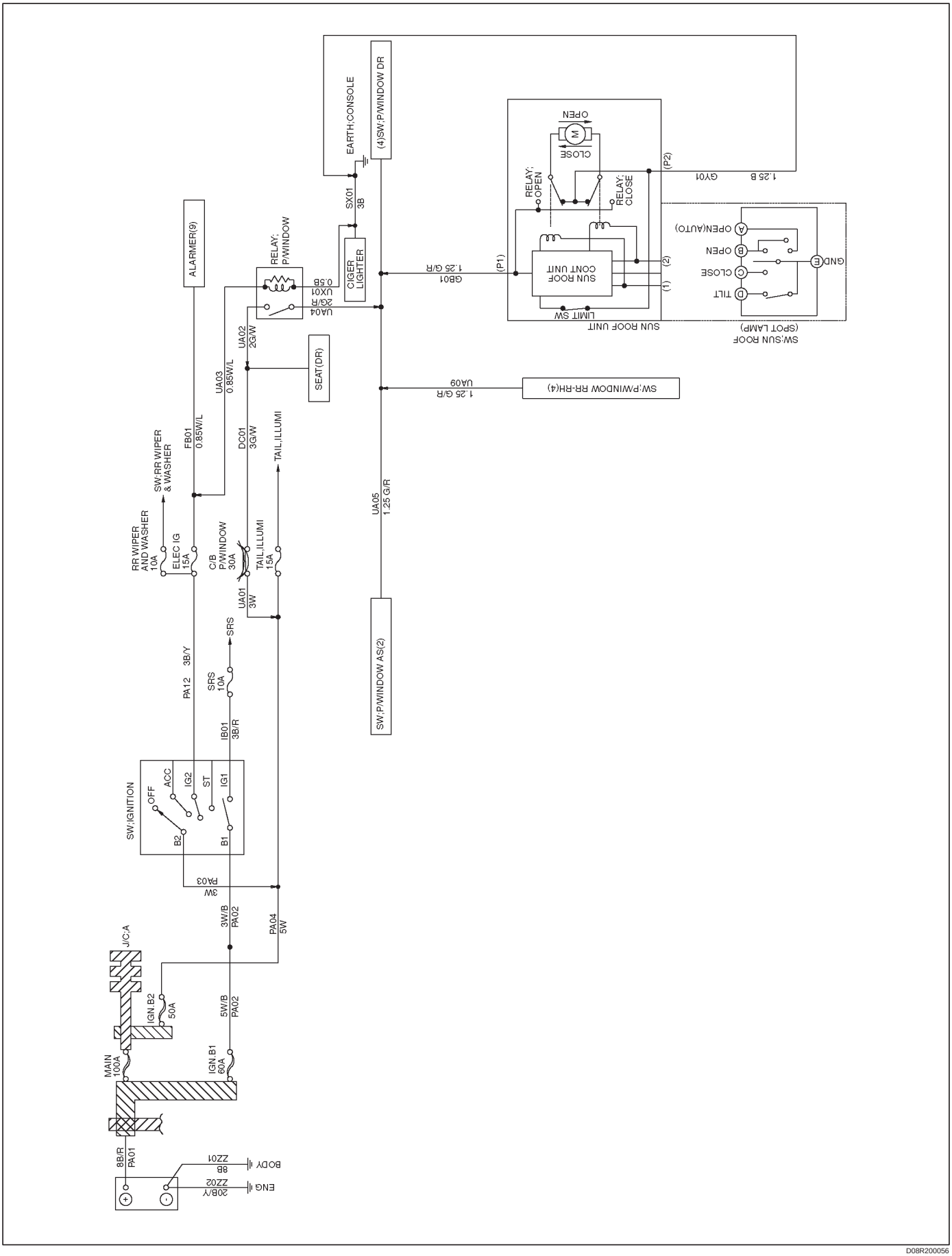
D08R200012

T.O.D



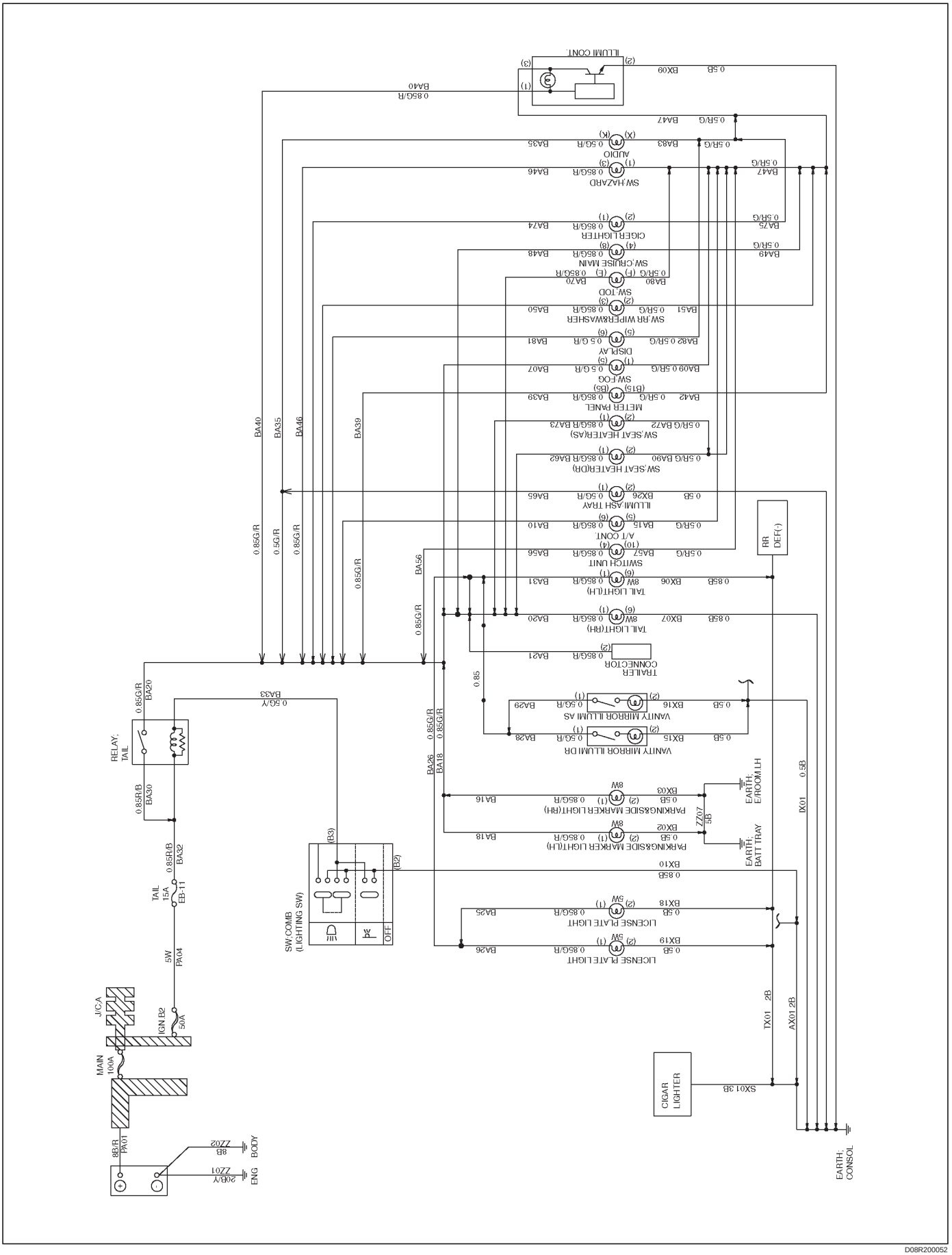
D08R200051

Sunroof



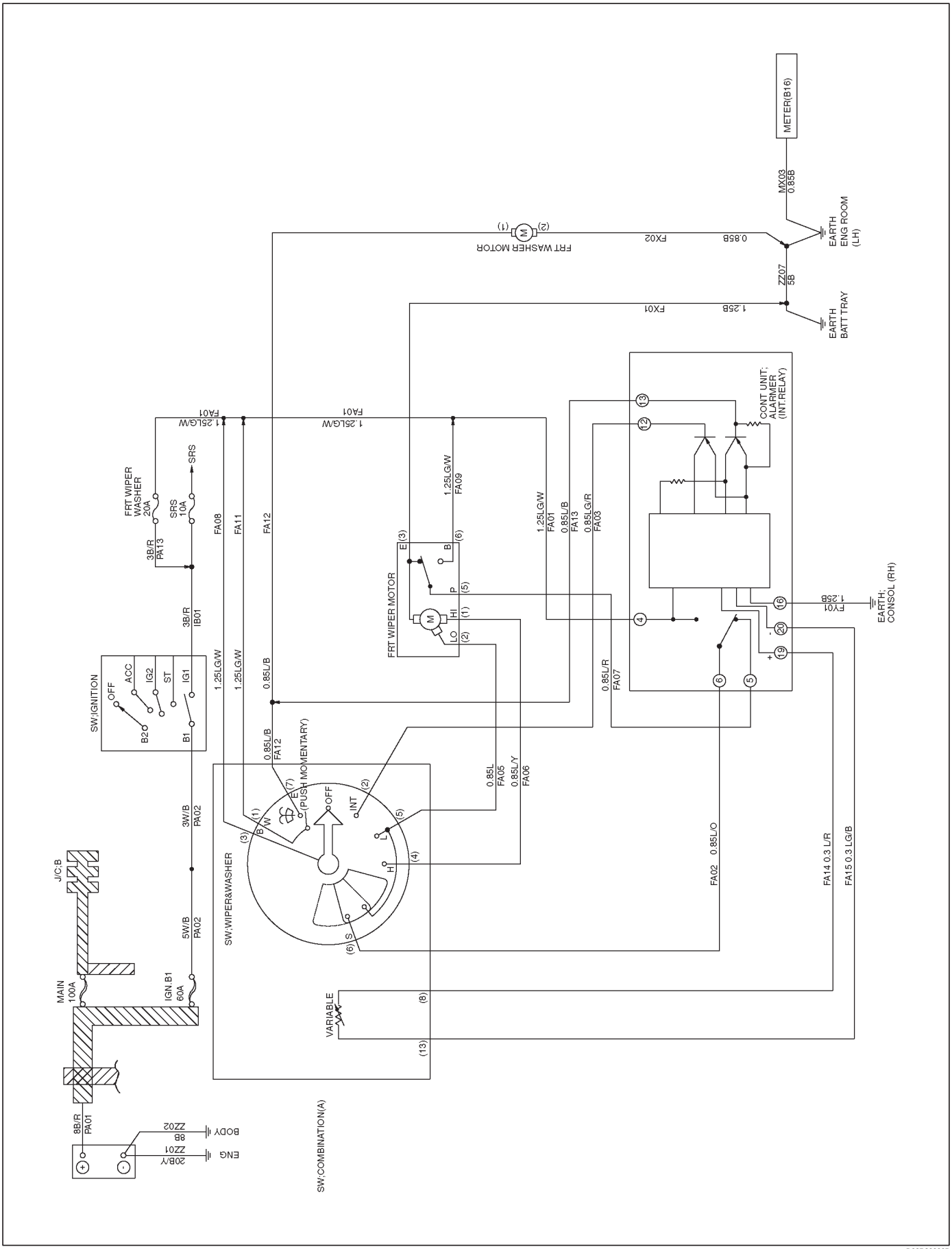
D08R200056

Illumination Light



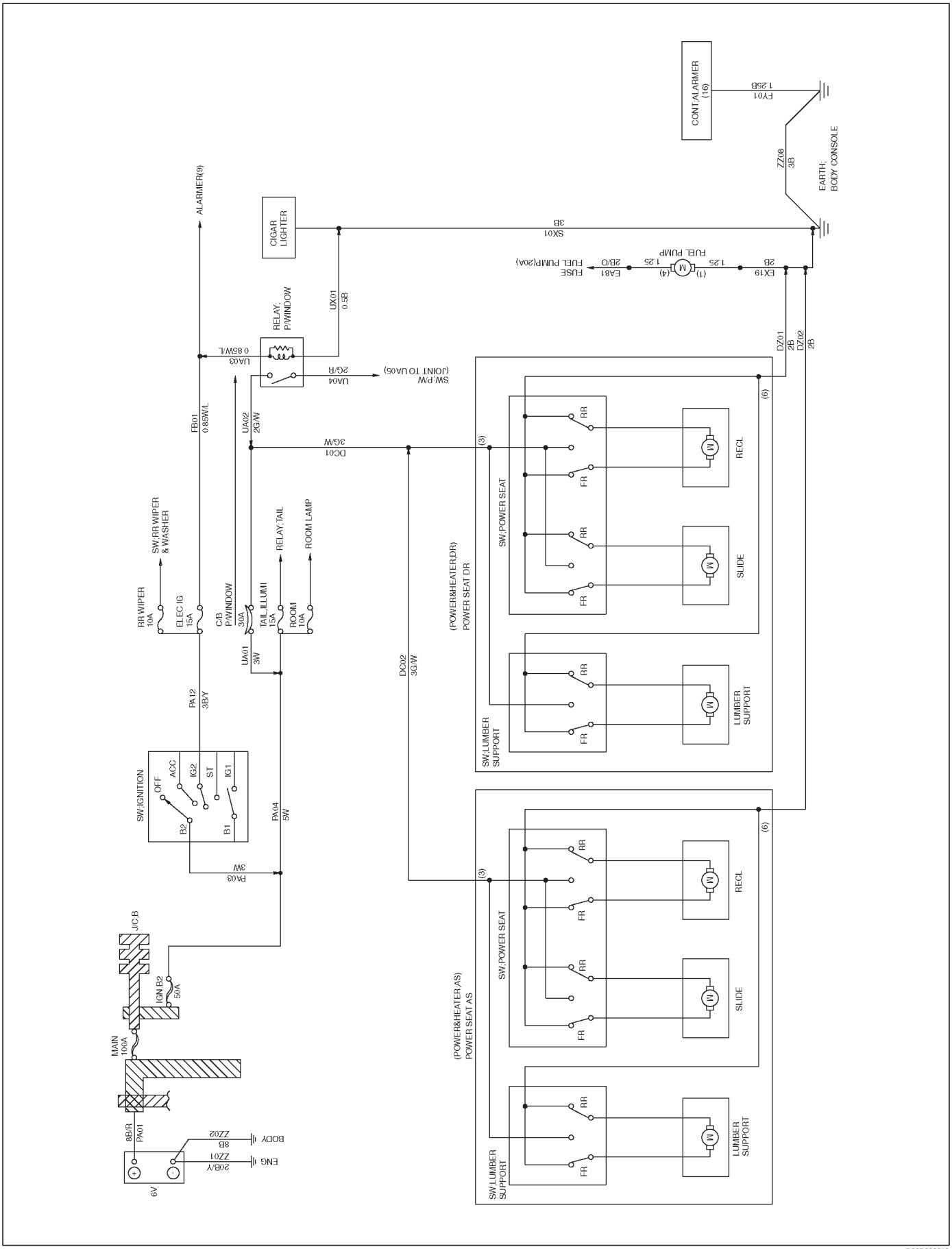
D08R200052

Windshield Wiper and Washer



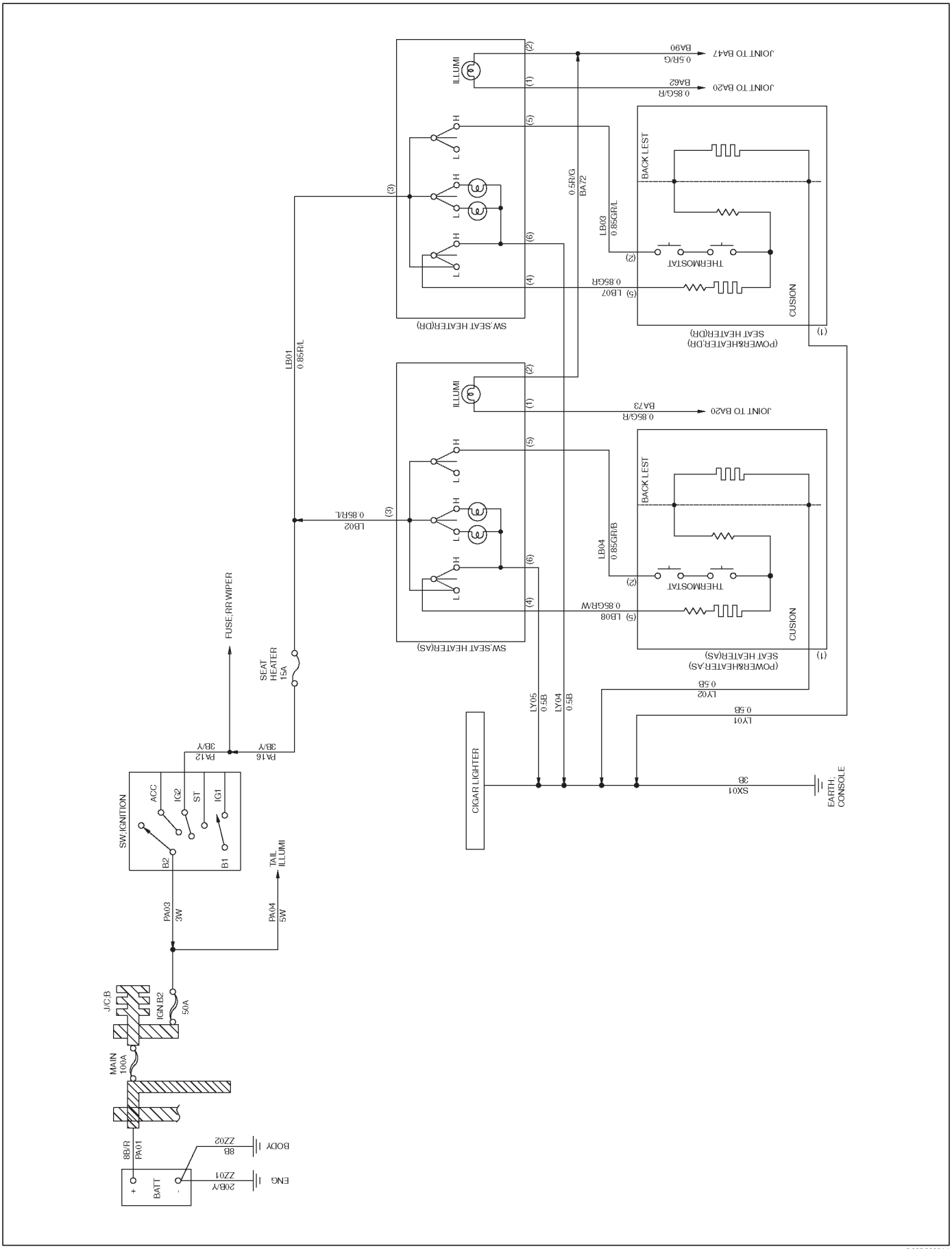
D08R200005

Power Seat



D08R200013

Seat Heater



D08R200014

AXIOM

BODY AND ACCESSORIES

METER AND GAUGE

CONTENTS

Service Precaution 8E–1
General Description 8E–1
Meter Assembly 8E–2
General Description 8E–2
Layout for Meters/Gauges, Warning Lights, Indicator Lights and Illumination Lights . . . 8E–2
Table for Meter/Gauge Connector Terminal Connections 8E–4
Removal 8E–6
Installation 8E–6
Warning Light Bulb and Indicator Light Bulb . 8E–6
Removal 8E–6
Installation 8E–6
A/T Shift Indicator Light Bulb 8E–7
Removal 8E–7
Installation 8E–8
Vehicle Speed Sensor 8E–9
Removal 8E–9
Installation 8E–9
Fuel Tank Unit 8E–9
Removal 8E–9
Main Data and Specifications 8E–10

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The circuit consists of the starter switch, meter assembly, vehicle speed sensor, transmission switch, lighting switch, turn signal switch, thermo unit, oil pressure unit, Powertrain Control Module (PCM), fuel tank unit, 4WD switch, oil pressure switch, parking brake switch, brake fluid switch, seat belt switch, illumination controller, meter and ambient sensor.

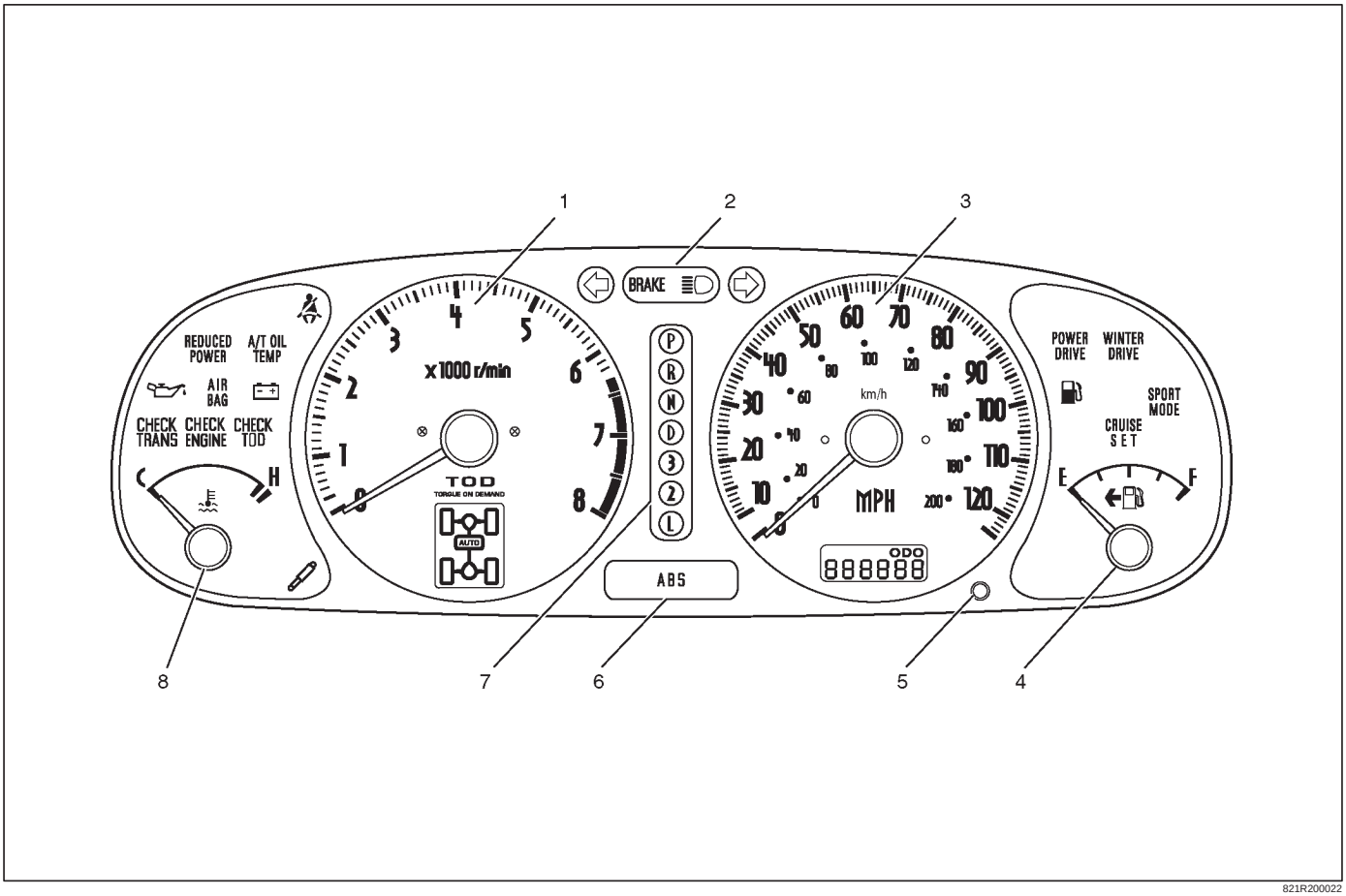
Meter Assembly

General Description

The meter assembly has the speedometer, tachometer, engine coolant temperature gauge, fuel gauge and warning/indicator lights.

Layout for Meters/Gauges, Warning Lights, Indicator Lights and Illumination Lights

Front View

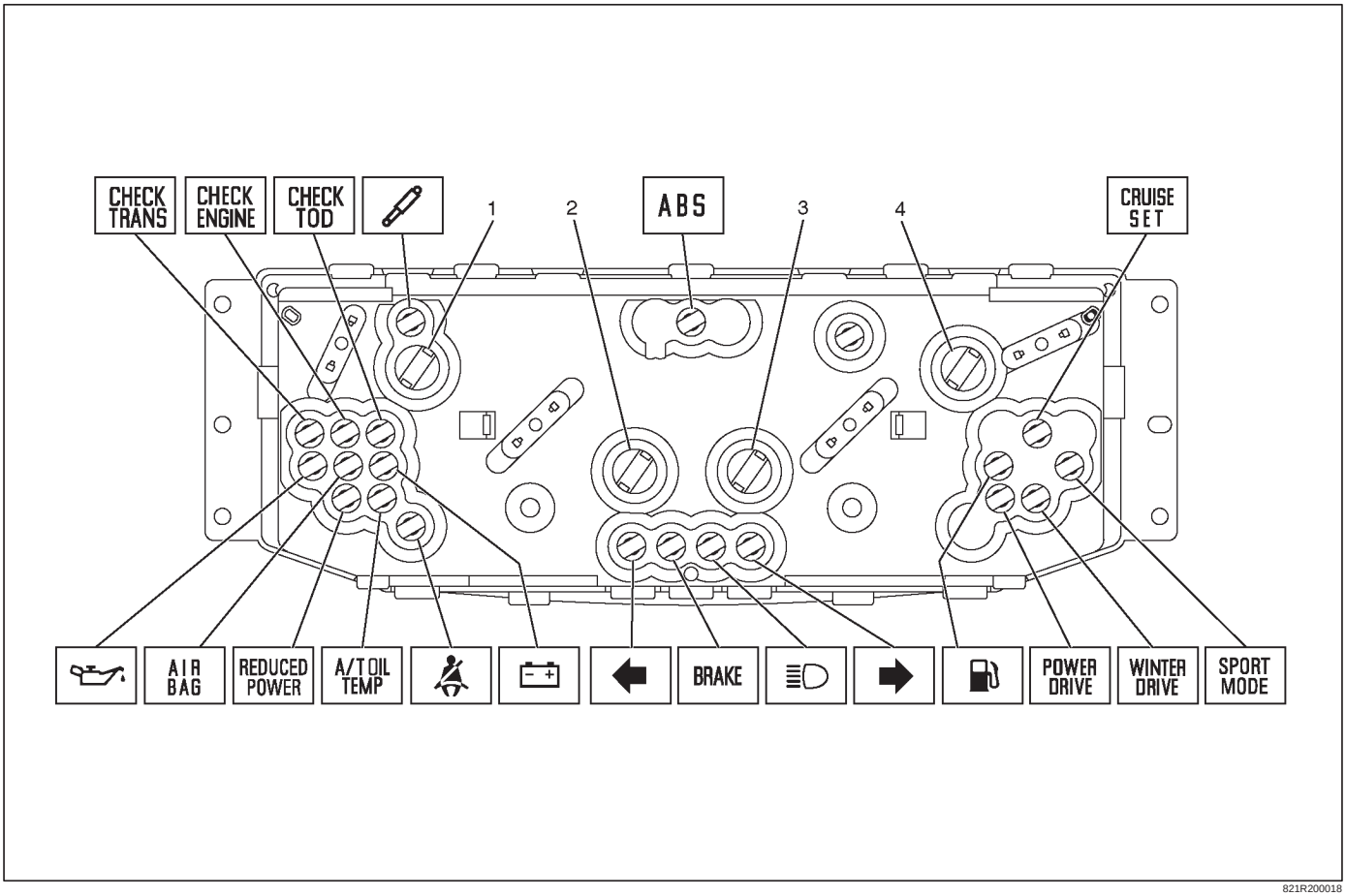


821R200022

Legend

(1) Tachometer
(2) Warning Light Lens
(3) Speedometer
(4) Fuel Gauge
(5) Reset Button
(6) Warning Light Lens
(7) A/T Shift Indicator
(8) Engine Coolant Temperature Gauge

Rear View

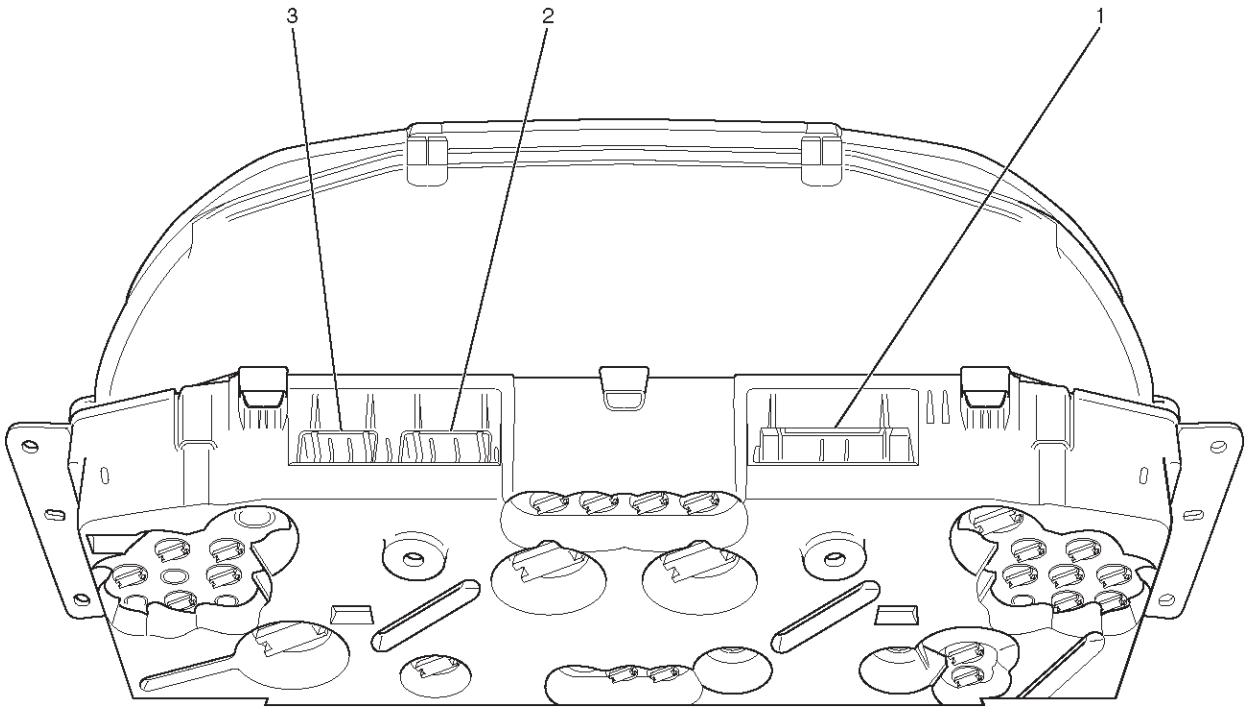


821R200018

Legend

(1) Illumination Light Bulb
(2) Illumination Light Bulb
(3) Illumination Light Bulb
(4) Illumination Light Bulb

Table for Meter/Gauge Connector Terminal Connections



821RY00053

Legend

(1) Connector A
(2) Connector B
(3) Connector C

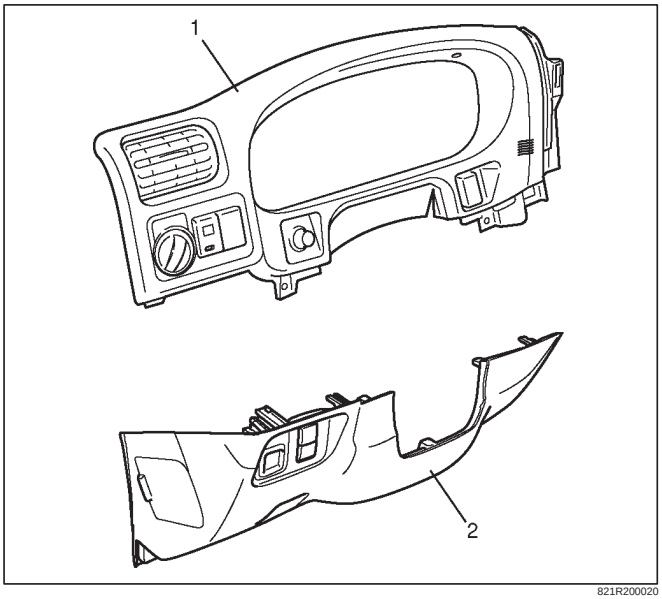
Connector A	
Terminal	**Function**
1	—
2	Intelligent suspension indicator light
3	TOD indicator light “Rear”
4	—
5	TOD indicator light “AUTO”
6	—
7	TOD indicator light “Front”
8	A/T shift indicator light “3”
9	A/T shift indicator light “D”
10	A/T shift indicator light “2”
11	SRS – air bag warning light
12	Ground
13	Battery
14	Stater switch
15	A/T oil temperature warning light
16	Seat belt indicator light
17	Charge warning light
18	—
19	—
20	—
21	A/T shift indicator light “L”
22	ABS warning light
23	—
24	—
25	Reduced power warning light
26	Oil pressure warning light
27	Check trans warning light
28	MIL(check engine) warning light
29	Check TOD
30	Engine coolant temperature gauge

Connector B	
Terminal	**Function**
1	A/T shift indicator light “R”
2	A/T shift indicator light
3	A/T shift indicator light “N”
4	A/T shift indicator light “P”
5	Illumination light
6	Engine revolution pulse
7	Speed sensor pulse
8	Turn signal indicator light (LH)
9	Brake warning light
10	High beam indicator light (+)
11	High beam indicator light (–)
12	Turn signal indicator light (RH)
13	Turn signal indicator light
14	—
15	Illumination light
16	Ground

Connector C	
Terminal	**Function**
1	Starter switch
2	—
3	Fuel gauge
4	Low fuel warning light
5	Cruise set indicator light
6	—
7	—
8	—
9	—
10	Sport mode indicator light
11	—
12	Winter drive indicator light
13	Power drive indicator light
14	—

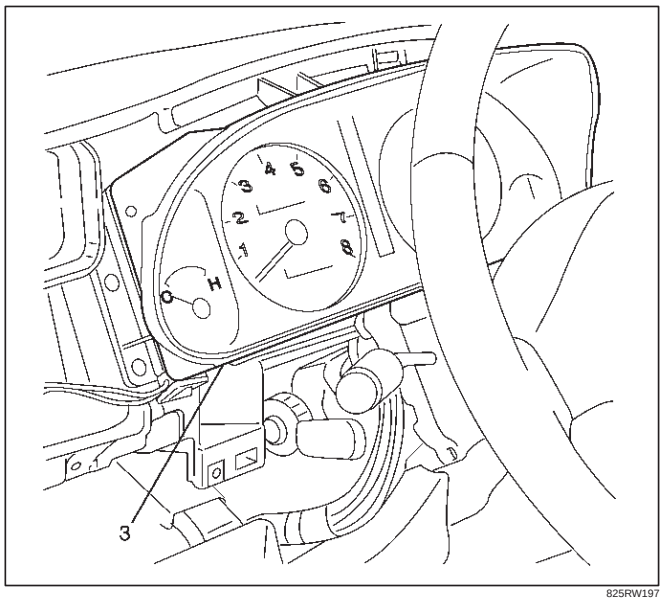
Removal

1. Disconnect the battery ground cable.
2. Remove the Dash Side Trim Panel –LH.
3. Remove the lower cover Assembly(2).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.
4. Remove the meter cluster Assembly(1).
   ▼Refer to *Instrument Panel Assembly in Body Structure* section.



821R200020

5. Remove the meter assembly(3).
   ▼Remove four fixing screws.
   ▼Disconnect the meter connectors.



825RW197

CAUTION: The removed meter assembly should be placed upright or with its face side up.

Installation

To install, follow the removal steps in the reverse order.

Warning Light Bulb and Indicator Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter assembly.
   ▼Refer to *Meter Assembly* in this section.
3. Remove the bulb.
   ▼Hold the bulb socket by hand, rotate it counterclockwise and pull it out.

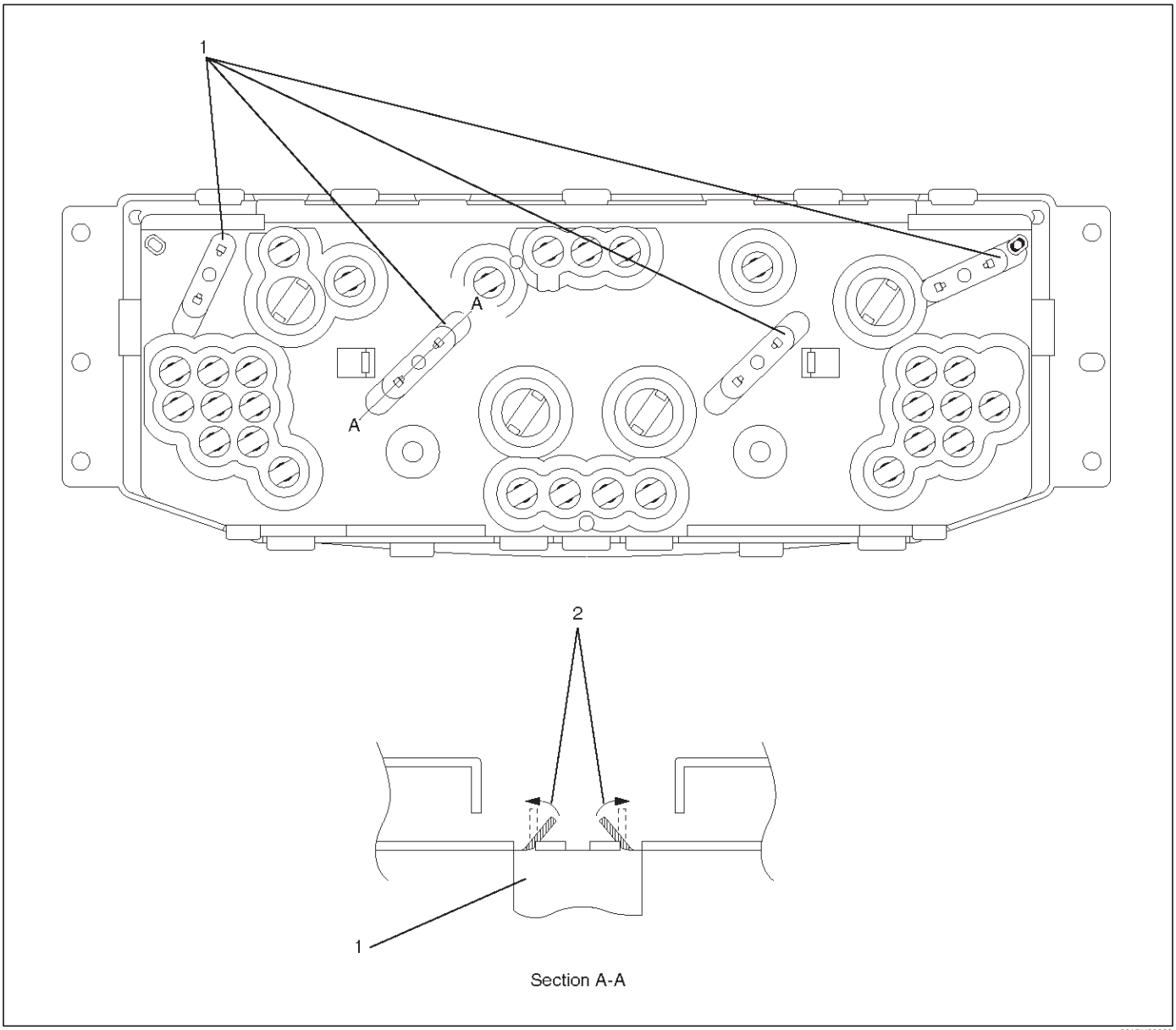
Installation

To install, follow the removal steps in the reverse order.

A/T Shift Indicator Light Bulb

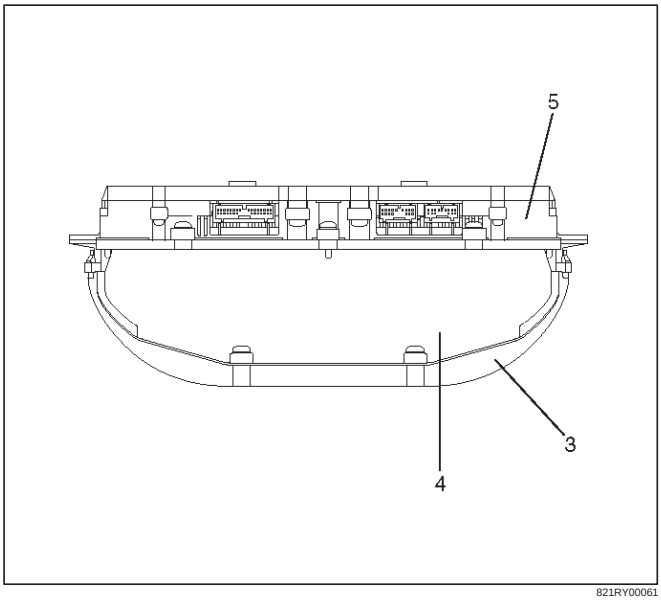
Removal

1. Disconnect the battery ground cable.
2. Pry up the bended portions(2) of the metal cover(1).



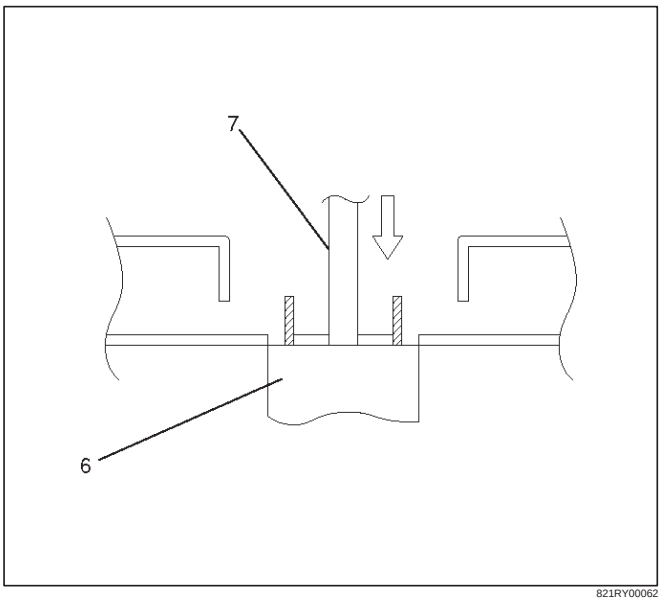
821RY00060

3. Remove the meter lense(3) from the meter visor(4).
4. Remove the meter visor from the meter case(5).



821RY00061

5. Remove the meter assembly.
   ▼Push the metal cover(6) with the screw driver(7).



821RY00062

6. Remove the meter rear cover.
7. Remove the meter circuit board.
8. Remove the A/T shift indicator bulb.

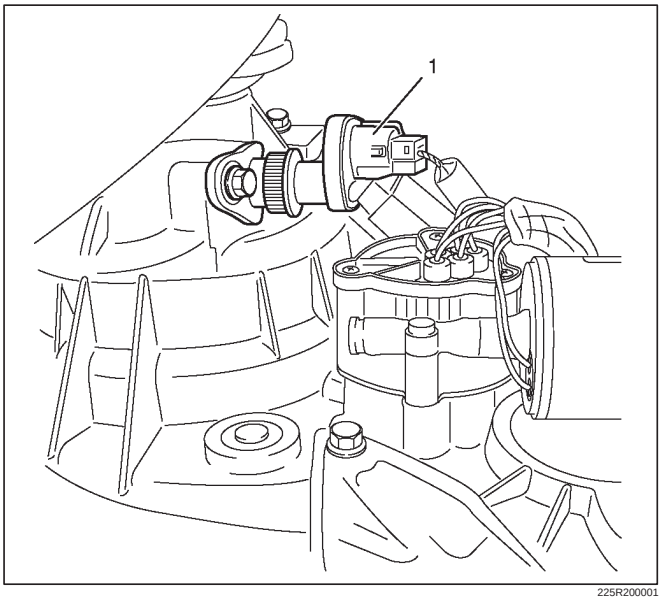
Installation

To install, follow the removal steps in the reverse order.

Vehicle Speed Sensor

Removal

1. Disconnect the battery ground cable.
2. Remove the vehicle speed sensor(1).
   ▼Disconnect the connector.
   ▼Rotate the sensor counterclockwise.



225R200001

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the vehicle speed sensor to the specified torque.

   Torque: 25 N·m (18 lb ft)

Fuel Tank Unit

Removal

Refer to *Engine Fuel* section.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Vehicle Speed Sensor Fixing	27	20	—

AXIOM

BODY AND ACCESSORIES

BODY STRUCTURE

CONTENTS

Service Precaution 8F–2
Frame 8F–2
General Description 8F–2
Frame Dimensions 8F–3
General Description (Bumper) 8F–4
Front Bumper 8F–4
Parts Location 8F–4
Removal 8F–5
Installation 8F–6
Rear Bumper 8F–7
Parts Location 8F–7
Removal 8F–8
Installation 8F–9
General Description (Sheet Metal) 8F–10
Engine Hood 8F–10
Parts Location 8F–10
Removal 8F–11
Installation 8F–11
Engine Hood Lock 8F–13
Parts Location 8F–13
Removal 8F–13
Installation 8F–14
Front Fender Panel 8F–15
Parts Location 8F–15
Removal 8F–16
Installation 8F–16
Body Mounting 8F–18
Parts Location 8F–18
Tightening Torque 8F–18
Body Dimension 8F–19
Front Section 8F–19
Room Section (Front Side) 8F–22
Room Section (Rear Side) 8F–24
Rear Section 8F–26
Side Body Section (Front side) 8F–28
Side Body Section (Rear side) 8F–30
General Description (Body) 8F–32
Instrument Panel Assembly 8F–32
Parts Location 8F–32
Removal 8F–33
Installation 8F–34
Front Door Assembly 8F–35
Parts Location 8F–35
Removal 8F–35
Installation 8F–36
Rear Door Assembly 8F–37
Parts Location 8F–37
Removal 8F–37
Installation 8F–38
Front Window Regulator, Glass and Glass Run 8F–39
Parts Location 8F–39
Removal 8F–40
Installation 8F–41
Rear Window Regulator, Glass and Glass Run 8F–42
Parts Location 8F–42
Removal 8F–43
Installation 8F–45
Tailgate 8F–46
Parts Location 8F–46
Removal 8F–47
Installation 8F–48
Spare Tire Hanger 8F–49
Parts Location 8F–49
Removal 8F–50
Installation 8F–50
Windshield 8F–51
Parts Location 8F–51
Removal 8F–51
Installation 8F–52
Rear Quarter Glass 8F–55
Parts Location 8F–55
Removal 8F–55
Installation 8F–56
Tailgate Glass 8F–57
Parts Location 8F–57
Removal 8F–57
Installation 8F–58
Main Data and Specifications 8F–59

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

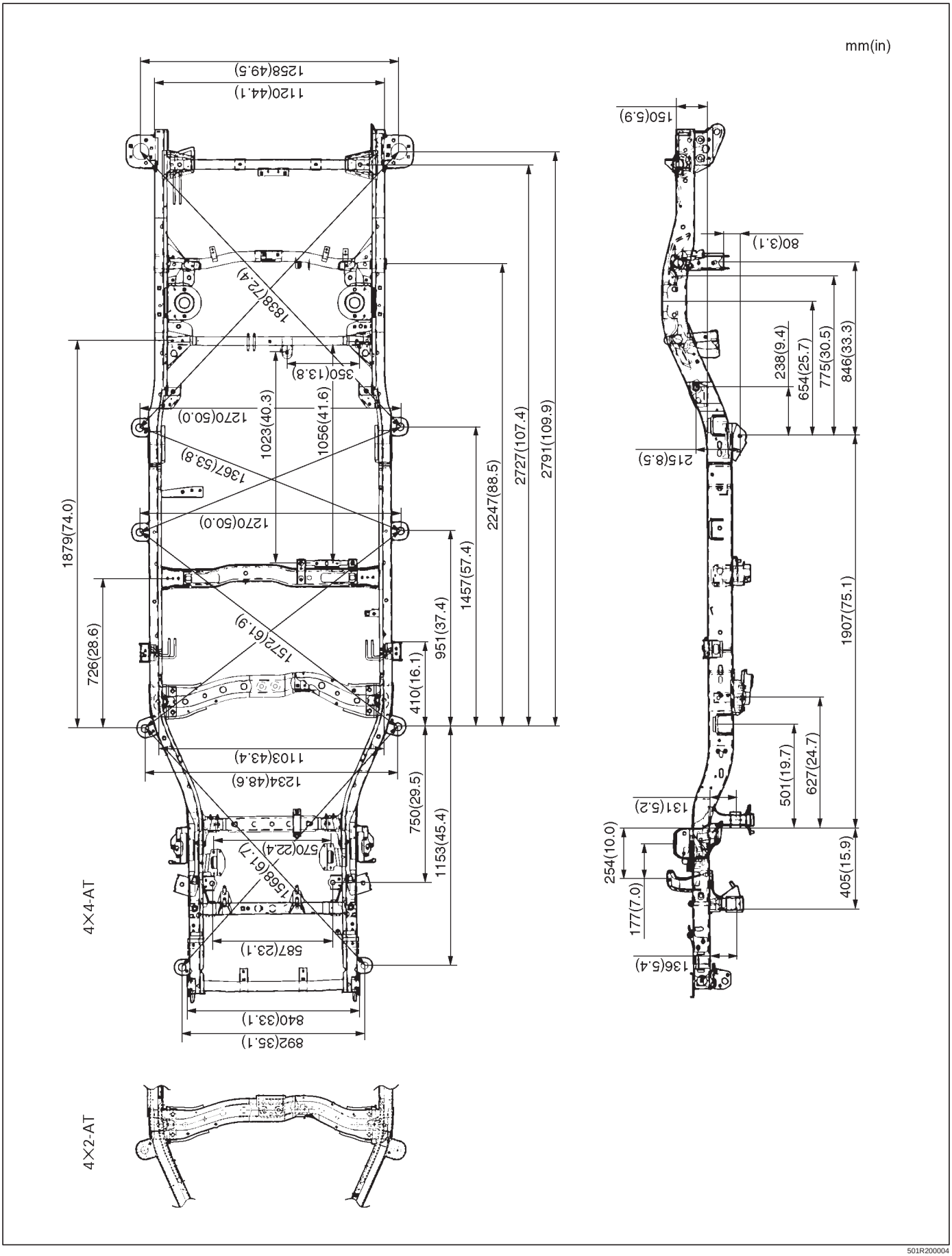
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Frame

General Description

Proper frame alignment is important to assure normal vehicle life and performance of many other parts of the vehicle. If the vehicle has been involved in a fire, collision or has been overloaded, it is necessary to check the frame alignment.

Frame Dimensions



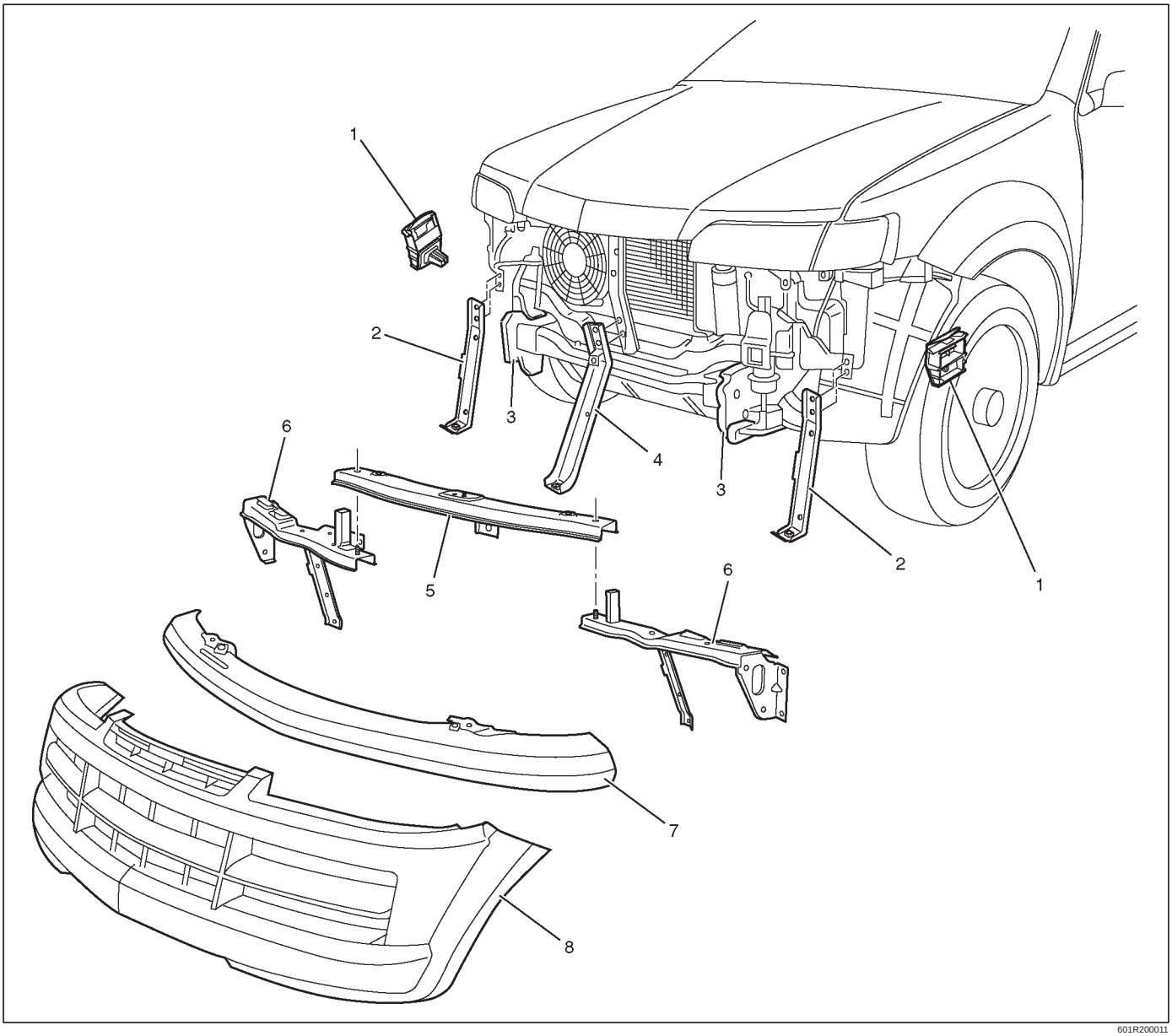
501R200004

General Description (Bumper)

Front and rear bumpers consist of bumper fascia, support, and reinforcement.
The absorbing capability for both front and rear bumper systems are achieved through reinforcements in each bumper.

Front Bumper

Parts Location



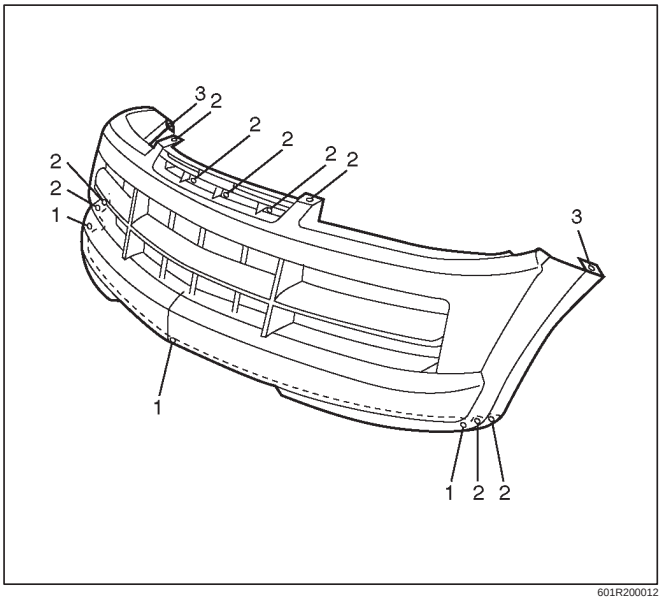
601R200011

Legend

(1) Front Bumper Mounting
(2) Front Bumper Side Bracket
(3) Front Bumper Back Bar Assembly
(4) Front Bumper Center Bracket
(5) Front Bumper Center Retainer
(6) Front Bumper Side Retainer
(7) Front Bumper Reinforcement Assembly
(8) Front Bumper Fascia

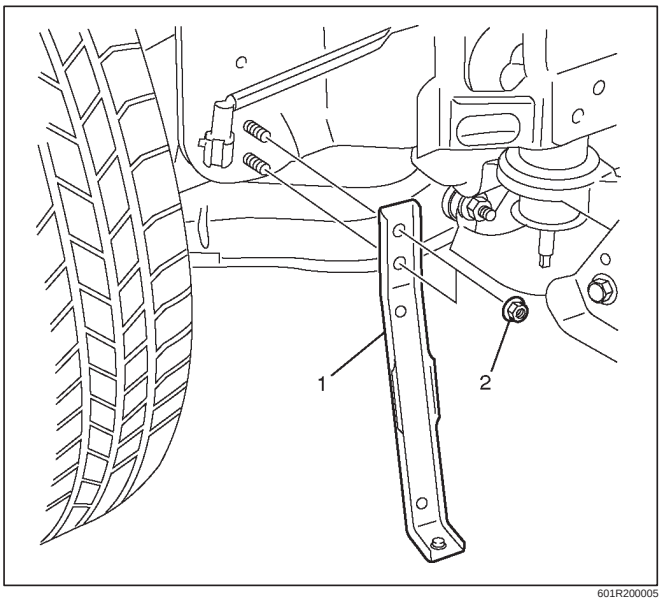
Removal

1. Disconnect the battery ground cable.
2. Remove the front bumper fascia.
   ▼Remove the nine clips (2), the three bolts (1) and two screws (3).



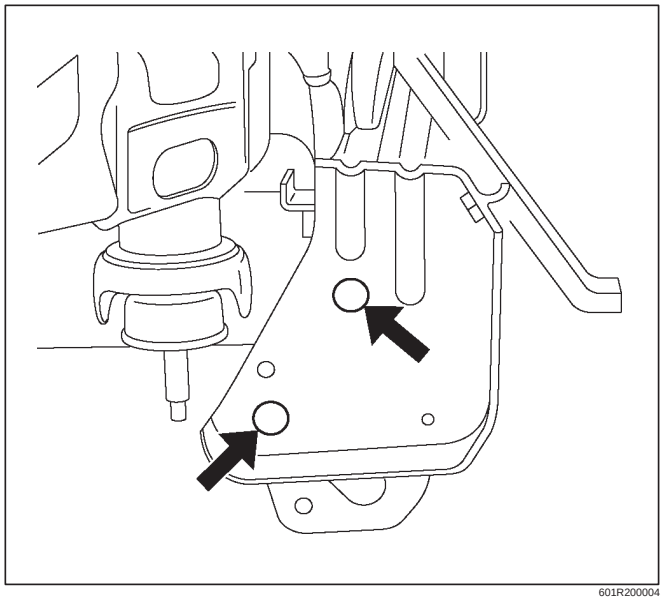
601R200012

3. Remove the front bumper center retainer.
   ▼Remove the two nuts and the bolt.
4. Remove the front bumper sides's retainers.
   ▼Remove the four nuts and the bolt from both sides.
5. Remove the front bumper reinforcement assembly.
   ▼Remove the four bolts.
6. Remove the front bumper center bracket.
   ▼Remove the two bolts.
7. Remove the front bumper sides's brackets (1).
   ▼Remove the two nuts (2) from both sides.

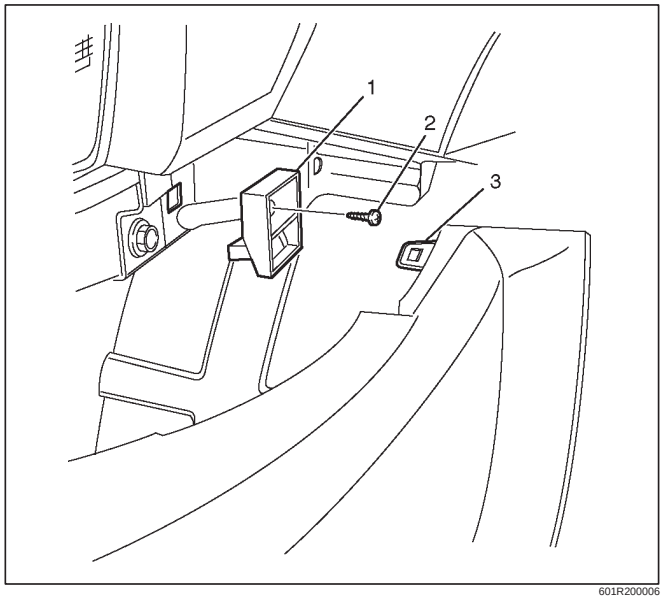


601R200005

8. Remove the front bumper back bar assembly.
   ▼Remove the two bolts from both sides of the front bumper.


601R200004

9. Remove the front bumper mounting (1).
   ▼Remove the screw (2) from both sides.



601R200006

Installation

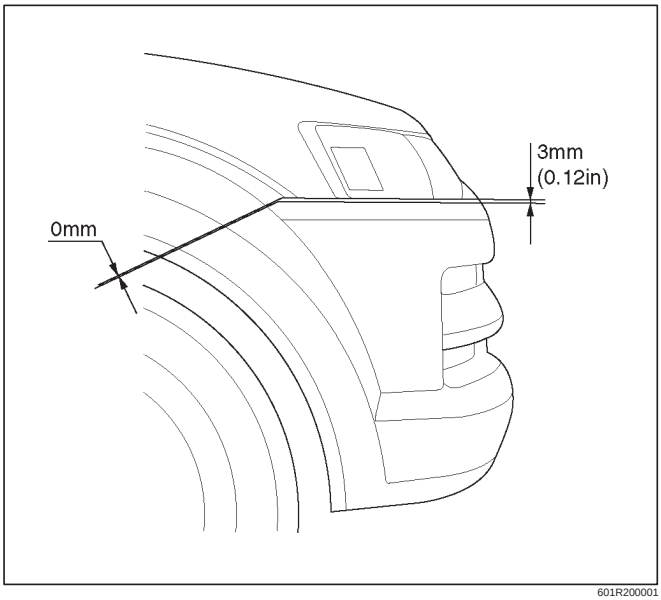
To install, follow the removal steps in reverse order noting the following points:

1. Tight the front bumper back bar assembly fixing bolts to the specified torque.

   Torque : 147 N·m (108 lb ft)

2. Front bumper adjustment.

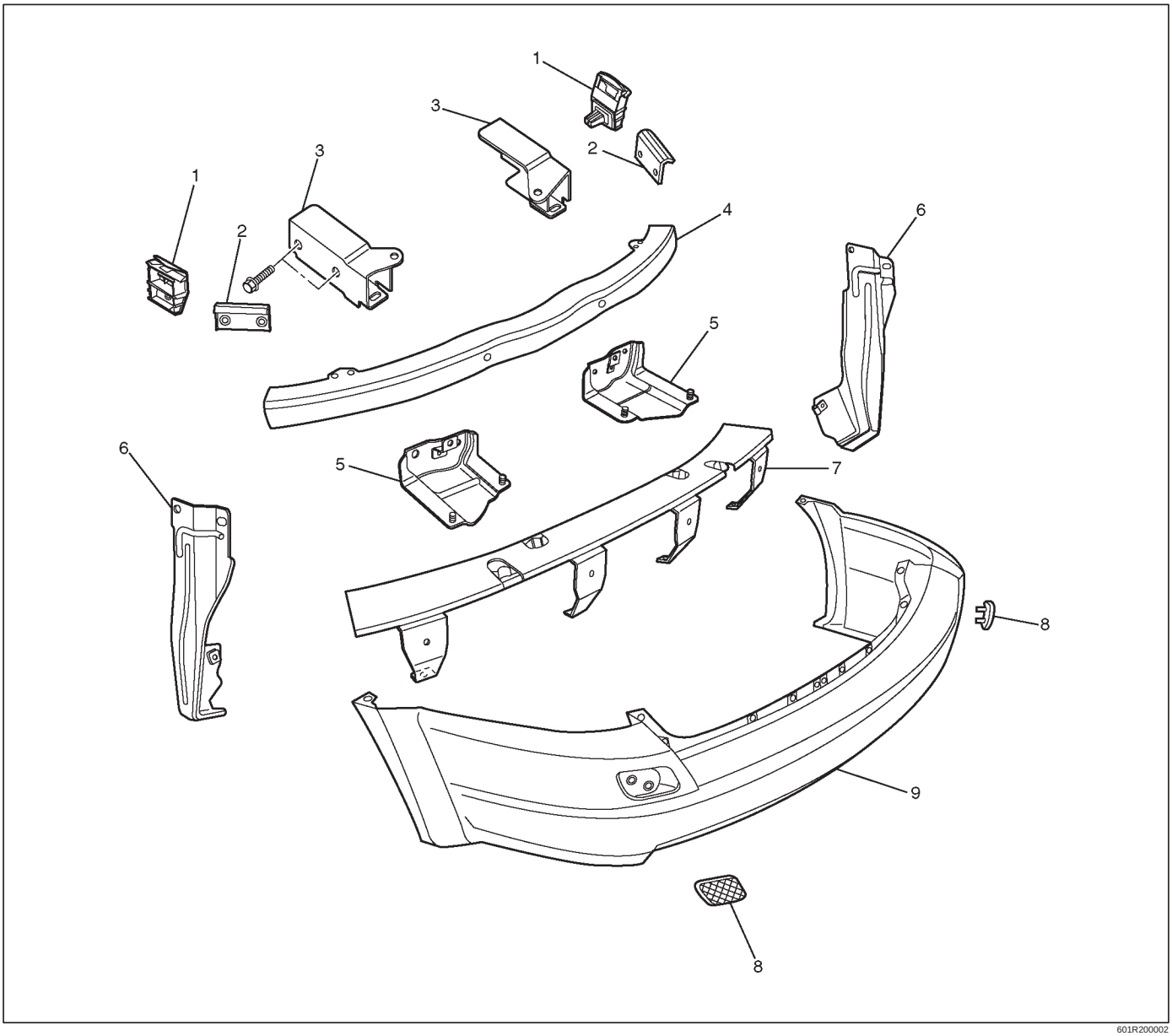
   ▼When the bolts fixing front bumper assembly are tightened, adjustment should be made between the back bar and front side bumper so that there is a clearance of 3 mm (0.12 in) between the top of the bumper and the fender. The angled portion of the bumper must be flush with the fender.



601R200001

Rear Bumper

Parts Location



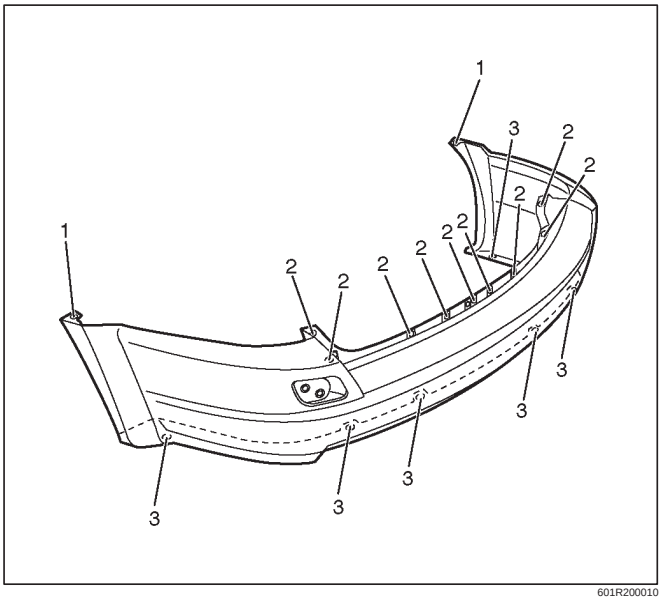
601R200002

Legend

(1) Rear Bumper Mounting
(2) Rear Bumper Side Bracket
(3) Rear Bumper Back Bar Assembly
(4) Rear Bumper Reinforcement Assembly
(5) Rear Bumper Retainer Bracket Assembly
(6) Rear Bumper Support Assembly
(7) Rear Bumper Retainer Assembly
(8) Rear Reflector Assembly
(9) Rear Bumper Fascia

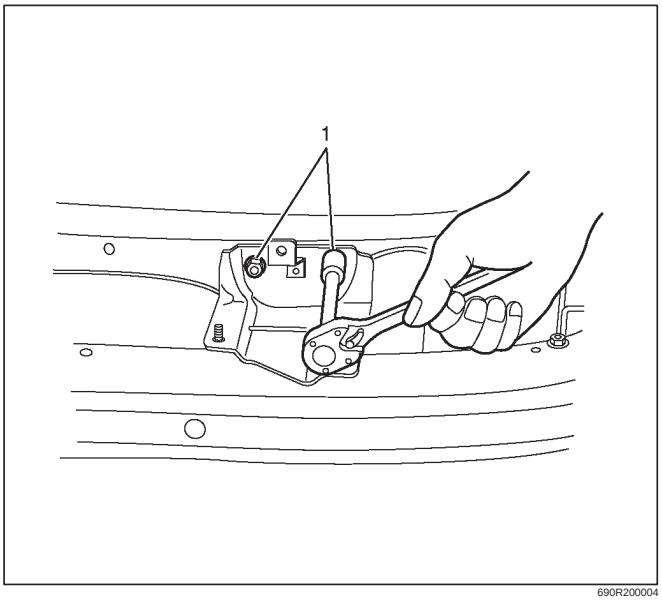
Removal

1. Disconnect the battery ground cable.
2. Remove the rear bumper fascia.
   ▼Remove the two screws (1), six bolts (3) and nine clips (2).



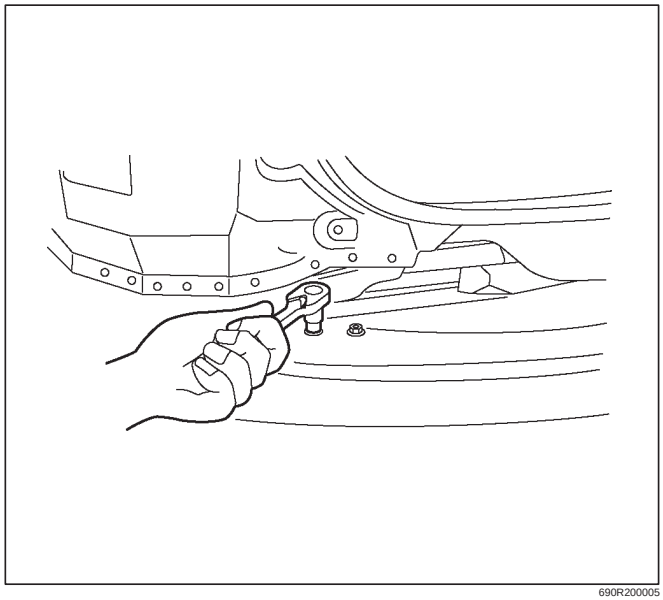
601R200010

3. Remove the rear bumper retainer assembly.
   ▼Remove the four nuts.
4. Remove the rear bumper retainer bracket assembly.
   ▼Remove the two nuts (1) from both sides.

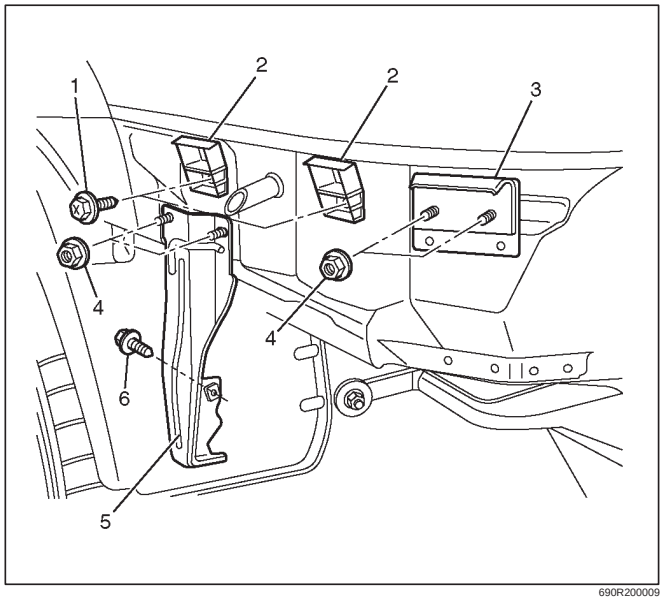


690R200004

5. Remove the rear bumper reinforcement assembly.
   ▼Remove the six bolts.

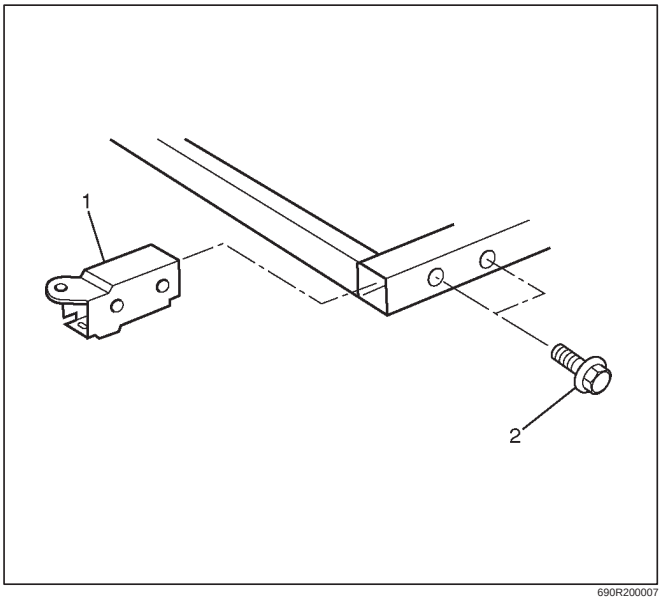

690R200005

6. Remove the rear bumper support assembly (5).
   ▼Remove the two nuts (4) and the screw (6) from both sides.
7. Remove the rear bumper side bracket (3).
   ▼Remove the two nuts (4) from both sides.
8. Remove the rear bumper mounting (2).
   ▼Remove the screw (1) from each sides.



690R200009

9. Remove the rear bumper back bar assembly.
   ▼Remove the two bolts from both sides.



690R200007

10. Remove the reflector assembly.
    ▼Remove the two nuts.

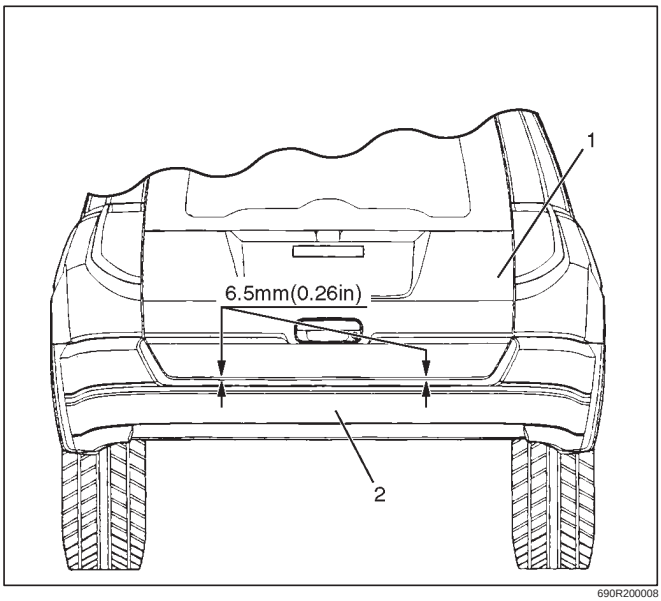
Installation

To install, follow the removal steps in reverse order, noting the following points:

1. Tighten the rear bumper back bar assembly fixing bolts to the specified torque.

   Torque : 147 N·m (108 lb ft)

2. Rear bumper adjustment.
   ▼When the bolts fixing rear bumper assembly are tightened, adjustment should be made with shims so that clearances shown in the figure below are provided between the body (tailgate) (1) and the rear bumper (2).



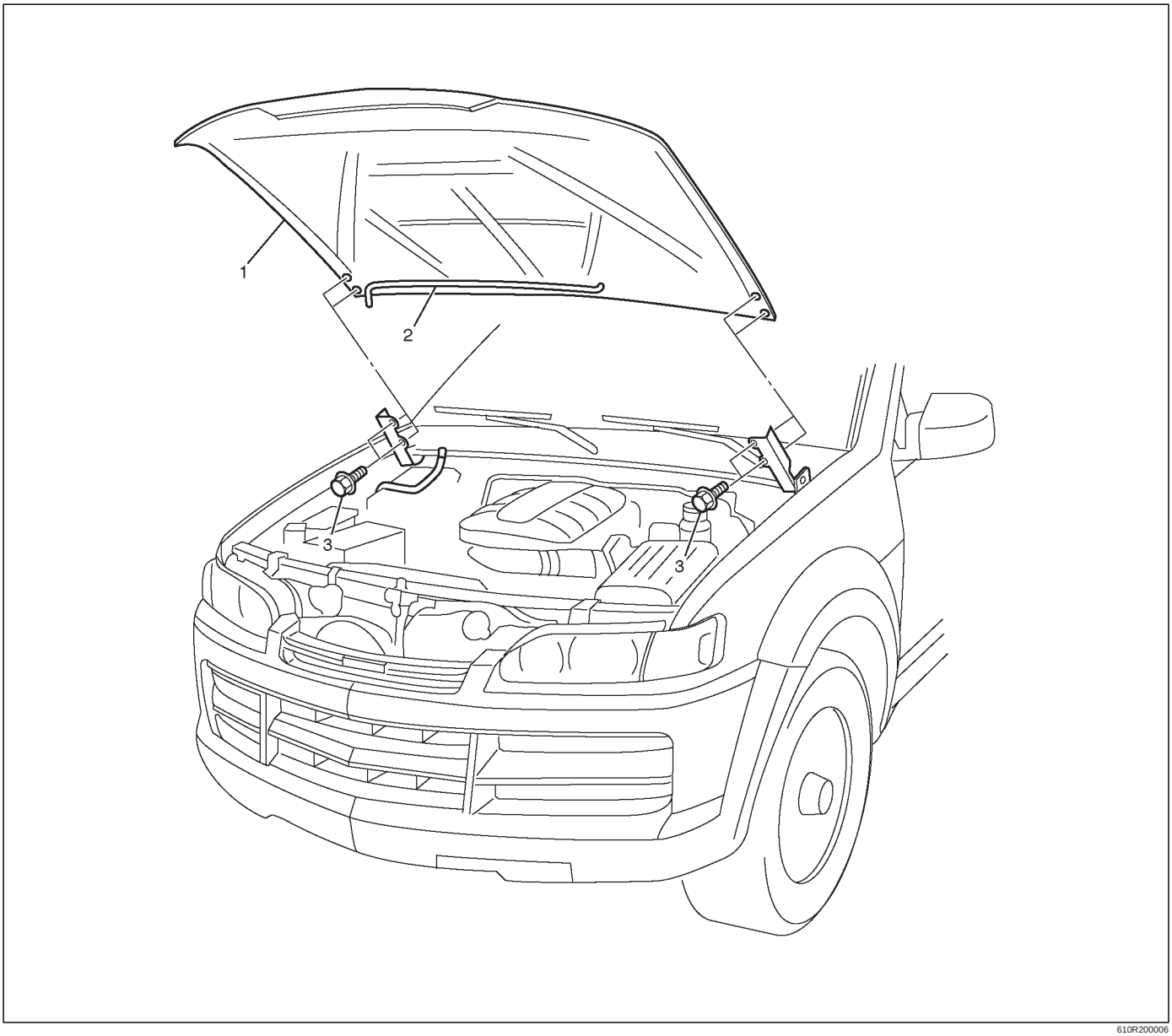
690R200008

General Description (Sheet Metal)

This section includes items of front end sheet metal that are attached by bolts, screws or clips and related accessory components.
Anticorrosion materials have been applied to the interior surfaces of some metal panels to provide rust resistance. When servicing these panels, areas on which this material has been disturbed, should be properly recoated with service–type anticorrosion material.

Engine Hood

Parts Location



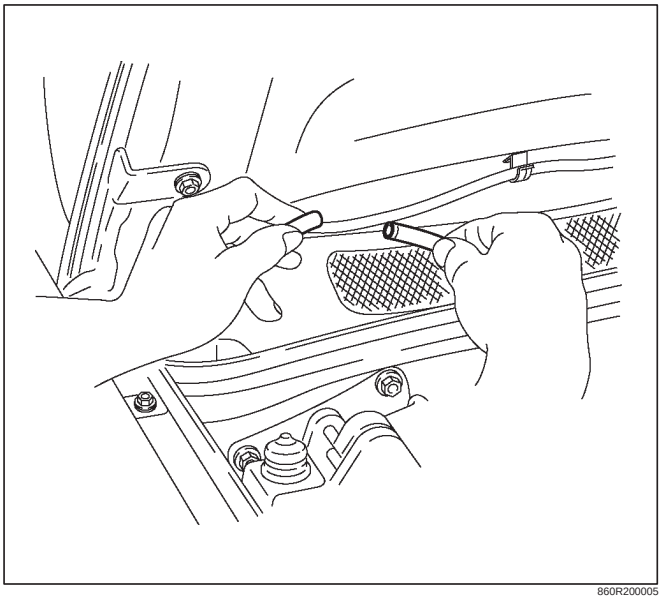
610R200006

Legend

(1) Engine Hood Assembly
(2) Windowshield Washer Nozzle Tube
(3) Hood Hinge Bolt

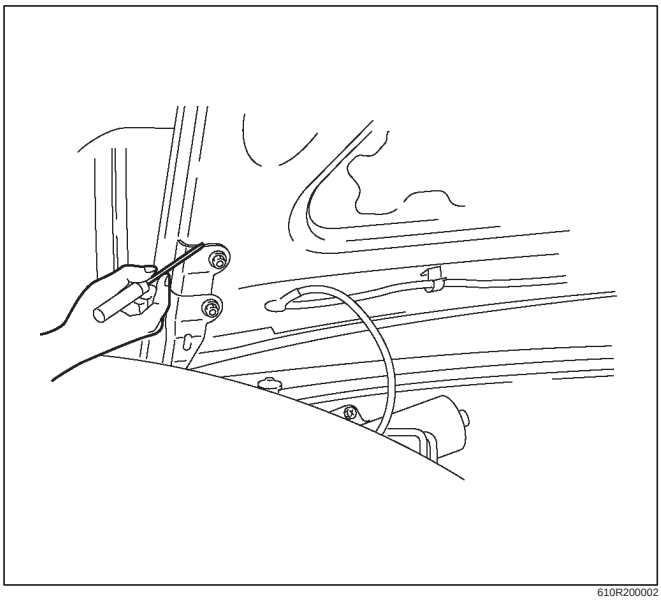
Removal

1. Open the hood.
2. Support the hood.
3. Remove the windshield washer nozzle tube.



860R200005

4. Remove the hood hinge bolts.
   ▼Before removing the hinges from the engine hood, scribe a mark showing location of the hinges to facilitate installation in the original position.



610R200002

5. Remove the engine hood.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the engine hood hinge fixing bolts to the specified torque.

   Torque : 10 N·m (87 lb in)

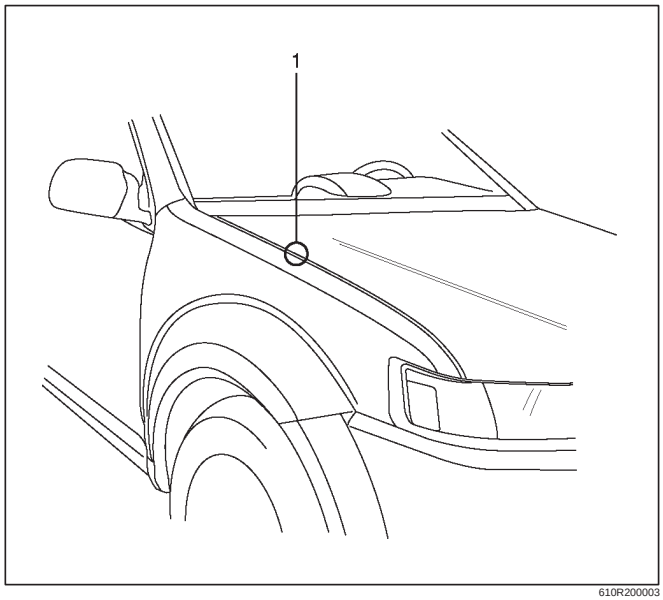
2. Check the engine hood and fender(1).

   Clearance: 4.5 mm (0.18 in)

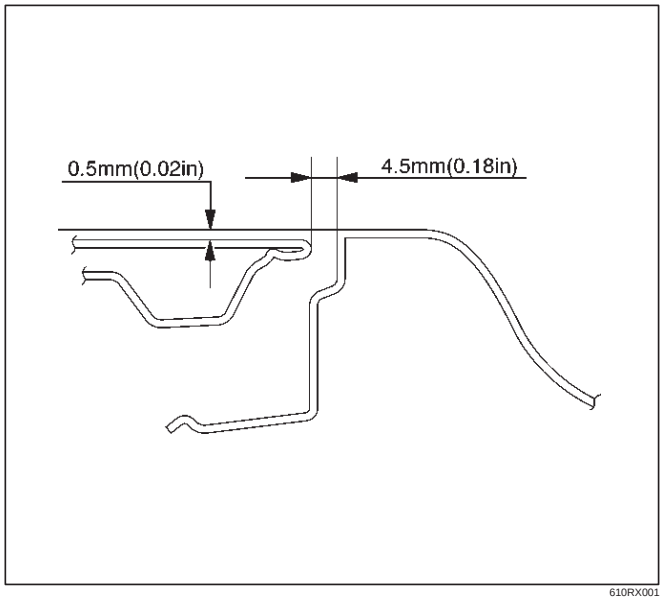
   Height (step): 0.5 mm (0.02 in)

   ▼Adjust clearance with the hinges on the engine hood.

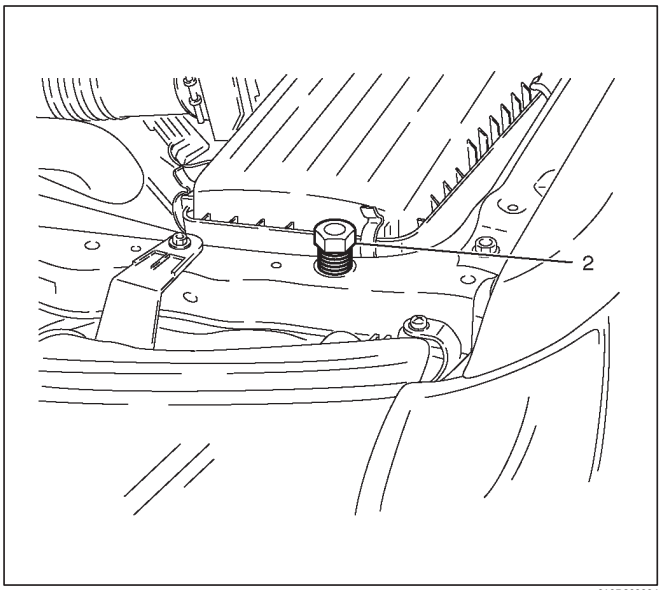
   ▼Adjust height (step) with the hood rests(2).



610R200003



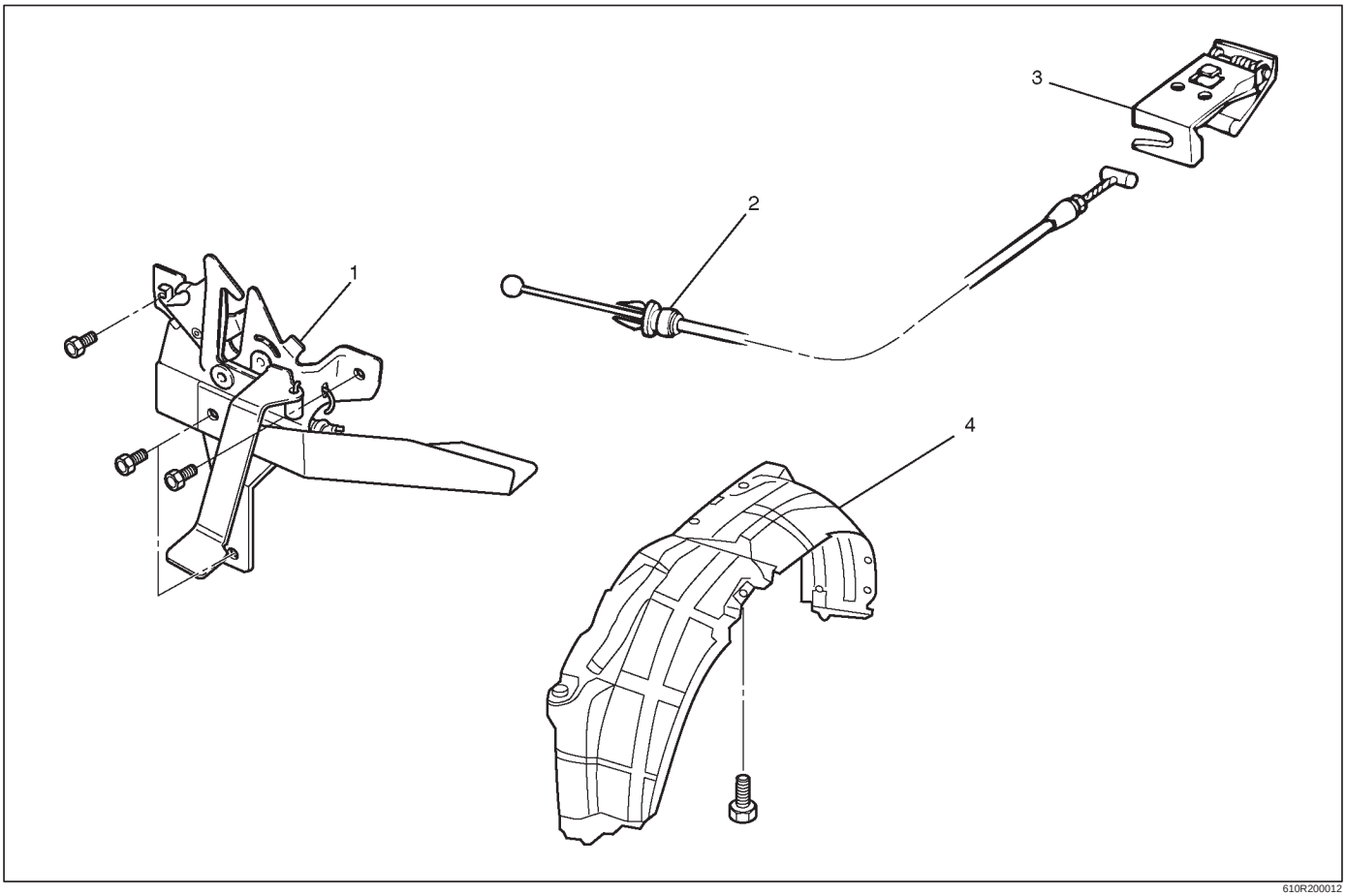
610RX001



610R200004

Engine Hood Lock

Parts Location



610R200012

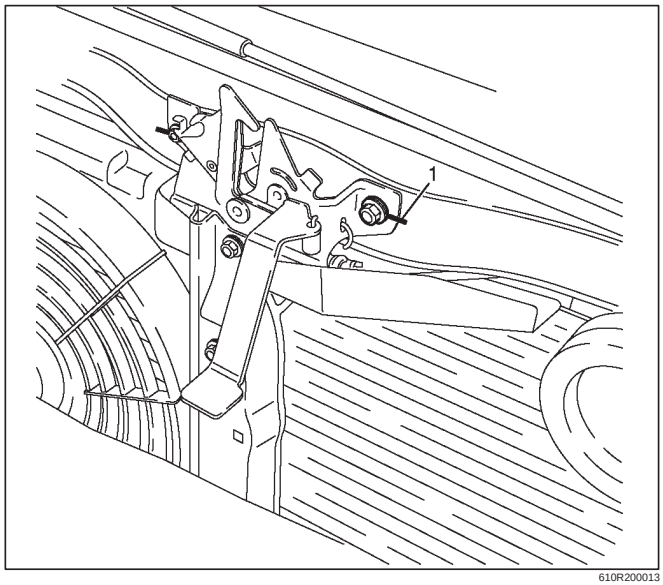
Legend

(1) Engine Hood Lock Assembly
(2) Control Cable
(3) Hood Lock Control Lever
(4) Inner Liner

Removal

1. Remove the hood lock control lever.
2. Remove the inner liner.
3. Remove the engine hood lock assembly.

▼Apply setting marks(1) to the hood lock assembly and the body prior to removal.



610R200013

4. Remove the control cable.

▼Remove the cable fixing clips from the engine hood lock.

Installation

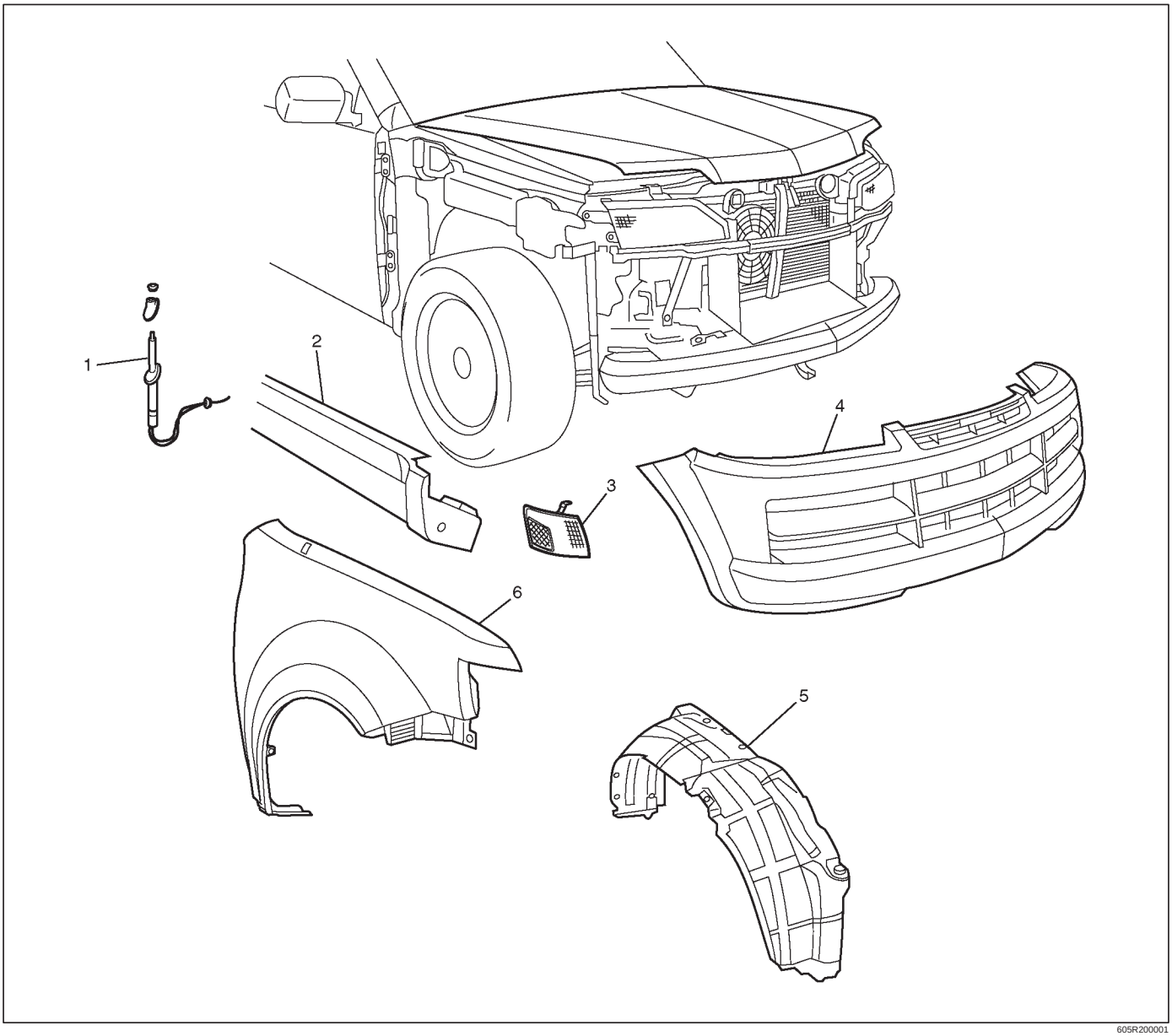
To install, follow the removal steps in the reverse order noting the following points:

1. Reroute the control cable to its original position, and check and see if the lock assembly and control lever work normally.
2. Tighten the hood lock assembly fixing bolts to the specified torque.

Torque : 10 N·m (87 lb in)

Front Fender Panel

Parts Location



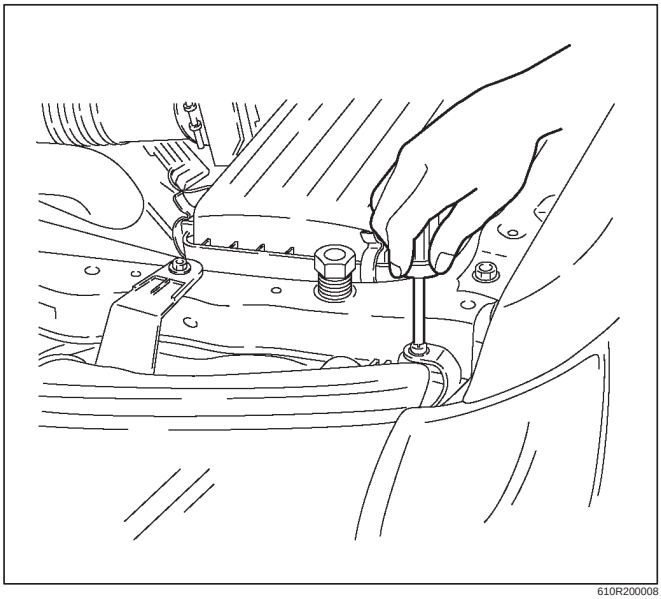
605R200001

Legend

(1) Antenna Assembly
(2) Rocker Cover Assembly
(3) Front Turn Signal Light Assembly
(4) Front Bumper Fascia Assembly
(5) Inner Liner
(6) Front Fender Panel

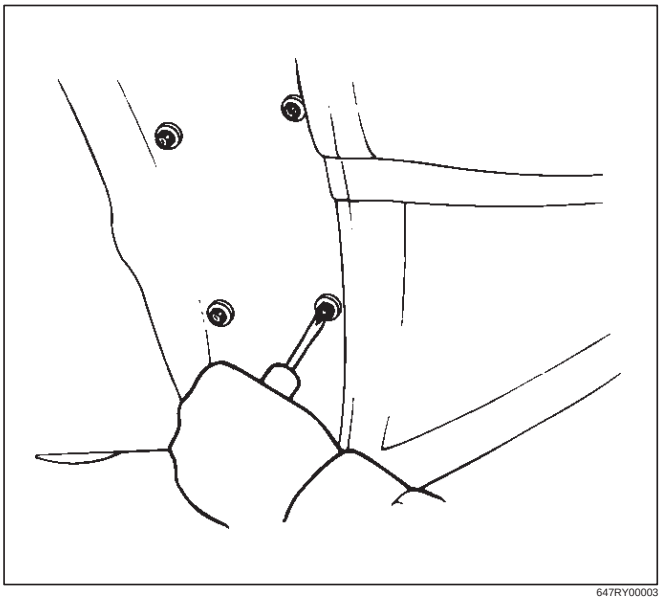
Removal

1. Disconnect the battery ground cable.
2. Remove the front bumper fascia assembly.
   ▼Refer to *Front Bumper in this section.*
3. Remove the front turn signal light assembly.
   ▼Remove the fixing screw and disconnect the connector.



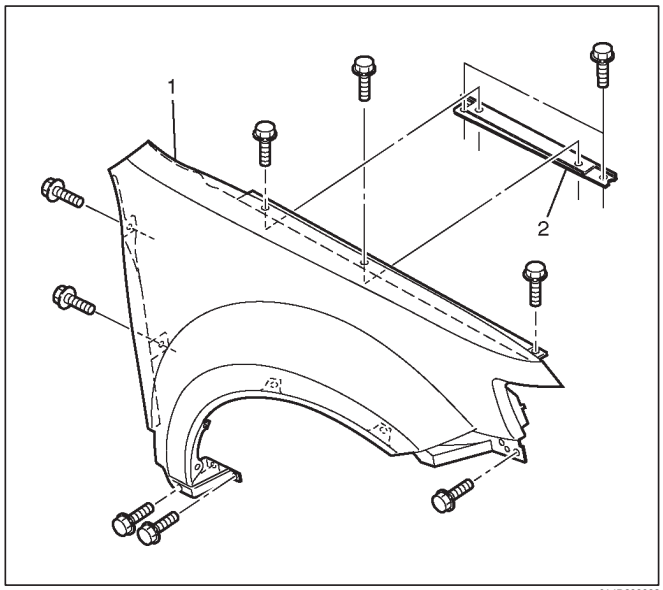
610R200008

4. Remove the rocker cover assembly.
   ▼Refer to *Rocker Cover Assembly in Exterior/Interior Trim section.*
5. Remove the inner liner.



647RY00003

6. Remove the antenna assembly.
   ▼Refer to *Rod Type Antenna in Entertainment section.*
7. Remove the front fender panel (1).
   ▼Remove the eight fixing bolts.
8. Remove the engine compartment upper extension (2).



614R200002

Installation

To install, follow the removal steps in the reverse order, noting the following points:

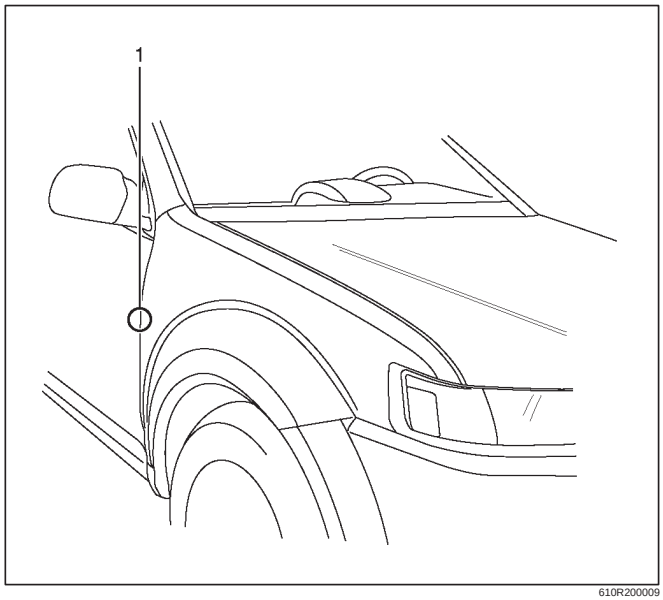
1. Tighten the front fender panel fixing bolts to the specified torque.

   Torque : 7 N·m (61 lb in)

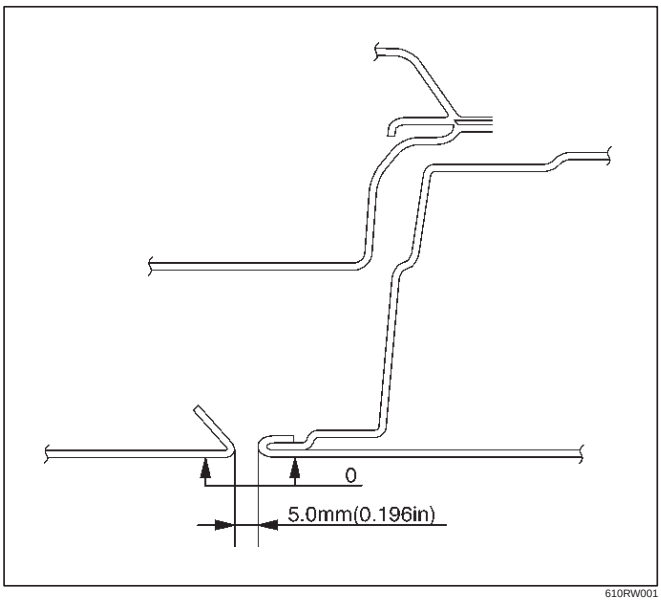
2. Check the fender and front door (1).

   Clearance: 5.0 mm (0.196 in)

   Height (step): Flush



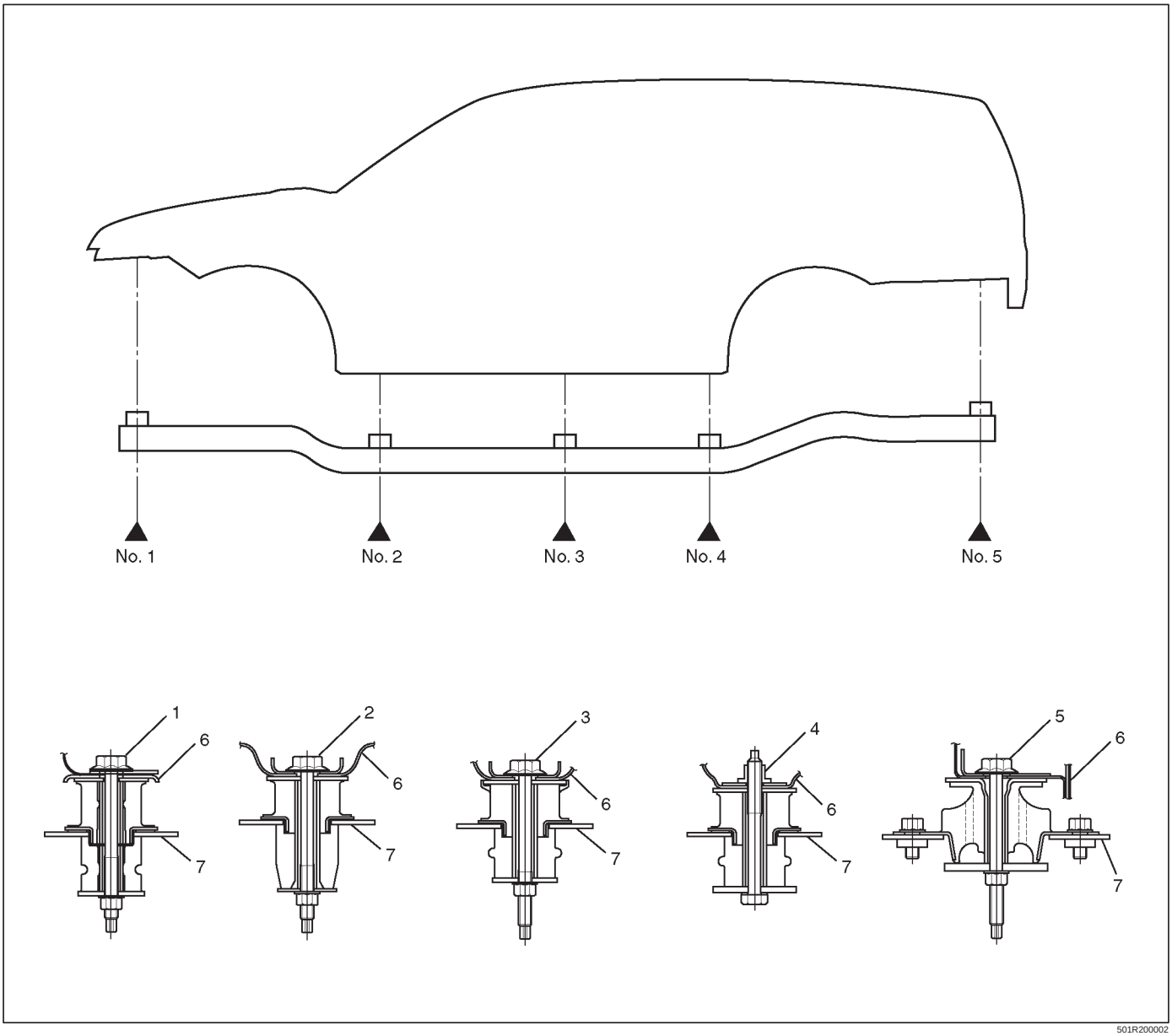
610R200009



610RW001

Body Mounting

Parts Location



501R200002

Legend

(1) No.1 Body Mounting
(2) No.2 Body Mounting
(3) No.3 Body Mounting
(4) No.4 Body Mounting
(5) No.5 Body Mounting
(6) Body Side Mounting Bracket
(7) Frame Side Mounting Bracket

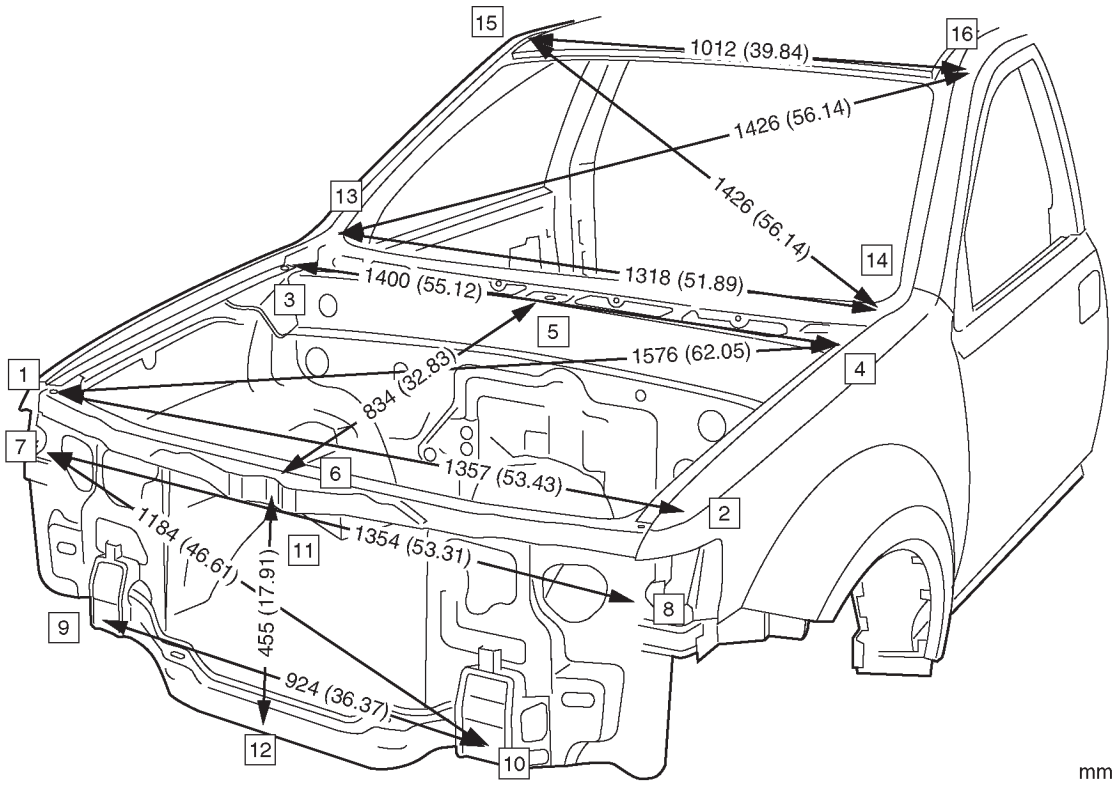
Tightening Torque

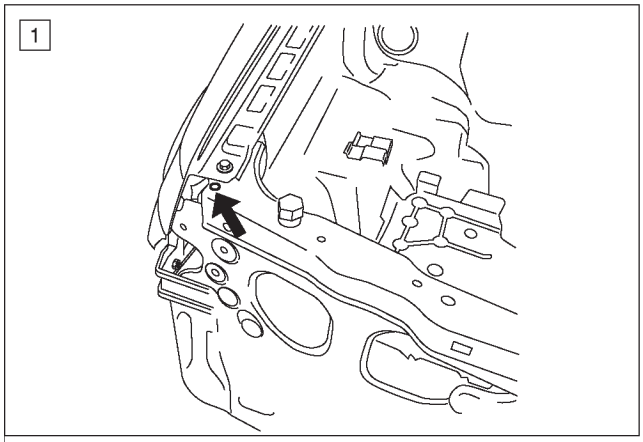
1. Tighten the body mounting bolts to specified torque.

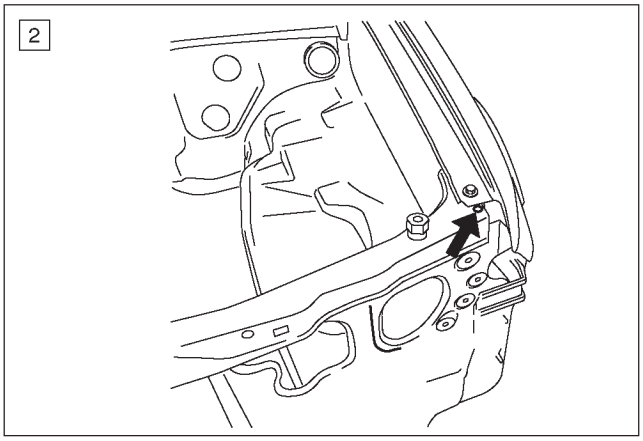
Torque : 50 N·m (41 lb ft)

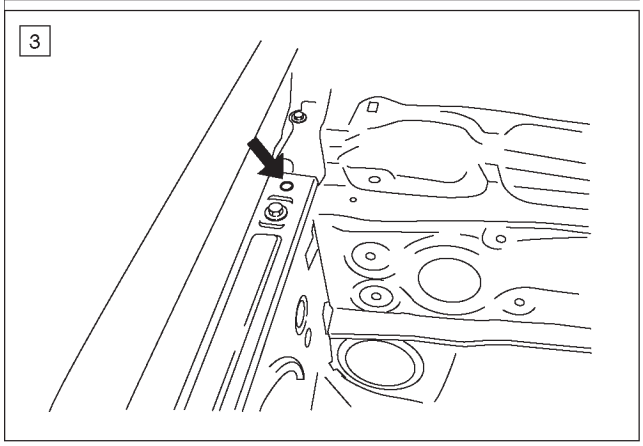
Body Dimension

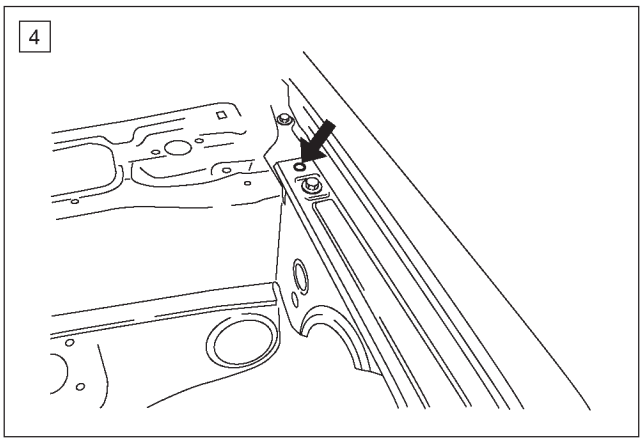
Front Section





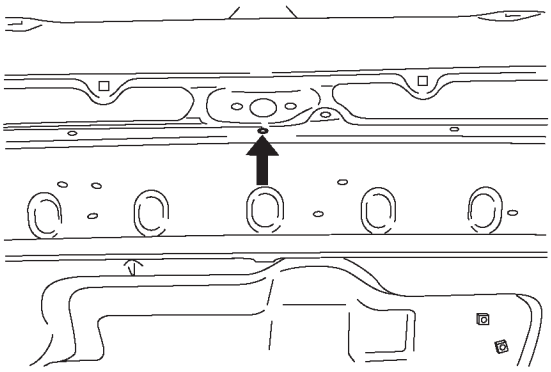




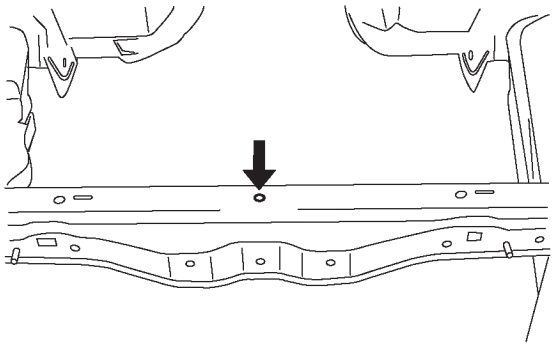


A10R200015

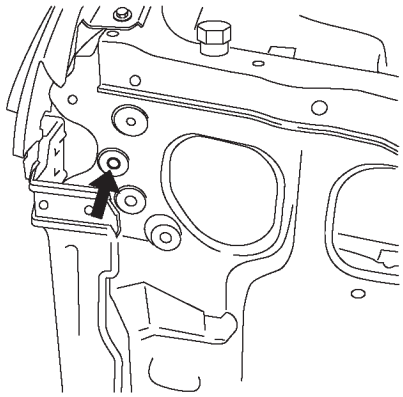
5



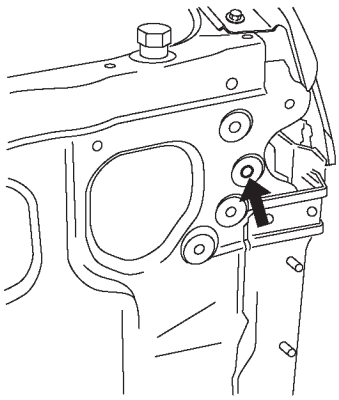
6



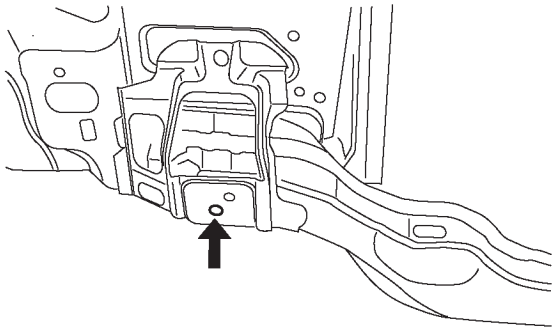
7



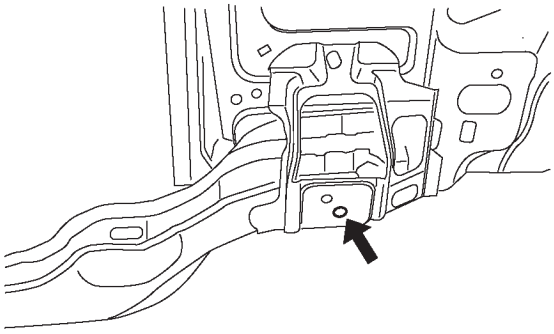
8



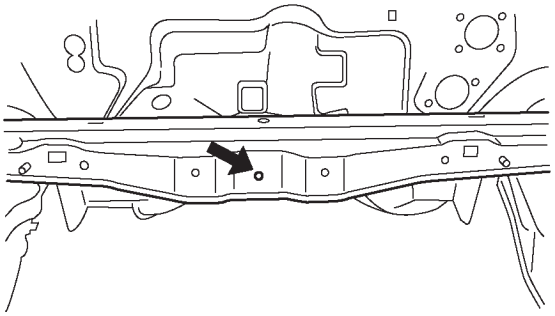
9



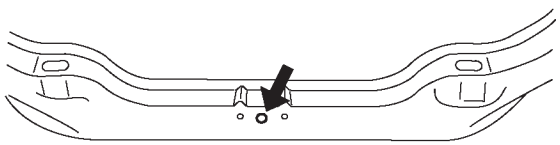
10



11

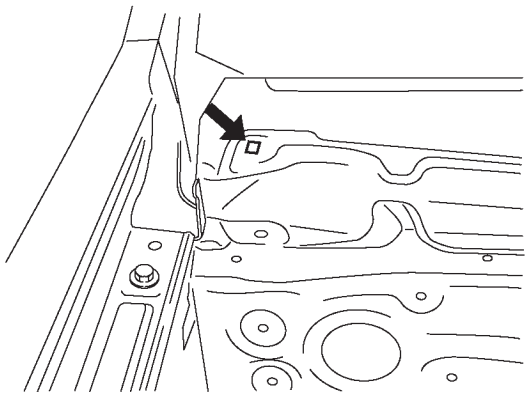


12

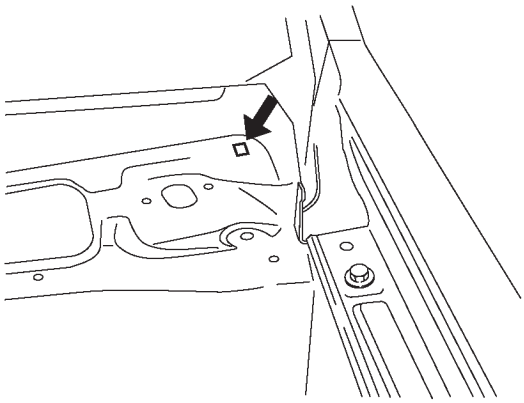


A10R200002

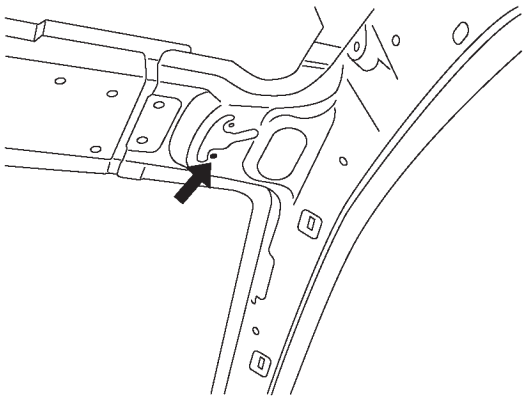
13



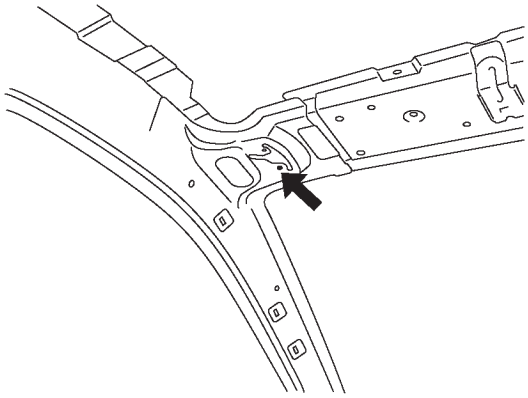
14



15

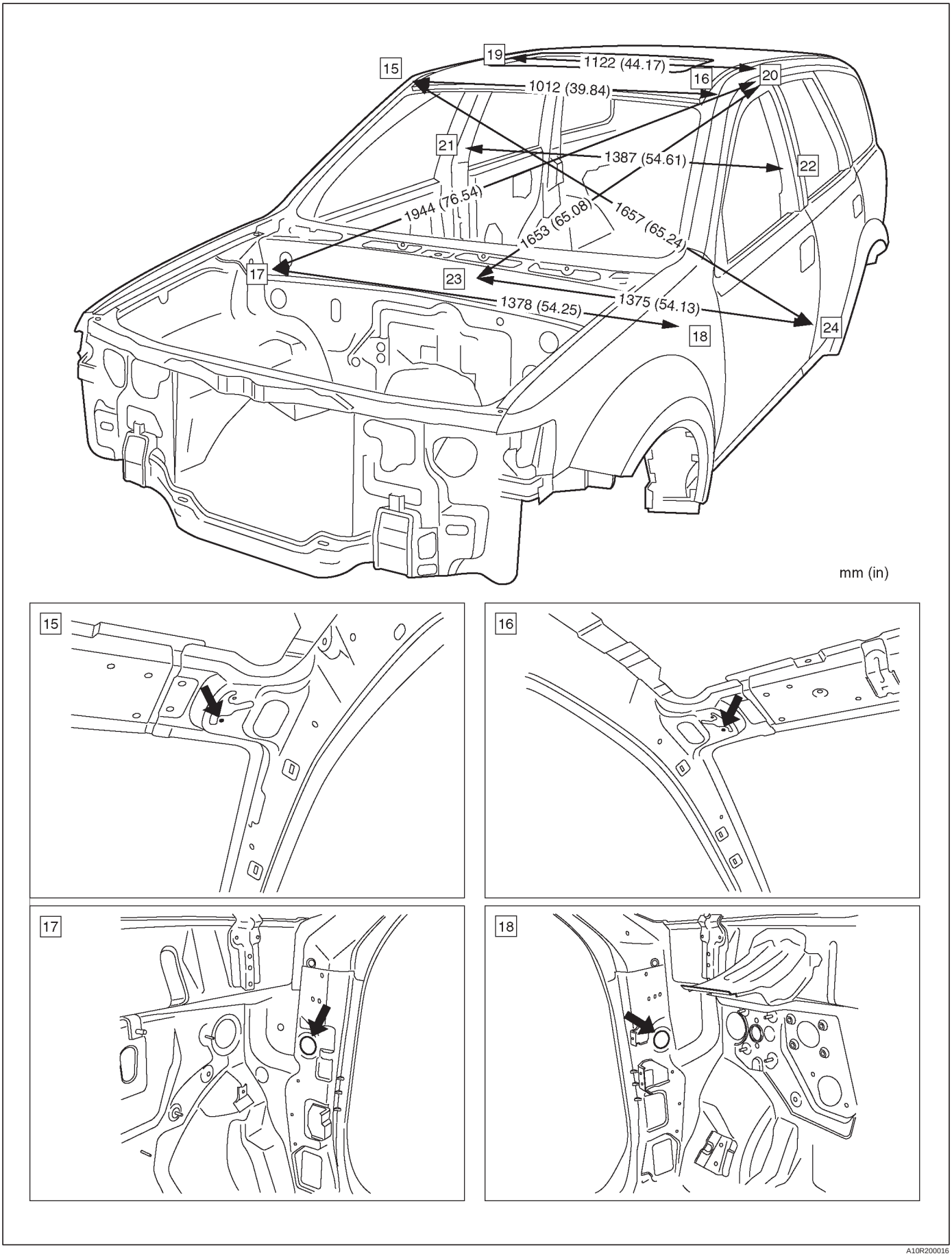


16



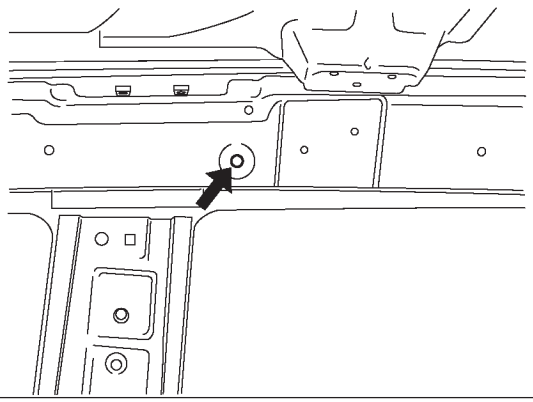
A10R200003

Room Section (Front Side)

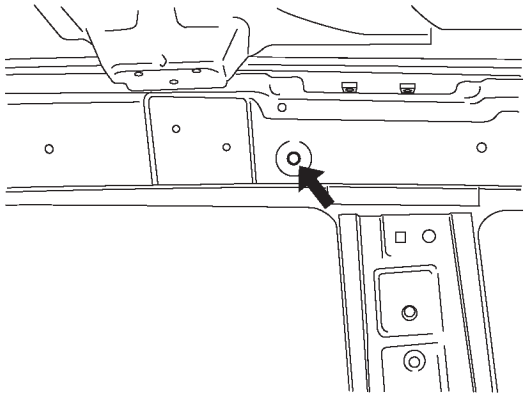


A10R200016

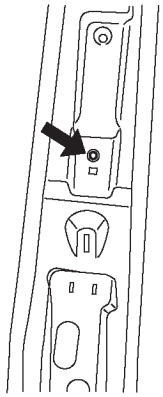
19



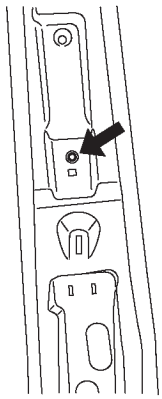
20



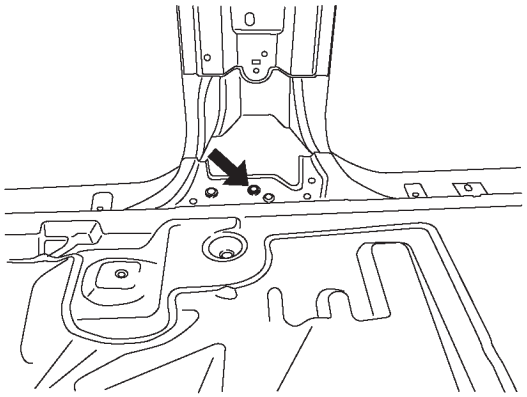
21



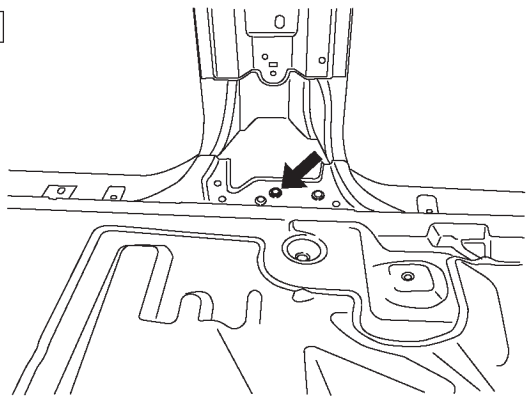
22



23

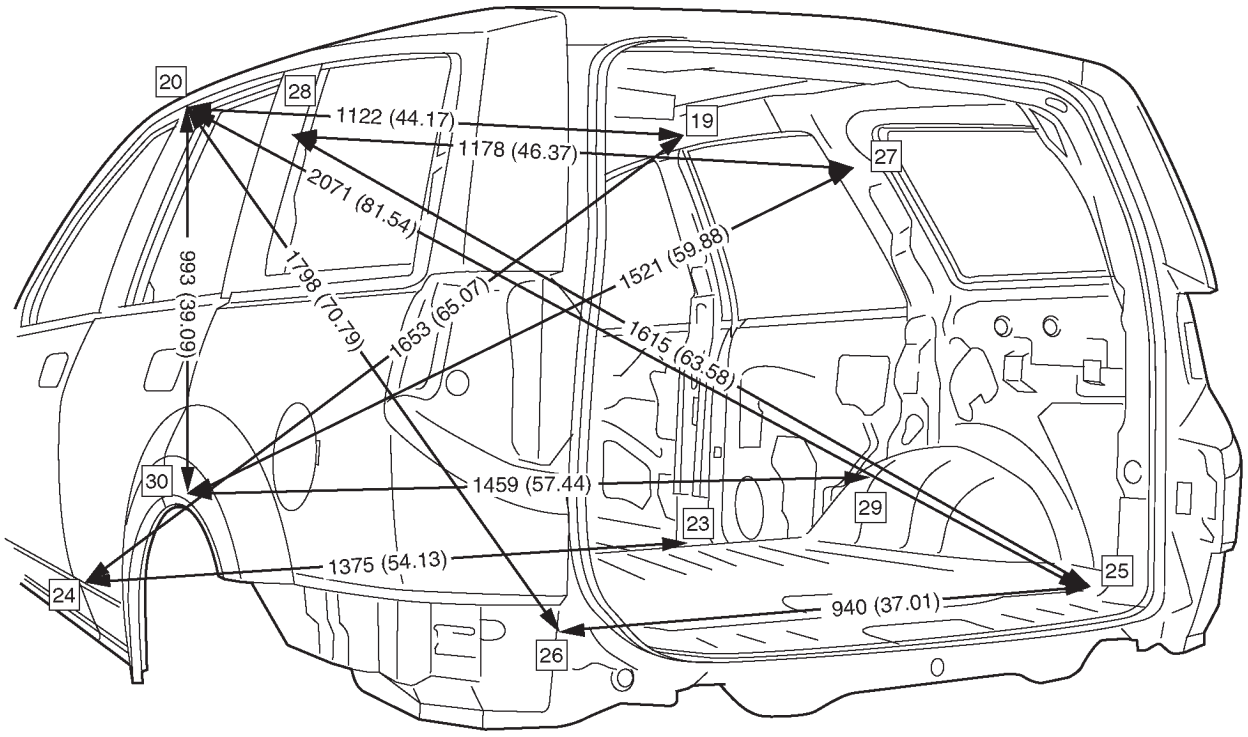


24

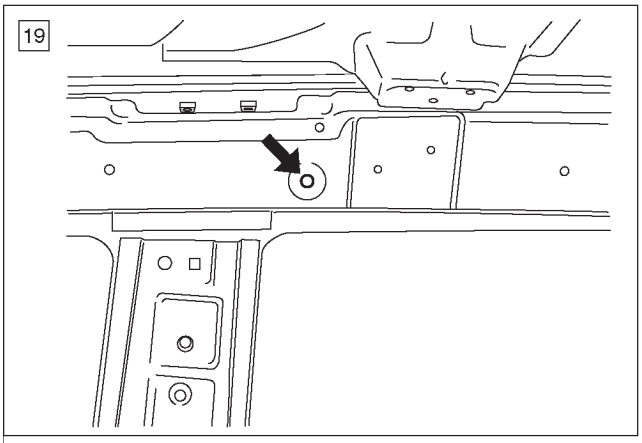


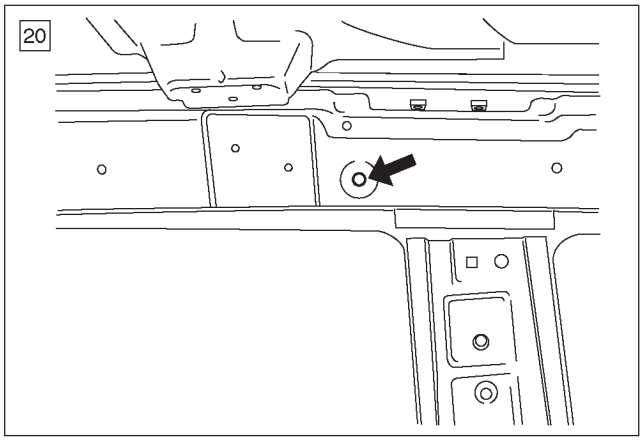
A10R200005

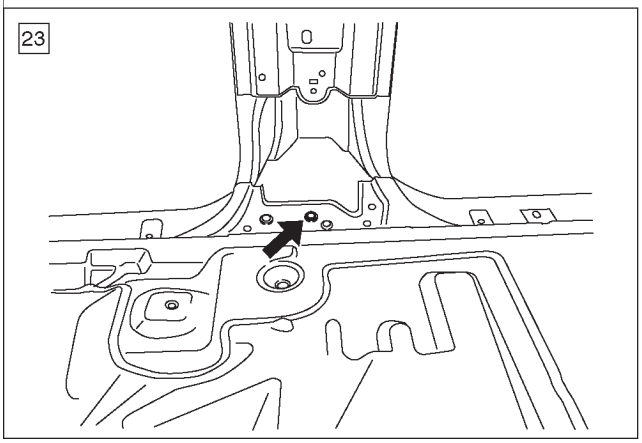
Room Section (Rear Side)

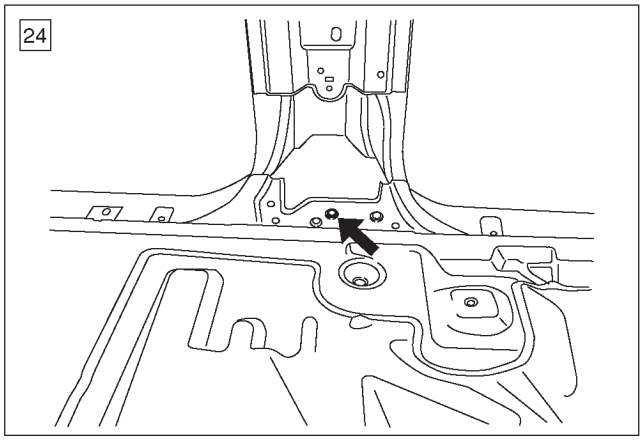


mm (in)



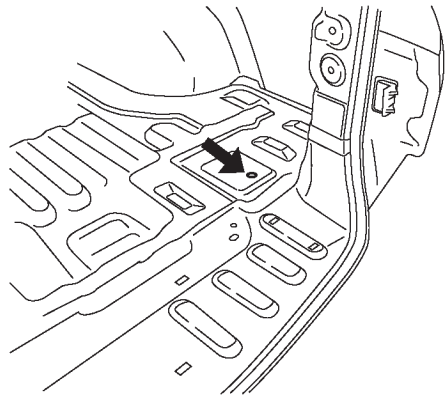




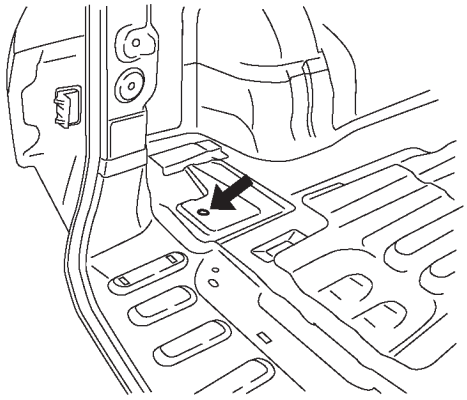


A10R200017

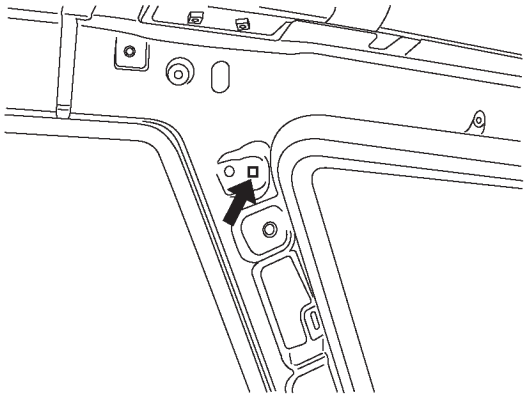
25



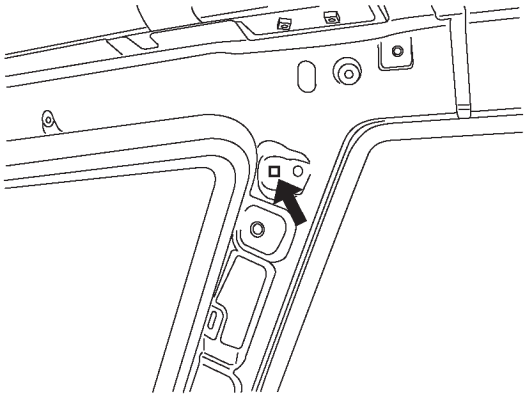
26



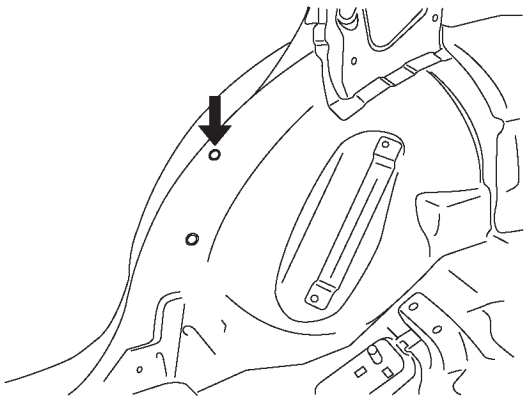
27



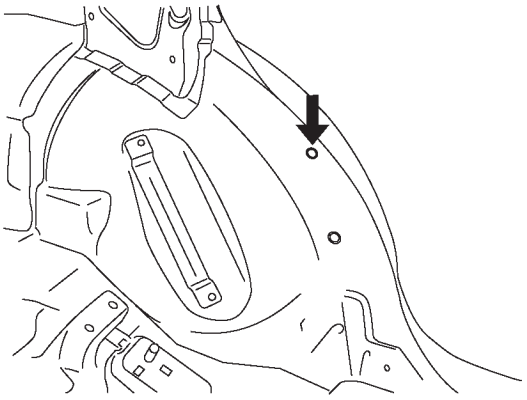
28



29

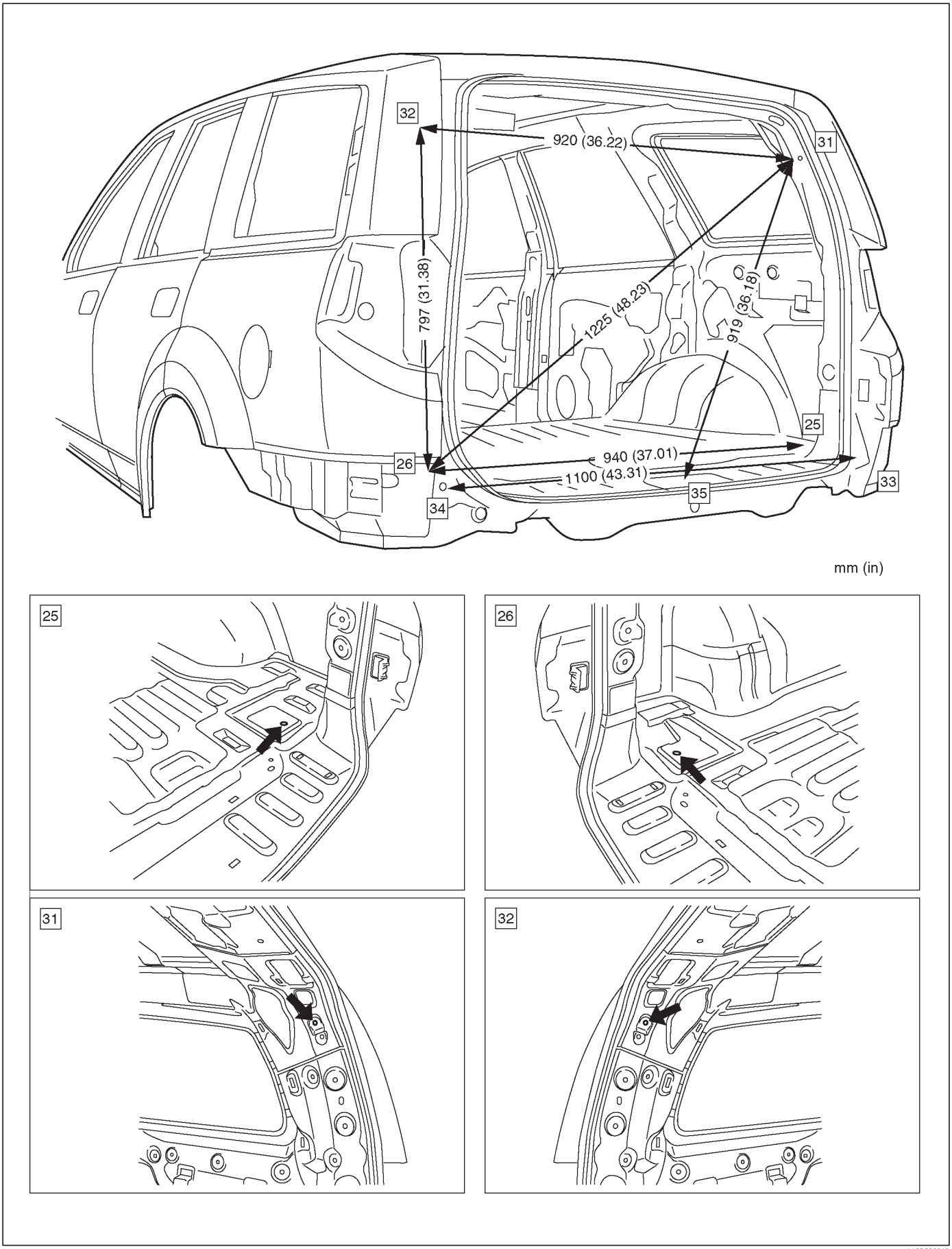


30



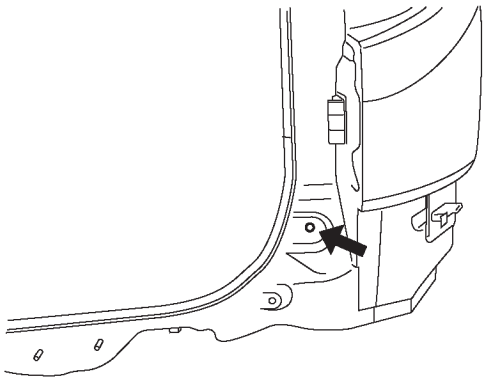
A10R200007

Rear Section

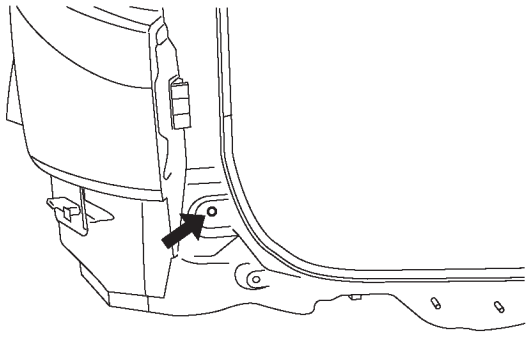


A10R200018

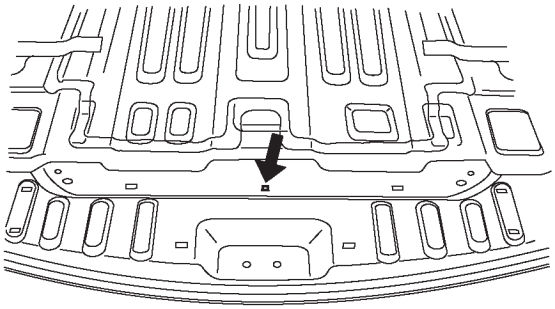
33



34

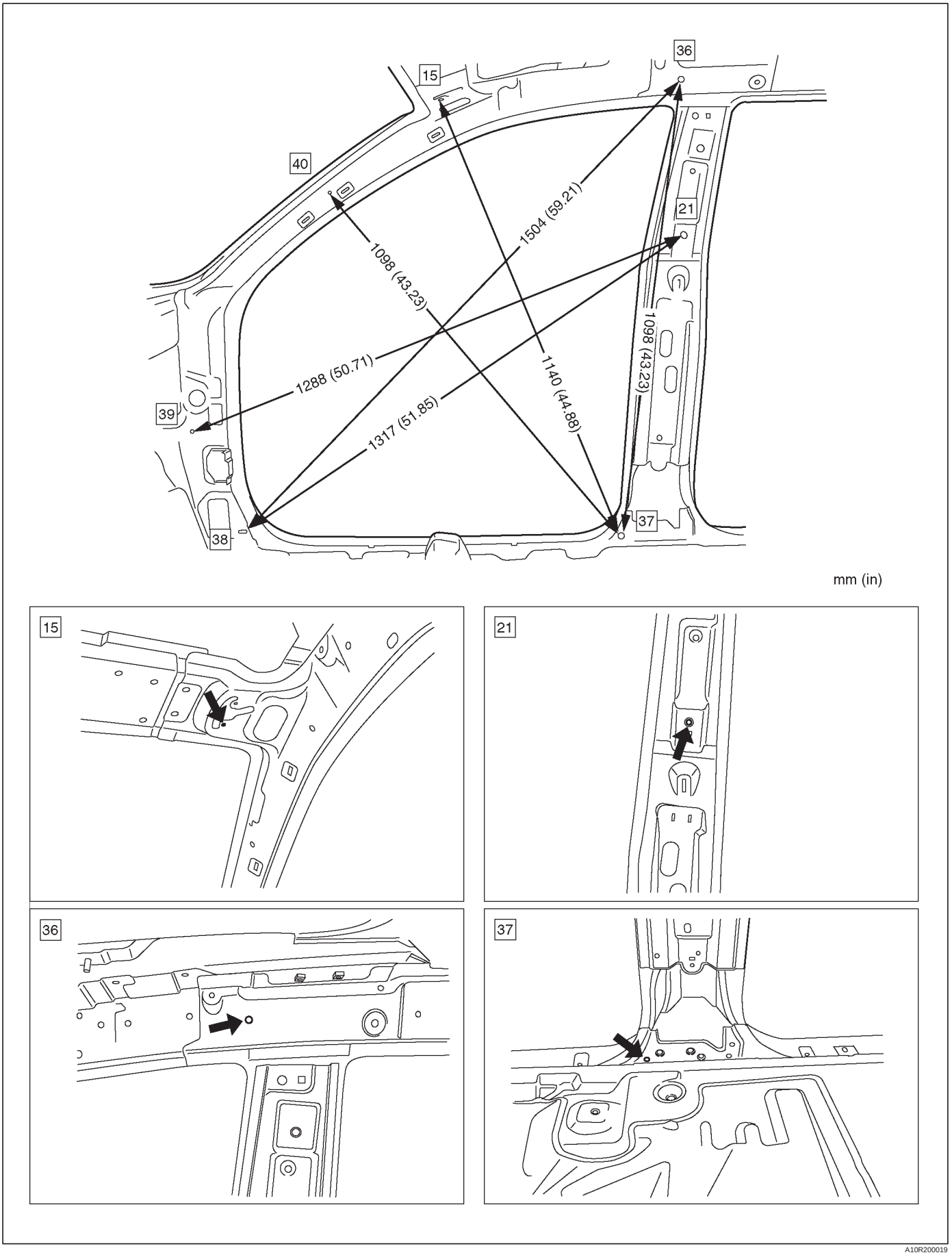


35

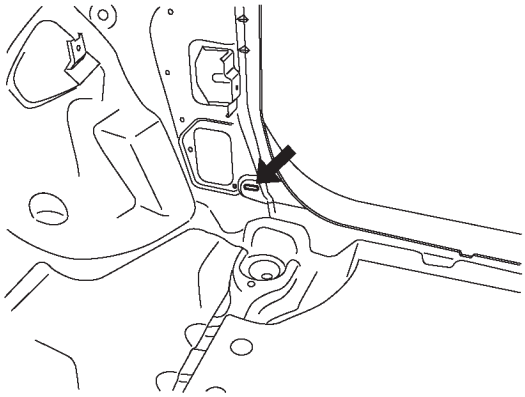


A10R200009

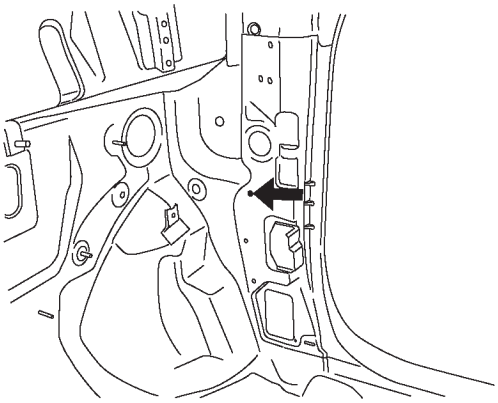
Side Body Section (Front side)



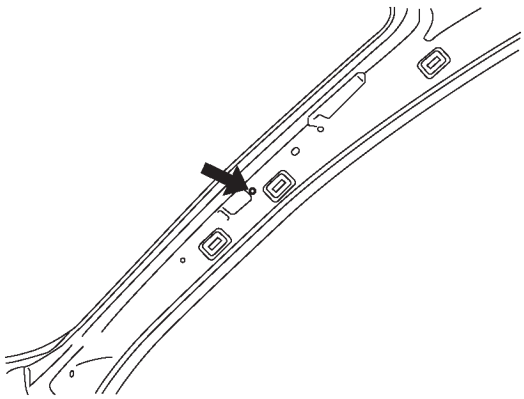
38



39

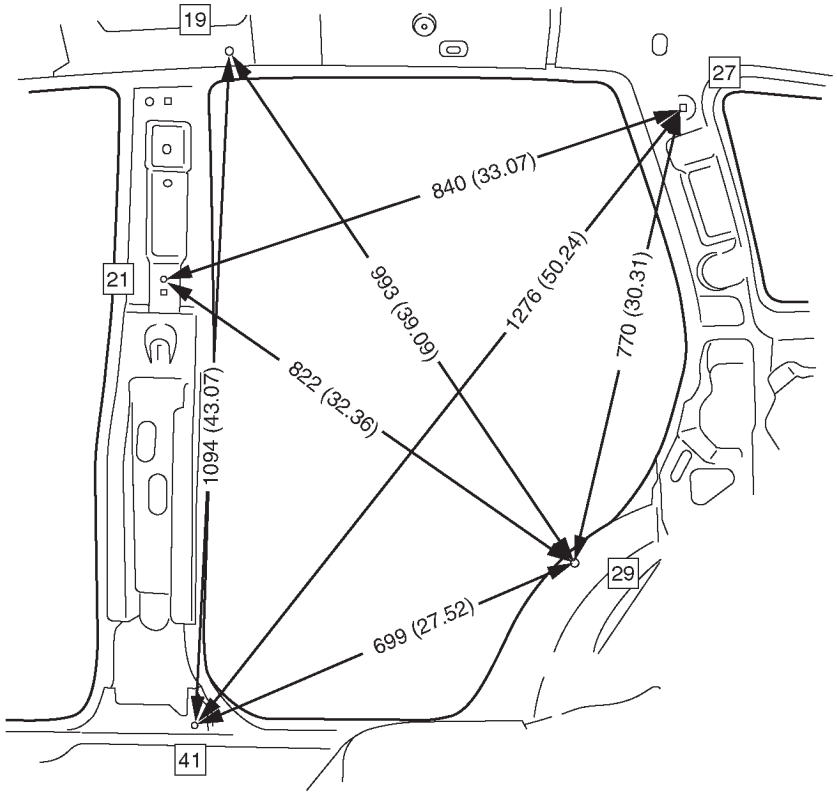


40

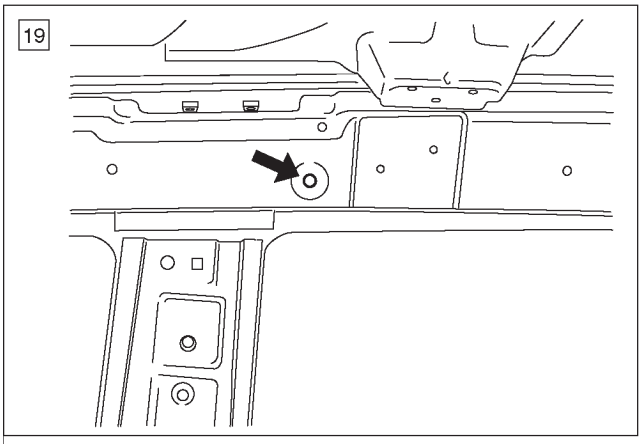


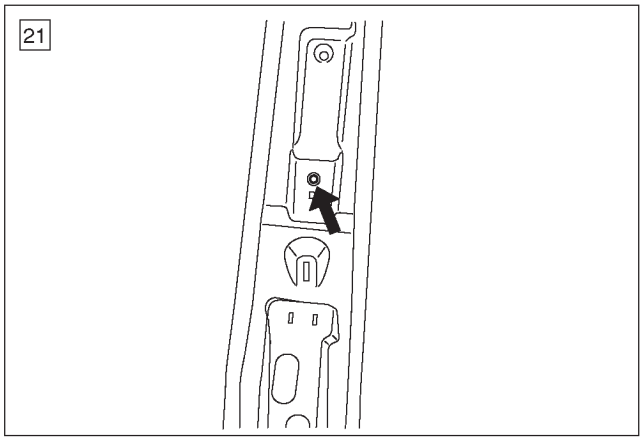
A10R200011

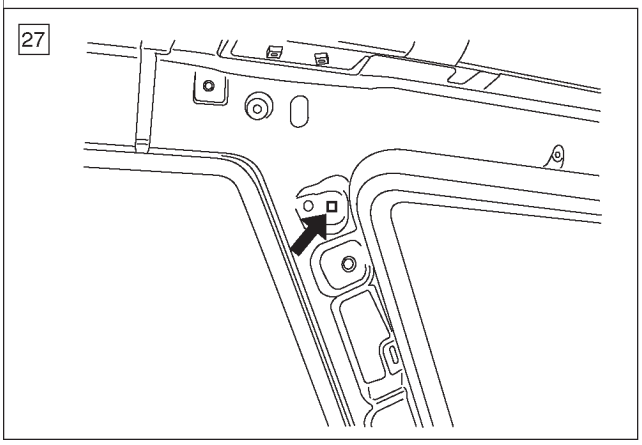
Side Body Section (Rear side)

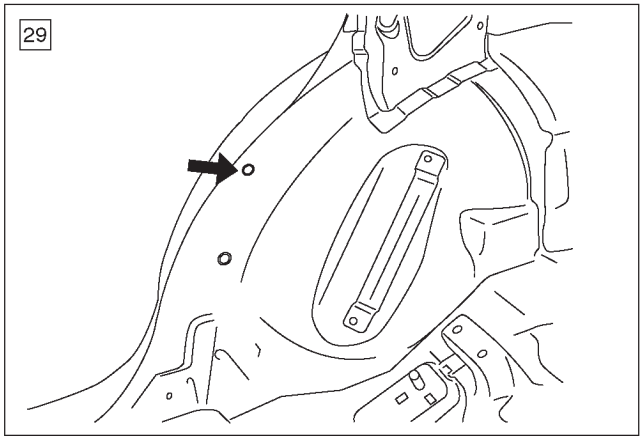


mm (in)



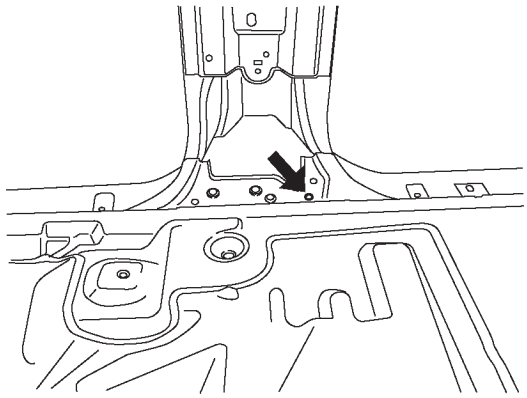






A10R200020

41



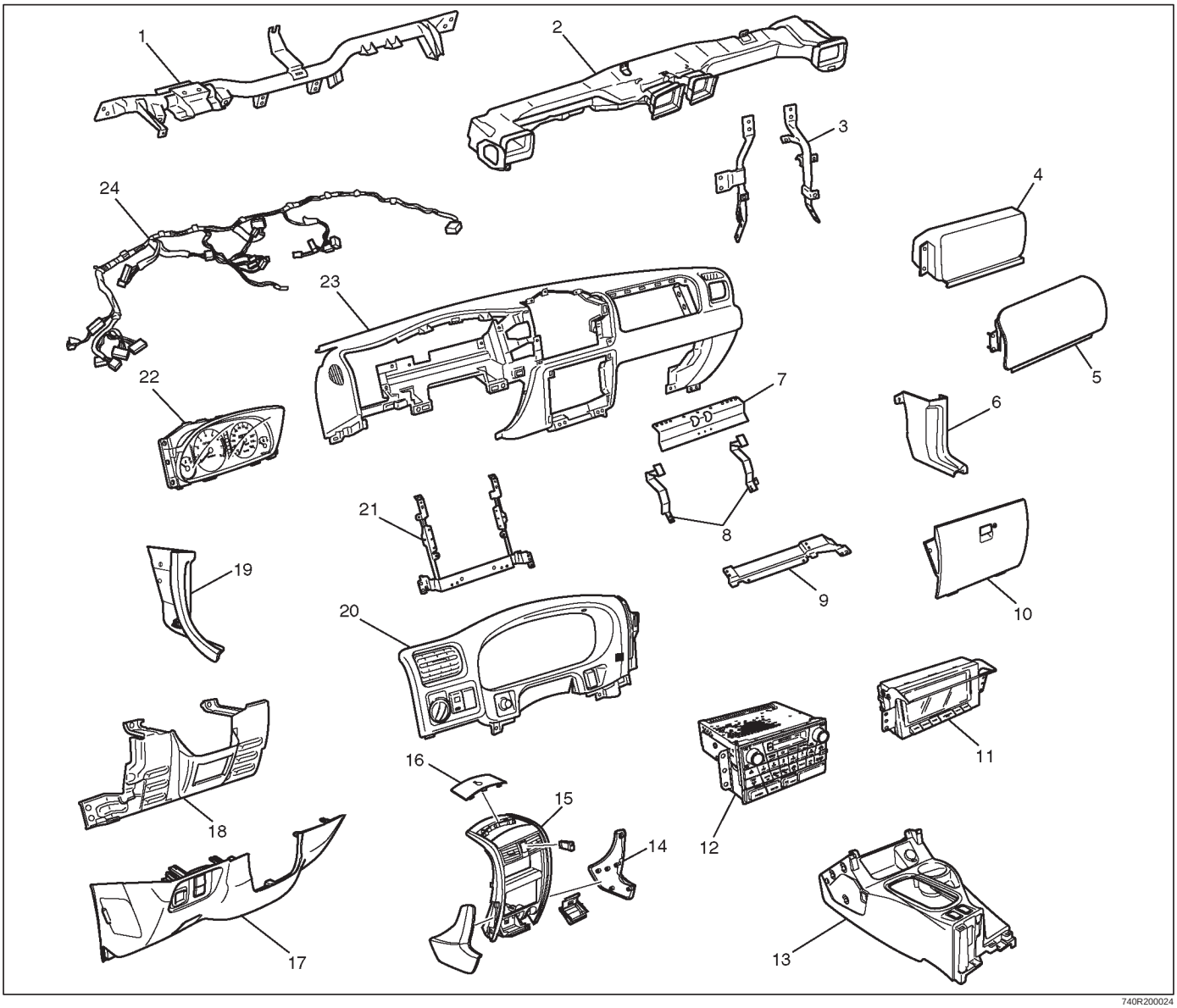
A10R200013

General Description (Body)

This publication contains essential removal, installation, adjustment and maintenance procedures.

Instrument Panel Assembly

Parts Location



740R200024

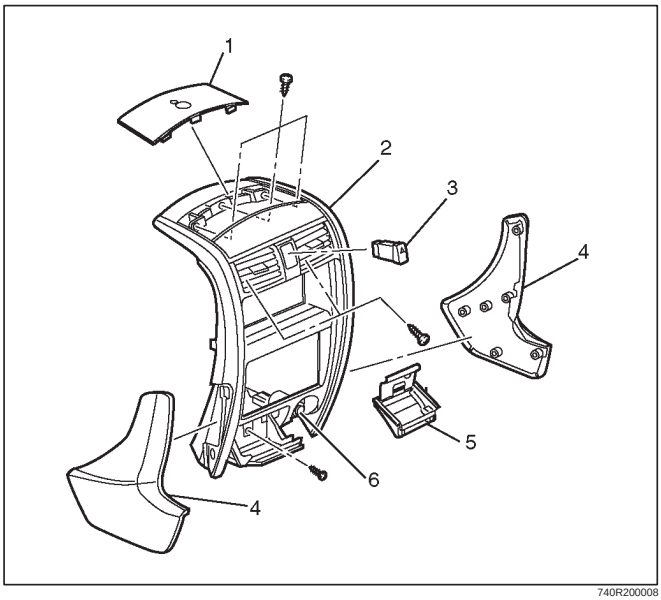
Legend

(1) Cross Beam
(2) Vent Duct Assembly
(3) Instrument Panel Stay
(4) Passenger Air Bag
(5) Passenger Air Bag Cover
(6) Dash Side Trim Panel (RH)
(7) Instrument Upper Reinforcement
(8) Glove Box Side Reinforcement
(9) Passenger Lower Bracket
(10) Glove Box
(11) Display Unit
(12) Audio Kit
(13) Front Console Assembly
(14) Knee Pad
(15) Center Cluster Assembly
(16) Cluster Upper Cover
(17) Instrument Panel Driver Lower Cover Assembly
(18) Driver Knee Bolster Assembly
(19) Dash Side Trim Panel (LH)
(20) Meter Cluster Assembly
(21) Instrument Panel Center Reinforcement
(22) Meter Assembly
(23) Instrument Panel Assembly
(24) Instrument Harness Assembly

Removal

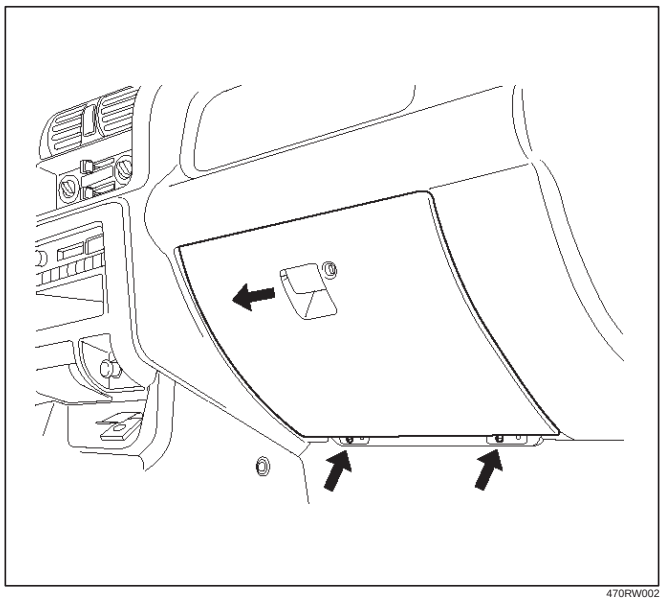
CAUTION: For precautions on installation or removal of SRS – air bag system, refer to *Supplemental Restraint System (SRS) – AIR BAG in Restraint section.*

1. Disconnect the battery ground cable.
2. Pry the knee pads (4).
3. Remove the cluster upper cover (1) and connectors.
4. Remove the center cluster assembly (2).
   ▼Remove six screws and pull out the cluster at the six clip positions.
   ▼Disconnect the cigarette lighter (6), ash tray (5) illumination and hazard switch (3) connectors.

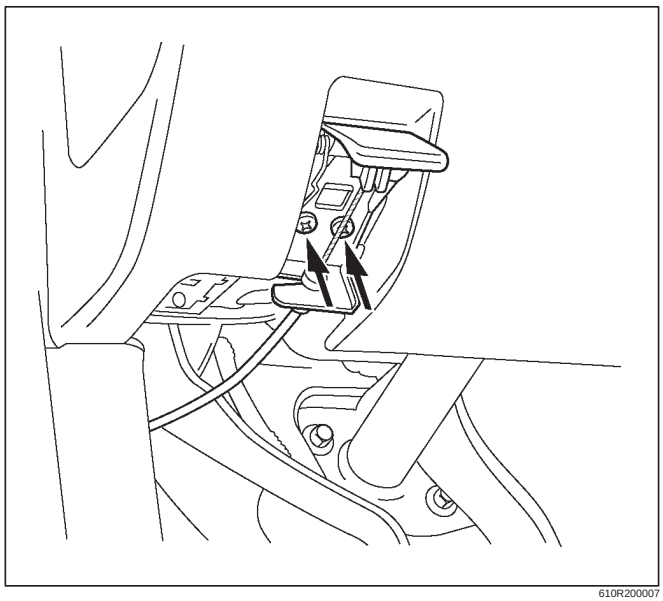


740R200008

5. Remove the display unit.
   ▼Remove the four fixing screws and connectors.
6. Remove the audio kit.
   ▼Remove the four fixing screws and connectors.
7. Remove the front and rear consoles.
   ▼Refer to *Consoles in Exterior/Interior Trim section.*
8. Remove the dash side trim panels.
   ▼Remove the sill plates, then remove the trim panels.
9. Remove the glove box.
   ▼Remove the two fixing screws.


470RW002

10. Remove the instrument panel driver lower cover assembly.
    ▼Remove the engine hood opener two fixing screws and another one fixing screw.
    After four clips are pried, disconnect switch connector and duct.


610R200007

11. Remove the meter cluster assembly.
    ▼Remove the six fixing screws and switch connectors.
12. Remove the meter assembly.
    ▼Remove the four fixing screws and disconnect the connectors.
13. Remove the driver knee bolster assembly.
    ▼Remove the six fixing bolts and screw.
14. Remove the instrument panel assembly.

CAUTION: For precautions on installation or removal of SRS – air bag system, refer to *Supplemental Restraint System (SRS) – AIR BAG in Restraint section.*

▼Disconnect the instrument harness connectors (six connectors on the driver's side, three connectors on the passenger side and two connectors on the center side).

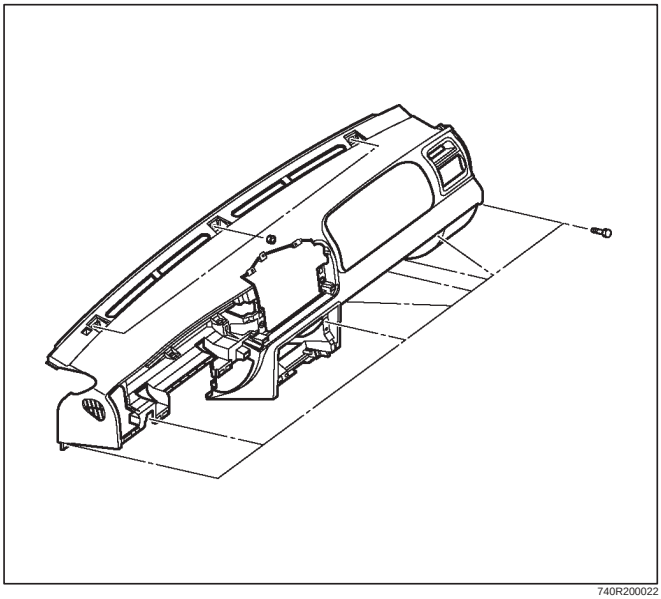
▼Disconnect radio antenna cable plug and the ground cable fixing bolts from dash side panel.

▼Remove the two fixing bolts of passenger air bag assembly and disconnect the connector.

▼Remove the two fixing screws from fuse box.

▼After pry the three hole cover from the surface of instrument panel, remove the three nuts.

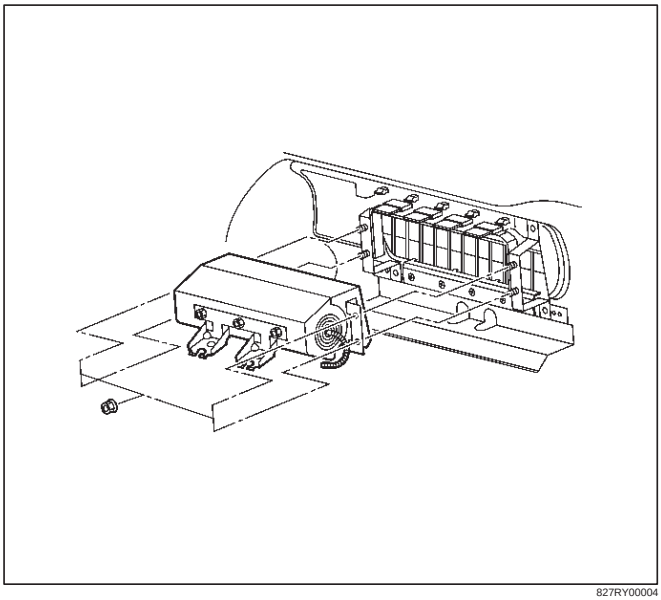
▼Remove the six bolts and one screw.



740R200022

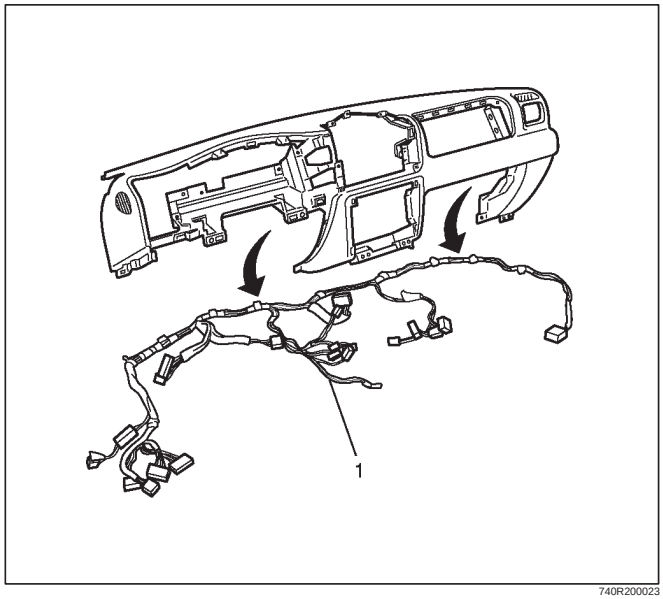
15. Remove the passenger air bag (1).
    ▼Remove the four fixing nuts.

CAUTION: For precautions on installation or removal of SRS – air bag system, refer to *Supplemental Restraint System in Restraint section.*



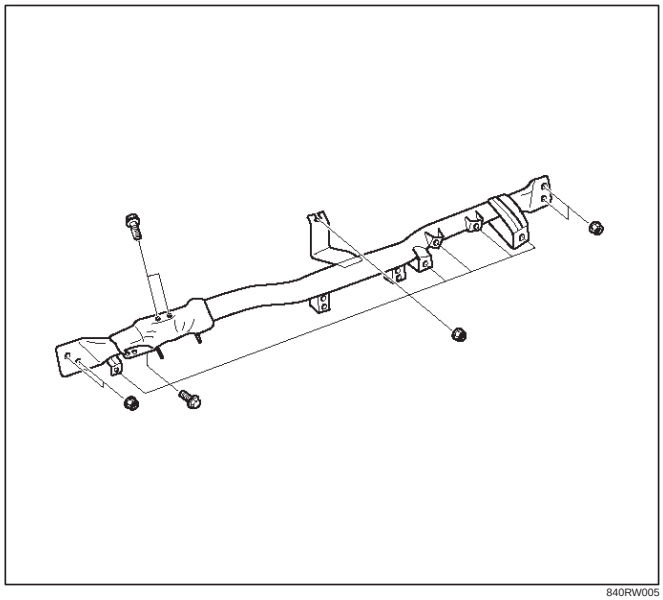
827RY00004

16. Remove the vent duct assembly.
    ▼Remove the five fixing screws.
17. Remove the passenger lower bracket.
    ▼Remove the three screws.
18. Remove the glove box side reinforcement.
19. Remove the instrument upper reinforcement.
    ▼Remove the nine screws.
20. Remove the instrument panel center reinforcement.
    ▼Remove the six screws.
21. Remove the instrument panel harness assembly (1).
    ▼Remove the clips.



740R200023

22. Remove the instrument panel stays.
    ▼Remove the two fixing nuts and two fixing bolts for each bracket.
23. Remove the cross beam.
    ▼Remove the five fixing nuts, two fixing bolts (upper) and six fixing bolts (lower).



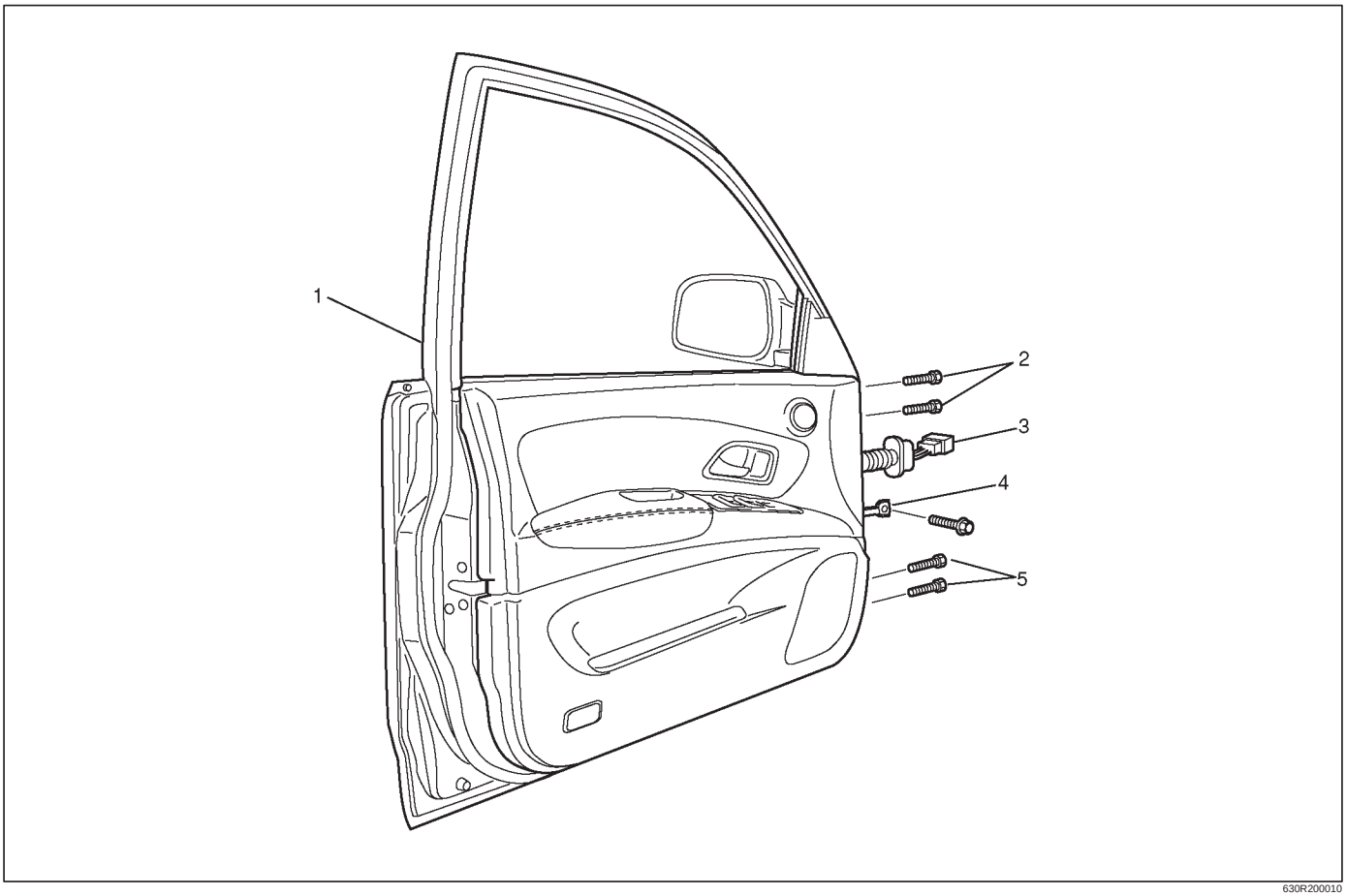
840RW005

Installation

To install, follow the removal steps in the reverse order.

Front Door Assembly

Parts Location



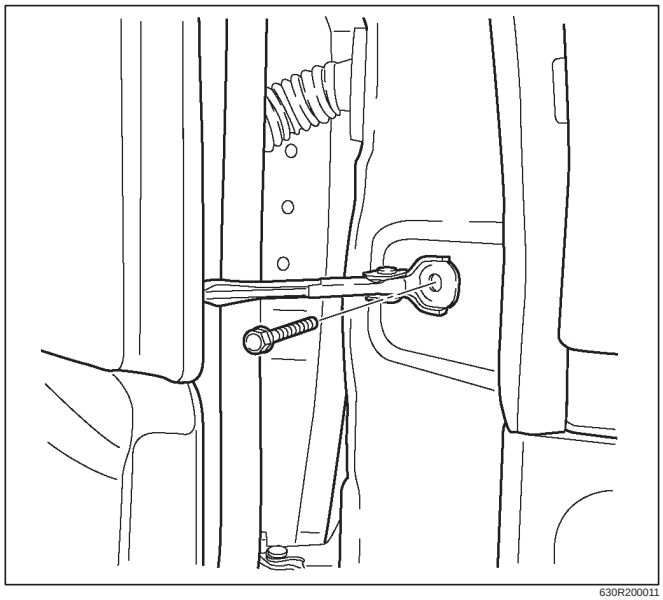
630R200010

Legend

(1) Front Door Assembly
(2) Upper Hinge Bolt
(3) Door Harness Connector
(4) Door Check Arm
(5) Lower Hinge Bolt

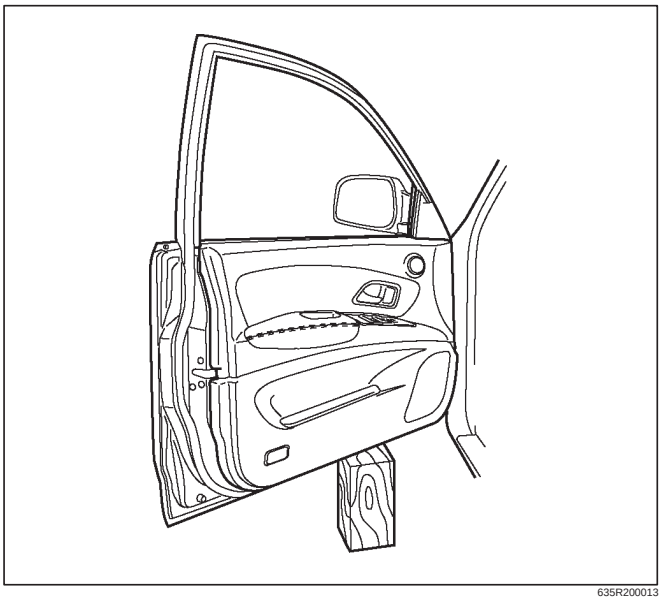
Removal

1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove the door check arm bolt.

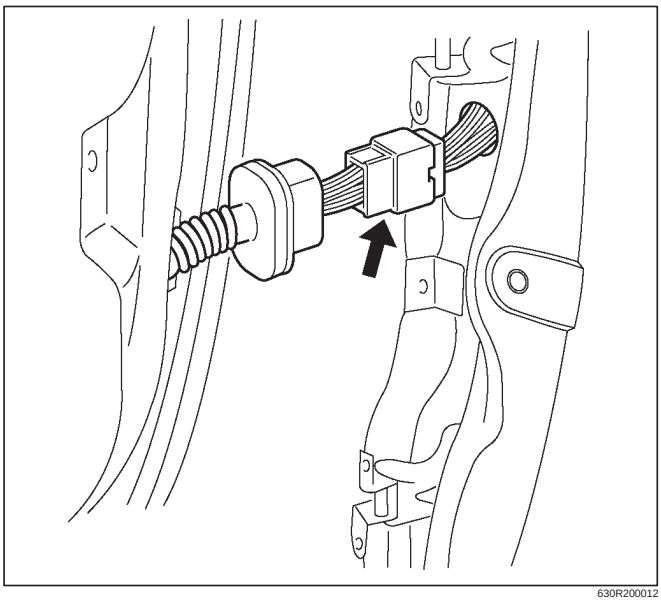


630R200011

4. Remove the upper and lower hinge bolts.
   ▼Position a wood block under the door for protection and support the door assembly with hands during removal or installation.


635R200013

5. Remove the door harness connector.
   ▼Pull the door harness grommet out in order to disconnect the harness connector.

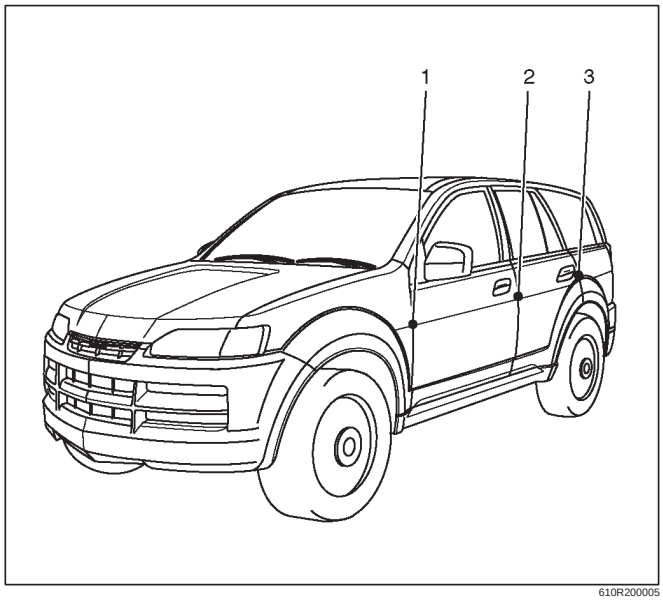

630R200012

6. Remove the front door assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Align the door fitting to the body.
   ▼Check the fender and front door (1).
   Clearance: 5.0 mm (0.196 in)
   Height (step): Flush
   ▼Check the front door and rear door (2).
   Clearance: 5.0 mm (0.196 in)
   Height (step): Flush
   ▼Check the rear door and body (3).
   Clearance: 5.0 mm (0.196 in)
   Height (step): Flush
   Adjust clearance with door hinges.
   Adjust height (step) by tapping on the fender lightly with a rubber hammer.

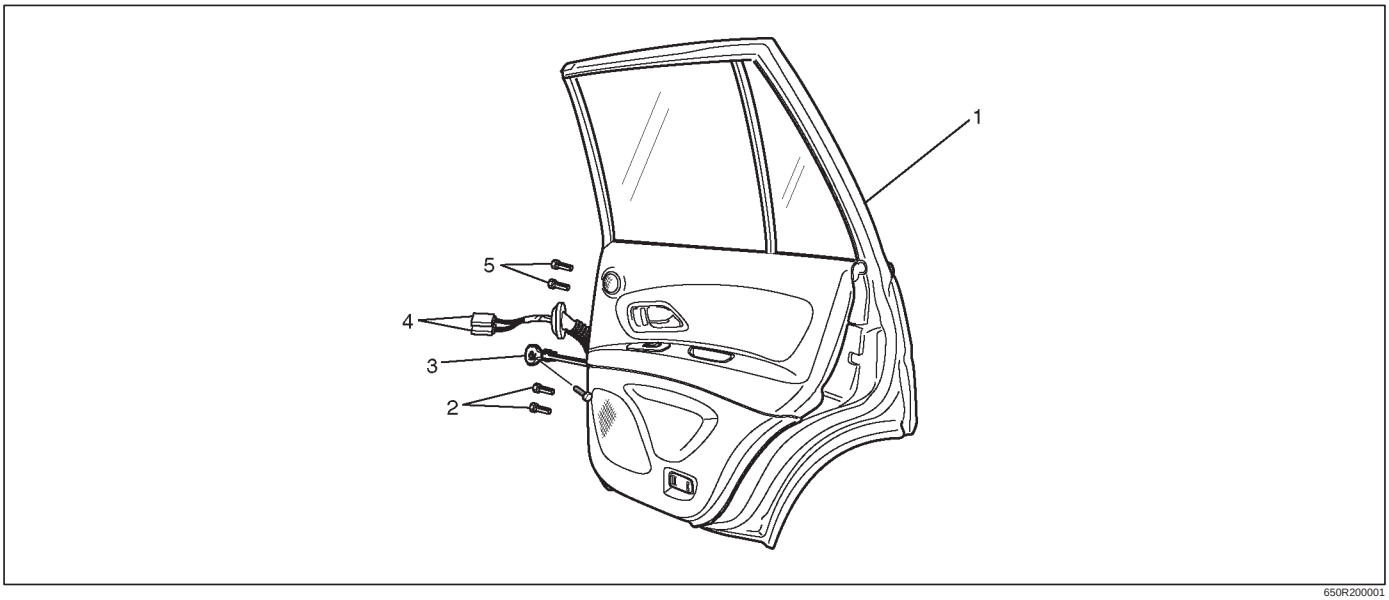


610R200005

2. Tighten the door hinge bolts to the specified torque.
   Torque : 34 N·m (25 lb ft)
3. Tighten the door check arm bolt and nuts to the specified torque.
   Torque : 9 N·m (78 lb in)

Rear Door Assembly

Parts Location



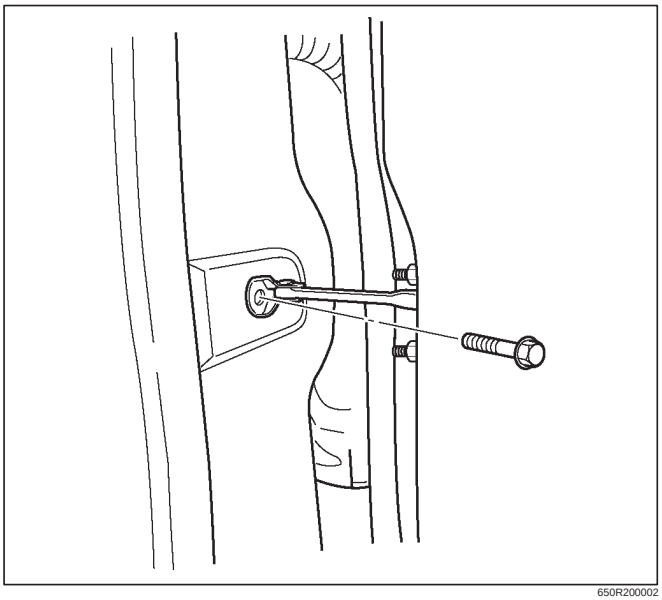
650R200001

Legend

(1) Rear Door Assembly
(2) Lower Hinge Bolt
(3) Door Check Arm
(4) Door Harness Connector
(5) Upper Hinge Bolt

Removal

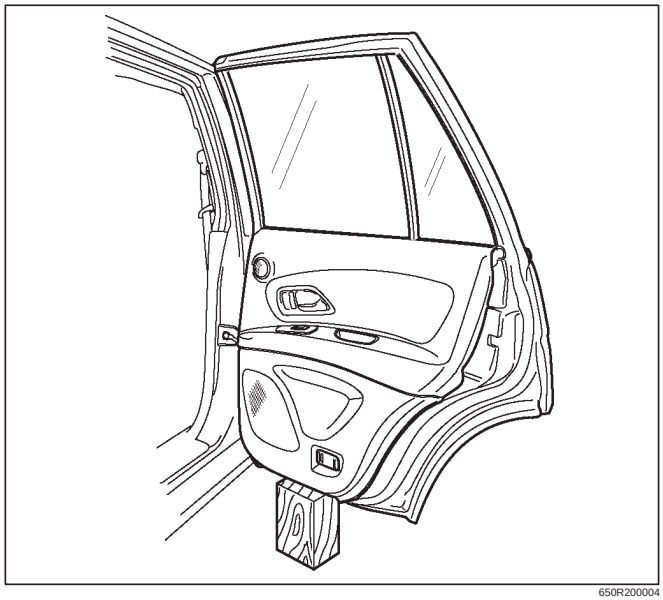
1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove the door check arm bolt.



650R200002

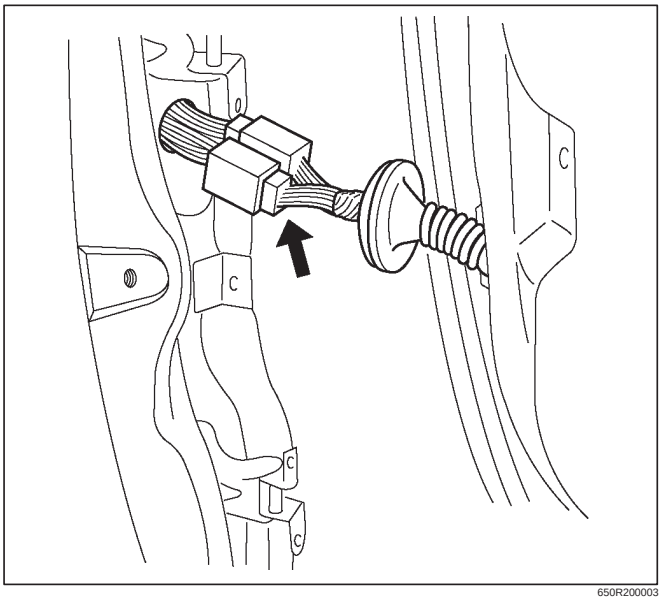
4. Remove the upper and lower hinge bolts.

▼Position a wood block under the door for protection and support the door assembly with hands during removal or installation.



650R200004

5. Remove the door harness connectors.
   ▼Pull the door harness grommet out in order to disconnect the door harness connectors.



650R200003

6. Remove the rear door assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

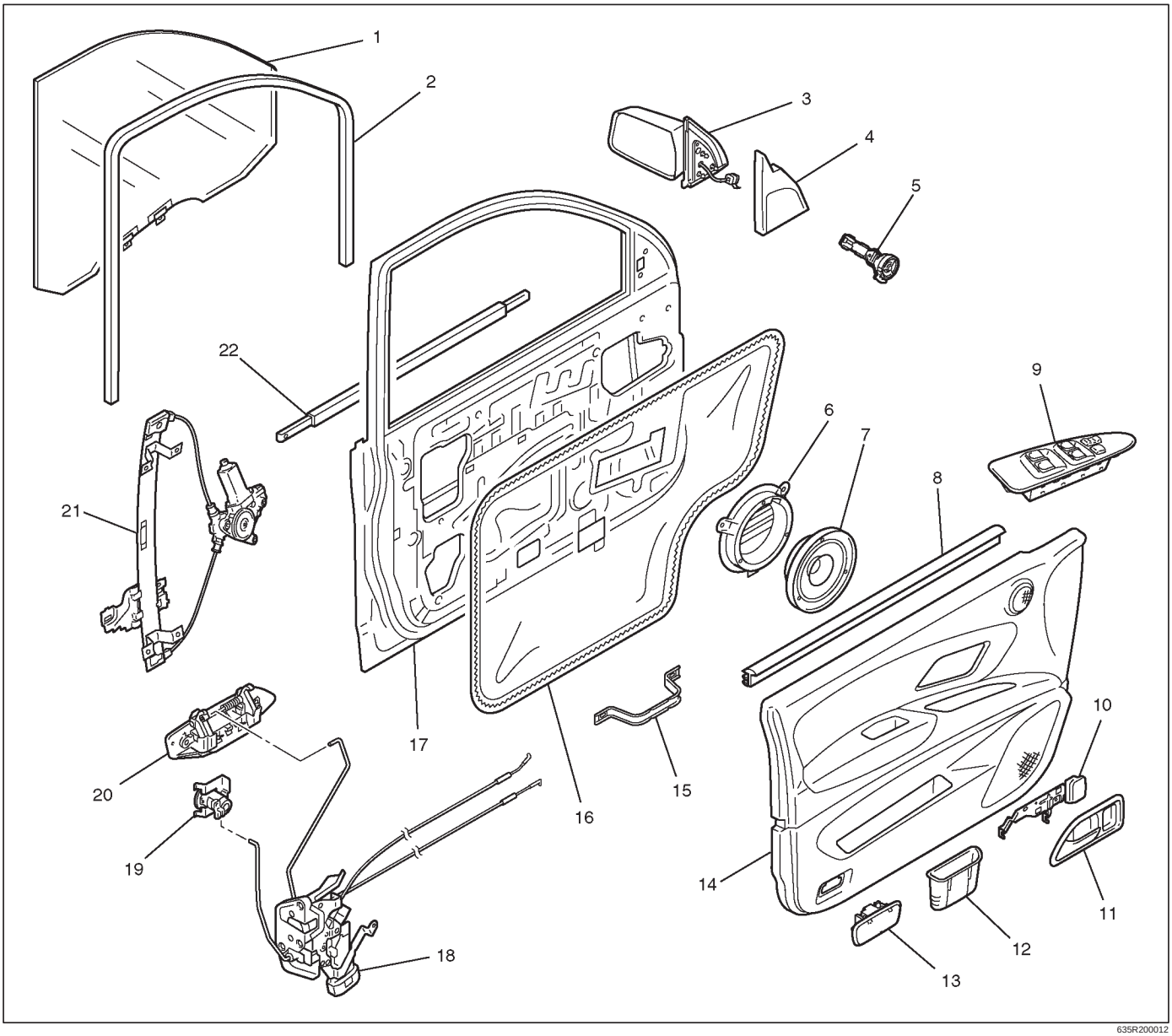
1. Align the door fitting to the body by referring to Front Door Assembly in this section.
2. Tighten the door hinge bolts to the specified torque.

   Torque : 34 N·m (25 lb ft)
3. Tighten the door check arm bolt and nuts to the specified torque.

   Torque : 9 N·m (78 lb in)

Front Window Regulator, Glass and Glass Run

Parts Location



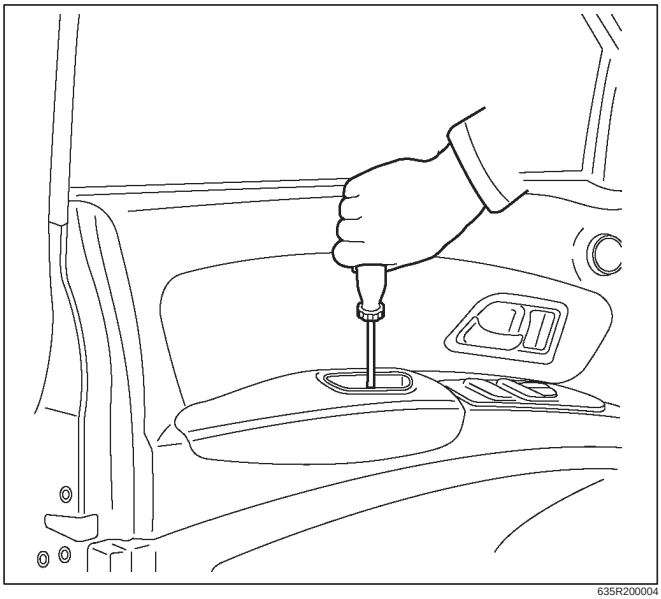
635R200012

Legend

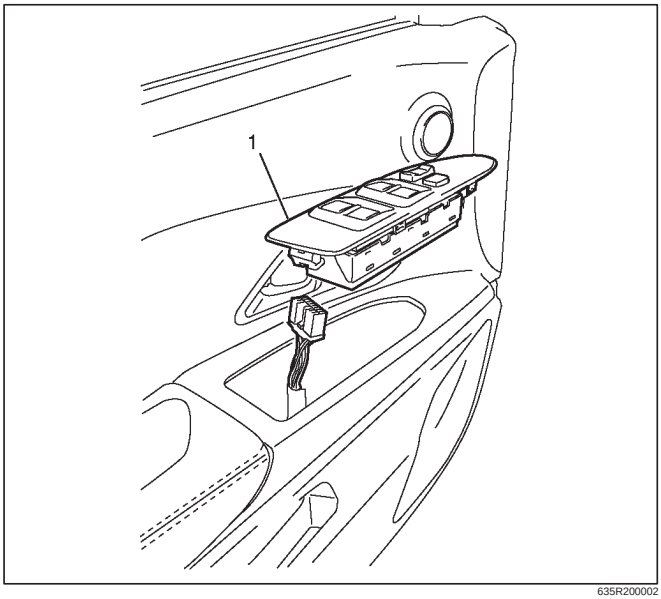
(1) Glass
(2) Glass Run
(3) Door Mirror Assembly
(4) Door Mirror Cover
(5) Tweeter
(6) Speaker Spacer
(7) Speaker Assembly
(8) Inner Waist Seal
(9) Door Trim Panel
(10) Power Window Switch
(11) Inside Lock Bracket
(12) Inside Handle
(13) Pull Box
(14) Courtesy Light
(15) Pull Box Bracket
(16) Waterproof Sheet
(17) Front Door Panel
(18) Door Lock Assembly
(19) Door Lock Cylinder
(20) Outside Handle
(21) Window Regulator
(22) Outer Waist Seal

Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the one fixing screw.

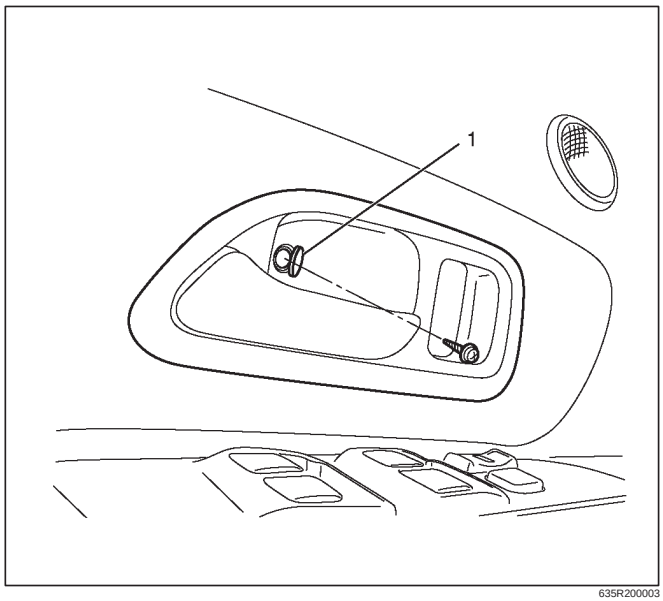

635R200004

3. Remove the power window switch (1).
   ▼Pull the power window switch and remove the connector.



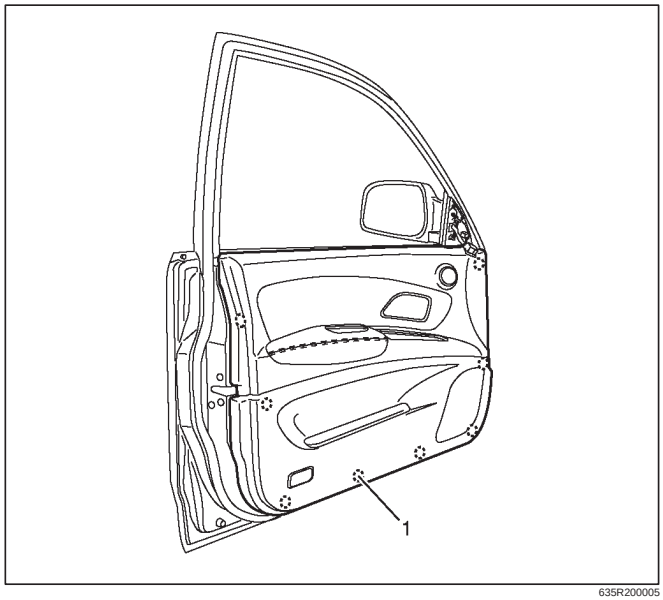
635R200002

4. Remove the inside handle.
   ▼Open the screw cover (1) and remove the screw.
   ▼Disconnect the cable.



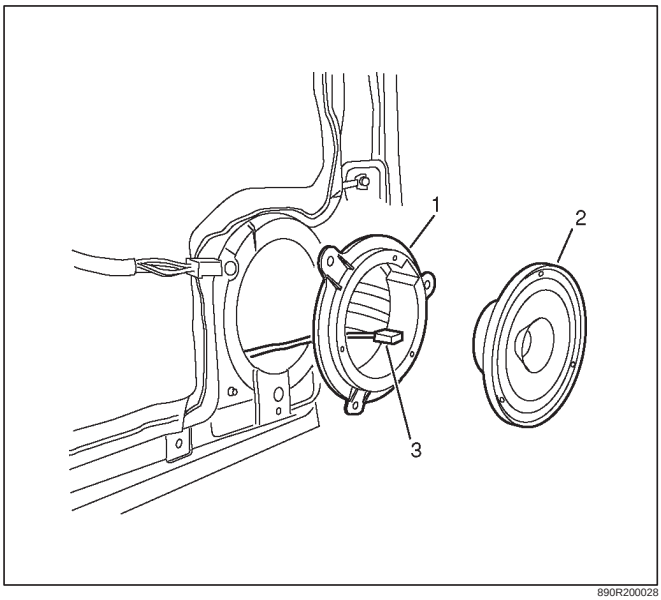
635R200003

5. Remove the door mirror cover.
6. Remove the trim panel at the 8 clip positions (1).
   ▼Disconnect the tweeter and courtesy light connectors.



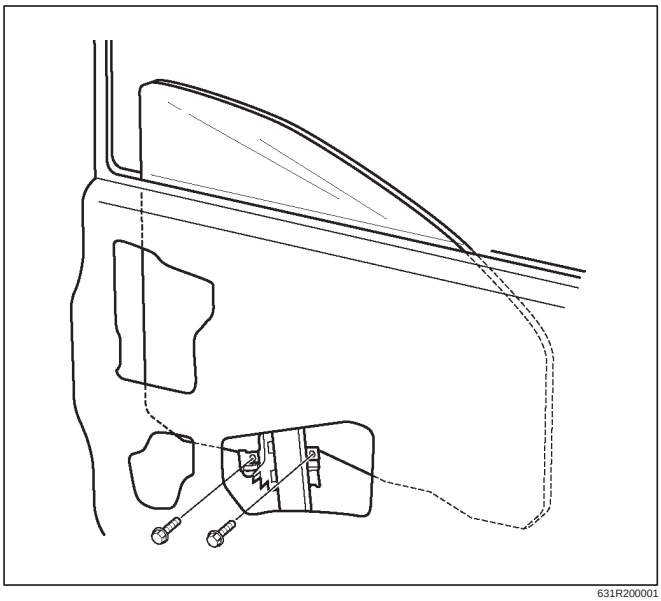
635R200005

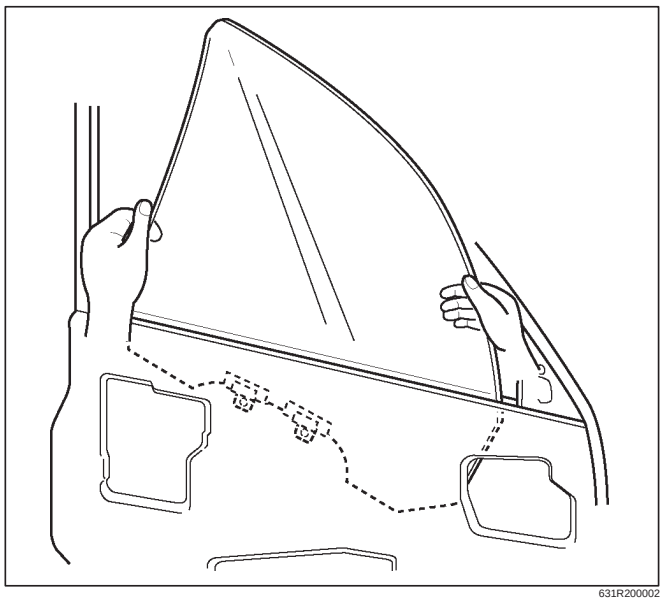
7. Remove the inner waist seal.
8. Remove the tweeter.
9. Remove the courtesy light.
10. Remove the pull box bracket.
11. Remove the inside lock bracket.
    ▼Disconnect the cable.
12. Remove the speaker (2) and speaker spacer (1).
    ▼Disconnect the speaker connector (3).



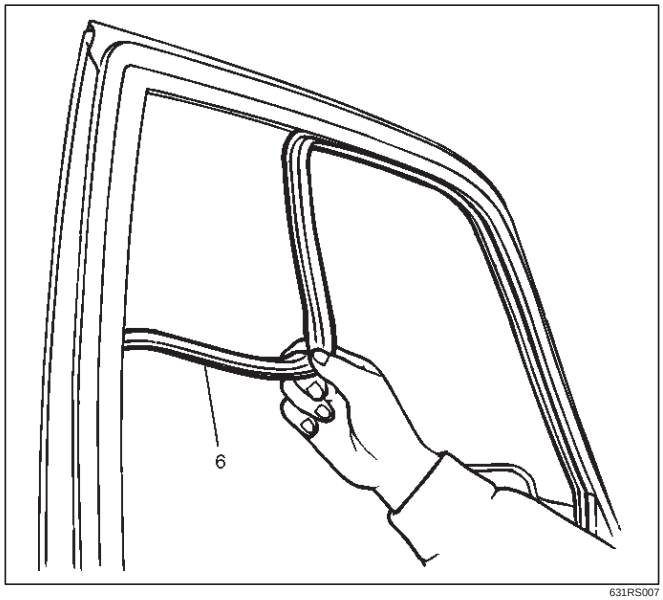
890R200028

13. Remove the waterproof sheet.
14. Remove the outer waist seal.
    ▼Remove the rear side screw and pull the outer waist seal upward.
15. Remove the window glass.
    ▼Operate the requlator (power window switch) to adjust the glass height and expose the access hole. Remove the 2 bolts fixing the bottom channel and the requlator. Remove the glass.


631R200001


631R200002

16. Remove the window regulator.
    ▼Remove the 7 fixing bolts and disconnect the window regulator motor harness connector.
17. Remove the glass run.
    ▼Pull the glass run (6) from the door frame.



631RS007

Installation

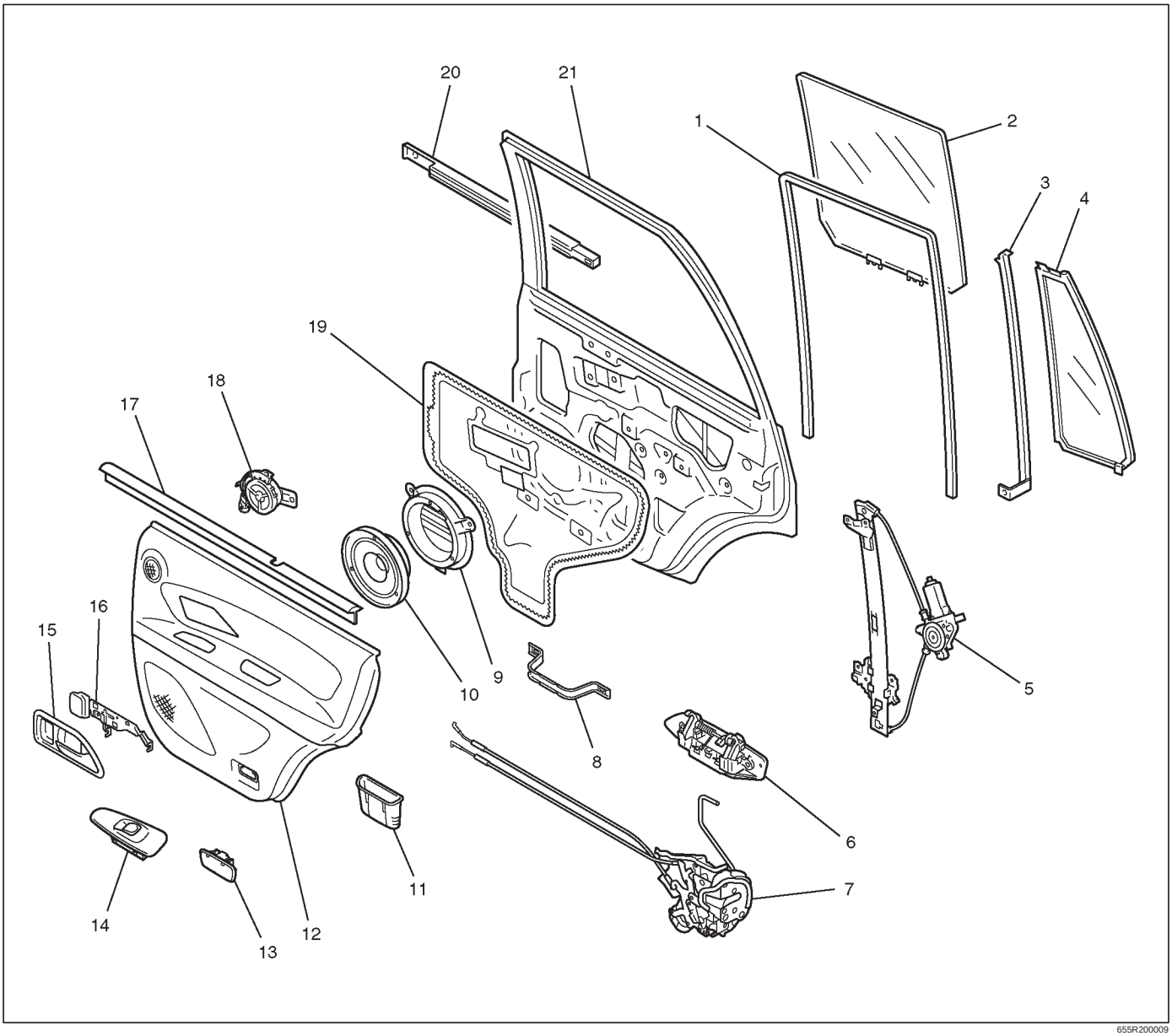
To install, follow the removal steps in the reverse order, noting the following points:

1. Check to see that the window regulator operates smoothly and the glass opens and closes properly.
2. Install the waterproof sheet tightly against the door panel.
3. Tighten the window regulator assembly fixing bolts to the specified torque.

Torque : 6 N·m (52 lb in)

Rear Window Regulator, Glass and Glass Run

Parts Location



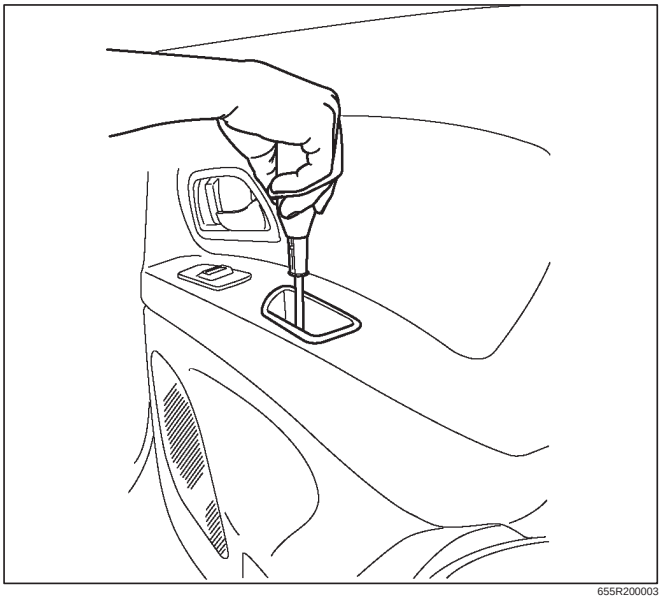
655R200009

Legend

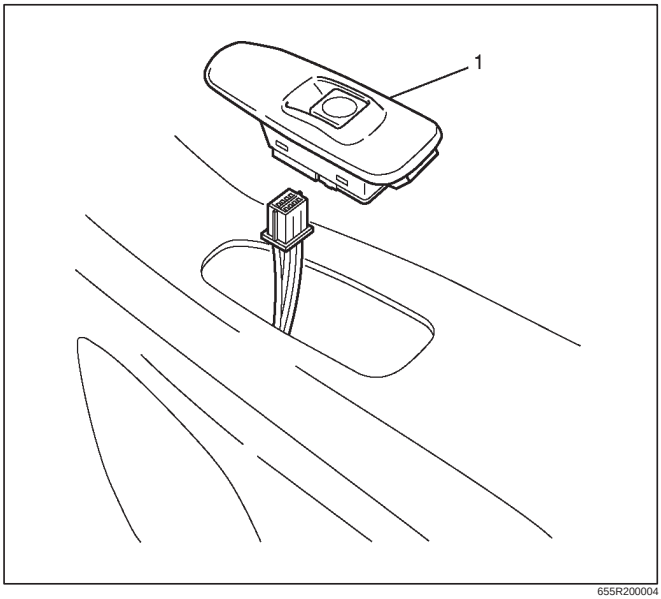
(1) Glass Run
(2) Glass
(3) Division Bar
(4) Fixed Glass
(5) Window Regulator
(6) Outside Handle
(7) Door Lock Assembly
(8) Pull Box Bracket
(9) Speaker Spacer
(10) Speaker
(11) Pull Box
(12) Door Trim Panel
(13) Courtesy Light
(14) Power Window Switch
(15) Inside Handle
(16) Inside Lock Bracket
(17) Inner Waist Seal
(18) Tweeter
(19) Waterproof Sheet
(20) Outer Waist Seal
(21) Rear Door Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the fixing screw.

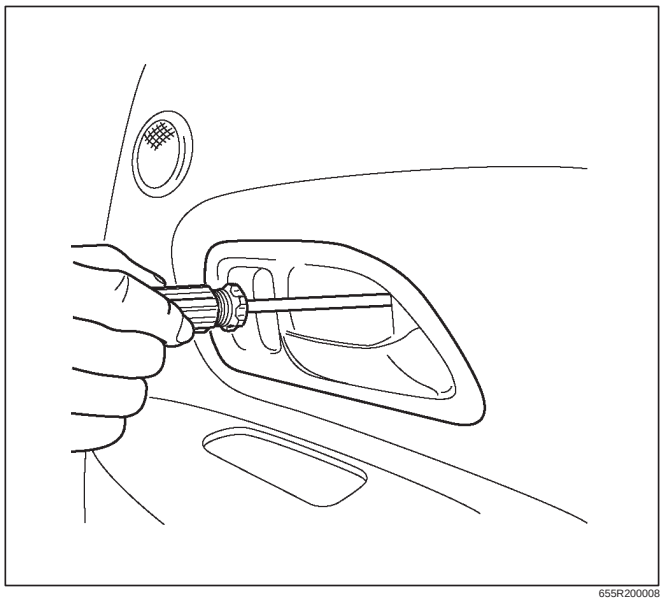

655R200003

3. Remove the power window switch (1).
   ▼Pull the power window switch and remove the connector.

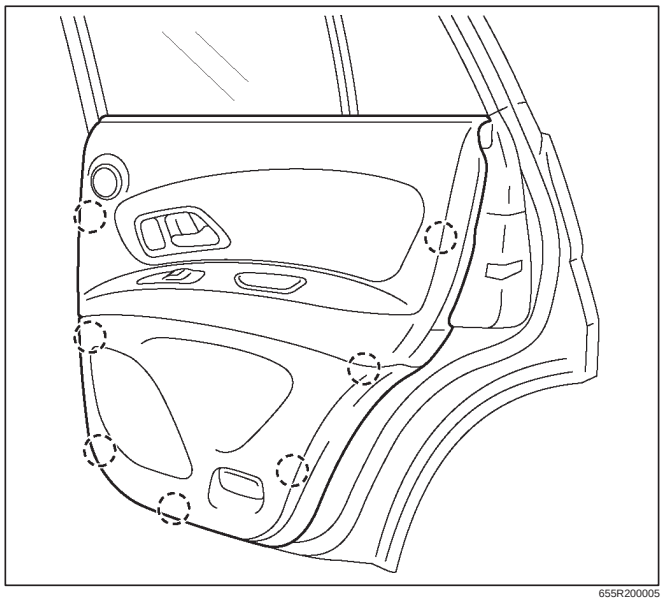


655R200004

4. Remove the inside handle.
   ▼Open the screw cover and remove the screw.
   ▼Disconnect the cable.

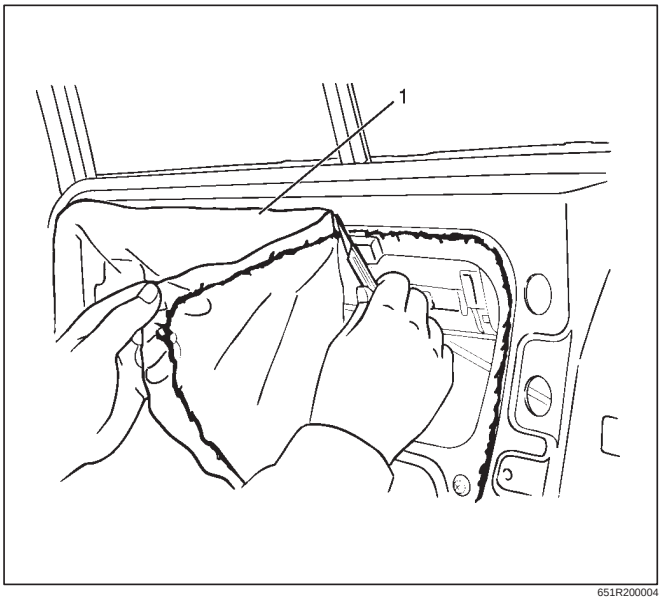

655R200008

5. Pull the trim panel at the 7 clip positions.
   ▼Disconnect the tweeter and courtesy light connectors.


655R200005

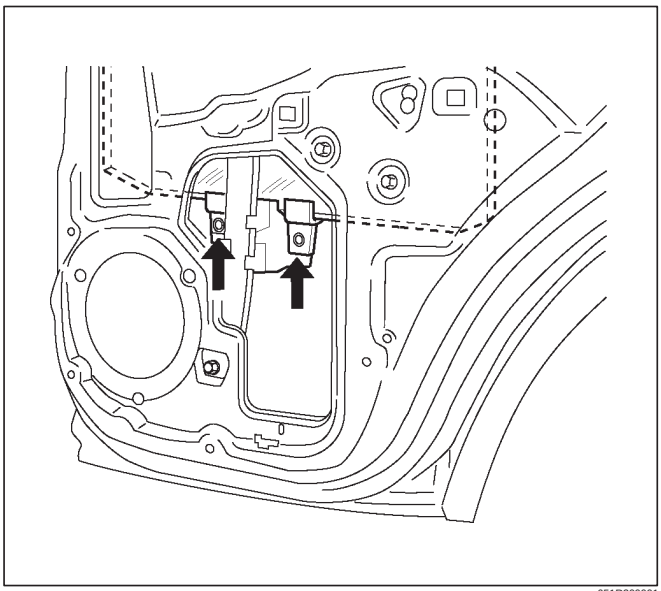
6. Remove the inner waist seal.
7. Remove the tweeter and the courtesy light.
8. Remove the pull box bracket.
9. Remove the speaker and the speaker spacer.
   ▼Disconnect the speaker harness connector.
10. Remove the inside lock bracket.
    ▼Disconnect the cable.

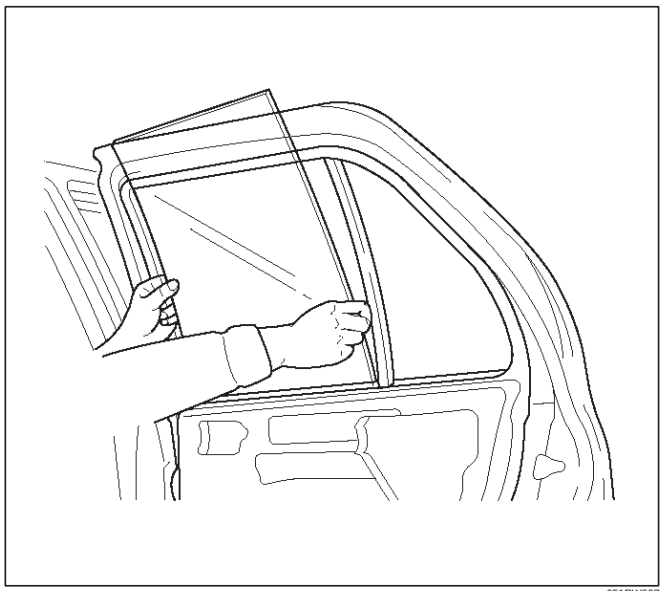
11. Remove the waterproof sheet (1).
    ▼Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.



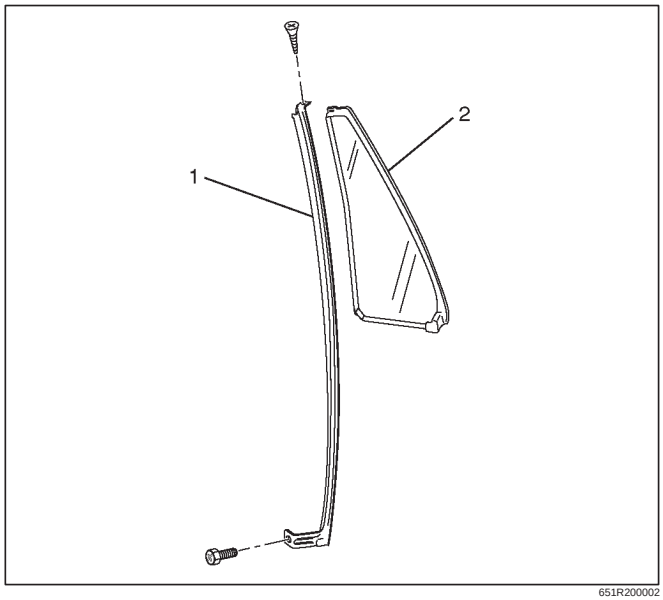
651R200004

12. Remove the outer waist seal.
    ▼Remove the front side screw and pull the waist seal upward.
13. Remove the window glass.
    ▼Operate the requlator (powe window switch) to adjust the glass hight and expose the access hole. Remove the 2 bolts fixing the bottom channel and the requlator. Remove the galss.


651R200001

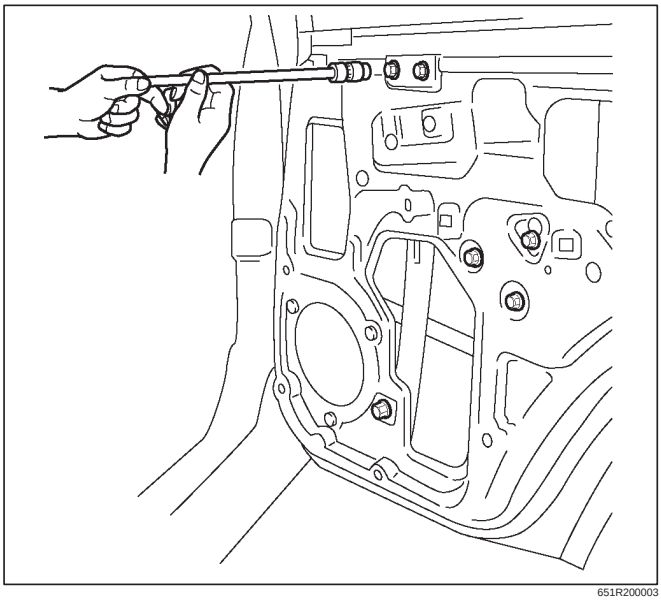

651RW007

▼Remove the fixed window glass (2) by removing the screw from the top of the division bar (1) and the bolt from the bottom of the division bar.



651R200002

14. Remove the window regulator.
    ▼Remove the 6 fixing bolts and pull the regulator out from the lower hole of the door panel.



651R200003

15. Remove the glass run.
    ▼Pull the glass run from the door frame.

Installation

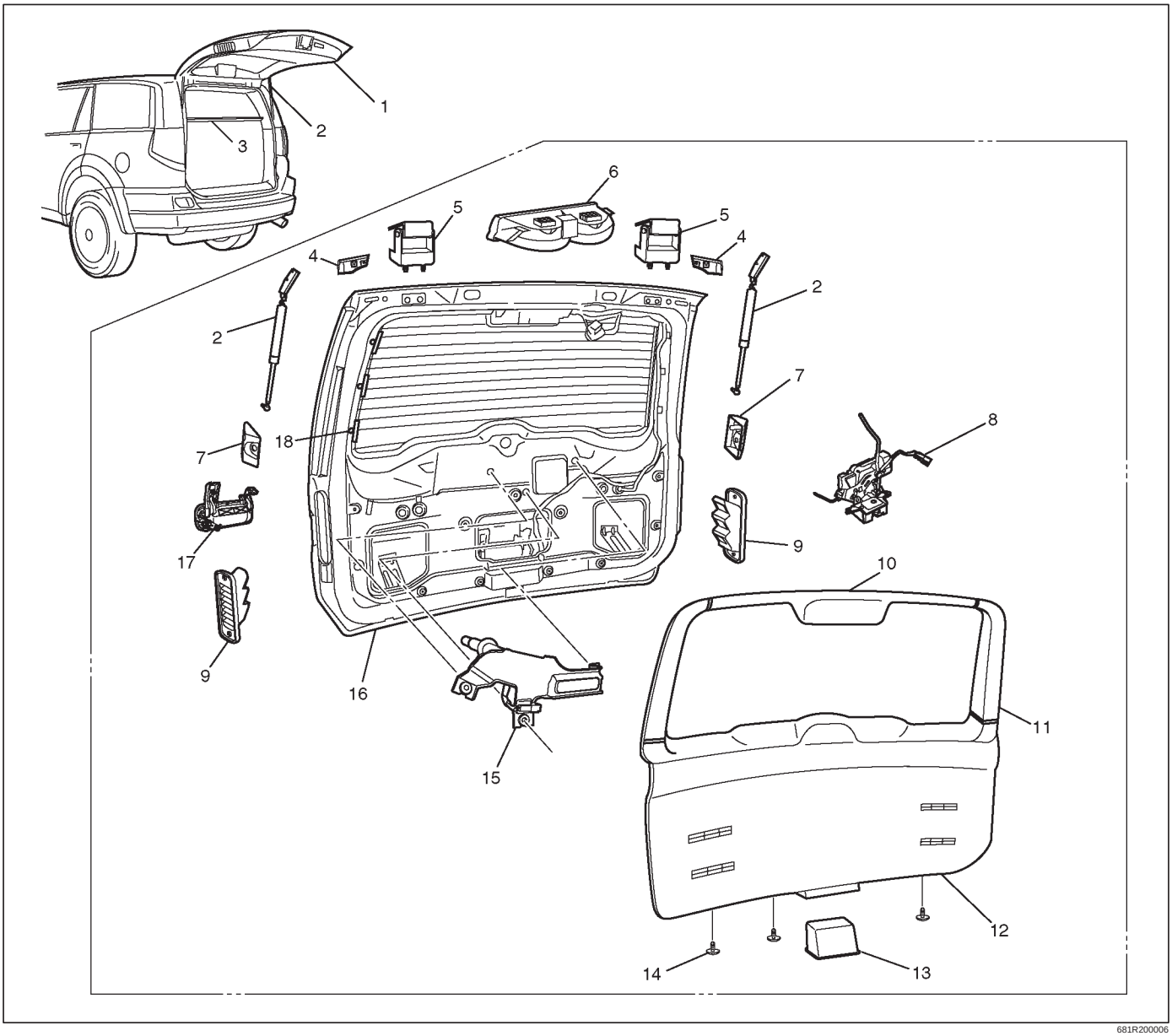
To install, follow the removal steps in the reverse order, noting the following points:

1. Check to see that the window regulator operates smoothly and the glass opens and closes properly.
2. Install the waterproof sheet tightly against the door panel.
3. Tighten the window regulator assembly fixing bolts to the specified torque.

Torque : 6 N·m (52 lb in)

Tailgate

Parts Location



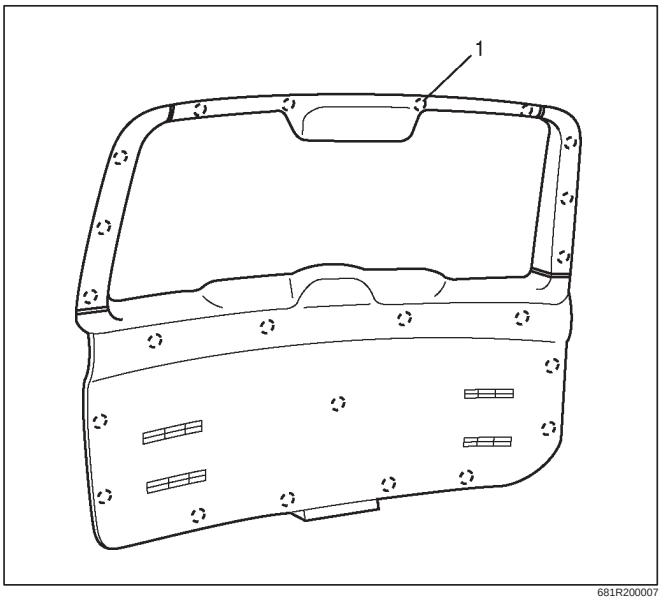
681R200006

Legend

(1) Tailgate Assembly
(2) Tailgate Stay Assembly
(3) Rear Roof Trim Cover
(4) Tailgate Upper Cover Assembly
(5) Tailgate Hinge
(6) High Mount Stoplight
(7) Dove Tail
(8) Tailgate Lock Assembly
(9) Vent Grill
(10) Tailgate Upper Center Trim Cover
(11) Tailgate Upper Side Trim Cover
(12) Tailgate Lower Trim Cover
(13) Tailgate Pull Box
(14) Clip
(15) Rear Wiper Motor Assembly
(16) Tailgate Panel Assembly
(17) Outside Handle
(18) Clip

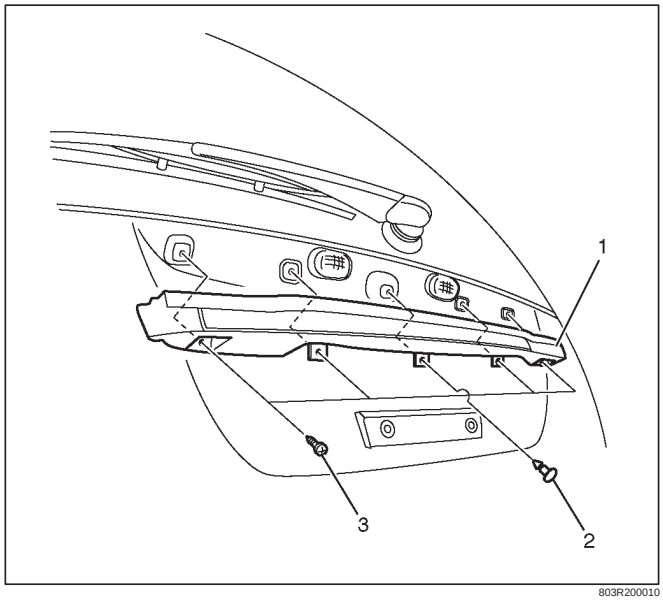
Removal

1. Disconnect the battery ground cable.
2. Remove the rear roof trim cover.
   ▼Pry the six clip positions free from the body panel.
3. Remove the tailgate upper center trim cover.
   ▼Pry the four clip positions (1) free from the tailgate.
4. Remove the tailgate pull box.
   ▼Pry the tailgate pull box from the tailgate assembly.
5. Remove the three clips.
6. Remove the tailgate lower trim cover.
   ▼Pry the thirteen clip positions (1) free from the tailgate.
7. Remove the tailgate upper side trim cover.
   ▼Pry the three clip positions (1) free from the tail gate (RH/LH).



681R200007

8. Disconnect the high mount stoplight and rear defogger and tailgate lock harness connectors.
9. Pull out the washer hose.
10. Remove the tailgate hinges (RH/LH).
    ▼Remove the two bolts.
11. Remove the tailgate stay assembly (RH/LH).
    ▼Remove the two bolts.
12. Remove the tailgate assembly.
    ▼Remove the tailgate assembly may require two people.
    ▼Carefully remove the tailgate assembly not to damage the hinge.
13. Remove the tailgate upper cover assemblies (RH/LH).
14. Remove the dove tails (RH/LH).
15. Remove the vent grills (RH/LH).
16. Remove the high mount stoplight.
17. Remove the rear wiper arm.
    ▼Refer to *Rear Wiper Arm/Blade in Wiper/Washer System section.*
18. Remove the rear wiper motor assembly.
19. Remove the tailgate lock assembly and outside handle.
    ▼Refer to *Tailgate Lock in Security And Locks section.*
20. Remove the license plate garnish (1).
    ▼Remove the four screws (3) and the clip (2).



803R200010

21. Remove the license plate light.
22. Remove the tailgate harness.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. When installing the hinge to the body, exercise special care not to damage the body paint surface.
2. Align the tailgate fitting to the body.

▼Check the roof and tailgate (1).

Clearance: 10.7 mm (0.42 in)

Height (step): –2 mm (0.08 in)

▼Check the tailgate fitting to the rear quarter panel (2), (4).

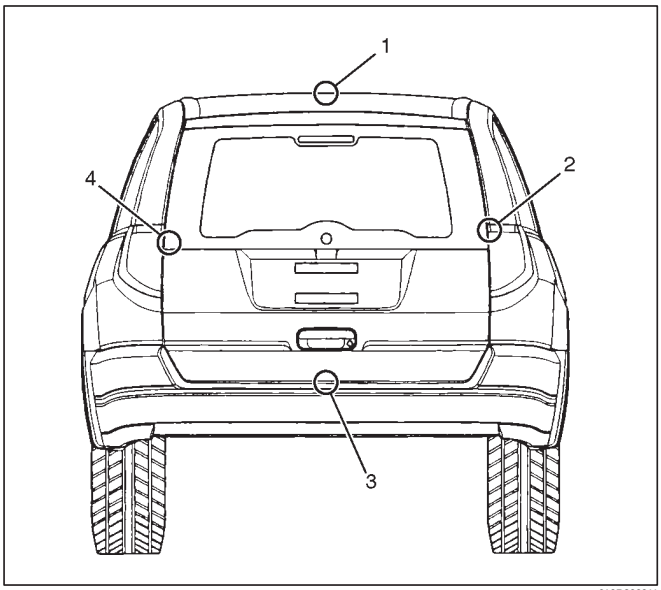
Clearance: 5.0 mm (0.196 in)

Height (step): Flush

▼Check the tailgate fitting to the rear bumper.

Clearance: 6.5 mm (0.26 in)

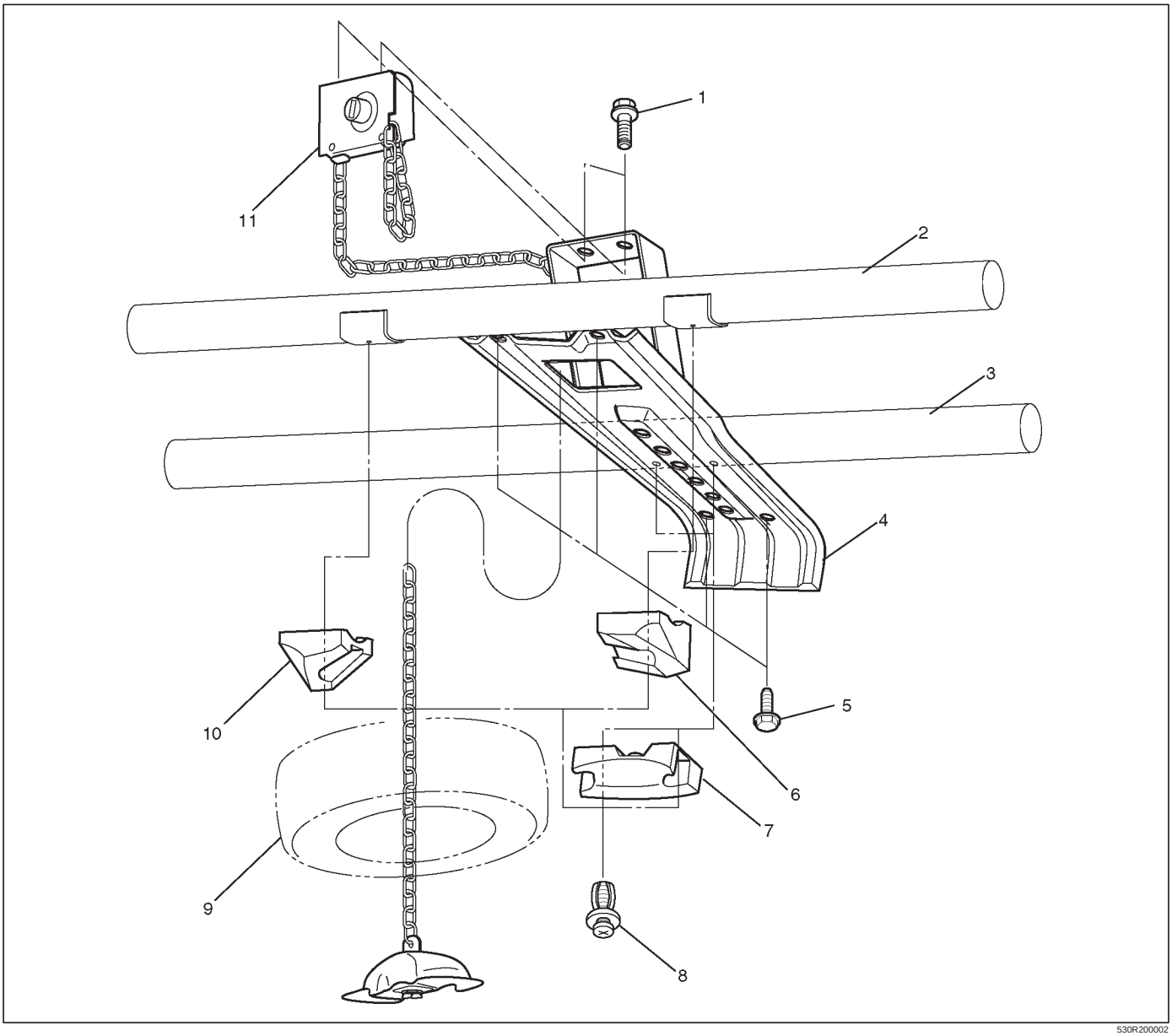
Adjust clearance with tailgate hinges. Adjust height (step) by tapping on the tailgate lightly with a rubber hammer.



610R200011

Spare Tire Hanger

Parts Location



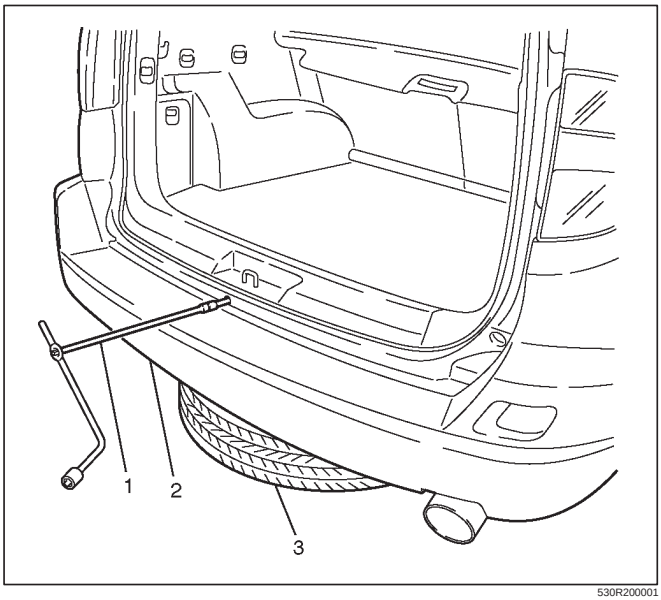
530R200002

Legend

(1) Spare Tire Hanger Assembly Fixing Bolt
(2) End Cross Member
(3) Rear Suspension · Cross Member
(4) Spare Tire Support
(5) Spare Tire Support Fixing Bolt
(6) Spare Tire Stopper Rubber (RH)
(7) Spare Tire Stopper Rubber (Front)
(8) Stopper Rubber Fixing Clip
(9) Spare Tire
(10) Spare Tire Stopper Rubber (LH)
(11) Spare Tire Hanger Assembly

Removal

1. Open the hatch gate and tail gate.
2. Remove the spare tire (3).
   ▼Put the spare tire handle (1) to the center of upper side of rear bumper (2) and turn counterclockwise. Put spare tire down.



530R200001

3. Remove the spare tire support.
   ▼Remove the four bolts that are fixed to frame cross member.
4. Remove the spare tire hanger assembly.
   ▼Remove the two fixing bolts.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

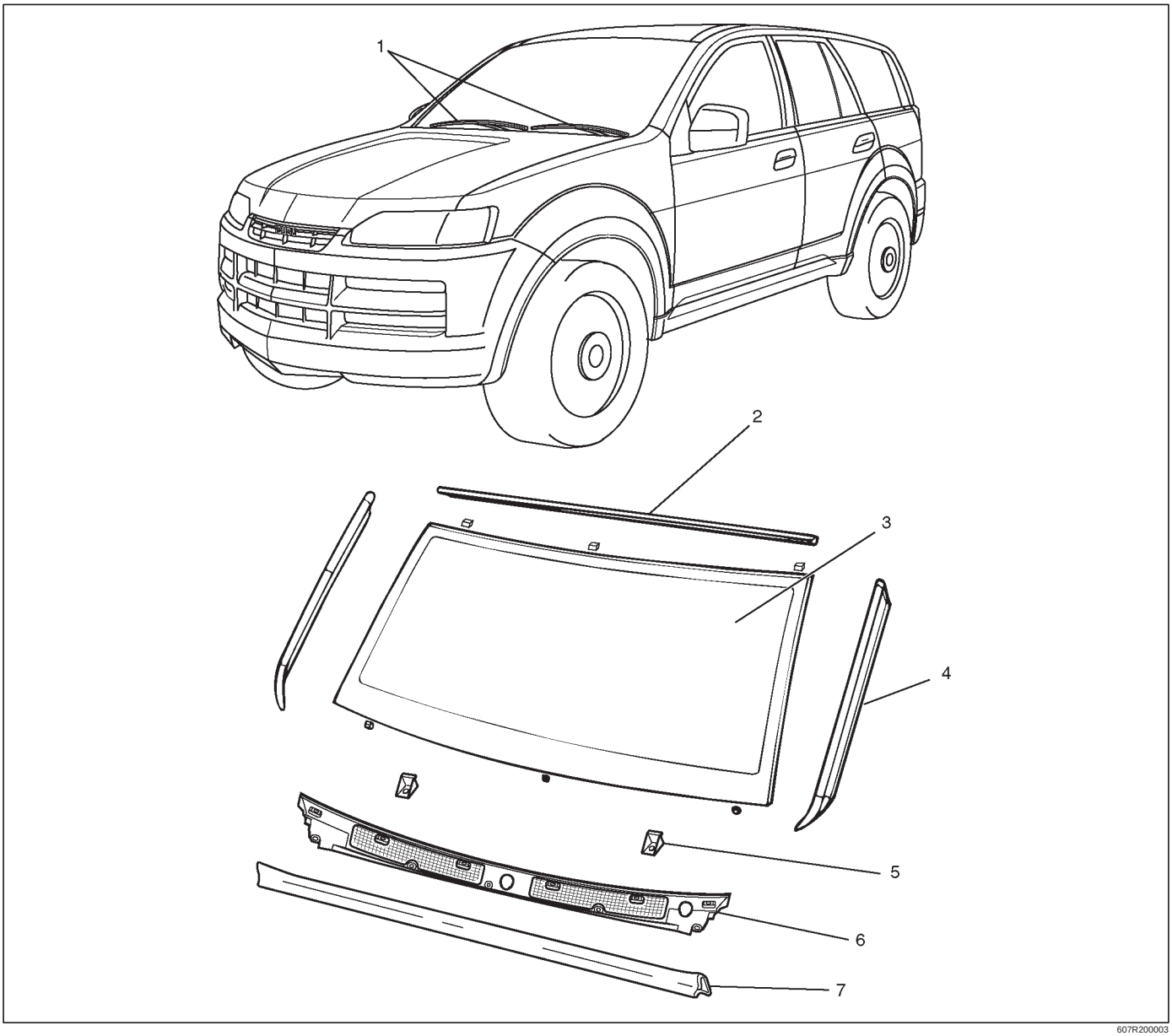
1. Install the spare tire firmly.
2. Tighten the spare tire support fixing bolts to the specified torque.

   Torque : 40 N·m (4.1 kg·m)
3. Tighten the spare tire hanger fixing bolts to the specified torque.

   Torque : 19 N·m (1.9 kg·m)

Windshield

Parts Location



607R200003

Legend

(1) Windshield Wiper Arm
(2) Windshield Upper Molding
(3) Windshield
(4) Windshield Side Molding
(5) Windshield Support
(6) Front Cowl Cover
(7) Hood Rear Seal

Removal

1. Disconnect the battery ground cable.
2. Remove the front pillar trim cover.
   ▼Turn up the finisher and pry the trim cover clips free from the body panel.
3. Remove the sunvisors and sunvisor holders.
   ▼Refer to *Headlining in Exterior/Interior Trim section.*
4. Remove the interior mirror.
   ▼Refer to *Interior Mirror Assembly in Exterior/Interior Trim section.*
5. Remove the windshield wiper arm.
   ▼Refer to *Windshield Wiper Arm/Blade in Wiper/Washer System section.*
6. Remove the windshield side molding.
   ▼Pull the molding out from drip rail.
7. Remove the front cowl cover.

8. Remove the windshield support.
9. Remove the upper moulding.
10. Remove the windshield.

▼Use a knife to cut through part of the adhesive caulking material.

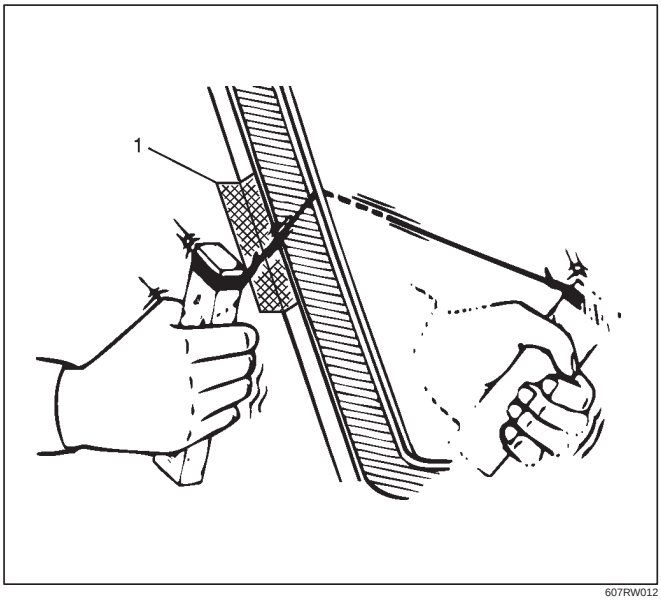
▼Secure one end of a piece of steel piano wire (0.02 inches in diameter) to a piece of wood that can serve as a handle.

▼Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the windshield glass.

▼Secure the other end of the piano wire to another piece of wood.

▼With the aid of an assistant, carefully move the piano wire with a sawing motion to cut through the adhesive caulking material around the entire circumference of the windshield glass.

▼Attach some cloth tape (1) on the body for protecting the painting surface.



607RW012

▼Clean the remaining adhesive caulking material from the area of the body which holds the windshield.

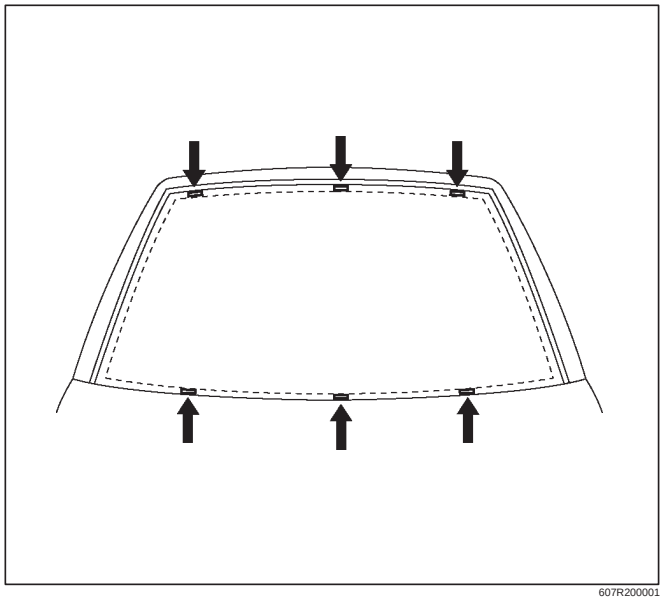
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Clean the bonding surfaces of both the windshield and body panel with a soft rag and white gasoline.
2. Install the spacer.

▼Attach spacers in six locations as shown in the figure.

▼Always use new spacer.


607R200001

3. Install the windshield upper molding.

▼Peel off the tear-away paper from the windshield upper molding, and start applying it with one end of the glass and cut away the surplus at the other end of the glass for length adjustment.

▼Always use new upper molding.

4. Temporary install the windshield support.
5. Apply the primer to the windshield and body panel.

▼Apply the primer (3) (Sun star # 435-40 or equivalent) to the windshield side bonding surface as shown in the figure.

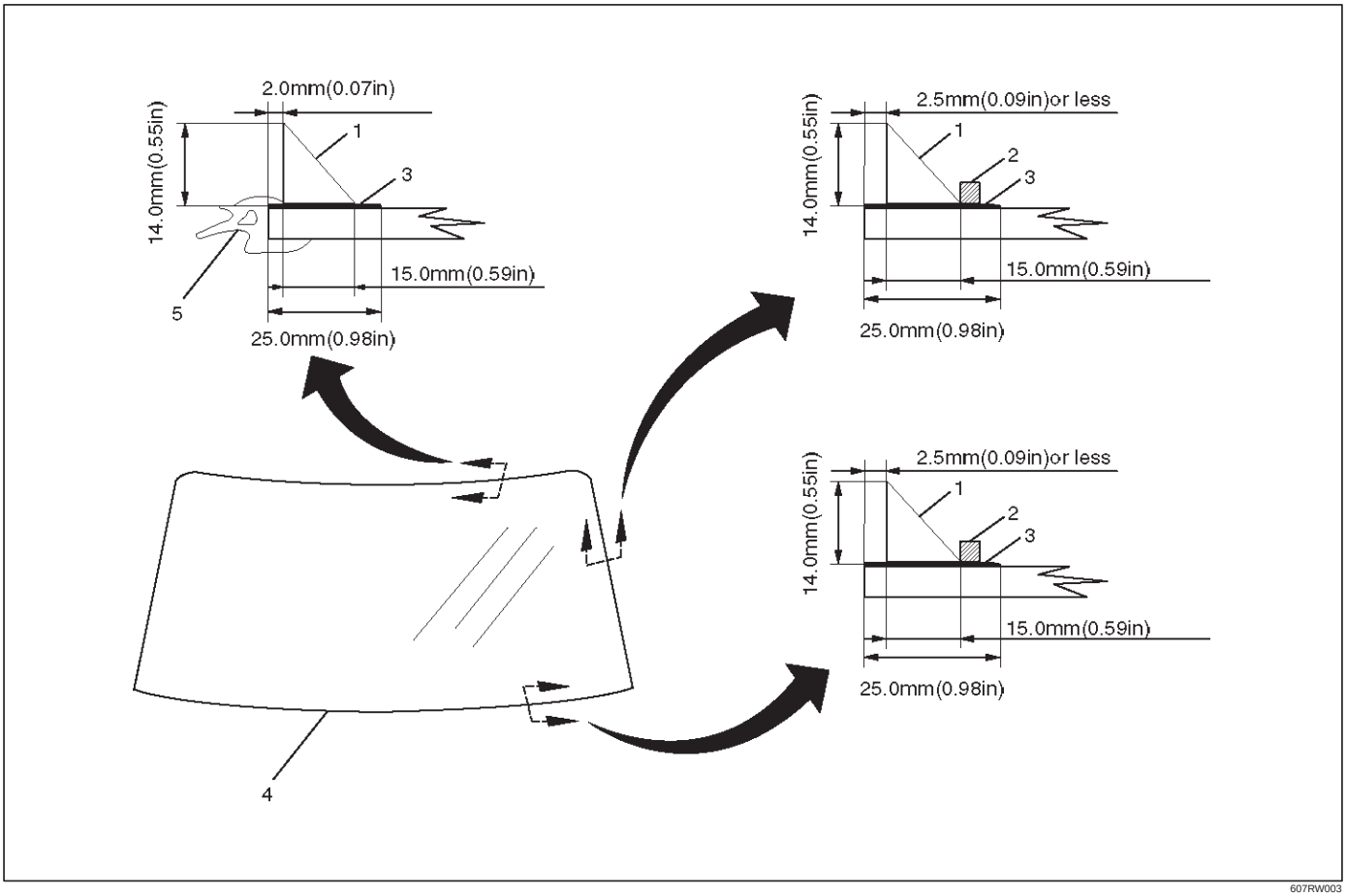
▼Apply the primer (Sun star # 435-95 or equivalent) to the body side bonding surface.

NOTE: Apply an adhesive 3 minutes or more but within 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

Primer should be handled as following:

1. Use the primer manufactured 3 months or less ago and having been kept in an refrigerator.
2. Wipe off primer-stains on positions other than requires application.

3. Stir the primer for a minute or more before use.

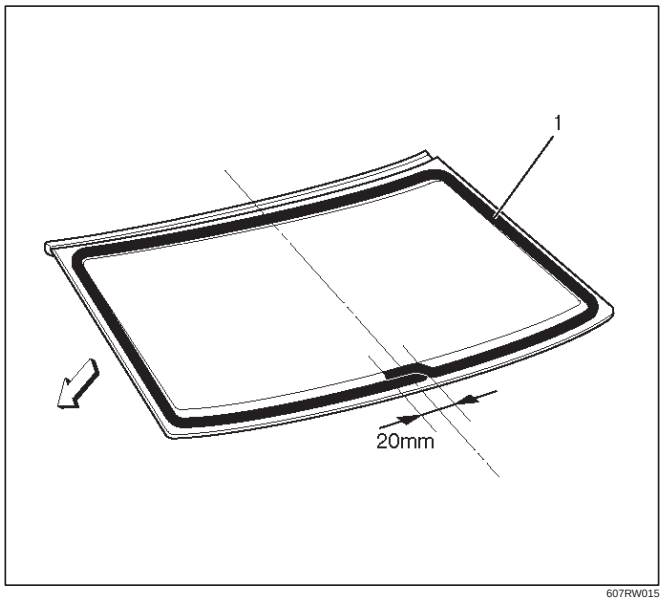


607RW003

Legend

(1) Adhesive
(2) Sealing Dam
(3) Primer Coating Area
(4) Windshield
(5) Upper Molding

6. Apply the adhesive (1) to the windshield.
   ▼After drying primer completely, apply a sealing adhesive (Sun star # 555 or equivalent) along the edge of the glass so that the sealing adhesive has a 20 mm (0.79 in) junction at middle of the base of the glass.



607RW015

NOTE: Apply an adhesive 3 minutes or more but within 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

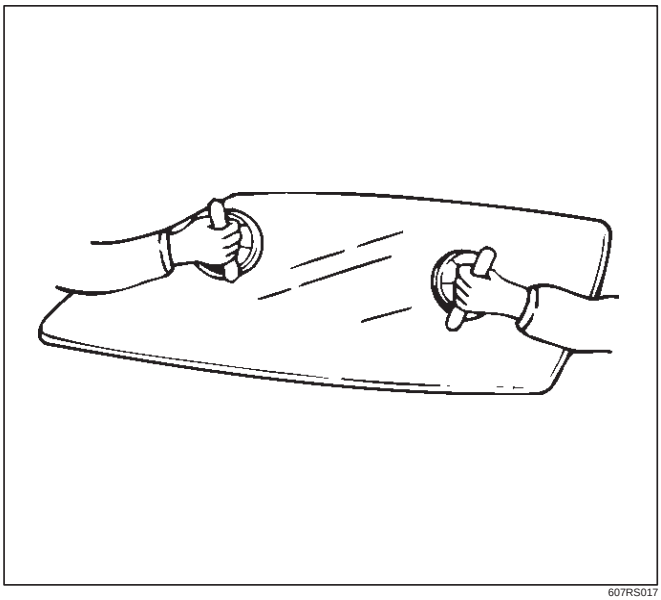
Adhesive should be handled as follows:

1. Use the adhesive manufactured 3 months or less ago.
2. Wipe off adhesive-stains on positions other than requires application.

7. Install the windshield.

▼Set the windshield with sealing adhesive applied to entire circumference in the body panel. Specifically, adjust windshield support with the upper molding making contact with the body panel, press the glass, and tighten the windshield support.

NOTE: Affix the glass within 5 minutes of application.



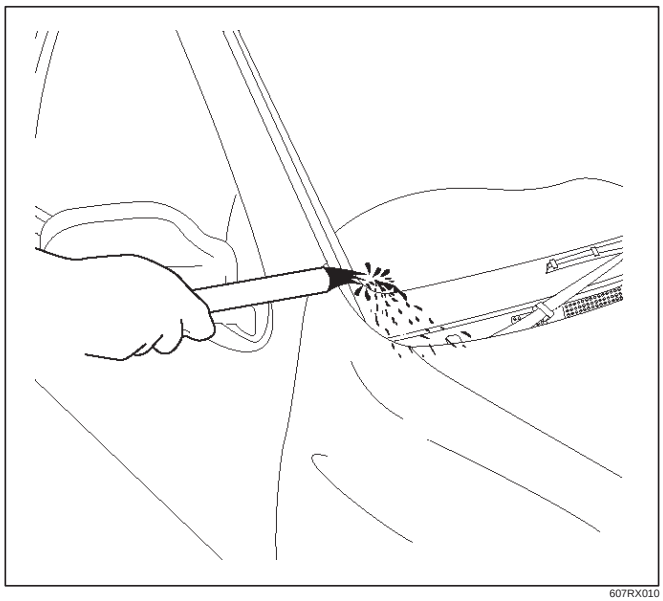
607RS017

8. Install the front cowl cover.
9. Install side molding.

▼Use alcohol wipe or equivalent cleaner with soft cloth to wipe away any excess adhesive.

▼Cure the bonding at a temperature of 20˚C – 30˚C (68˚F – 86˚F) for 24 hours.

▼Check the windshield for any signs of water leak.

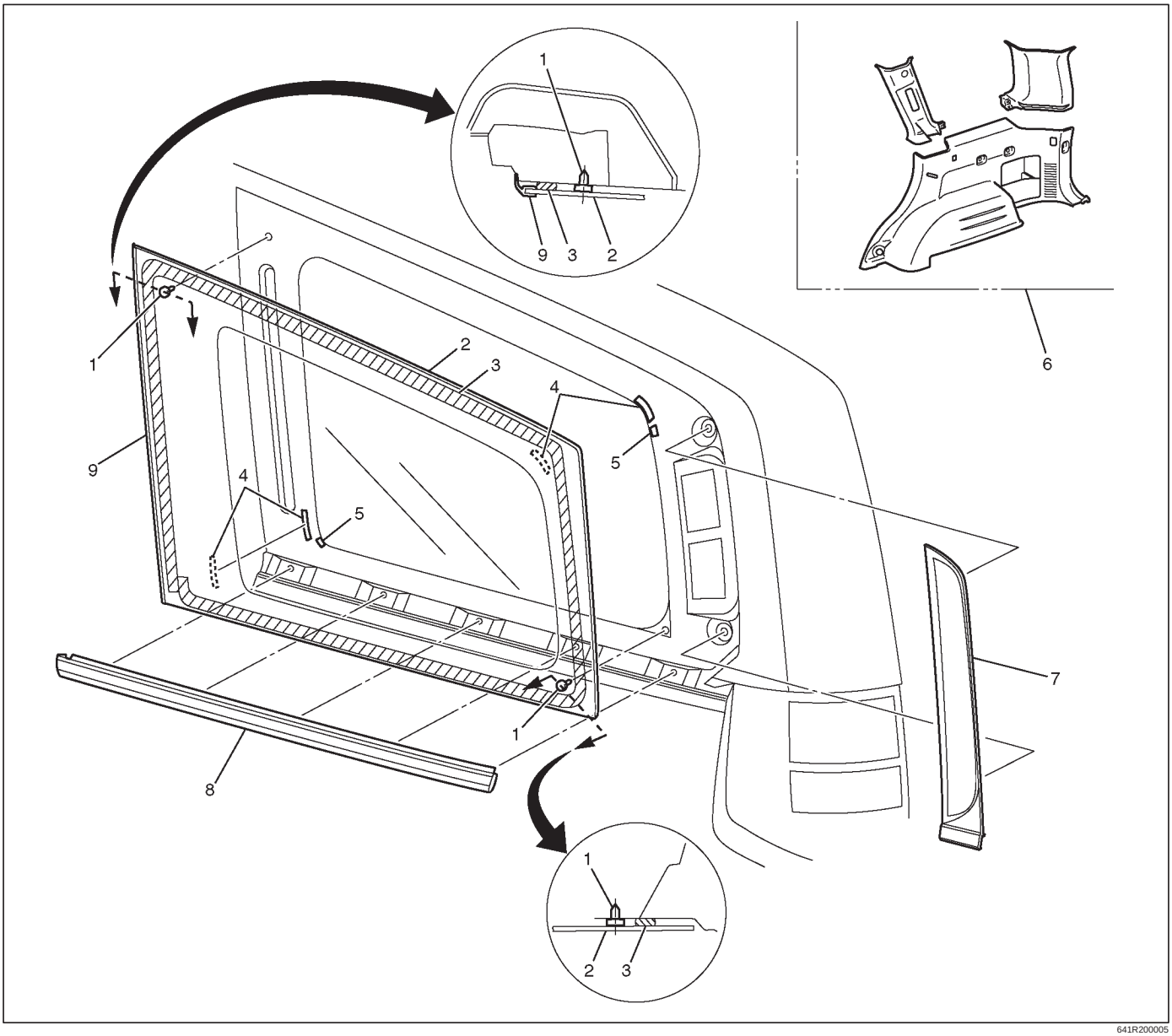


607RX010

10. Install windshield wiper arm.

Rear Quarter Glass

Parts Location



641R200005

Legend

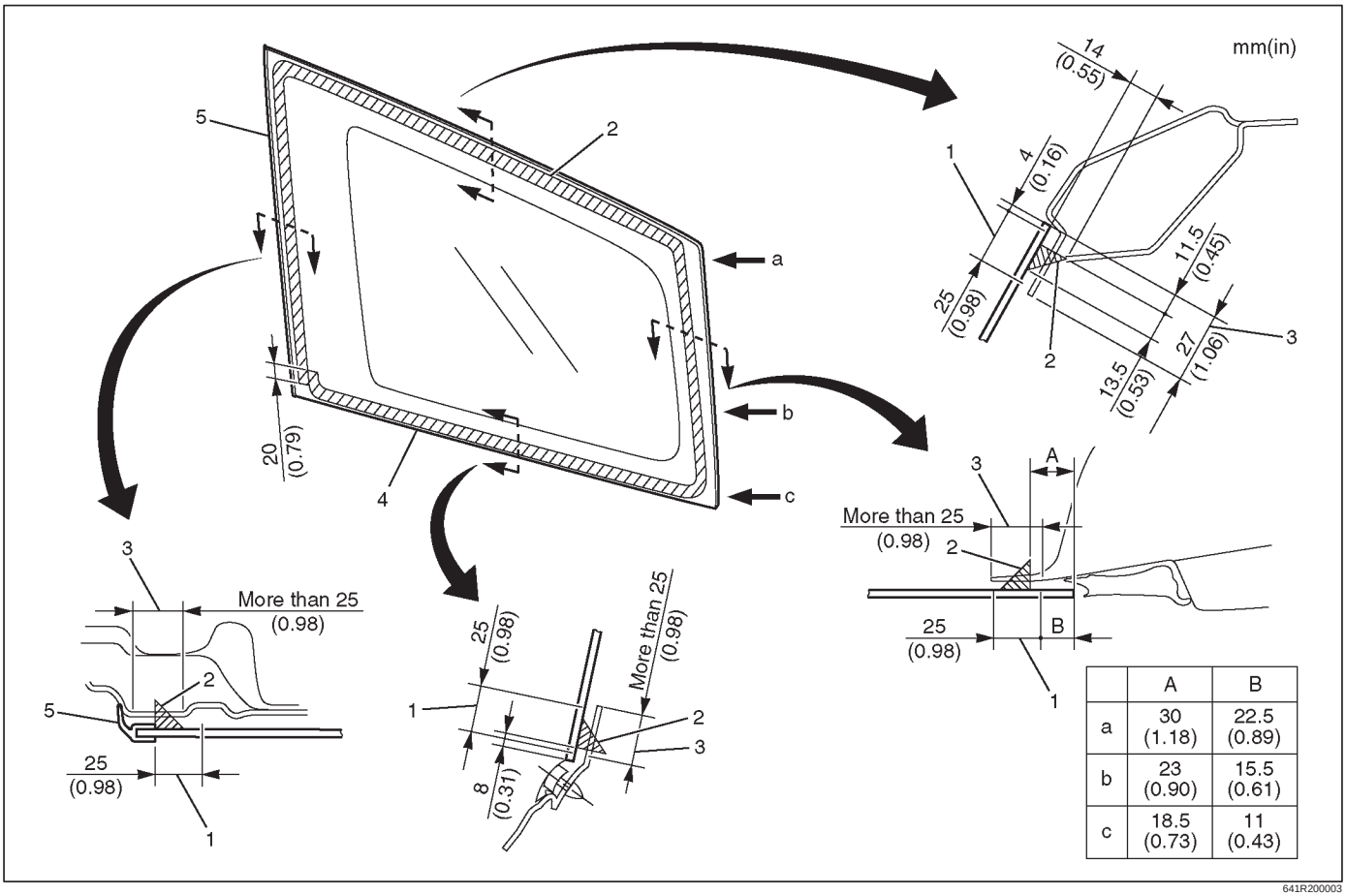
(1) Clip
(2) Rear Quarter Glass
(3) Adhesive
(4) Fastener Tape
(5) Spacer
(6) Rear Quarter Trim Covers
(7) Air Outlet Garnish Assembly
(8) Rear Quarter Moulding
(9) Moulding

Removal

1. Disconnect the battery ground cable.
2. Remove the rear quarter trim covers.
   ▼Refer to *Interior Trim Panels in Exterior/Interior Trim section.*
3. Remove the air outlet garnish assembly.
   ▼Pry the two clip positions free from the body panel.
4. Remove the rear quarter moulding.
   ▼Pry the five clip positions free from the body panel.
5. Remove the rear quarter glass.
   ▼Refer to *Windshield in this section.*

Installation

To install, follow the removal steps in the reverse order, noting the following points:



	A	B
a	30 (1.18)	22.5 (0.89)
b	23 (0.90)	15.5 (0.61)
c	18.5 (0.73)	11 (0.43)

Legend

(1) Primer Coating Area (Glass side)
(2) Adhesive
(3) Primer Coating Area (Body panel side)
(4) Rear Quarter Glass
(5) Moulding

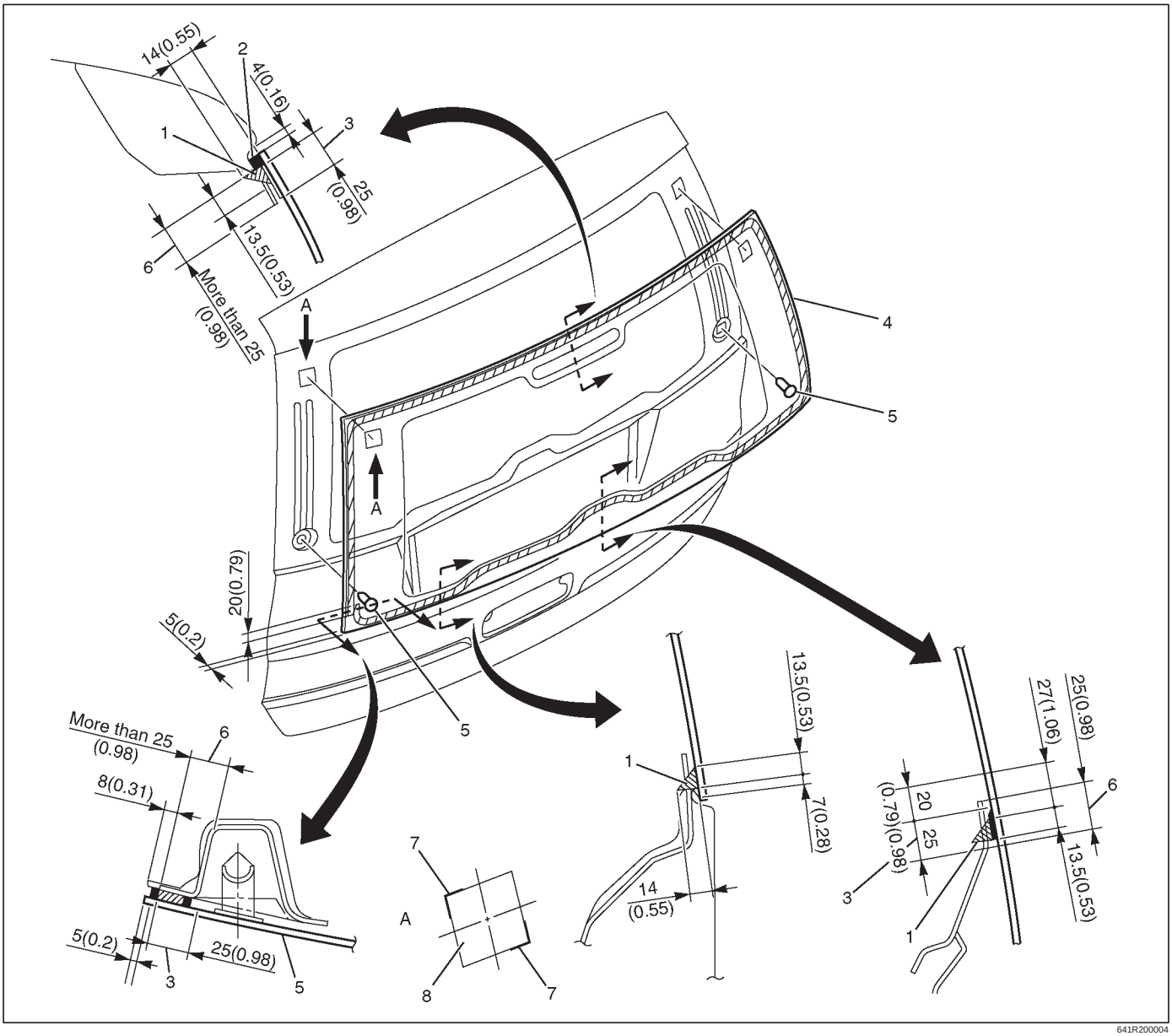
1. Clean the bonding surfaces of both the window glass and body panel with a soft rag and white gasoline.
2. Apply the primer to the window glass and body panel.
   - ▼Apply the primer (Sun star # 435-40 or equivalent) to the window glass side bonding surface as shown in the figure.
   - ▼Apply the primer (Sun star # 435-95 or equivalent) to the body side bonding surface.
3. Apply sealing adhesive to the window glass.
   - ▼Make sure that the primer has dried completely.
   - ▼Apply sealing adhesive (SunStar 555 or the equivalent) to the circumference of the window glass. There should be a 20 mm (0.79 in) overlap at the lower front corner of the glass.
4. Attach the fastener tape and spacers to the points shown in the illustration.
5. Attach the glass clips to the panel. Press the glass into the panel until it adheres to the panel.

NOTE: Immediately wipe away any excess sealing adhesive oozing from the panel and glass.

6. Allow the assembly to dry for 24 hours (20~30˚C).
7. Check to make sure that there is no water leakage from the rear quarter glass.

Tailgate Glass

Parts Location



Legend

(1) Adhesive
(2) Sealing Dam
(3) Primer Coating Area (Glass Side)
(4) Tailgate Glass
(5) Clip
(6) Primer Coating Area (Body Panel Side)
(7) Mark Stamping Location
(8) Fastner

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim covers.
   ▼Refer to *Tail Gate in Body Structure section.*
3. Remove the rear wiper arm.
   ▼Refer to *Rear Wiper Arm/Blade in Wiper/Washer System section.*
4. Remove the license plate garnish.
   ▼Refer to *Tailgate in this section.*
5. Disconnect the high mount stoplight and rear defogger harness connector.
6. Remove the high mount stoplight.

7. Remove the tailgate glass assembly.

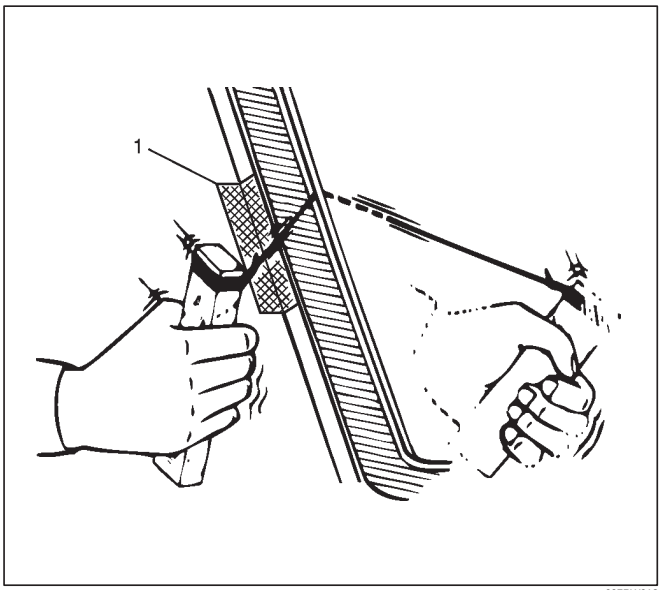
▼Use a knife to cut through part of the adhesive caulking material. Secure one end of a piece of steel piano wire (0.02 inches in diameter) to a piece of wood that can serve as a handle.

▼Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the tailgate glass.

▼Secure the other end of the piano wire to another piece of wood.

▼With the aid of an assistant, carefully move the piano wire with a sawing motion to cut through the adhesive caulking material around the entire circumference of the tailgate glass.

▼Attach some cloth tape (1) on the body for protecting the painting surface.



607RW012

▼Clean the remaining adhesive caulking material from the area of the body which holds the tailgateglass.

Installation

To install, follow the removal steps in reverse order, noting the following points:

1. Clean the bonding surfaces of both the tailgate glass and tailgate with a soft rag and white gasoline.
2. Apply the primer to the tailgate glass and tailgate.

▼Apply the primer (Sun star # 435-40 or equivalent) to the tailgate side bonding surface.

▼Apply the primer (Sun star # 435-95 or equivalent) to the tailgate side bonding surface.

NOTE: Apply an adhesive 3 minutes or more but with in 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

Primer should be handled as following:

1. Use the primer manufactured 3 months or less ago having been kept in an refrigerator.
2. Wipe off primer-stains on positions other than require application.
3. Stir the primer for a minute or more before use.

3. Apply the adhesive to the tailgate glass.

▼After drying primer completely, apply a sealing adhesive (Sun star # 555 or equivalent) along the edge of the glass so that the sealing adhesive has a 20 mm (0.79 in) junction at middle of the base of the glass.

NOTE: Adhesive an adhesive 3 minutes or more but with in 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

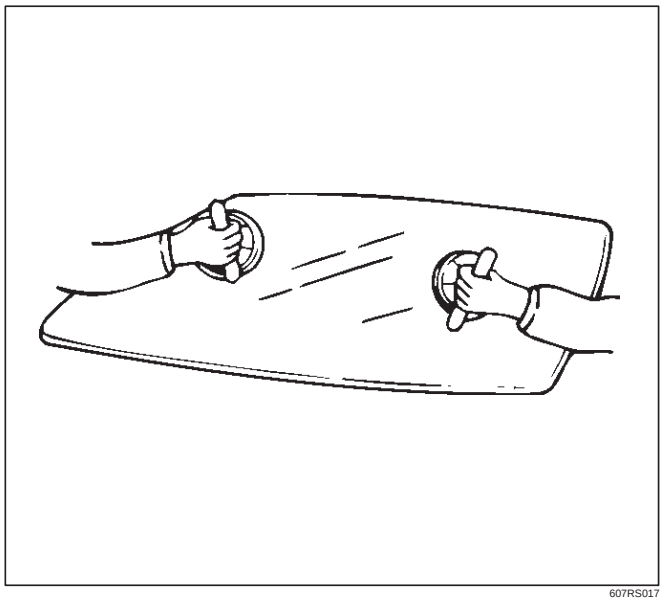
Primer should be handled as follows:

1. Use the adhesive manufactured 3 months or less ago.
2. Wipe off adhesive-stains on positions other than requires application.

4. Install the tailgate glass.

▼Set the window (adhesive applied) to the tailgate window frame. Carefully align the clips (bottom corners) and fasteners (top corners).

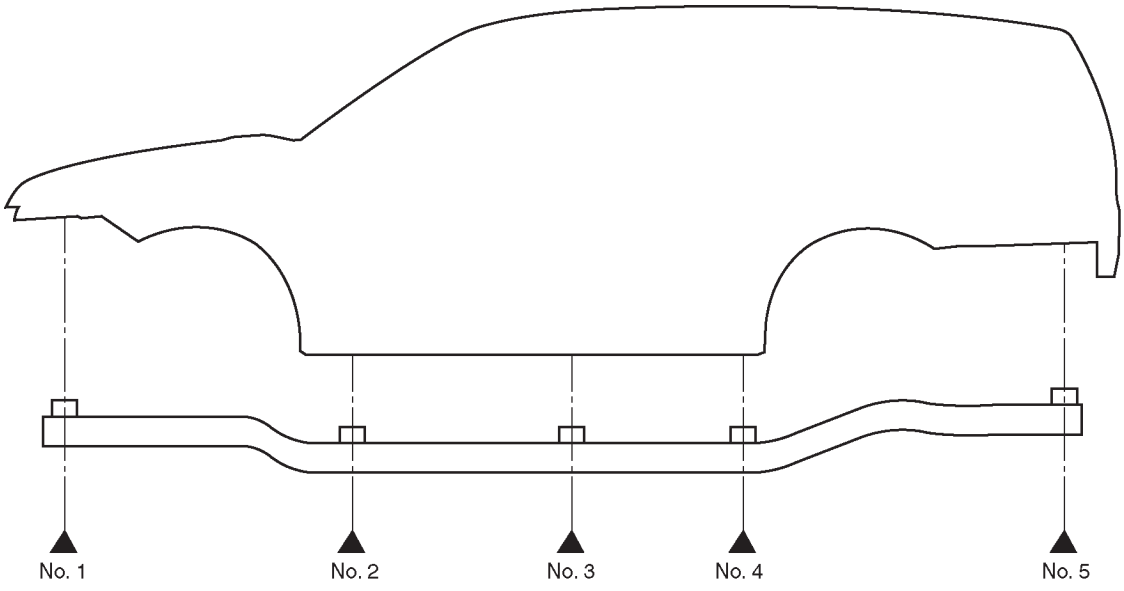
NOTE: Affix the glass within 5 minutes of application.


607RS017

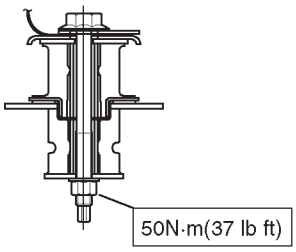
5. Install tailgate wiper arm.

Main Data and Specifications

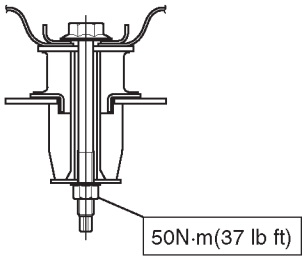
Torque Specification



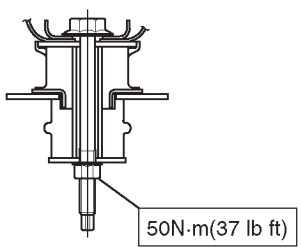
No. 1



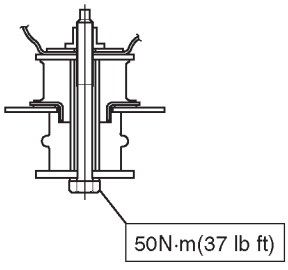
No. 2



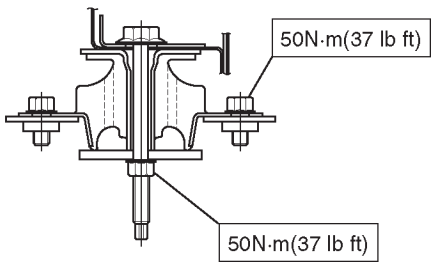
No. 3



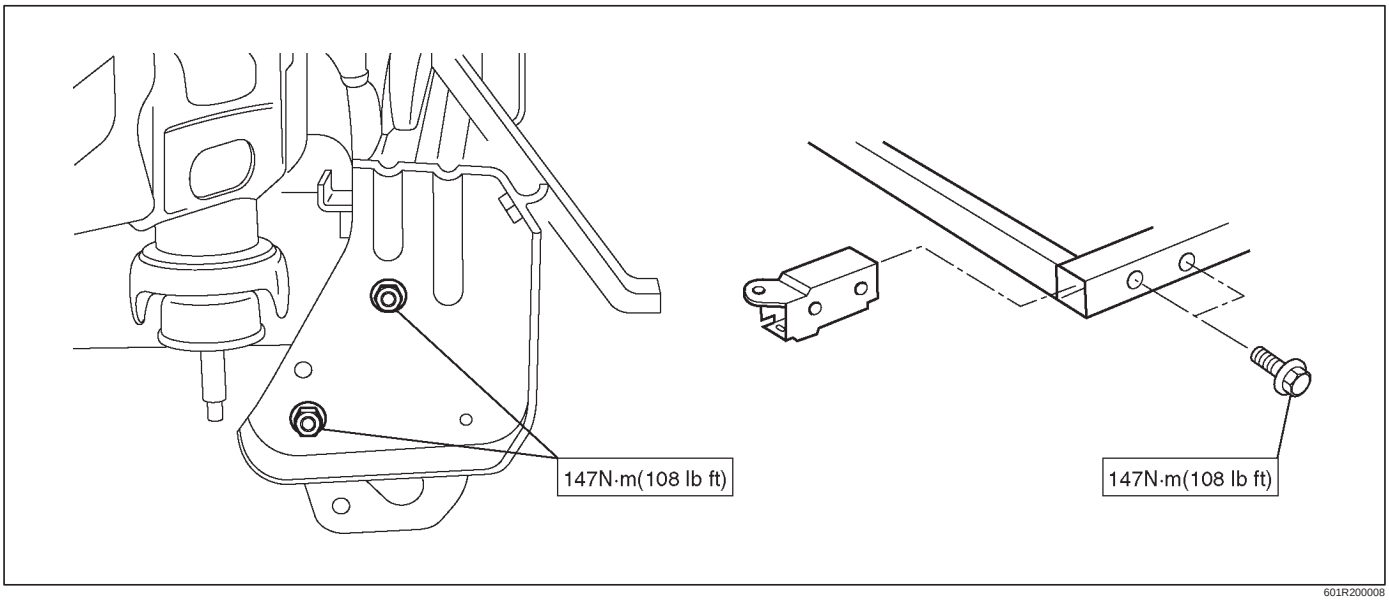
No. 4



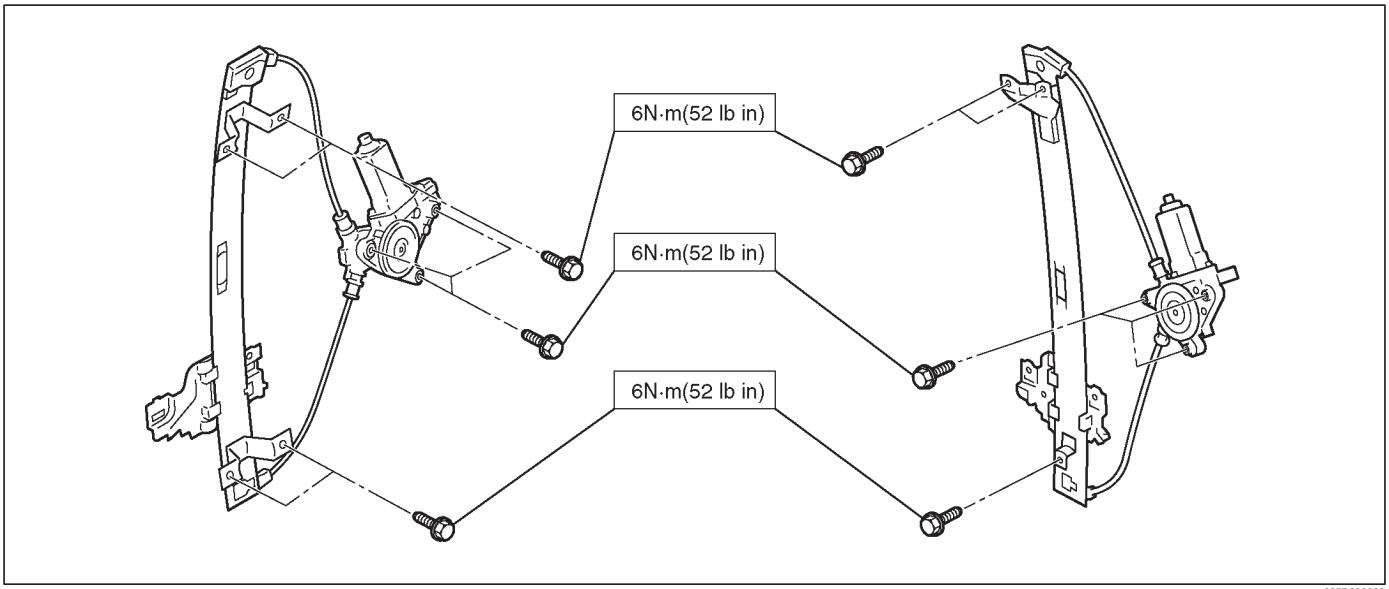
No. 5



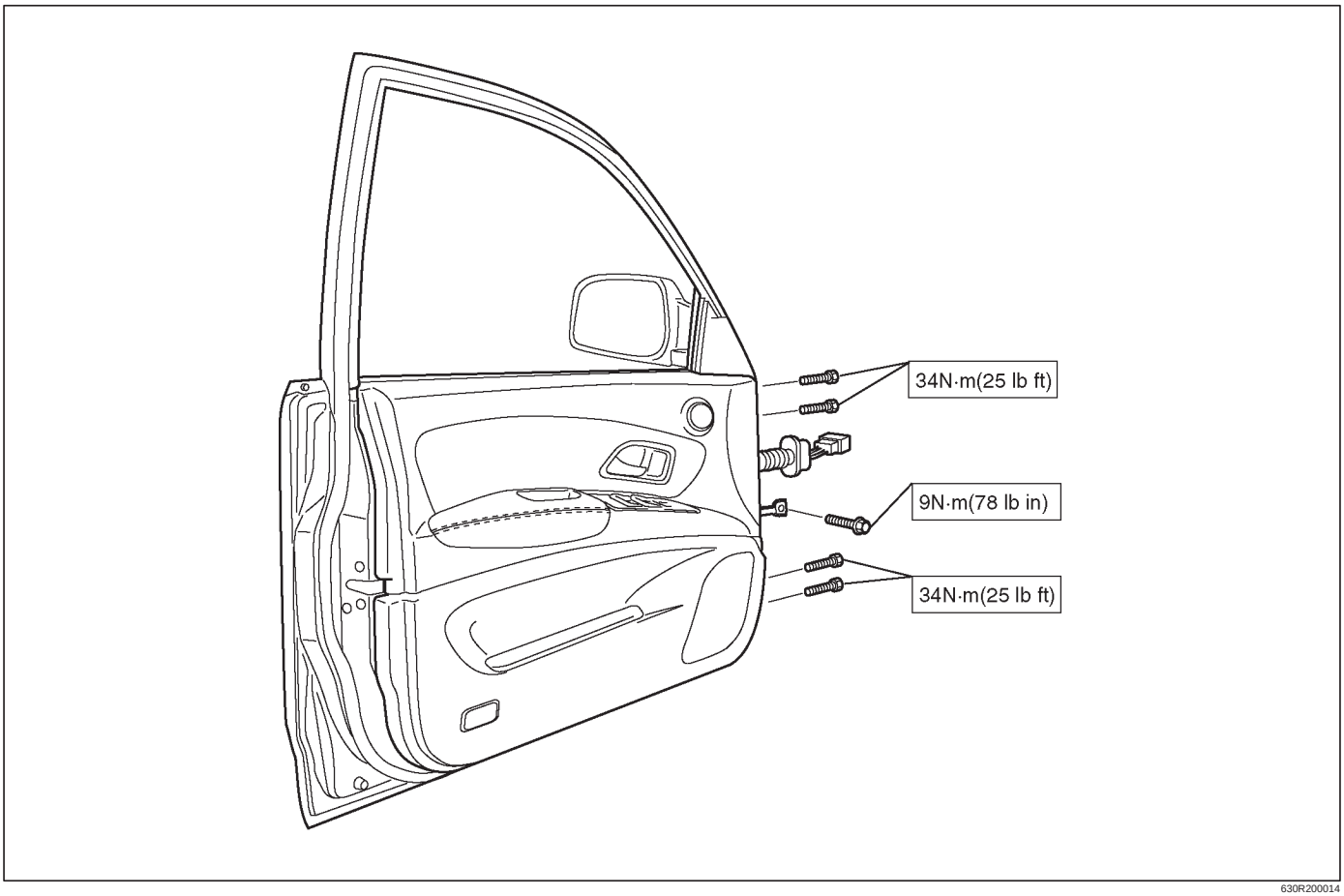
501R200003



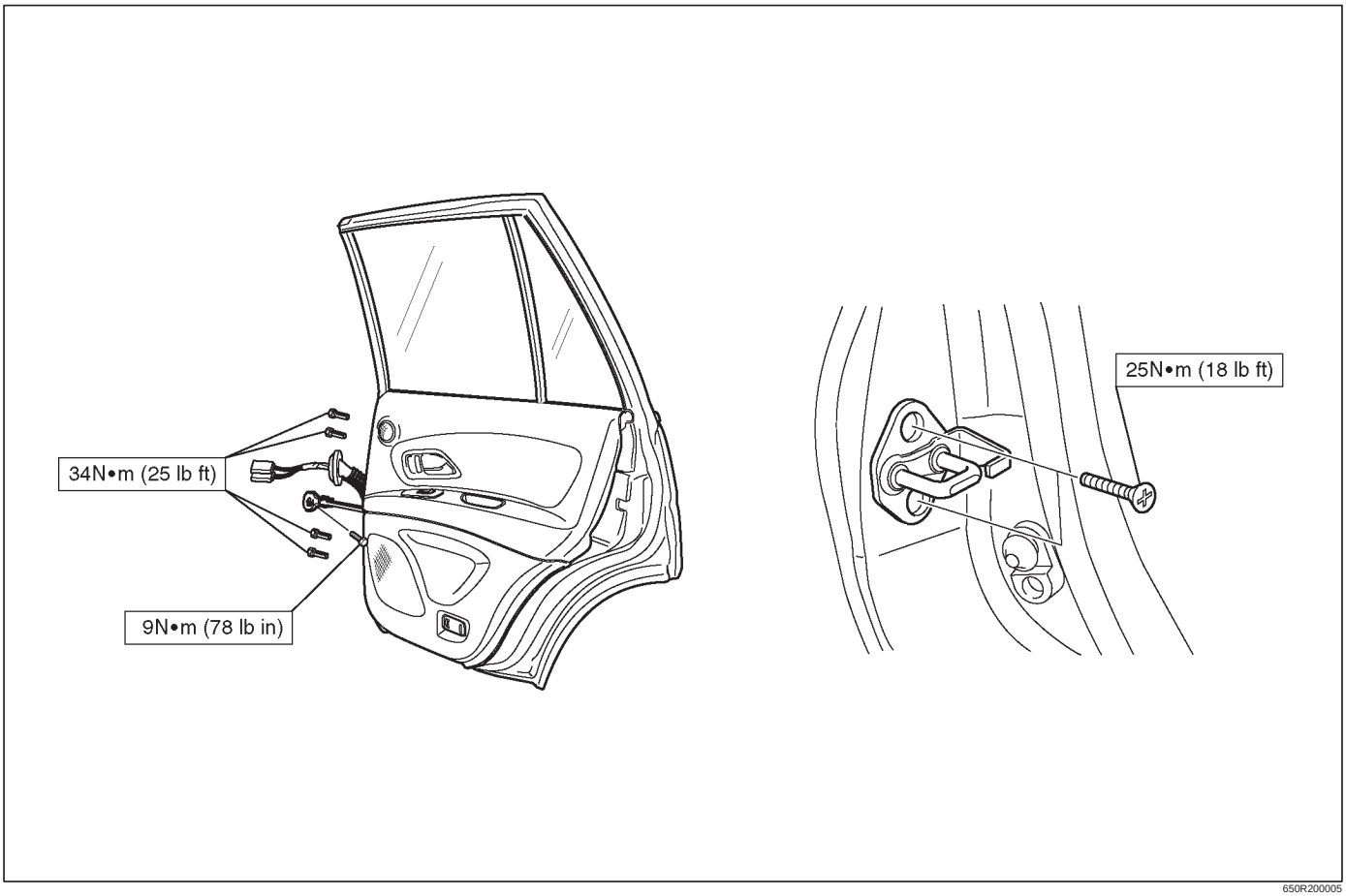
601R200008



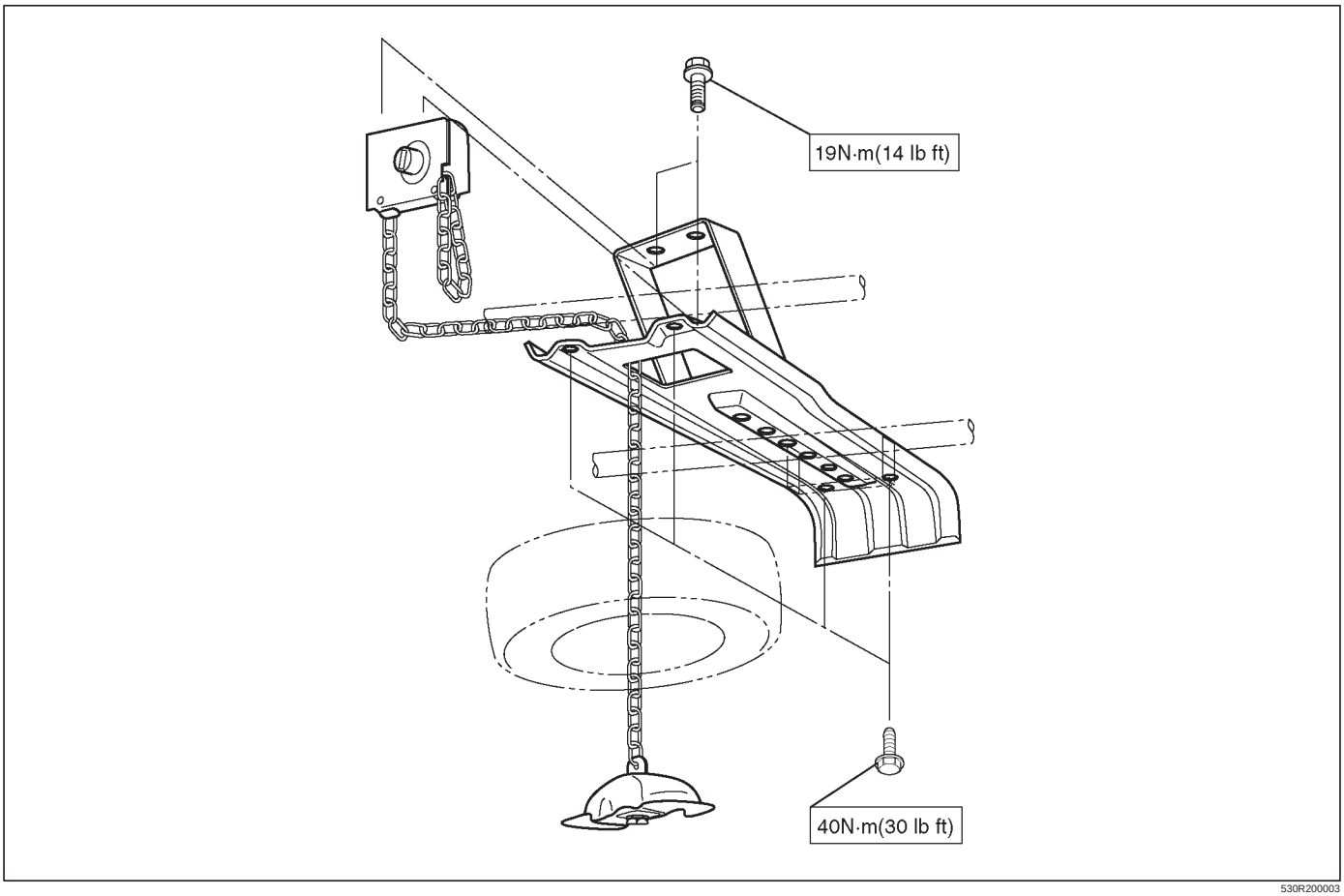
635R200009



630R200014



650R200005



530R200003

AXIOM

BODY AND ACCESSORIES

SEATS

CONTENTS

Service Precaution 8G–1
Front Seat Assembly 8G–2
Front Seat Assembly and Associated Parts 8G–2
Removal 8G–2
Installation 8G–3
Power Seat Assembly 8G–4
Power Seat Assembly and Associated Parts 8G–4
Removal 8G–5
Installation 8G–6
Rear Seat Assembly 8G–7
Rear Seat Cushion Assembly and Associated Parts 8G–7
Removal 8G–8
Installation 8G–8
Rear Seat Back Assembly and Associated Parts 8G–9
Removal 8G–9
Installation 8G–10
Main Data and Specifications 8G–11

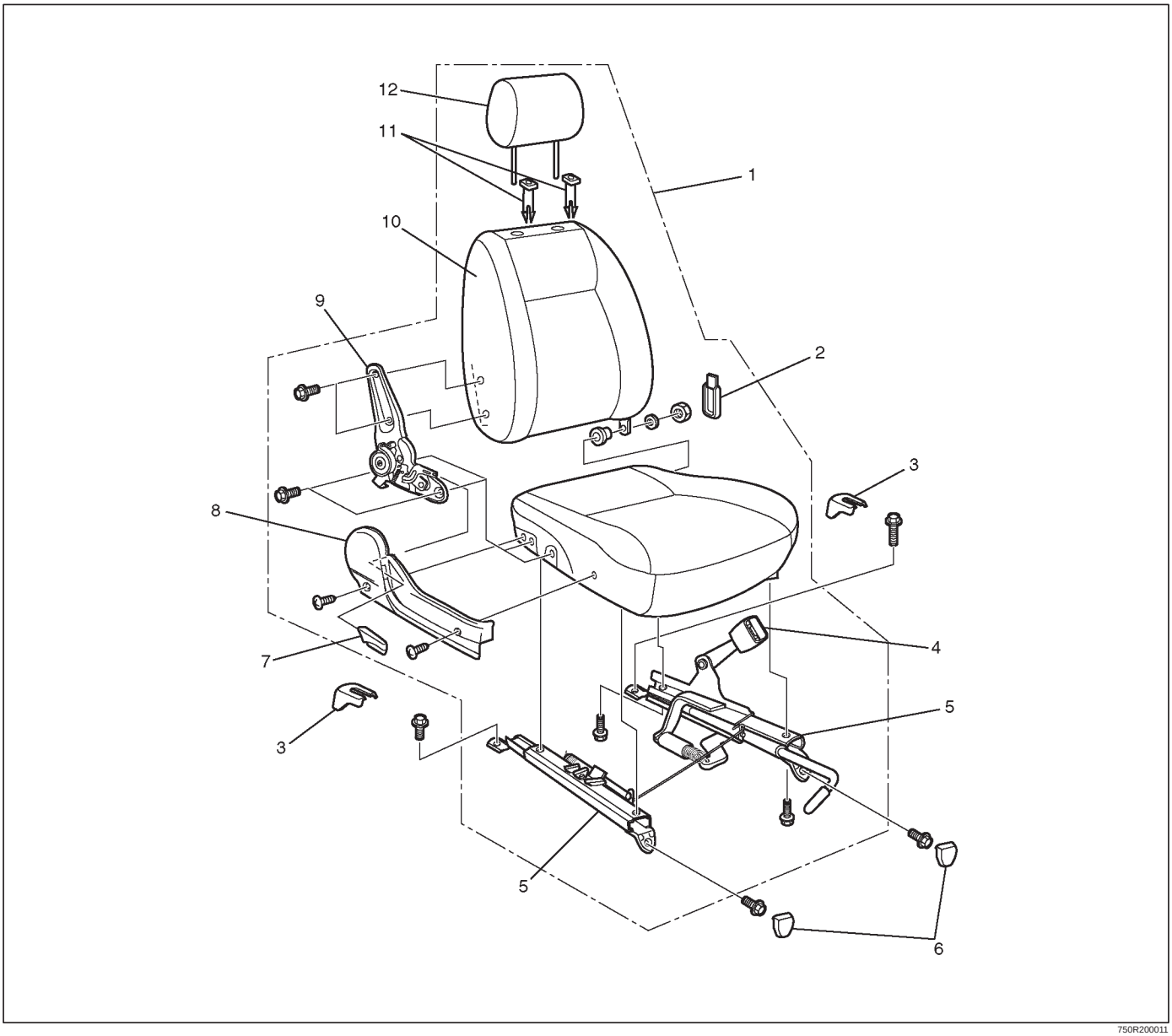
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Seat Assembly

Front Seat Assembly and Associated Parts



750R200011

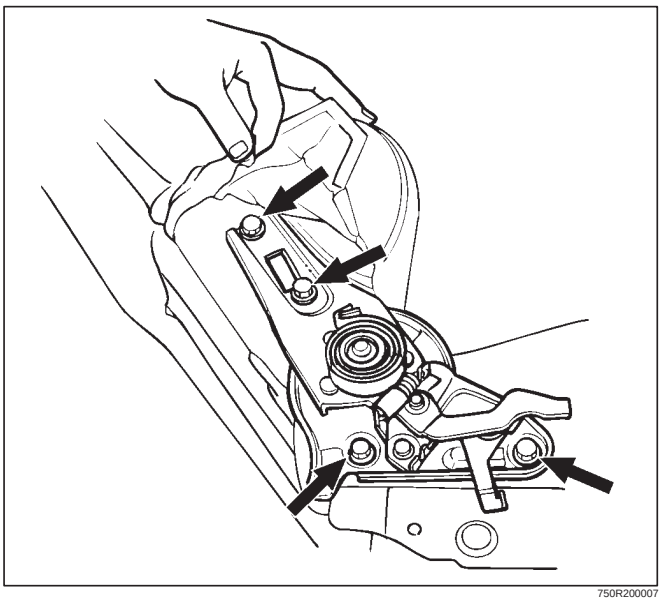
Legend

(1) Front Seat Assembly (Passenger's Seat Only)
(2) Hinge Cover
(3) Rear Cover
(4) Front Seat Belt Buckle Assembly
(5) Seat Adjuster
(6) Front Cover
(7) Reclining Knob
(8) Side Cover
(9) Reclining Device
(10) Seat Back Assembly
(11) Guide Holder
(12) Headrest

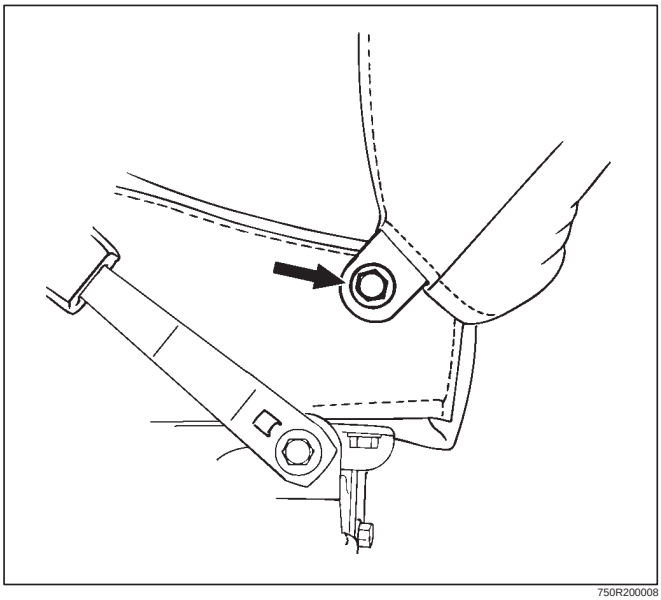
Removal

1. Disconnect the battery ground cable.
2. Remove the front and rear covers.
3. Remove the front seat assembly.
   ▼Remove the four fixing bolts.

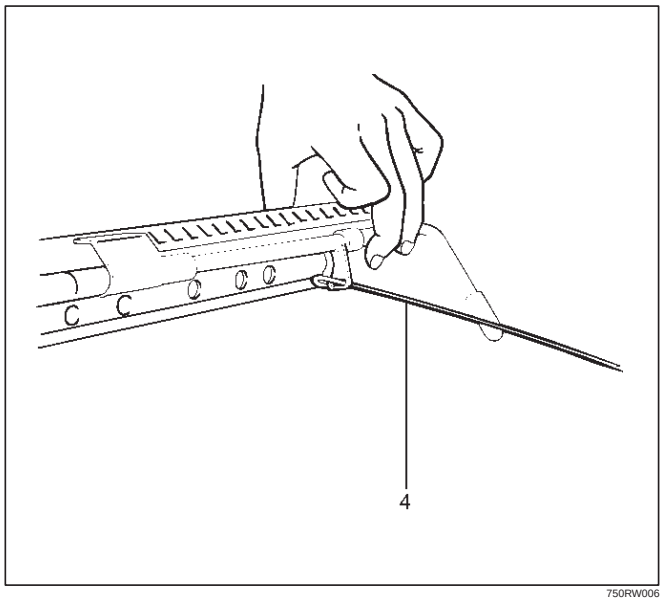
4. Pull out the reclining knob.
5. Remove the side cover.
   ▼Remove the two screws.
6. Remove the headrest.
7. Remove the reclining device.
   ▼Pull up on the seat back trim cover in order to remove the reclining device fixing bolts.


750R200007

8. Remove the seat back assembly.
   ▼Remove the seat back assembly fixing nut on the opposite side of the reclining device.


750R200008

9. Remove the trim cover (Seat back side).
10. Remove the guide holder.
    ▼Pull the guide holder out by holding the bottom end of it from the seat back assembly.
11. Remove the seat adjuster.
    ▼Disconnect the release wire (4) and remove the fixing bolts.



750RW006

12. Remove the seat belt buckle assembly.
13. Remove the trim cover (Seat cushion side).

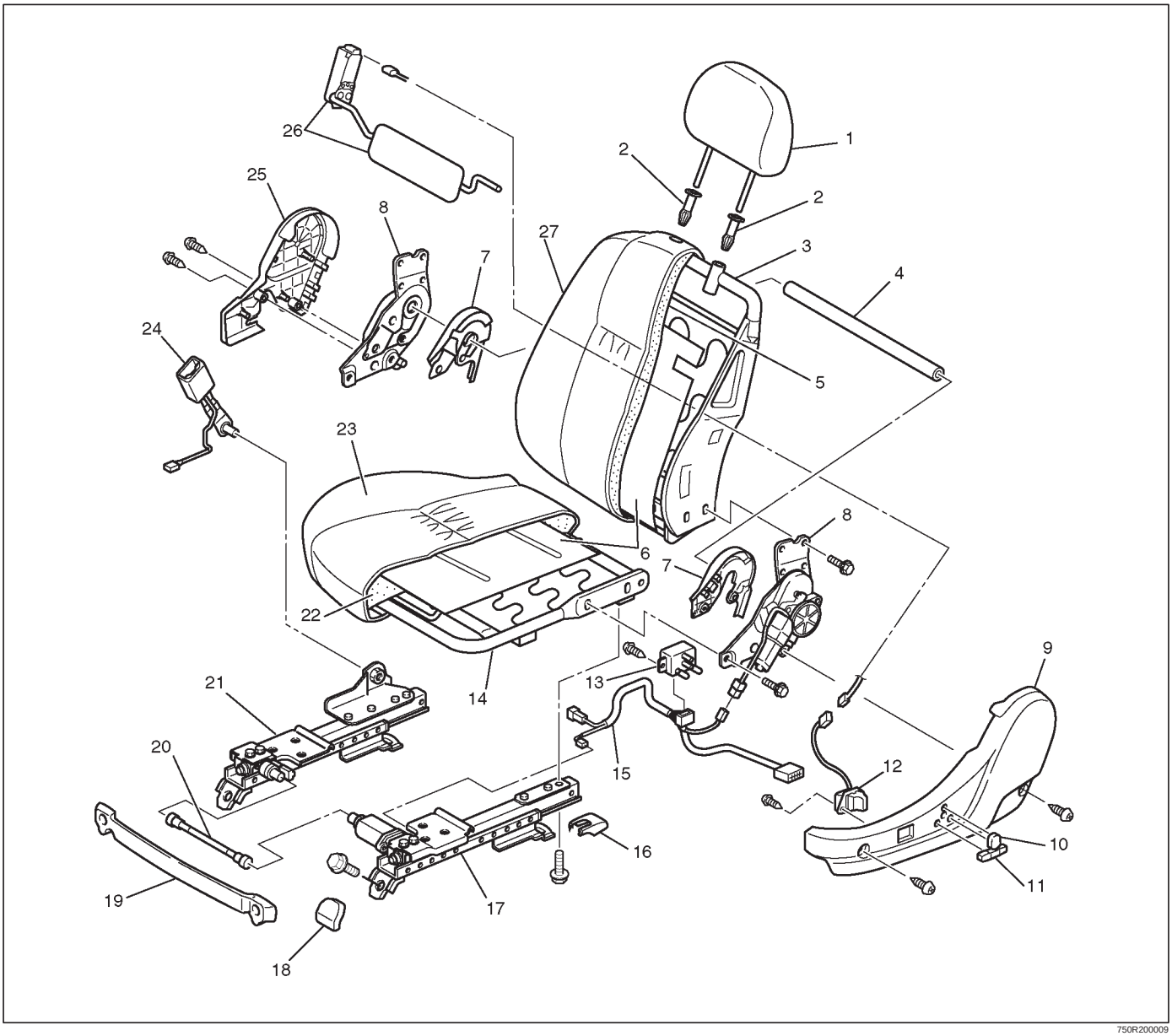
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the reclining device fixing bolts to the specified torque.
   Torque: 46 N·m (34 lb ft)
2. Tighten the front seat assembly fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)

Power Seat Assembly

Power Seat Assembly and Associated Parts



750R200009

Legend

(1) Headrest
(2) Guide Holder
(3) Seat Back Frame Assembly
(4) Connecting Pipe
(5) Seat Back Pad
(6) Seat Heater (Required Option)
(7) Reclining Device Cover
(8) Reclining Device
(9) Outer Side Cover
(10) Reclining Switch Knob
(11) Slide Switch Knob
(12) Power Lumbar Switch (Driver's Side)
(13) Power Seat Switch
(14) Seat Cushion Frame Assembly
(15) Power Seat Harness
(16) Adjuster Bracket Rear Cover
(17) Outer Seat Adjuster Assembly
(18) Adjuster Bracket Front Cover
(19) Front Cover
(20) Sliding Motor Cable
(21) Inner Seat Adjuster Assembly
(22) Seat Cushion Pad
(23) Seat Cushion Assembly/Seat Cushion Trim Cover
(24) Seat Belt Buckle Assembly
(25) Inner Side Cover
(26) Power Lumbar Support Assembly (Driver's Side)
(27) Seat Back Assembly/Seat Back Trim Cover

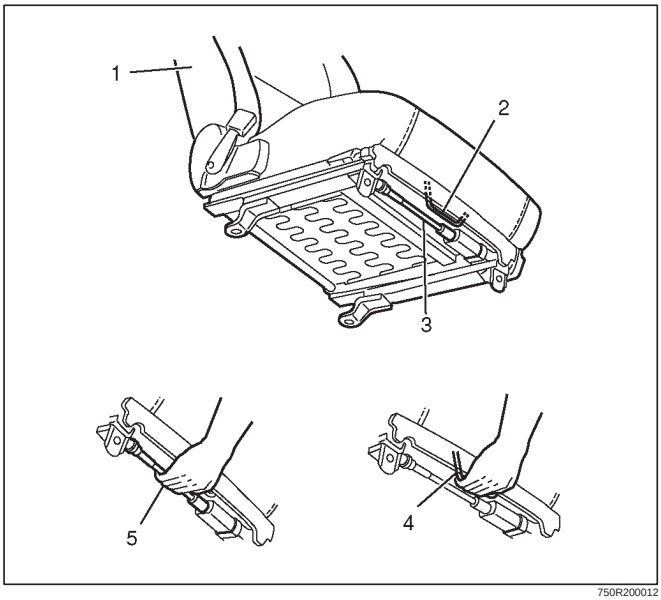
Removal

1. Remove the adjuster bracket rear cover and the fixing bolts on the rear side of the seat adjuster assembly.
   ▼Before removal, slide the power seat assembly forward.
2. Remove the adjuster bracket front cover and the fixing bolts on the front side of the seat adjuster assembly.
   ▼Before removal, slide the power seat assembly backward.
3. Disconnect the battery ground cable.
4. Remove the power seat assembly.
   ▼Disconnect the power seat harness connectors and the seat belt warning connector of the driver side.

CAUTION: When raising power seat assembly (1), use the handle (2) not the cable (3). A bent cable causes noise to occur during power seat operation.

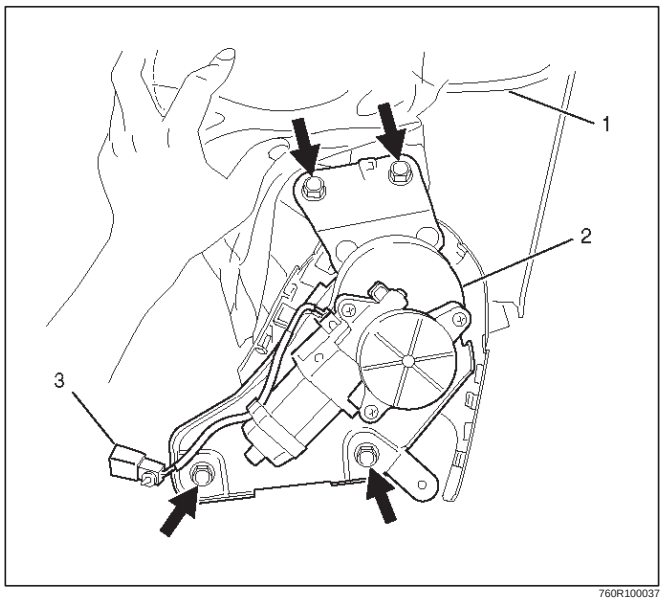
▼Please grip the handle (4).

▼Don't grip the cable (5).



750R200012

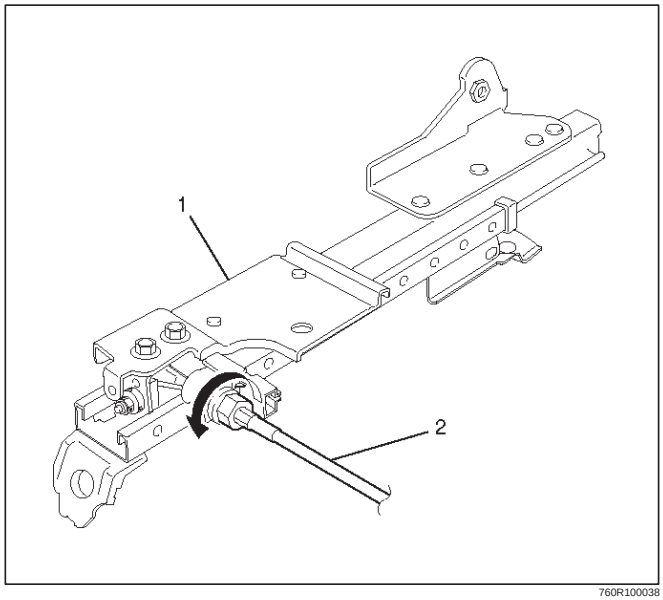
5. Pull the switch knobs out.
6. Remove the outer side cover.
   ▼Remove the two fixing screws and disconnect the power seat switch connector.
7. Remove the power seat switch.
   ▼Remove the two fixing screws.
8. Remove the power lumber switch.
   ▼Remove the two fixing screws and connectors.
9. Remove the inner side cover.
10. Remove the headrest.
11. Remove the reclining device (2).
    ▼Flip up the seat back trim cover (1) in order to remove the reclining device fixing bolts.
    ▼Disconnect the reclining motor harness connector (3).



760R100037

12. Remove the reclining device covers.
13. Remove the trim cover and pad (Seat back side).
14. Remove the seat heater and connector (seat back side).
15. Remove the power lumbar support assembly.
16. Remove the guide holder.
    ▼Pull the guide holder out by holding the bottom end of it from the seat back assembly.
17. Remove the seat adjuster assembly.
    ▼Remove the four fixing bolts and disconnect the sliding motor connector.
18. Remove the sliding motor cable (2).
    ▼Remove the nuts of each side.

CAUTION: Be sure to maintain the same position for both outer and inner seat adjust assembly (1).



760R100038

19. Remove the seat belt buckle assembly.
20. Remove the trim cover and pad (Seat cushion side)
21. Remove the seat heater and connector (Seat cushion side).
22. Remove the power seat harness.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the reclining device fixing bolts to the specified torque.

   Torque: 46 N·m (34 lb ft)

2. Tighten the seat adjuster fixing bolts to the specified torque.

   Torque: 21 N·m (15 lb ft) to seat cushion

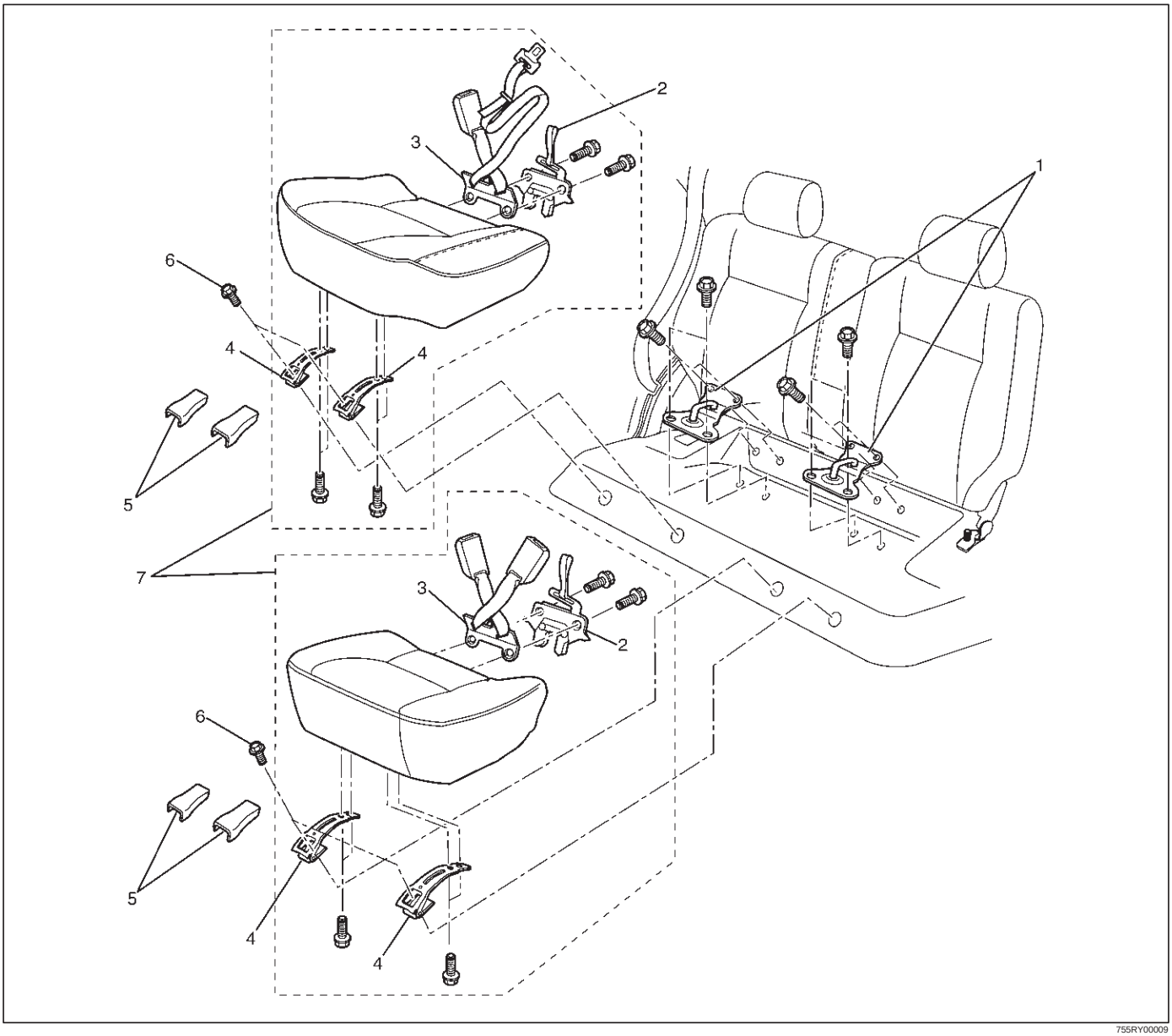
   Torque: 39 N·m (29 lb ft) to body

3. Tighten the seat belt buckle assembly fixing bolts to the specified torque.

   Torque: 29 N·m (22 lb ft)

Rear Seat Assembly

Rear Seat Cushion Assembly and Associated Parts



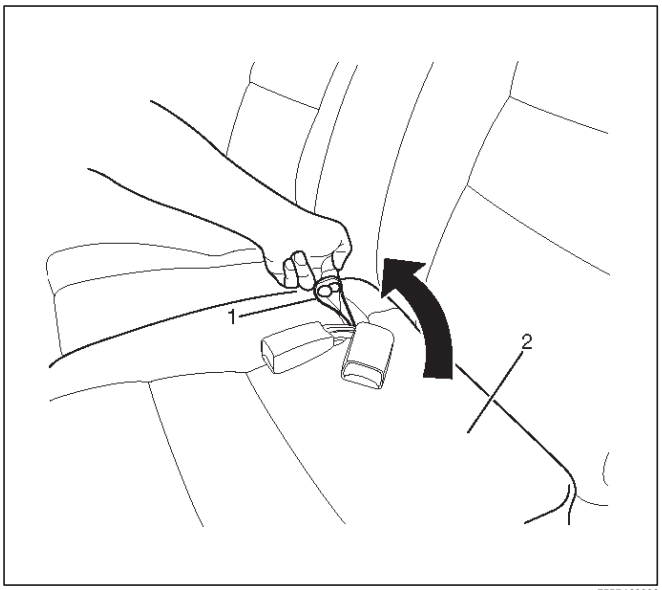
755RY00009

Legend

(1) Rear Seat Lock Striker
(2) Rear Seat Lock Assembly
(3) Rear Seat Belt Buckle Assembly
(4) Seat Cushion Hinge
(5) Hinge Cover
(6) Seat Cushion Fixing Bolt
(7) Rear Seat Cushion Assembly

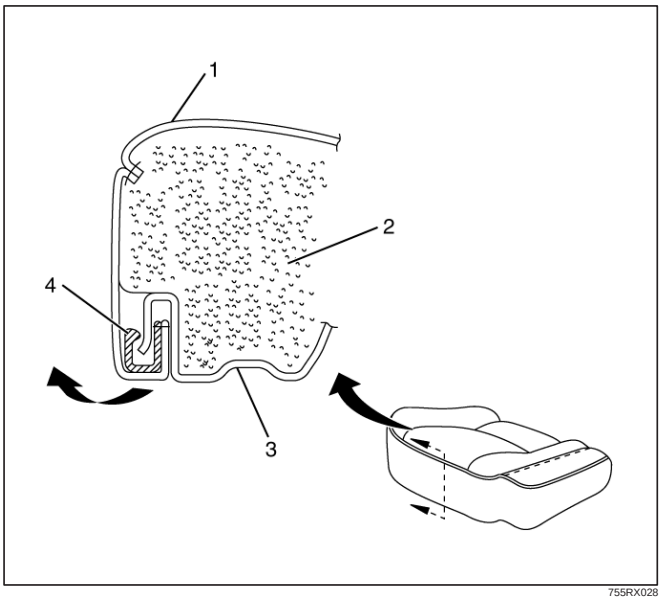
Removal

1. Remove the hinge covers.
2. Remove the seat cushion fixing bolts.
3. Remove the seat cushion assembly (2).
   ▼Pull the strap (1) of the rear seat lock assembly to release the seat lock.



755R100006

4. Remove the seat cushion hinges.
5. Remove the rear cushion trim cover (1) and rear seat cushion pad (2).
   ▼Remove cushion trim cover from the rear cushion frame (3) by prying on the plastic retainers (4).



755RX028

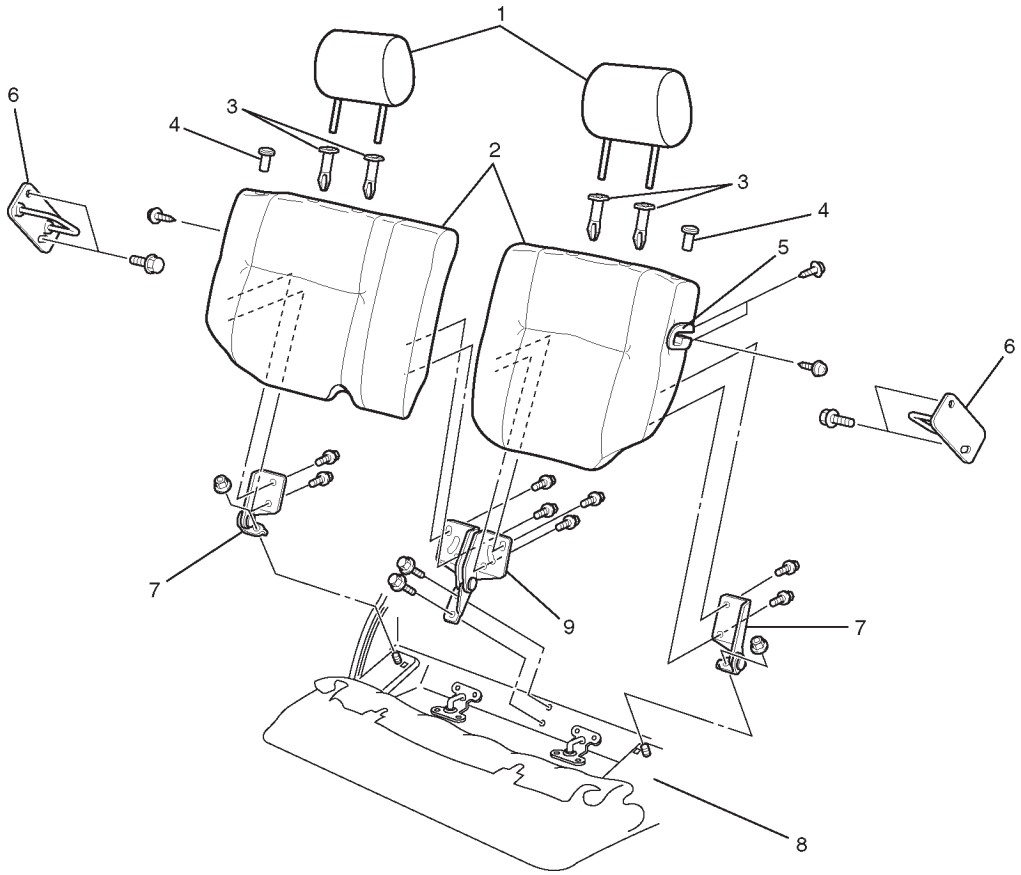
6. Remove the rear seat lock assembly and rear seat belt buckle assembly.
7. Remove the rear seat lock strikers.
   ▼Remove the four bolts at each striker.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the rear seat lock assembly and rear seat belt buckle assembly fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)
2. Tighten the rear seat lock striker fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)
3. Tighten the seat cushion hinge fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)

Rear Seat Back Assembly and Associated Parts



755R200005

Legend

(1) Headrest
(2) Seat Back Assembly
(3) Guide Holder
(4) Release Knob
(5) Seat Lock Cover
(6) Seat Lock Striker
(7) Side Hinge
(8) Body Floor Panel
(9) Center Hinge

Removal

1. Pull the release knob and pull the seat back assembly forward.
2. Remove the seat lock covers.
   ▼Remove the three screws from each side.
3. Remove the luggage floor carpets.
   ▼Pull the nine carpet fixing clips from the backside of the seat back assembly.
4. Remove the seat back assembly.
   ▼Remove the four fixing bolts at each seat back.
5. Remove the headrests.
6. Remove the release knobs.
   ▼Turn the knob counterclockwise to remove it.
7. Remove the trim covers.
8. Remove the guide holders.
9. Remove the side hinges.
   ▼Remove the one fixing nut at each side hinge.

10. Remove the center hinge.
    ▼Remove the two fixing bolts.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the center hinge fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

2. Tighten the side hinge fixing nuts to the specified torque.

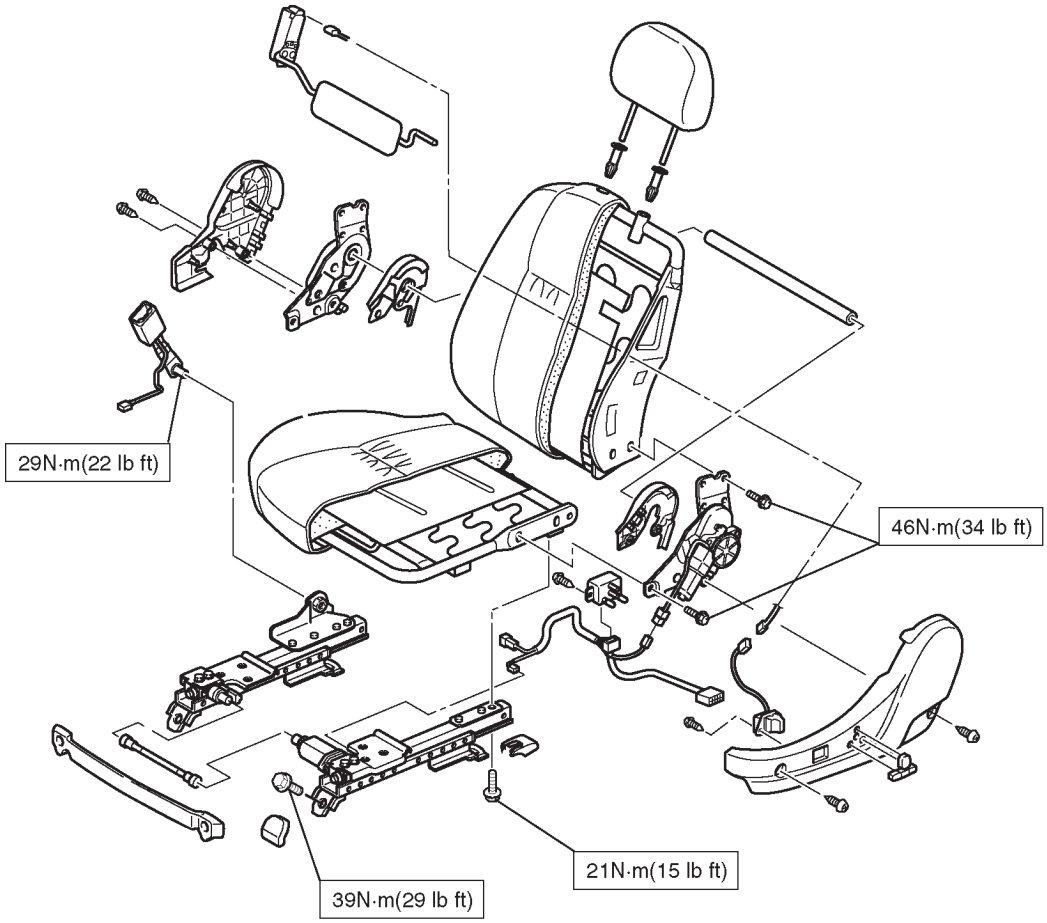
   Torque: 29 N·m (22 lb ft)

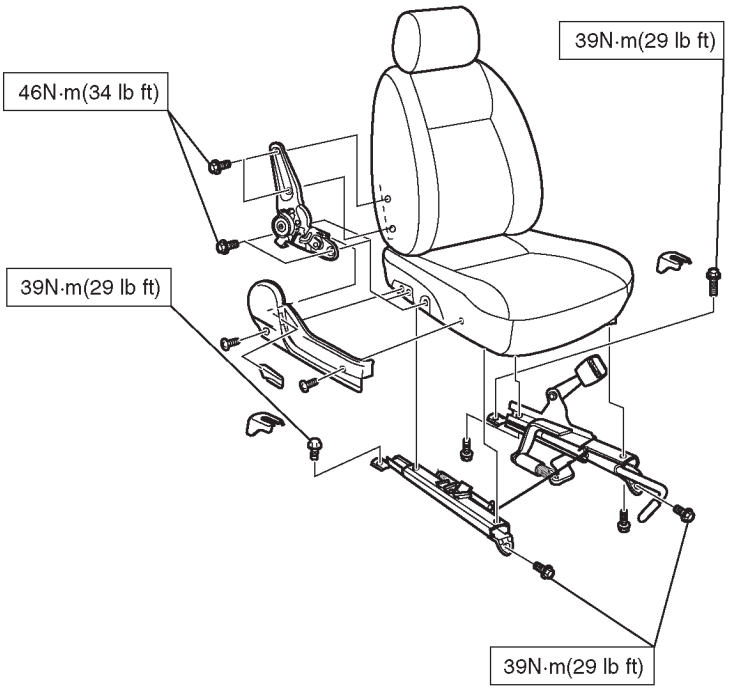
3. Tighten the side lock striker fixing bolts to the specified torque.

   Torque: 19 N·m (14 lb ft)

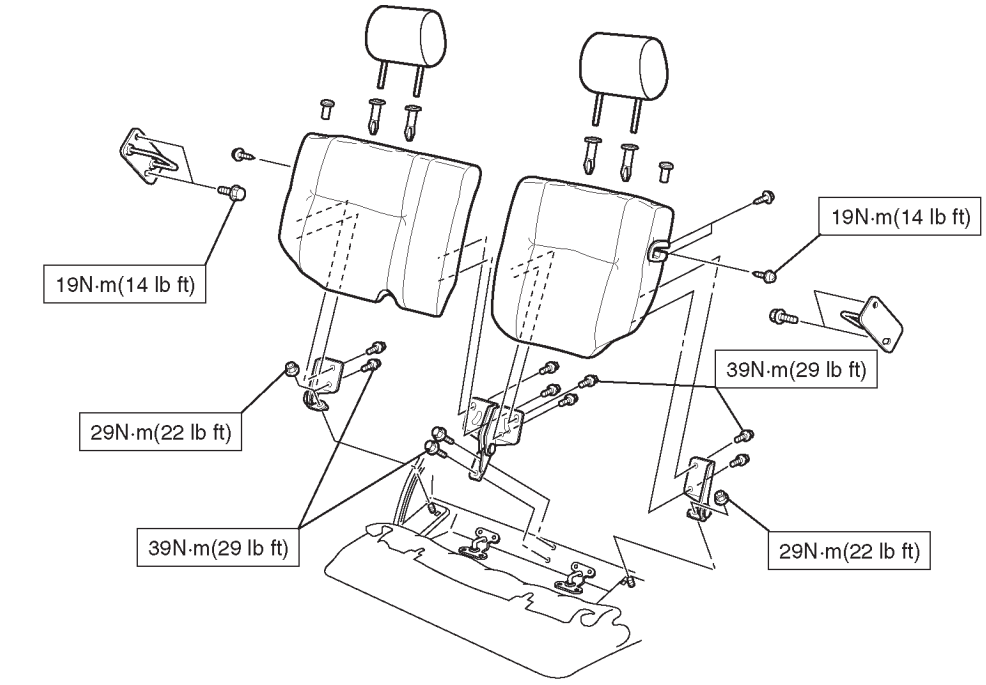
Main Data and Specifications

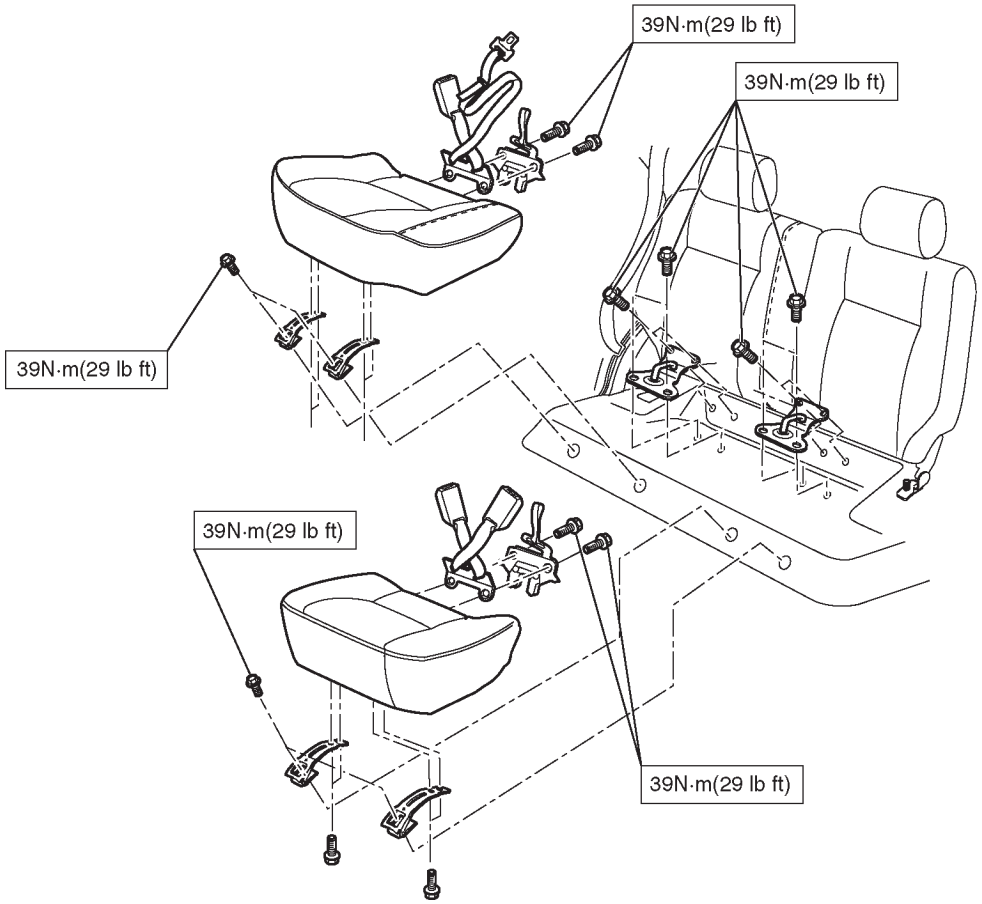
Torque Specifications





750R200010


19N·m(14 lb ft)
19N·m(14 lb ft)
39N·m(29 lb ft)
29N·m(22 lb ft)
39N·m(29 lb ft)
29N·m(22 lb ft)


39N·m(29 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)

755R200009

AXIOM

BODY AND ACCESSORIES

SECURITY AND LOCKS

CONTENTS

Service Precaution 8H–1
Front Door Lock Assembly 8H–2
Front Door Lock Assembly and Associated Parts 8H–2
Removal 8H–2
Installation 8H–4
Front Outside Handle 8H–5
Front Outside Handle and Associated Parts 8H–5
Removal 8H–5
Installation 8H–5
Rear Door Lock Assembly 8H–6
Rear Door Lock Assembly and Associated Parts 8H–6
Removal 8H–6
Installation 8H–8
Rear Outside Handle 8H–9
Rear Outside Handle and Associated Parts 8H–9
Removal 8H–9
Installation 8H–9
Tailgate Lock and Outside Handle 8H–10
Tailgate Lock, Outside Handle and Associated Parts 8H–10
Removal 8H–10
Installation 8H–11
Key 8H–12
Key Coding 8H–12
Key Styles 8H–12
Power Door Lock System 8H–13
General Description 8H–13
Door Lock Key Switch 8H–13
Front Door Lock Actuator 8H–13
Rear Door Lock Actuator 8H–13
Tailgate Lock Actuator 8H–13
Anti-Theft System 8H–14
General Description 8H–14
Anti–Theft & Keyless Entry Controller 8H–14
Anti–Theft Indicator 8H–14
Anti–Theft Horn 8H–14
Engine Hood Switch 8H–15
Anti–theft & Keyless Entry Control Unit/Transmitter Replacement 8H–15
Keyless Entry System 8H–16
ID Code Registration 8H–16
Main Data and Specifications 8H–19

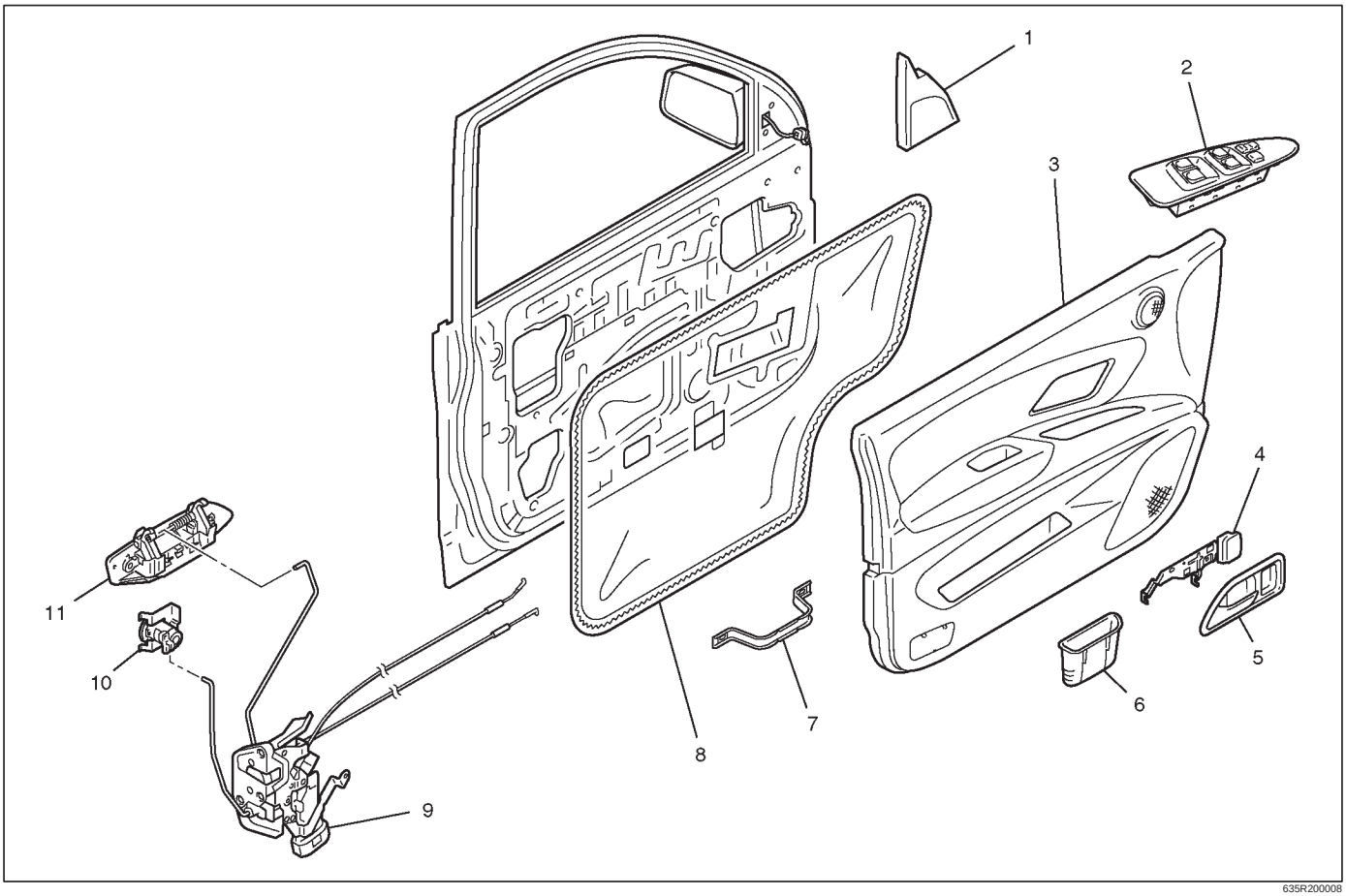
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Door Lock Assembly

Front Door Lock Assembly and Associated Parts



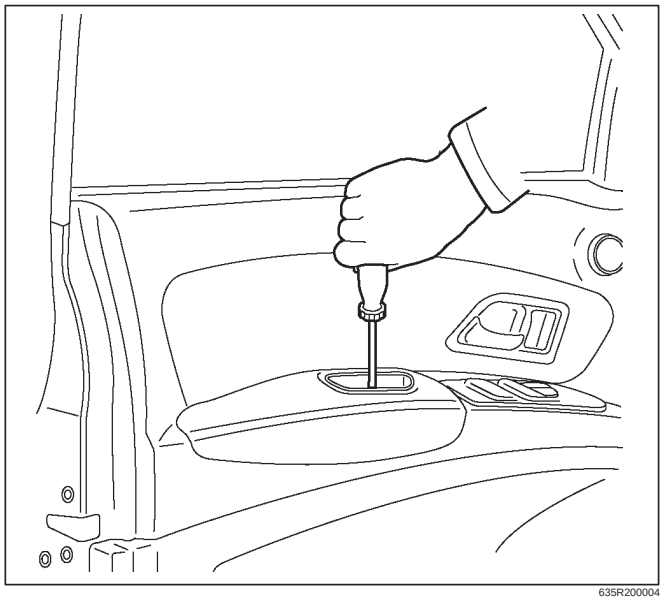
635R200008

Legend

(1) Door Mirror Cover
(2) Power Window Switch
(3) Door Trim Panel
(4) Inside Lock Bracket
(5) Inside Handle
(6) Pull Box
(7) Pull Box Bracket
(8) Waterproof Sheet
(9) Door Lock Assembly
(10) Door Lock Cylinder
(11) Outside Handle

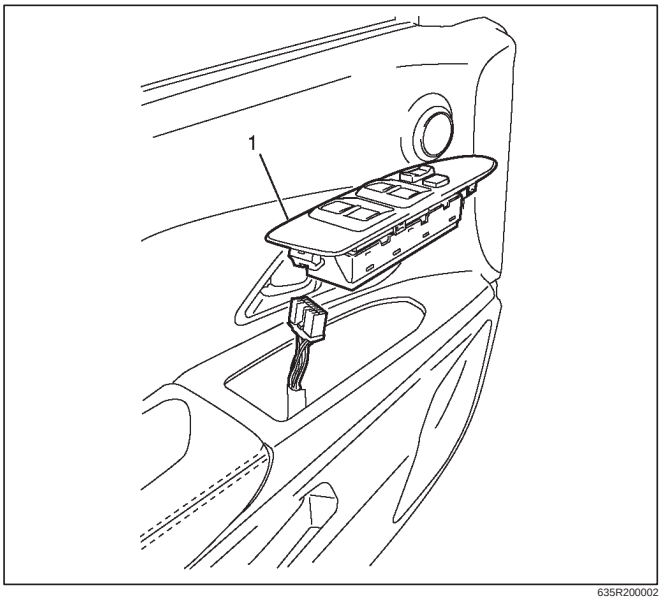
Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the one fixing screw.



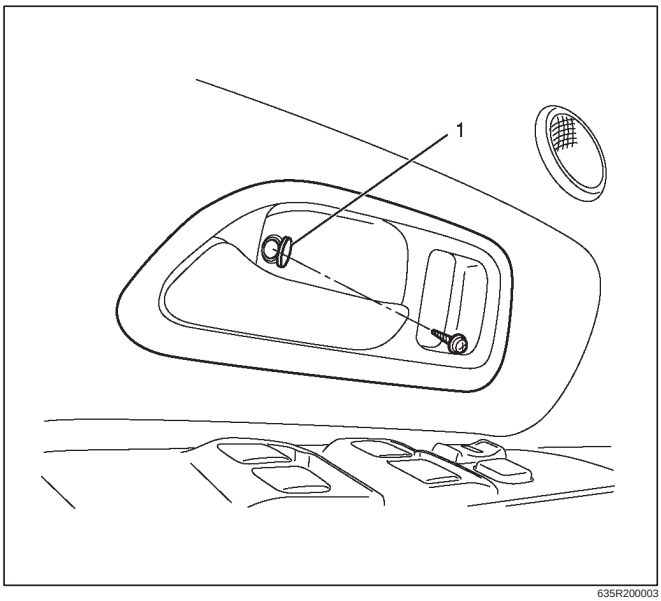
635R200004

3. Remove the power window switch (1).
   ▼Pry the power window switch and remove the connector.



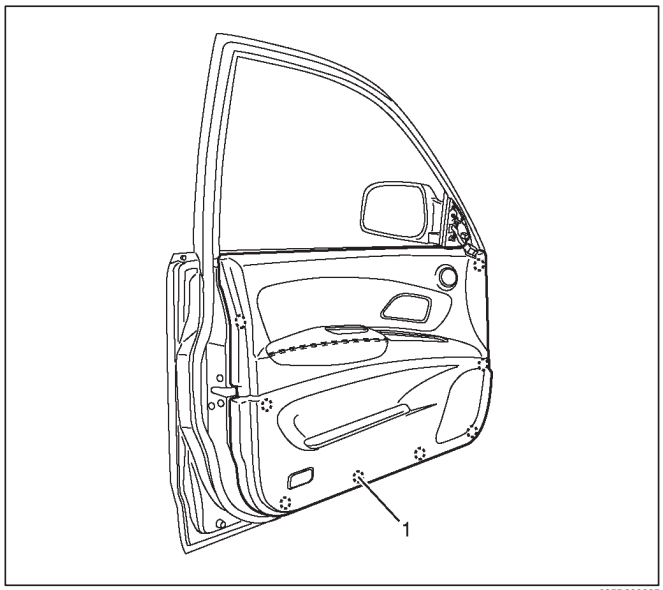
635R200002

4. Remove the inside handle.
   ▼Open the screw corer (1) and remove the screw.
   ▼Disconnect the cable.



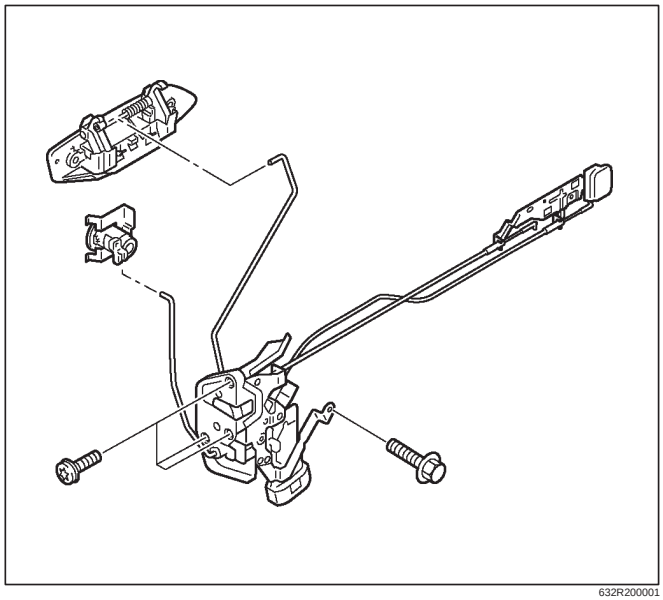
635R200003

5. Remove the door mirror cover.
6. Pull the door trim panel at the 8 clip positions (1).
   ▼Disconnect the courtesy light and tweeter harness connectors.



635R200005

7. Remove the pull box bracket.
8. Remove the inside lock bracket.
   ▼Disconnect the cable.
9. Remove the waterproof sheet.
   ▼Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
10. Raise the glass up to the uppermost position.
11. Remove the door lock assembly.
    ▼Disconnect the locking links and harness connector.
    ▼Remove the 3 fixing Torx screws and bolt.


632R200001

Installation

To install, follow the removal steps in the reverse order, noting the following points:

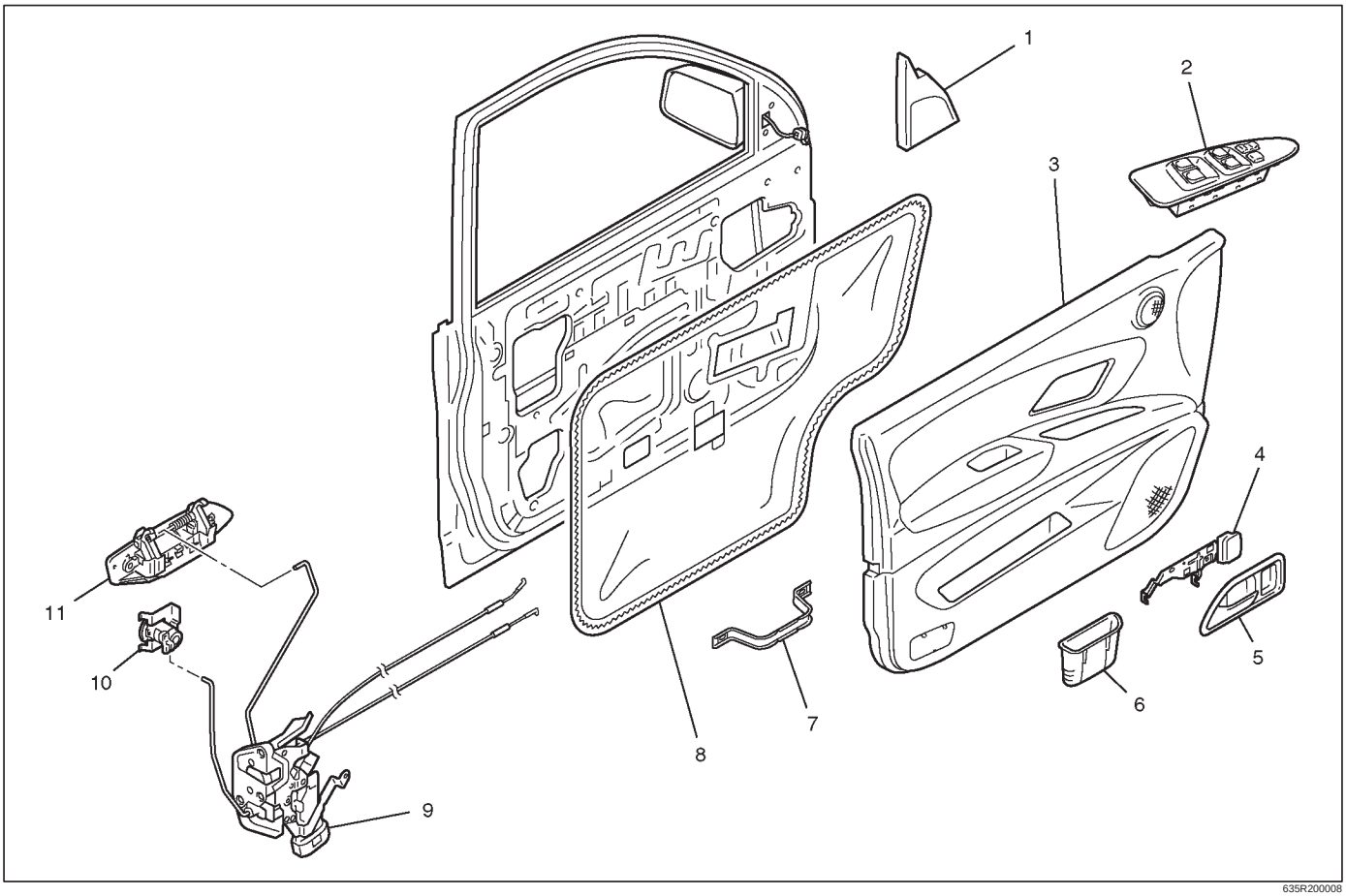
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

   Torque 7 N·m (61 Ib in)

3. Check that the door lock operates smoothly.

Front Outside Handle

Front Outside Handle and Associated Parts



635R200008

Legend

(1) Door Mirror Cover
(2) Power Window Switch
(3) Door Trim Panel
(4) Inside Lock Bracket
(5) Inside Handle
(6) Pull Box
(7) Pull Box Bracket
(8) Waterproof Sheet
(9) Door Lock Assembly
(10) Door Locking Cylinder
(11) Outside Handle

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
   ▼Refer to *Front Door Lock Assembly in this section.*
3. Remove the waterproof sheet.
   ▼Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
4. Disconnect the locking links and remove the outside handle.
5. Remove the fixing clip to remove the door lock cylinder.

Installation

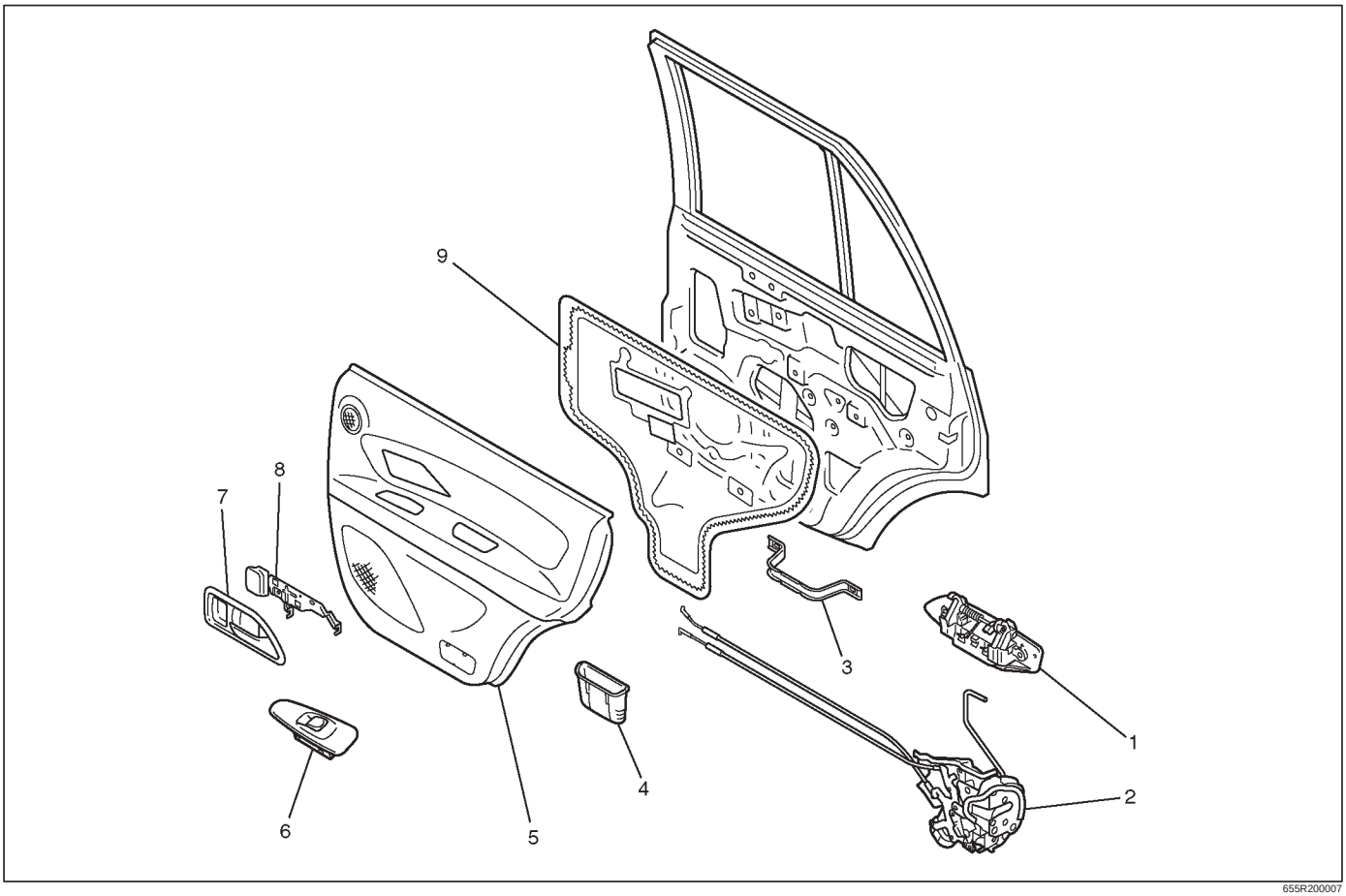
To install, follow the removal steps in the reverse order, noting the following points:

1. Be sure to install the door lock cylinder at a specified angle to the outside handle.
2. Check for smooth outside handle and lock cylinder operation.
3. Tighten the outside handle fixing bolts to the specified torque.

   Torque 7 N·m (61 lb in)

Rear Door Lock Assembly

Rear Door Lock Assembly and Associated Parts



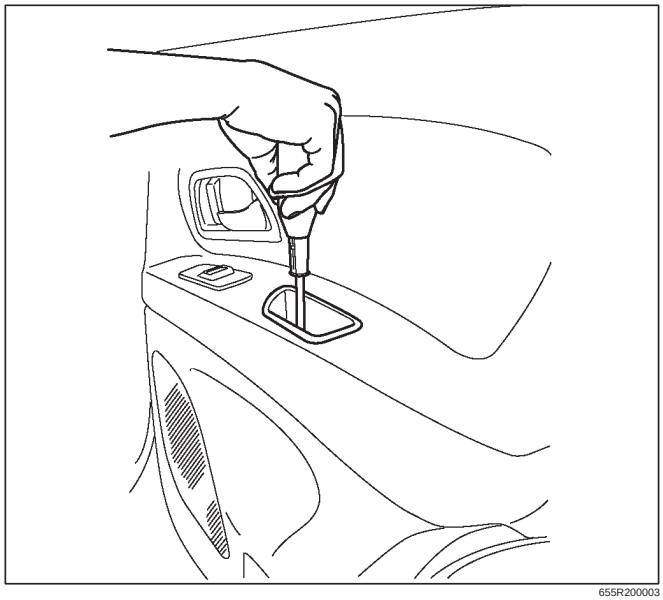
655R200007

Legend

(1) Outside Handle
(2) Door Lock Assembly
(3) Pull Box Bracket
(4) Pull Box
(5) Door Trim Panel
(6) Power Window Switch
(7) Inside Handle
(8) Inside Lock Bracket
(9) Waterproof Sheet

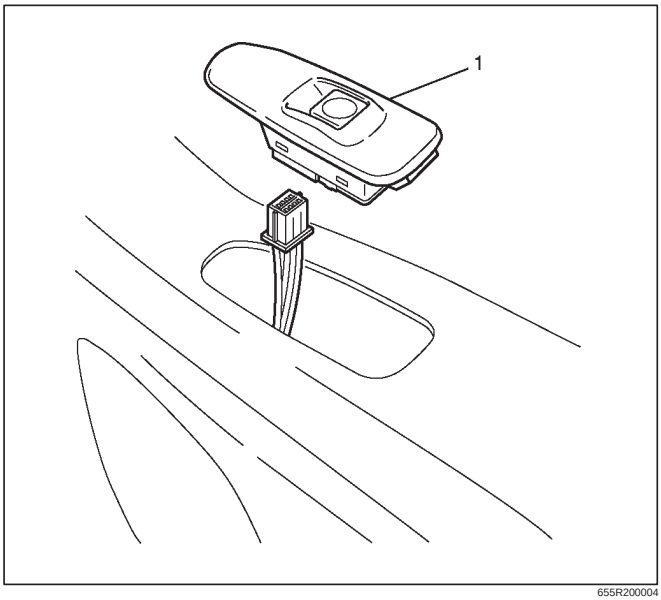
Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the fixing screw.



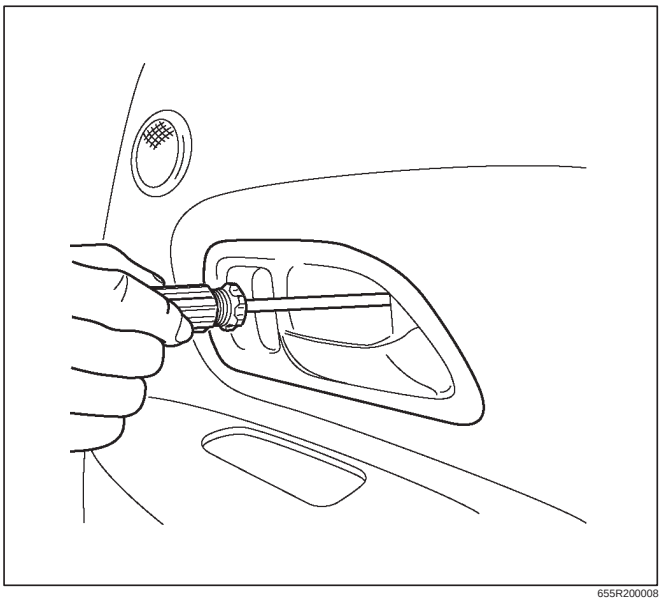
655R200003

3. Remove the power window switch (1).
   ▼Pry the power window switch and remove the connector.

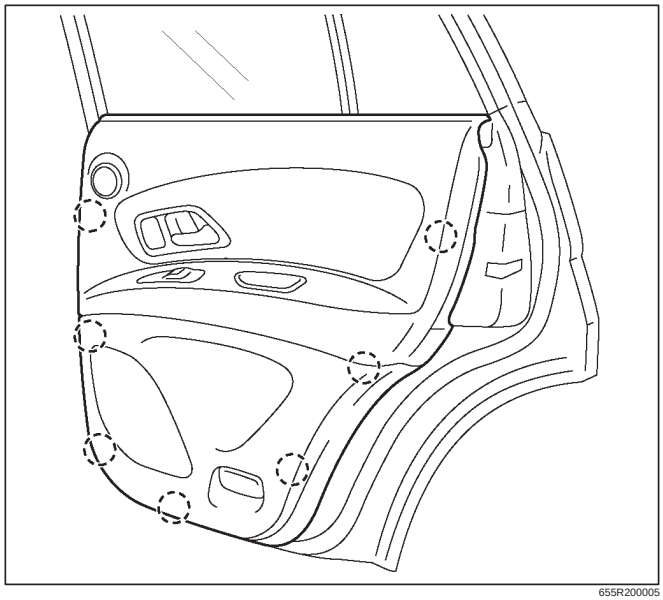


655R200004

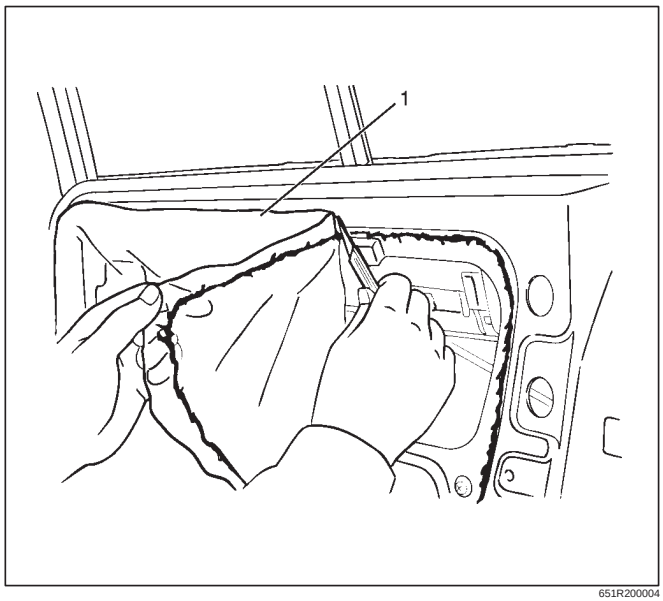
4. Remove the inside handle.
   ▼Open the screw cover and remove the screw.
   ▼Disconnect the cable.


655R200008

5. Pull the trim panel at the 7 clip positions.
   ▼Disconnect the tweeter and courtesy light connectors.

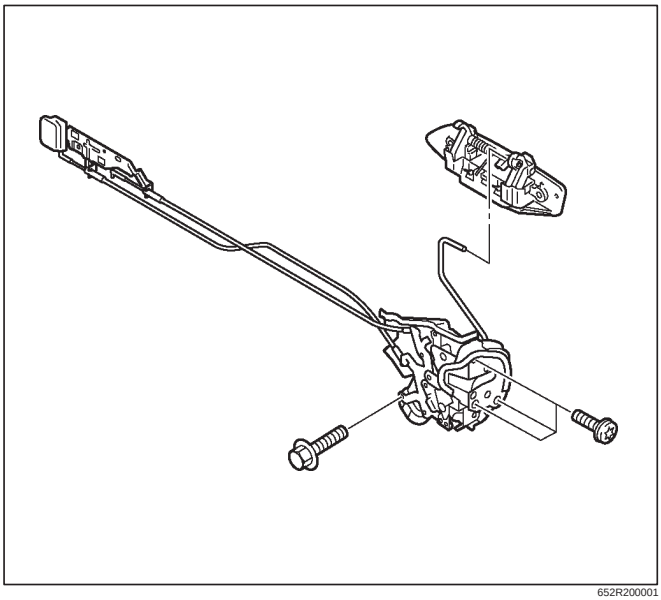

655R200005

6. Remove the pull box bracket.
7. Remove the inside lock bracket.
   ▼Disconnect the cable.
8. Peel the waterproof sheet.
   ▼Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.



651R200004

9. Remove the door lock assembly.
   ▼Disconnect the locking link and harness connector.
   ▼Remove the 3 fixing Torx screws and bolt.



652R200001

Installation

To install, follow the removal steps in the reverse order, noting the following points.

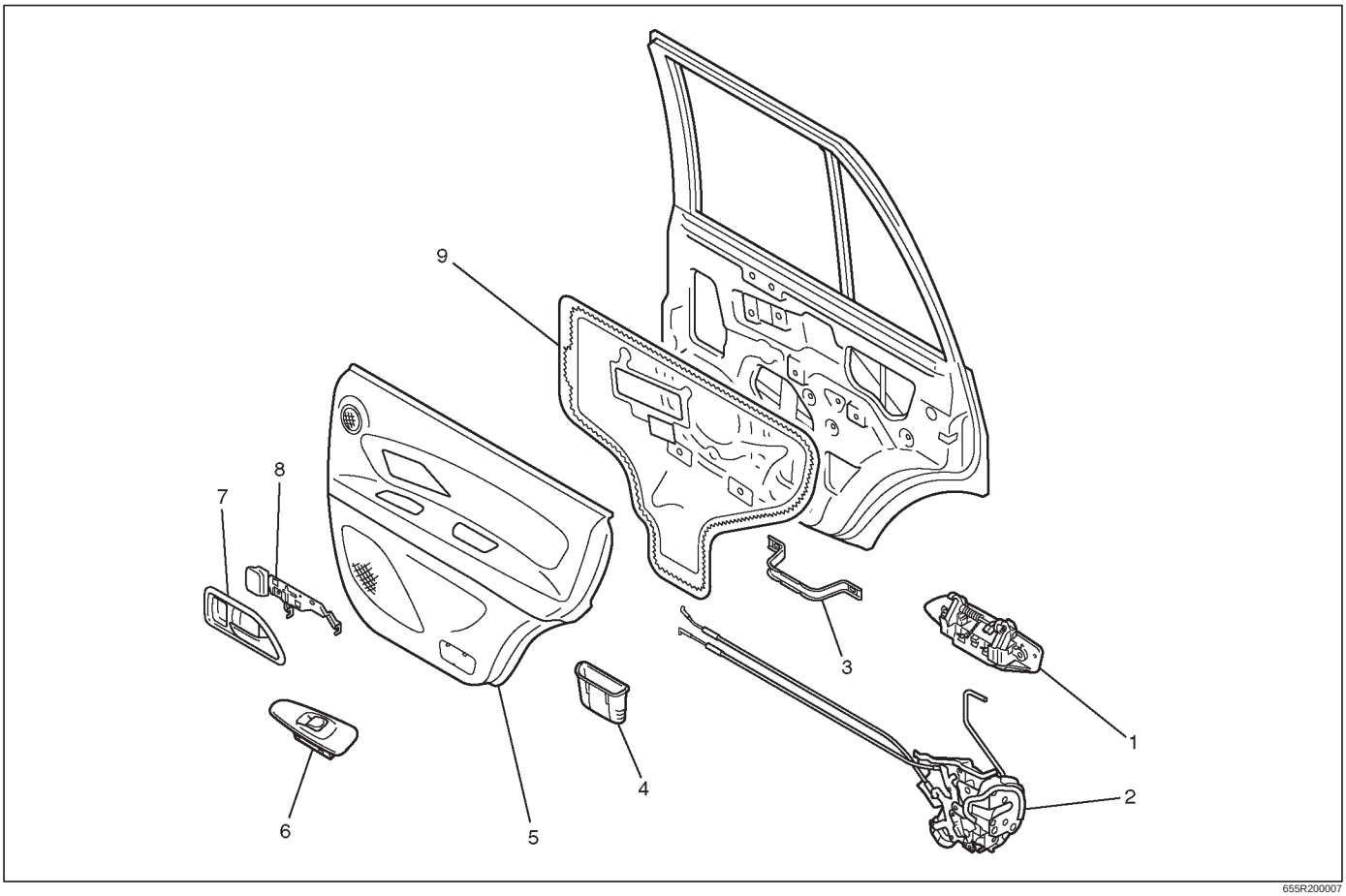
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

   Torque 7 N·m (61 lb in)

3. Check that the door lock operates smoothly.

Rear Outside Handle

Rear Outside Handle and Associated Parts



655R200007

Legend

(1) Outside Handle
(2) Door Lock Assembly
(3) Pull Box Bracket
(4) Pull Box
(5) Door Trim Panel
(6) Power Window Switch
(7) Inside Handle
(8) Inside Lock Bracket
(9) Waterproof Sheet

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
   ▼Refer to *Rear Door Lock Assembly in this section.*
3. Peel the waterproof sheet.
   ▼Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
4. Disconnect the locking link and remove fixing bolts to remove the outside handle.

Installation

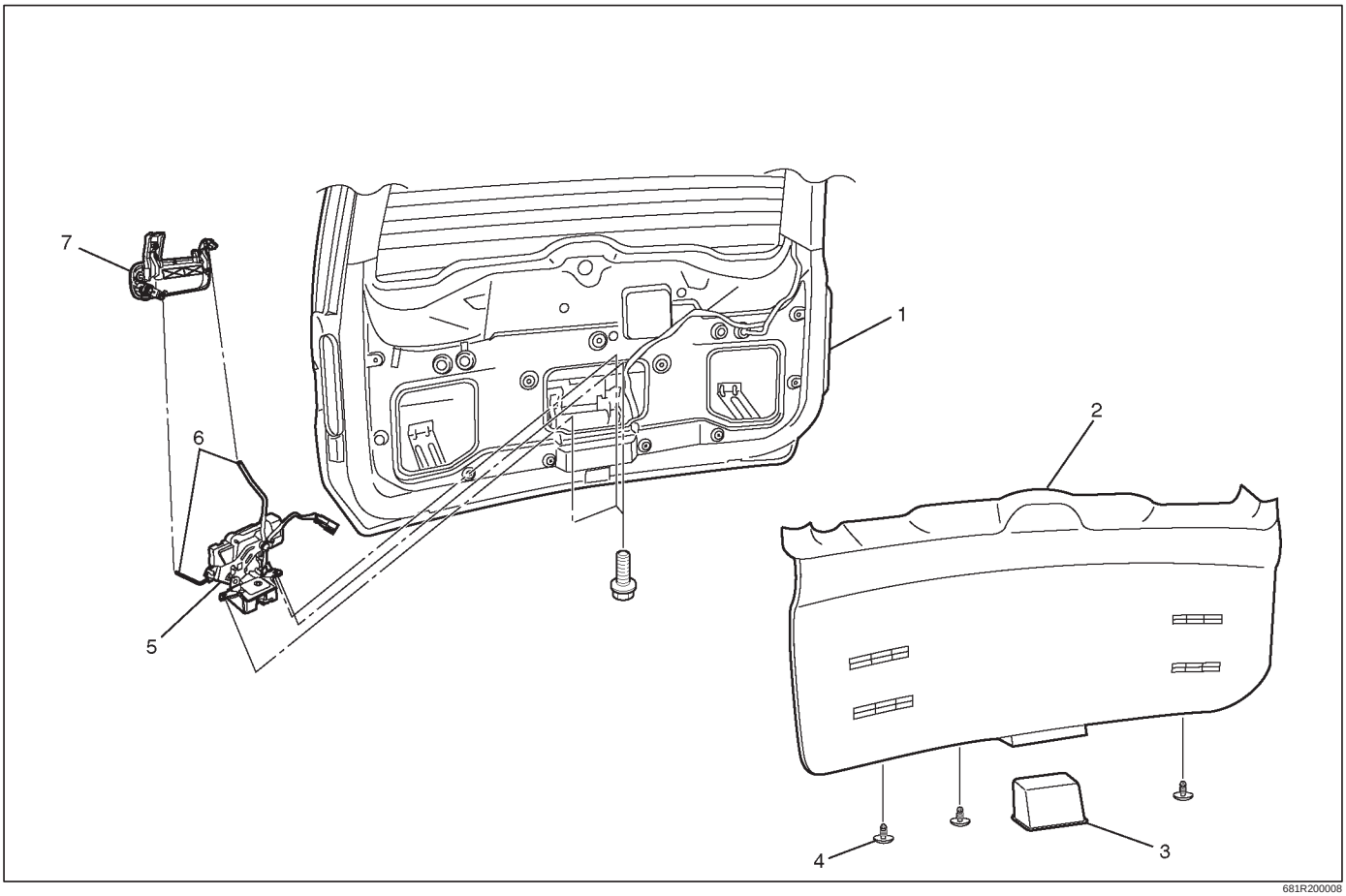
To install, follow the removal steps in the reverse order, noting the following points.

1. Check that the outside handle operates smoothly.
2. Tighten the outside handle fixing bolts to the specified torque.

   Torque 7 N·m (61 lb in)

Tailgate Lock and Outside Handle

Tailgate Lock, Outside Handle and Associated Parts



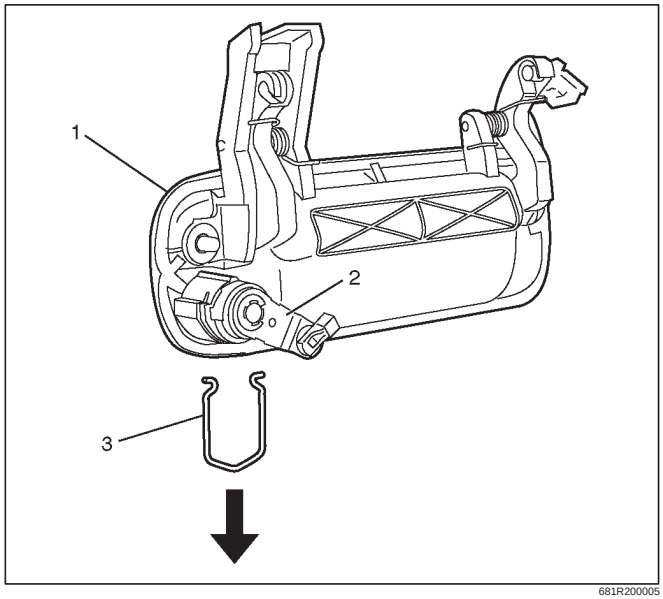
681R200008

Legend

(1) Tailgate Panel Assembly
(2) Tailgate Lower Trim Cover
(3) Tailgate Pull Box
(4) Clip
(5) Tailgate Lock Assembly
(6) Locking Link
(7) Tailgate Outside Handle

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate pull box.
3. Remove the three clips.
4. Remove the tailgate lower trim cover.
   ▼Pull the tailgate lower trim cover at the thirteen clip positions.
5. Remove the tailgate lock assembly.
   ▼Remove the three fixing bolts.
   ▼Disconnect the locking links and harness connector.
6. Remove the tailgate outside handle.
   ▼Remove the two fixing nuts.
7. Remove the tailgate lock cylinder(2).
   ▼Remove the fixing clip(3) pull lock cylinder from the outside handle (1).



681R200005

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Check for smooth outside handle and lock cylinder operation.
2. Tighten the tailgate lock assembly fixing bolts to the specified torque.

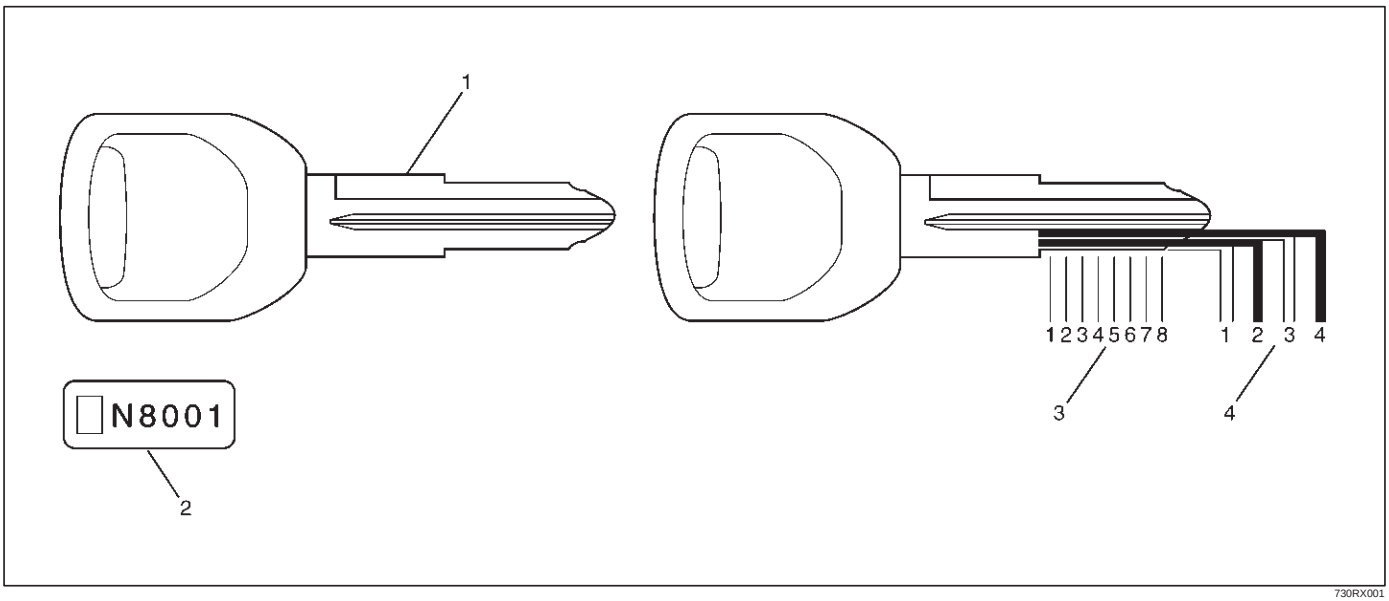
   Torque 7 N·m (61 lb in)

3. Tighten the tailgate outside handle fixing nuts to the specified torque.

   Torque 7 N·m (61 lb in)

Key

Key Coding



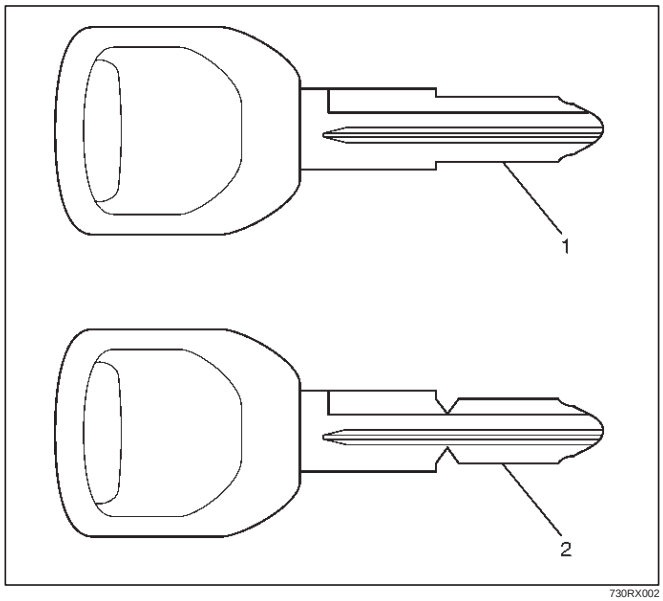
730RX001

Legend

(1) Key (Actual size)
(2) Key Code Tag
(3) Position
(4) Level

One key is used for the ignition, door, and tailgate lock cylinders. The keys are cut on both edges to make them reversible.
Key identification is obtained from the five character key code stamped on the key code tag. From this key code, the key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).
If key codes are not available from records or tags, the key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.
If the original key is available, the key code cutting combination can be determined by laying the key on the diagram shown in the figure.

Key Styles



730RX002

Legend

(1) Blank Key Style “A”
(2) Blank Key Style “B”

The keys come in styles A or B depending on the key code cutting combination. When the first position in the combination is a 1, 2 or 3, Style A is used. When the first position is a 4, Style B (factory pre-cut key) is used.

Power Door Lock System

General Description

The circuit consists of the door lock (& power window) switch, door lock actuator for the front and rear door, tailgate lock actuator and the door lock key switch.
The front door lock switch–LH is always provided with the battery voltage.
The key or the inside lock button on both driver's and front passenger's door can activate the lock mechanism of all the doors (including the tailgate).
When the driver's door lock switch or the front passenger's door lock switch is turned on, current flows for about one second to the door lock actuator of each door connected in parallel with the front door lock (& power window) switch–LH to activate the actuator to lock and unlock the doors.

Door Lock Key Switch

Removal and Installation

▼ Refer to *the Front Door Lock Assembly removal and installation steps in this section.*

Front Door Lock Actuator

Removal and Installation

▼ Refer to *the Front Door Lock Assembly removal and installation steps in this section.*

Rear Door Lock Actuator

Removal and Installation

▼ Refer to *the Rear Door Lock Assembly removal and installation steps in this section.*

Tailgate Lock Actuator

Removal and Installation

▼ Refer to *the Tailgate Lock Assembly removal and installation steps in this section.*

Anti-Theft System

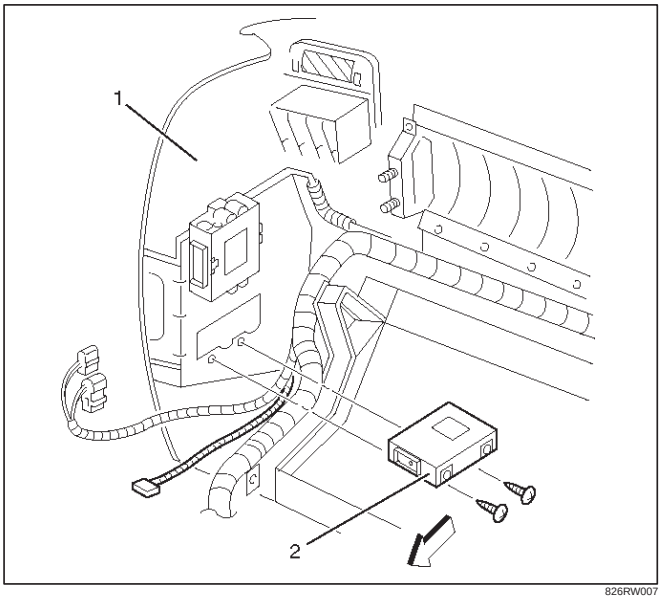
General Description

The circuit consists of the starter switch, anti–theft & keyless entry controller, anti–theft horn, front door and tailgate key switch (detect and tamper) switch, door lock actuator for each door, engine hood switch, clutch start switch (M/T), ANTI–THEFT indicator light and mode switch (A/T).
The system operates as follows: After locking the starter switch and removing the starter key (this sets the alarm), if the door is unlocked in any way other than with the proper key, the headlights will start flashing, the horn sounds, and the starter circuit is disabled. (However, the engine hood and all the doors must be locked and closed.) Once the system has been placed in the warning or alarm condition, it can be released only when the starter switch is shifted from “OFF” to “ACC” by the starter key, or when the lock of the front door or the tailgate is released (to activate the detect switch) by the starter key.

Anti–Theft & Keyless Entry Controller

Removal

1. Disconnect the battery ground cable.
2. Remove the glove box from the instrument panel assembly (1).
   ▼Refer to *the Instrument Panel Assembly in Body Structure section.*
3. Remove the anti–theft & keyless entry controller (2).
   ▼Disconnect the connector.
   ▼Remove two fixing screws.



826RW007

Installation

To install, follow the removal steps in the reverse order.

Anti–Theft Indicator

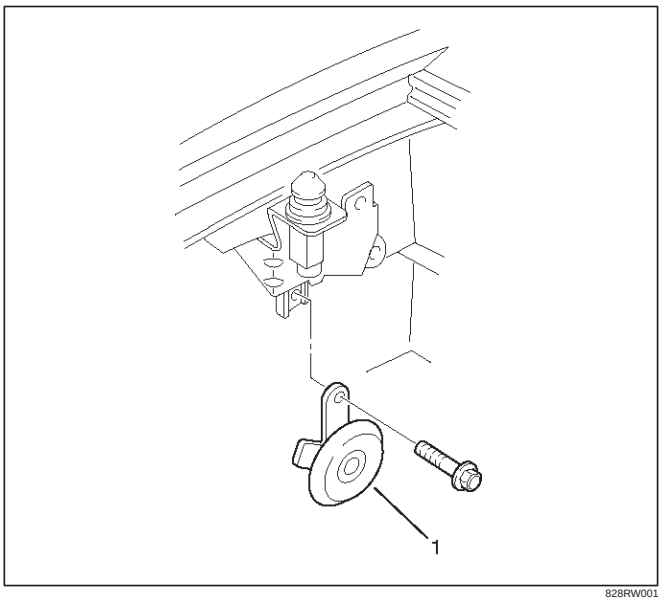
Removal and Installation

Refer to *GPS in Entertainment section.*

Anti–Theft Horn

Removal

1. Disconnect the battery ground cable.
2. Remove the anti–theft horn (1).
   ▼Disconnect the connector.
   ▼Remove a fixing bolt.



828RW001

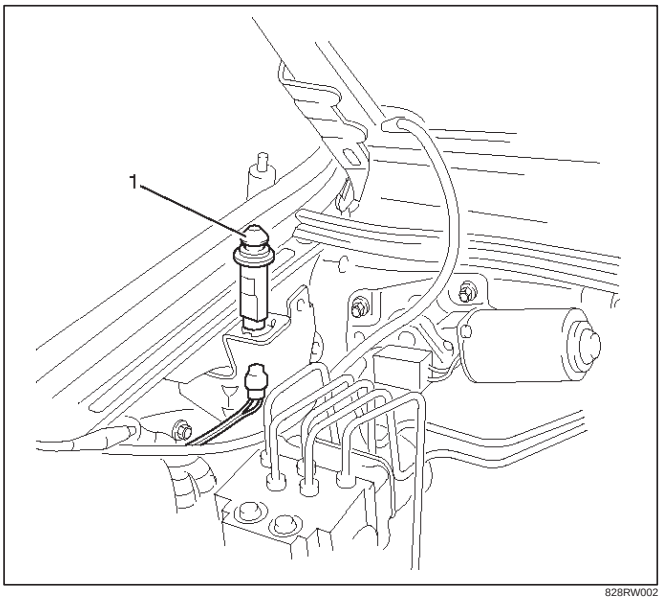
Installation

To install, follow the removal steps in the reverse order.

Engine Hood Switch

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove the engine hood switch (1).



Installation

To install, follow the removal steps in the reverse order.

Anti–theft & Keyless Entry Control Unit/Transmitter Replacement

Anti–theft & Keyless Entry Control Unit Replacement

1. Remove and install the control unit.
   ▼Refer to *Anti–theft & Keyless Entry Control Unit Removal and Installation in this section.*
2. Register ID code.
   ▼Refer to *ID Code Registration in this section.*
3. Check that the keyless entry system works normally.

Transmitter Replacement

1. Prepare a new transmitter.
2. Register ID code.
   ▼Refer to *ID Code Registration in this section.*
3. Check that the keyless entry system works normally.

Transmitter Battery Replacement

1. Remove a screw to remove the cover.
2. Remove the batteries.
3. Set the new batteries into the transmitter.
4. Install the cover to the transmitter.
5. Check that the keyless entry system works normally.

Keyless Entry System

ID Code Registration

The following procedures are available to register keyless entry ID codes.
There are four different ID codes which can be registered for each vehicle.

ID Code New Registration

This procedure erases all registered ID codes and registers a new ID code instead.

Step	Action	Yes	No
1	1. Make sure that the all the doors are closed and unlocked. 2. Open the driver's side door. 3. Insert the starter key into the starter switch. Is the action complete?	Go to *Step 2*	—
2	Turn the starter switch to ACC position and return it to OFF position quickly three times. NOTE: This step must be carried out within five seconds after step 1 is finished. Is the action complete?	Go to *Step 3*	Go to *Step 1*
3	Close and open the drive's side door quickly two times. NOTE: This step must be carried out within ten seconds after step 2 is finished. Is the action complete?	Go to *Step 4*	Go to *Step 1*
4	1. Turn the starter switch to ACC position and return it to OFF position quickly five times. 2. Close and open the driver's side door quickly one time. NOTE: This step must be carried out within ten seconds after step 3 is finished. Is the action complete?	Go to *Step 5*	Go to *Step 1*
5	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to *Step 6*	Go to *Step 1*
6	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 5 is finished. Is the action complete?	Go to *Step 7*	Go to *Step 1*
7	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to *Step 8*	Go to *Step 1*
8	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 7 is finished. Is the action complete?	Go to *Step 9*	Go to *Step 1*
9	If registration succeeds, the control unit locks and unlocks the doors one time. If registration fails, the control unit locks and unlocks the doors three times.	Go to *Step 1*	Go to *Step 1*

ID Code Additional Registration

This procedure additionally registers a new ID code with holding registered ID codes. If total number of registered ID codes and newly registered ID code exceed four, the oldest one is erased.

Step	Action	Yes	No
1	1. Make sure that the all the doors are closed and unlocked. 2. Open the driver's side door. 3. Insert the starter key into the starter switch. Is the action complete?	Go to *Step 2*	—
2	Turn the starter switch to ACC position and return it to OFF position quickly three times. NOTE: This step must be carried out within five seconds after step 1 is finished. Is the action complete?	Go to *Step 3*	Go to *Step 1*
3	Close and open the driver's side door quickly two times. NOTE: This step must be carried out within ten seconds after step 2 is finished. Is the action complete?	Go to *Step 4*	Go to *Step 1*
4	1. Turn the starter switch to ACC position and return it to OFF position quickly three times. 2. Close and open the driver's side door quickly one time. NOTE: This step must be carried out within ten seconds after step 3 is finished. Is the action complete?	Go to *Step 5*	Go to *Step 1*
5	The control unit locks and unlocks the doors two times. Does the control unit work normally?	Go to *Step 6*	Go to *Step 1*
6	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 5 is finished. Is the action complete?	Go to *Step 7*	Go to *Step 1*
7	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to *Step 8*	Go to *Step 1*
8	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 7 is finished. Is the action complete?	Go to *Step 9*	Go to *Step 1*
9	If registration succeeds, the control unit locks and unlocks the doors one time. If registration fails, the control unit locks and unlocks the doors three times.	Go to *Step 1*	Go to *Step 1*

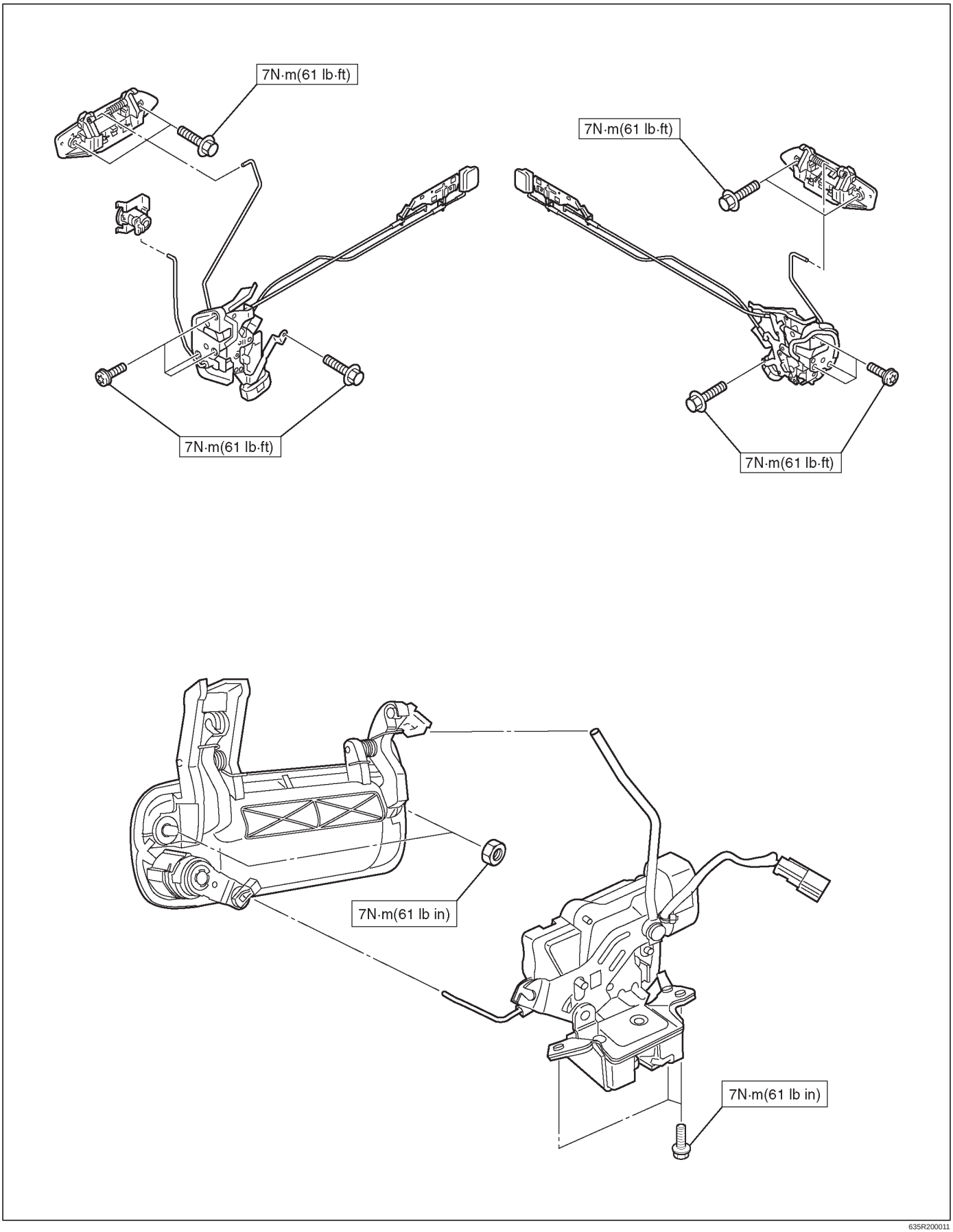
ID Code Check

This procedure checks how many ID codes are registered.

Step	Action	Yes	No
1	1. Make sure that the all the doors are closed and unlocked. 2. Open the driver's side door. 3. Insert the starter key into the starter switch. Is the action complete?	Go to *Step 2*	—
2	Turn the starter switch to ACC position and return it to OFF position quickly three times. NOTE: This step must be carried out within five seconds after step 1 is finished. Is the action complete?	Go to *Step 3*	Go to *Step 1*
3	Close and open the drive's side door quickly two times. NOTE: This step must be carried out within ten seconds after step 2 is finished. Is the action complete?	Go to *Step 4*	Go to *Step 1*
4	1. Turn the starter switch to ACC position and return it to OFF position quickly one time. 2. Close and open the drive's side door quickly one time. NOTE: This step must be carried out within ten seconds after step 3 is finished. Is the action complete?	Go to *Step 5*	Go to *Step 1*
5	The control unit locks and unlocks the doors twice as many registered ID codes.	Go to *Step 1*	Go to *Step 1*

Main Data and Specifications

Torque Specifications



635R200011

AXIOM

BODY AND ACCESSORIES

SUNROOF/CONVERTIBLE TOP

CONTENTS

Service Precaution 8I–1
Sunroof Glass 8I–2
Sunroof Glass and Associated Parts 8I–2
Removal 8I–2
Installation 8I–3
Sunroof Deflector 8I–3
Removal 8I–3
Installation 8I–3
Sunshade 8I–4
Disassembled View 8I–4
Removal 8I–4
Installation 8I–5
Sunroof Frame Complete Assembly 8I–6
Sunroof Frame Complete Assembly and Associated Parts 8I–6
Removal 8I–6
Installation 8I–7
Sunroof Switch 8I–7
Removal 8I–7
Installation 8I–7
Sunroof Control Unit 8I–8
Removal 8I–8
Installation 8I–8
Sunroof Motor 8I–8
Removal 8I–8
Installation 8I–8
Main Data and Specifications 8I–9

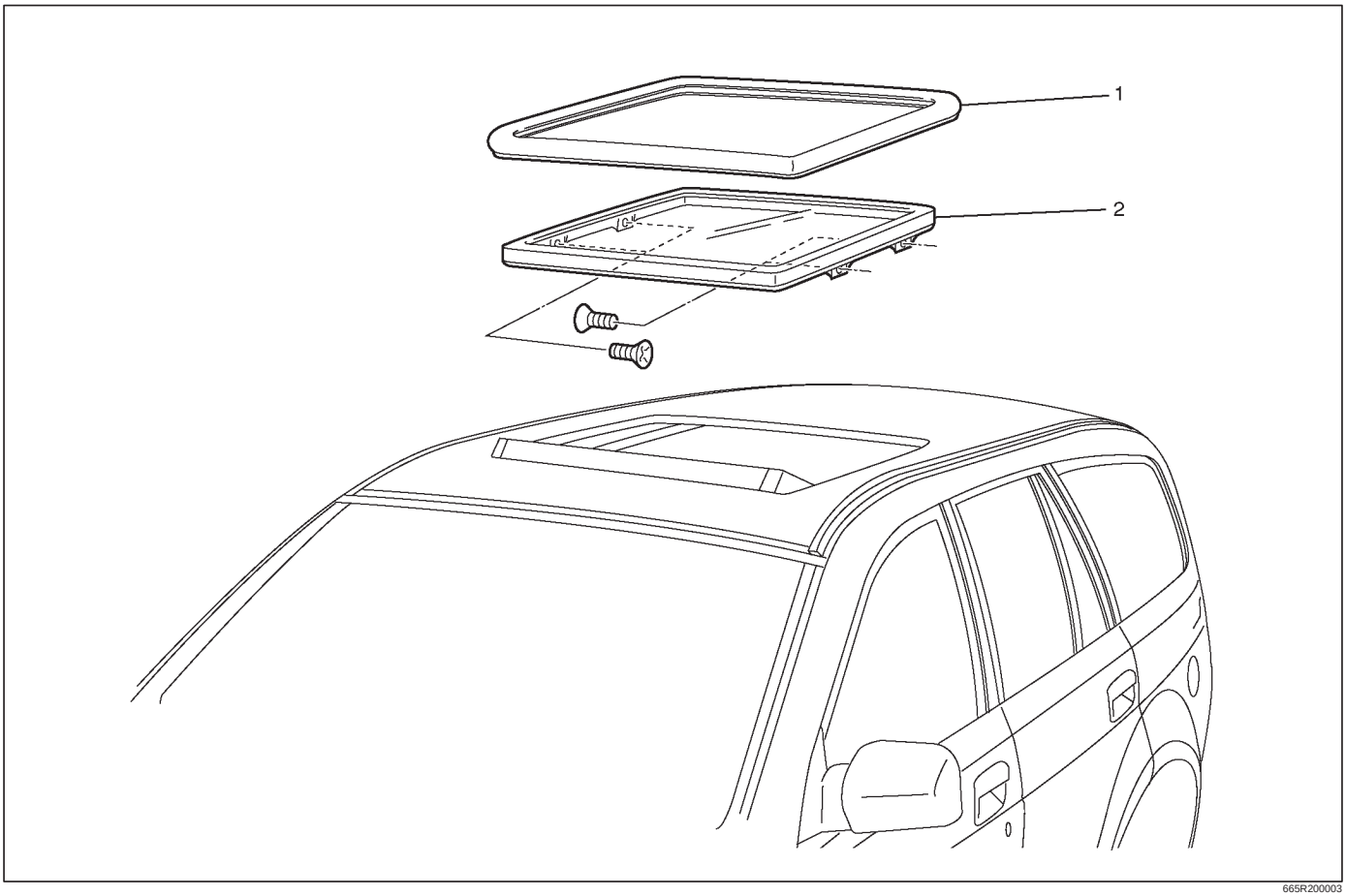
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Sunroof Glass

Sunroof Glass and Associated Parts



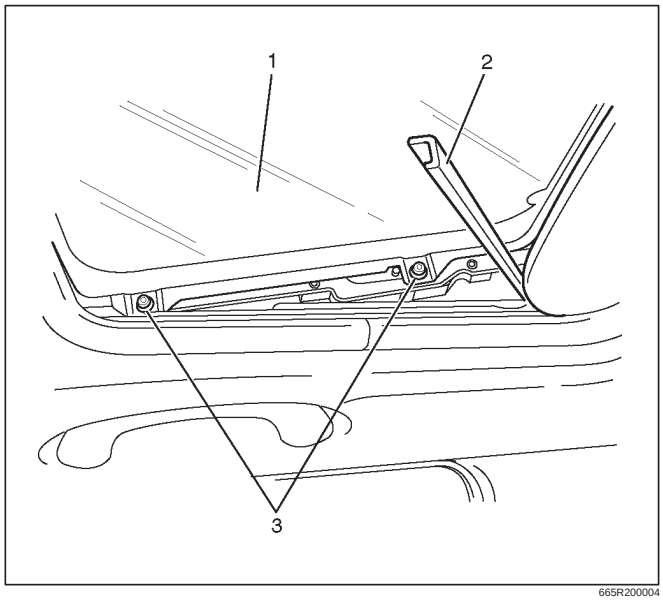
665R200003

Legend

(1) Sunroof Weatherstrip
(2) Sunroof Glass

Removal

1. Tilt the sunroof and open the sunshade.
2. Disconnect the battery ground cable.
3. Pull out the front of sight shield (2).
4. Remove four sunroof glass fixing Torx screws (3) to remove the sunroof glass (1).



665R200004

Installation

1. Be sure to install the sunroof weatherstrip so that the joint of the weatherstrip is on the rear side of the vehicle.
2. Temporary install the glass to the sunroof frame.
3. Open and shut the sunroof four to five times to position correctly the sunroof weatherstrip and the glass in the longitudinal and latitudinal setting positions.
4. Adjust the setting position to flush the surface between the roof panel and weatherstrip of sunroof glass.
5. Tighten the sunroof glass fixing screws to the specified torque.

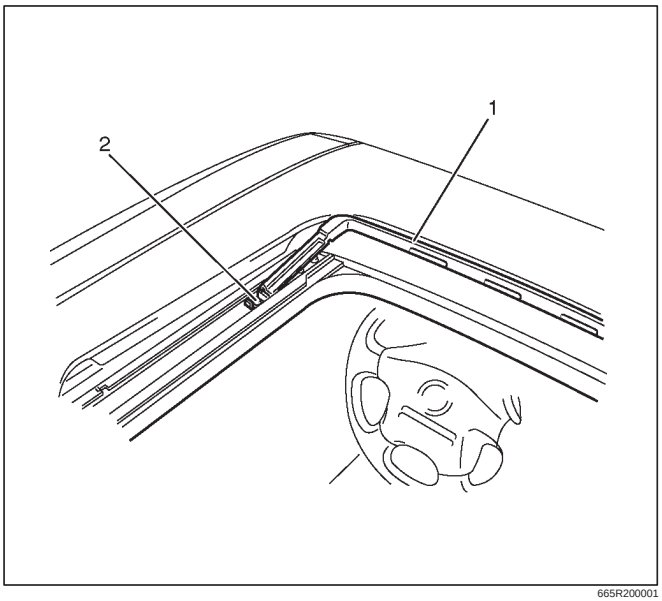
   Torque: 4 N·m (35 lb in)
6. Inspect the sunroof alignment after installing the sunroof glass. Use the fixing screws to adjust the sunroof if not aligned.

Sunroof Deflector

Removal

1. Open the sunroof.

   ▼Let a 5 mm (0.20 in) drill go through two blind rivets (2) to disengage riveted portions.
2. Remove the sunroof deflector (1).



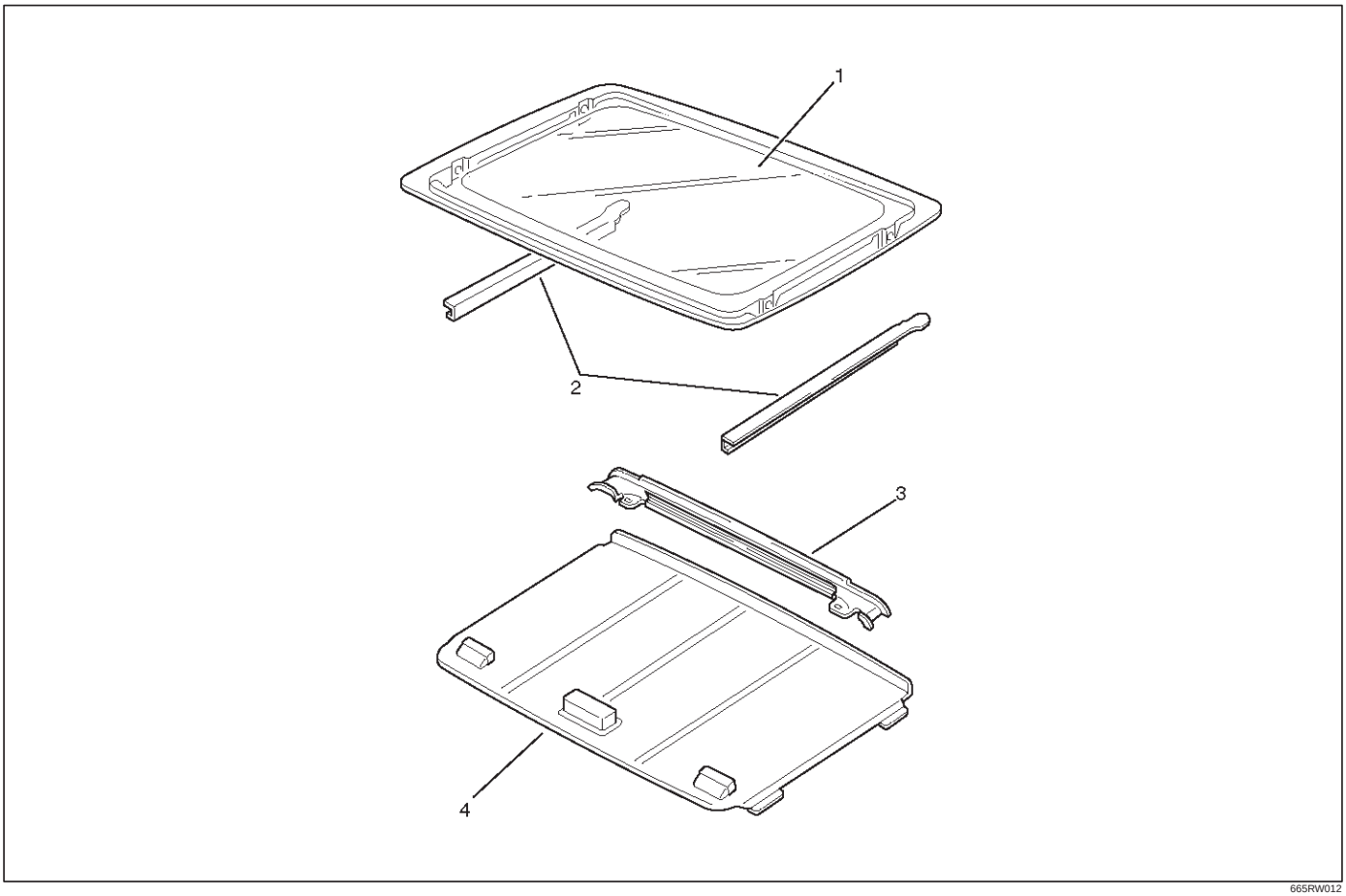
665R200001

Installation

To install, follow the removal steps in the reverse order.

Sunshade

Disassembled View



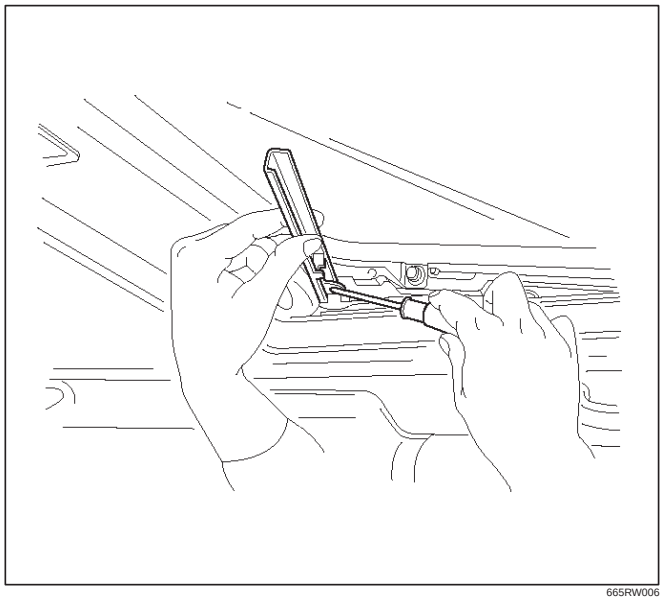
665RW012

Legend

(1) Sunroof Glass
(2) Sight Shield
(3) Sunshade Stopper
(4) Sunshade

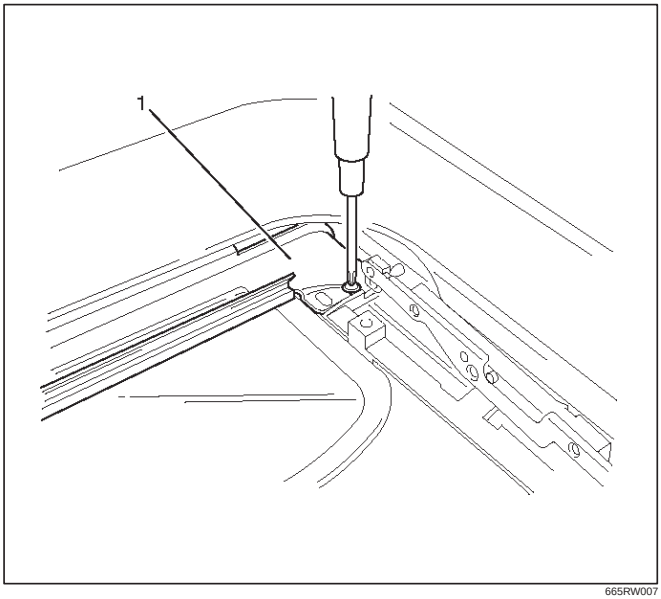
Removal

1. Tilt the sunroof.
2. Disconnect the battery ground cable.
3. Remove the sunroof glass.
   ▼Refer to Sunroof Glass in this section.
4. Pull the sight shield upward using screwdriver.



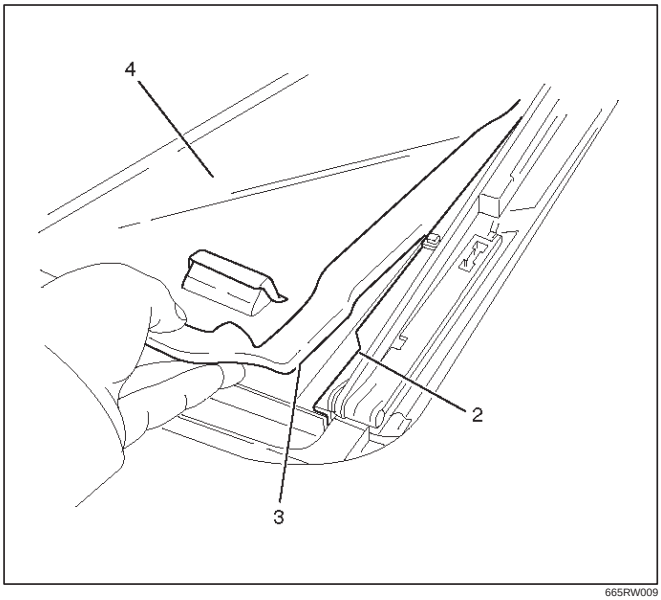
665RW006

5. Remove 2 sunshade stopper fixing screws and remove sunshade stopper (1).



665RW007

6. Pull out the sunshade (4) up to the guide rail edge. Lift the front of sunshade and clear the projection (3) of sunshade through the notch (2) of guide rail edge, then draw the sunshade out of the roof.



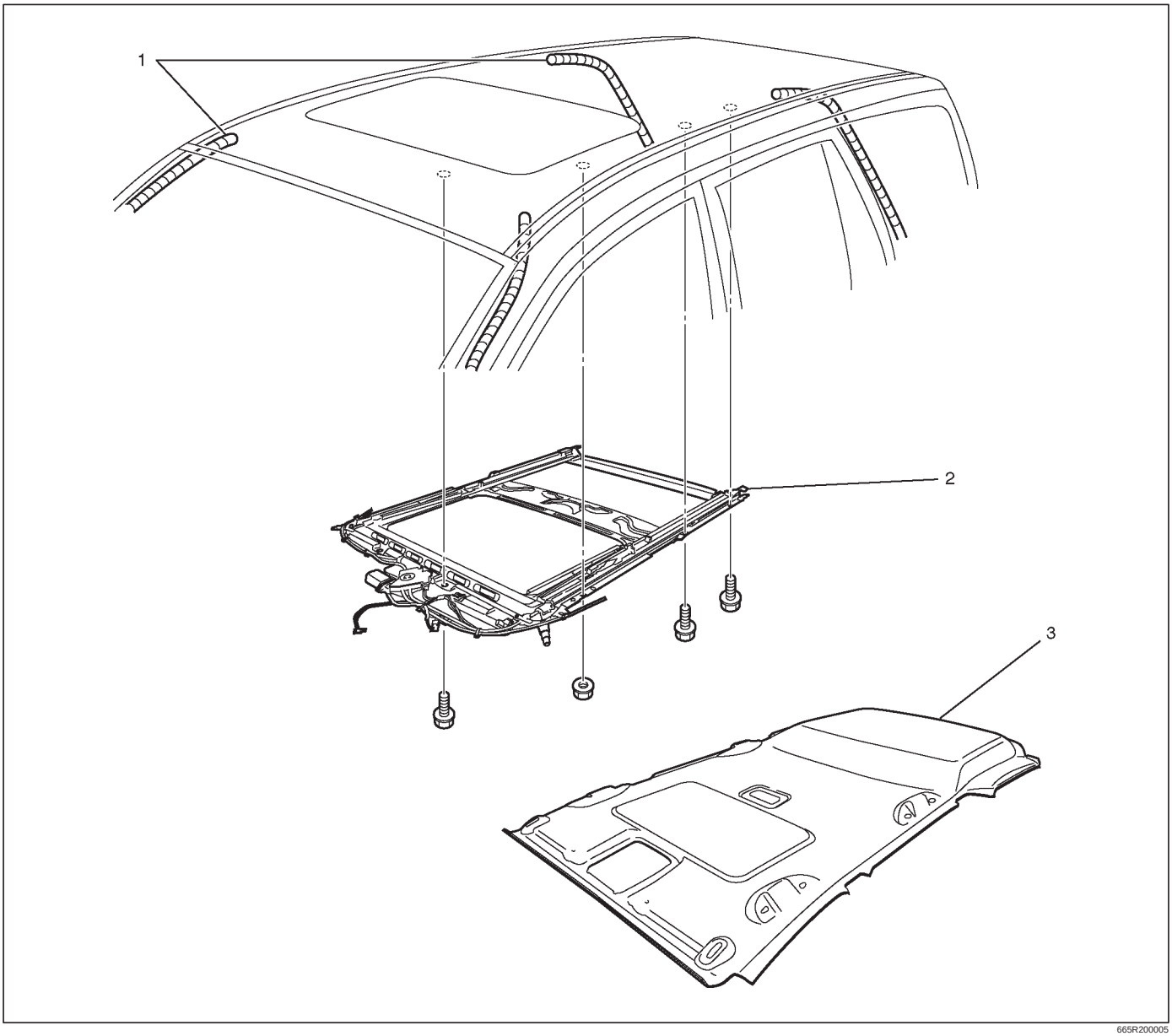
665RW009

Installation

To install, follow the removal steps in the reverse order.

Sunroof Frame Complete Assembly

Sunroof Frame Complete Assembly and Associated Parts



665R200005

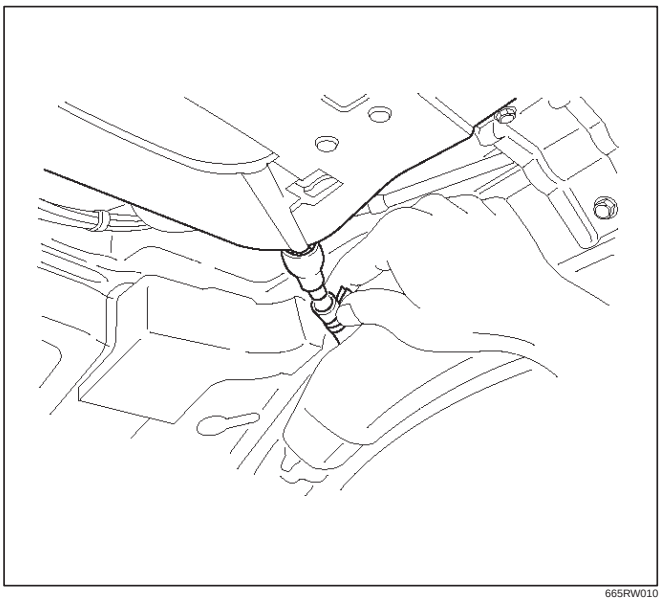
Legend

(1) Sunroof Drain Hose
(2) Sunroof Frame Complete Assembly
(3) Headlining

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
   ▼Refer to Headlining in Exterior/Interior Trim section.

3. Disconnect the sunroof drain hose at the sunroof frame side as shown in the figure.



665RW010

4. Disconnect the sunroof harness connection.
5. Remove two sunroof frame assembly fixing nuts (front side) and six fixing bolts from the frame complete assembly, and then remove the sunroof frame complete assembly.

NOTE: Be sure to remove the frame assembly while supporting it.

Installation

1. Install the sunroof frame assembly.
2. After installing the frame assembly, loosen the sunroof glass fixing nuts and adjust the sunroof glass setting position.

   ▼Refer to Sunroof Glass in this section.
3. Install the sunroof drain hose.
4. Install the headlining.

   ▼Refer to Headlining in Exterior/Interior Trim section.

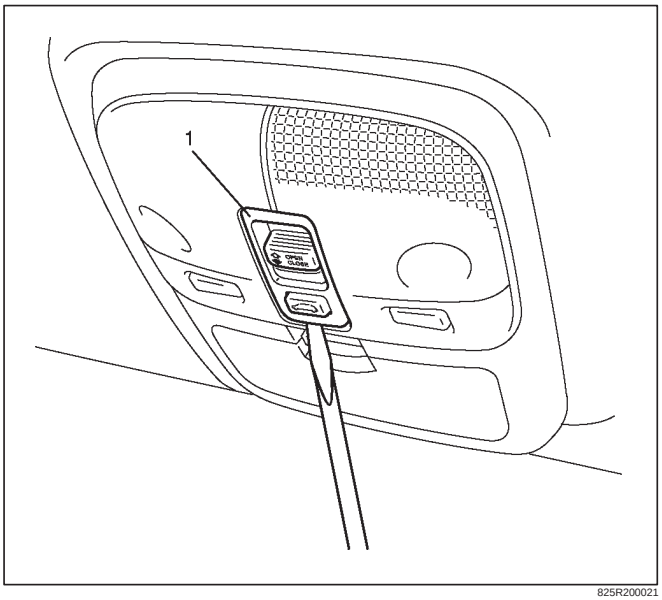
Sunroof Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the sunroof switch (1).

   ▼Remove the switch by pushing the spring with the tip of a screwdriver.

   ▼Disconnect the switch connector.



825R200021

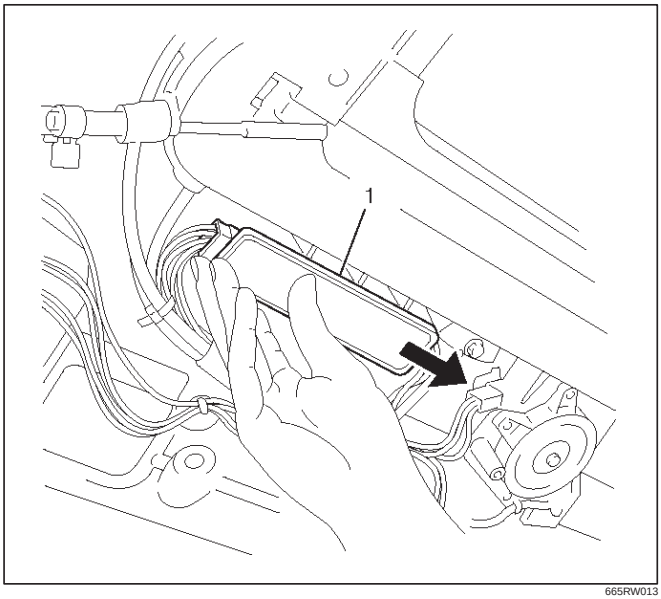
Installation

To install, follow the removal steps in the reverse order.

Sunroof Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
   ▼Refer to Headlining in Exterior/Interior Trim section.
3. Remove the sunroof control unit (1).
   ▼Disconnect two connectors.
   ▼Remove two screws.



665RW013

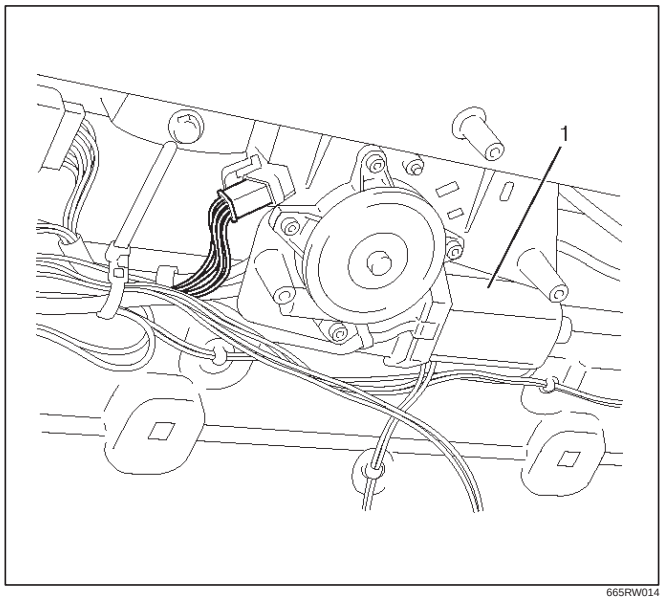
Installation

To install, follow the removal steps in the reverse order.

Sunroof Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
   ▼Refer to Headlining in Exterior/Interior Trim section.
3. Remove the sunroof motor (1).
   ▼Disconnect the connector.
   ▼Remove three nuts and two screws.



665RW014

Installation

To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specification

Application	N·m	lb ft	lb in
Sunroof Glass Fixing Screws	4	—	35
Sunroof Frame Fixing Bolts and Nuts	8	—	69

AXIOM

BODY AND ACCESSORIES

EXTERIOR / INTERIOR TRIM

CONTENTS

Service Precaution 8J–2
Consoles 8J–3
Consoles and Associated Parts 8J–3
Removal 8J–3
Installation 8J–4
Front Door Trim Panel 8J–4
Front Door Trim Panel and Associated Parts 8J–4
Removal 8J–5
Installation 8J–5
Rear Door Trim Panel 8J–6
Rear Door Trim Panel and Associated Parts 8J–6
Removal 8J–7
Installation 8J–7
Door Mirror Assembly 8J–8
Removal 8J–8
Installation 8J–8
Interior Mirror Assembly 8J–8
Removal 8J–8
Installation 8J–8
Interior Trim Panels 8J–9
Interior Trim Panels and Associated Parts 8J–9
Removal 8J–9
Installation 8J–11
Headlining 8J–12
Parts Location 8J–12
Removal 8J–12
Installation 8J–13
Overhead Console 8J–14
Parts Location (W/O Sunroof) 8J–14
Removal 8J–14
Installation 8J–14
Parts Location (W/ Sunroof) 8J–15
Removal 8J–15
Installation 8J–15
Wheel Arch Cover 8J–16
Wheel Arch Cover and Associated Parts .. 8J–16
Removal 8J–16
Installation 8J–16
Locker Cover 8J–17
Locker Cover and Associated Parts 8J–17
Removal 8J–17
Installation 8J–17
Fuel Filler Door 8J–18
Parts Location 8J–18
Removal 8J–18
Installation 8J–18
Roof Moulding 8J–19
Parts Location 8J–19
Removal 8J–19
Installation 8J–19
Power Door Mirror System 8J–20
General Description 8J–20
Door Mirror Switch 8J–20
Power Window System 8J–21
General Description 8J–21
Power Window Switch Driver Seat Side .. 8J–21
Power Window Motor 8J–22
Main Data and Specifications 8J–23

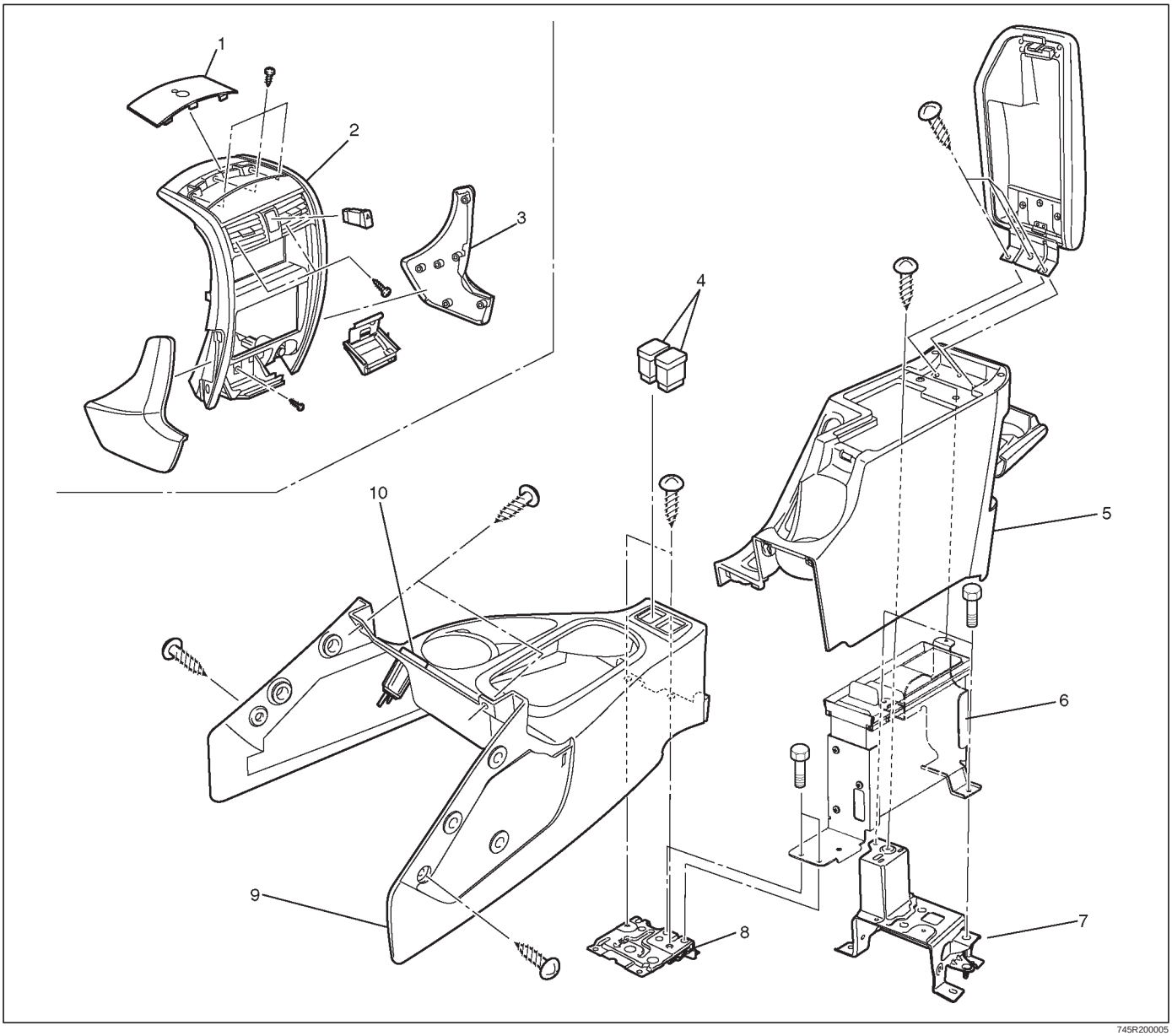
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Consoles

Consoles and Associated Parts



745R200005

Legend

(1) Cluster Upper Cover
(2) Center Cluster
(3) Knee Pad
(4) Seat Heater Switch (Required Option)
(5) Rear Console Assembly
(6) CD Changer
(7) Rear Console Bracket
(8) Front Console Bracket
(9) Front Console Assembly
(10) Accessory Socket

Removal

1. Disconnect the battery ground cable.
2. Remove the cluster upper cover and connectors.
3. Pry the knee pads.
4. Remove the center cluster.
   ▼Remove the six screws and pull out the center cluster at the six clip positions.
   ▼Disconnect the connectors.
5. Remove the rear console assembly.
   ▼Open the rear console lid and remove two screws.
6. Remove the front console assembly.
   ▼Remove six fixing screws and disconnect the accessory socket connectors.
   ▼Disconnect the seat heater switch connectors (if so equipped).

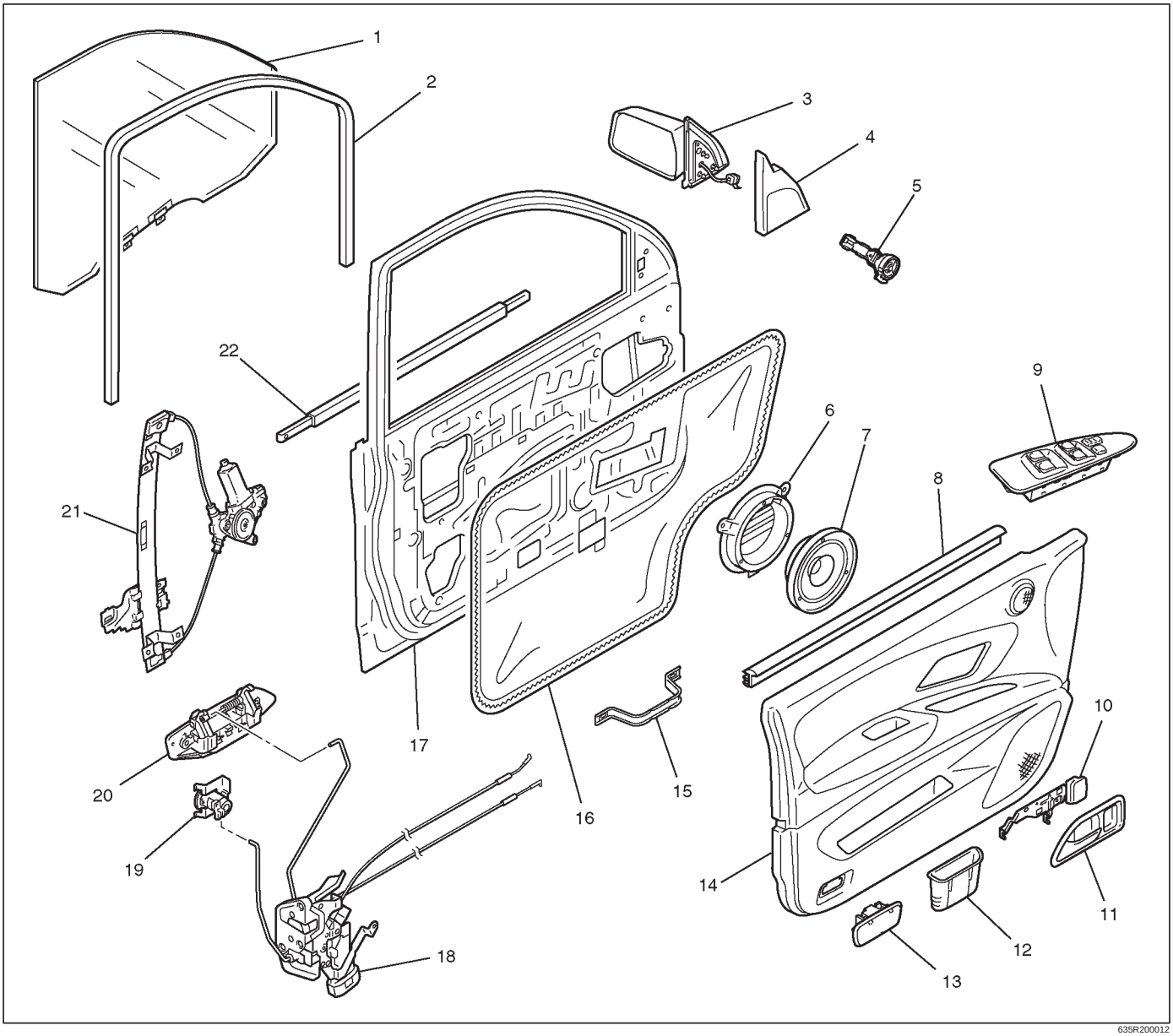
7. Remove the CD changer.
   ▼Remove the four fixing bolts and the connector.

Installation

To install, follow the removal steps in the reverse order.

Front Door Trim Panel

Front Door Trim Panel and Associated Parts



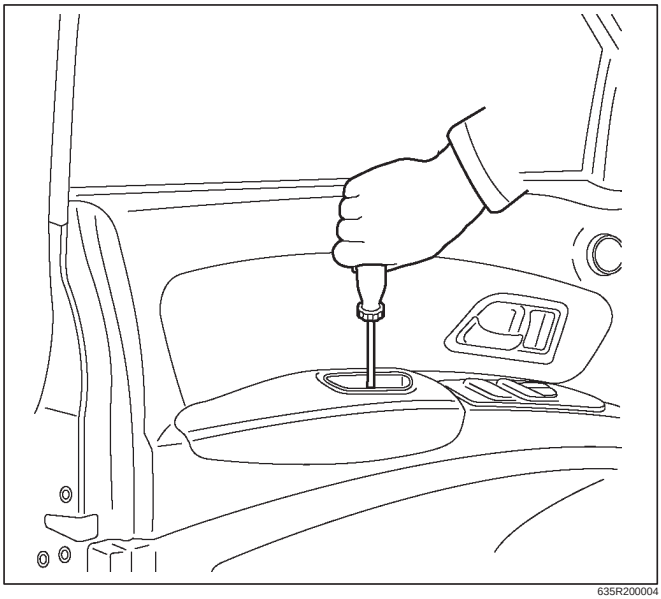
635R200012

Legend

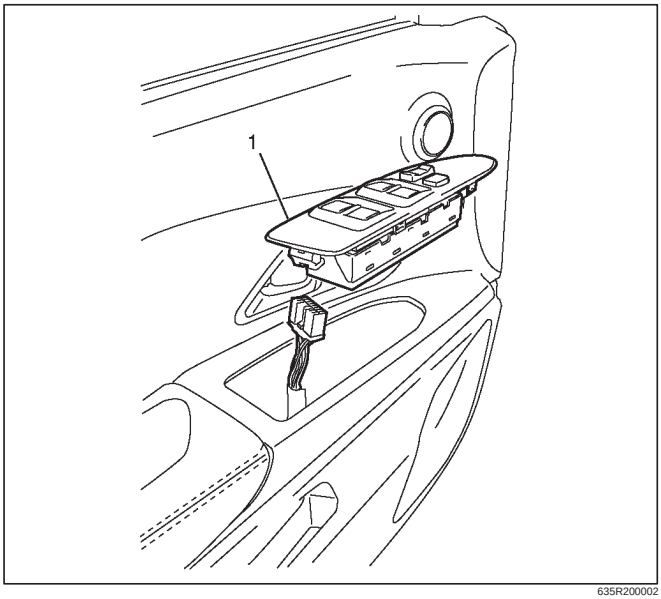
(1) Glass
(2) Glass Run
(3) Door Mirror Assembly
(4) Door Mirror Cover
(5) Tweeter
(6) Speaker Spacer
(7) Speaker Assembly
(8) Inner Waist Seal
(9) Door Trim Panel
(10) Power Window Switch
(11) Inside Lock Bracket
(12) Inside Handle
(13) Pull Box
(14) Courtesy Light
(15) Pull Box Bracket
(16) Waterproof Sheet
(17) Front Door Panel
(18) Door Lock Assembly
(19) Door Lock Cylinder
(20) Outside Handle
(21) Power Window Regulator
(22) Outer Waist Seal

Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the one fixing screw.

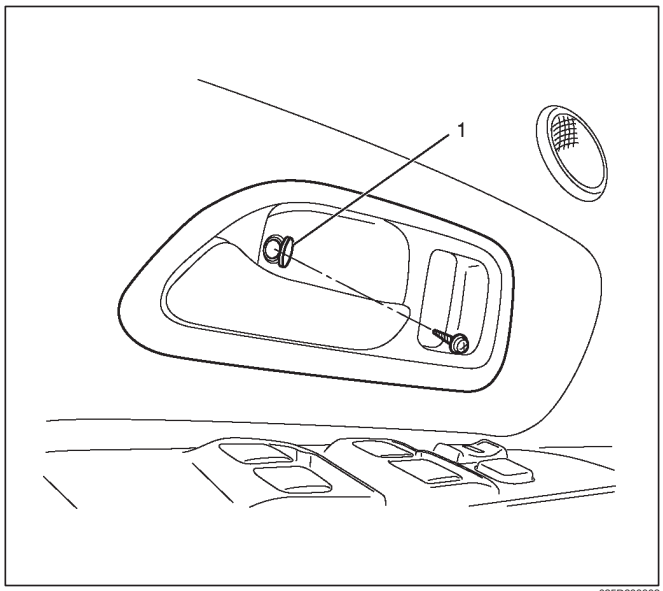

635R200004

3. Remove the power window switch (1).
   ▼Pry the power window switch out and disconnect the switch connector.



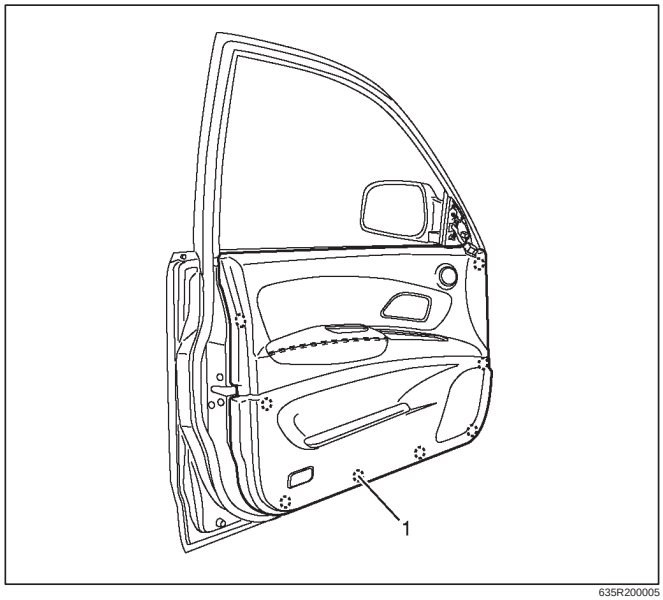
635R200002

4. Remove the inside handle.
   ▼Open the screw cover (1) and remove the screw.
   ▼Disconnect the cable.



635R200003

5. Remove the door mirror cover.
6. Remove the door trim panel.
   ▼Remove the trim panel with the eight clips (1) from the door panel.



635R200005

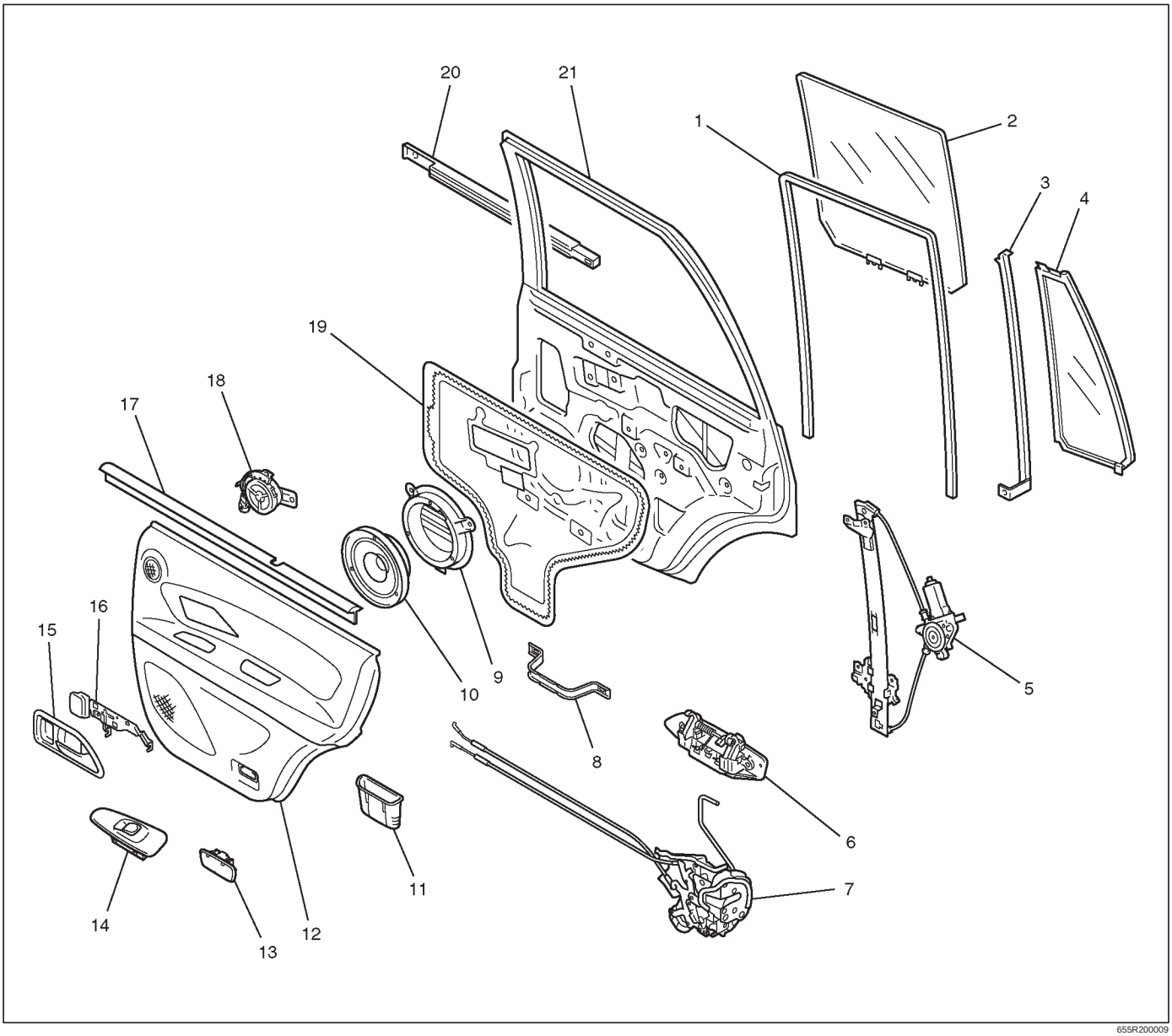
   ▼Disconnect the tweeter and courtesy light connectors.
7. Remove the inner waist seal.
8. Remove the courtesy light.
9. Remove the tweeter.

Installation

To install, follow the removal steps in the reverse order.

Rear Door Trim Panel

Rear Door Trim Panel and Associated Parts



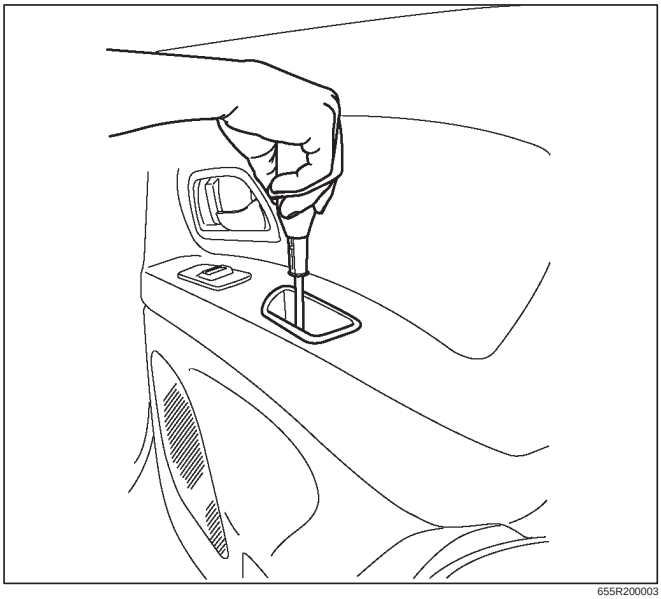
655R200009

Legend

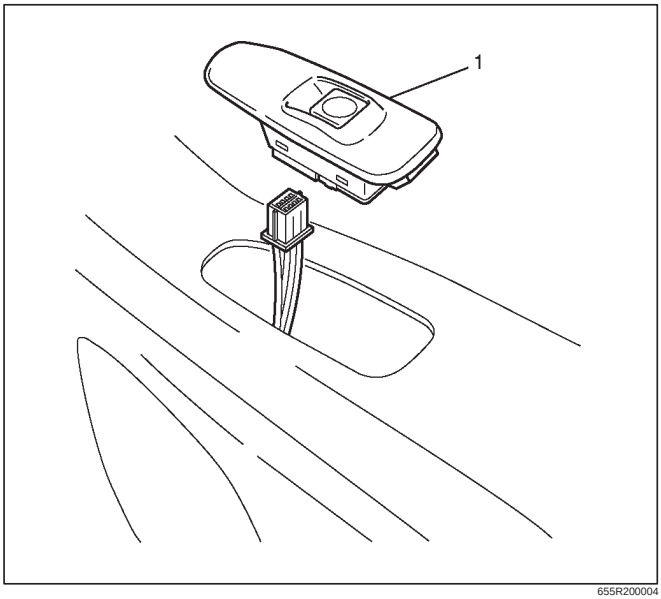
(1) Glass Run
(2) Glass
(3) Division Bar
(4) Fix Window Glass
(5) Power Window Regulator
(6) Outside Handle
(7) Door Lock Assembly
(8) Pull Box Bracket
(9) Speaker Spacer
(10) Speaker
(11) Pull Box
(12) Door Trim Panel
(13) Courtesy Light
(14) Power Window Switch
(15) Inside Handle
(16) Inside Lock Bracket
(17) Inner Waist Seal
(18) Tweeter
(19) Waterproof Sheet
(20) Outer Waist Seal
(21) Rear Door Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the pull box.
   ▼Remove the fixing screw.

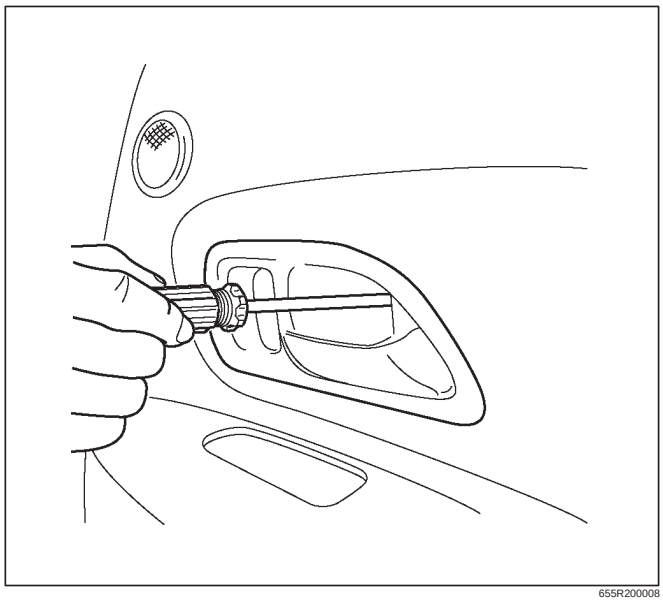

655R200003

3. Remove the power window switch.
   ▼Pry the power window switch (1) and remove the connector.

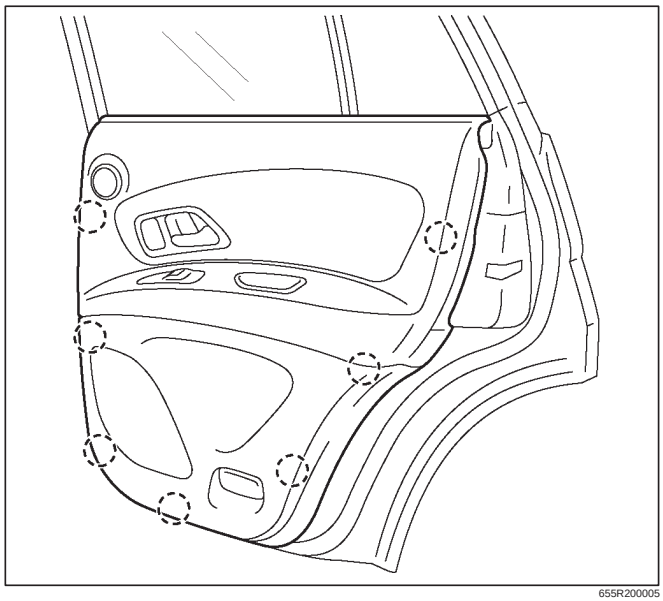


655R200004

4. Remove the inside handle.
   ▼Open the screw cover and remove the screw.
   ▼Disconnect the cable.


655R200008

5. Remove the door trim panel.
   ▼Remove the trim panel with the seven clips from the door panel.


655R200005

   ▼Disconnect the tweeter and the courtesy light connectors.
6. Remove the inner waist seal.
7. Remove the tweeter.
8. Remove the courtesy light.

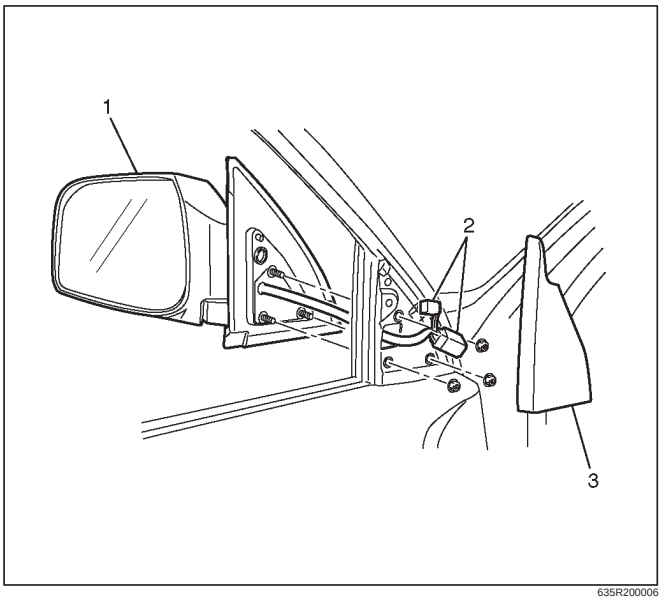
Installation

To install, follow the removal steps in the reverse order.

Door Mirror Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the door mirror cover (3).
3. Remove the door mirror assembly (1).
   ▼Remove the three nuts and disconnect the connector (2).



635R200006

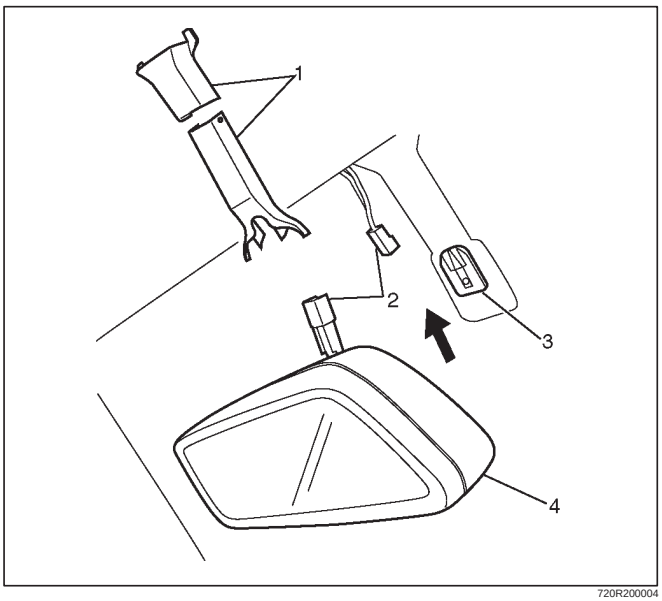
Installation

To install, follow the removal steps in the reverse order.

Interior Mirror Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the covers (1).
3. Remove the interior mirror assembly (4).
   ▼Pull the interior mirror up with the stay and remove the interior mirror from the base (3).
   ▼Disconnect the connector (2).



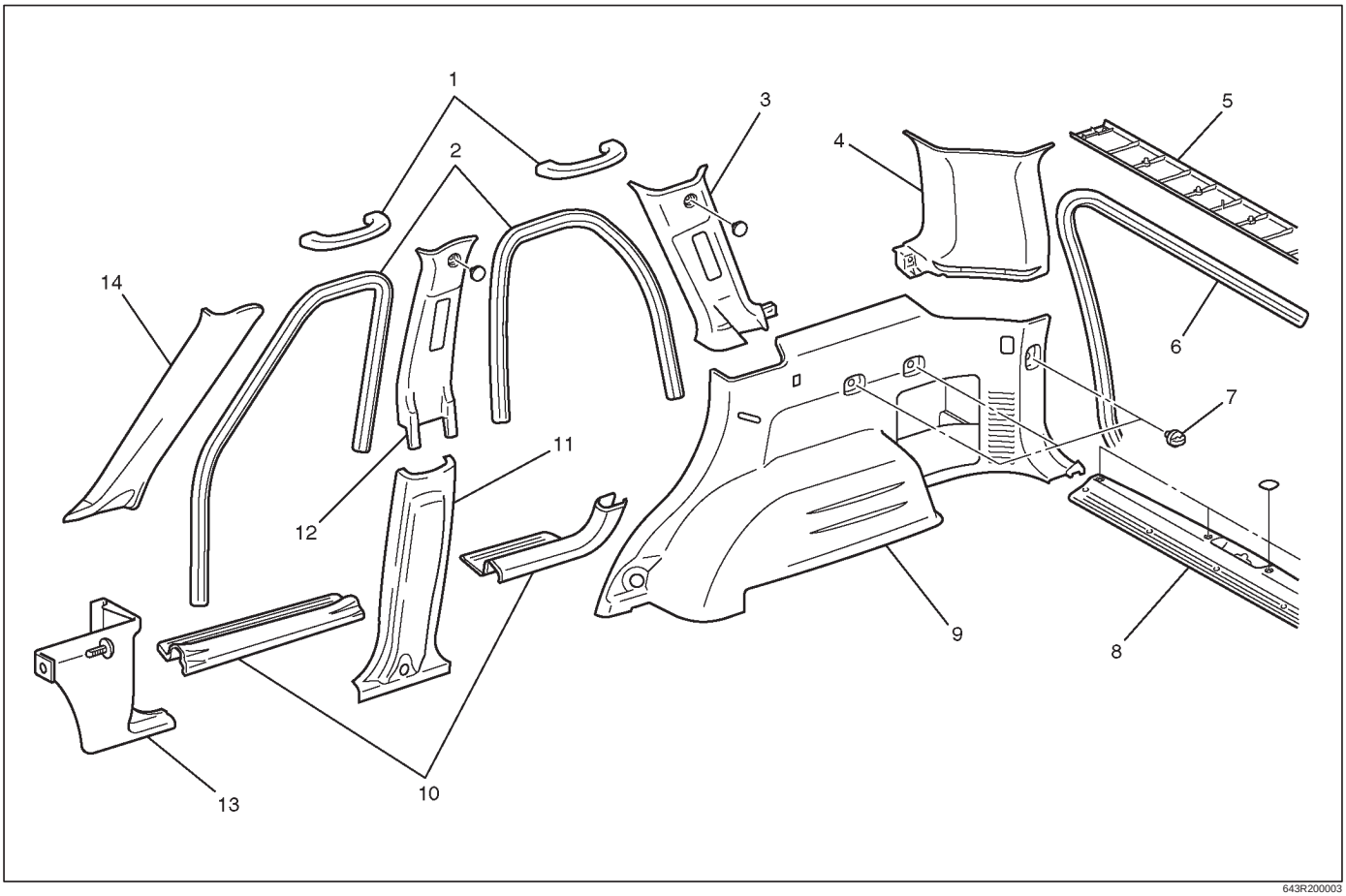
720R200004

Installation

To install, follow the removal steps in the reverse order.

Interior Trim Panels

Interior Trim Panels and Associated Parts



643R200003

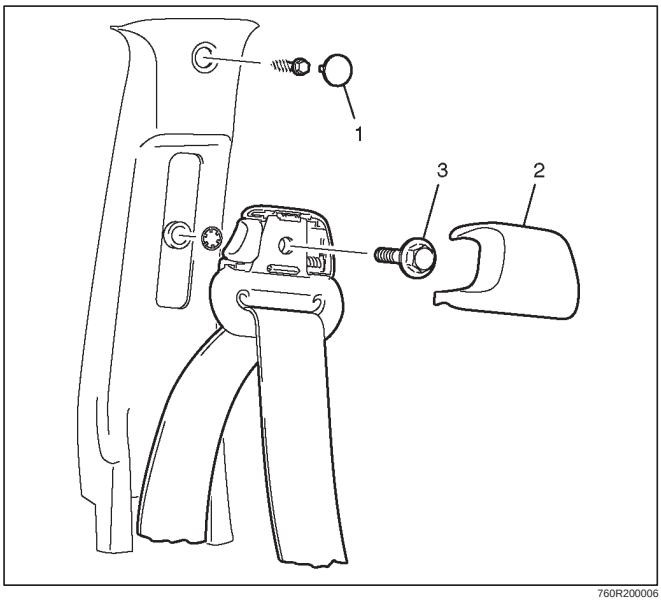
Legend

(1) Assist Grip (Front & Rear)
(2) Door Finisher (Front & Rear)
(3) Upper Quarter Pillar Trim Cover
(4) Upper Rear Pillar Trim Cover
(5) Rear Roof Trim Cover
(6) Tailgate Weather Strip
(7) Multi Hook
(8) Rear End Floor Trim Cover
(9) Lower Quarter Trim Cover
(10) Sill Plate (Front & Rear)
(11) Lower Center Pillar Trim Cover
(12) Upper Center Pillar Trim Cover
(13) Dash Side Trim Cover
(14) Front Pillar Trim Cover

Removal

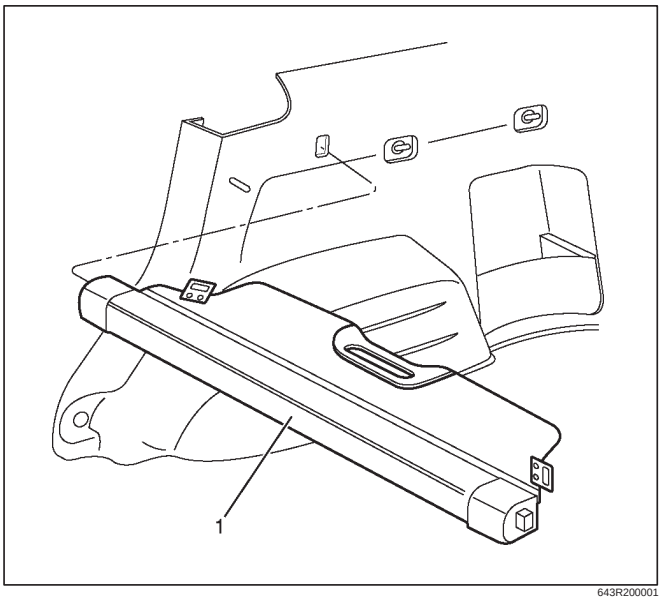
1. Disconnect the battery ground cable.
2. Remove the sill plates (Front & Rear).
3. Remove the dash side trim cover.
4. Remove the lower center pillar trim cover.
   ▼Remove the lower anchor bolt cover and lower anchor bolt from the front seat belt.
   ▼Pry the trim cover with the clips from the body panel.
5. Remove the door finishers (Front & Rear).

6. Remove the upper center pillar trim cover.
   ▼Remove the cover (1) and screw.
   ▼Remove the shoulder anchor cap (2) and upper anchor bolt (3) from the front seat belt.
   ▼Pry the trim cover with the clip from the body panel.



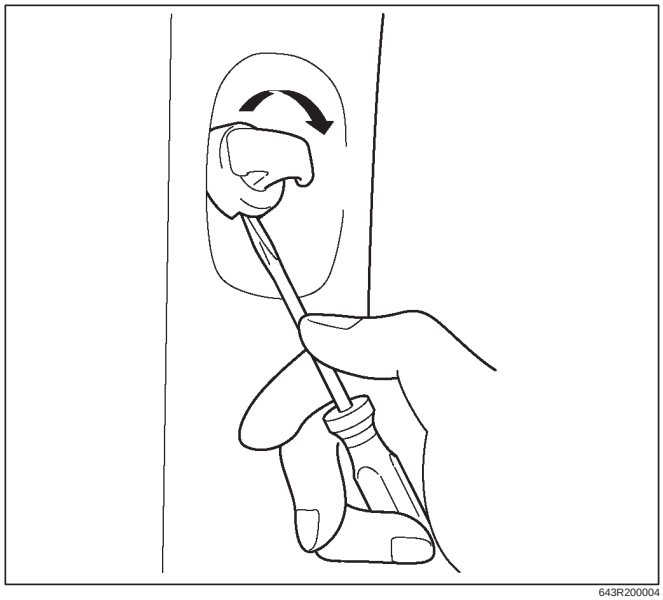
760R200006

7. Remove the front pillar trim cover.
   ▼Ply the trim cover with the clips from the body panel.
8. Remove the tailgate weather strip.
9. Remove the rear end floor trim cover.
   ▼Remove the four screw cover and nine fixing screws.
10. Remove the rear roof trim cover.
    ▼Pry the trim cover with the clips from the body panel.
11. Remove the tonneau cover assembly (1).

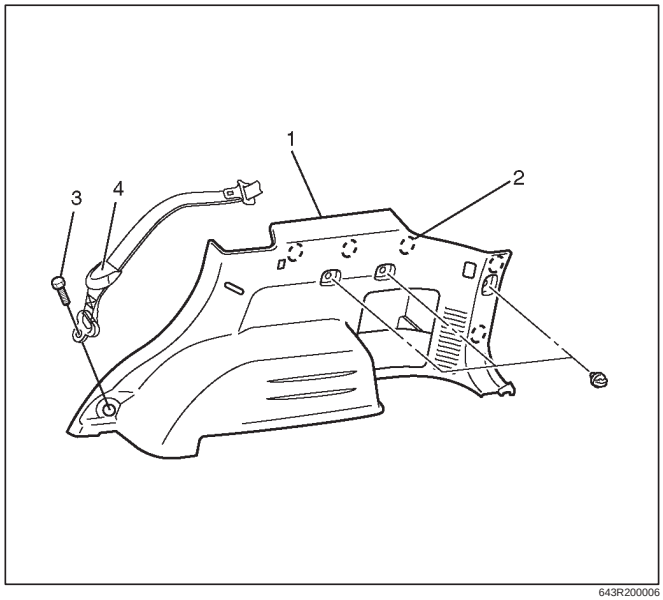


643R200001

12. Remove the multi hooks.
    ▼While raising the notch of the hook with the screwdriver, pull out the hook by turning 180°.


643R200004

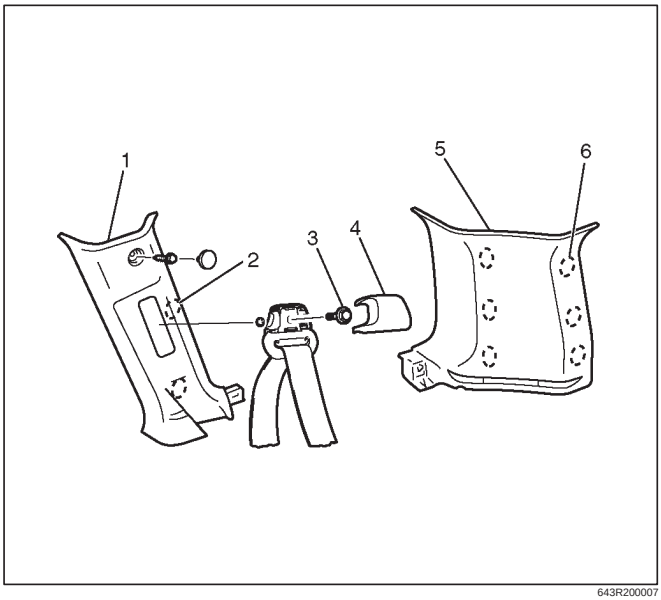
13. Remove the lower quarter trim cover (1).
    ▼Remove the lower anchor bolt cover (4) and the lower anchor bolt (3) from the rear seat belt.
    ▼Pull the trim cover at the five clip positions (2).
    ▼Disconnect the accessory socket connectors (LH side).



643R200006

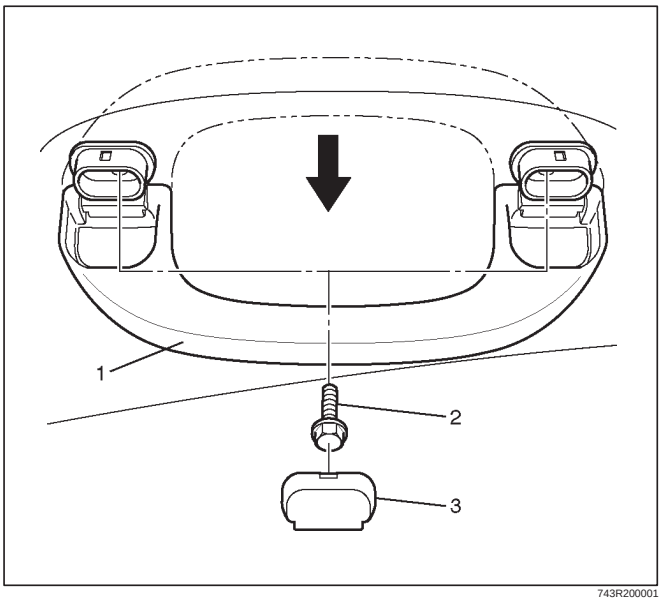
14. Remove the upper quarter pillar trim cover (1).
    ▼Remove the cover and screw, pull the trim cover at the two clip positions (2).
    ▼Remove the shoulder anchor cap (4) and upper anchor bolt (3) from the rear seat belt.

15. Remove the upper rear pillar trim cover (5).
    ▼Pull the trim cover at the six clip positions (6) from the body panel.



643R200007

16. Remove the assist grip (1) (Front & Rear).
    ▼Pull the assist grip downword.
    ▼Remove the caps and fixing bolts.



743R200001

Installation

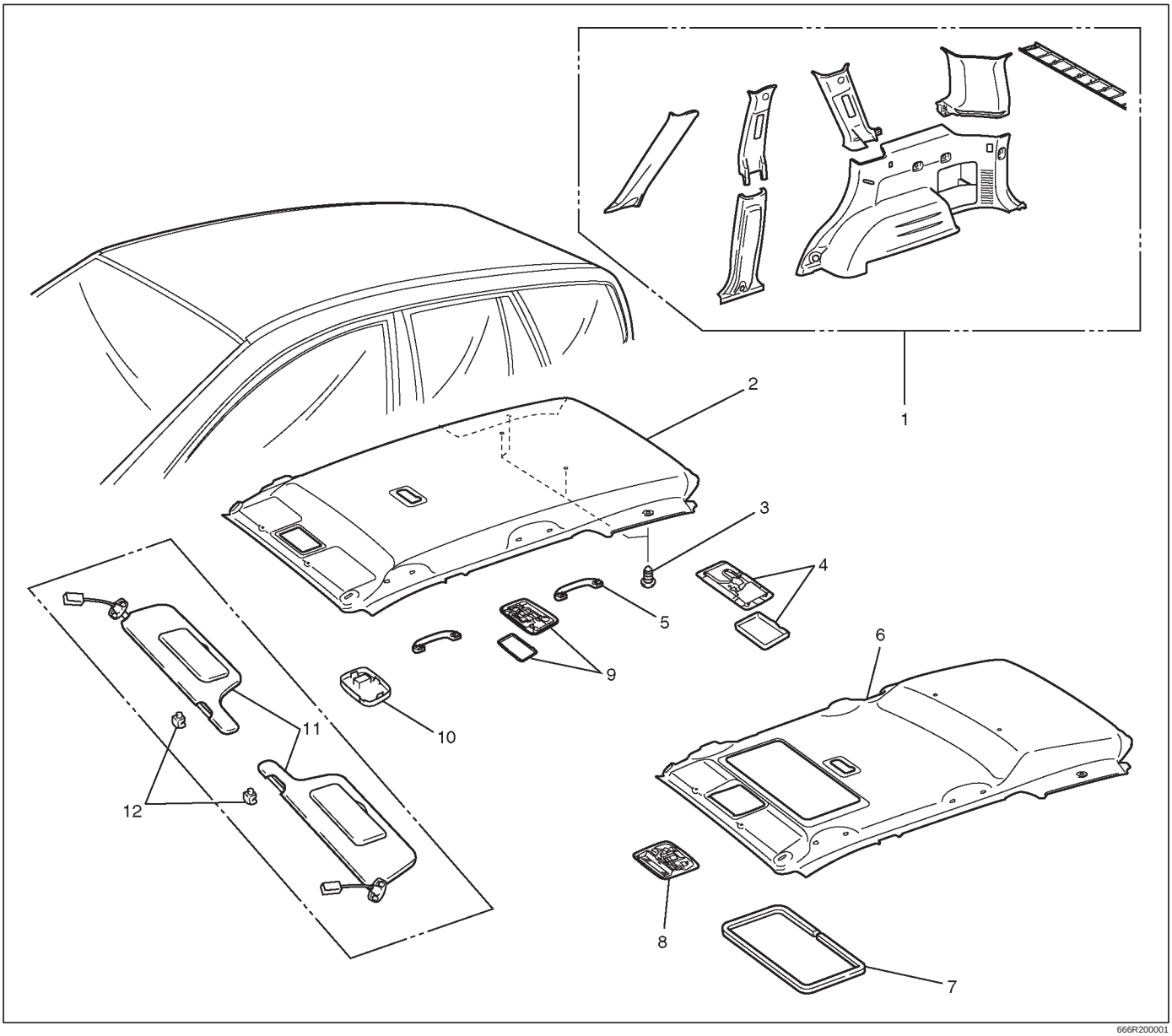
To install, follow the removal steps in the reverse order, noting the following point:

1. Tighten the seat belt anchor bolt to the specified torque.

   Torque: 39 N·m (29 lb ft)

Headlining

Parts Location



666R200001

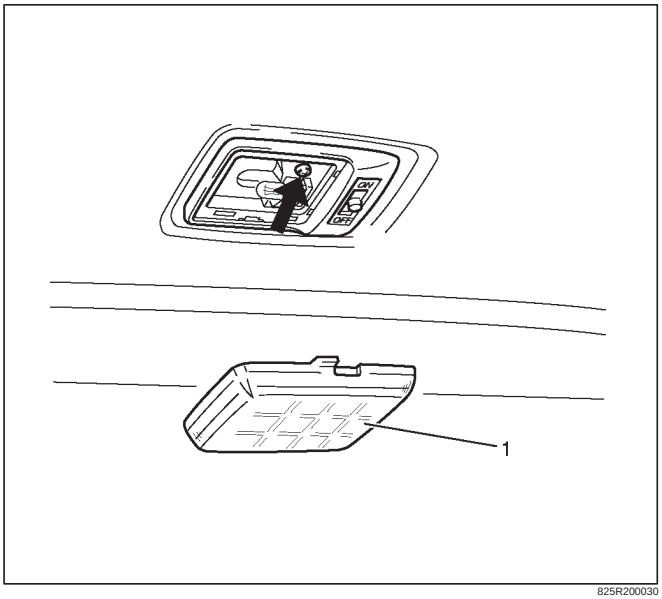
Legend

(1) Interior Trim Panels
(2) Headlining (Without Sunroof)
(3) Clip
(4) Luggage Room Light
(5) Assist Grip
(6) Headlinng (With Sun Roof)
(7) Sunroof Finisher (With Sunroof)
(8) Overhead Console/Sunroof Switch (With Sunroof)
(9) Dome Light
(10) Overhead Console (Without Sunroof)
(11) Sunvisors
(12) Sunvisor Holder

Removal

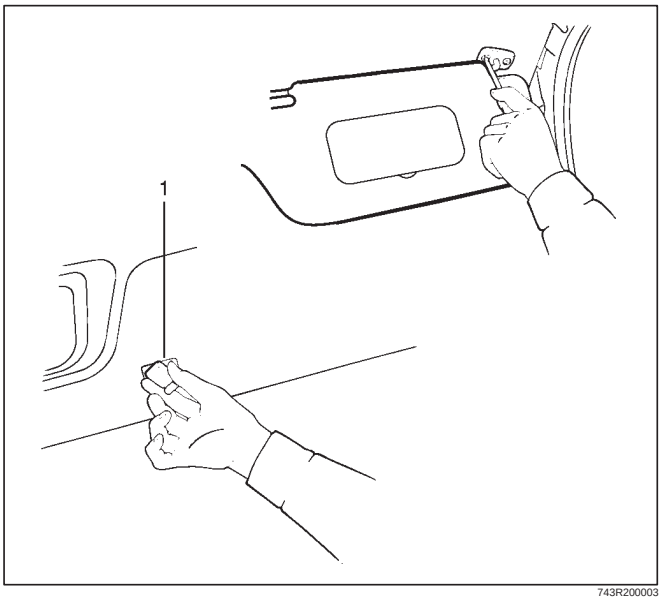
1. Disconnect the battery ground cable.
2. Remove the interior trim panels.
   ▼Refer to *Interior Trim Panels in this section.*
3. Remove the dome light.
   ▼Remove the dome light lens and the fixing screws.
   ▼Disconnect the dome light connectors.

4. Remove the luggage room light.
   ▼Remove the luggage room light lens (1) and the fixing screw.
   ▼Disconnect the luggage room light connector.



825R200030

5. Remove the overhead console/sunroof switch (With sunroof).
   ▼Refer to *Overhead Console in this section.*
6. Remove the overhead console (without sunroof).
7. Remove the sunvisors.
   ▼Remove the fixing screws and pull out the sunvisor holder (1) to remove it.
   ▼Disconnect the vanity mirror illumination connector.



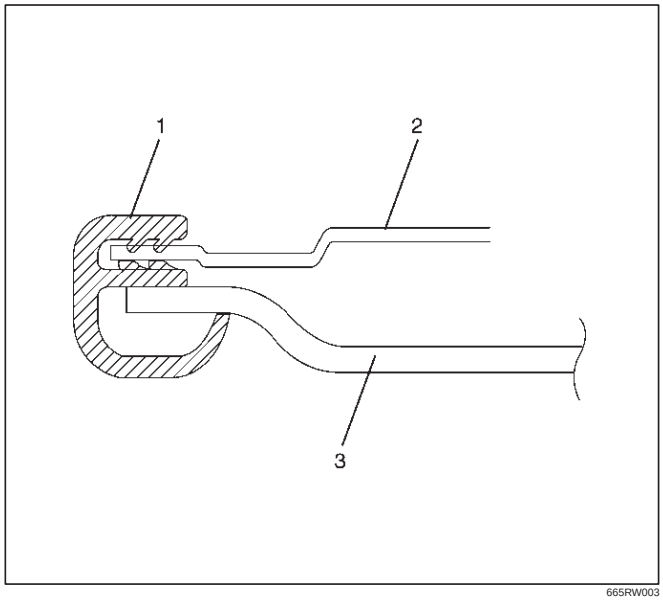
743R200003

8. Remove the sunroof finisher (With sunroof).
9. Remove the headlining.
   ▼Remove the four headlining fixing clips.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

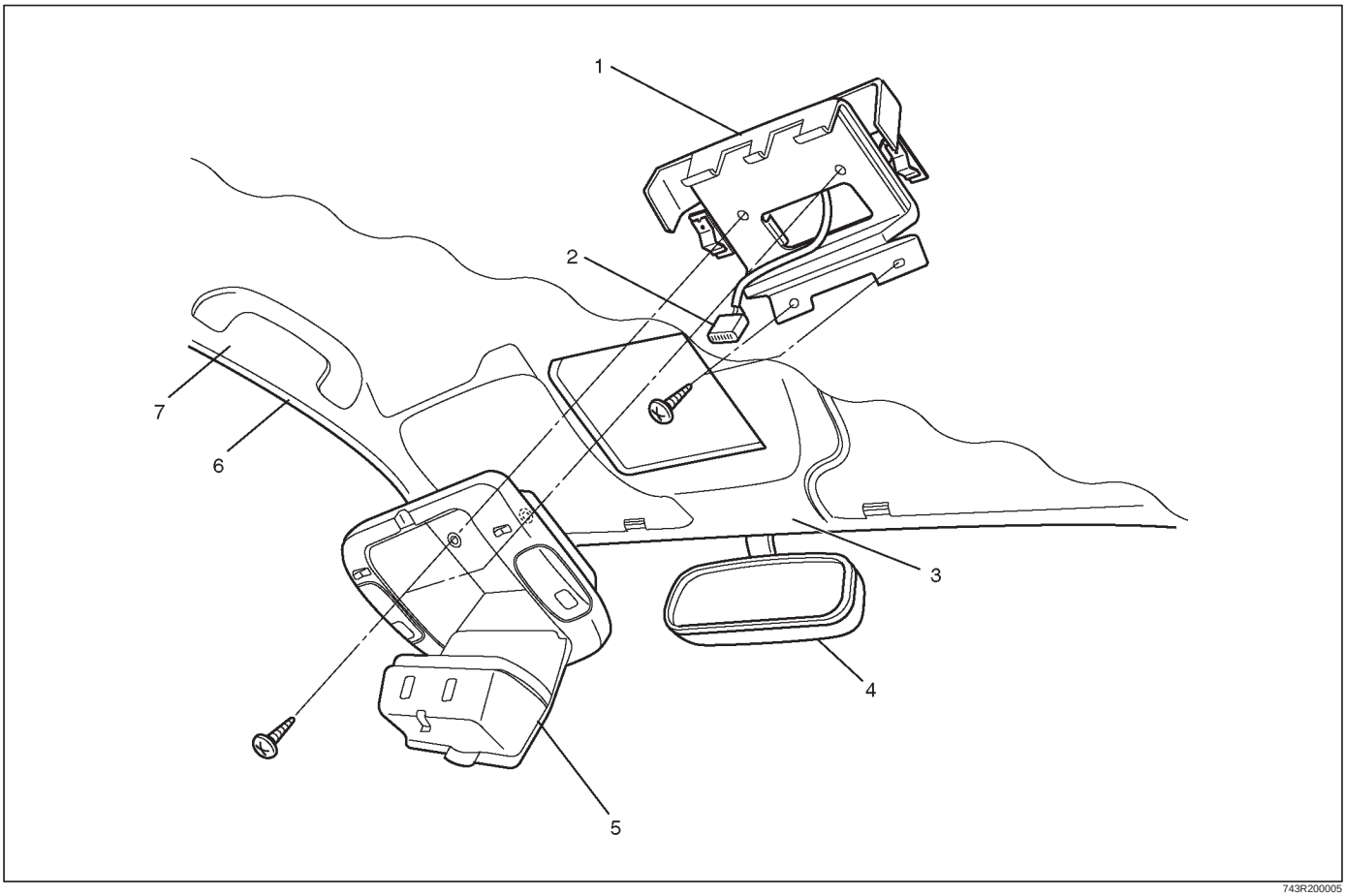
1. Install the headlining so that the fixing clips will not come off.
2. To install the sunroof finisher (1), first fit it in at one place with the headlining (3) close to the sunroof frame (2), then install the entire finisher tightly by hitting it with a plastic hammer, not allowing it to move up.



665RW003

Overhead Console

Parts Location (W/O Sunroof)



743R200005

Legend

(1) Overhead Console Bracket
(2) Harness Connector
(3) Head Lining
(4) Room Mirror
(5) Overhead Console Assembly
(6) Front Door Finisher
(7) Front Assist Grip

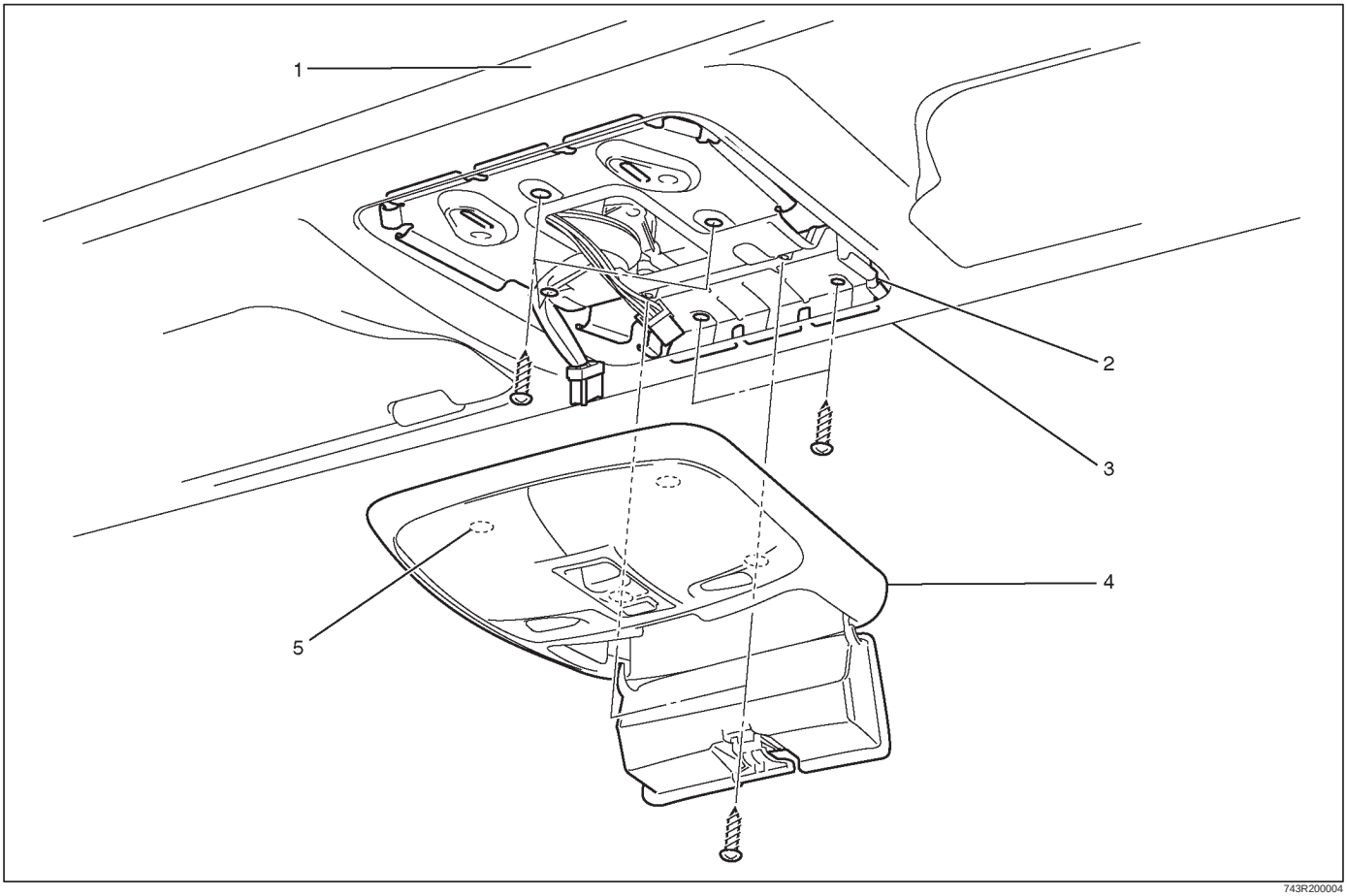
Removal

1. Disconnect the battery ground cable.
2. Remove the overhead console assembly.
   ▼Open the lid and remove the two screws.
   ▼Disconnect the harness connector.
3. Remove the sunvisor and sunvisor holder. (right and left)
4. Remove the front assist grip. (right and left)
5. Remove the front piller trim cover.
6. Remove the front door finisher.
   ▼Remove the upper side of door finisher.
7. Remove the interior mirror.
   ▼Refer to *Interior Mirror in this section.*
8. Remove the overhead console bracket.
   ▼Remove the two screws.

Installation

To install, follow the removal steps in the reverse order.

Parts Location (W/ Sunroof)



Legend

(1) Sunroof Weatherstrip
(2) Overhead Console Bracket
(3) Head Lining
(4) Overhead Console
(5) Clip Position

Removal

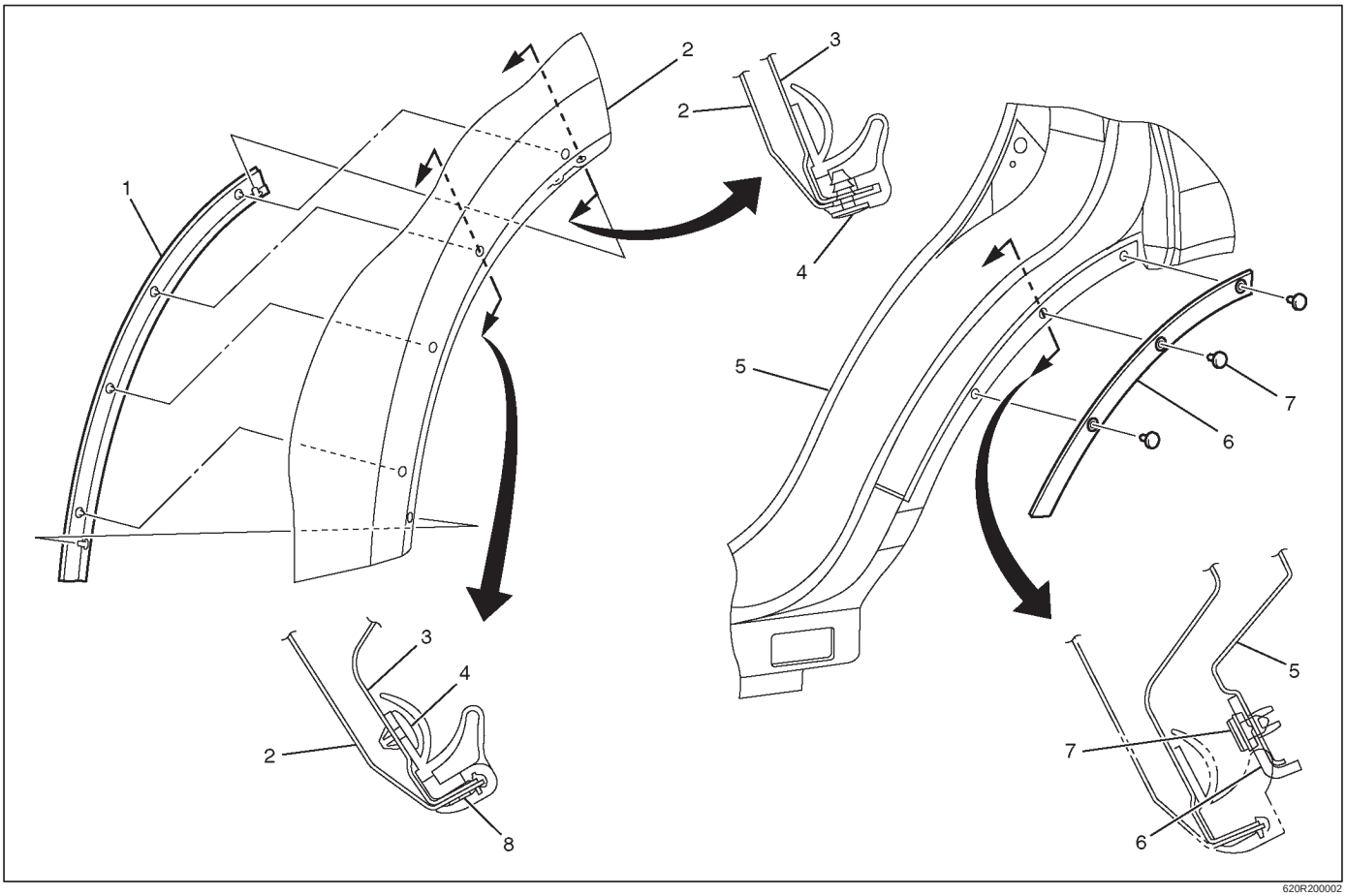
1. Disconnect the battery ground cable.
2. Remove the overhead console.
   ▼Open the lid and remove the two screws.
   ▼Pull the over head console at the two clip positions.
   ▼Disconnect the harness connectors.
3. Remove the head lining.
   ▼Refer to *Head Lining in this section.*
4. Remove the overhead console bracket.
   ▼Remove the five fixing screws.

Installation

To install, follow the removal steps in the reverse order.

Wheel Arch Cover

Wheel Arch Cover and Associated Parts



Legend

(1) Wheel Arch Seal Assembly
(2) Rear Door Outer Panel
(3) Rear Door Inner Panel
(4) Clip
(5) Body Side Outer Panel
(6) Wheel Arch Cover
(7) Screw Cover
(8) Adhesive Tape

Removal

1. Remove the rear door wheel arch seal.
   ▼After disengage four six, peel off the double sided adhesive tape.
2. Remove the wheel arch cover.
   ▼Remove the three fixing screws.

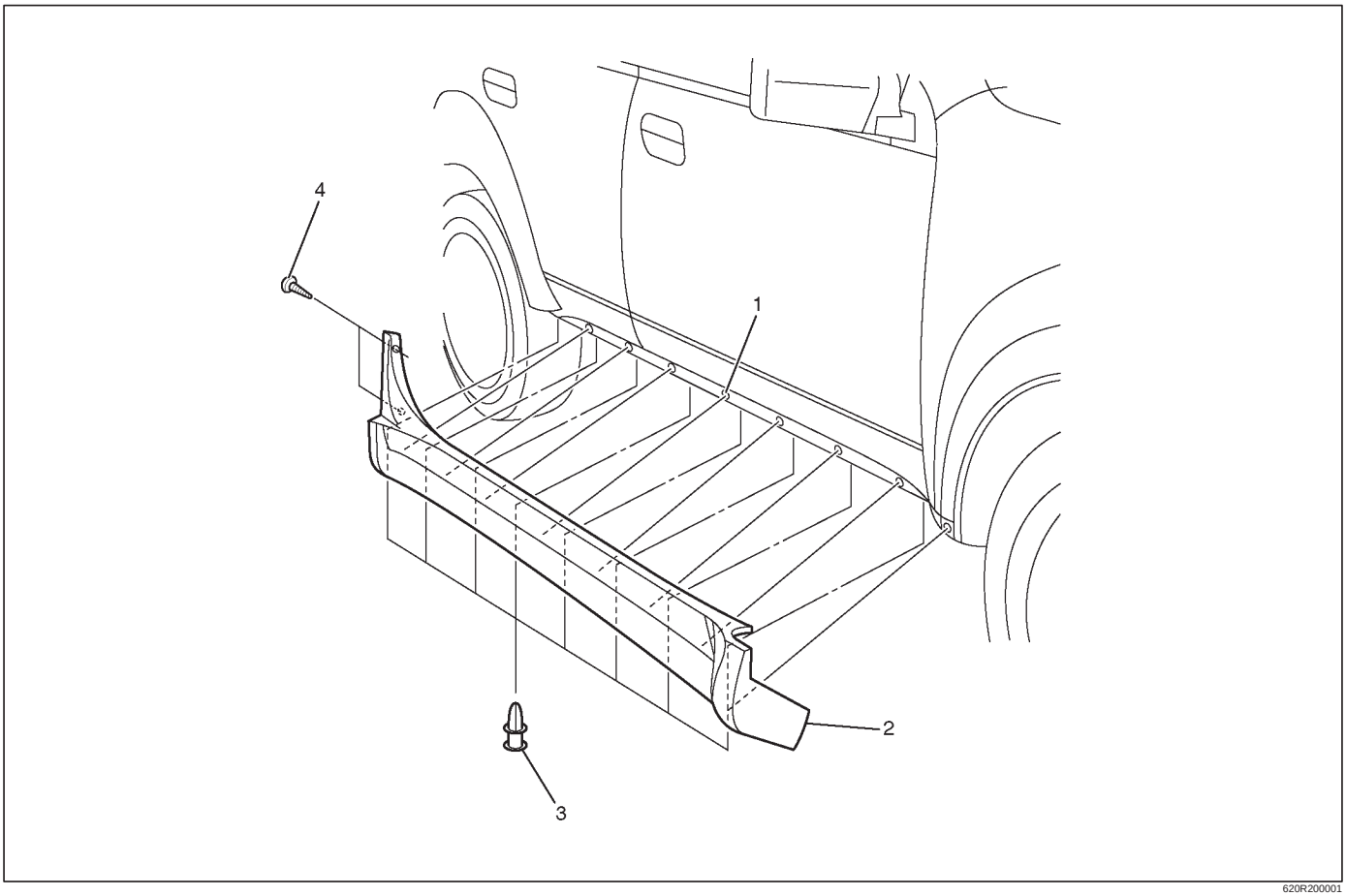
Installation

To install, follow the removal steps in the reverse order, noting following point.

1. Use a new double sided adhesive tape whenever installing the rear door wheel arch seal.
   Use rubbing alcohol to clean the area where the double sided adhesive is to be attached.

Locker Cover

Locker Cover and Associated Parts



620R200001

Legend

(1) Clip Position
(2) Lock Cover Assembly
(3) Clip
(4) Screw

Removal

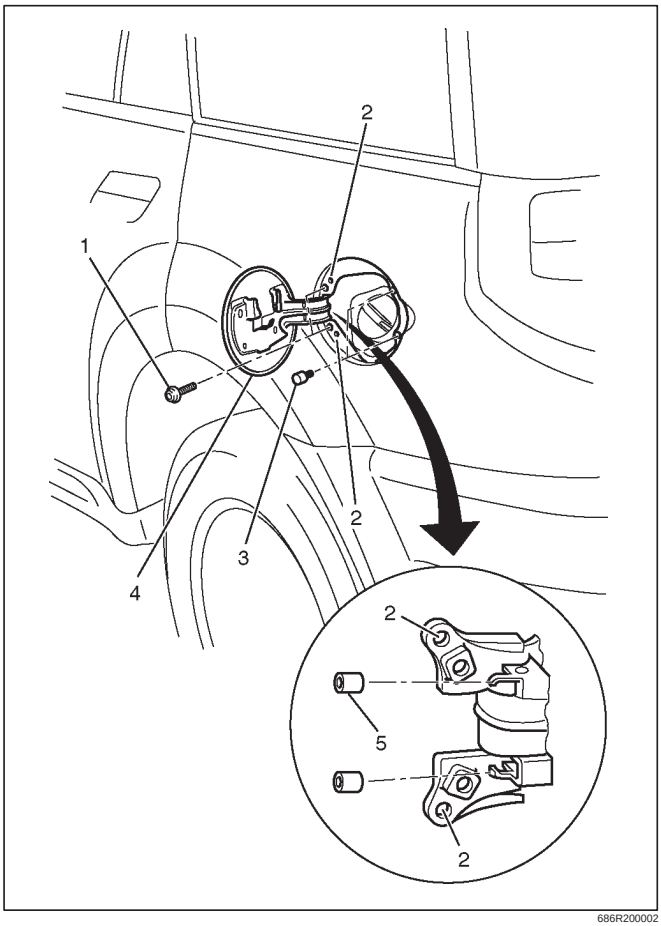
1. Remove the 8 clips.
2. Remove the two screws.
3. Remove the 8 clip positions.
4. Remove the locker cover assembly.

Installation

To install, follow the removal steps in the reverse order.

Fuel Filler Door

Parts Location



686R200002

Legend

(1) Fuel Filler Door Fixing Screw
(2) Basic Hole
(3) Fuel Filler Door Buffer
(4) Fuel Filler Door
(5) Fuel Filler Door Hinge Buffer

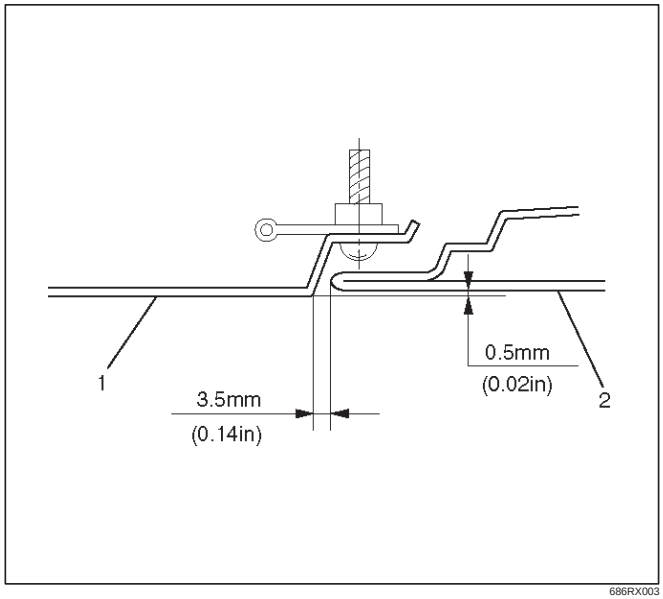
Removal

1. Open the fuel filler door.
2. Remove the fuel filler door.
   ▼Remove the two fixing screws.
3. Pull out the fuel filler door buffer.
4. Pull out the fuel filler hinge buffer.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

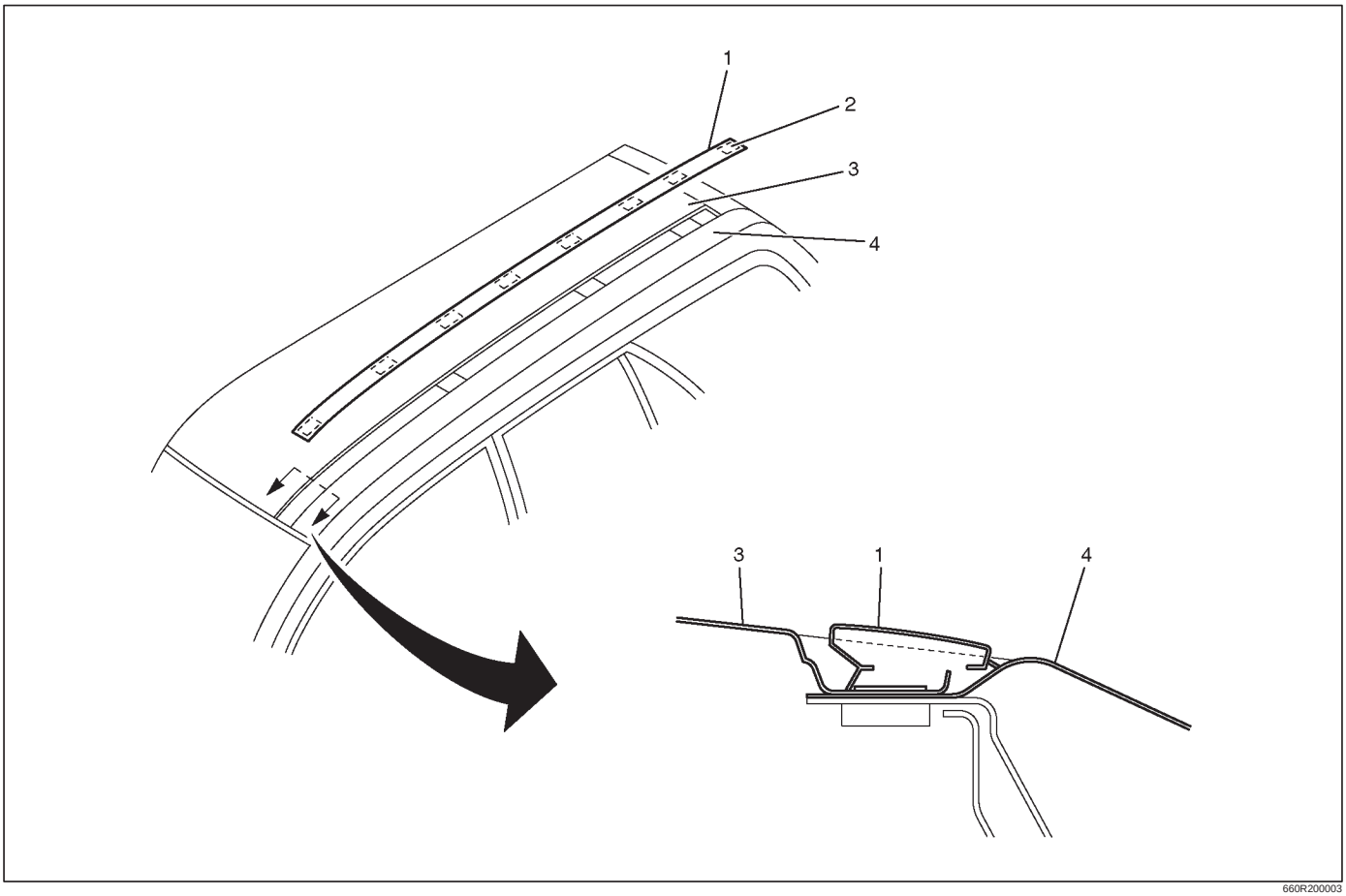
1. Install the fuel filler door to match the basic hole.
2. Adjust the clearance between outer quarter panel (1) and fuel filler door (2).



686RX003

Roof Moulding

Parts Location



Legend

(1) Roof Moulding Assembly
(2) Clips
(3) Roof Panel
(4) Body Side Outer Panel

Removal

1. Remove the roof moulding.
   ▼Pry the roof moulding covers with the nine clip positions from the roof panel.

Installation

To install, follow the removal steps in the reverse order.

Power Door Mirror System

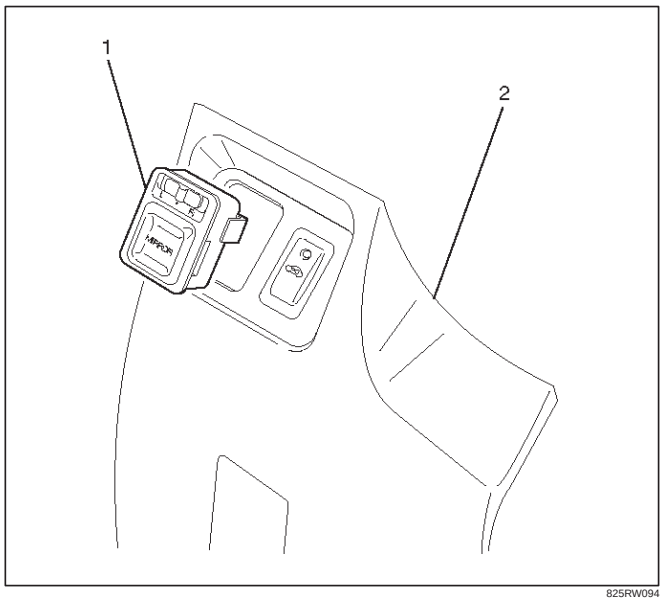
General Description

The system consists of the starter switch, door mirror switch, rear defogger/mirror defogger switch and door mirrors on both sides.
When the door mirror switch is operated with the starter switch at either “ACC” or “ON” position, the motor in the door mirror (on either side) rotates to allow the horizontal and vertical adjustment of mirror angles.
When the rear defogger/mirror defogger switch is turned “ON” with the starter switch “ON”, the heater of the left and right mirrors and the tailgate glass are activated.

Door Mirror Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel lower cover (2).
   Refer to the *Instrument Panel Assembly in Body Structure section.*
3. Remove the door mirror switch (1).



825RW094

Rear Defogger/Mirror Defogger Switch

Refer to the *Rear Defogger/Mirror switch removal and installation steps in Lighting System section.*

Door Mirrors

Refer to *Door Mirror Assembly in this section.*

Power Window System

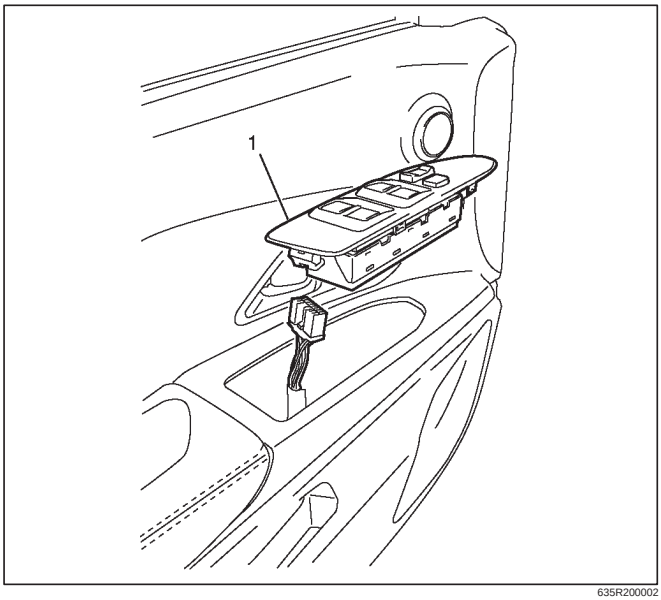
General Description

The power window system consists of power window switches and power window motors on driver and passenger sides and power window relay. With the starter switch in “ON” position, the battery voltage is supplied through power window relay to the power window switches on driver and passenger sides. Selection of up or down switch changes the motor rotating direction to open or close the window.
When the power window “LOCK” switch on the driver side is pressed, the power source for the other switches are disconnected causing the power window operation to seize.

Power Window Switch Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch (1).
   ▼Pull out the switch by pushing the spring with the tip of a screwdriver.
   ▼Disconnect the connector.



635R200002

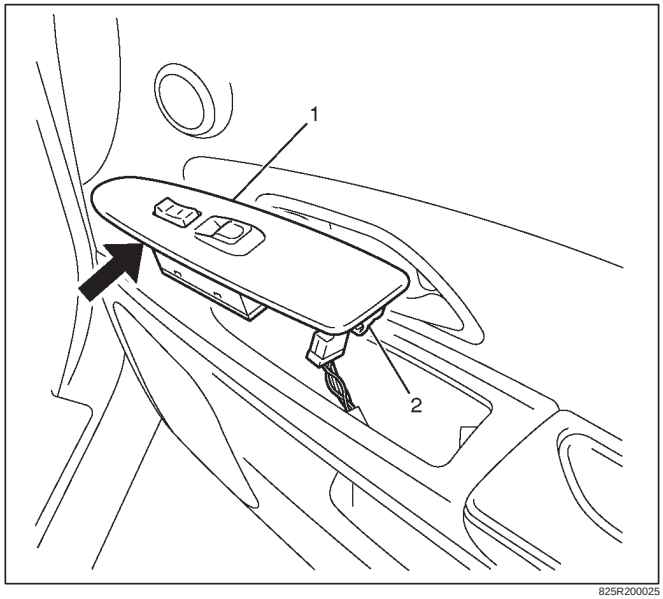
Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch (1).
   ▼Pull out the switch by pushing the spring (2) with the tip of a screwdriver.
   ▼Disconnect the connector.



825R200025

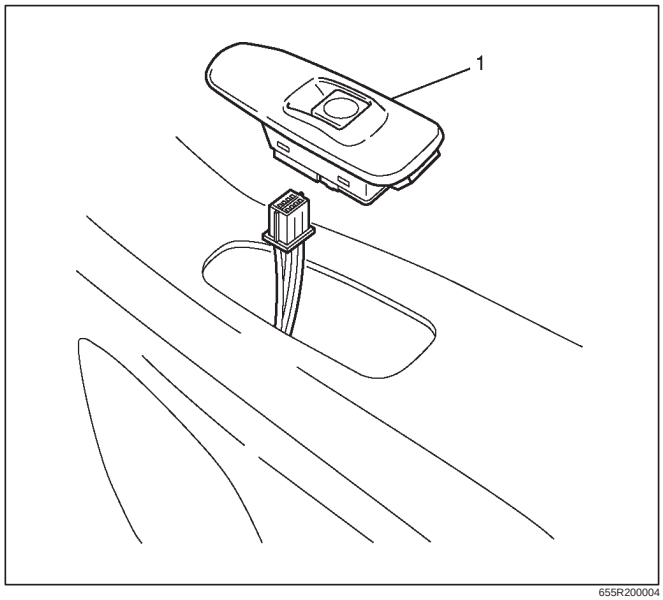
Installation

To install, follow the removal steps in the reverse order.

Rear-Left and Right Sides

Removal

1. Disconnect the battery ground cable.
2. Remove the rear power window switch (1).
   ▼Pull out the switch by pushing the spring with the tip of a screwdriver.
   ▼Disconnect the connector.



655R200004

Installation

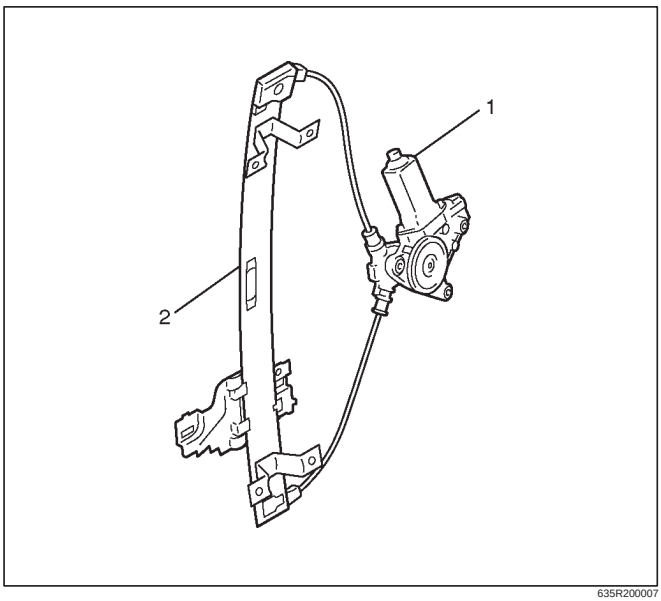
To install, follow the removal steps in the reverse order.

Power Window Motor

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (2).
   ▼Refer to the *Window Regulator and Glass removal steps in Body Structure section.*
3. Remove the power window motor (1).
   ▼Remove three screws.



635R200007

Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

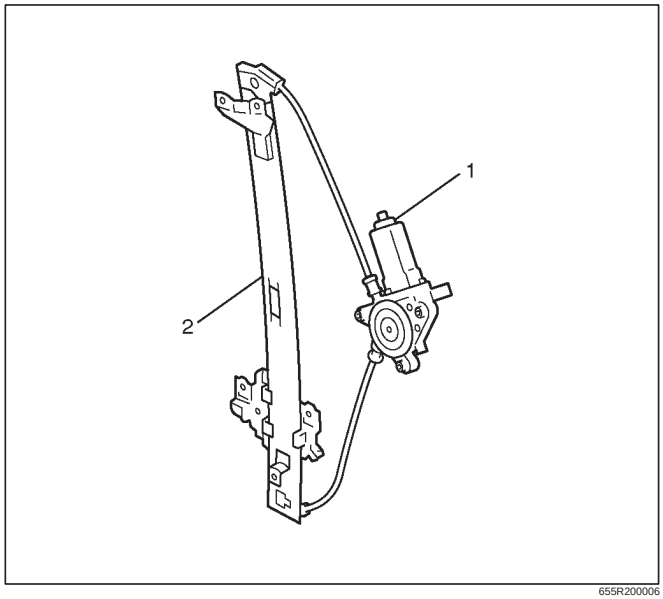
Removal and Installation

Refer to the *Front Window Motor — Driver Seat side removal and installation steps in this section.*

Rear-Right Side

Removal

1. Disconnect the battery ground cable.
2. Remove the rear window regulator assembly (2).
   ▼Refer to the *Rear Window Regulator and Glass removal steps in Body Structure section.*
3. Remove the power window motor (1).
   ▼Remove three screws.



655R200006

Installation

To install, follow the removal steps in the reverse order.

Rear-Left Side

Removal and Installation

Refer to the *Rear Power Window Motor — Right Side removal and installation steps in this section.*

Main Data and Specifications

Torque Specifications

Application	N·m	lb ft	lb in
Front & Rear Seat Belt Anchor Bolts	39	29	—

AXIOM

RESTRAINTS

SEAT BELT SYSTEM

CONTENTS

Service Precaution 9A–1
Front Seat Belt 9A–2
Front Seat Belt and Associated Parts 9A–2
Removal 9A–2
Inspection 9A–3
Installation 9A–4
Rear Seat Belt 9A–5
Rear Seat Belt and Associated Parts 9A–5
Removal 9A–5
Inspection 9A–6
Installation 9A–6
Front Seat Buckle Assembly 9A–7
Removal 9A–7
Installation 9A–7
Rear Center Seat Belt / Buckle Assembly . . . 9A–8
Rear Center Seat Belt / Buckle Assembly and Associated Parts 9A–8
Removal 9A–8
Installation 9A–8
Child Seat Tether Anchorage Bracket (Child Restraint) 9A–9
Child Seat Tether Anchorage Bracket and Associated Parts 9A–9
Removal 9A–9
Installation 9A–9
Child Seat Lower Anchorage Striker 9A–10
Child Seat Lower Anchorage Striker and Associated Parts 9A–10
Removal 9A–10
Installation 9A–11
Main Data and Specifications 9A–12

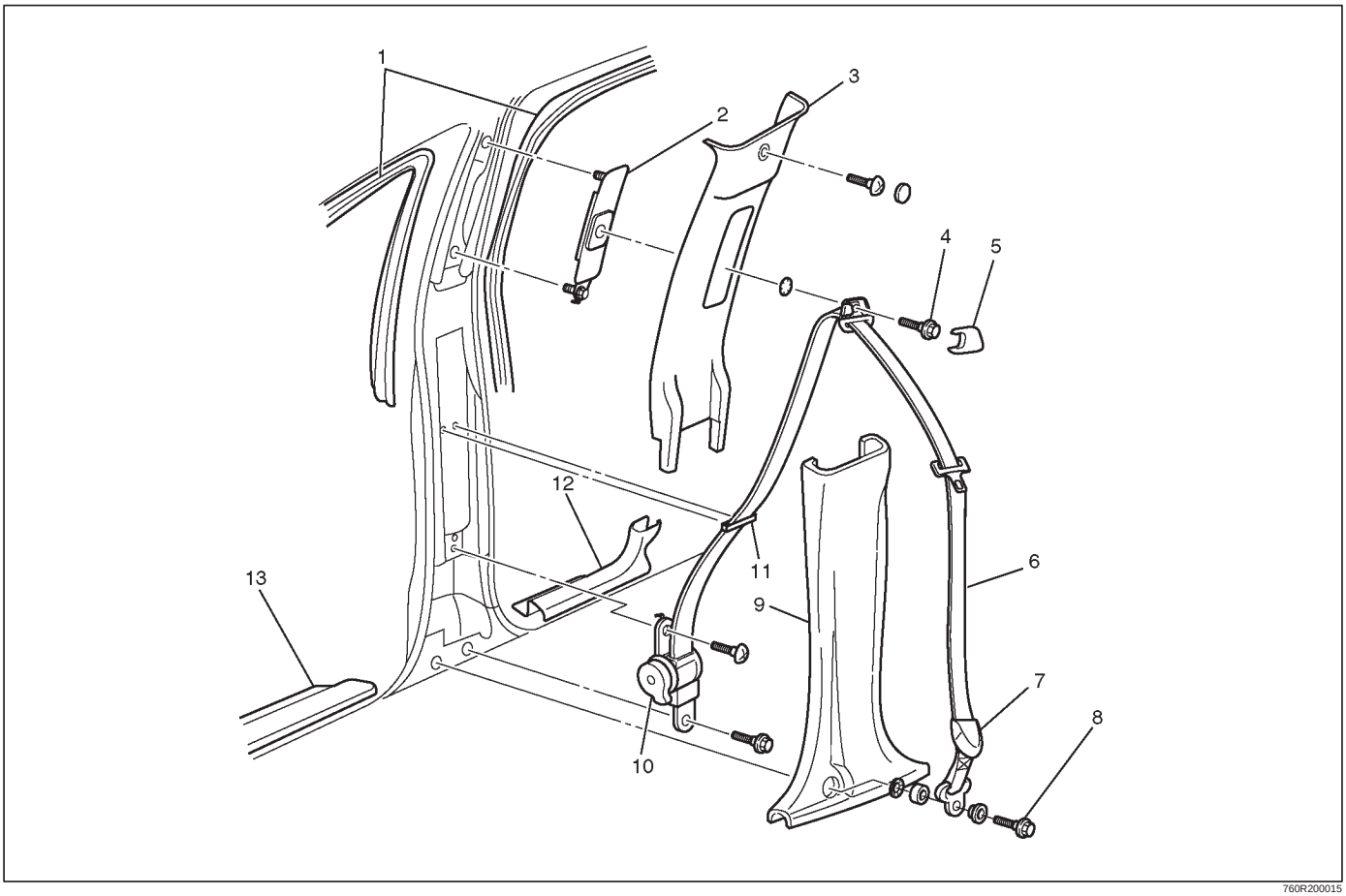
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Seat Belt

Front Seat Belt and Associated Parts



760R200015

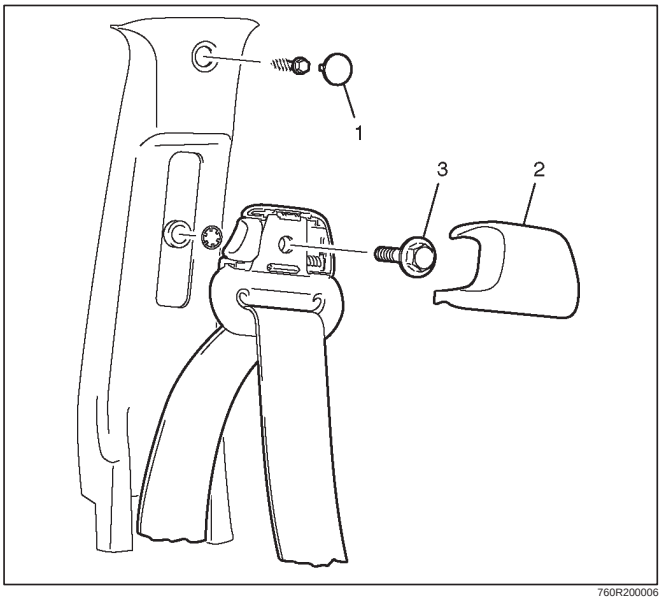
Legend

(1) Door Seal Finisher (Front & Rear)
(2) Adjustable Shoulder Anchor Assembly
(3) Upper Center Pillar Trim Cover
(4) Seat Belt Upper Anchor Bolt
(5) Shoulder Anchor Cap
(6) Front Seat Belt Assembly
(7) Anchor Cover
(8) Seat Belt Lower Anchor Bolt
(9) Lower Center Pillar Trim Cover
(10) Retractor
(11) Webbing Guide
(12) Rear Sill Plate
(13) Front Sill Plate

Removal

1. Disconnect the battery ground cable.
2. Remove the sill plate (Front & Rear).
3. Remove the anchor cover and seat belt lower anchor bolt.
4. Remove the lower center pillar trim cover.
5. Remove the door seal finisher (Front & Rear).
6. Remove the seat belt upper anchor bolt (3).
   ▼Remove the shoulder anchor cap (2).

7. Remove the upper center pillar trim cover.
   ▼Remove screw cover (1) and screw.
   ▼Pry the trim cover with the clip from the body panel.



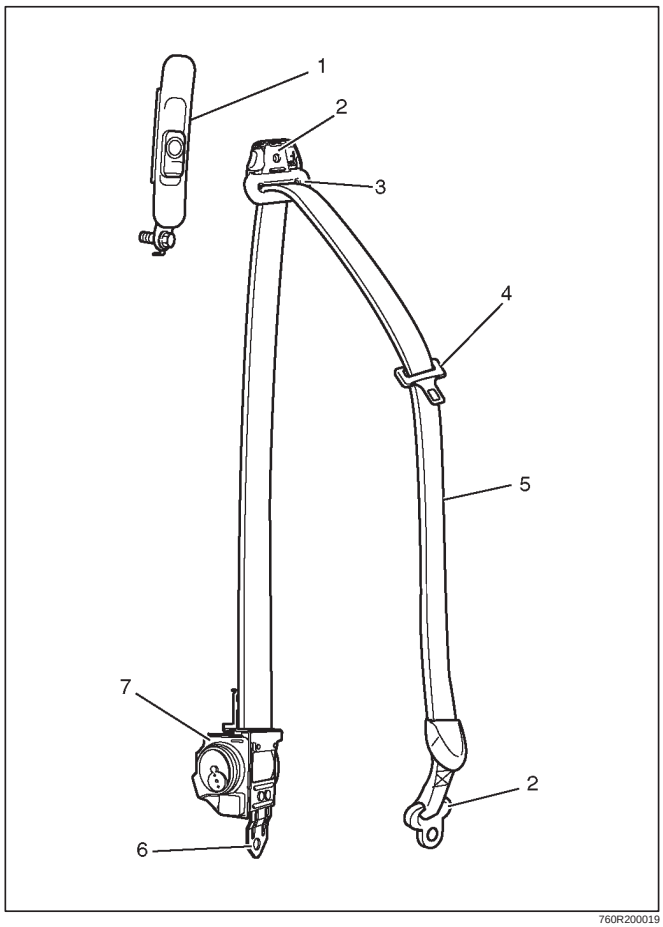
760R200006

8. Remove the retractor fixing bolt and screw.
9. Remove the seat belt assembly.
   ▼Pull out the webbing guide.
10. Remove the adjustable shoulder anchor assembly.
    ▼Remove the two fixing bolts.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- ▼Deformed and malfunctioning adjustable shoulder anchor (1).
- ▼Uneven movement of upper/lower anchors (2) in the circumferential direction.
- ▼Damaged and/or deformed through ring (3).
- ▼Damaged and/or deformed tongue (4).
- ▼Damaged and/or frayed webbing (5).
- ▼Deformed retractor bracket (6).
- ▼Seat belt does not retract (7).
- ▼Resistance or abnormal sound when seat belt is pulled out or retracted (7).
- ▼Retractor (7) abnormality.



760R200019

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   ▼The seat belt should not lock when pulled gently at a 15 degree angle. Also, the seat belt should lock when pulled at a 45 degree angle or higher.
2. ELR lock check.
   ▼The seat belt should not lock when pulled slowly, however, the seat belt should lock when pulled quickly.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   ▼Make sure the seat belt is locked when pulled out fully.
   ▼Make sure the seat belt can be pulled out and retracts after when rewound fully.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

CAUTION: When replacing the front seat belt, always replace the seat belt with the same parts/part number.

1. Tighten the adjustable shoulder anchor assembly fixing bolts to the specified torque.

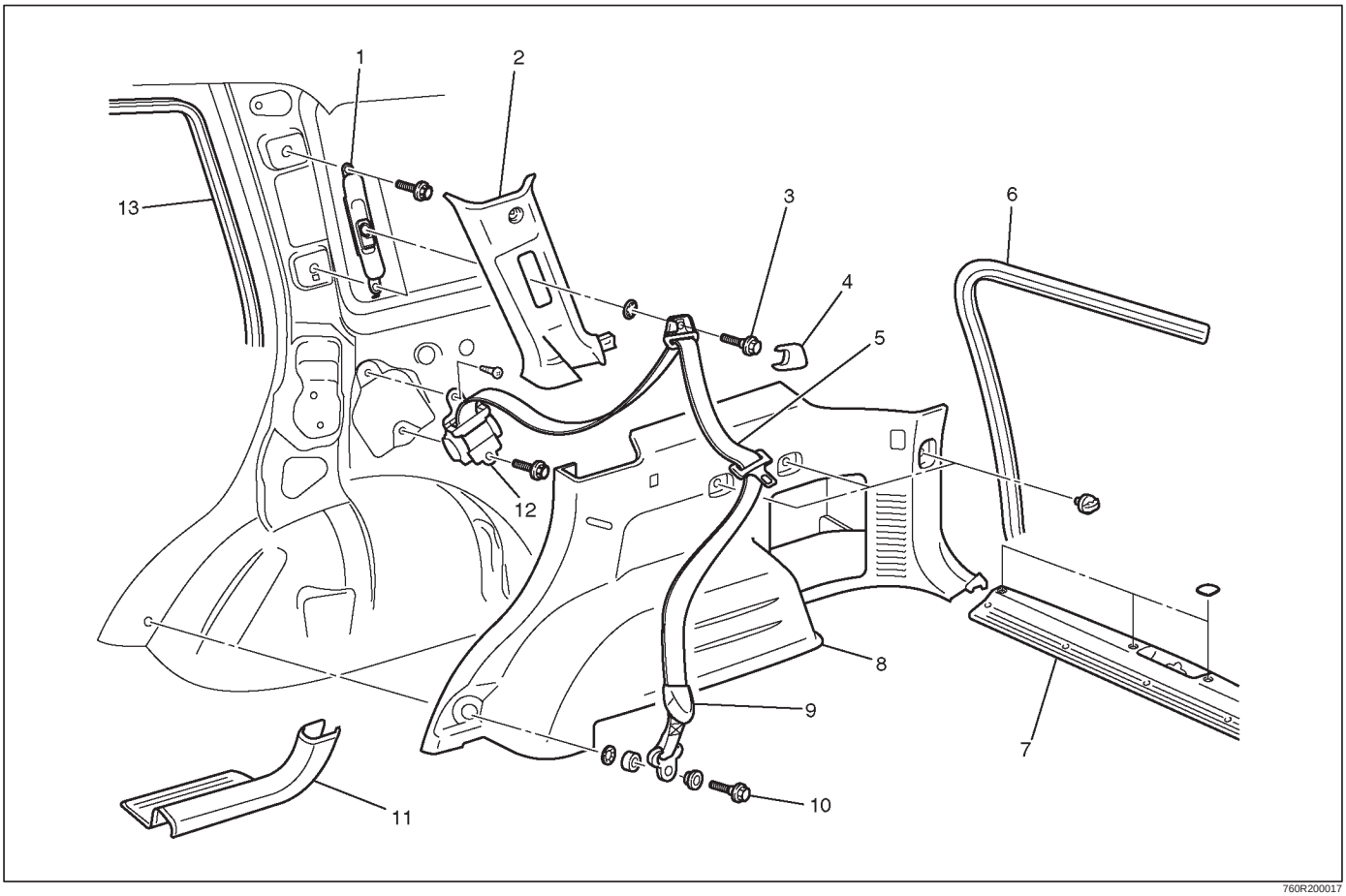
   Torque: 39 N·m (29 lb ft)

2. Tighten the seat belt anchor bolts (Upper & Lower) and the retractor fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Seat Belt

Rear Seat Belt and Associated Parts



760R200017

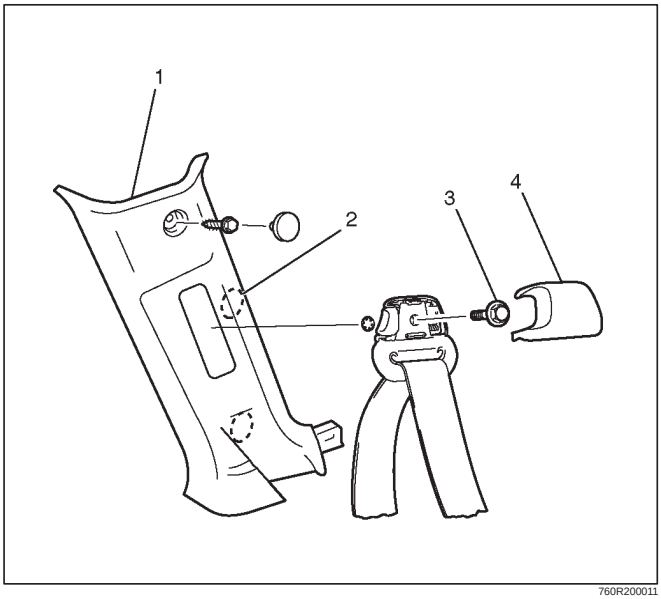
Legend

(1) Adjustable Shoulder Anchor Assembly
(2) Upper Quarter Pillar Trim Cover
(3) Seat Belt Upper Anchor Bolt
(4) Shoulder Anchor Cap
(5) Rear Seat Belt Assembly
(6) Tailgate Weather Strip
(7) Rear End Floor Trim Cover
(8) Lower Quarter Trim Cover
(9) Anchor Cover
(10) Seat Belt Lower Anchor Bolt
(11) Rear Sill Plate
(12) Retractor
(13) Rear Door Seal Finisher

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate weather strip.
3. Remove the rear end floor trim cover.
4. Remove the rear sill plate.
5. Remove the anchor cover and the lower anchor bolt.
6. Remove the lower quarter trim cover.
   ▼Refer to Interior Trim Panel in Exterior/Interior Trim section.
7. Remove the seat belt upper anchor bolt (3).
   ▼Remove the shoulder anchor cap (4).

8. Remove the upper quarter pillar trim cover (1).
   ▼Remove the screw cover and screw.
   ▼Pry the trim cover with the clip positions (2) from the body panel.



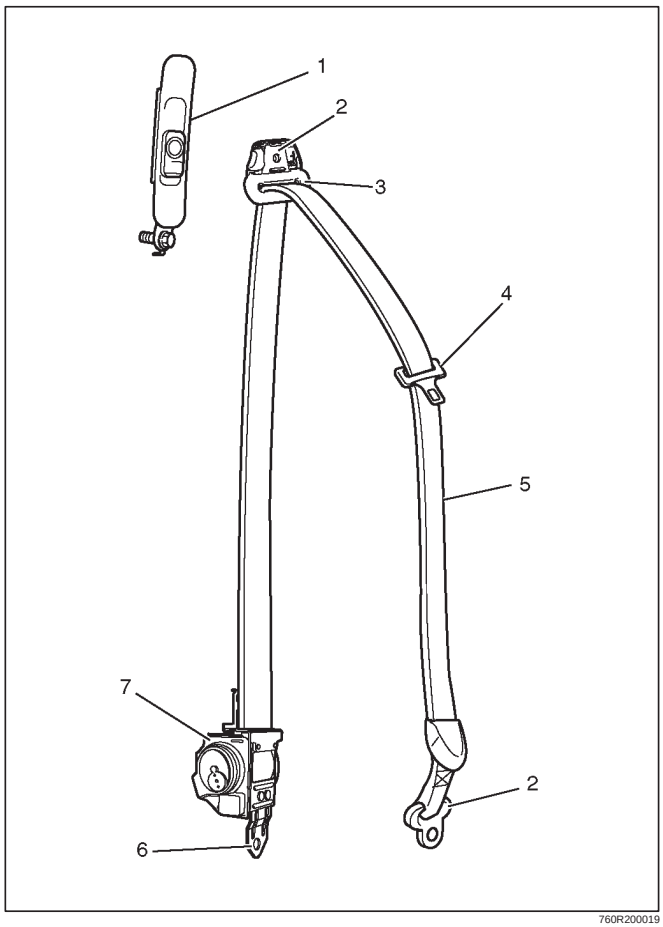
760R200011

9. Remove the retractor.
   ▼Remove the screw and bolt.
10. Remove the rear seat belt assembly.
11. Remove the adjustable shoulder anchor assembly.
    ▼Remove the two fixing bolts.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- ▼Deformed and malfunctioning adjustable shoulder anchor (1).
- ▼Uneven movement of upper/lower anchors (2) in the circumferential direction.
- ▼Damaged and/or deformed through ring (3).
- ▼Damaged and/or deformed tongue (4).
- ▼Damaged and/or frayed webbing (5).
- ▼Deformed retractor bracket (6).
- ▼Seat belt does not retract (7).
- ▼Resistance or abnormal sound when seat belt is pulled out or retracted (7).
- ▼Retractor (7) abnormality.



760R200019

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   ▼The seat belt should not lock when pulled gently at a 15 degree angle. Also, the seat belt should lock when pulled at a 45 degree angle or higher.
2. ELR lock check.
   ▼The seat belt should not lock when pulled slowly, however, the seat belt should lock when pulled quickly.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   ▼Make sure the seat belt is locked when pulled out fully.
   ▼Make sure the seat belt can be pulled out and retracts after when rewound fully.

CAUTION: Do not disassemble the retractor.

Installation

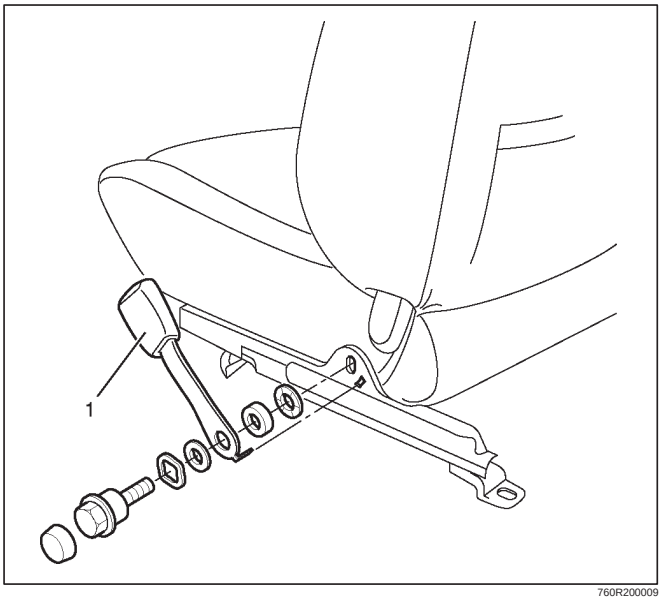
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the adjustable shoulder anchor assembly fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)
2. Tighten the seat belt anchor bolts (Upper & Lower) and the retractor fixing bolts to the specified torque.
   Torque: 39 N·m (29 lb ft)

Front Seat Buckle Assembly

Removal

1. Disconnect the battery ground cable.
2. Disconnect the seat belt warning connector (driver's side) and remove a clip.
3. Remove the front seat buckle assembly (1).



760R200009

Installation

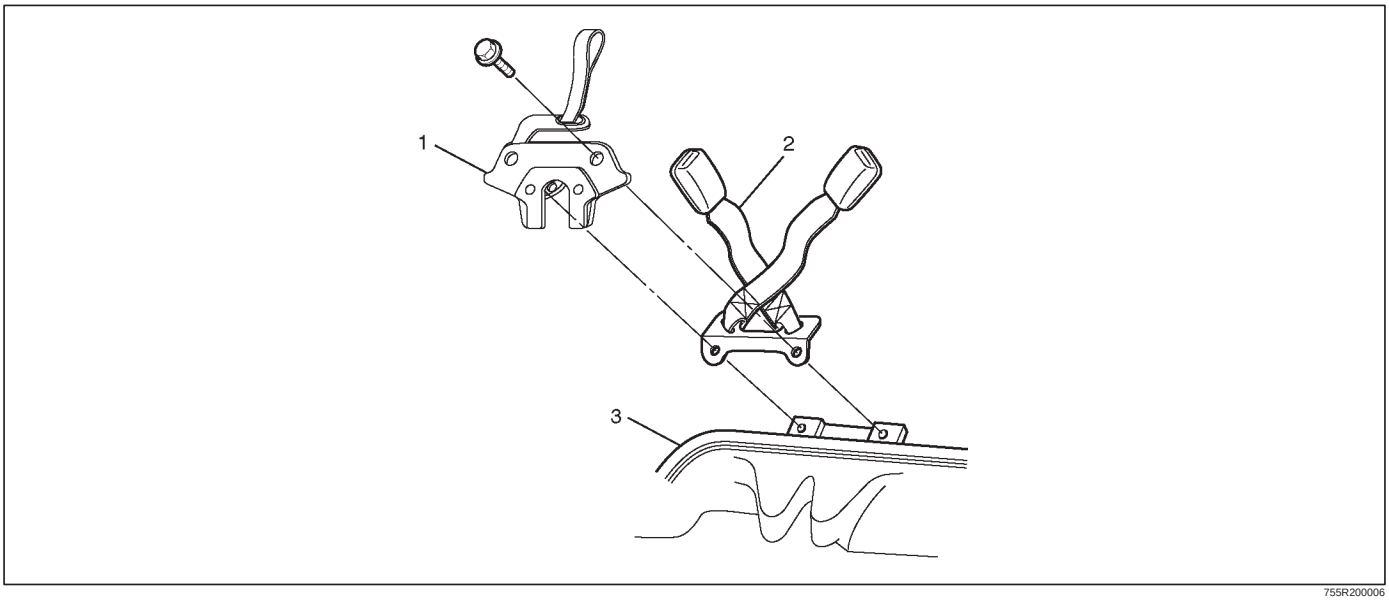
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the buckle anchor bolt to the specified torque.

   Torque: 29 N·m (22 lb ft)

Rear Center Seat Belt / Buckle Assembly

Rear Center Seat Belt / Buckle Assembly and Associated Parts



Legend

(1) Rear Seat Lock Assembly
(2) Rear Seat Belt Buckle Assembly
(3) Rear Cushion Frame Assembly

Removal

1. Remove the rear cushion frame assembly.
   ▼Refer to Rear Seat Assembly in Seats section.
2. Remove the rear seat lock assembly and rear seat belt buckle assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

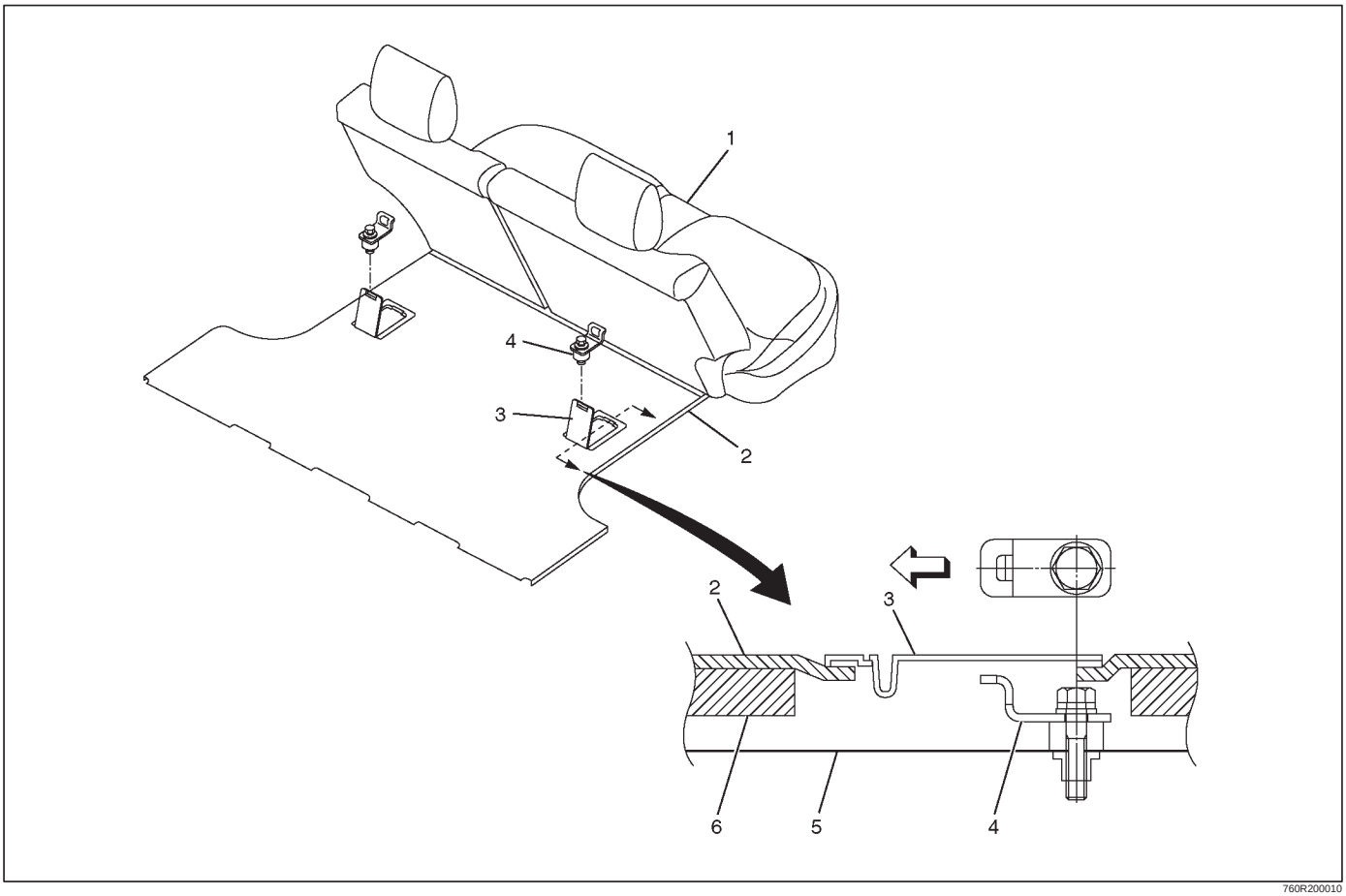
1. Tighten the rear seat lock assembly and rear seat belt buckle assembly fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

NOTE: Removal and installation procedure of rear center seat belt assembly same as rear seat belt buckle assembly procedures.

Child Seat Tether Anchorage Bracket (Child Restraint)

Child Seat Tether Anchorage Bracket and Associated Parts



760R200010

Legend

(1) Rear Seat
(2) Luggage Floor Carpet
(3) Tether Anchorage Bracket Cover
(4) Child Seat Tether Anchorage Bracket
(5) Luggage Floor Panel
(6) Insulation

Removal

1. Open the tether anchorage bracket cover.
2. Remove the fixing bolt and child seat tether anchorage bracket.

Installation

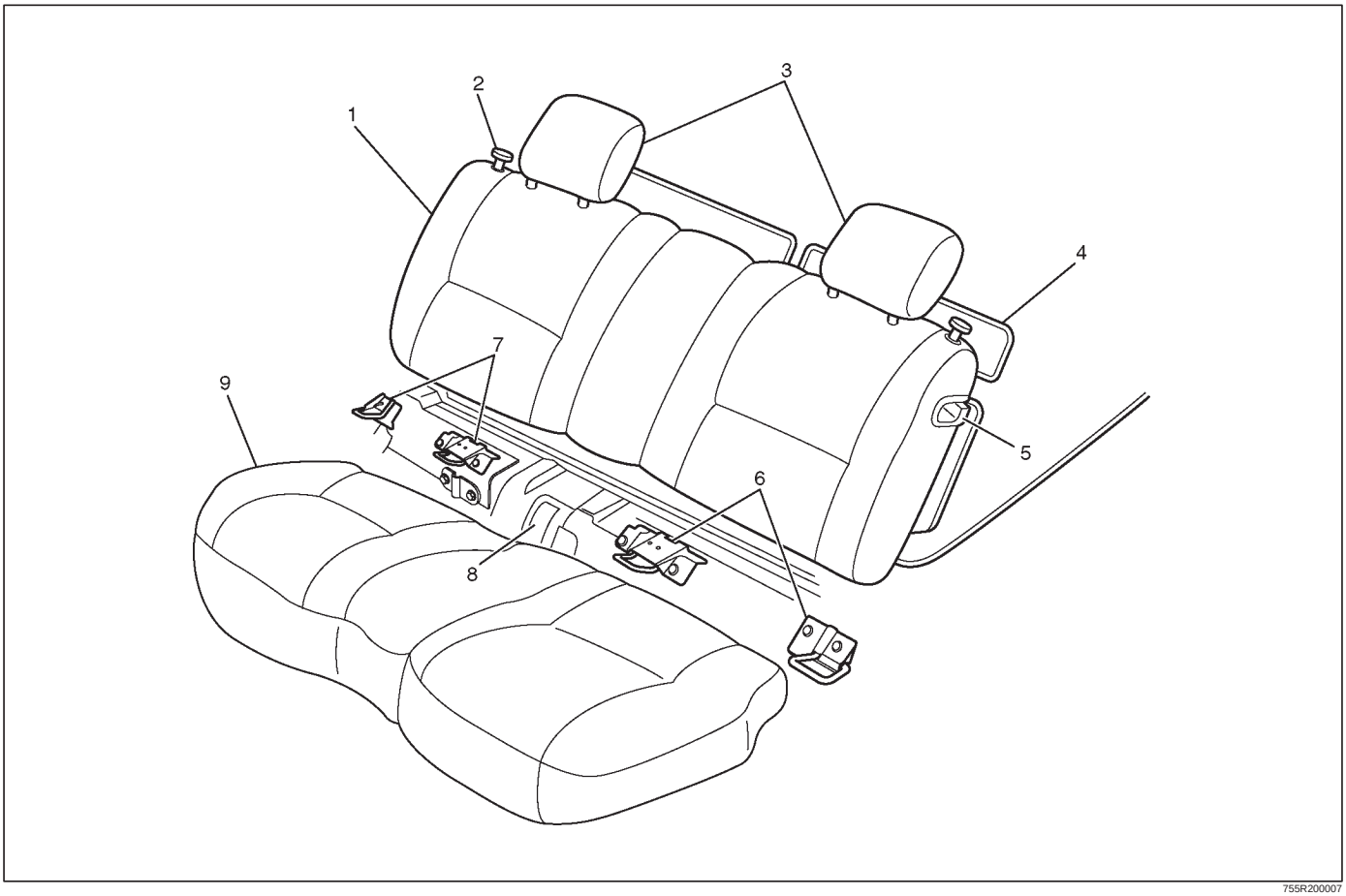
To install, follow the removal steps in the reverse order, noting the following points.

1. Install the bracket such that its tether belt hook hole is facing toward the front of the vehicle.
2. Tighten the fixing bolts to the specified torque.

Torque: 19 N·m (14 lb ft)

Child Seat Lower Anchorage Striker

Child Seat Lower Anchorage Striker and Associated Parts



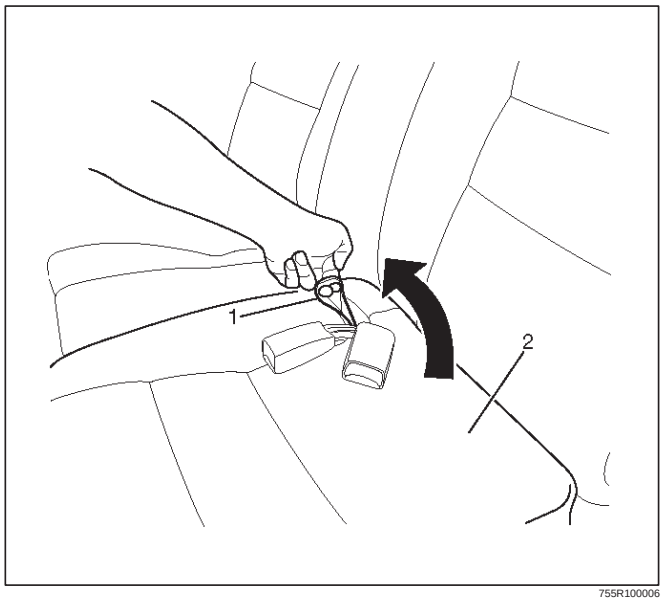
755R200007

Legend

(1) Rear Seat Back Assembly
(2) Release Knob
(3) Headrest
(4) Front Luggage Floor Carpet
(5) Seat Lock Cover
(6) Lower Anchorage Striker (LH)
(7) Lower Anchorage Striker (RH)
(8) Body Floor Panel
(9) Rear Seat Cushion Assembly

Removal

1. Raise the seat cushion assembly (2).
   ▼Pull the strap (1) of the rear seat lock assembly to release the seat lock.



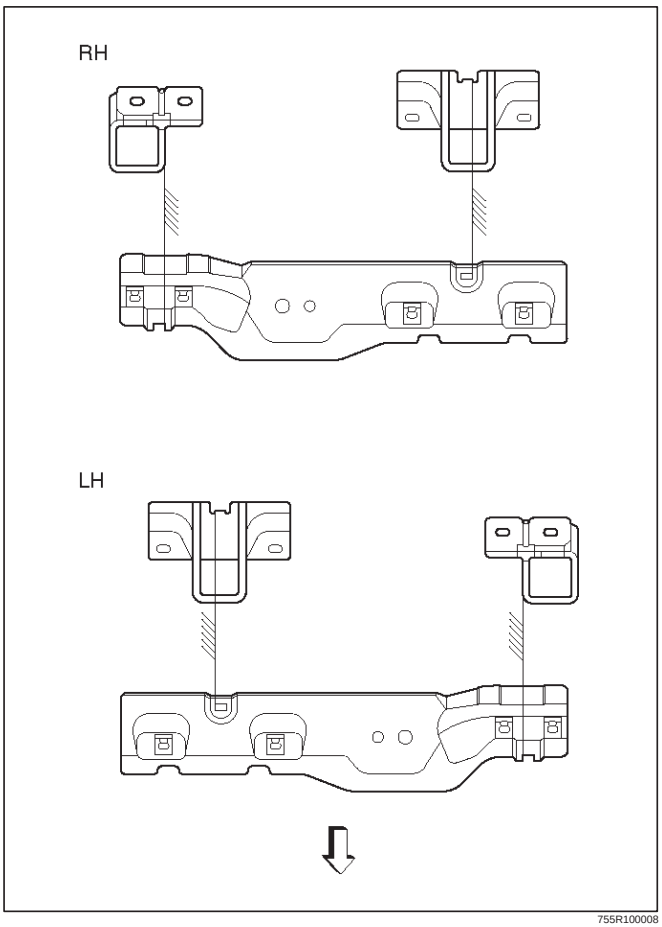
755R100006

2. Remove the headrests.
3. Pull the release knobs and fall down the seat back assembly forward.
4. Remove the seat lock covers.
   ▼Remove the three fixing screws from each seat lock cover.
5. Remove the front luggage floor carpets.
   ▼Pull the nine carpet fixing clips from the backside of the seat back assembly.
6. Remove the four lower anchorage strikers.
   ▼Remove the two fixing bolts of each lower anchorage striker.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Install the lower anchorage strikers with matching the inside of the tab and the trim edge of the body floor panel.

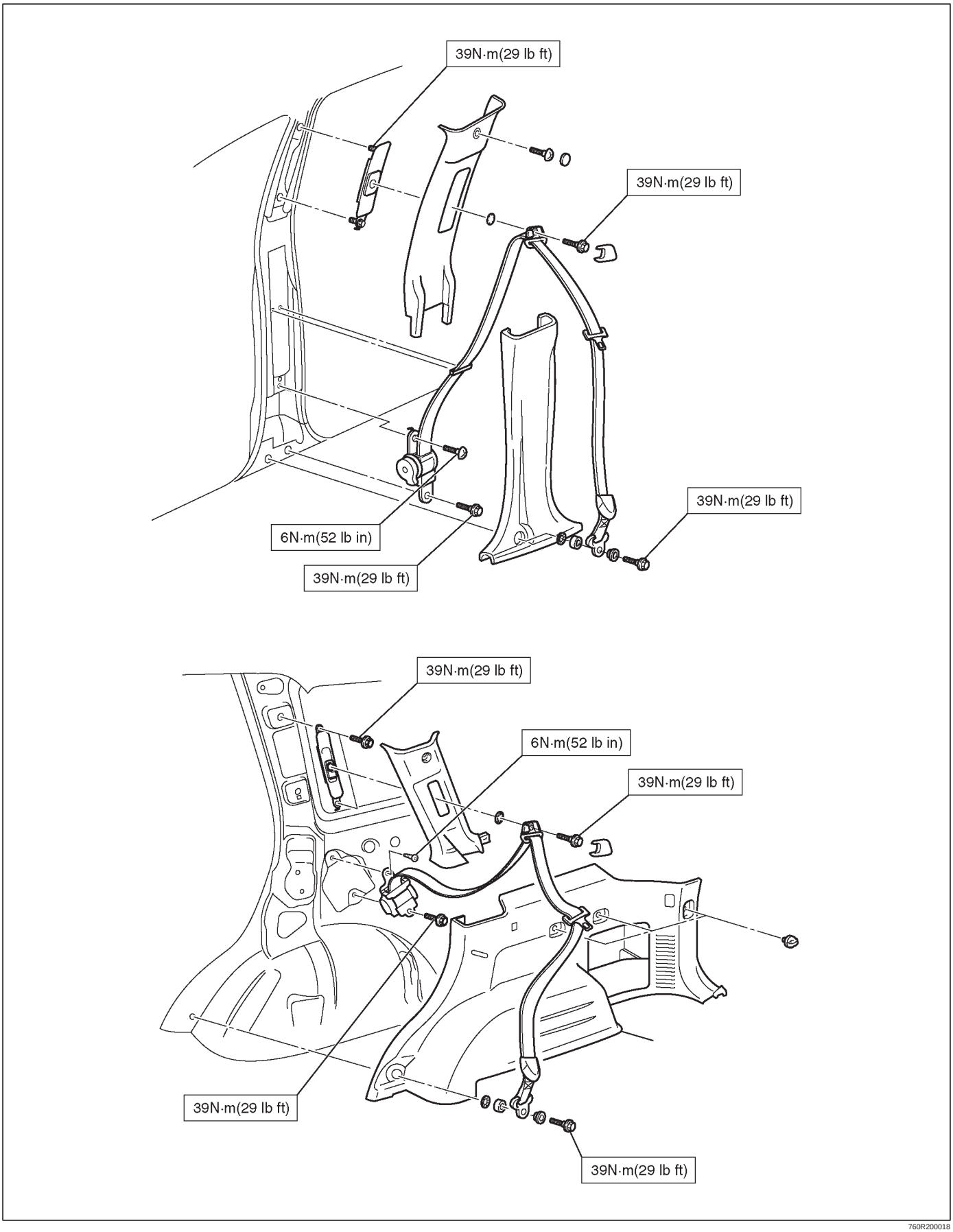


2. Tighten the lower anchorage striker fixing bolts to the specified torque.

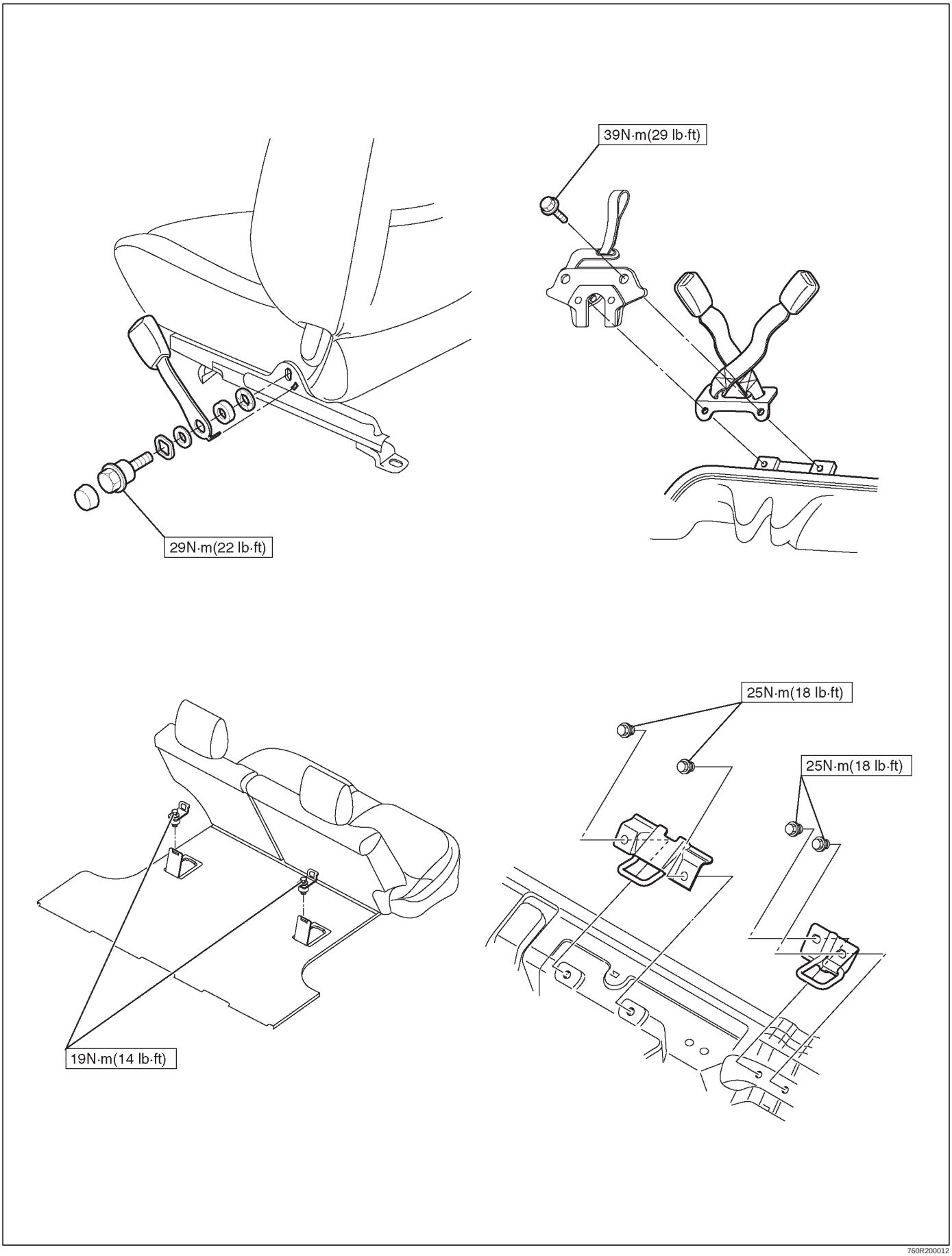
   Torque: 25 N·m (18 lb ft)

Main Data and Specifications

Torque Specifications



760R200018


39N·m(29 lb·ft)
29N·m(22 lb·ft)
25N·m(18 lb·ft)
25N·m(18 lb·ft)
19N·m(14 lb·ft)

760R200012

AXIOM

RESTRAINTS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

Service Precaution 9J–2
General Description 9J–2
Restraint Devices 9J–2
System Description 9J–3
SRS Component and Wiring Location View 9J–4
Component Description 9J–4
SDM (Sensing and Diagnostic Module) . . . 9J–4
“Air Bag” Warning Lamp 9J–5
SRS Coil Assembly 9J–5
Air Bag Assemblies 9J–5
Steering Column 9J–6
Knee Bolster 9J–6
Definition 9J–6
Diagnosis 9J–7
Diagnostic Trouble Codes 9J–7
Scan Tool Diagnostics 9J–7
Use of Special Tools 9J–8
SRS Connector Body Face Views 9J–8
Repairs and Inspections Required After an Accident 9J–8
Accident With Deployment – Component Replacement and Inspections 9J–9
Accident With or Without Deployment—Component Inspection 9J–9
SDM Replacement Guidelines 9J–9
Wiring Damage 9J–9
SRS Connector (Plastic Body And Terminal Metal Pin) Damage 9J–9
SRS Wire Pigtail Damage 9J–9
On–Vehicle Service 9J–9
Service Precautions 9J–9
Disabling The SRS 9J–9
Enabling The SRS 9J–9
Handling / Installation / Diagnosis 9J–10
Air Bag Assembly Handling / Shipping / Scrapping 9J–10
Live (Undeployed) Air Bag Assembly 9J–10
Air Bag Assembly Shipping Procedure For Live (Undeployed) Air Bag Assemblies . . . 9J–11
Deployed Air Bag Assembly 9J–11
Air Bag Assembly Scrapping Procedure . . 9J–11
Deployment Outside Vehicle (Driver Air Bag Assembly) 9J–11
Deployment Outside Vehicle (Passenger Air Bag Assembly) 9J–13
Deployment Inside Vehicle (Vehicle Scrapping Procedure) 9J–15
Deployed Air Bag Assembly Handling 9J–18
Special Tools 9J–18
J–41433 SRS Driver/Passenger Load Tool 9J–18
J–39200 DVM 9J–19
Scan Tool 9J–19
J–35616–A Connector Test Adapter Kit . . . 9J–19
J–42986 SRS Deployment Tool 9J–19
J–42987 SRS Adapter For Load Tool 9J–20
J–41497 SRS Deployment Fixture 9J–20
Tech 2 Scan Tool 9J–21
DTC Modes 9J–24
Plottong Snapshot Graph 9J–24
Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information) 9J–25
Flow Chart for Snapshot Replay (Plotting Graph) 9J–26
Service Precaution 9J–27
Disabling The SRS 9J–27
Enabling The SRS 9J–27
Handling / Installation / Diagnosis 9J–27
Inspections Required After An Accident . . 9J–27
Sensing and Diagnostic Module (SDM) 9J–28
Service Precautions 9J–28
Removal 9J–28
Installation 9J–29
Driver Air Bag Assembly 9J–29
Service Precautions 9J–29
Removal 9J–29
Installation 9J–30
Steering Wheel 9J–30
Service Precautions 9J–30
Removal 9J–30
Installation 9J–31
SRS Coil Assembly 9J–32
Service Precaution 9J–32
Removal 9J–32
Installation 9J–32
Steering Column 9J–34
Service Precaution 9J–34
Removal 9J–34
Installation 9J–35
Passenger Air Bag Assembly 9J–36
Service Precaution 9J–36

Removal 9J–36
Installation 9J–36

Service Precaution

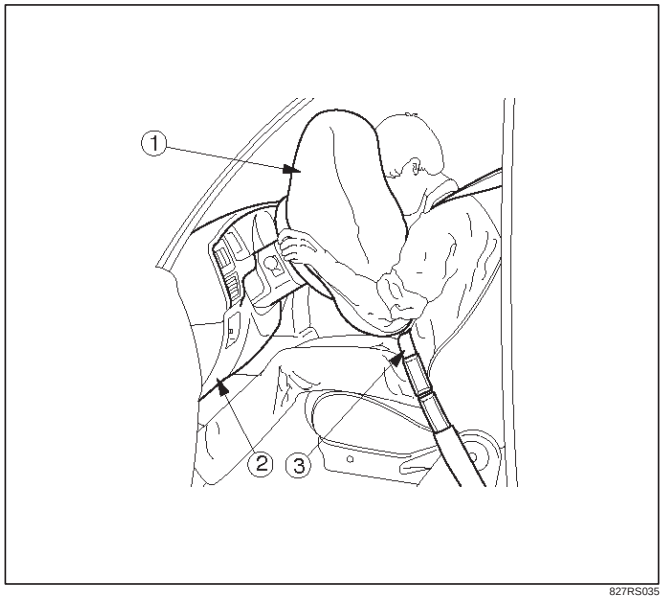
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

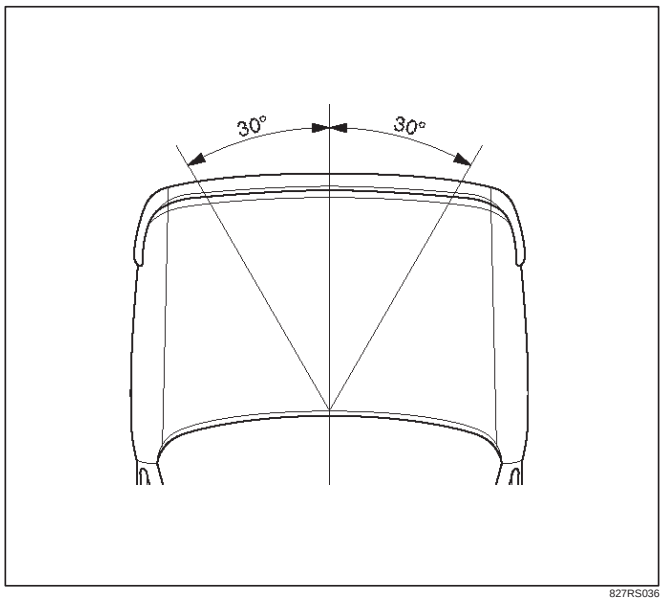
Restraint Devices



827RS035

Legend
(1) Deployed Air Bag
(2) Knee Bolster
(3) Seat Belt

The Supplemental Restraint System (SRS) helps supplement the protection offered by the driver and front passenger seat belts by deploying an air bag from the center of the steering wheel and from the top of the right side of the instrument panel.
The air bag deploys when the vehicle is involved in a frontal crash of sufficient force up to 30 degrees off the centerline of the vehicle. To further absorb the crash energy there is a knee bolster located beneath the instrument panel for both the driver and passenger, and the steering column is collapsible.

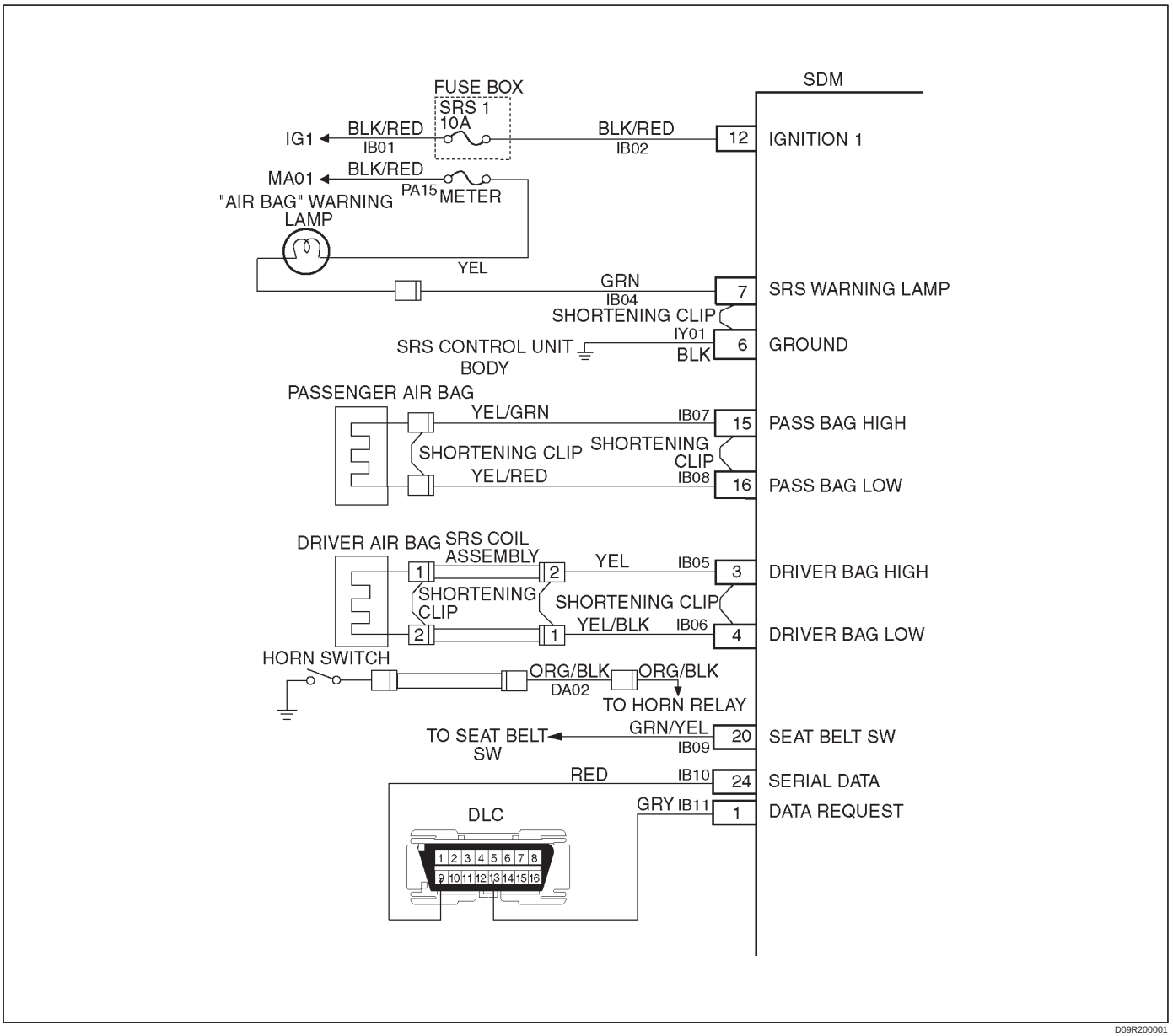


827RS036

System Description

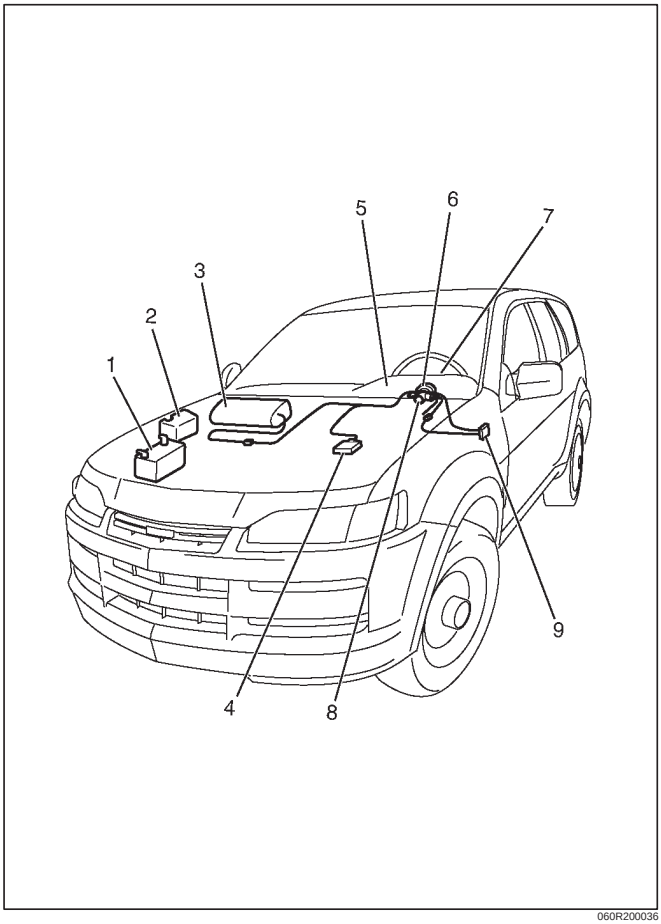
The SRS consists of the Sensing and Diagnostic Module (SDM), the driver air bag assembly, the SRS coil assembly, the passenger air bag assembly, and the “AIR BAG“ warning lamp in the instrument cluster. The SDM, SRS coil assembly (driver side only), driver air bag assembly, passenger air bag assembly and connector wire make up the deployment loops. The function of the deployment loops is to supply current through air bag assembly, which will cause deployment of the air bags in the event of a frontal crash of sufficient force, up to 30 degrees off the centerline of the vehicle. The air bag assemblies are only supplied enough current to deploy when the SDM detects vehicle velocity changes severe enough to warrant deployment.

The SDM contains a sensing device which converts vehicle velocity change to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags.



D09R200001

SRS Component and Wiring Location View



060R200036

Legend

(1) Battery
(2) Relay & Fuse Box
(3) Passenger Air Bag Assembly
(4) SDM
(5) Meter Assembly
(6) SRS Coil Assembly
(7) Driver Air Bag Assembly
(8) Starter Switch
(9) Fuse Box, SRS–1

Component Description

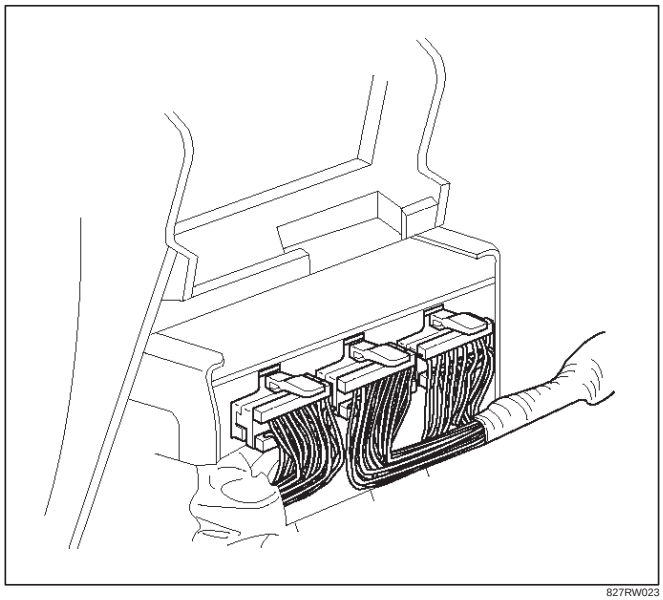
SDM (Sensing and Diagnostic Module)

WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTED TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

The Sensing and Diagnostic Module (SDM) is designed to perform the following functions in the SRS:

1. Energy Reserve — The SDM maintains 24–Volt Loop Reserve (24VLR) energy supply to provide deployment energy when ignition voltage is lost in a frontal crash.
2. Frontal Crash Detection — The SDM monitors vehicle velocity changes to detect frontal crashes which are severe enough to warrant deployment.
3. Air Bag Deployment — When a frontal crash of sufficient force is detected, the SDM will cause enough current to flow through the air bag assembly to deploy the air bag.
4. Malfunction Detection — The SDM performs diagnostic monitoring of SRS electrical components and sets a diagnostic trouble code when a malfunction is detected.
5. Frontal Crash Recording — The SDM records information regarding SRS status during frontal crash.
6. Malfunction Diagnosis — The SDM displays SRS diagnostic trouble codes and system status information through the use of a scan tool.
7. Driver Notification — The SDM warns the vehicle driver of SRS malfunctions by controlling the “Air Bag” warning lamp.

The SDM is connected to the SRS wiring harness by a 24–pin connector. This harness connector uses a shorting clip across certain terminals in the contact area. This shorting clip connects the “AIR BAG” warning lamp to ground when the SDM harness connector is disconnected or CPA (Connector Position Assurance) is not inserted even if completely connected. This will cause the “AIR BAG” warning lamp to come “ON” steady whenever the ignition switch is at the ON or START positions with the SDM disconnected.



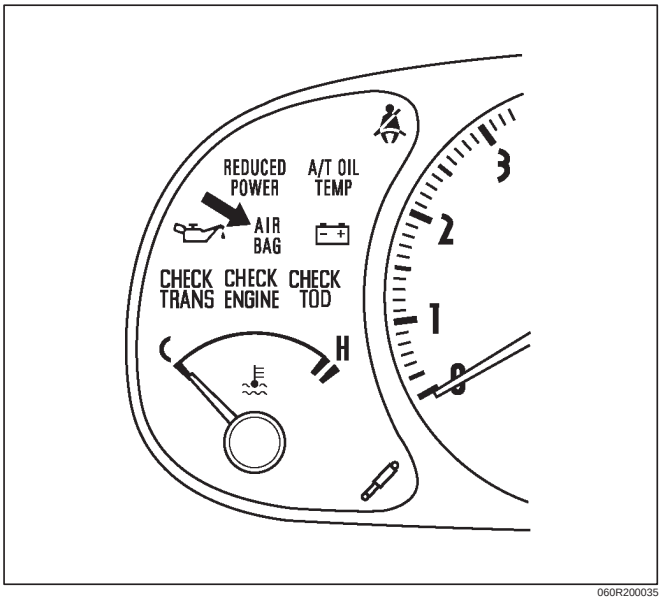
827RW023

“Air Bag” Warning Lamp

Ignition voltage is applied to the “AIR BAG” warning lamp when the ignition switch is at the ON or START positions. The SDM controls the lamp by providing ground with a lamp driver. The “AIR BAG” warning lamp is used in the SRS to do the following:

1. Verify lamp and SDM operation by flashing SEVEN (7) times when the ignition switch is first turned “ON”.
2. Warn the vehicle driver of SRS electrical system malfunctions which could potentially affect the operation of the SRS. These malfunctions could result in nondeployment in case of a frontal crash or deployment for conditions less severe than intended.

The “AIR BAG” warning lamp is the key to driver notification of SRS malfunctions. For proper lamp operation, refer to the “SRS Diagnostic System Check” in this section.



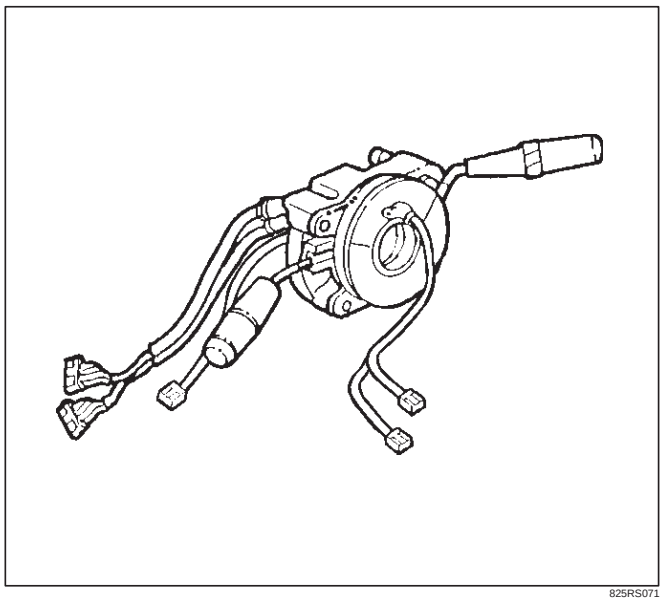
060R200035

SRS Coil Assembly

The SRS coil assembly consists of two current carrying coils. This is attached to the steering column and allow rotation of the steering wheel while maintaining continuous contact of the driver deployment loop to the driver air bag assembly.

There is a shorting clip on the yellow 2–pin connector near the base of steering column which connects the SRS coil to the SRS wiring harness.

The shorting clip shorts to the SRS coil and driver air bag assembly when the yellow 2–pin connector is disconnected. The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the steering column or other SRS components.



825RS071

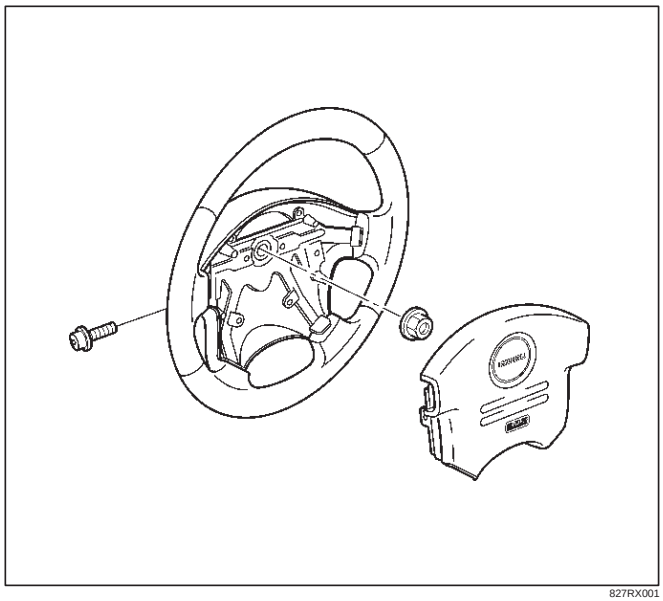
Air Bag Assemblies

The air bag assembly consist of an inflatable air bag assembly and an inflator (a canister of gas–generating material and an initiating device). When the vehicle is in a frontal crash of sufficient force.

The SDM causes current flow through the deployment loops. Current passing through the inflator ignites the material in the air bag assembly. The gas produced from this reaction rapidly inflates the air bag assembly.

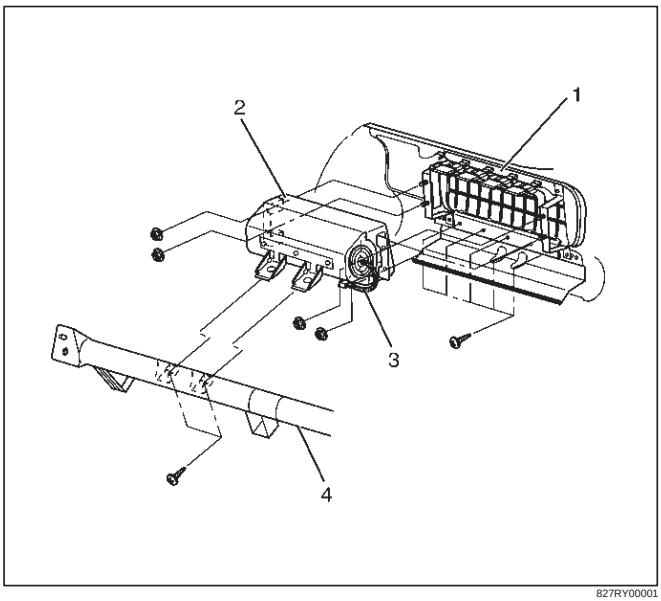
There is a shorting clip on the driver air bag assembly connector which connects the SRS coil assembly. The shorting clip shorts across the driver air bag assembly circuits when driver air bag assembly connector is disconnected.

The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the driver air bag assembly, the steering column or other SRS components.



827RX001

There is a shorting clip on the passenger air bag assembly connector which connects to the SRS harness. The shorting clip shorts across the passenger air bag assembly circuit when the passenger air bag assembly connector is disconnected. The circuit to the passenger air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the passenger air bag assembly, the instrument panel or other SRS components.



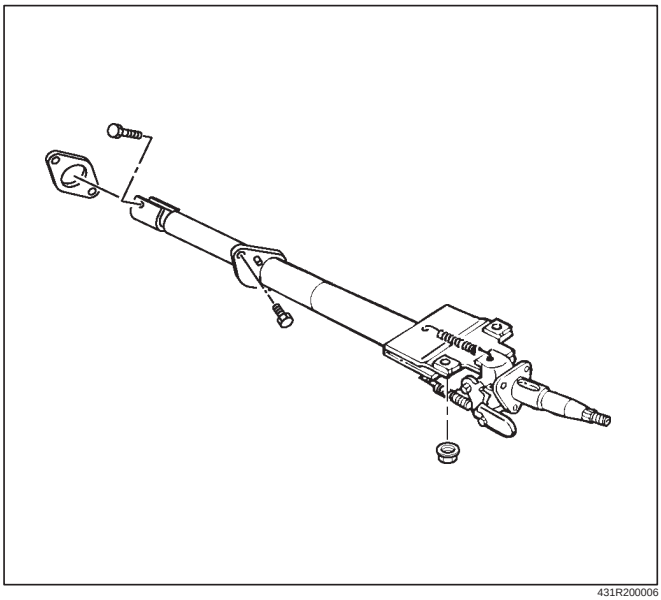
827RY00001

Legend

(1) Passenger Air Bag Door
(2) Passenger Air Bag Assembly
(3) Passenger Air Bag Harness
(4) Cross Beam

Steering Column

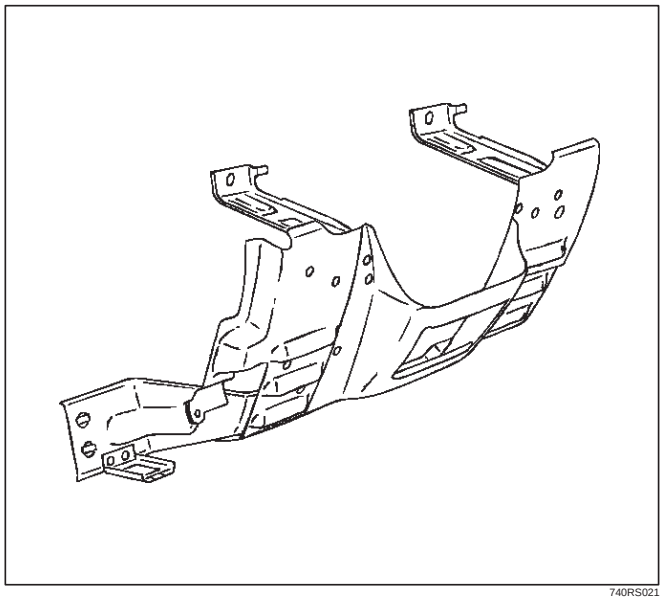
The steering column absorbs energy and is designed to compress in a frontal crash to decrease the chance of injury to the driver.



431R200006

Knee Bolster

The knee bolsters are used to absorb energy to protec knees and control the forward movement of the vehicle's front seat occupants during a frontal crash, by limiting leg movement.



740RS021

Definition

Air Bag
An inflatable cloth cushion designed to deploy in certain frontal crashes. It supplements the protection offered by the seat belts by distributing the impact load more evenly over the vehicle occupant's head and torso.

Asynchronous
Performed in a nonperiodic fashion, (i. e., no defined time or interval).

(B+)
Battery voltage, (B+) The voltage available at the battery at the time of the indicated measurement. With the key "ON" and the engine not running, the system voltage will likely be between 12 and 12.5 volts. At idle the voltage may be 14 to 16 volts. The voltage could be as low as 10 volts during engine cranking.

Bulb Check
The SDM will cause the "AIR BAG" warning lamp to flash seven times and then go "OFF" whenever the ignition switch transitions to the ON position from any other ignition switch position and no malfunctions are detected.

"CONTINUOUS MONITORING"
Tests performed by the SDM on the SRS every 100 milliseconds while "Ignition 1" voltage is in the normal operating voltage range at the SDM.

Data Link Connector (DLC)
Formerly "DLC" a connector which allows communication with an external computer, such as a scan tool.

Datum Line
A base line parallel to the plane of the underbody or frame from which all vertical measurements originate.

Deploy
To inflate the air bag.

Deployment Loops
The circuits which supply current to the air bag assemblies to deploy the air bag.

Diagnostic Trouble Code (DTC)
Formerly “Code”, a numerical designator used by the SDM to indicate specific SRS malfunctions.

Driver Current Source
An output of the SDM which applies current into the driver air bag assembly circuit during the “Initiator Assembly Resistance Test”.

Driver Air Bag Assembly
An assembly located in the steering wheel hub consisting of an inflatable bag, an inflator and an initiator.

EEPROM
Electronically Erasable Programmable Read Only Memory. Memory which retains its contents when power is removed from the SDM.

Ignition Cycle
The voltage at the SDM “Ignition 1” inputs, with ignition switch “ON”, is within the normal operating voltage range for at least ten seconds before turning ignition switch “OFF”.

Ignition 1
A battery voltage (B+) circuit which is only powered with the ignition switch in the ON, or START positions.

Initiator
The electrical component inside the air bag assembly which, when sufficient current flows, sets off the chemical reaction that inflates the air bag.

“Initiator Assembly Resistance Test”
Tests performed once each ignition cycle when no malfunctions are detected during “Turn–ON” or “Continuous Monitoring.” This test checks for the correct SDM configuration for the vehicle, shorts to “Ignition 1” in the deployment loops, high resistance or opens in the “Driver Side High”, “Driver Side Low”, “Passenger Side High” and “Passenger Side Low” circuits and measures the resistance of the inflator assembly consisting of: 1) Initiators, 2) SRS coil assembly (driver side only), 3) Connectors and associated wiring.

Normal Operating Voltage Range
The voltage measured between the SDM “Ignition 1” terminals and “Ground” terminals is between 9 and 16 volts.

Passenger Current Source
An output of the SDM which applies current into the passenger air bag assembly circuit during the “Initiator Assembly Resistance Test”.

Passenger Air Bag Assembly
An assembly located in the right side of the instrument panel consisting of an inflatable bag, an inflator and an initiator.

Scan Tool
An external computer used to read diagnostic information from onboard computers via the data link connector.

SDM
Sensing and Diagnostic Module which provides reserve energy to the deployment loops, deploys the air bags when required and performs diagnostic monitoring of all SRS components.

Serial Data
Information representing the status of the SRS.

SRS
Supplemental Restraint System.

SRS Coil Assembly
An assembly of two current–carrying coils in the driver deployment loop that allows the rotation of the steering wheel while maintaining the continuous contact of the driver deployment loop to the driver air bag assembly.

SRS Wiring Harness
The wires and connectors that electrically connect the components in the SRS.

“Turn–ON”
Test which the SDM performs on the SRS once during each ignition cycle immediately after “Ignition 1” voltage is applied to the SDM and before “Continuous Monitoring”.

Diagnosis

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON–POWERED PROVE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

Diagnostic Trouble Codes

The “SRS Diagnostic System Check” must always be the starting point of any SRS diagnosis. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for SRS diagnostic trouble codes using the scan tool.

1. Current diagnostic trouble codes – Malfunctions that are presently being detected. Current diagnostic trouble codes are stored in RAM (Random Access Memory).
2. History diagnostic trouble codes – All malfunctions detected since the last time the history memory was cleared. History diagnostic trouble codes are stored in EEPROM.

Scan Tool Diagnostics

A scan tool is used to read current and history diagnostic trouble codes and to clear all diagnostic trouble codes after a repair is completed. The scan tool must be updated to communicate with the SRS through a replaceable cartridge before it can be used for SRS diagnostics. To use the scan tool, connect it to the data link connector and turn the ignition switch “ON”. The scan

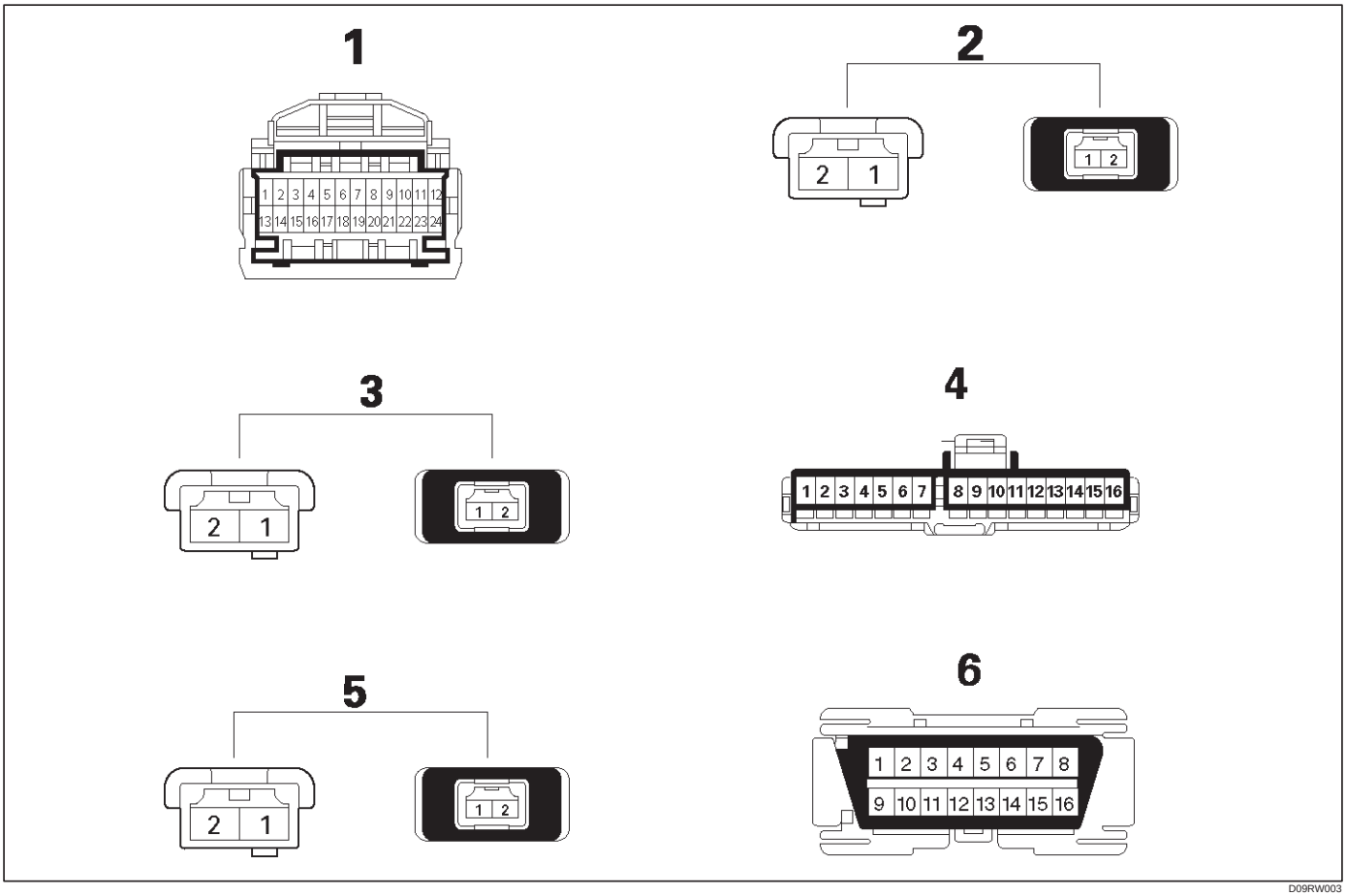
tool reads serial data from the SDM “Serial Data” line terminal “24” to the data link connector terminal “9”.

Use of Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC, OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROVE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT. YOU SHOULD BE FAMILIAR WITH THE TOOLS LISTED IN THIS SECTION UNDER THE HANDLING SRS SPECIAL TOOLS.

You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as the Tech 2 Diagnostic Computer, SRS Driver/Passenger Load Tool J–41433, Connector Test Adapter Kit J–35616–A, and the DVM (Digital Multimeter) J–39200.

SRS Connector Body Face Views



D09RW003

Legend

(1) SDM
(2) Driver Air Bag Assembly
(3) Passenger Air Bag Assembly
(4) “Air Bag” Warning Lamp
(5) SRS Coil Assembly
(6) DLC

Repairs and Inspections Required After an Accident

NOTE: If any SRS components are damaged, they must be replaced. If SRS component mounting points are damaged, they must be replaced.

- Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized dealer; they may be used for SRS repairs.
- Do not attempt to service the SDM, the SRS coil assembly, or the air bag assembly. Service of these items is by replacement only.
- Verify the part number of replacement air bag assembly.

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for AXIOM (UP) models.

CAUTION: Proper operation of the sensors and Supplemental Restraint System (SRS) requires that any repairs to the vehicle structure return it to the original production configuration. Deployment requires, at a minimum, replacement of the SDM, air bag assembly and dimensional inspection of the steering column. Any visible damage to the SDM mounting bracket (s) requires replacement, and the steering column must be dimensionally inspected, whether deployment occurred or not.

Accident With Deployment – Component Replacement and Inspections

Certain SRS components must be replaced or inspected for damage after a frontal crash involving air bag deployment. Those components are:

- ▼ Air bag assembly
- ▼ SDM

CAUTION: Refer to "SDM Replacement Guidelines" below for important information on SDM replacement in both deployment and non deployment crashes.

- ▼ SRS coil assembly—Inspect wiring and connector for any signs of scorching, melting, or damage due to excessive heat. Replace if damaged. Refer to SRS coil assembly in this section.

Accident With or Without Deployment—Component Inspection

Certain SRS and restraint system components must be inspected after any crash, whether the air bag deployed or not. Those components are:

- ▼ Steering column—Dimensionally inspect per "Checking Steering Column for Accident Damage" in 3 of this workshop manual.
- ▼ Knee bolsters and mounting points— Inspect for any distortion, bending, cracking, or other damage.
- ▼ I/P steering column reinforcement plate— Inspect for any distortion, bending, cracking, or other damage.
- ▼ I/P braces—Inspect for any distortion, bending, cracking, or other damage.
- ▼ Seat belts and mounting points—Refer to "Seat Belts" in 10 of this workshop manual.

SDM Replacement Guidelines

SDM replacement policy requires replacement of SDM, after crash involving air bag deployment when "SRS Warning Lamp" turn "ON", "SRS Diagnosis" should be done according to "Section 9J1".

Wiring Damage

If any SRS wire harness is damaged, it should be replaced. Don't repair SRS. It is replace only.

SRS Connector (Plastic Body And Terminal Metal Pin) Damage

If any connector or terminal in the SRS wire harness (except pigtails) is damaged, it should be replaced.

SRS Wire Pigtail Damage

If the wiring pigtail (a wire or wires attached directly to the device, not by a connector) is damaged, the entire component (with pigtail) must be replaced. Examples of "pigtail" components are the driver air bag assembly, the passenger air bag assembly, and the SRS coil assembly.

On–Vehicle Service

Service Precautions

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver—Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF", the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the "SRS–1" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "lock" and remove key.

1. Remove SRS fuse SRS–1, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly, Refer to "Passenger Air Bag Assembly Replacement" in section 9J–28.
4. Disconnect yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "SRS–1" fuse removed and ignition switch "ON", "AIR BAG" warning lamp will be "ON". This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for AXIOM (UP) models.

Turn ignition switch to “LOCK” and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly, refer to “Passenger Air Bag Assembly Replacement” in section 9J–28.
3. Connect yellow 2–pin connector at the base of steering column.
4. Install “AIR BAG” fuse SRS–1 to left dash side lower fuse block or connect battery.

Turn ignition switch to “ON” and verify that the “AIR BAG” warning lamp flashes seven times and then turns “OFF” If it does not operate as described, perform the “SRS Diagnostic System Check” in section 9J1–3.

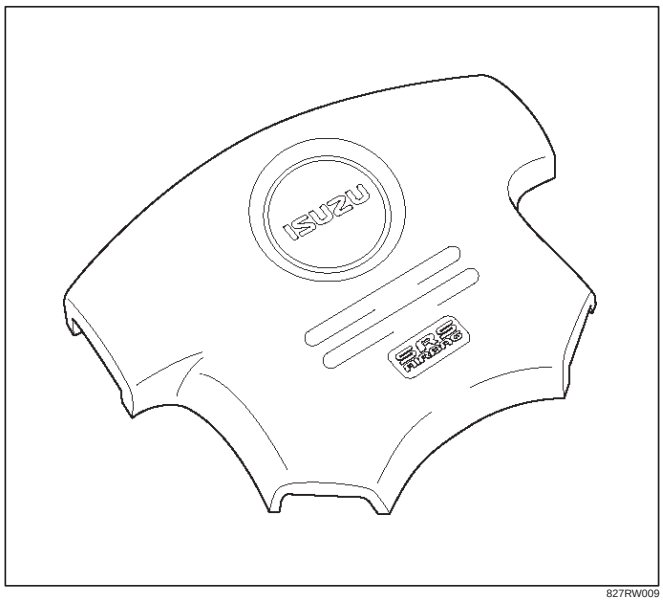
Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 93˚C (200˚F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet).
3. When a SDM is replaced, it must be oriented with the arrow on the sensor pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The “SRS Diagnostic System Check” must be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” will verify proper “AIR BAG” warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.

Air Bag Assembly Handling / Shipping / Scrapping

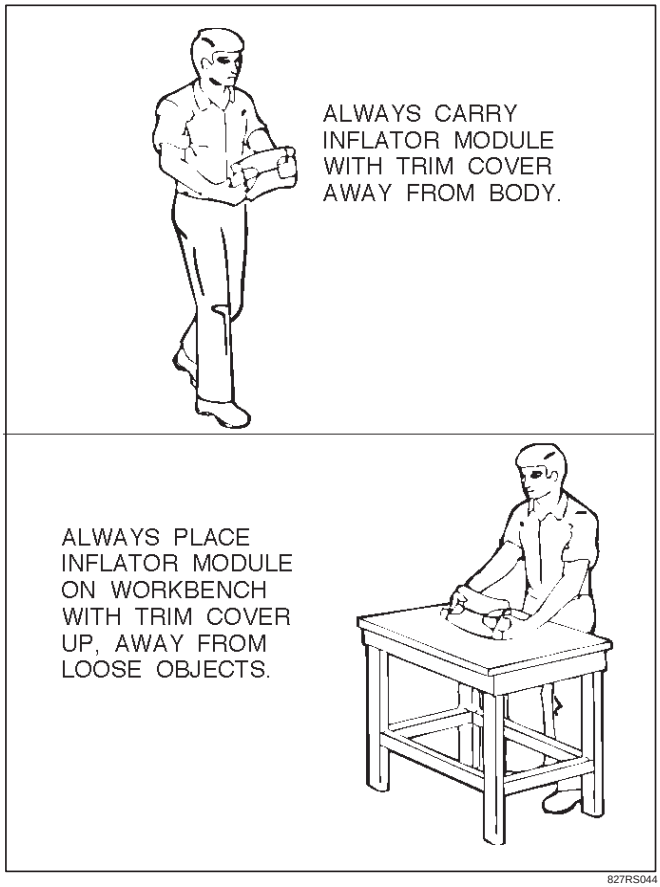
Live (Undeployed) Air Bag Assembly

Special care is necessary when handling and storing a live (undeployed) air bag assembly. The rapid gas generation produced during deployment of the air bag could cause the air bag assembly, or an object in front of the air bag assembly, to be thrown through the air in the unlikely event of an accidental deployment.



827RW009

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG OPENING IS POINTED AWAY FROM YOU. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. NEVER CARRY THE AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE.



827RS044

Air Bag Assembly Shipping Procedure For Live (Undeployed) Air Bag Assemblies

Service personnel should refer to the latest Service Bulletins for proper SRS air bag assembly shipping procedures.

Deployed Air Bag Assembly

You should wear gloves and safety glasses. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present.

Air Bag Assembly Scrapping Procedure

During the course of a vehicle's useful life, certain situations may arise which will necessitate the disposal of a live (undeployed) air bag assembly. This information covers proper procedures for disposing of a live air bag assembly.

Before a live air bag assembly can be disposed of, it must be deployed. Alive air bag assembly must not be disposed of through normal refuse channels.

WARNING: FAILURE TO FOLLOW PROPER SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. AN UNDPLOYED AIR BAG ASSEMBLY MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE, AND / OR LOCAL LAW.

In situations which require deployment of a live air bag assembly module, deployment may be accomplished inside or outside the vehicle. The method employed depends upon the final disposition of the particular vehicle, as noted in "Deployment Outside Vehicle" and "Deployment Inside Vehicle" in this section.

Deployment Outside Vehicle (Driver Air Bag Assembly)

Deployment outside the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which the vehicle will be returned to useful service after a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of a malfunctioning air bag assembly is, of course, subject to any required retention period.

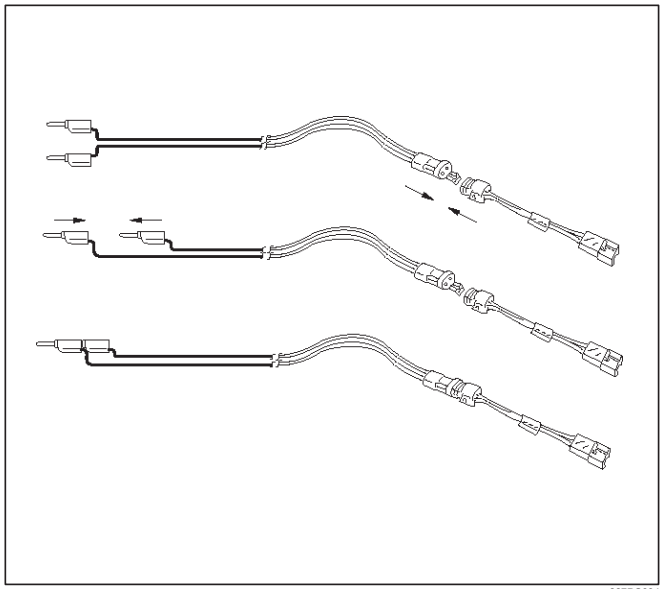
For deployment of a live (undeployed) air bag assembly outside the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until a deployed air bag assembly is scrapped or until an undeployed air bag assembly is shipped. Before performing the procedures you should be familiar with servicing the SRS and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

The following procedure requires use of J–41434 SRS deployment harness with appropriate pigtail adapter. Do not attempt procedure without J–41434 adapter.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE DRIVER AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to driver air bag assembly . Refer to "Deployment Outside Vehicle (Passenger Air Bag Assembly)" in this section for information on passenger air bag assembly scrapping.

1. Turn ignition switch to "LOCK", remove key and put on safety glasses.
2. Inspect J–41434 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail adapter is damaged, discard and obtain a replacement.
3. Short the two SRS deployment harness leads together by fully seating one banana plug into the other. SRS deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.

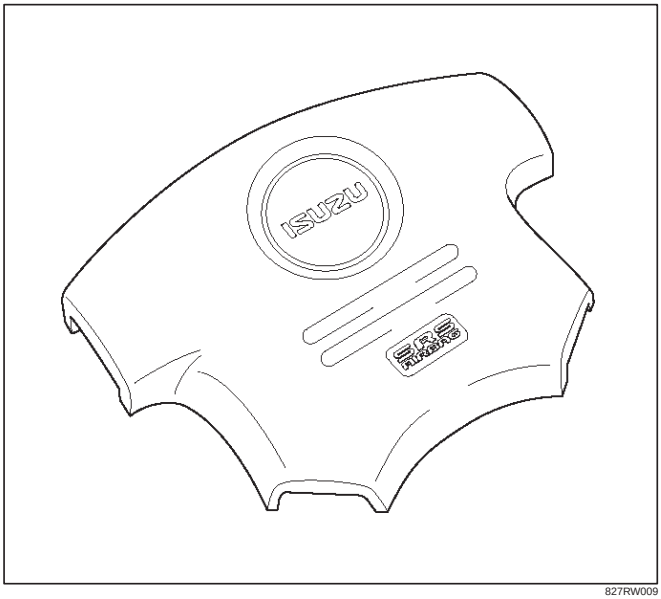


827RS004

4. Connect the appropriate pigtail adapter to the SRS deployment harness.
5. Remove the driver air bag assembly from vehicle. Refer to Inflator Module Removal in this Section 9J–3.

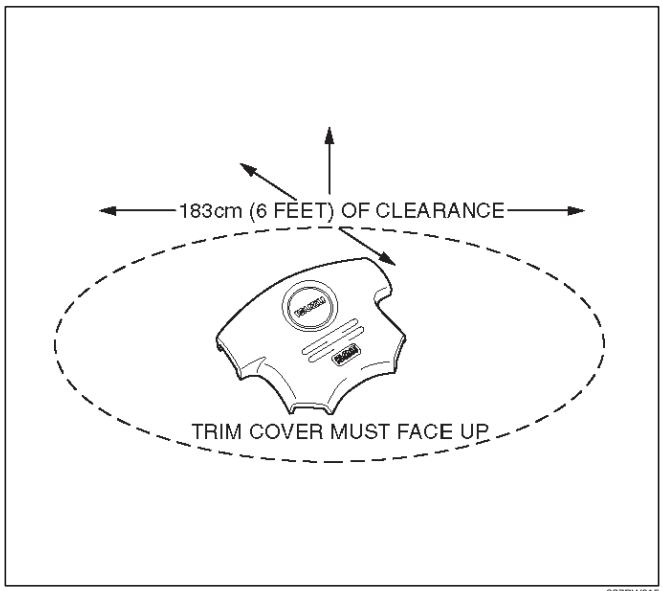
WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE AIR BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

6. Place the driver air bag assembly on a work bench or other surface away from all loose or flammable objects with its trim cover facing up, away from the surface.



827RW009

7. Clear a space on the ground about 183 cm (six feet) in diameter where the driver air bag assembly is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the deployment area.



827RW015

8. Place the driver air bag assembly, with its trim cover facing up, on the ground in the space just cleared.
9. Stretch the SRS deployment harness and pigtail adapter from the driver air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
11. Connect the driver air bag assembly to the pigtail adapter on the SRS deployment harness. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The driver air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the driver air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the driver air bag assembly connector functioning (shorted) and may result in non deployment of the driver air bag assembly.

12. Verify that the area around the driver air bag assembly is clear of all people and loose or flammable objects.
13. Verify that the driver air bag assembly is resting with its trim cover facing up.
14. Notify all people in the immediate area that you intend to deploy the driver air bag. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the air bag deploys, the driver air bag assembly may jump about 30 cm (one foot) vertically. This is a normal reaction of the driver air bag to the force of the rapid gas expansion inside the air bag.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all

people in the immediate area that you intend to deploy the driver air bag.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the driver air bag. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the driver air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the driver air bag assembly did deploy, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed driver air bag assembly. After the driver air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This power consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with the atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE INFLATOR MODULE TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY.

AFTER A DRIVER AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE DRIVER AIR BAG ASSEMBLY WILL BE VERY HOT. DO NOT TOUCH THE METAL AREAS OF THE DRIVER AIR BAG ASSEMBLY FOR ABOUT TEN MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED DRIVER AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG OR TRIM COVER.

21. Disconnect the pigtail adapter from the driver air bag assembly as soon after deployment as possible. This will prevent damage to the pigtail adapter or SRS deployment harness due to possible contact with the hot driver air bag assembly canister. The pigtail adapter can be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed driver air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the driver air bag assembly did not deploy after following these procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the driver air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE INFLATOR MODULE UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the driver air bag assembly with its trim cover facing up, away from the surface upon which it rests.

Deployment Outside Vehicle (Passenger Air Bag Assembly)

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

Deployment out of the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of an air bag assembly is, of course, subject to any required retention period.

For deployment of a live air bag assembly out of the vehicle, the deployment procedure must be followed exactly. ALWAYS wear safety glasses during this

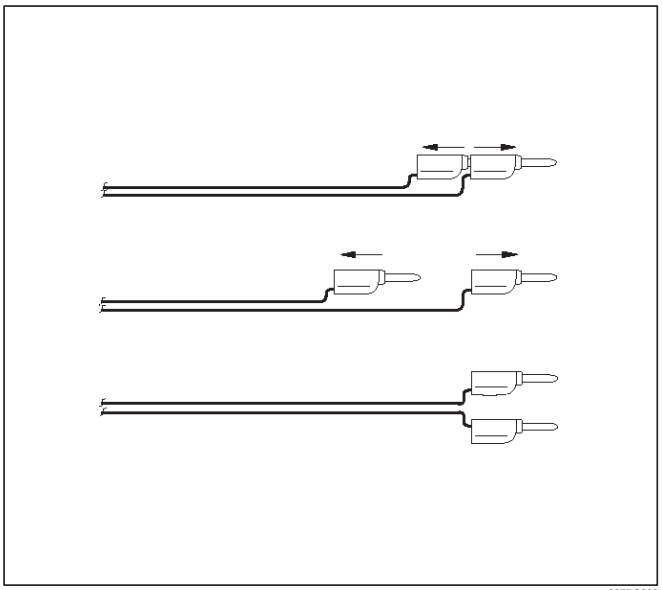
deployment procedure until the deployed air bag assembly is scrapped. Before performing the procedures, you should be familiar with servicing the SRS system and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

The following procedure requires use of J–42986 SRS Deployment Harness with the appropriate pigtail adapter. The procedure also requires the use of J–41497 Passenger Side SRS Module Deployment Fixture. Do not attempt this procedure without J–42986 and fixture J–41497.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

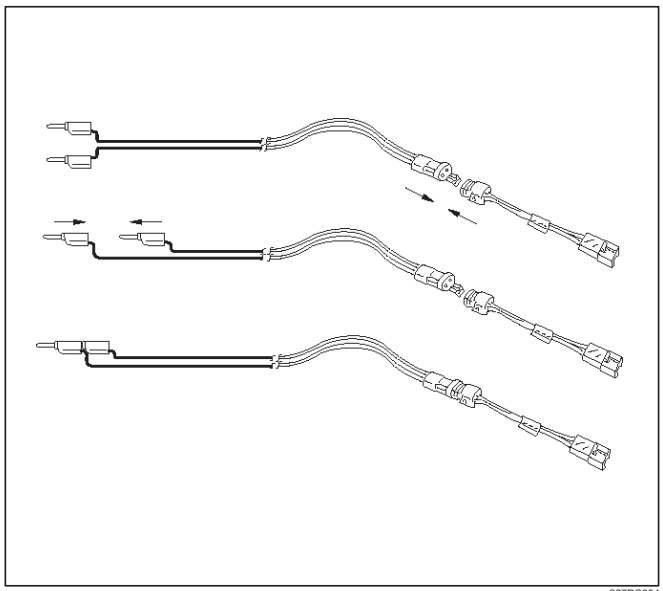
NOTE: This information applies only to passenger air bag assembly. Information for disposing of a live driver air bag assembly can be found in “Deployment Outside Vehicle” (Driver Air Bag Assembly) in this section.

1. Turn ignition switch to “LOCK” remove key, and put on safety glasses.
2. Inspect J–41434 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail is damaged, discard and obtain a replacement.
3. Short the two SRS Deployment Harness leads together by fully seating one banana plug into the other. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.



827RS003

4. Connect the appropriate pigtail adapter to the SRS Deployment Harness



827RS004

5. Remove passenger air bag assembly from vehicle. Refer to “Passenger Air Bag Assembly Removal ” in this Section.
6. Clear a space on the ground approximately 185 cm (six feet) in diameter where the fixture with attached air bag assembly is to be placed for deployment. A paved outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where is no activity and sufficient ventilation is recommended. Ensure that no loose or flammable objects are within the deployment area.
7. Place the J–41497 on the bench vice. This is necessary to provide sufficient stabilization of the fixture during deployment.
8. Attach the passenger air bag assembly in the J–41497. Air bag assembly must be mounted such that the bag will deploy upward. SECURELY HAND–TIGHTEN ALL FASTENERS PRIOR TO DEPLOYMENT.
9. Stretch the SRS Deployment Harness and pigtail adapter from the air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. (Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.)
11. Connect the air bag assembly to the pigtail adapter on the SRS deployment harness. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in non deployment of the air bag assembly.

12. Verify that the area around the passenger air bag assembly is clear of all people and loose or flammable objects.

13. Verify that the passenger air bag assembly is firmly and properly in J–41497.
14. Notify all people in the immediate area of your intention to deploy the passenger air bag assembly. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bag assembly.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the air bag assembly. Recommended application : 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the passenger air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the passenger air bag assembly deployed as intended, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide quickly reacts with the atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present for very long after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED INFLATOR MODULE NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY. AFTER AN AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE AIR BAG ASSEMBLY WILL BE HOT. DO NOT TOUCH THE METAL AREAS OF THE AIR BAG ASSEMBLY FOR ABOUT THIRTY MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG ITSELF.

21. Disconnect the pigtail adapter from the air bag assembly as soon after deployment as possible to avoid damage to the pigtail adapter or SRS deployment harness from contacting the hot air bag assembly canister. The pigtail adapter and SRS deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following the above procedures.

24. Ensure that the SRS deployment harness has been disconnected from the the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the air bag assembly with the bag facing up, away from the surface upon which it rests.

Deployment Inside Vehicle (Vehicle Scrapping Procedure)

Deployment inside vehicle is proper when the vehicle is to be destroyed or salvaged for component parts. This includes, but is not limited to, the following situations:

1. The vehicle has completed its useful life.
2. The vehicle has been damaged beyond repair in a non deployment type accident.
3. The vehicle has been stripped or damaged beyond repair in a theft.
4. The vehicle will be salvaged for component parts to be used on a vehicle with a different Vehicle Identification Number (VIN) as opposed to being rebuilt as same VIN. Never use SRS components from another vehicle.

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

1. Turn ignition switch to “LOCK”, remove key and put on safety glasses.
2. Remove all loose objects from front seats.
3. Disconnect SRS coil assembly, yellow 2–pin connector located at the base of the steering column.
4. Cut the SRS coil assembly yellow 2–pin harness connector from the vehicle leaving at least 16 cm (six inches) of wire at the connector.
5. Strip 1/2 inch (13 mm) of insulation from yellow–green and yellow–black wire lead of the connector.
6. Cut two 30 feet (900 cm) deployment wires from 18 gauge (0.8 mm^2) or thicker multi–strand wire. These wires will be used to fabricate the driver deployment harness.
7. Strip 1/2 inch (13 mm) of insulation from both ends of the wires cut in the previous step.
8. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

9. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
10. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
11. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
12. Connect the deployment harness to the driver air bag assembly, yellow 2–pin connector at the base of the steering column. Route deployment harness out the driver side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED.

THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT.

CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE.

FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

13. Disconnect passenger air bag assembly, yellow 2–pin connector located behind glove box assembly.
14. Cut the passenger air bag assembly harness connector from the vehicle leaving at least six inches (16 cm) of wire at the connector.
15. Strip 1/2 inch (13 mm) of insulation from yellow–green and yellow–red wire lead of the connector.
16. Cut two 30 feet (900 cm) deployment wires from 18 gauge (0.8 mm^2) or thicker multi–strand wire. These wires will be used to fabricate the passenger deployment harness.
17. Strip 1/2 inch (13 mm) of insulation from both ends of the wires cut in the previous step.
18. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

19. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
20. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
21. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
22. Connect the deployment harness to the passenger air bag assembly, yellow 2–pin connector located behind the glove box assembly. Route deployment harness out the passenger side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE

DEPLOYMENT WIRES SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

23. Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
24. Stretch the driver and passenger deployment harness to their full length.
25. Completely cover windshield area and front door window openings with a drop cloth, blanket or similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
26. Notify all people in the immediate area that you intend to deploy the air bags. The deployment will be accompanied by a substantial noise which may startle the uninformed.
27. Separate the two ends of the driver deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bags.

28. Connect the driver deployment harness wires to a power source to immediately deploy the driver air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
29. Separate the two ends of the passenger deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

30. Connect the passenger deployment harness wires to a power source to immediately deploy the passenger air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested. Put on a pair of shop gloves and safety gasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After an air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE HOT DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN FIRE OR PERSONAL INJURY.

After an air bag assembly has been deployed, the metal canister and surrounding areas of the air bag assembly will be very hot. Do not touch the metal areas of the air bag assembly for about 30 minutes after deployment. If the deployed air bag assembly must be moved before it is cool, wear gloves and handle by the air bag or trim cover.

31. Short the driver deployment harness wires by twisting together one end from each. Repeat this procedure for the passenger deployment harness.
32. Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
33. Disconnect driver deployment harness and passenger deployment harness from vehicle and discard.
34. In the unlikely event that either or both of the air bag assemblies did not deploy after following these procedures, proceed immediately with Steps 36 through 37. If the air bag assembly deployed, proceed to step 35.
35. With both air bags deployed, the vehicle may be scrapped in the same manner as a non–SRS equipped vehicle.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following these procedures.

36. Remove the undeployed air bag assembly (s) from the vehicle. For driver air bag assembly refer to in the "Passenger Air Bag Assembly Removal" in this section 9J–28.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG

ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN PERSONAL INJURY.

37. Temporarily store the air bag assembly with the air bag opening facing up, away from the surface upon which it rests.

Deployed Air Bag Assembly Handling

Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

J–41433 SRS Driver/Passenger Load Tool

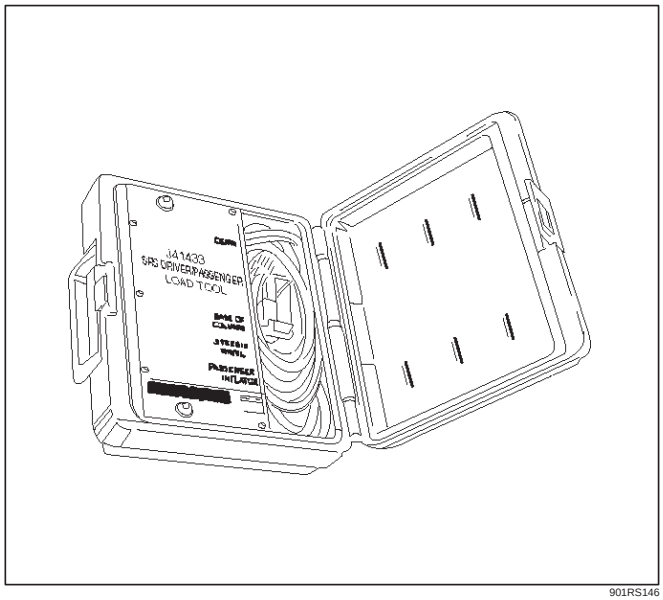
The SRS Driver/Passenger Load Tool J–41433 is used only when called for in this section. It is used as a diagnostic aid and safety device to prevent inadvertent air bag assembly deployment.

The load tool has four yellow connectors attached to its case.

The three small connectors are electrically functional and serve as resistive load substitutions.

No more than two connectors are used at any time. One of the small connectors is used to substitute for the load of the driver air bag assembly when it is connected at the top of the column to the SRS coil assembly. Another small connector is used to substitute for the load of the driver air bag assembly and the SRS coil assembly when it is connected at the base of the column to the SRS wiring harness. The third small connector is used to substitute for the load of the passenger air bag assembly when connected to the passenger air bag assembly harness connector.

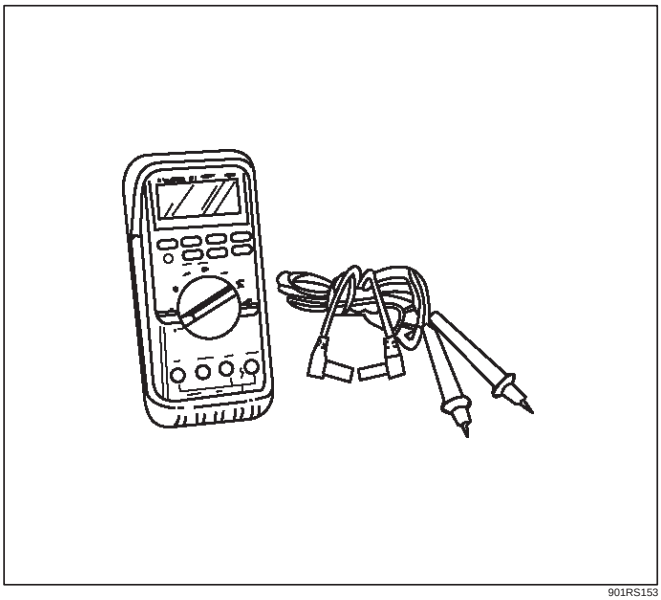
By substituting the resistance of the load tool when called for, a determination can be made as to whether an inflator circuit component is causing system malfunction and which component is causing the malfunction. The load tool should be used only when specifically called for in the diagnostic procedures.



901RS146

J–39200 DVM

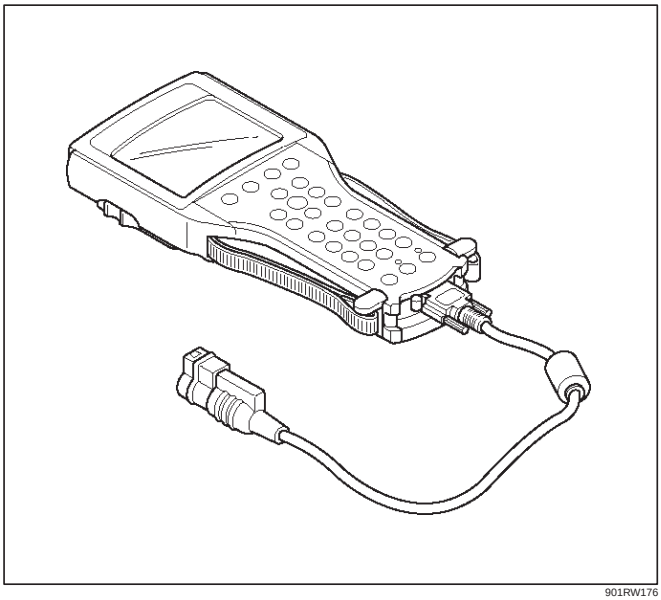
The J–39200 DVM is the preferred DVM for use in SRS diagnosis and repair. However, J–34029–A may be used if J–39200 is not available. No other DVMs are approved for SRS diagnosis and repair.



901RS153

Scan Tool

The Tech 2 is used to read and clear SRS Diagnostic Trouble Codes (DTCs). Refer to the Tech 2 Operator's Manual for specific information on how to use the Tech 2.



901RW176

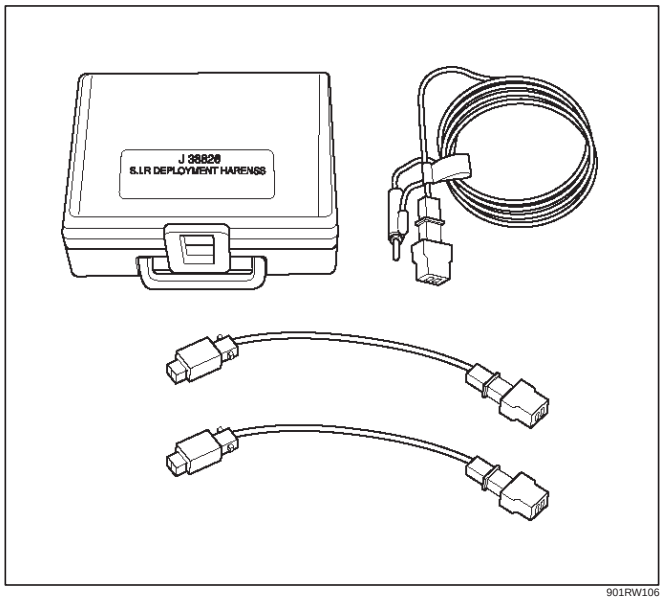
J–35616–A Connector Test Adapter Kit

The J–35616–A Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the appropriate adapter will ensure that no damage to the terminal will occur from the DVM prove, such as spreading or bending. The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.

901RS151

J–42986 SRS Deployment Tool

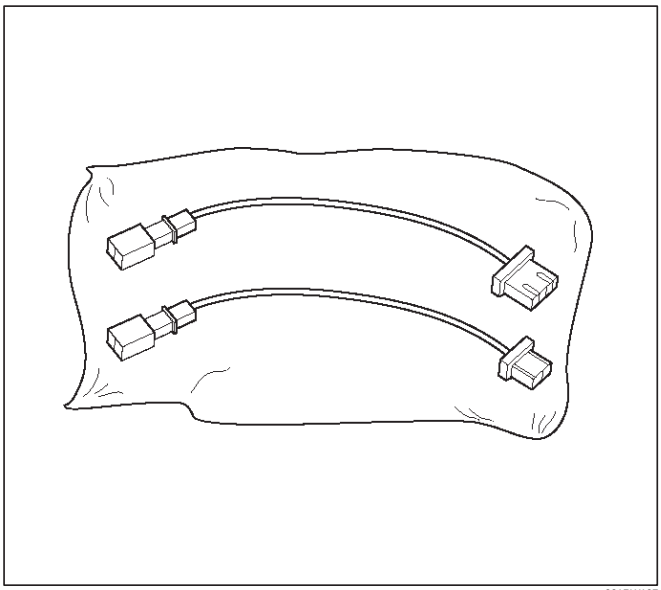
The J–42986 SRS Deployment Tool must be used for deployment of the undeployed air bag.



901RW106

J–42987 SRS Adapter For Load Tool

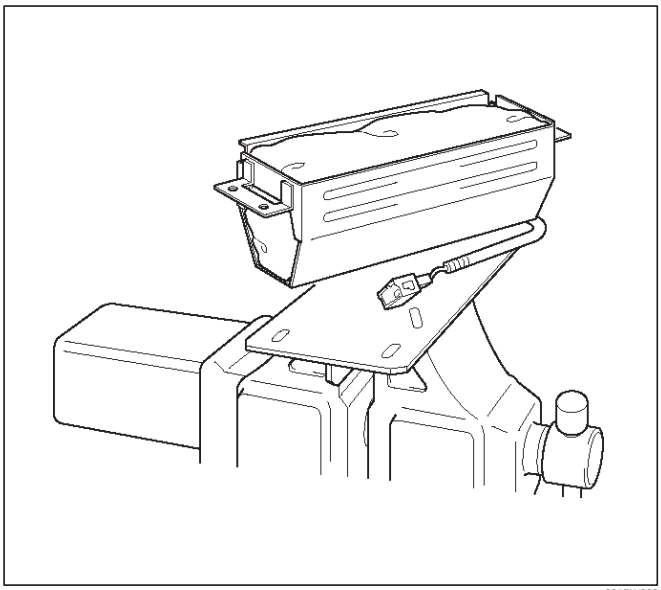
The J–42987 SRS Adapter be used for connect previous load tool to new SRS system when inspect SRS system harness.



901RW107

J–41497 SRS Deployment Fixture

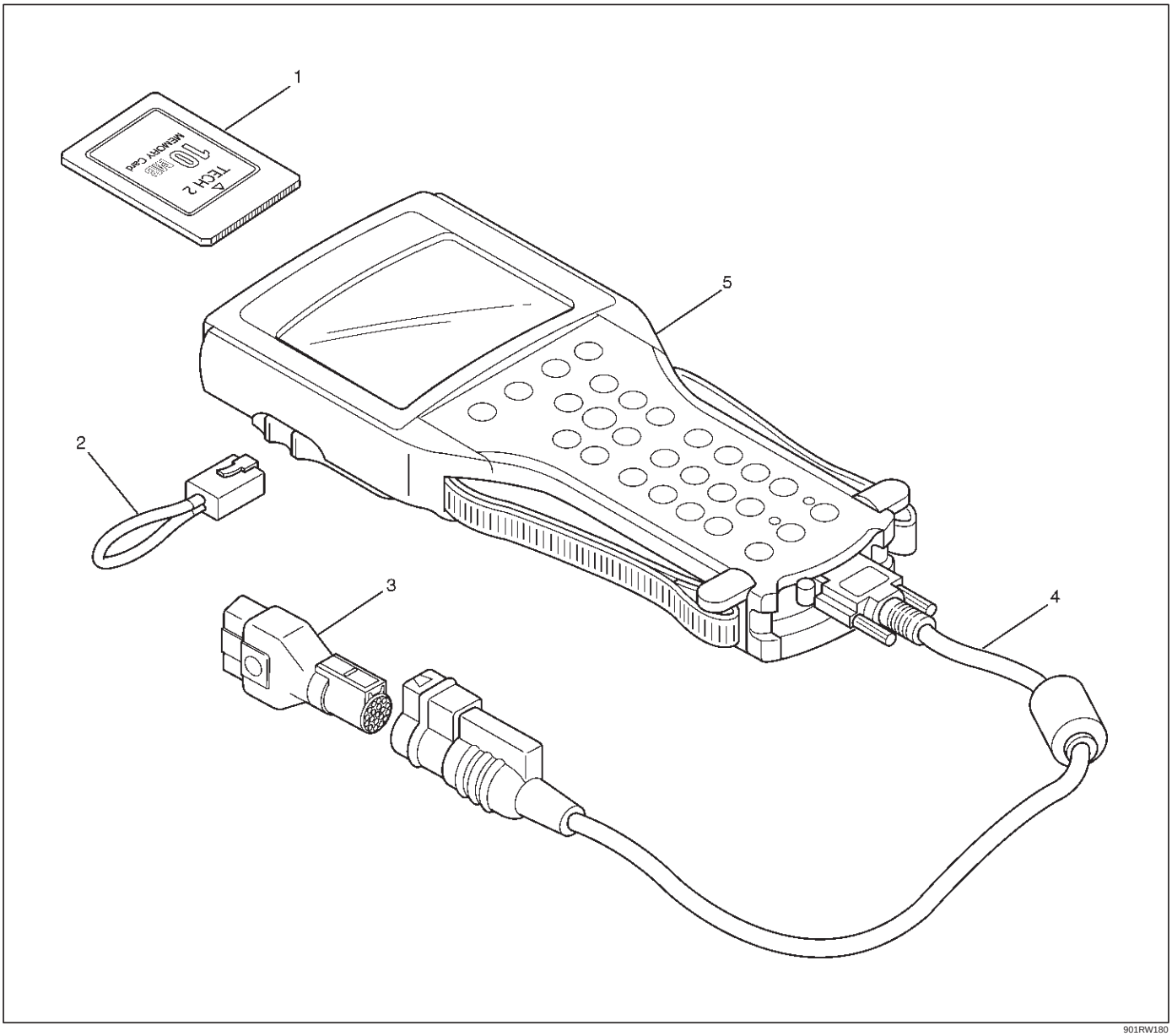
The J–41497 SRS Deployment Fixture must be used for deployment of the undeployed passenger side air bag.



901RW088

Tech 2 Scan Tool

From 2002 AXIOM (UP), dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW180

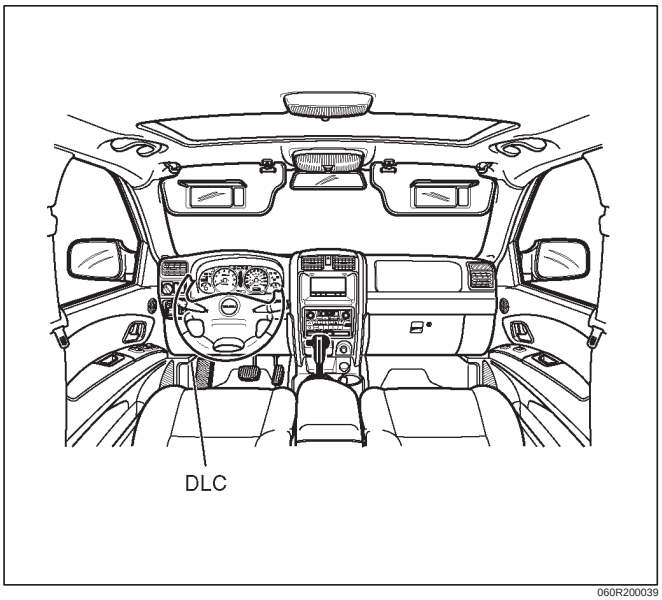
Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

Getting Started

▼ Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



060R200039

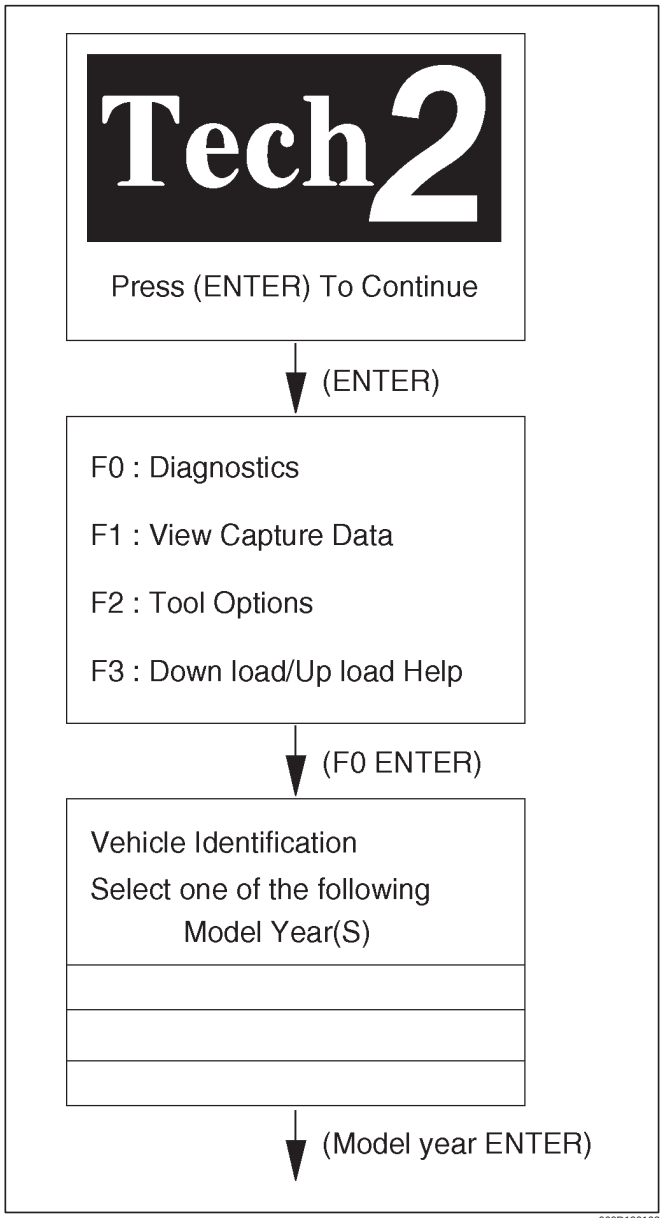
6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

060RW009

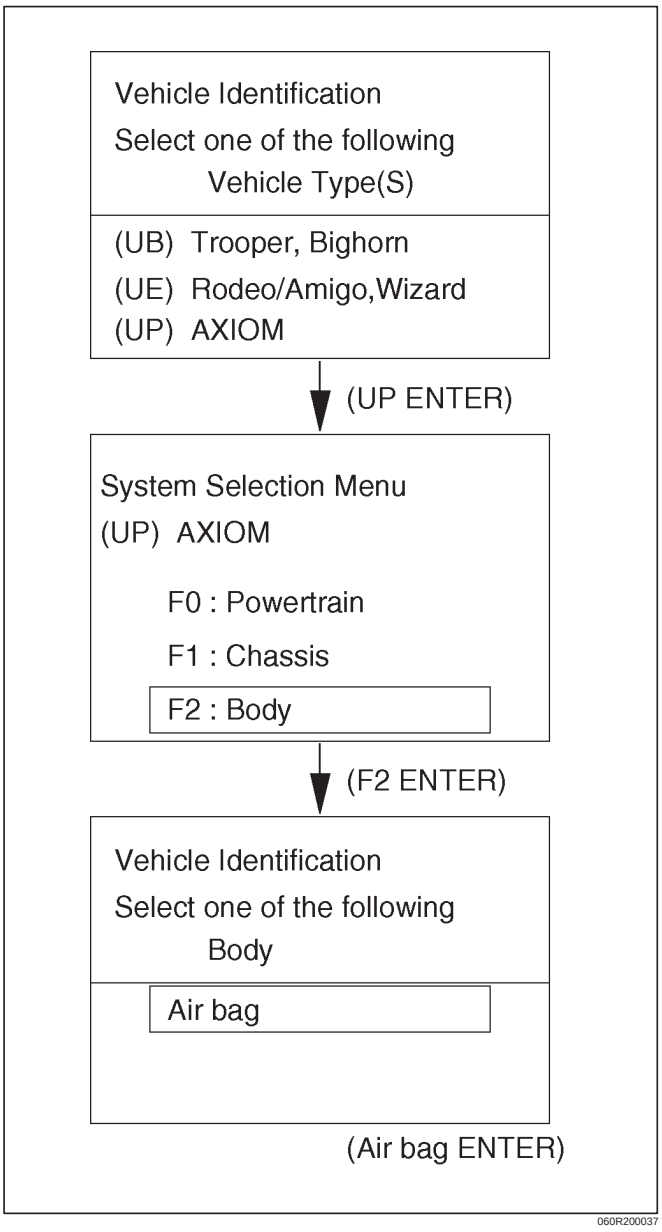
NOTE: The RS232 loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.

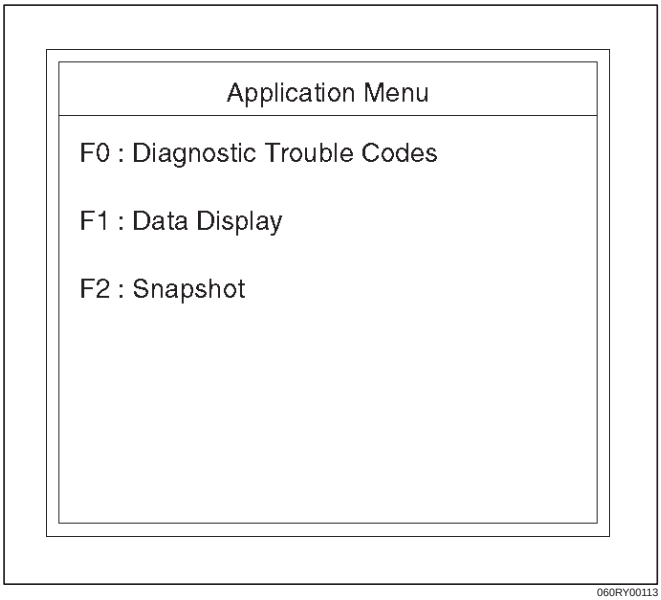


060R100102


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper, Bighorn
(UE) Rodeo/Amigo,Wizard
(UP) AXIOM
(UP ENTER)
System Selection Menu
(UP) AXIOM
F0 : Powertrain
F1 : Chassis
F2 : Body
(F2 ENTER)
Vehicle Identification
Select one of the following
Body
Air bag
(Air bag ENTER)
060R200037

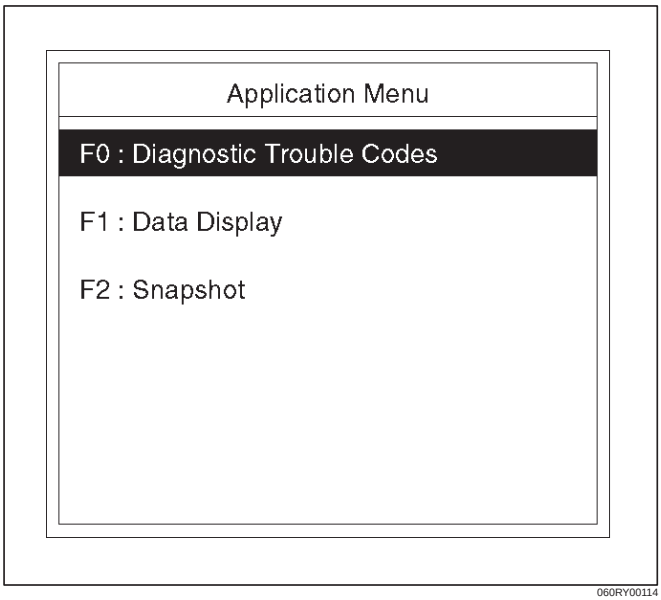
Menu

▼The following table shows which functions are used for the available equipment versions.



060RY00113

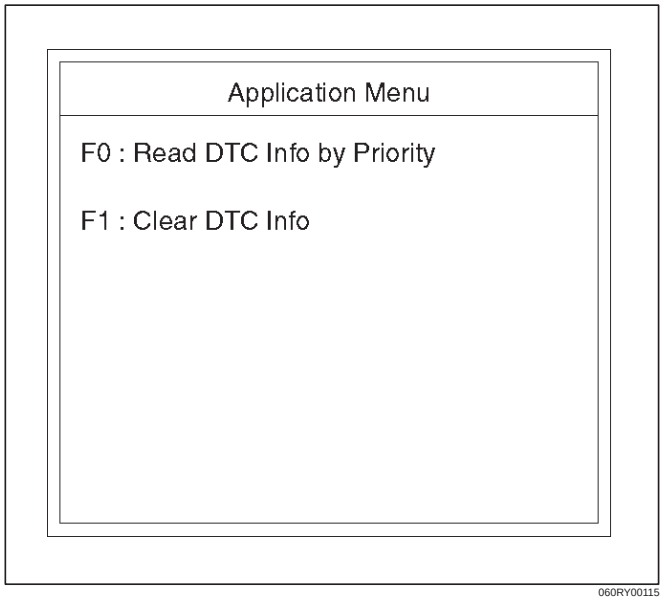
DTC Modes



060RY00114

▼Read DTC info by Priority

▼Clear Info



060RY00115

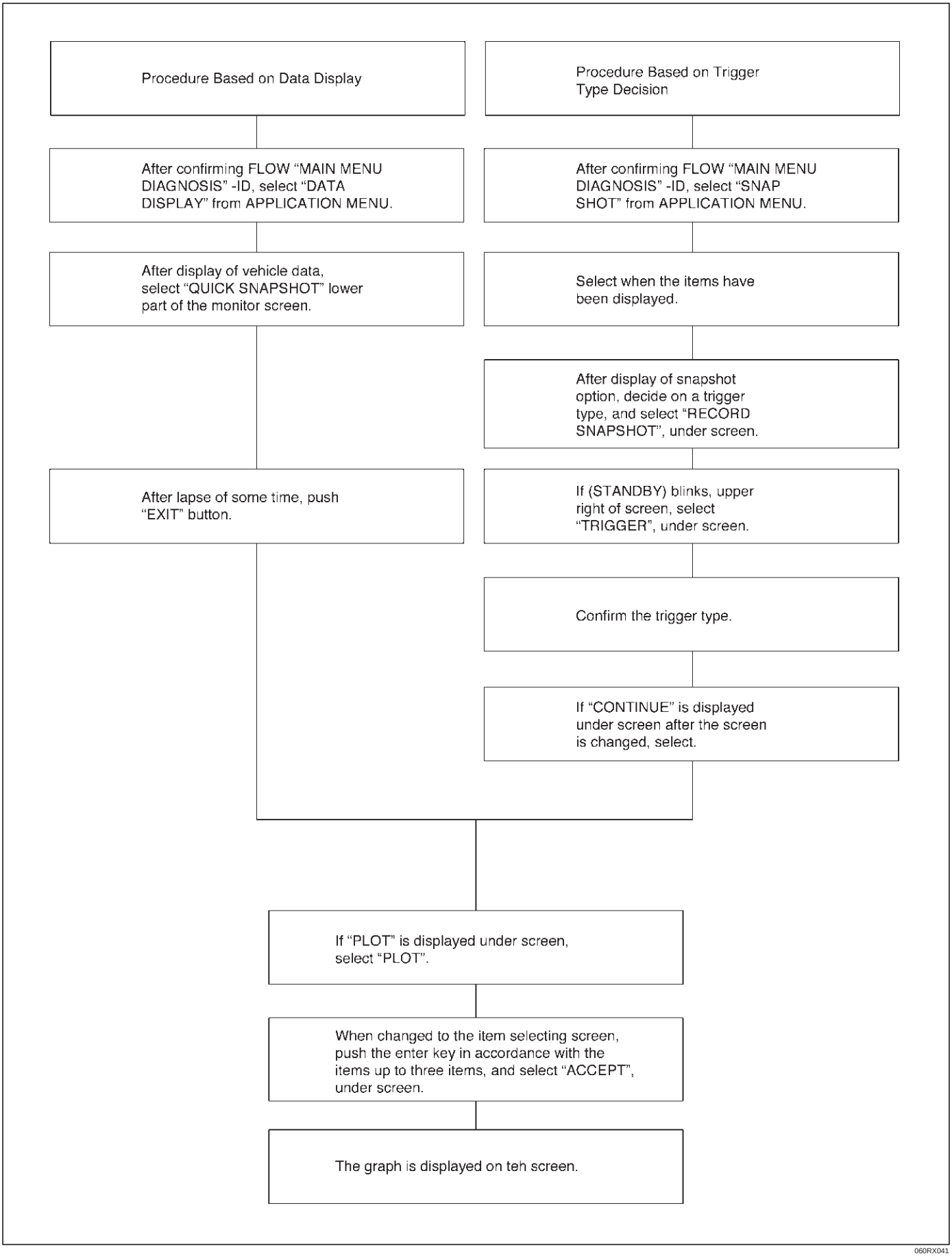
Plottong Snapshot Graph

This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.

For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.

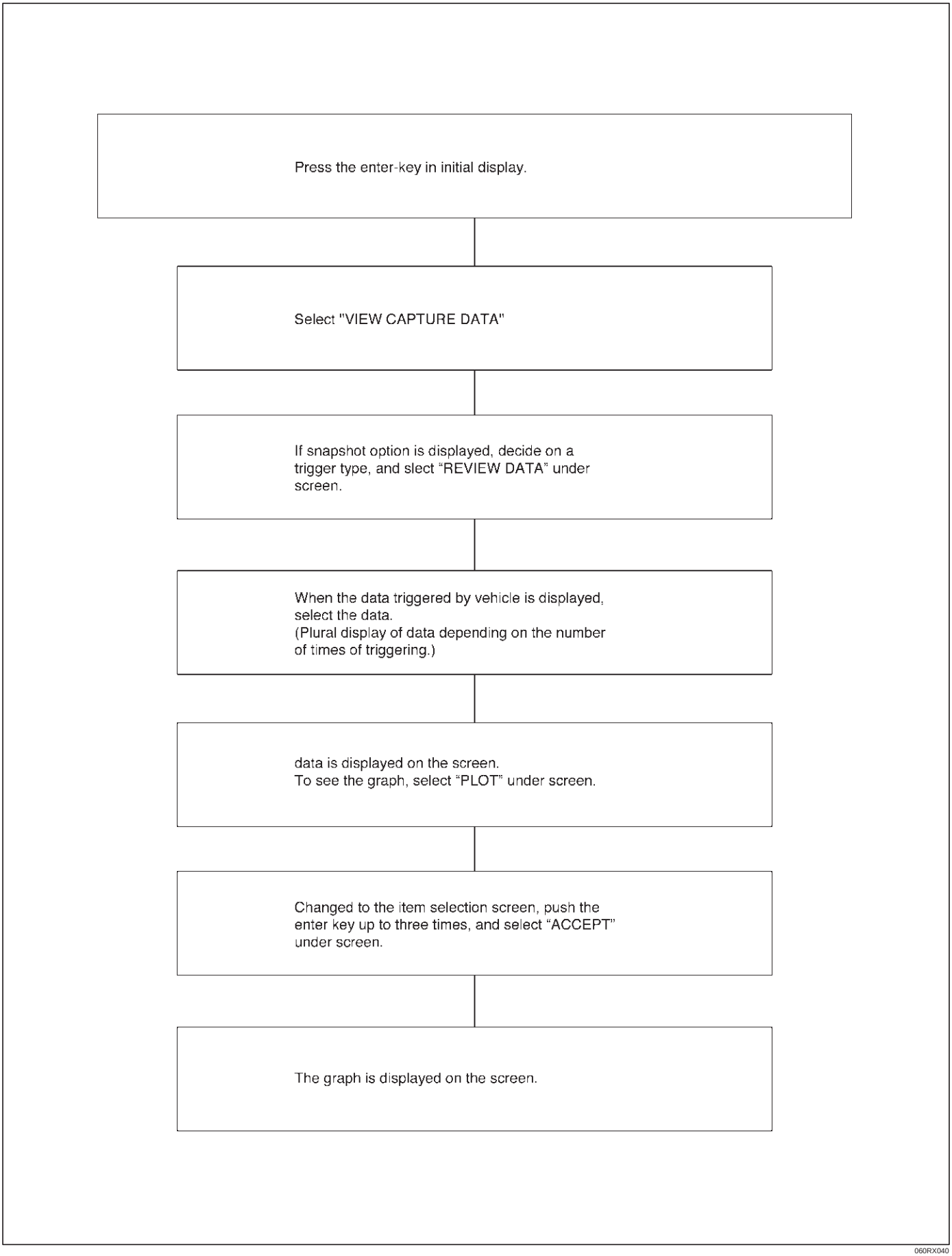
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



060RX041

Flow Chart for Snapshot Replay (Plotting Graph)



060RX040

Service Precaution

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF," the battery is disconnected, or the fuse powering the SDM is removed.
Many of the service procedures require removal of the "SRS–1" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "OFF" and turn the steering wheel so that the vehicle's wheels are pointing straight ahead.

1. Remove SRS fuse SRS–1, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly; Refer to "Passenger Air Bag Assembly Replacement" in this section.
4. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "SRS–2" fuse removed and ignition switch "ON," the "AIR BAG" warning lamp will be "ON." This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

Turn ignition switch to "LOCK" and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly, Refer to "Passenger Air Bag Assembly Replacement" in this section.
3. Connect yellow 2–pin connector at the base of the steering column.
4. Install "AIR BAG" fuse SRS–1 to left dash side lower fuse block or connect battery.

Turn ignition switch to "ON" and verify that the "AIR BAG" warning lamp flashes seven times and then turns "OFF" If it does not operate as described, perform the "SRS Diagnostic System Check" in section 9J–2.

Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 65˚C (150˚F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the SDM pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" will verify proper "AIR BAG" warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacements.

Inspections Required After An Accident

CAUTION: Certain SRS components must be replaced after a frontal crash involving air bag deployment.
In all types of accidents regardless of "Air Bag" deployment, visually inspect all of the following components and replace as required:

— Driver air bag assembly
— Passenger air bag assembly
— Steering wheel
— SRS coil assembly
— Steering column
— Knee bolster and instrument panel mounting attachments
— Driver seat and belt
— Passenger seat and belt
— SDM

SDM always should be checked according to "SDM Replacement Guidelines".

CAUTION: Refer to "SDM replacement Guidelines" below for important information on SDM replacement in both deployment and non–deployment crashes.
Inspect SRS coil assembly wiring and steering wheel for any signs of scorching, meting, or damage due to excessive heat. If coil assembly wire or steering wheel is

damaged, replace them. The steering column and wheel must be dimensionally checked to determine if they are damaged. Refer to in this Section 9J–3 of this manual.
Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized Retailer; they may be used for SRS repairs.
Do not attempt to repair the SDM, the SRS harness, the SRS coil assembly, the air bag assembly, the steering wheel, or the steering column. Service of these items is replacement only. Verify replacement part numbers.

CAUTION: Proper operation of the SDM and Supplemental Restraint System (SRS) requires that any repairs to the vehicle structure return it to its original production configuration.

Sensing and Diagnostic Module (SDM)

Service Precautions

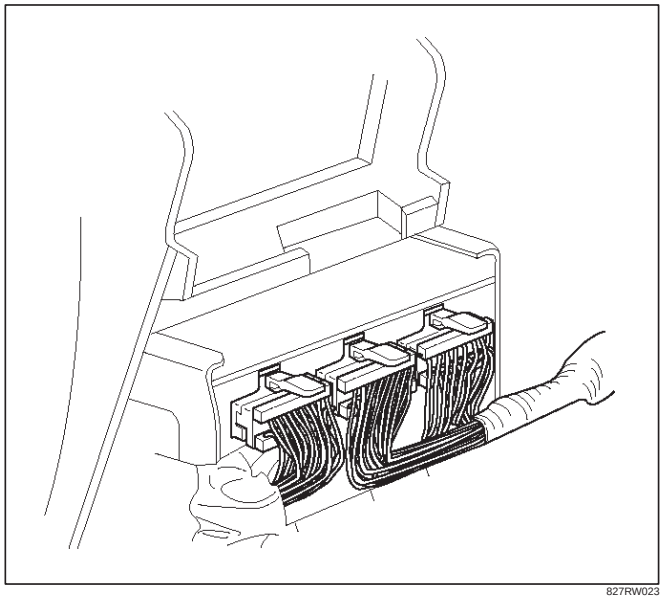
WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING SDM. NEVER STRIKE OR JAR SDM. UNDER SOME CIRCUMSTANCES, IT COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY OR IMPROPER OPERATION OF THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS). SDM MOUNTING BRACKET BOLTS MUST BE CAREFULLY TORQUED TO ASSURE PROPER OPERATION. NEVER POWER UP THE SRS WHEN SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

WARNING: PROPER OPERATION OF THE SENSING AND DIAGNOSTIC MODULE (SDM) REQUIRES THE SDM TO BE RIGIDLY ATTACHED TO THE VEHICLE STRUCTURE AND THAT THE ARROW ON THE SENSOR BE POINTING TOWARD THE FRONT OF THE VEHICLE.

SDM is specifically calibrated and is keyed to the SDM location SRS wiring harness. Caution should be used to ensure proper location of the SDM. The keying of the SDM to its location and wiring harness connectors should never be modified in the field.

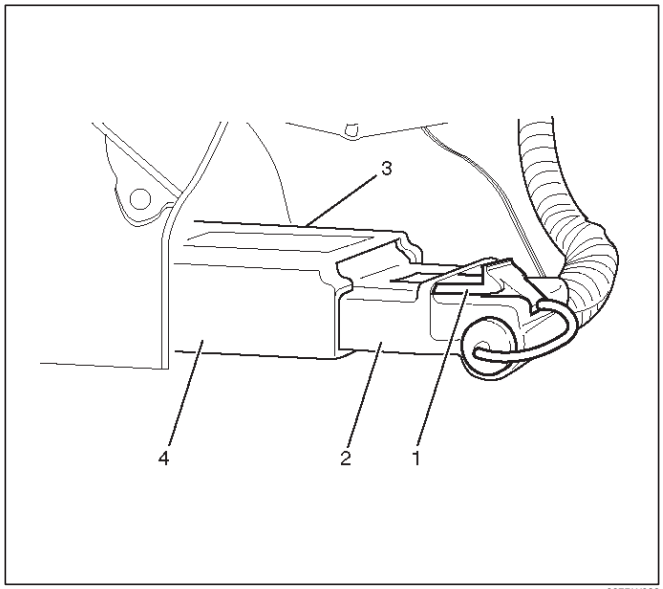
Removal

1. Disable the SRS. (Refer to “Disable the SRS” in this manual)
2. Remove dressing panel around the radio and disconnect cigar lighter harness.
3. Remove the transfer sift lever knob.
4. Remove the center console.
5. Remove three connector from PCM.
6. Remove PCM with bracket.(Fixed four bolts)
7. Remove right side stay between instrument panel and floor.
8. Remove driver and passenger seat.
9. Turn over carpet to rear side.
10. Remove air conditioning duct for rear seat. (Transform the duct during removing it)



827RW023

11. Pull CPA (1) (Connector Position Assurance–red color) out and push connector lock down to disconnect the SDM harness connector (2).
12. Remove the three SDM fixing bolts (4) and remove SDM (3).



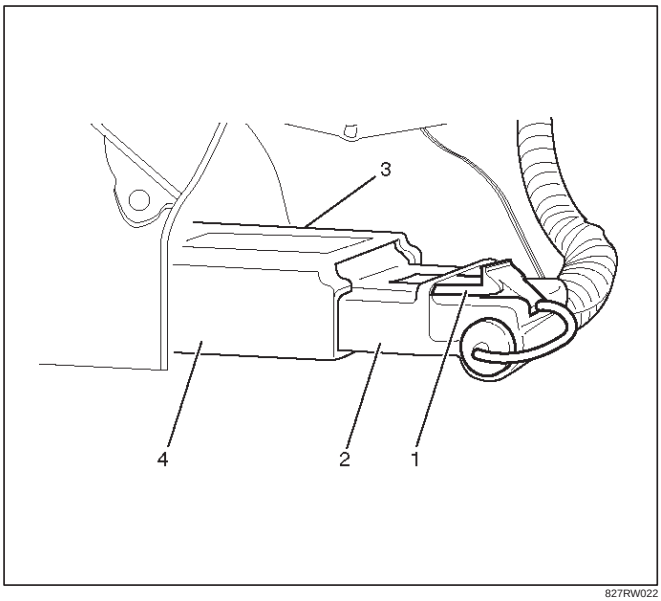
827RW022

Installation

1. Install the SDM (3) on bracket and fixing bolts (4) and tighten the fixing bolts to the specified torque.

   Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

2. Connect the SDM harness connector (2) and after that, put CPA into connector (1).



827RW022

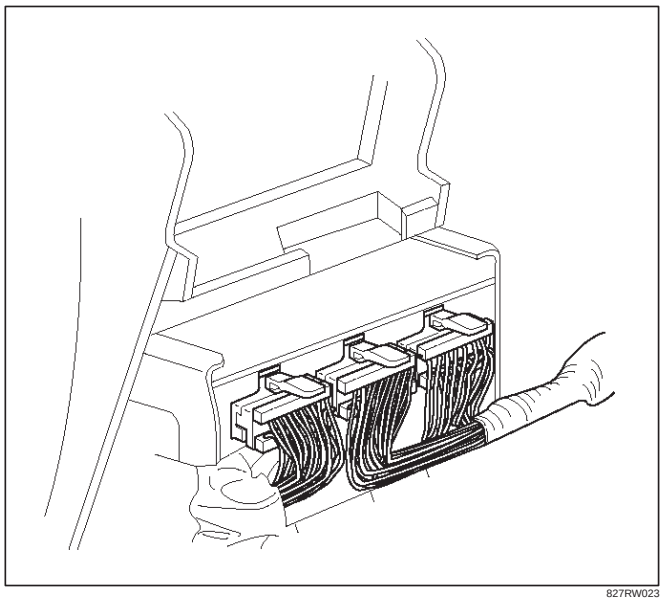
3. Install air conditioning duct for rear seat to normal position.
4. Return carpet normal position.
5. Install right side stay between instrument panel and floor, tighten to the specified torque.

   Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

6. Install PCM with bracket and tighten to the specified torque.

   Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

7. Reconnect three connector to PCM.
8. Install the center console.
9. Install the transfer shift lever knob.
10. Install the dressing panel around the radio and reconnect cigar lighter harness.
11. Enable the SRS. (Refer to “Enabling the SRS” in this manual)



827RW023

Driver Air Bag Assembly

Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

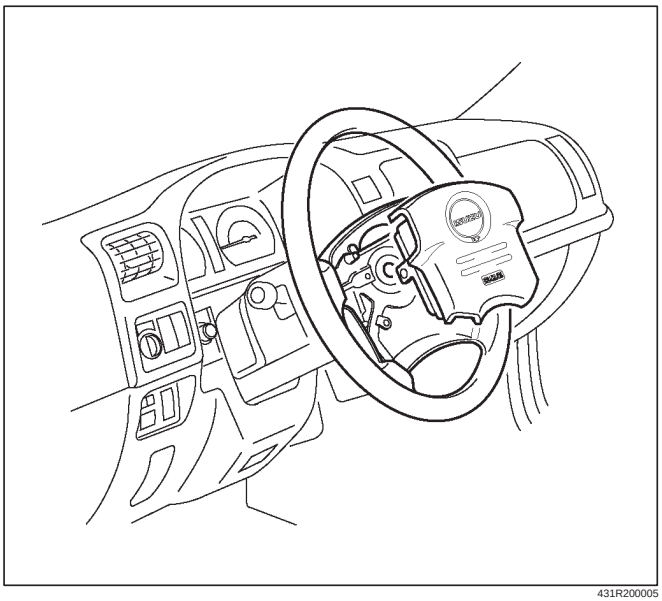
WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove air bag assembly from steering wheel by removing two bolts. Lift air bag assembly out of steering wheel.

3. Disconnect connector and remove air bag assembly.



431R200005

Installation

1. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

2. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8.8 N·m (78 lb in)

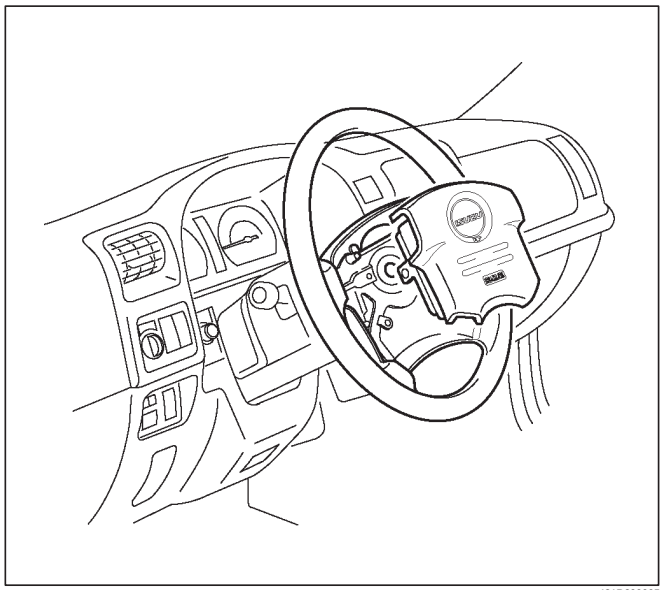
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for "UP".



431R200005

3. Enable the SRS. (Refer to "Enabling the SRS" in this section.)

Steering Wheel

Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

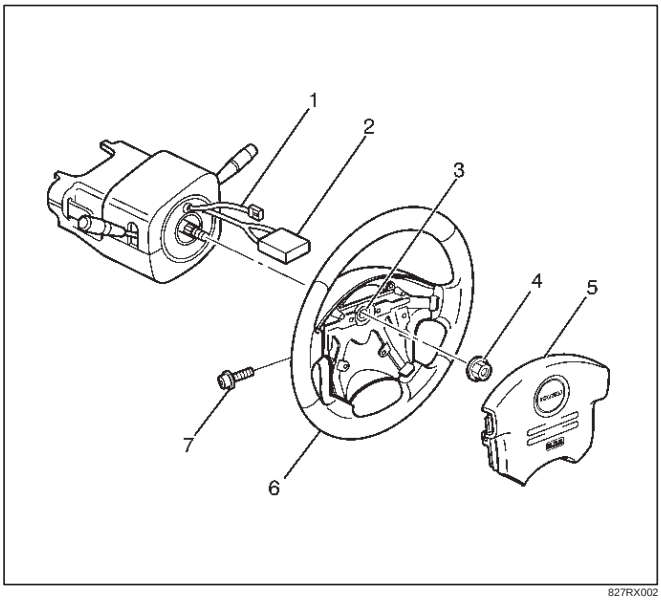
NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to "Disabling the SRS" in this section.)
2. Remove the air bag assembly (5) from steering wheel (6) by removing two bolts (7). Lift air bag assembly out of steering wheel.
3. Disconnect connector (2) and remove air bag assembly.
4. Disconnect horn lead (1)
5. Remove steering wheel attachment nut (4).

6. Move the tires to the straight ahead position before removing the steering wheel. Install steering wheel puller onto steering wheel and remove steering wheel with J–29752.
7. Apply a setting mark (3) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring through the wheel and remove wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



827RX002

Installation

1. Install the steering wheel and align the setting marks (3).
2. Tighten the steering wheel fixing nut (4) to the specified torque.

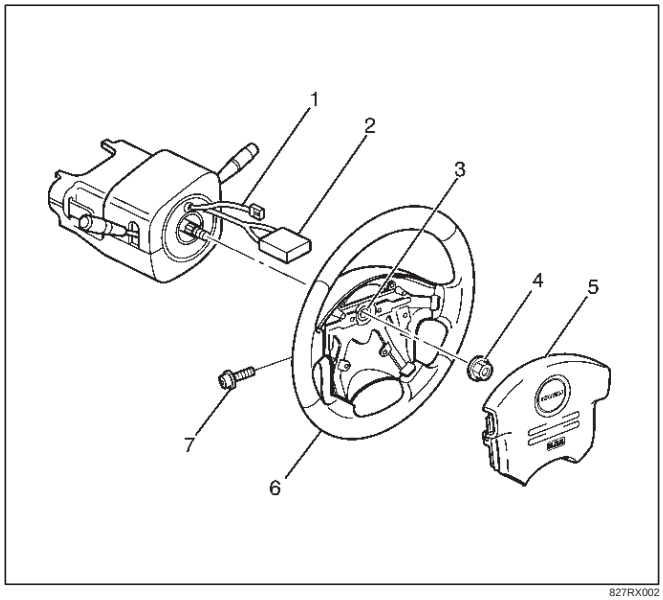
   Torque: 34 N·m (25 lb ft)
3. Connect horn lead (1).
4. Connect air bag to wiring harness connector (2).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

5. Install air bag into steering wheel and tighten bolts (7) to specified sequence as show in figure.

   Torque: 8.8 N·m (78 lb in)

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.
The air bag assembly has identification colors on the bar code label as follows.
Light blue color for driver air bag assembly.
Light blue color for passenger air bag assembly.
Use only the air bag assembly for "UP".



827RX002

6. Enable the SRS. (Refer to "Enabling The SRS" in this section.)

SRS Coil Assembly

Service Precaution

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

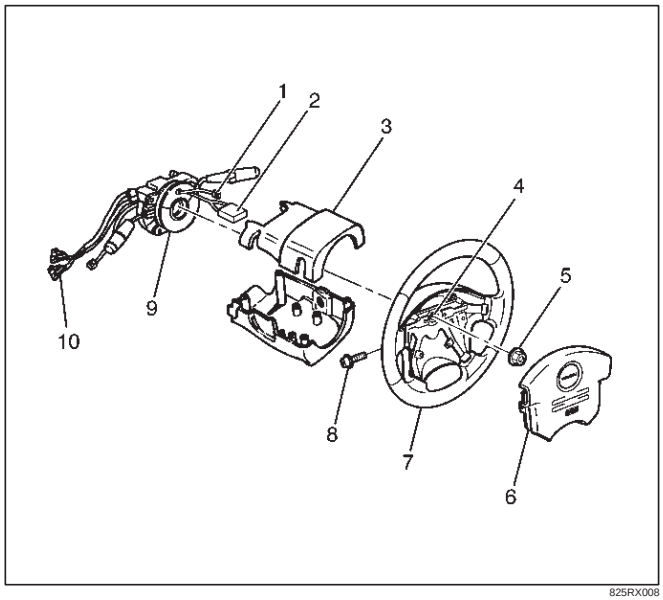
Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove the air bag assembly (6) from steering wheel (7) by removing two bolts (8). Lift air bag assembly out of steering wheel.
3. Disconnect the 2–pin yellow connector (2) and remove air bag assembly.
4. Disconnect horn lead connector (1).
5. Remove the steering wheel attachment nut (5).
6. Move the tires to the straight ahead position before removing the steering wheel and remove wheel with J–29752.
7. Apply a setting mark (4) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring though the wheel and remove wheel.
9. Remove the steering lower cover.
10. Remove the driver knee bolster assembly.
11. Remove the steering column cover (3).
12. Disconnect the wiring harness connectors (10) located at the base of steering column.

CAUTION: Never apply force to the steering wheel in the direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

13. Remove the combination switch assembly with SRS coil (9).

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



825RX008

Installation

1. Install the combination switch assembly with SRS coil (9).
2. Connect the wiring harness connectors (10) located at the base of steering column.
3. Turn the SRS coil clockwise to full, return about 3 turns and align the neutral mark.

NOTE: Whenever installing the new combination switch with SRS coil, be sure to tear off the lock pin for aligning the neutral position before it is installed to the base of steering column.

CAUTION: When turning the SRS coil clockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.

4. Install the steering column cover (3).

CAUTION: When installing the steering column cover, be sure to through each harness as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.

5. Install the driver knee bolster assembly.
6. Install the steering lower cover.

7. Install the steering wheel and align the setting marks (4).
8. Tighten the steering wheel fixing nut (5) to the specified torque.

   Torque: 34 N·m (25 lb ft)

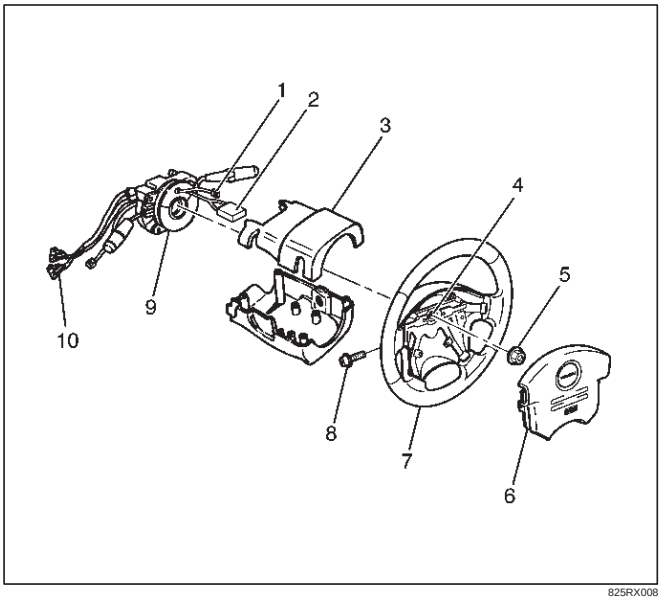
9. Connect horn lead (1).
10. Connect air bag to wiring harness connector (2).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

11. Install Air Bag (6) into steering wheel and tighten bolts (8) to specified sequence as figure.

    Torque: 8.8 N·m (78 lb in)

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.
The air bag assembly has identification colors on the bar code label as follows.
Light blue color for driver air bag assembly.
Light blue color for passenger air bag assembly.
Use only the air bag assembly for "UP".



12. Enable the SRS. (Refer to "Enabling The SRS" in this section.)

Steering Column

Service Precaution

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

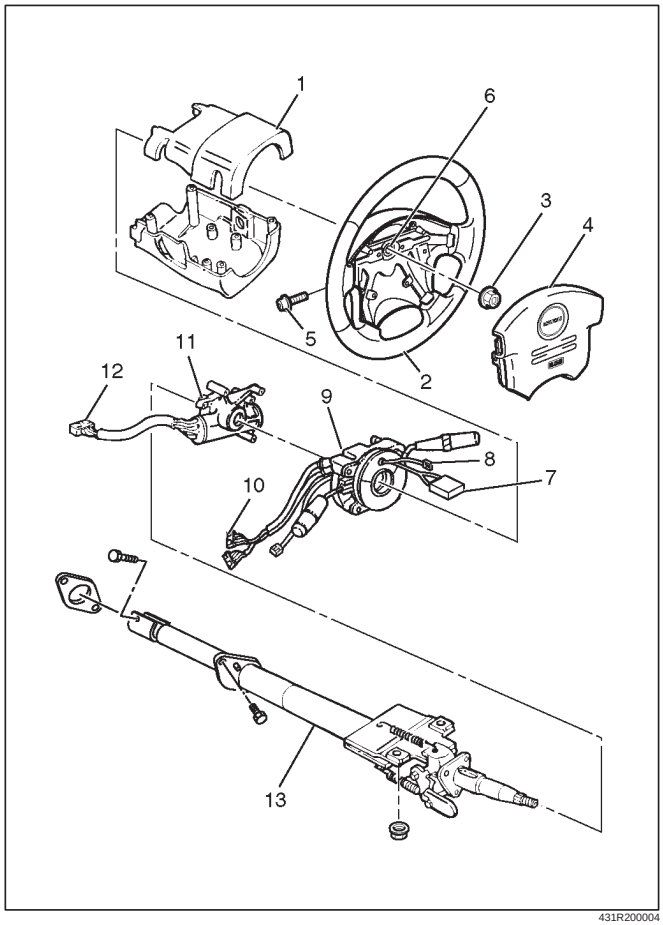
1. Disable the SRS. (Refer to “Disabling The SRS” in this section.)
2. Remove the air bag assembly (4) from steering wheel (2) by removing two bolts (5). Lift air bag assembly out of steering wheel.
3. Disconnect the 2–pin yellow connector (7) and remove air bag assembly.
4. Disconnect horn lead connector (8).
5. Remove the steering wheel attachment nut (3).
6. Move the tires to the straight ahead position before removing the steering wheel and removing wheel with J–29752.
7. Apply a setting mark (6) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring though the wheel and remove wheel.
9. Remove the steering lower cover.
10. Remove the driver knee bolster assembly.
11. Remove the steering column cover (1).
12. Disconnect the wiring harness connectors (10) located at the base of steering column.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

13. Remove the combination switch assembly with SRS coil (9).

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

14. Remove the snap ring.
15. Remove the cushion rubber.
16. Disconnect shift lock cable (A/T only)
17. Disconnect the starter switch harness connector (12) located base of steering column.
18. Remove steering lock cylinder assembly (11).
19. Remove steering column assembly (13).



431R200004

Installation

1. Install the steering column assembly (13) and align the setting marks on the universal joint and steering shaft made during removal.
2. Tighten the steering column fixing bolts (dash panel side) to the specified torque.

   Torque: 20 N·m (14 lb ft)
3. Tighten the steering column fixing nuts (Cross beam) to the specified torque.

   Torque: 20 N·m (14 lb ft)
4. Tighten the universal joint to the specified torque.

   Torque: 31 N·m (23 lb ft)
5. Install steering lock cylinder assembly (11).
6. Connect shift lock cable (For A/T)
7. Install cushion rubber.
8. Install snap ring.
9. Install the combination switch assembly with SRS coil (9).
10. Connect the wiring harness connector (10) located on the base of steering column.
11. Turn the SRS coil clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil clockwise to full, stop turning if resistance is felt. Further forced turning may damage the cable in the SRS coil.

12. Install steering column cover (1).

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.

13. Install the steering wheel (2) and align the setting marks (6).
14. Tighten the steering wheel fixing nut (3) to the specified torque.

    Torque: 34 N·m (25 lb ft)
15. Connect horn lead (8).
16. Connect air Bag wiring harness connector (7).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

17. Install air bag into steering wheel and tighten bolts (5) to specified sequence as shown in figure.

    Torque: 8.8 N·m (78 lb in)

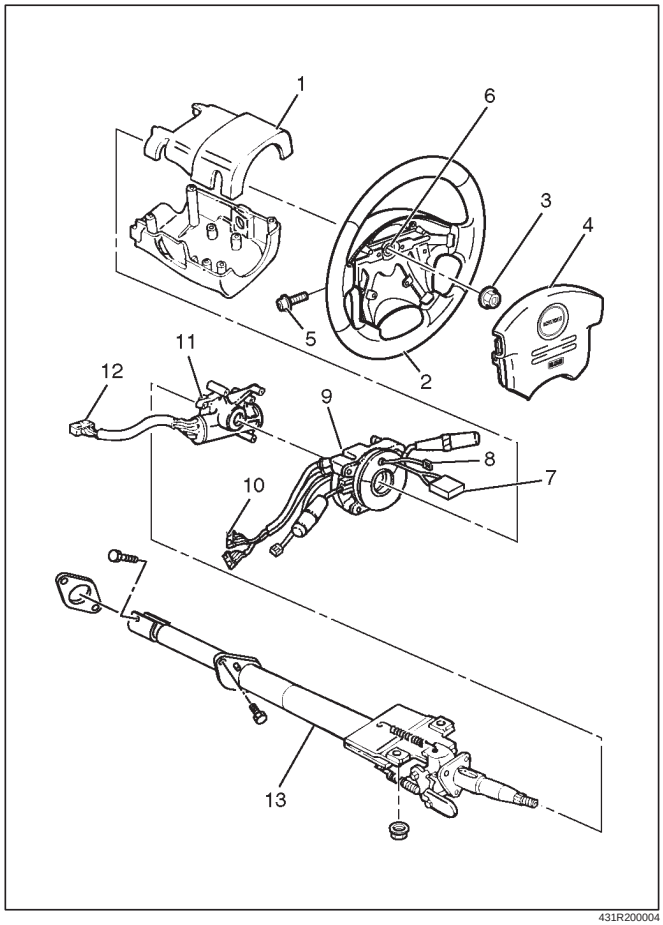
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for "UP".



431R200004

18. Enable the SRS (Refer to "Enabling The SRS" in this section.)

Passenger Air Bag Assembly

Service Precaution

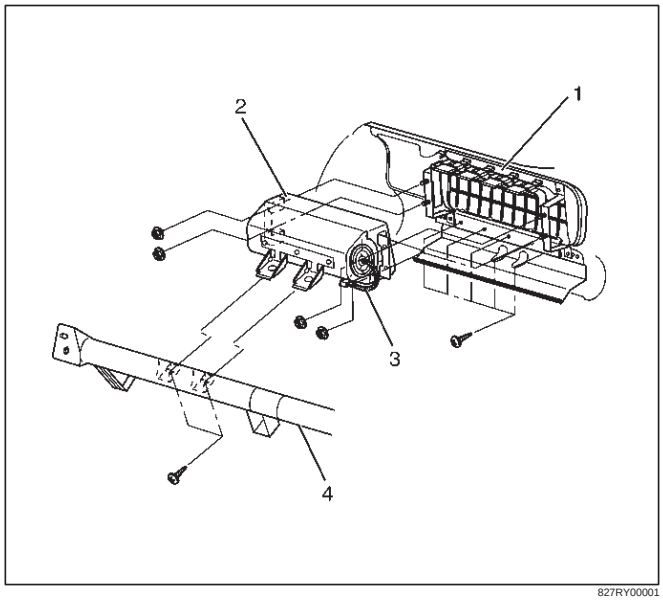
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove glove box assembly.
3. Disconnect passenger air bag assembly harness connector.
4. Remove air bag assembly fixing bolts and nuts.
5. Remove passenger air bag assembly from glove box opening of instrument panel.



827RY00001

Legend

(1) Passenger Air Bag Door
(2) Passenger Air Bag Assembly
(3) Passenger Air Bag Harness
(4) Cross Beam

Installation

1. Install passenger air bag assembly from glove box opening of instrument panel.
2. Install air bag assembly fixing nuts and bolts, and tighten to specified torque.

   Torque: 7.8 N·m (69 lb in)
3. Connect air bag assembly harness connector.
4. Install glove box assembly.
5. Enable the SRS (Refer to “Enabling the SRS” in this section.)

AXIOM

RESTRAINTS

SRS CONTROL SYSTEM

CONTENTS

Service Precaution 9J1–1
Diagnostic Information 9J1–2
Diagnostic Procedures 9J1–2
Diagnostic Codes 9J1–2
How To Read Trouble Codes 9J1–2
How To Clear Trouble Codes 9J1–2
Scan Tool Diagnostics 9J1–2
Basic Knowledge Required 9J1–2
Basic Electrical Circuits 9J1–2
“Flash Code” Diagnostics 9J1–3
System Schematic 9J1–3
SRS Diagnostic System Check 9J1–4
Circuit Description 9J1–4
Notes On System Check Chart: 9J1–4
Diagnostic Aids: 9J1–4
Chart A SDM Integrity Check 9J1–6
Chart B “AIR BAG” Warning Lamp Comes “ON” Steady 9J1–8
Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady 9J1–10
DTC 15 Passenger Deployment Loop Resistance High 9J1–13
DTC 16 Passenger Deployment Loop Resistance Low 9J1–16
DTC 17 Passenger Deployment Loop Open 9J1–19
DTC 18 Passenger Deployment Loop Short To Ground 9J1–21
DTC 19 Passenger Deployment Loop Short To Voltage 9J1–23
DTC 21 Driver Deployment Loop Resistance High 9J1–25
DTC 22 Driver Deployment Loop Resistance Low 9J1–28
DTC 24 Driver Deployment Loop Short To Ground 9J1–31
DTC 25 Driver Deployment Loop Short To Voltage 9J1–33
DTC 26 Driver Deployment Loop Open 9J1–36
DTC 51 Deployment Event Commanded . . . 9J1–39
DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range 9J1–41
DTC 61 Warning Lamp Circuit Failure 9J1–43
DTC 71 Internal SDM Fault 9J1–45

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnostic Information

Diagnostic Procedures

WARNING: WHEN FASTENERS ARE REMOVED, ALWAYS REINSTALL THEN AT THE SAME LOCATION FROM WHICH THEY WERE REMOVED. IF A FASTENER NEEDS TO BE REPLACED, USE THE CORRECT PART NUMBER FASTENER FOR THAT APPLICATION. IF THE CORRECT PART NUMBER FASTENER IS NOT AVAILABLE, A FASTENER OF EQUAL SIZE AND STRENGTH (OR STRONGER) MAY BE USED. FASTENERS THAT ARE NOT REUSED, AND THOSE REQUIRING THREAD LOCKING COMPOUND WILL BE CALLED OUT. THE CORRECT TORQUE VALUE MUST BE USED WHEN INSTALLING FASTENERS THAT REQUIRE IT. IF THE ABOVE CONDITIONS ARE NOT FOLLOWED, PARTS OR SYSTEM DAMAGE COULD RESULT.

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED, PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

The diagnostic procedures used in this section are designed to aid in finding and repairing SRS problems. Outlined below are the steps to find and repair SRS problems quickly and effectively. Failure to carefully follow these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

1. **Perform The “SRS Diagnostic System Check.”**

The “SRS Diagnostic System Check” should always be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for SRS trouble codes using both “Flash Code” and “Scan Tool” Methods.

2. **Refer To The Proper Diagnostic Chart As Directed By The “SRS Diagnostic System Check.”**

The “SRS Diagnostic System Check” will lead you to the correct chart to diagnose any SRS problems. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

3. **Repeat the “SRS Diagnostic System Check” After Any Repair Or Diagnostic Procedures Have Been Performed.**

Performing the “SRS Diagnostic System Check” after all repair or diagnostic procedures will assure that the repair has been made correctly and that no other conditions exist.

Diagnostic Codes

The Sensing and Diagnostic Module (SDM) maintains a history record of all diagnostic codes that have been detected since the SRS codes were last cleared during service.

1. Active Codes—Faults that are presently detected this ignition cycle. Active codes are stored in RAM (Random Access Memory).
2. History Codes—All faults detected since the last time the history fault memory was cleared. History codes are stored in EEPROM. (Electronically Erasable Programmable Read only Memory)

How To Read Trouble Codes

All codes (Active and history) can be read (or cleared) by using a scan tool or equivalent.
If a DTC is not available, have the vehicle serviced by dealer.

How To Clear Trouble Codes

Trouble codes can only be cleared by using a scan tool. If a scan tool is not available then inform the owner of the stored codes and suggest that the codes are cleared upon the next visit to a dealership.

Scan Tool Diagnostics

A scan tool can be used to read current and history codes and to clear all history codes after a repair is complete. The scan tool must be updated to communicate with the SRS through a replaceable cartridge for SRS diagnostics. To use the scan tool, connect it to the DLC and turn the ignition switch “ON”. Then follow the manufacturer’s directions for communication with the SRS. The scan tool reads serial data from the SDM “Serial Data” output (terminal 24) to the DLC.

Basic Knowledge Required

Before using this section of the Service Manual, there is some basic knowledge which will be required. Without this knowledge, you will have trouble using the diagnostic procedures in this section. Use care to prevent harm or unwanted deployment. Read all cautions in the service manual and on warning labels attached to SRS components.

Basic Electrical Circuits

You should understand the basic theory of electricity including series and parallel circuits, and understand the voltage drops across series resistors. You should know the meaning of voltage (volts), current (amps), and resistance (ohms). You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram.

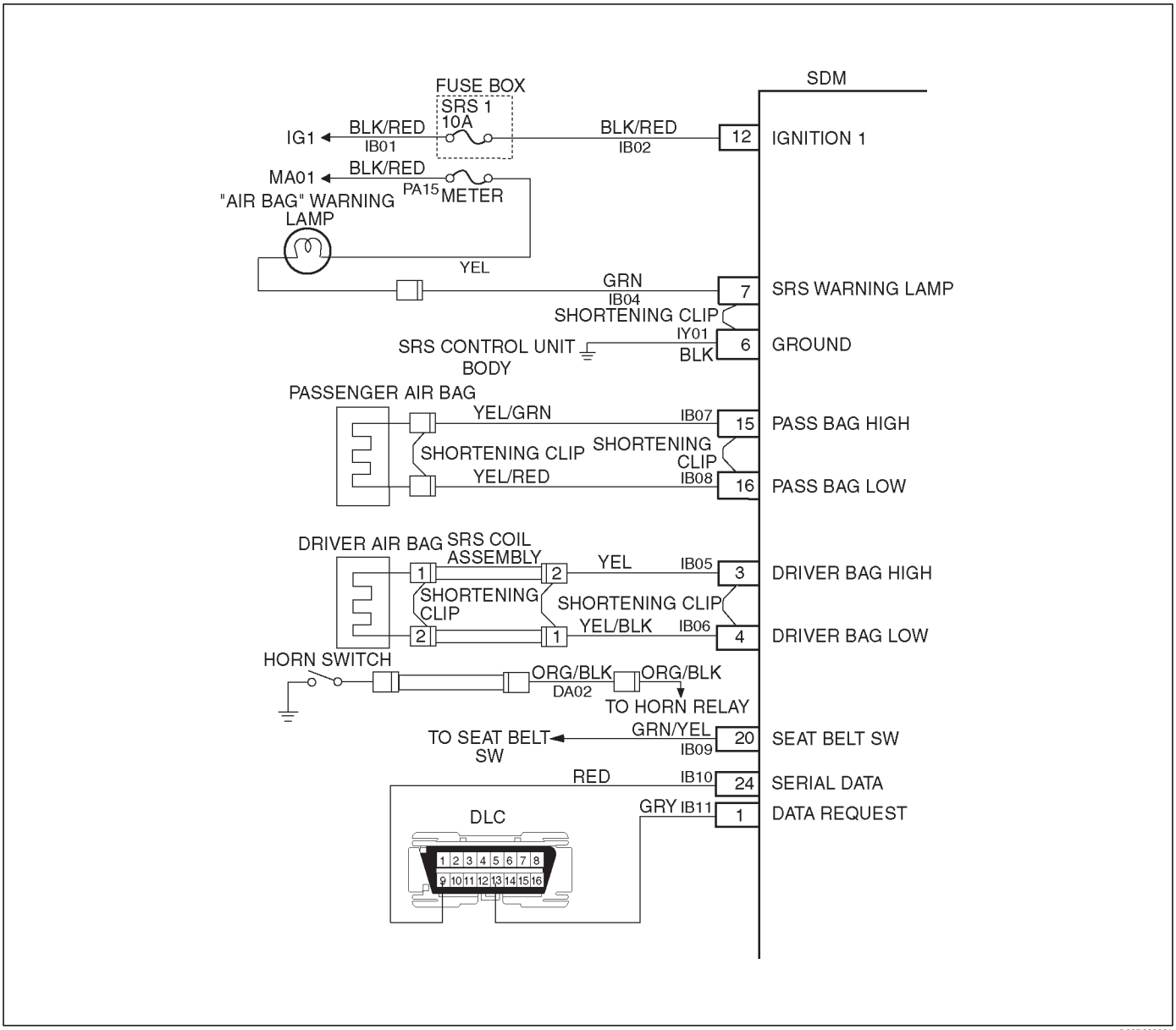
"Flash Code" Diagnostics

Flash code diagnostics can be used to read current codes and to determine if history codes are present but cannot be used to clear codes or read history codes. Flash code diagnostics is enabled by grounding by terminal 13 shorting to terminal 4 of the DLC with the ignition switch "ON". Grounding terminal 13 of the DLC pulls the "Diagnostics Request" input (Terminal 1) of the SDM low and signals the SDM to enter the flash code diagnostic display mode.

The SDM displays the trouble codes by flashing the warning lamp. Each code that is displayed will consist of a number of flashes which represents the tens digit, a 1.2 second pause, following by a number of flashes which represents the ones digit of the code. Each code is displayed one time before moving on to the next code. After all of the codes have been displayed, the entire code sequence will continually by repeated until ground is removed from terminal 13 of the DLC.

Two special codes exist when reading in the flash code mode (Flash Code 12 and Flash Code 13). "Flash Code 12" will always be the first code displayed when the flash code mode is enabled Code 12 is not an indication of a SRS problem but an indication that the flash code mode has been enabled. If there are no current or history codes present, the SDM will display code 12 until ground is removed from the DLC at terminal 13. "Flash Code 13" will be displayed if there are history codes. To read the history codes, a scan tool must be used.

System Schematic



D09R200001

SRS Diagnostic System Check

The diagnostic procedures used in this section are designed to find and repair SRS malfunctions. To get the best results, it is important to use the diagnostic charts and follow the sequence listed below:

A. Perform the “SRS Diagnostic System Check.”
   The “SRS Diagnostic System Check” must be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation, the ability of the SDM to communicate through the “Serial Data” line and whether SRS diagnostic trouble codes exist.

B. Refer to the proper diagnostic chart as directed by the “SRS Diagnostic System Check.”
   The “SRS Diagnostic System Check” will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

C. Repeat the “SRS Diagnostic System Check” after any repair or diagnostic procedures have been performed.
   Performing the “SRS Diagnostic System Check” after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist

Circuit Description

When the ignition switch is first turned “ON”, “ignition 1” voltage is applied from the “SRS–1” fuse to the SDM at the “ignition 1” input terminals “12”. The SDM responds by flashing the “AIR BAG” warning lamp seven times while performing tests on the SRS.

Notes On System Check Chart:

Number(s) below refer to step number(s) on the “SRS Diagnostic System Check” chart.

1. The “AIR BAG” warning lamp should flash seven times after ignition is first turned “ON.”
2. After the “AIR BAG” warning lamp flashes seven times, it should turn “OFF.”
3. Improper operation of the “AIR BAG” warning lamp is indicated. This test differentiates a warning lamp stays “ON” condition from a warning lamp does not come “ON” condition.
4. This test checks for the proper operation of the “Serial Data” line. This test will also determine whether history diagnostic trouble codes are stored and, if so, identify them.
5. This test checks for proper operation of the “Serial Data” line. This test will also identify the stored diagnostic trouble codes and whether they are current or history.

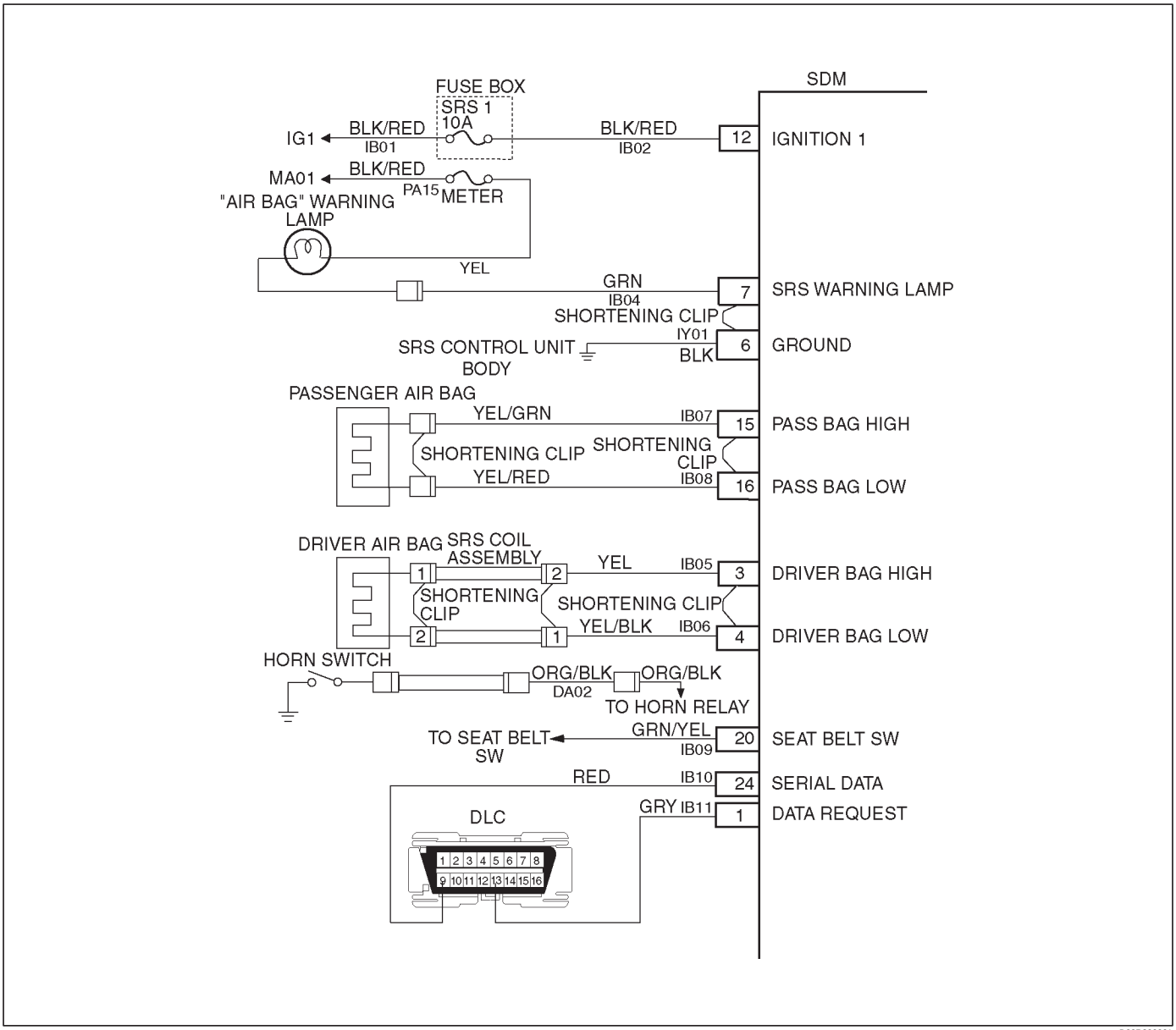
Diagnostic Aids:

The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

SRS Diagnostic System Check

Step	Action	Yes	No
1	Confirm the “AIR BAG” warning lamp when ignition switch is turned “ON.” Does the “AIR BAG” warning lamp flash seven (7) times?	Go to *Step 2*	Go to *Step 3*
2	Confirm the “AIR BAG” warning lamp after it flashed 7 times. Does the “AIR BAG” warning lamp go “OFF”?	Go to *Step 4*	Go to *Step 5*
3	Confirm the “AIR BAG” warning lamp when ignition switch is turned “ON.” Does the “AIR BAG” warning lamp come “ON” steady?	Go to *Chart B.*	Go to *Chart C.*
4	1. Ignition switch “OFF.” 2. Connect a scan tool to data link connector. 3. Follow direction given in the scan tool instruction manual. 4. Ignition switch “ON.” 5. Request the SRS diagnostic trouble code display recode all history diagnostic trouble code(s) specify as such, on repair order. Is diagnostic trouble code(s) displayed?	Ignition switch “OFF.” When DTC 71 is set, go to *DTC 71 chart.* For all other history codes refer to “Diagnostics Aids” for that specific DTC. A history DTC indicates the malfunction has been repaired or is intermittent.	SRS is functional and free of malfunctions, no further diagnosis is required. If scan tool indicates “No Data Received,” refer to chassis electrical section.
5	1. Ignition switch “OFF.” 2. Connect a scan tool to data link connector. 3. Follow directions as given in the scan tool instruction manual. 4. Ignition switch “ON.” 5. Request the SRS diagnostic trouble code display, recode all diagnostic trouble code(s), specifying as current or history on repair order. Is diagnostic trouble code(s) displayed?	Ignition switch “OFF.” When DTC 53 is set, go to *DTC 53 chart.* When DTC 51 is set, go to *DTC 51 chart.* When DTC 19 is set, go to *DTC 19 chart.* When DTC 25 is set, go to *DTC 25 chart.* Diagnose remaining current DTCs from lowest to highest.When only history DTCs exist, Refer to “Diagnostics Aids” for that specific DTC. A history DTC indicates the malfunction has been repaired or is intermittent.	If scan tool indicates “No Data Received,” refer to chassis electrical section.

Chart A SDM Integrity Check



D09R200001

Circuit Description:

When the SDM recognizes “ignition 1” voltage, applied to terminals “12”, is greater than 9 volts, the “AIR BAG” warning lamp is flashed 7 times to verify operation. At this time the SDM performs “Turn–ON” tests followed by “Continuous Monitoring” tests. When a malfunction is detected, the SDM sets a current diagnostic trouble code and illuminates the “AIR BAG” warning lamp. The SDM will clear current diagnostic trouble codes and move them to a history file when the malfunction is no longer detected and/or the ignition switch is cycled, except for DTCs 51, 53 and 71. DTC 71 can only be cleared using a scan tool “Clear Codes” command in case that the malfunction on DTC 71 has been solved and no DTCs 51 and 53 were remained. DTCs 51, 53 and 71 can not be cleared after a “Clear Codes” command is issued.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

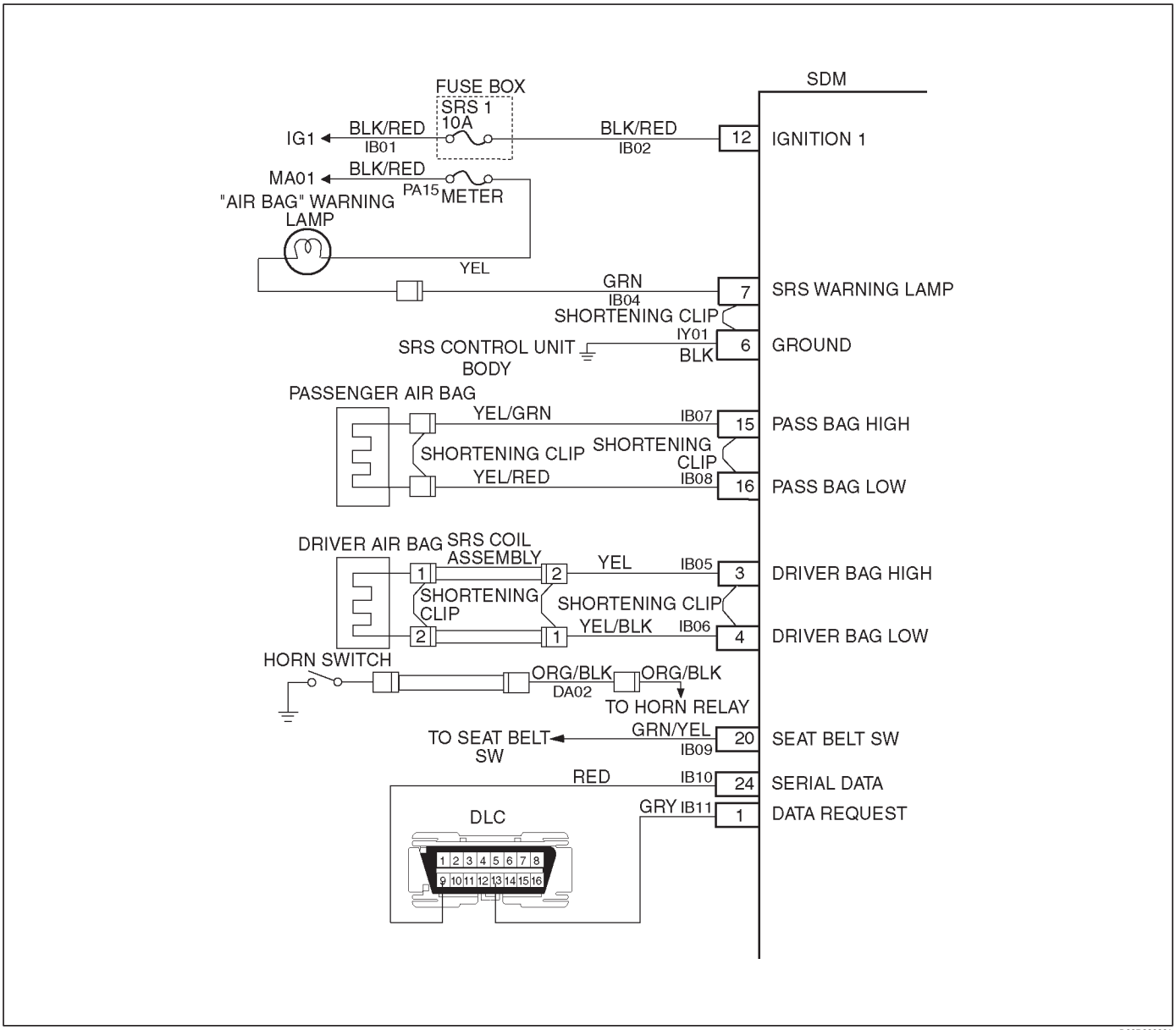
1. This test Confirm s a current malfunction. If no current malfunction is occurring (history DTC set) the “Diagnostic Aids” for the appropriate diagnostic trouble code should be referenced. The SDM should not be replaced for a history diagnostic trouble code.
2. This test checks for a malfunction introduced into the SRS during the diagnostic process. It is extremely unlikely that a malfunctioning SDM would cause a new malfunction to occur during the diagnostic process.
3. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, then and only then should the SDM be replaced.

Chart A SDM Integrity Check

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	1. This chart assumes that the “SRS Diagnostic System Check” and either a symptom chart or a diagnostic trouble code chart diagnosis have been performed When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, and the symptom or DTC remains current, the following diagnostic procedures must be performed to verify the need for SDM Replacement. 2. Ignition switch “OFF.” 3. Reconnect all SRS components, ensure all components are properly mounted. 4. Ensure the ignition switch has been “OFF” for at least 15 seconds. 5. Confirm “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	The symptom or DTC is no longer occurring. Clear SRS diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to *Step 2*
2	Using a scan tool, request diagnostic trouble code display. Is the same symptom or DTC occurring as was when the “SRS Diagnostic System Check ” was first performed?	Ignition switch “OFF.” Go to the appropriate chart for the indicated malfunction.	Go to *Step 3*
3	1. Clear “SRS Diagnostic Trouble Codes.” 2. Ignition switch “OFF” for at least two minutes. 3. Confirm “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	SRS is functional and free of malfunctions. No further diagnosis is required. Go to *Step 4*	Ignition switch “OFF.” Replace SDM. Go to *Step 4*
4	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 4*

Chart B “AIR BAG” Warning Lamp Comes “ON” Steady



D09R200001

Circuit Description:

When the ignition switch is first turned “ON”, “ignition 1” voltage is applied from the “MA01” meter fuse to “AIR BAG”, warning lamp which is connected to “SRS warning lamp”, terminal “7”. The “SRS–1” fuses apply system voltage to the “ignition 1” inputs, terminals “12”. The SDM responds by flashing the “AIR BAG” warning lamp 7 times. If “ignition 1” voltage is less than 9 volts, the “AIR BAG” warning lamp will come “ON” solid with no DTCs set.

Chart Test Description:

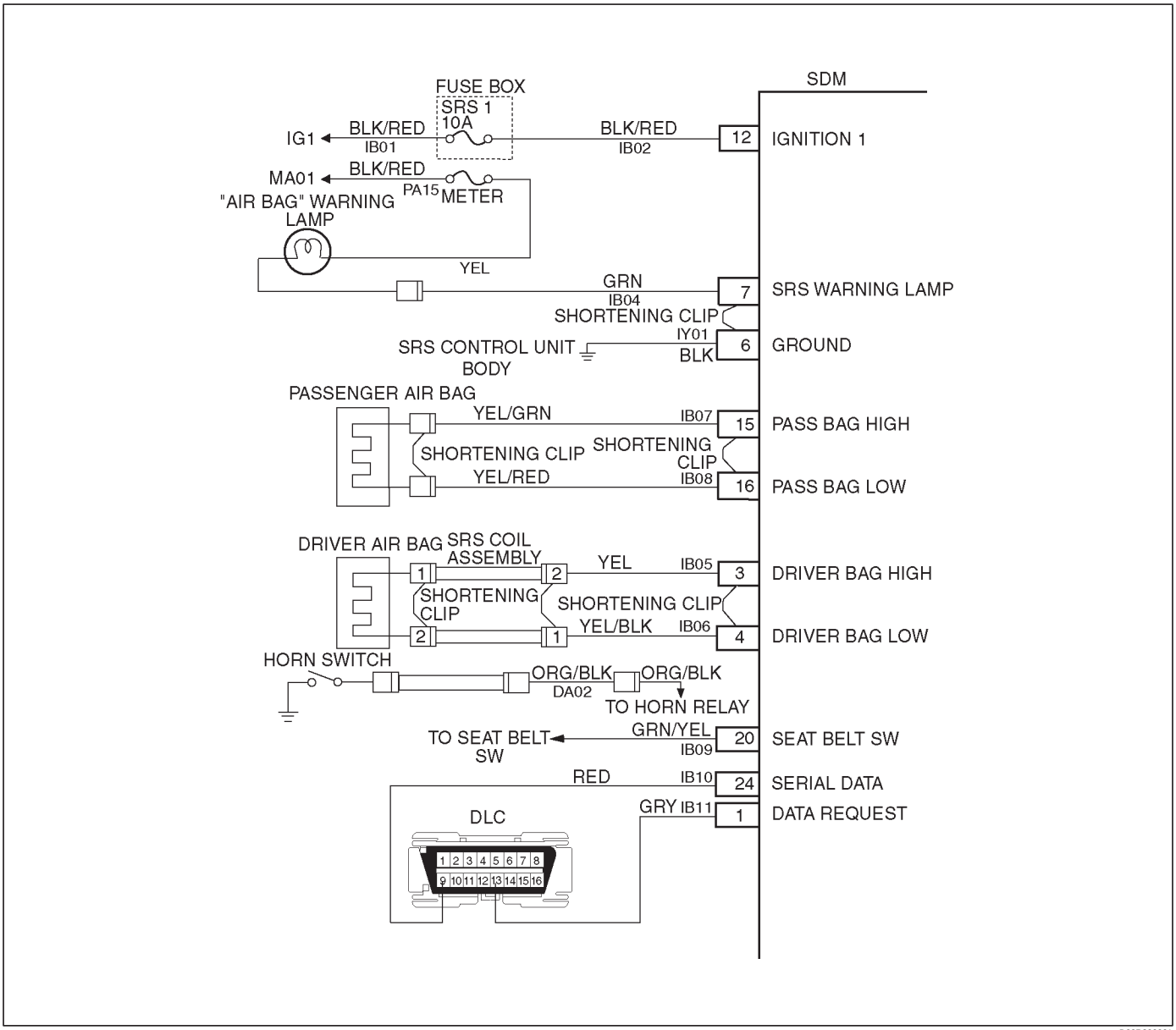
Number (s) below refer to step number (s) on the diagnostic chart.

2. This test checks for an open in the “ignition 1” circuit to the SDM.
3. This test checks for the voltage of “ignition 1.”
4. This test determines whether the malfunction is a short to ground in CKT IB04 – GRN.

Chart B “AIR BAG” Warning Lamp Comes “ON” Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool to data link connector, Follow directions as given in the scan tool instruction manual. 4. Ignition switch “ON.” 5. Request SRS diagnostic trouble code display. Does scan tool indicate “No Data Received”?	Go to *Step 2*	Go to *Step 3*
2	1. Ignition switch “OFF.” 2. Inspect SDM harness connector connection to SDM. Is it securely connected to the SDM?	Ignition switch “OFF.” Replace SDM. Go to *Step 5*	Connect SDM securely to de–activate shorting clip in SDM harness connector. Go to *Step 5*
3	Using scan tool, request SRS data list. Is “ignition” more than 9 volts?	Go to *Step 4*	Ignition switch “OFF.” Replace SDM. Go to *Step 5*
4	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 3. Disconnect SDM. 4. Measure resistance from SDM harness connector terminal “6” to ground. Does J–39200 display “0L” (infinite)?	Go to *Chart A.*	Replace SRS harness. Go to *Step 5*
5	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 5*

Chart C "AIR BAG" Warning Lamp Does Not Comes "ON" Steady



D09R200001

Circuit Description:

When the ignition switch is first turned "ON", "ignition 1" voltage is applied from the "MA01" meter fuse to the "AIR BAG" warning lamp which is connected to "SRS warning lamp", terminal "7". The "SRS–1" fuse apply system voltage to the "ignition 1" inputs, terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp seven times. If "ignition 1" voltage is more than 16 volts, the "AIR BAG" warning lamp will be still "OFF" solid with no DTCs set.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

1. This test decides whether power is available to SDM warning lamp power feed circuit.
2. This test determines whether the voltage is present in the warning lamp circuit.
3. This test determines if the malfunction is in the instrument cluster.
4. This test checks for open in the warning lamp circuitry.
5. This test isolates the IB04–GRN circuit and checks for a short in the IB04–GRN circuit to B+.
8. This test checks for a short from the SDM warning lamp power feed circuit to ground.
9. This test determines whether the short to ground is due to a short in the wiring.

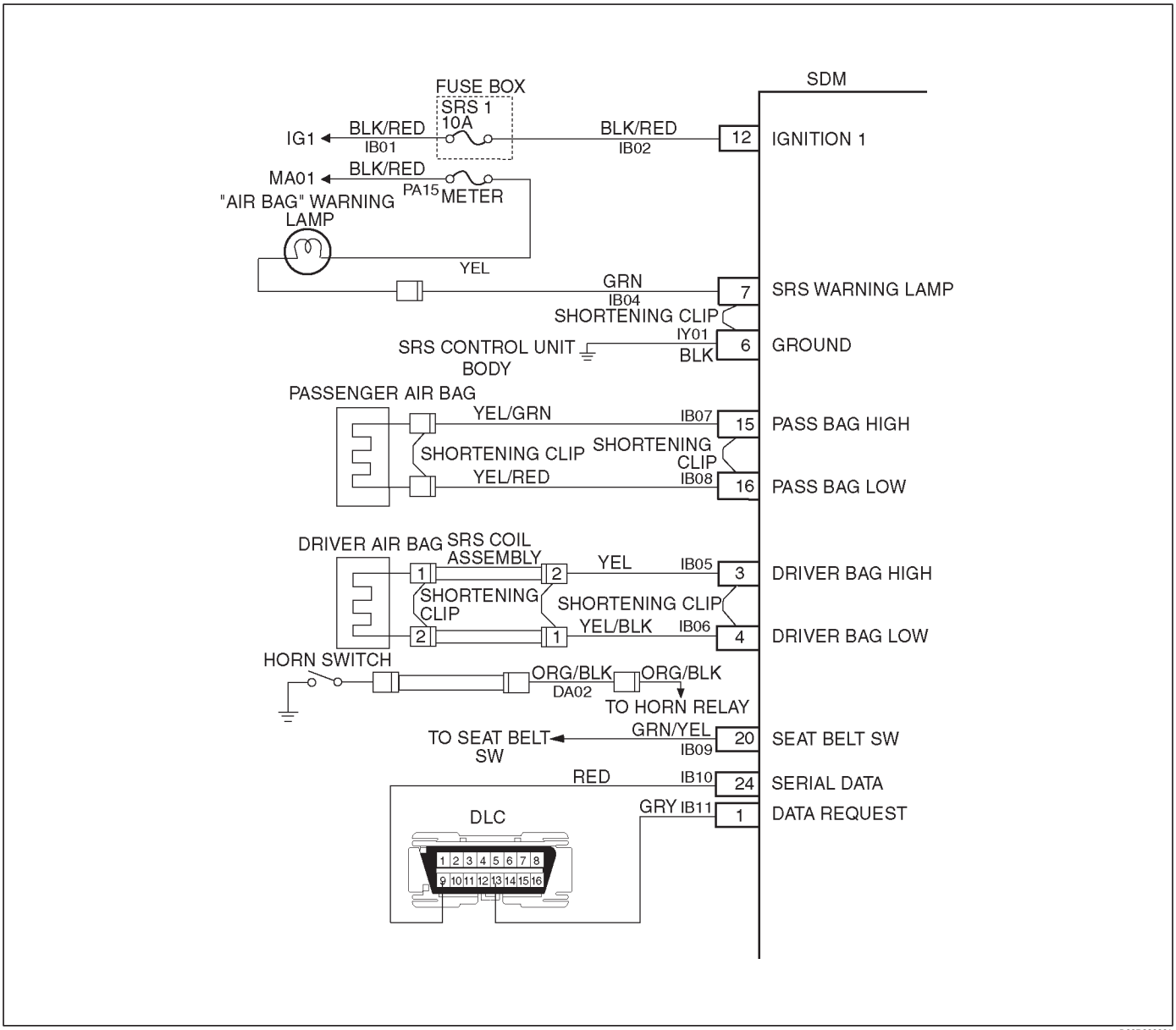
Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Remove and inspect “MA01” meter fuse to the “AIR BAG” warning lamp. Is fuse good?	Go to *Step 2*	Go to *Step 7*
2	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 3. Disconnect SDM. 4. Ignition switch “ON.” 5. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground). Is system voltage present on terminal “7”?	Go to *Step 4*	Go to *Step 3*
3	1. Ignition switch “OFF.” 2. Remove instrument meter cluster. 3. Check for proper connection to instrument cluster at IB04–GRN terminal. 4. If OK, then remove and inspect “AIR BAG” bulb. Is bulb good?	Go to *Step 5*	Replace bulb. Go to *Step 6*
4	1. Ignition switch “OFF.” 2. Disconnect instrument meter cluster harness connector. 3. Ignition switch “ON.” 4. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground). Is voltage 1 volt or less?	Go to *Chart A.*	Replace SRS harness. Go to *Step 6*
5	1. Install bulb. 2. Measure resistance from instrument meter cluster harness connector IB04–GRN terminal to SDM harness connector terminal “7”. Is resistance 5.0 ohms or less?	Service instrument meter cluster. Go to *Step 6*	Replace SRS harness. Go to *Step 6*
6	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 6*
7	Were you sent here from chart C?	Go to *Step 8*	Go to *Step 1*
8	1. Replace “MA01” meter fuse. 2. Ignition switch “ON” wait 10 seconds then ignition switch “OFF.” 3. Remove and inspect “MA01” meter fuse. Is fuse good?	Install “MA01” meter fuse. Go to *Step 10*	Go to *Step 9*

Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady (Cont’d)

Step	Action	Yes	No
9	1. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 2. Disconnect SDM. 3. Replace “MA01” meter fuse. 4. Ignition switch “ON” wait to 10 seconds. 5. Ignition switch “OFF”. 6. Remove and inspection “MA01” meter fuse. Is fuse good?	Install “MA01” meter fuse. Go to *Chart A* .	Replace SRS harness. Replace“MA01” meter fuse. Go to *Step 10*
10	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 10*

DTC 15 Passenger Deployment Loop Resistance High



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the “Resistance Measurement Test”. “Passenger Bag Low” terminal “16” is grounded through a resister and the passenger current source connected to “Passenger Bag High” terminal “15” allows a known amount of current to flow. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low” the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON.”
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector.
4. This test checks for proper contact and/or corrosion of the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the malfunction is due to high resistance in the wiring.

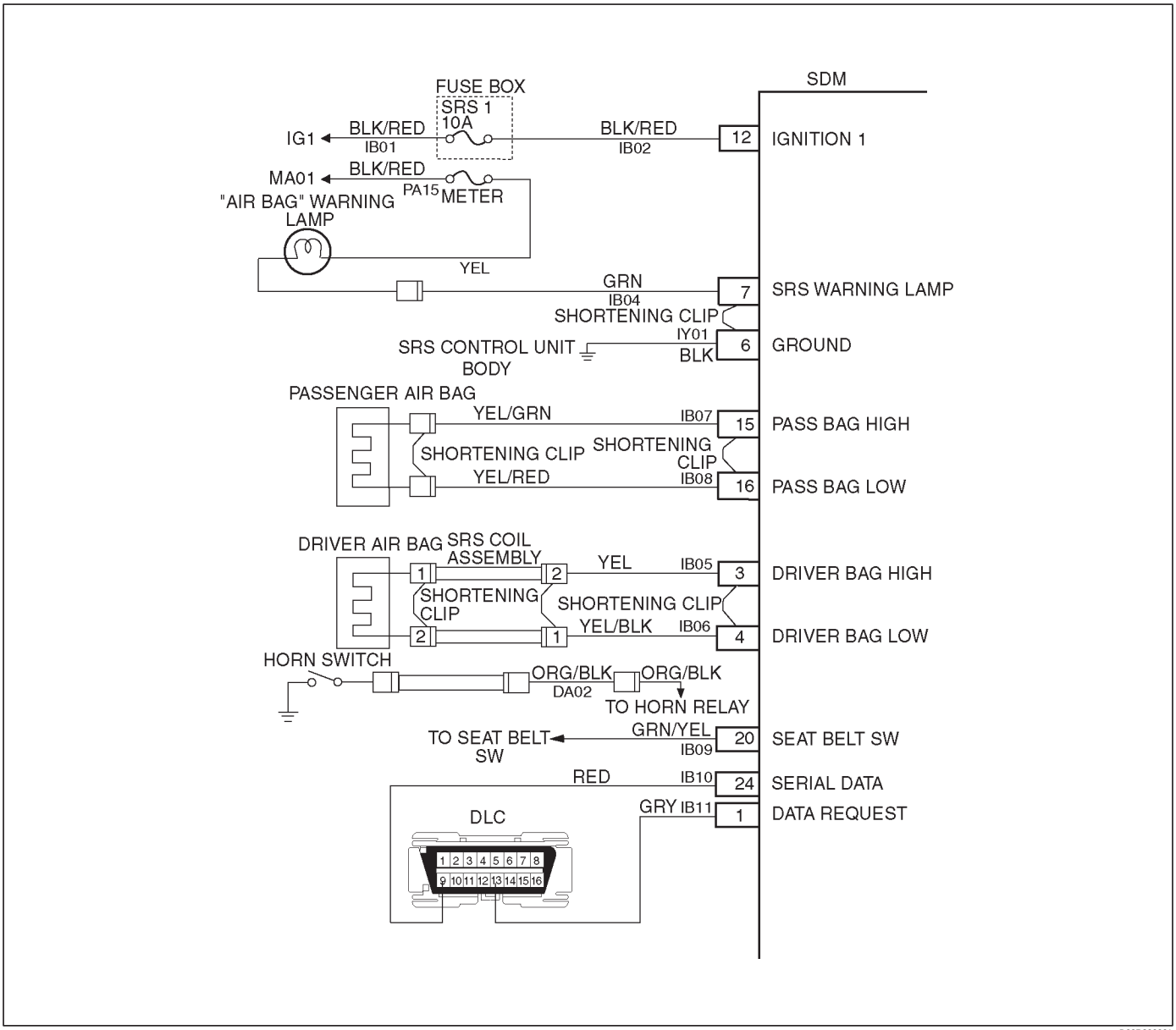
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals “1” and “2”, SDM terminal “15” and “16”, or a poor wire to terminal connection in CKTs IB07–YEL/GRN and IB08–YEL/RED. This test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 15 Passenger Deployment Loop Resistance High

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist more than 2.9 ohms?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to *Step 4*	Seat passenger air bag assembly yellow 2–pin connector properly. Go to *Step 7*
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Is DTC 15 current?	Go to *Step 5*	Ignition switch “OFF.” Go to *Step 7*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 15 current?	Go to *Step 6*	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been an increase in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 7*	Go to *Chart A* .
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 7*

DTC 16 Passenger Deployment Loop Resistance Low



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the “Resistance Measurement Test”. “Passenger Bag Low” terminal “16” is grounded through a resistor and the passenger current source connected to “Passenger Bag High” terminal “15” allows a known amount of current to flow. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low”, the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”,
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies connection of the yellow 2–pin connector.
4. This test cheeks for proper operation of the shorting clip in the yellow 2–pin connector.
5. The test checks for a malfunction passenger air bag assembly.
6. This test determines whether the malfunctioning is due to shorting in the wiring.

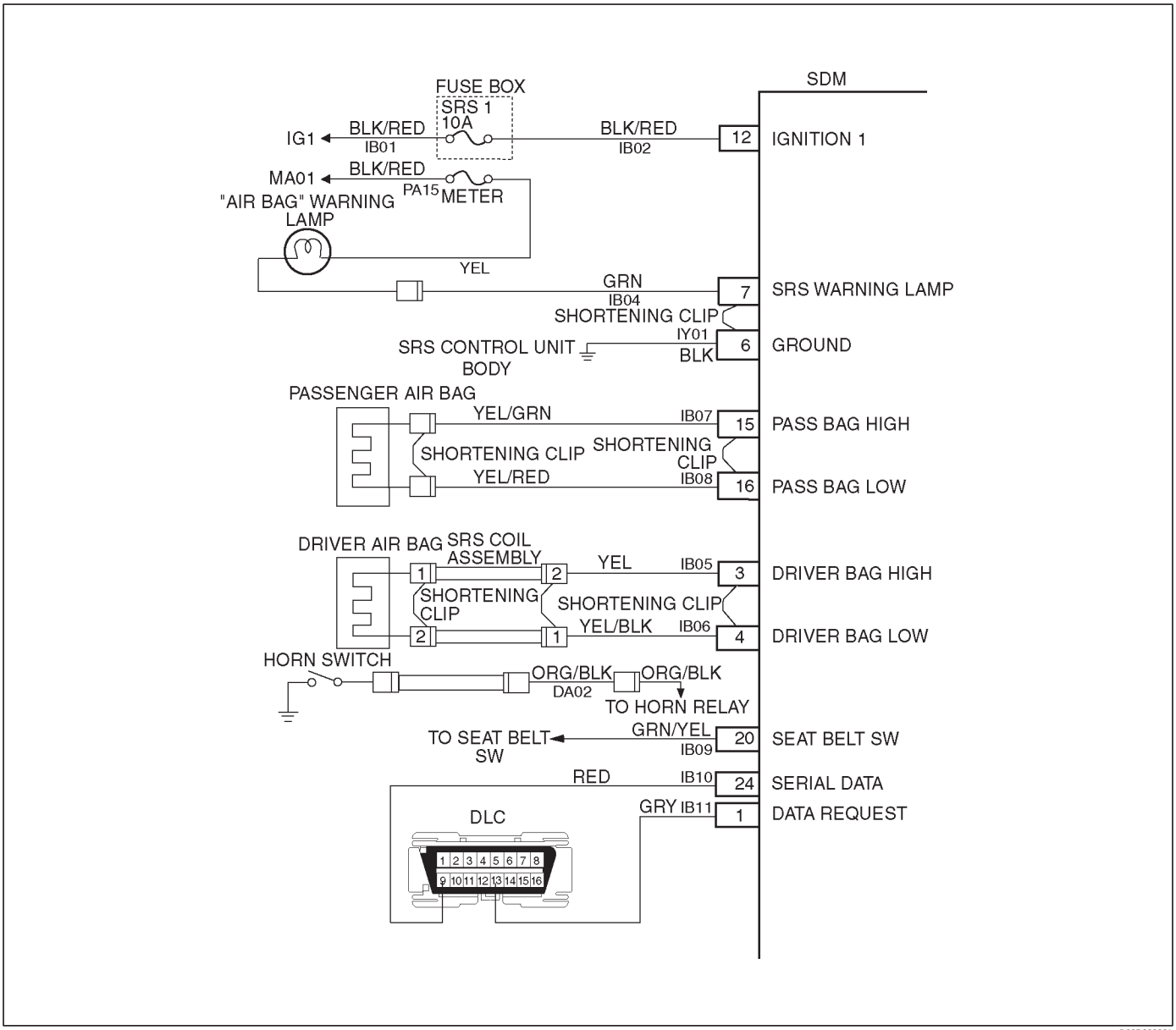
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKTs IB07–YEL/GRN and IB08–YEL/RED, or a malfunctioning shorting clip on the passenger air bag assembly which would require replacement of the air bag assembly. The test for this diagnostic trouble code is only run while “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 16 Passenger Deployment Loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist. less than 1.4 ohms?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to *Step 4*	Seat passenger air bag assembly yellow 2–pin connector properly. Go to *Step 7*
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Us DTC 16 current?	Go to *Step 5*	Ignition switch “OFF.”Go to *Step 7*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 16 current?	Go to *Step 6* .	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been a decrease in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 7*	Go to *Chart A* .
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 7*

DTC 17 Passenger Deployment Loop Open



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. During “Continuous Monitoring” diagnostics, a fixed amount of current is flowing in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low”, the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact.

DTC Will Set When:

The voltage difference between “Passenger Bag High” terminal “15” and “Passenger Bag Low” terminal “16” is above or equal to a specified value for 500 milliseconds during “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between “Passenger Bag High” terminal “15” and “Passenger Bag Low” terminal “16” is below a specified value for 500 milliseconds during “Continuous Monitoring”.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector.
4. This test cheeks for proper contact and/or corrosion of the shorting clip in the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether there is an open in the wiring.

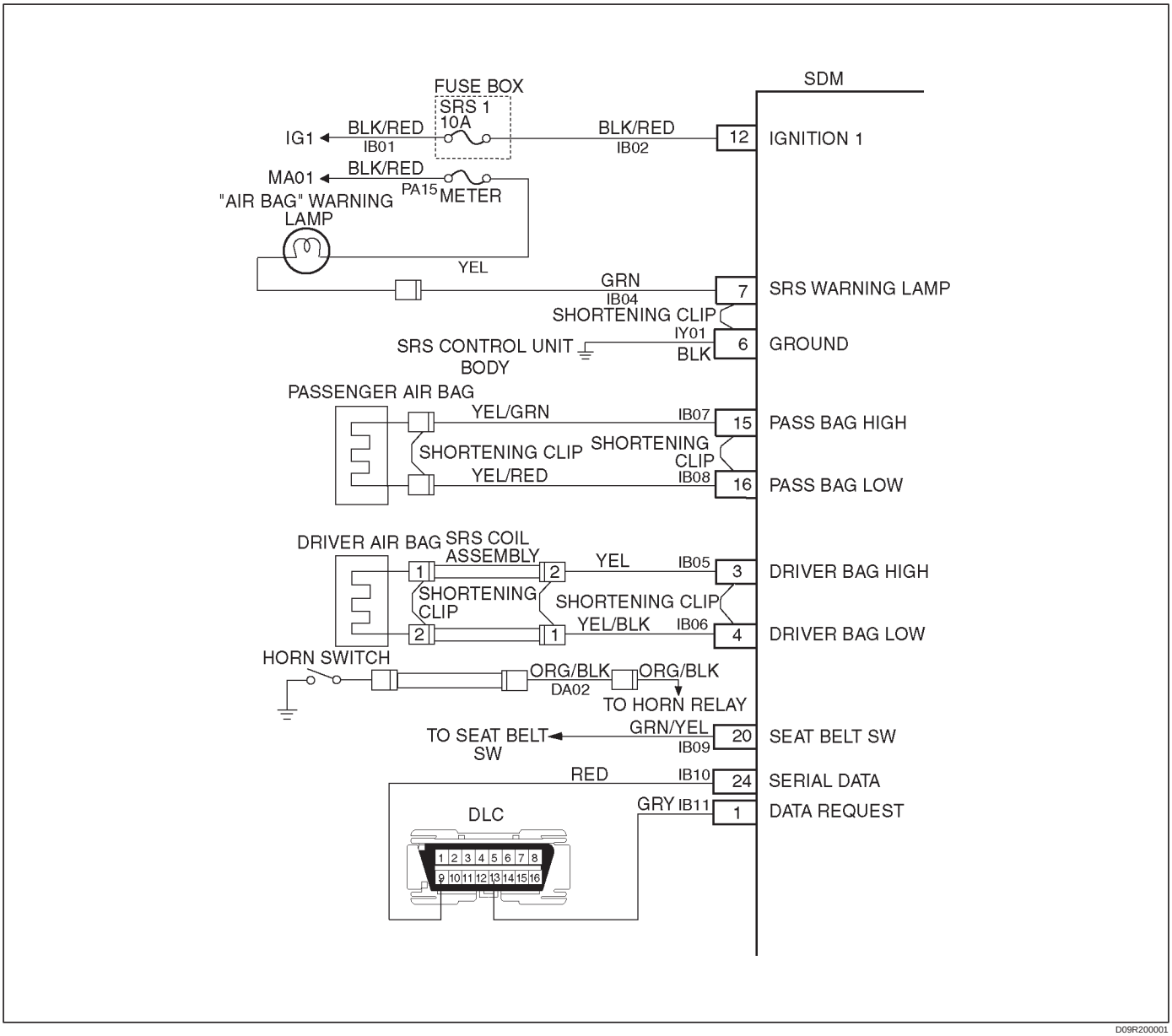
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals “1” and “2,” SDM terminals “15” and “16,” or an open in CKT IB07–YEL/GRN and IB08–YEL/RED.

DTC 17 Passenger Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger differential voltage. Is passenger differential voltage. more than 4.0 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to *Step 4*	Seat passenger air bag assembly yellow 2–pin connector properly. Go to *Step 7*
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnected the passenger air bag assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 17 current?	Go to *Step 5*	Ignition switch “OFF.” Go to *Step 7*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly yellow 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 17 current?	Go to *Step 6*	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been an open circuit in the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 7*	Go to *Chart A* .
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 7*

DTC 18 Passenger Deployment Loop Short To Ground



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.
“Ignition 1” is within the normal operating voltage range.
Once these conditions are met and the voltage at “Passenger Bag Low” is below a specified value, DTC 18 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

This malfunction is no longer occurring and the ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box compartment.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.

5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

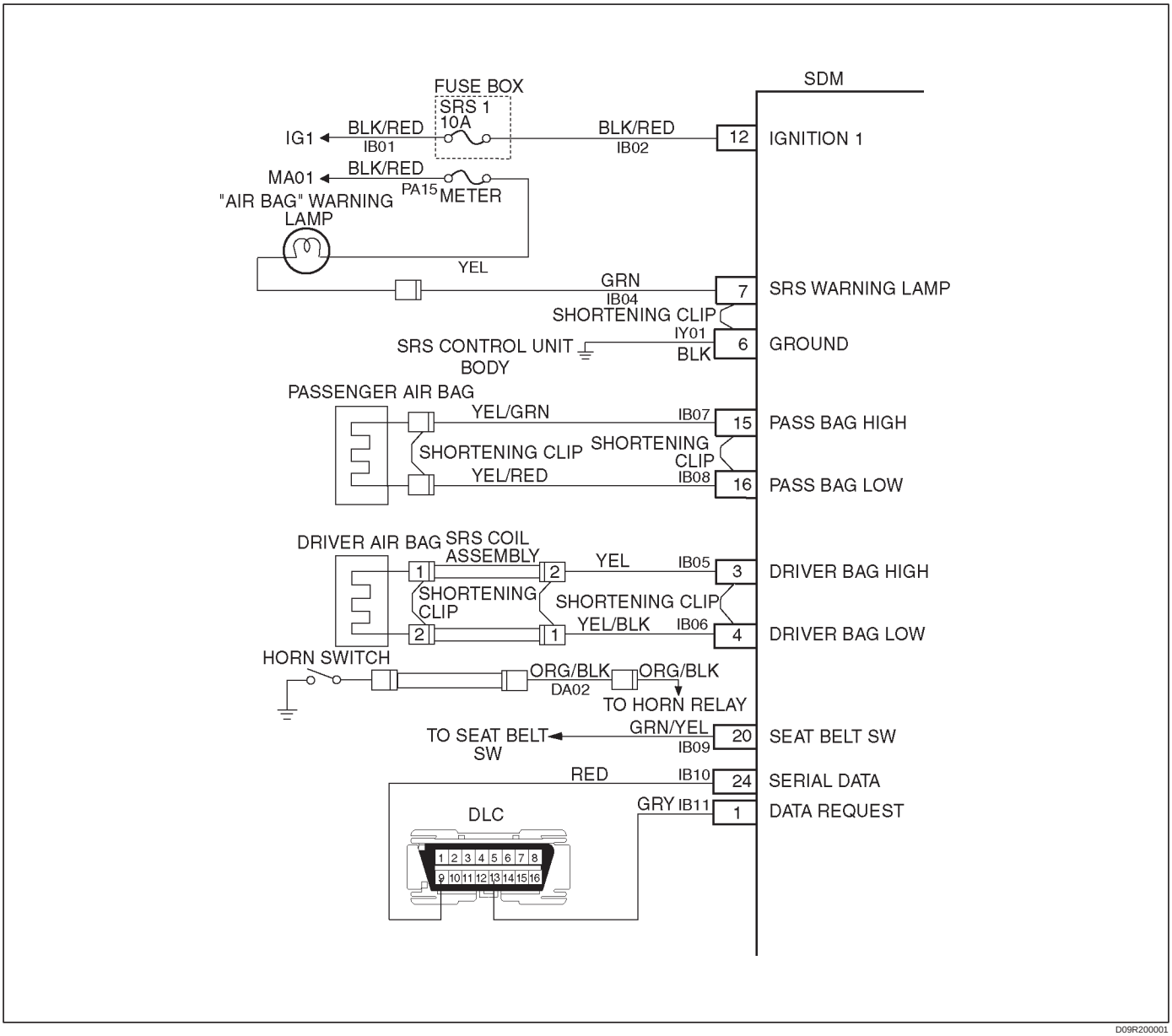
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced.

DTC 18 Passenger Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator’s manual. 4. Ignition switch “ON.” 5. Read passenger sense LO. Is passenger sense LO less than 1.5 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.. 3. Leave driver air bag assembly connected. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 4. Ignition switch “ON.” Is DTC 18 current?	Go to *Step 4*	Ignition switch “OFF.” Replace passenger air bag assembly. Go to *Step 6*
4	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool. 3. Measure resistance on SDM harness connector from terminal “15” to terminal “6” (ground). Does J–39200 display “0L” (infinite)?	Go to *Step 5*	Replace SRS harness. Go to *Step 6*
5	Measure resistance on SDM harness connector from terminal “6” “16” to terminal (ground). Does J–39200 display “0L” (infinite)?	Go to *Chart A* .	Replace SRS harness. Go to *Step 6*
6	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 6*

DTC 19 Passenger Deployment Loop Short To Voltage



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is within the normal operating voltage range. Once these conditions are met and the voltage at “Passenger Bag Low” is above a specified value, DTC 19 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 19 and also DTC 71.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box compartment.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.

5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

Diagnostic Aids:

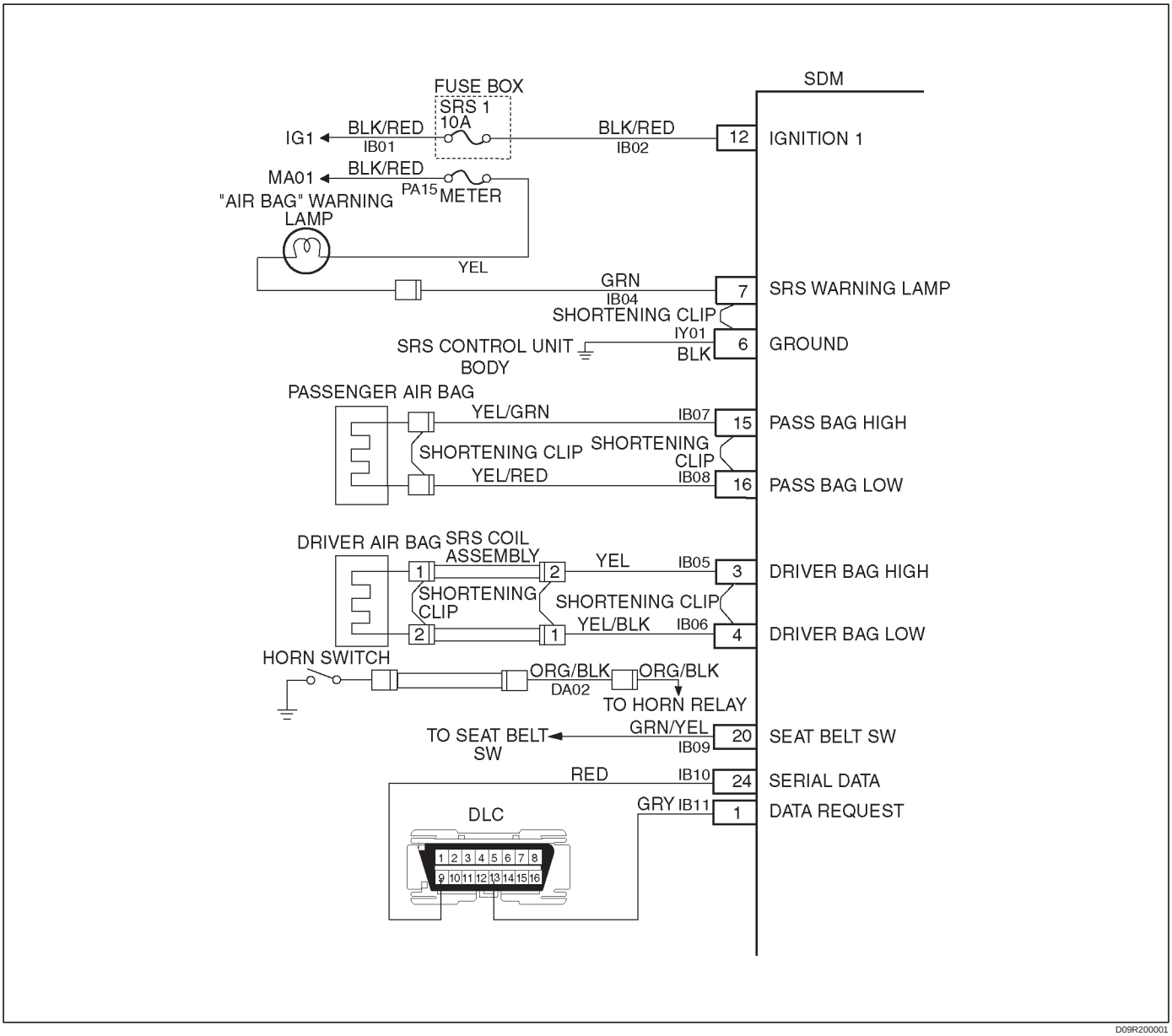
An intermittent condition is likely to be caused by a short to B+ in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced. A careful inspection of CKT IB07–YEL/GRN and IB08–YEL/RED, including the passenger air bag assembly pigtail is essential to ensure that the replacement SDM will not be damaged.

DTC 19 Passenger Deployment Loop Short To Voltage

CAUTION: When DTC 19 has been set, it is necessary to replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to *Step 2*	Go to the "SRS Diagnostic System Check."
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger sense LO. Is passenger sense LO more than 3.5 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch "OFF." 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly. 3. Leave driver air bag assembly connected. 4. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch "ON." Is passenger sense LO more than 3.5 volts?	Go to *Step 4*	Ignition switch "OFF." Replace passenger air bag assembly. Go to *Step 6*
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "15" to terminal "12" (IGNITION 1). Does J–39200 display "0L" (infinite)?	Go to *Step 5*	Replace SRS harness. Go to *Step 6*
5	Measure resistance on SDM harness connector from terminal "16" to terminal "12" (IGNITION 1). Does J–39200 display "0L" (infinite)?	Go to *Chart A* .	Replace SRS harness. Go to *Step 6*
6	1. Reconnect all components, ensure all component are properly mounted. 2. Ignition switch "ON." Is passenger sense LO less than 3.5 volts?	Ignition switch "OFF."Replace SDM.Go to *Step 7*	Go to *Chart A* .
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to *Step 7*

DTC 21 Driver Deployment Loop Resistance High



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low”, the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact is above a specified value. This test run once each ignition cycle during the “Resistance Measurement Test” when:

No “higher priority faults” are detected during “Turn–ON”

“Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 21.

DTC Will Clear When:

The ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the 2–pin connector terminals at the base of steering column.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of the steering column.
6. This test determines whether the malfunction is due to high resistance in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

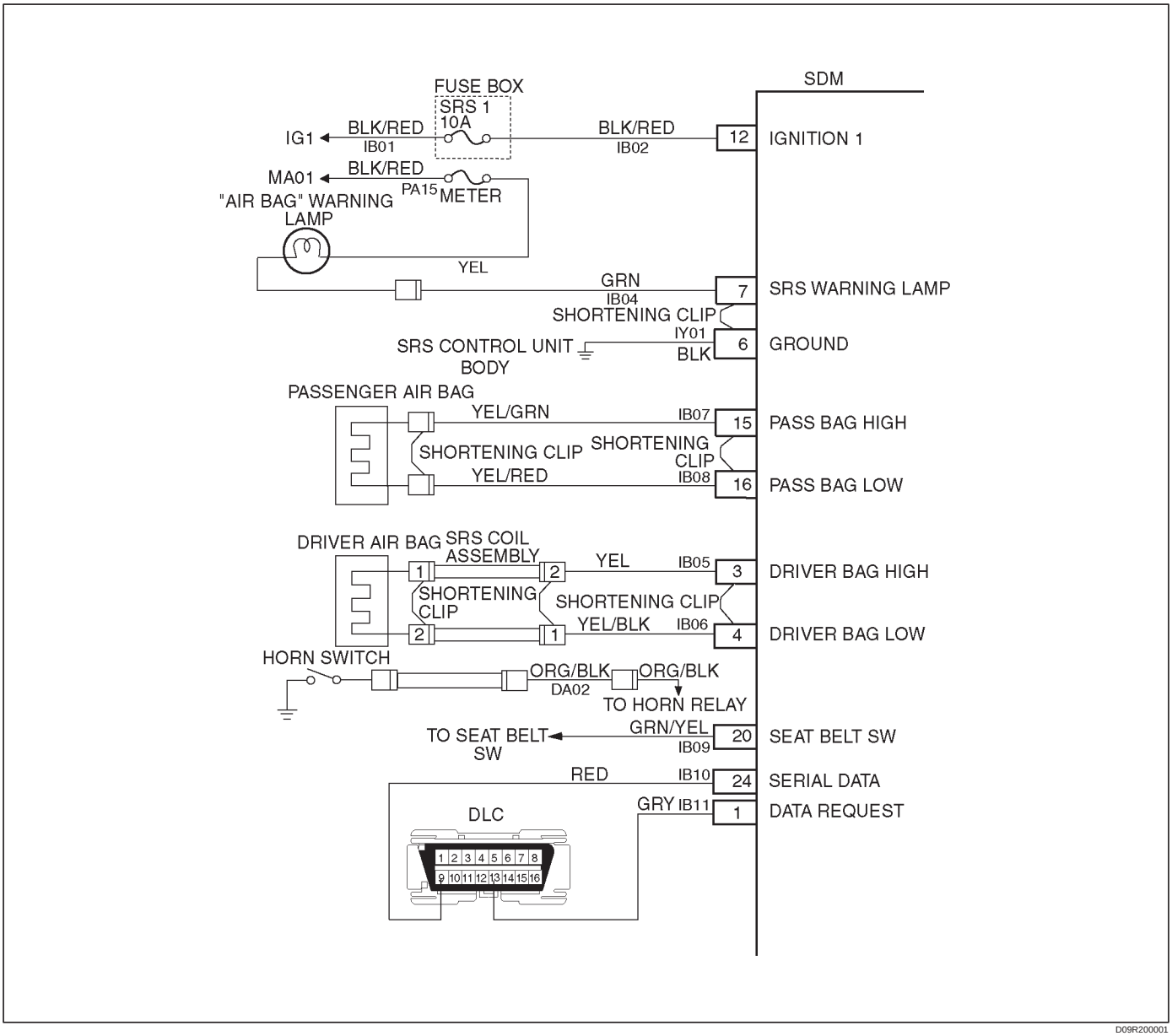
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at terminals “1” and “2” of the SRS coil 2–pin connector at the base of the steering column, terminal “1” and “2” of the driver air bag assembly 2–pin connector at the top of the steering column, SDM terminals “3” and “4” or a poor wire to terminal connection in CKT IB05–YEL or IB06–YEL/BLK. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 21 Driver Deployment Loop Resistance High

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver deployment loop resistance more than 4.4 ohms?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Disconnect driver air bag assembly yellow 2–pin connector located at base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to *Step 4*	Seat SRS coil assembly 2–pin connector properly.Go to *Step 8*
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 21 current?	Go to *Step 5*	Ignition switch “OFF.” Go to *Step 8*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly yellow 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 21 current?	Go to *Step 6*	Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been a increase in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05–YEL/IB06–GRN and YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 8*	Go to *Chart A* .
7	1. Ignition switch “OFF.” Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. Connect SRS driver / passenger load tool J–41433 on the top of steering column. Reconnect SRS coil assembly harness connector as the base of steering column. Ignition switch “ON.” Is DTC 21 current?	Ignition switch “OFF.” Replace SRS COIL ASSEMBLY. Refer to in this section 9J–24. Go to *Step 8*	Ignition switch “OFF.” Replace driver air bag assembly. Go to *Step 8*
8	Reconnect all components, ensure all component are properly mounted. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 8* .

DTC 22 Driver Deployment Loop Resistance Low



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low” the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 22.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper operation of the shorting clip in the yellow 2–pin connector.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
6. This test determines whether the malfunction is due to shorting in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

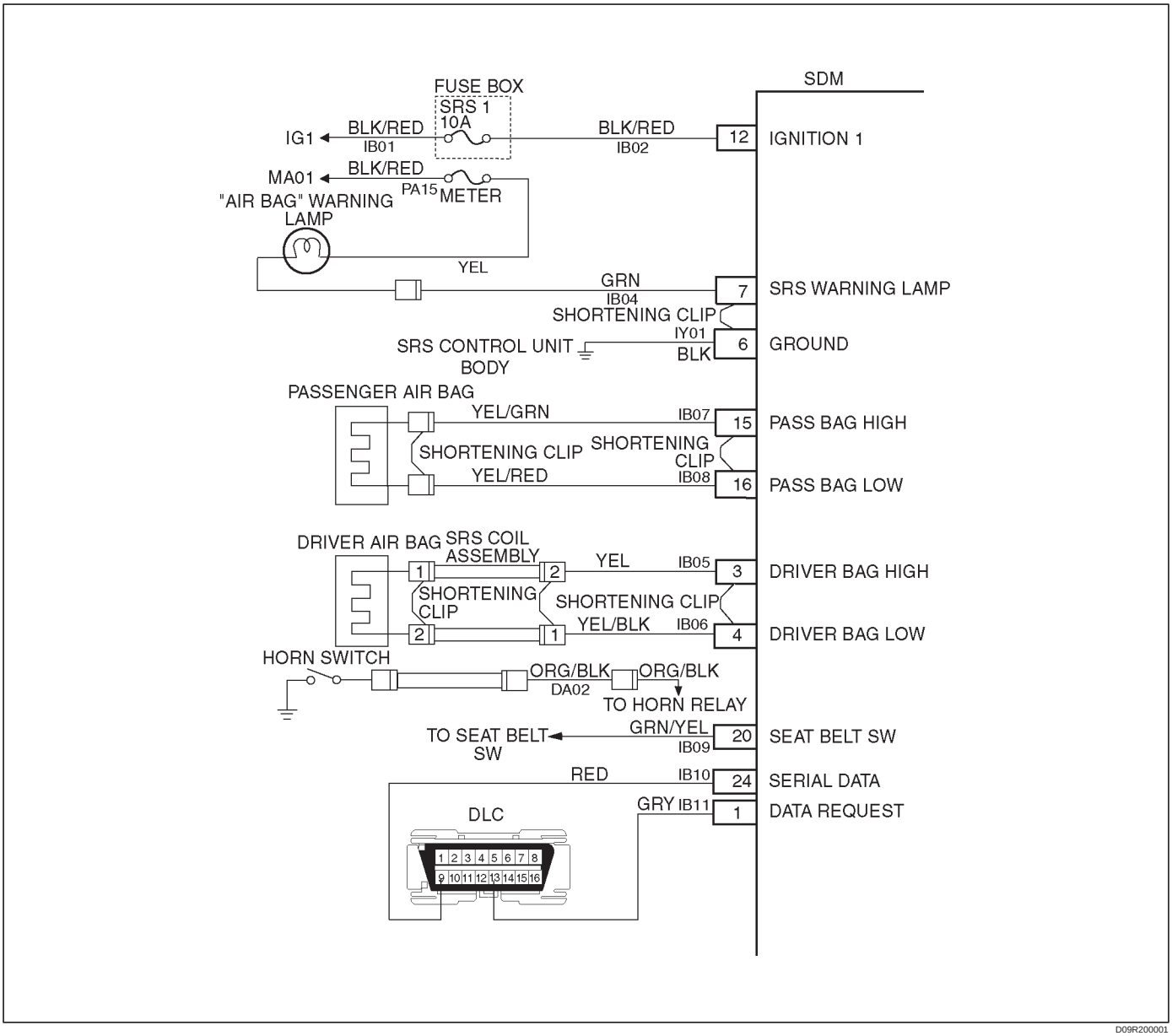
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKT IB05–YEL or IB06–YEL/BLK or a malfunctioning shorting clip on the driver air bag assembly or SRS coil assembly which would require replacement of the component. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 22 Driver Deployment Loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver resist. less than 1.9 ohms?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to *Step 4*	Seat driver air bag assembly 2–pin connector properly. Go to *Step 8*
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the driver air bag assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 22 current?	Go to *Step 5*	Ignition switch “OFF.” Go to *Step 8*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 22 current?	Go to *Step 6*	Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been a decrease in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05–YEL and IB06–YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 8*	Go to *Chart A* .
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 to the top of steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 22 current?	Ignition switch “OFF.” Replace SRS coil assembly. Refer to in this section 9J–24. Go to *Step 8*	Ignition switch “OFF.” Replace driver air bag assembly. Go to *Step 8*
8	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 8*

DTC 24 Driver Deployment Loop Short To Ground



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltage at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect shorts to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.
“Ignition 1” is within the normal operating voltage range.
This test is run once each ignition cycle and “Continuous Monitoring”. Once these conditions are met and the voltage at “Driver Bag Low” is below a specified value, DTC 24 will set.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector at the base of the steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.

5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

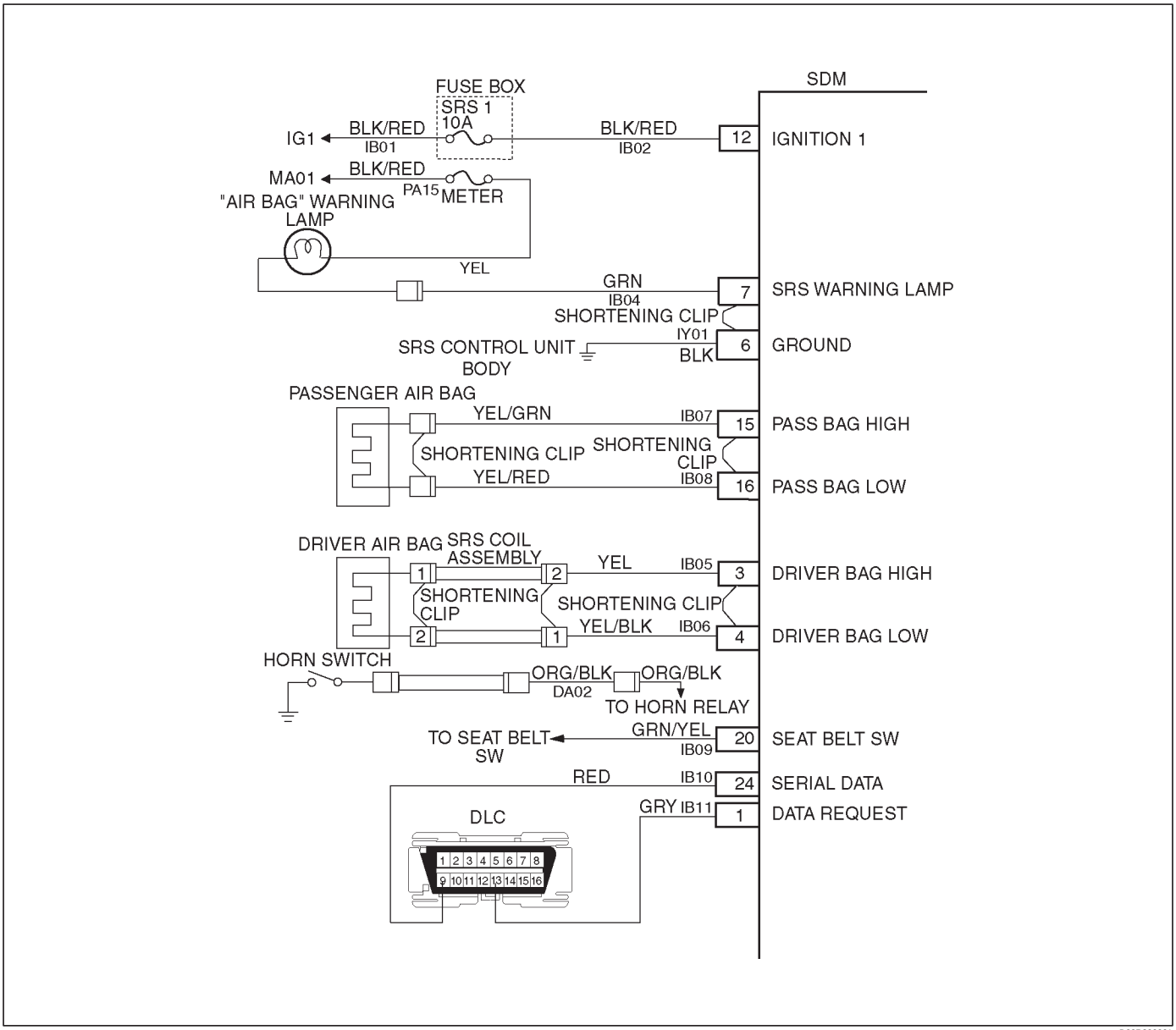
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing.

DTC 24 Driver Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator’s manual. Ignition switch “ON.” 4. Read driver sense LO. Is driver sense LO less than 1.5 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Disconnect SRS coil assembly yellow 2–pin connector located at base of the steering column. Leave passenger air bag assembly connected. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 4. Ignition switch “ON.” Is DTC 24 current?	Go to *Step 4*	Go to *Step 6*
4	1. Ignition switch “OFF.” 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector “3” to terminal “6” (ground). Does J–39200 display “0L” (infinite)?	Go to *Step 5*	Replace SRS harness. Go to *Step 7*
5	Measure resistance on SDM harness connector from terminal “4” to terminal “6” (ground). Does J–39200 display “0L” (infinite)?	Go to *Chart A* .	Replace SRS harness. Go to *Step 7*
6	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool J–41433 from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness connector. Located top of the steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 24 current?	Ignition switch “OFF.” Replace SRS coil assembly. Refer to in this section 9J–24. Go to *Step 7*	Ignition switch “OFF.” Replace driver air bag assembly. Go to *Step 7*
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 7*

DTC 25 Driver Deployment Loop Short To Voltage



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltage at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect shorts to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is in the normal operating voltage range. This test is run once each ignition cycle and “Continuous Monitoring”. Once these conditions are met and the voltage at “Driver Bag Low” is above a specified value, DTC 25 will set.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 25 and also DTC 71

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector at the base of steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.
5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.

6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

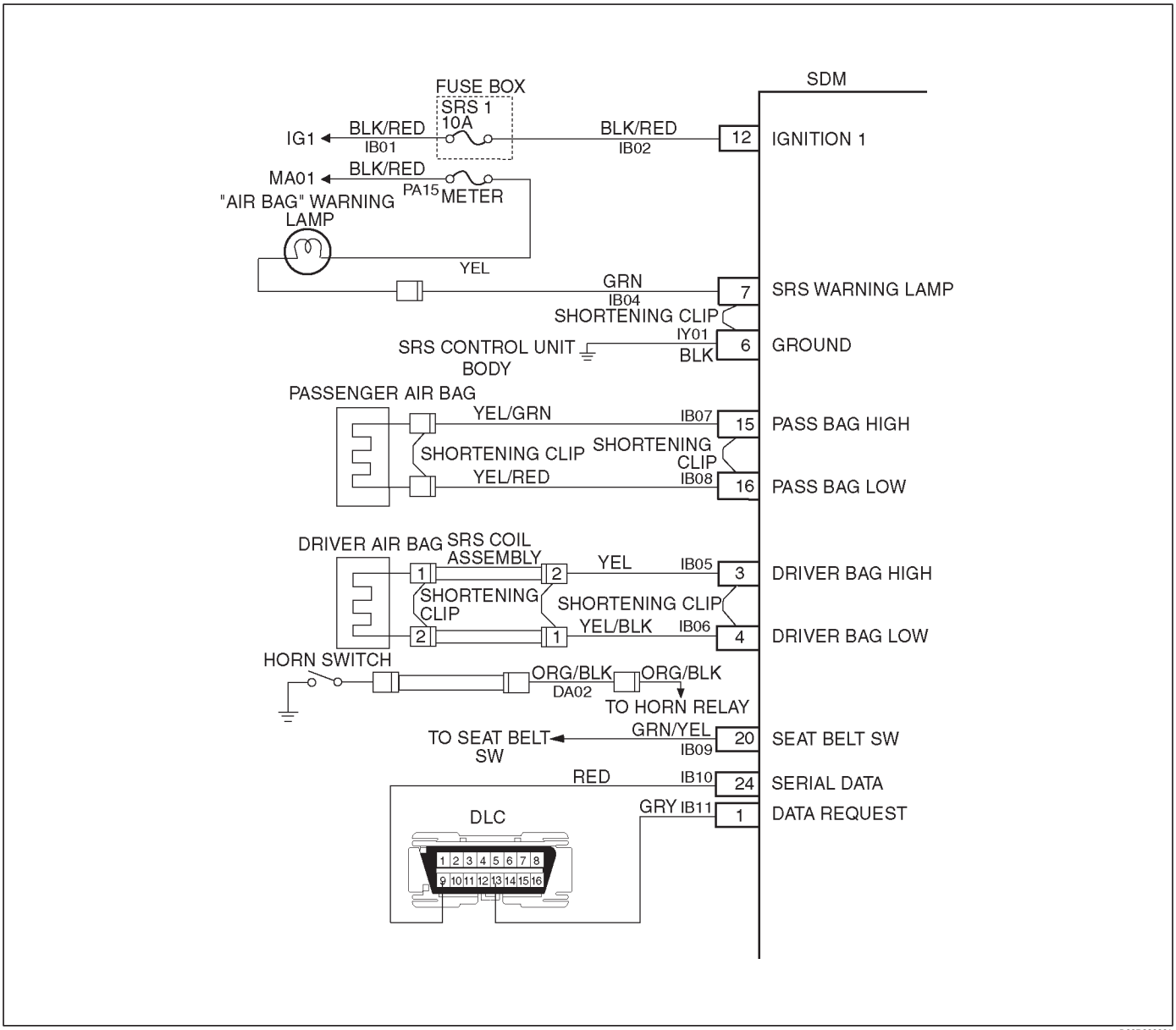
An intermittent condition is likely to be caused by a short to B+ in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing. If the wiring pigtail of the driver air bag assembly and SRS coil assembly is damaged, the components must be replaced. A careful inspection of CKT IB05–YEL and IB06–YEL/BLK, including the SRS coil assembly and driver air bag assembly is essential to ensure that the replacement SDM will not be damaged.

DTC 25 Driver Deployment Loop Short To Ignition

CAUTION: When DTC 25 has been set, it is necessary to replace the SDM. Setting DTC 25 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to *Step 2*	Go to the "SRS Diagnostic System Check."
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read driver sense LO. Is driver sense LO more than 3.5 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch "OFF." 2. Disconnect SRS coil assembly yellow 2–pin connector at the base of the steering column. Leave passenger air bag assembly connected. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 3. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Go to *Step 4*	Go to *Step 6*
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS drive / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "3" to terminal "12" (Ignition 1). Does J–39200 display "0L" (infinite)?	Go to *Step 5*	Replace SRS harness. Go to *Step 7*
5	Measure resistance on SDM harness connector from terminal "4" to terminal "12" (Ignition 1). Does J–39200 display "0L" (infinite)?	Go to *Chart A* .	Replace SRS harness. Go to *Step 7*
6	1. Ignition switch "OFF." 2. Connect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness connector located of top of the steering column. 3. Reconnect SRS coil assembly harness connector as the base of steering column. 4. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Ignition switch "OFF." Replace SRS coil assembly. Go to *Step 7*	Ignition switch "OFF." Replace driver air bag assembly. Go to *Step 7*
7	1. Reconnect all components, ensure all components are properly mounted. 2. Ignition switch "ON." Is passenger sense LO less than 3.5 volts?	Replace SDM. Go to *Step 8*	Go to *Chart A* .
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to *Step 8*

DTC 26 Driver Deployment Loop Open



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
During “Continuous Monitoring” diagnostics, a fixed amount of current is following in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low”, the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The voltage difference between “Driver Bag High” terminal “3” and “Driver Bag Low” terminal “4” is above or equal to a specified value for 500 milliseconds during “Continuous Monitoring.”

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between “Driver Bag High” terminal “3” and “Driver Bag Low” terminal “4” is below a specified value for 500 milliseconds during “Continuous Monitoring.”

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

1. This test determines whether the malfunction is in the SDM.

2. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
3. This test checks for proper contact and/or corrosion of the yellow 2–pin connector at the base of the steering column.
4. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
5. This test determines whether the open is in the wiring.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

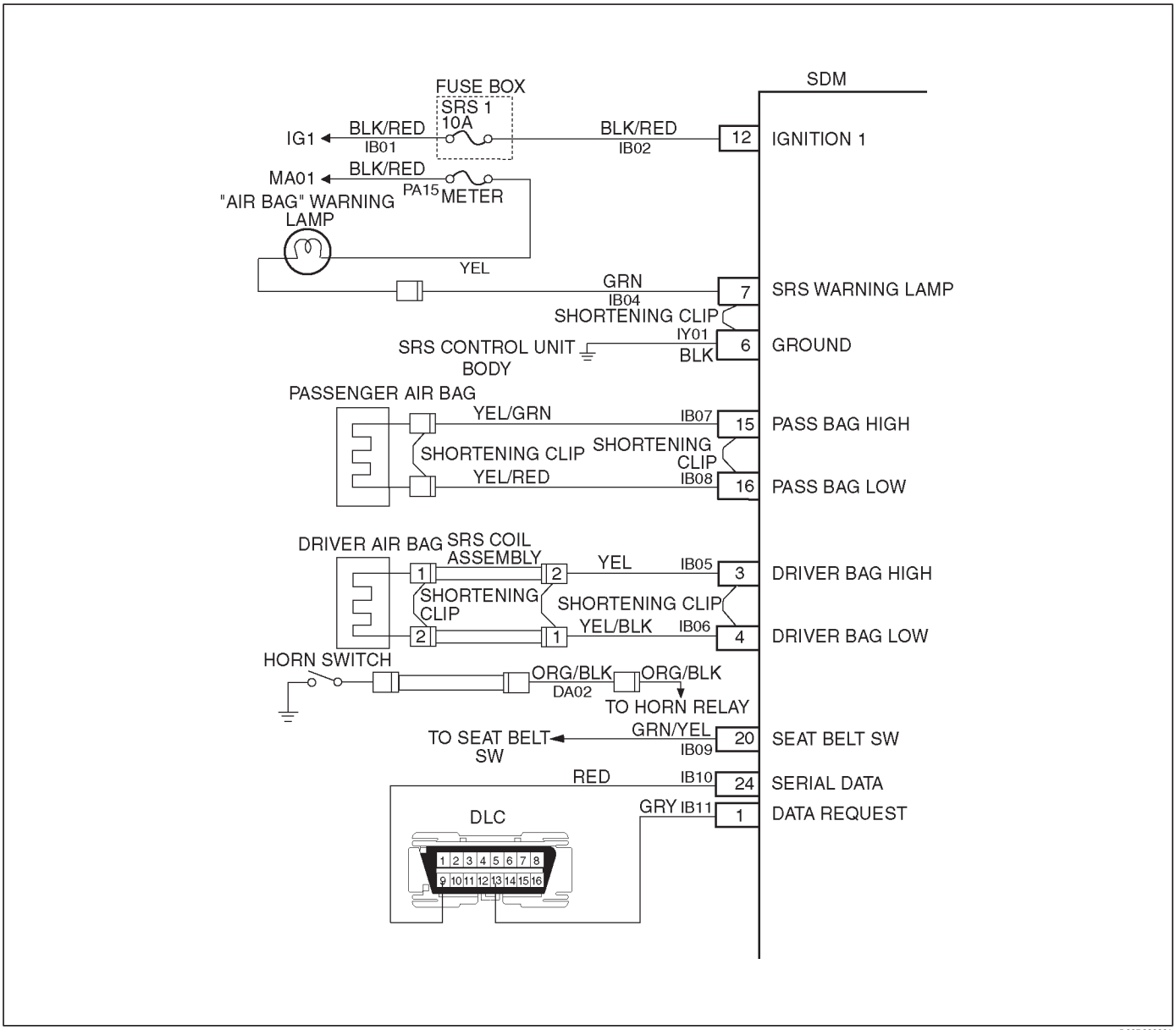
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the driver air bag assembly harness 2–pin connector terminals “1” and “2” at the top of the steering column, SRS coil assembly harness 2–pin connection terminals “1” and “2”, SDM terminals “3” and “4”, or an open in CKTs IB05–YEL and IB06–YEL/BLK.

DTC 26 Driver Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver differential voltage. Is driver differential voltage more than 4.0 volts?	Go to *Step 3*	Go to *Chart A* .
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the yellow 2–pin connector connected properly?	Go to *Step 4*	Seat driver air bag assembly 2–pin connector. Go to *Step 8*
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON”. Is DTC 26 current?	Go to *Step 5*	Ignition switch “OFF.” Go to *Step 8*
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 26 current?	Go to *Step 6*	Go to *Step 7*
6	1. Ignition switch “OFF.” 2. There has been an open circuit in the driver deployment loop. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05 YEL and IB06 YEL/BLK, and SDM connector terminal “3” AND “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to *Step 8*	Go to *Chart A* .
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 on steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 26 current?	Ignition switch “OFF.” Replace SRS coil assembly, refer to in this section 9J–3. Go to *Step 8*	Ignition switch “OFF.” Replace driver air bag assembly. Go to *Step 8*
8	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to *Step 8*

DTC 51 Deployment Event Commanded



D09R200001

Circuit Description:

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags and causing DTC 51 to set.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

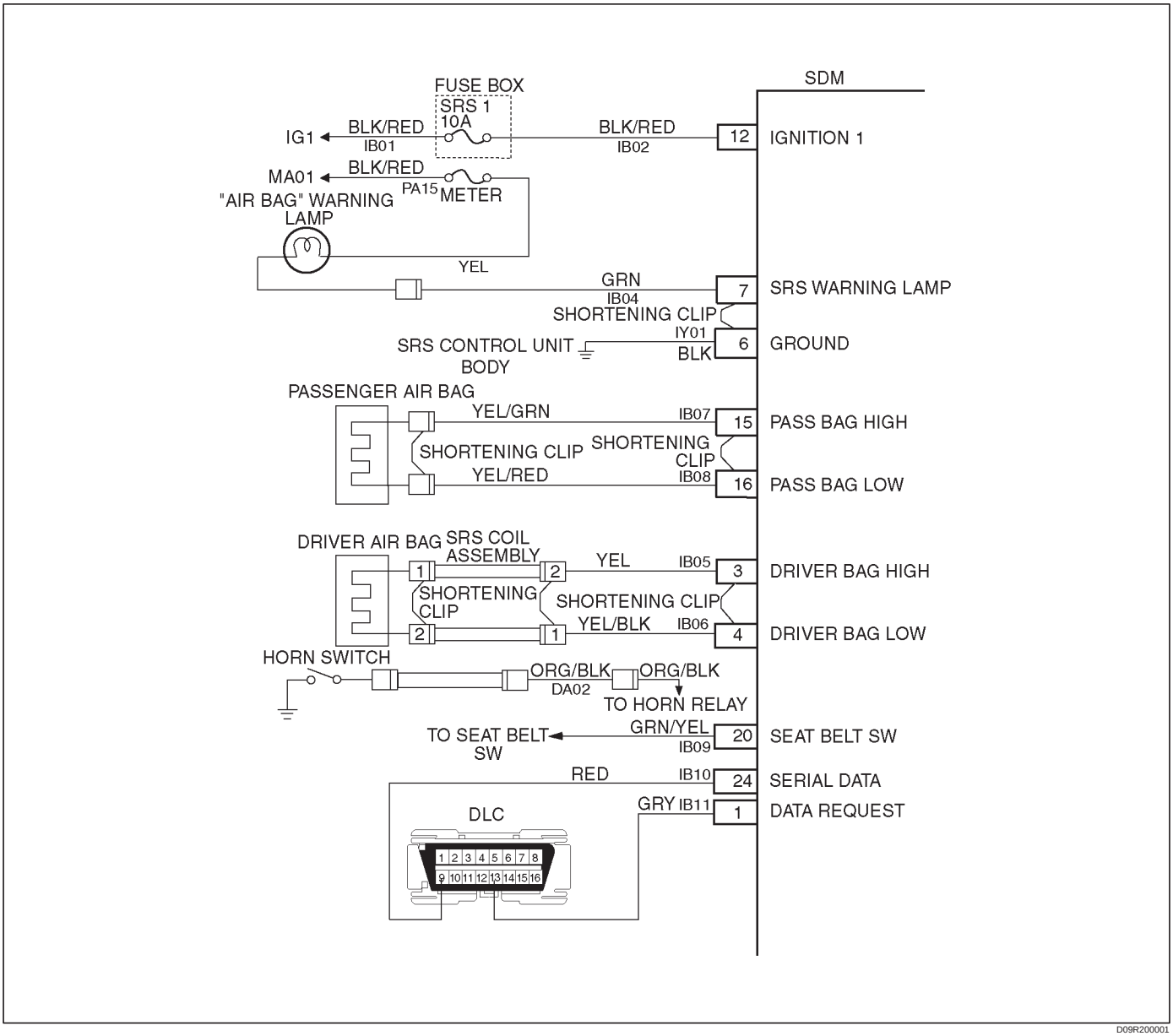
2. If air bag assembly (s) has not deployed, DTC 51 may have falsely set.
3. If DTC 51 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 51 Deployment Event Commanded

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	Ignition switch “OFF.” Have air bag assemblies deployed?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to *Step 3*
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Ignition switch “OFF.” Replace SDM. Reconnect all SRS system components, ensure all components are properly mounted.Repeat the “SRS Diagnostic System Check.”

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range



D09R200001

Circuit Description:

The SDM contains a sensing drive which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags. DTC 53 is set accompanying with DTC 51 when a deployment occurs while an air bag assembly circuit fault is present that could possible result in a no deployment situation in one or both air bag assemblies.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags and an inflator circuit fault is present.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced. If DTC 53 is set, one or more DTCs will be set in addition to DTC 53. Malfunction(s) setting DTC(s) (other than DTC 71) must be repaired so that DTC(s) will not be set when a new SDM is installed.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

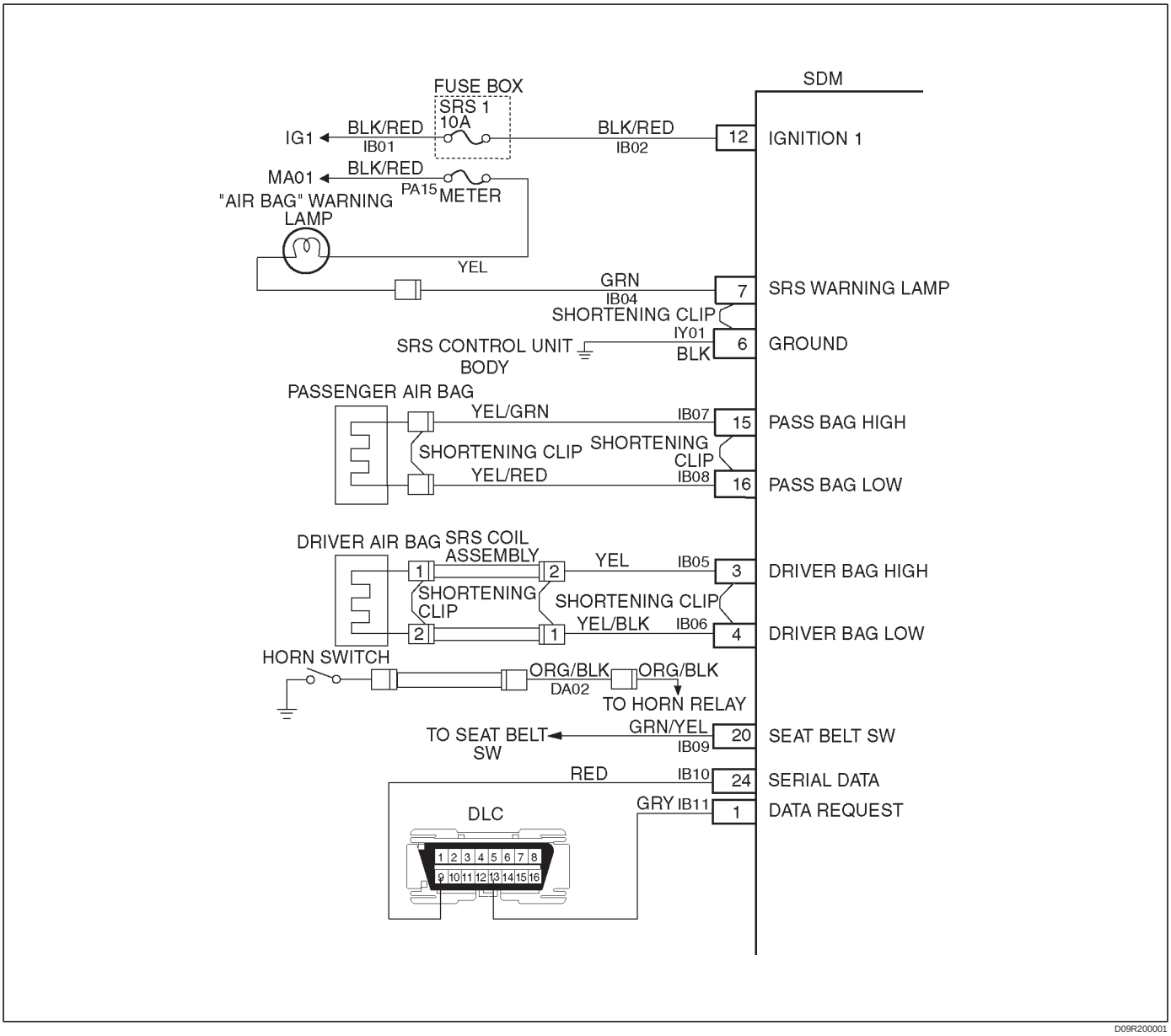
2. If air bag assembly has not deployed, DTC 53 may have falsely set.
3. If DTC 53 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	Ignition switch “OFF.” Have air bag assemblies deployed?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to *Step 3*
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Ignition switch “OFF.” Replace SDM. Reconnect all SRS system components, ensure all components are properly mounted. Repeat the “SRS Diagnostic System Check.”

DTC 61 Warning Lamp Circuit Failure



D09R200001

Circuit Description:

When the ignition switch is turned “ON”, battery voltage is applied to the “AIR BAG” warning lamp and to the “ignition 1” input terminal “12”. The SDM responds by flashing the “AIR BAG” warning lamp seven times. The SDM monitors the lamp driver output by comparing the output state at “SRS warning lamp” terminal “7” to the microprocessor commanded state. When “ignition 1” is in the specified value, and the output state Does not match the commanded state of the lamp driver for 500 milliseconds, DTC 61 is set.

DTC Will Set When:

“Ignition 1” voltage is in the specified value and the output state at the “SRS warning lamp” terminal does not match the commanded state of the lamp driver for 500 milliseconds. This test is run every 100 milliseconds during “Continuous Monitoring” tests and once per each ignition cycle at the beginning.

Action Taken:

SDM attempts to turn “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

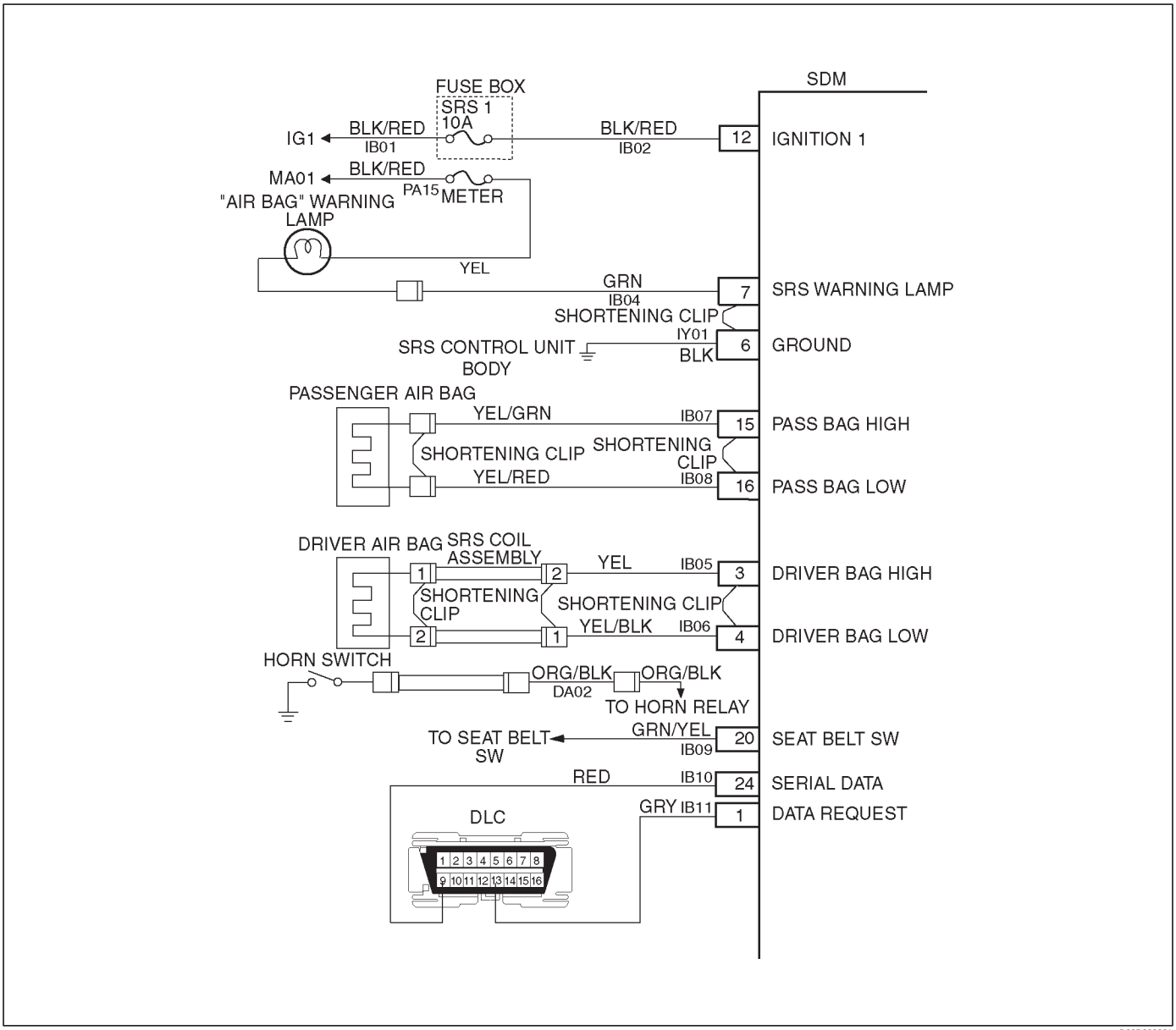
Diagnostic Aids:

Refer to Charts B and C to diagnose warning lamp circuit malfunctions.

DTC 61 Warning Lamp Circuit Failure

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to *Step 2*	Go to the “SRS Diagnostic System Check.”
2	1. Malfunctions within the “AIR BAG” warning lamp circuitry will set this diagnostic trouble code. 2. These malfunctions are addressed in the “SRS Diagnostic System Check” via Chart B and Chart C. 3. Failure to properly perform the “SRS Diagnostic System Check” may result in misdiagnosis. 4. Ignition switch “ON.” 5. Clear SRS diagnostic trouble codes. Is DTC 61 SET?	Ignition switch “OFF.” Go to *Chart A* .	Repeat the “SRS Diagnostic System Check.”

DTC 71 Internal SDM Fault



D09R200001

Circuit Description:

DTC 71 is an indication of a potential internal SDM malfunction and will set if any of the following conditions are detected:
1) Deployment or microprocessor energy reserve failure.
2) EEPROM failure.
3) ROM failure.
4) RAM failure.
5) Calibration check sum failure.
6) Deployment switch faults.
7) Accelerometer fault.
8) Arming sensor fault.
9) Diagnostic current faults.
10) DTC 19
11) DTC 25
12) DTC 51
13) DTC 53

DTC Will Set When:

Any of the above indicated malfunctions are detected by the SDM. The malfunctions described above are tested mainly during “Continuous Monitoring” and some ones run each ignition cycle.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

A scan tool “Clear Codes” commanded is received by the SDM. Some of the indicated malfunctions will only allow the “AIR BAG” warning lamp to go out.
But when DTC 19, 25, 51, 53 are also set, SDM is Replaced.

DTC 71 Internal SDM Fault

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

CAUTION: When DTC 19 or 25 or 51 or 53 has been set it is necessary to Replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 51 or 53 and DTC 71 will remain current. Ensure that the short to voltage condition DTC 19, 25 is repaired prior to installing a Replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to *Step 2*	Go to the "SRS Diagnostic System Check."
2	Confirm SRS "Diagnostic System Check." Is DTC 19 or 25 or 51 or 53 also set (current or history)? (Refer to notice above).	Go to *DTC 19* if DTC 19 is set. Go to *DTC 25* if DTC 25 is set. Go to *DTC 51* if DTC 51 is set. Go to *DTC 53* if DTC 53 is set.	Ignition switch "OFF." Replace SDM. Repeat the "SRS Diagnostic System Check."

AXIOM

CONTROL SYSTEM

CRUISE CONTROL SYSTEM

CONTENTS

Service Precaution 10A–1
General Description 10A–1
Brake Switch 10A–2
Removal and Installation 10A–2
Adjustment 10A–2
Powertrain Control Module (PCM) 10A–3
Removal and Installation 10A–3
Mode Switch 10A–3
Removal and Installation 10A–3
Cruise Control Main Switch 10A–3
Removal 10A–3
Installation 10A–3
Cruise Control Switch (Combination Switch) 10A–3
Removal and Installation 10A–3
Diagnosis 10A–4

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch “AUTO CRUISE” is turned on with the vehicle in the running mode, the battery voltage is applied to the PCM. When a signal from the control switch is input to the PCM while the vehicle is in this state, the cruise control system is activated. Also, while the system is operating, the “AUTO CRUISE” indicator light in the meter assembly lights up.

1 . SET/COAST Switch Function

1. **Set Function:** When the SET/COAST switch is pressed and released with the main switch on, the speed at which the vehicle is running at that moment is stored in the memory, and the vehicle automatically runs at the speed stored.
2. **Coast–Down Function:** When the SET/COAST switch is kept on while the vehicle is running, the vehicle decelerates during that time. The speed at which vehicle is running when the control switch is turned off is stored in the memory, and the vehicle automatically returns to the stored speed.
3. **Tap–Down Function:** When the SET/COAST switch is turned on and off instantaneously while the vehicle is running, the vehicle decelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the SET/COAST was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

2 . RESUME/ACCEL Switch Function

1. **Resume Function:** When the RESUME, ACCEL switch is turned on/off after the system is temporarily deactivated by pressing the brake or clutch pedal while the vehicle is running, the vehicle resumes, the speed stored before the system was released.
2. **Accelerate Function:** When the RESUME/ACCEL switch is kept on after the system is released completely, the vehicle accelerates its speed during that time. The vehicle speed at which the vehicle was running when the switch was turned off is stored in the memory, and the vehicle automatically returns to this speed.
3. **Tap–Up Function:** When the RESUME/ACCEL switch is turned on and off instantaneously while the vehicle is running, the vehicle accelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the switch was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

3 . CANCEL Function

1. **Temporary Cancellation:**
   - ▼When the cancel switch is turned on.
   - ▼When the brake pedal is pressed.
   - ▼When the clutch pedal is pressed. (M/T)
   - ▼When the select lever is shifted to any position other than “D”, “3”, “2” or “L”. (A/T)
   - ▼When the vehicle speed has decreased about 12.5 mph (20 km/h) or more than the stored speed.
   - ▼When the vehicle speed gets lower than 22.5 mph (36 km/h).
2. **Complete Cancellation:**
   - ▼When the starter switch or the main switch is turned off.
   - ▼When the failsafe function is activated.

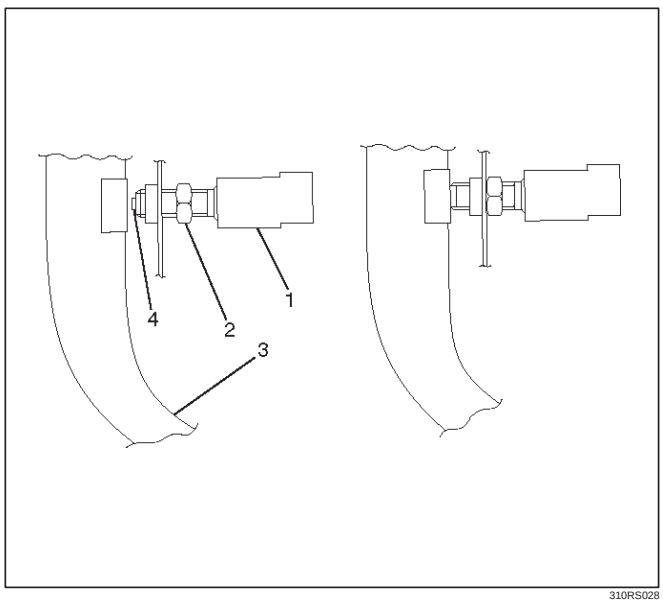
Brake Switch

Removal and Installation

Refer to the *Brake Pedal Replacement in Brake section.*

Adjustment

1. Check that the brake pedal (3) is fully returned by pedal return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (2).
4. Rotate the brake switch (1) by hand until push rod disappears from brake switch tip (4).
5. Return the brake switch by a half turn.
6. Tighten the lock nut.
7. Connect the switch connector.



310RS028

Powertrain Control Module (PCM)

Removal and Installation

Refer to *Powertrain Control Module (PCM) in Engine section.*

Mode Switch

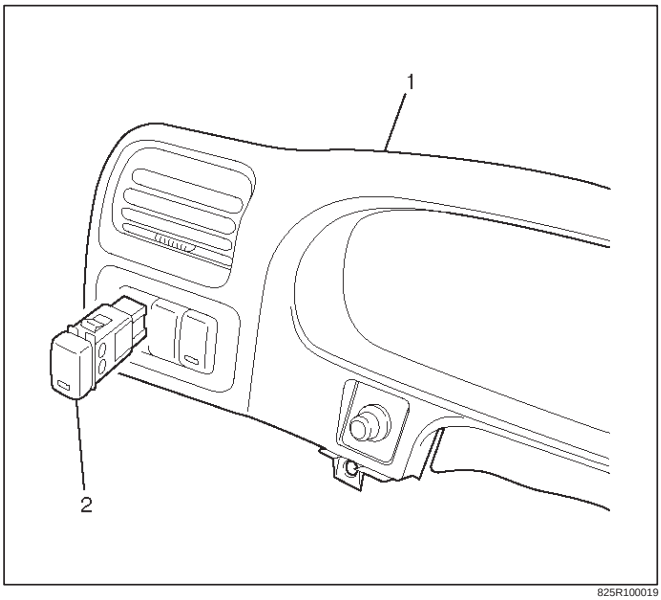
Removal and Installation

Refer to *Mode Switch removal and installation steps in Automatic Transmission section.*

Cruise Control Main Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster assembly (1).
   ▼Refer to *Instrument Panel Assembly in Body Structure section.*
3. Remove the cruise control main switch (2).
   ▼Disconnect the switch connector.
   ▼Push the lock from the back side of the instrument panel cluster assembly.



825R100019

Installation

To install, follow the removal steps in the reverse order.

Cruise Control Switch (Combination Switch)

Removal and Installation

Refer to *Lighting Switch (Combination Switch) removal and installation steps in Lighting System section.*

Diagnosis

Cruise control system is controlled by the PCM as well as 6VE1 engine and automatic transmission. DTC codes are stored in the PCM if troubles occur in the circuit. DTC codes categorized “type D” are shown only by the Tech 2 scan tool. The following chart only shows some typical DTCs for cruise control system. Refer to *PCM Diagnostic Trouble Codes in Driveability and Emissions for entire DTC diagnosis.*

DTC	TROUBLE PART	DTC TYPE	MAJOR CONDITION OF TROUBLE	DIAGNOSIS PERIOD
P0565	CRUISE MAIN CIRCUIT	D	▼THE SWITCH CONTACT REMAINS ON FOR 15 SECONDS OR MORE. ▼NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 60 TIMES WITHIN 1 SECOND.	DIAGNOSIS IS ENABLED IN 130 SECONDS AFTER THE SWITCH OPERATED.
P0566	CRUISE CANCEL CIRCUIT	D	▼THE SWITCH CONTACT REMAINS ON FOR 40 SECONDS OR MORE.	DIAGNOSIS IS ENABLED IN 120 SECONDS AFTER THE SWITCH OPERATED.
P0567	CRUISE RESUME CIRCUIT	D	▼THE SWITCH CONTACT REMAINS ON FOR 50 SECONDS OR MORE. ▼NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 110 SECONDS AFTER THE SWITCH OPERATED.
P0568	CRUISE SET CIRCUIT	D	▼THE SWITCH CONTACT REMAINS ON FOR 120 SECONDS OR MORE. ▼NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 125 SECONDS AFTER THE SWITCH OPERATED.

DTC: Diagnostic Trouble Code

NOTE: The DTCs are detected while the engine is running.