Body Electrical System

GENERAL
- SPECIFICATIONS ..... BE -3
- SPECIAL TOOLS ..... BE -6
- TROUBLESHOOTING ..... BE -7

AUDIO SYSTEM
- COMPONENTS ..... BE -30
- AUDIO UNIT
  - COMPONENTS ..... BE -31
  - REMOVAL AND INSTALLATION ..... BE -34
  - INSPECTION ..... BE -34
- SPEAKERS
  - REMOVAL AND INSTALLATION ..... BE -35
  - INSPECTION ..... BE -35
- ANTENNA
  - REMOVAL AND INSTALLATION ..... BE -36
  - INSPECTION ..... BE -36

MULTI FUNCTION SWITCH
- COMPONENTS ..... BE -37
- MULTI FUNCTION SWITCH
  - REMOVAL AND INSTALLATION ..... BE -39
  - INSPECTION ..... BE -40

HORNS
- COMPONENTS ..... BE -42
- HORN
  - REMOVAL AND INSTALLATION ..... BE -43
  - INSPECTION ..... BE -43

KEYLESS ENTRY AND BURGLAR ALARM
- COMPONENTS ..... BE -44
- INSPECTION ..... BE -45
- ETACS MODULE (ETACM)
  - ANTI-THEFT FUNCTION ..... BE -50
- TRANSMITTER
  - INSPECTION ..... BE -53
  - TRANSMITTER CODE REGISTRATION ... BE -53

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)
- DESCRIPTION ..... BE -55
- SPECIFICATIONS ..... BE -55
- ELECTRONIC TIME AND ALARM CONTROL MODULE
  - CIRCUIT DIAGRAM ..... BE -56
  - REMOVAL AND INSTALLATION ..... BE -57
  - INSPECTION ..... BE -57

FUSES AND RELAYS
- COMPONENTS ..... BE -61
- RELAY BOX (ENGINE COMPARTMENT)
  - COMPONENTS ..... BE -63
  - INSPECTION ..... BE -65
- RELAY BOX (PASSENGER COMPARTMENT)
  - COMPONENTS ..... BE -67
  - INSPECTION ..... BE -69

INDICATORS AND GAUGES
- COMPONENTS ..... BE -71
- INSTRUMENT CLUSTER
  - COMPONENTS ..... BE -72
  - CIRCUIT DIAGRAM ..... BE -73
  - REMOVAL AND INSTALLATION ..... BE -74
  - INSPECTION ..... BE -74

POWER DOOR LOCKS
- COMPONENTS ..... BE -80
- POWER DOOR LOCK ACTUATORS
  - INSPECTION ..... BE -81
- POWER DOOR LOCK RELAY
  - INSPECTION ..... BE -83

POWER DOOR MIRRORS
- COMPONENTS ..... BE -84
- POWER DOOR MIRROR SWITCH
  - CIRCUIT DIAGRAM ..... BE -85
  - INSPECTION ..... BE -86
- POWER DOOR MIRROR ACTUATOR
  - INSPECTION ..... BE -87

POWER WINDOWS
- COMPONENTS ..... BE -88
- POWER WINDOW MOTOR
  - INSPECTION ..... BE -89
- POWER WINDOW SWITCH
  - CIRCUIT DIAGRAM ..... BE -90
  - INSPECTION ..... BE -92

REAR WINDOW DEFOGGER
- COMPONENTS ..... BE -94
- REAR WINDOW DEFOGGER PRINTED HEATER
  - INSPECTION ..... BE -95
- REAR WINDOW DEFOGGER SWITCH
  - INSPECTION ..... BE -97

WINDSHIELD WIPER / WASHER
COMPONENTS ..... BE -98
WINDSHIELD WIPER / WASHER SWITCH
REMOVAL AND INSTALLATION ..... BE -99
INSPECTION ..... BE -100
FRONT WIPER MOTOR
REMOVAL ..... BE -101
INSPECTION ..... BE -102
INSTALLATION ..... BE -102
FRONT WASHER MOTOR
REMOVAL AND INSTALLATION ..... BE -103
INSPECTION ..... BE -103

REAR WIPER / WASHER
REAR WIPER MOTOR
COMPONENTS ..... BE -104
REMOVAL ..... BE -105
INSPECTION ..... BE -105
INSTALLATION ..... BE -106
REAR WAHSER SWITCH
INSPECTION ..... BE -107
REAR WAHSER MOTOR
INSPECTION ..... BE -108

SEAT WARMER
COMPONENTS ..... BE -109
SEAT WARMER SWITCH
INSPECTION ..... BE -109

SHIFT AND KEY LOCK CONTROL SYSTEM
COMPONENTS ..... BE -110
CIRCUIT DIAGRAM ..... BE -111
SYSTEM CHECK ..... BE -112
INSPECTION ..... BE -113

LIGHTING SYSTEM
COMPONENTS ..... BE -115
HEAD LAMPS
REMOVAL AND INSTALLATION ..... BE -116
AIMING INSTRUCTIONS ..... BE -116
INSPECTION ..... BE -119
TURN SIGNAL LAMP
REMOVAL AND INSTALLATION ..... BE -120
ROOM LAMP
REMOVAL AND INSTALLATION ..... BE -121
INSPECTION ..... BE -121
TURN / HAZARD LAMPS
INSPECTION ..... BE -122
FLASHER UNIT
INSPECTION ..... BE -123
FRONT FOG LAMPS
REMOVAL AND INSTALLATION ..... BE -124
INSPECTION ..... BE -124
REAR FOG LAMPS
INSPECTION ..... BE -125
TAIL, PARKING AND LICENSE LAMPS
REMOVAL AND INSTALLATION ..... BE -126
STOP LAMPS
REMOVAL AND INSTALLATION ..... BE -127
COURTESY AND TRUNK LAMPS
REMOVAL AND INSTALLATION ..... BE -128
INSPECTION ..... BE -128

DAYTIME RUNNING LIGHTS
DRL CONTROL MODULE
CIRCUIT DIAGRAM ..... BE -129
INSPECTION ..... BE -130

HEAD LAMP LEVELLING DEVICE
COMPONENTS ..... BE -131
HEAD LAMP LEVELLING SWITCH
CIRCUIT DIAGRAM ..... BE -132
INSPECTION ..... BE -132

HEAD LAMP WASHER
COMPONENTS ..... BE -134
CIRCUIT DIAGRAM ..... BE -135
HEAD LAMP WASHER SWITCH
INSPECTION ..... BE -136
HEAD LAMP WASHER RELAY
INSPECTION ..... BE -137
HEAD LAMP WASHER MOTOR
INSPECTION ..... BE -138

IMMOBILIZER CONTROL SYSTEM
DESCRIPTION ..... BE -139
COMPONENTS ..... BE -141
BLOCK DIAGRAM ..... BE -143
LIMP HOME FUNCTION ..... BE -144
DIAGNOSIS OF IMMOBILIZER FAULTS ..... BE -145

IGNITION SYSTEM
IGNITION SWITCH
REMOVAL AND INSTALLATION ..... BE -147
INSPECTION ..... BE -148

GENERAL

SPECIFICATIONS EEFDCD67

MULTIFUNCTION SWITCH

Items	Specifications
Rated voltage	DC 12 V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load	
Dimmer & passing switch	High : 15A (Lamp load) Low : 10A (Lamp load) Passing : 15A (Lamp load)
Lighting switch	Lighting : 0.22±0.05A (Relay load)
Turn signal & lane change switch	6.6±0.5A (Lamp load)
Wiper & mist switch	Low, High : 4A (Motor load) Intermittent : 0.22±0.05A (Relay load) Lock : Max. 23A (Motor load) Mist : 4A (Motor load)
Washer switch	4A (Motor load)
Variable intermittent volume switch	Max. 25mA
Horn switch	1A (Relay load)

INSTRUMENTS AND WARNING SYSTEM

Warning lamps	Bulb wattage (W)	Color
Illumination	Bulb type : 12V, 1.5W EL type : 47V, 470 Hz	White green
High beam	LED	Blue
Low fuel	LED	Amber
Turn signal (LH, RH)	LED	Green
Battery (charge)	LED	Red
Oil pressure	LED	Red
Air bag	Bulb (1.1W)	Red
Parking brake	LED	Red
Seat belt	LED	Red
Check engine	Bulb (1.1W)	Amber
ABS	Bulb (1.1W)	Amber
Door ajar	LED	Red
Trunk lid open	LED	Amber
Immobilizer	LED	Amber
OD OFF	LED	Amber
Glow (Diesel)	LED	Amber
Water separater (Diesel)	LED	Red

INDICATORS AND GAUGE

Speedometer

Type

- Stepper motor type

Input spec.

- Hall IC type : 4 pulses/rev.

Indication

- Km/h : 637rpm x 4 pulses/rev. indicates 60Km/h
- MPH : 1025 rpm x 4 pulses/rev. indicates 60MPH

Standard values

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	20-24.4	40-44.4	61-65.4	81-86.5	102-107.5
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	123-128.5	144-149.5	165-170.5	185-191.5	207-212.5

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	10-13	20-22	40-43	60-63.8
Tolerance (MPH)	10±1.5	20±1.5	40±1.5	60±1.7
Velocity (MPH)	80	100	120	Remark
Tolerance (MPH)	80.3-84.1	100.3-104.1	120.3-124.1	Except U.S.A
Tolerance (MPH)	80±1.7	100±1.7	120±1.7	U.S.A

- Tap the speedometer to prevent hysterisis effects during inspection.

Tachometer

Type

- Stepper motor type (4cyl : 2pulses/rev, 4cyl : 4pulses/rev)

Standard values

Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remark
Tolerance (RPM)	±100	±125	±150	±170	±200	±240	±280	Gasoline
Tolerance (RPM)	±100	±125	±150	±170	±200	-	-	Diesel

- Tap the tachometer to prevent hysterisis effects during inspection.

Fuel gauge

Type

- Stepper motor type

Standard values

Level	Gauge	
	Resistance (Ω)	Gauge angle (°)
E (Empty)	184	0 ± 4.0
1/2	66	50 ± 4.0
F (Full)	15	100 ± 4.0

- Inspection order : E → F → E

ETDD001A

<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Temperature gauge
Type
Indication standard</td><td>o Stepper motor type
<table>
<tr><th>Temperature</th><th>Angle (°)</th><th>Assembled tolerance (°)</th></tr>
<tr><td>55°C</td><td>0</td><td>-</td></tr>
<tr><td>85°C ~ 110°C</td><td>43</td><td>±4.0</td></tr>
<tr><td>125°C</td><td>95</td><td>±4.0</td></tr>
<tr><td>Red zone (over 125°C)</td><td>100</td><td>-</td></tr>
</table>
o Inspection order : OFF→C→H</td></tr>
<tr><td>Resistance of temperature sender (NTC)</td><td>
<table>
<tr><td>Temperature (°C)</td><td>55</td><td>85</td><td>110</td><td>125</td><td>Red zone (Over125°C)</td></tr>
<tr><td>Resistance (Ω)</td><td>160.3</td><td>70.3</td><td>27.9</td><td>18.6</td><td>15</td></tr>
</table>
</td></tr>
</table>

ETDD001B

LIGHTING SYSTEM

Items	Bulb wattage (W)
Head lamp	60W /55W (High / Low beam)
Front turn signal lamp	21W
Front position lamp	5W
Front fog lamp	27W
Rear combination lamps Tail/stop lamp Back up lamp Turn signal lamp	 5W / 21W 17W 21W
Luggage lamp	5W
Room lamp	10W
Center high mounted stop lamp	17W
Map lamp	10W x 2
License plate lamp	5W

AUDIO

Items	H210, H220	H260
Rated output	Max. 20W x 2	Max. 20W x 4
Load impedance	4Ω x 4	4Ω x 4
Band	AM/FM, LW/MW/FM	AM/FM, LW/MW/FM
Tuning type	PLL Synthesized type	PLL Synthesized type
Dark current	Max. 2mA	Max. 3.8mA
Frequency range / Channel	AM : 531 ~ 1602KHZ/9 KHZ	AM : 531 ~ 1602KHZ/9 KHZ
	FM : 87.5 ~ 108MHZ/100 KHZ	FM : 87.5 ~ 108 MHZ/100KHZ
	LW : 153 ~ 279KHZ/1 KHZ	LW : 153 ~ 279 KHZ/1KHZ
	MW : 531 ~ 1602KHZ/9KHZ	MW : 531 ~ 1602KHZ/9KHZ
	FM : 87.5~108 MHZ/50KHZ	FM : 87.5~108 MHZ/50KHZ

WINDSHIELD WIPER AND WASHER

Items	Specifications
Wiper motor	
Speed/current at 10kg·cm load test (1.0 Nm, 0.7 lb·ft)	Low : 44~52 rpm/3.5A or less High : 64~78 rpm/4.5A or less
Speed/current at 40kg·cm load test (3.9 Nm, 2.9 lb·ft)	Low : 39~47 rpm/5.5A or less High : 56~68 rpm/7.0A or less
Current when locking	Low : 24A or less High : 28A or less
Windshield washer	
Motor type	DC ferrite magnet
Pump type	Centrifugal type
Current	3.8A
Discharge pressure	1.2 kg/cm² or more
Flow rate	1,320 cc/min. or more
Overload capacity (Continuous operation)	
With water	60 sec. or less
Without water	20 sec. or less

SPECIAL TOOLS EAC63C6C

Tool (Number and Name)	Illustration	Use
09900-21300 Keyless adapter	 I0021300	Store transmitter code connecting the DLC (Data Link Connector) cable of Hi-scan to the multi purpose check connector.

TROUBLESHOOTING EE2AB0E0

INSTRUMENTS AND WARNING SYSTEM

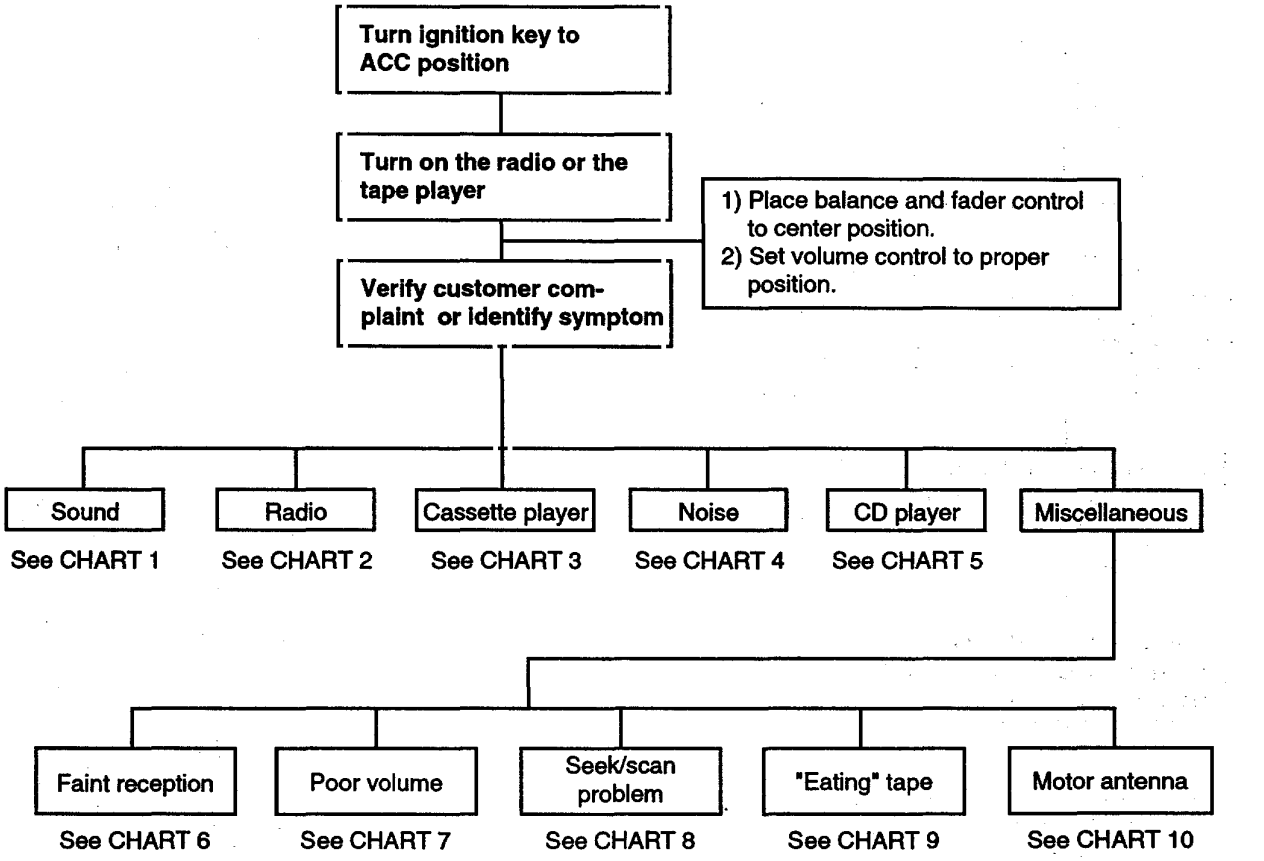
Symptom	Possible cause	Remedy
Tachometer does not operate	No.2 fuse (10A) blown Tachometer faulty Wiring faulty	Check for short and replace fuse Check tachometer Repair if necessary
Fuel gauge does not operate	No.2 fuse (10A) blown Fuel gauge faulty Fuel sender faulty Wiring faulty	Check for short and replace fuse Check gauge Check fuel sender Repair if necessary
Low fuel warning lamp does not light	No.2 fuse (10A) blown Bulb burned out Fuel level sensor faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check sensor Repair if necessary
Water temperature gauge does not operate	No.2 fuse (10A) blown Water temperature gauge faulty Water temperature sender faulty Wiring or ground faulty	Check for short and replace fuse Check gauge Check sender Repair if necessary
Oil pressure warning lamp does not light	No.2 fuse (10A) blown Bulb burned out Oil pressure switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Repair if necessary
Low brake fluid warning lamp does not light	No.2 fuse (10A) blown Bulb burned out Brake fluid level warning switch faulty Parking brake switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Check switch Repair if necessary
Open door warning lamp does not light	Room lamp fuse (10A) blown Battery fusible link (50A) blown Bulb burned out Door switch faulty Wiring or ground faulty	Check for short and replace fuse Replace the fusible link Replace bulb Check switch Repair if necessary
Seat belt warning lamp does not light	No.2 fuse (10A) blown Bulb burned out Buckle switch faulty Wiring or gound faulty	Check for short and replace fuse Replace bulb Check switch Repair if necessary

LIGHTING SYSTEM

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out Socket, wiring or ground faulty	Replace bulb Repair if necessary
Head lamps do not light	Bulb burned out No.10 fuse (10A) blown Fusible link (50A) blown Head lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace bulb Check for short and replace fuse Replace the fusible link Check relay Check switch Repair if necessary
Tail lamps and license plate lamps do not light	Tail lamp fuse (10A) blown Battery fusible link (50A) blown Tail lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace fuse and check for short Replace the fusible link Check relay Check switch Repair if necessary
Stop lamps do not light	No.8 fuse (10A) blown Stop lamp switch faulty Wiring or ground faulty	Replace fuse and check for short Adjust or replace switch Repair if necessary
Stop lamps stay on	Stop lamp switch faulty	Adjust or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty Wiring or ground faulty	Check rheostat Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out Turn signal switch faulty Wiring or ground faulty	Replace bulb Check switch Repair if necessary
Turn signal lamps do not operate	No.1 fuse (10A) blown Flasher unit faulty Turn signal switch faulty Wiring or ground faulty	Replace fuse and check for short Check flasher unit Check switch Repair if necessary
Hazard warning lamps do not operate	No.7 fuse (10A) blown Flasher unit faulty Hazard switch faulty Hazard relay faulty Wiring or ground faulty	Replace fuse and check for short Check flasher unit Check switch Replace relay Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified Defective flasher unit	Replace lamps Check flasher unit
Back up lamps do not light up	No.5 fuse (10A) blown Back up lamp switch faulty Wiring or ground faulty	Replace fuse and check for short Check switch Repair if necessary
Room lamp does not light up	Room lamp fuse (10A) blown Wiring or ground faulty	Replace fuse and check for short Repair if necessary

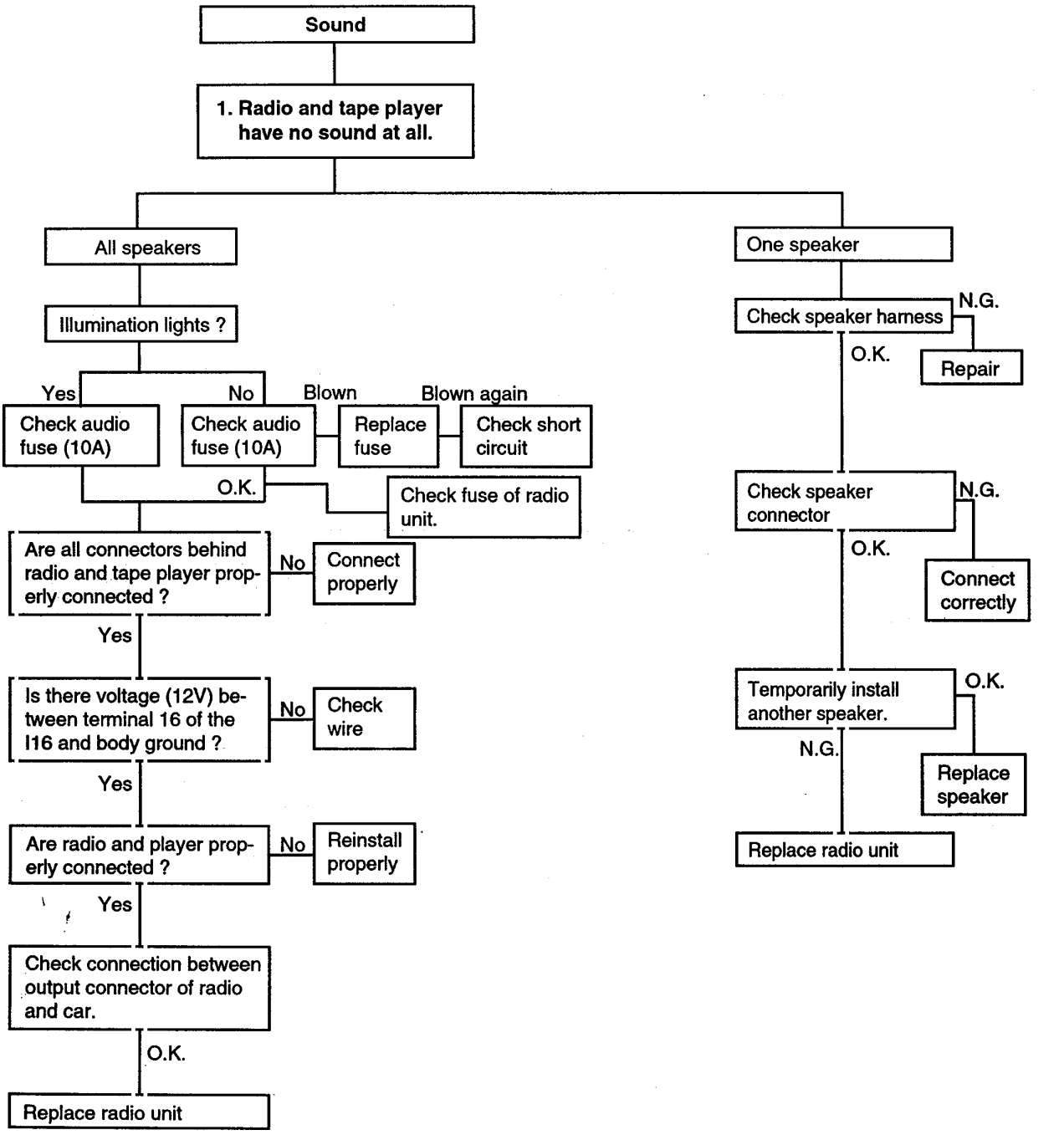
AUDIO

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, the speaker, and antenna. Troubleshooting enables you to confine the problem to a particular area.

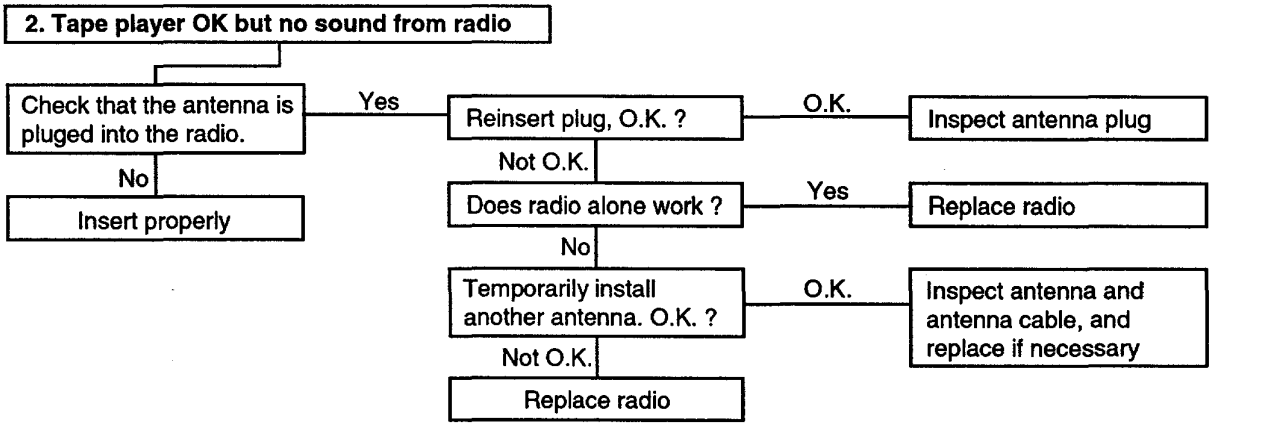


ETJA315A

CHART 1

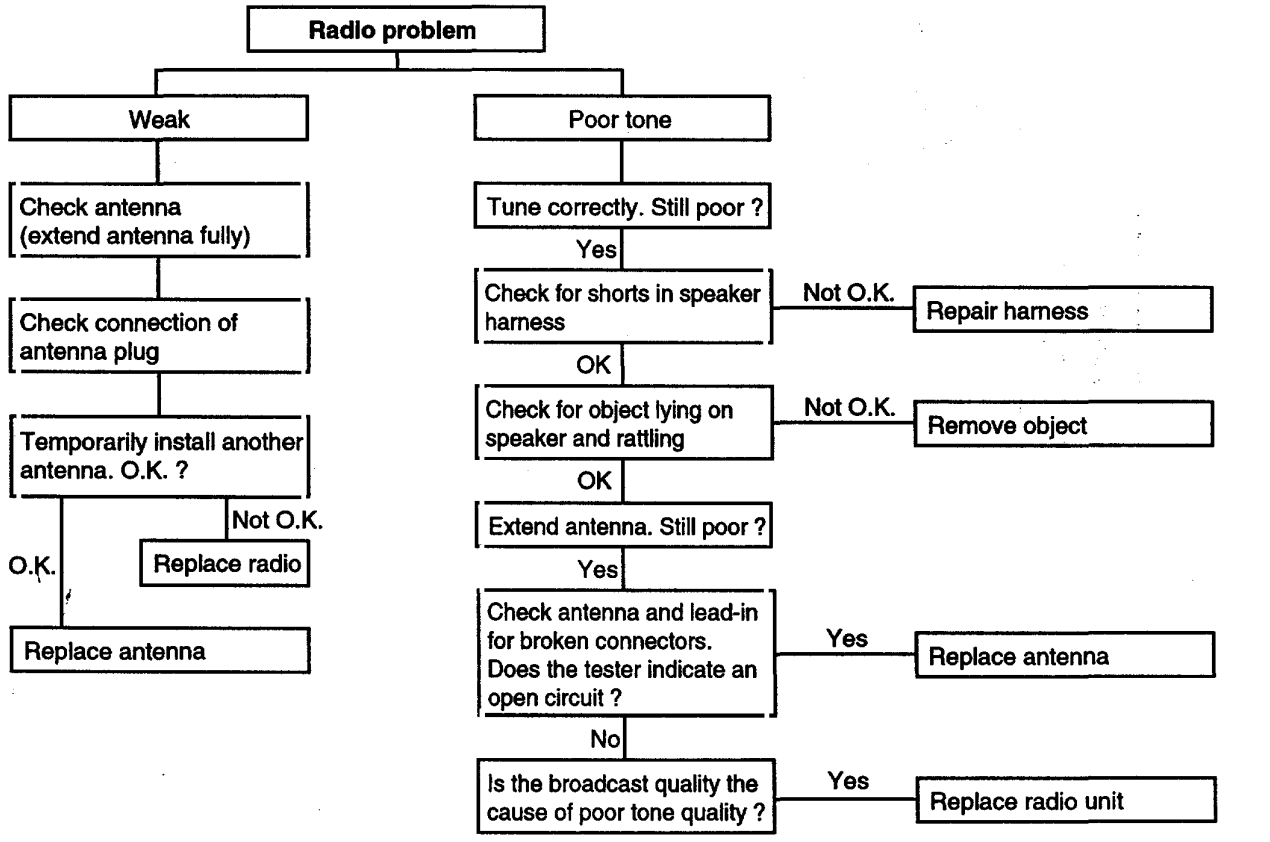


ETDD015A



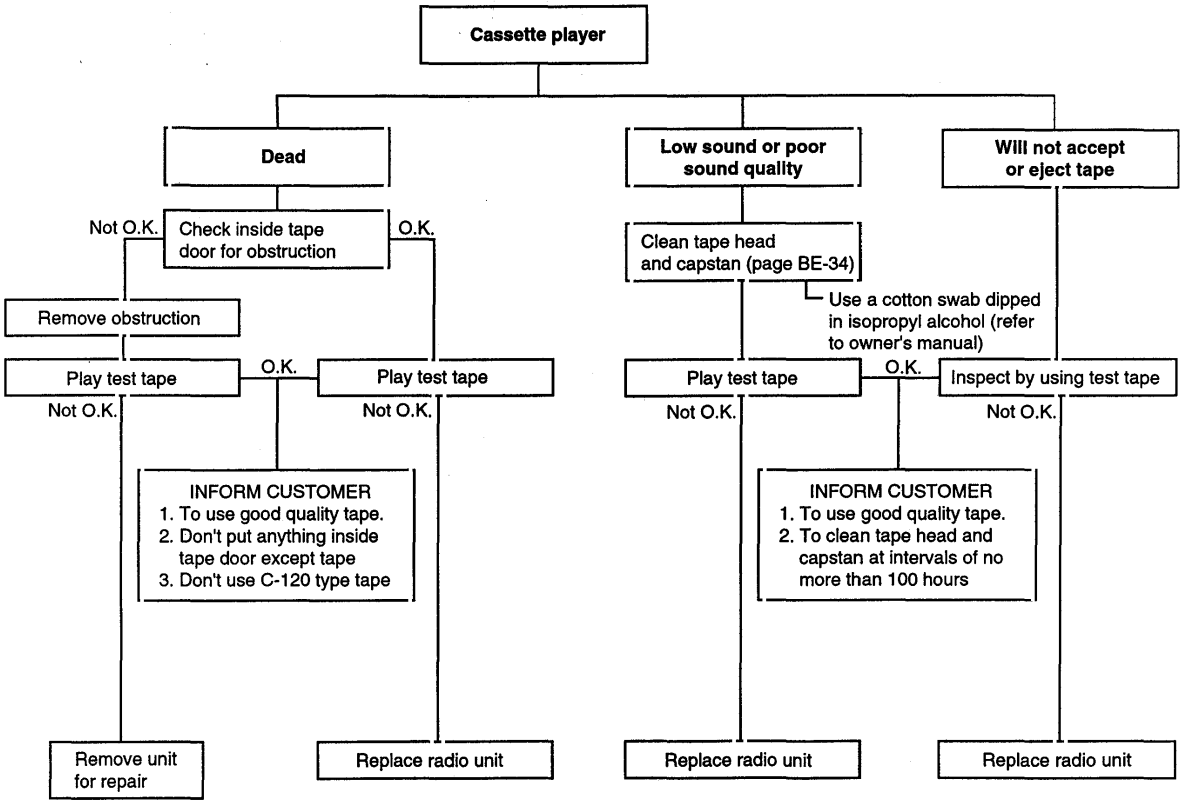
ETA9010C

CHART 2



ETA9010D

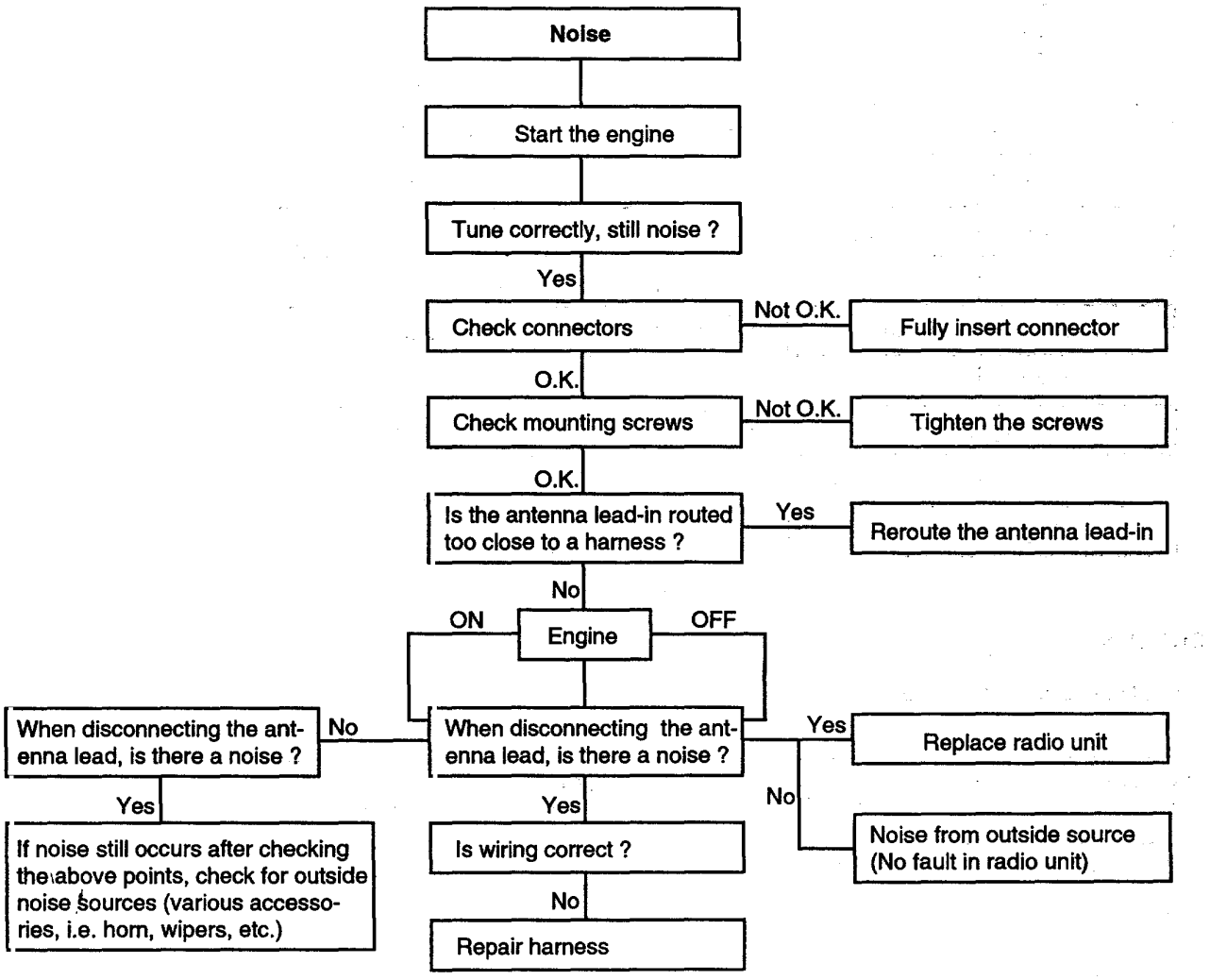
CHART 3



ETD00001D

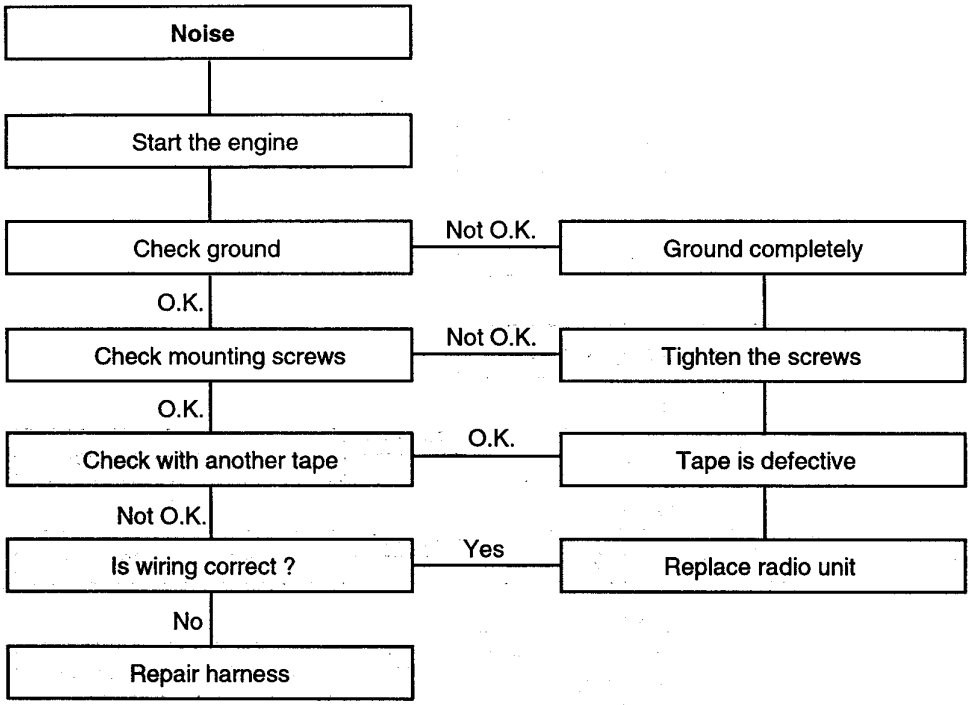
CHART 4

1. RADIO



ETA9010F

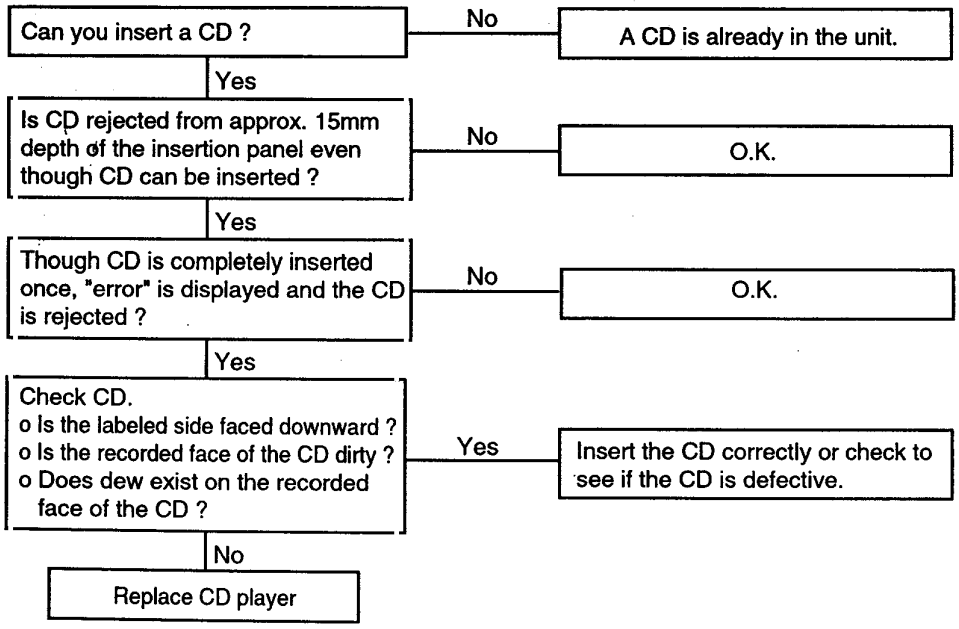
2. TAPE



ETA9010G

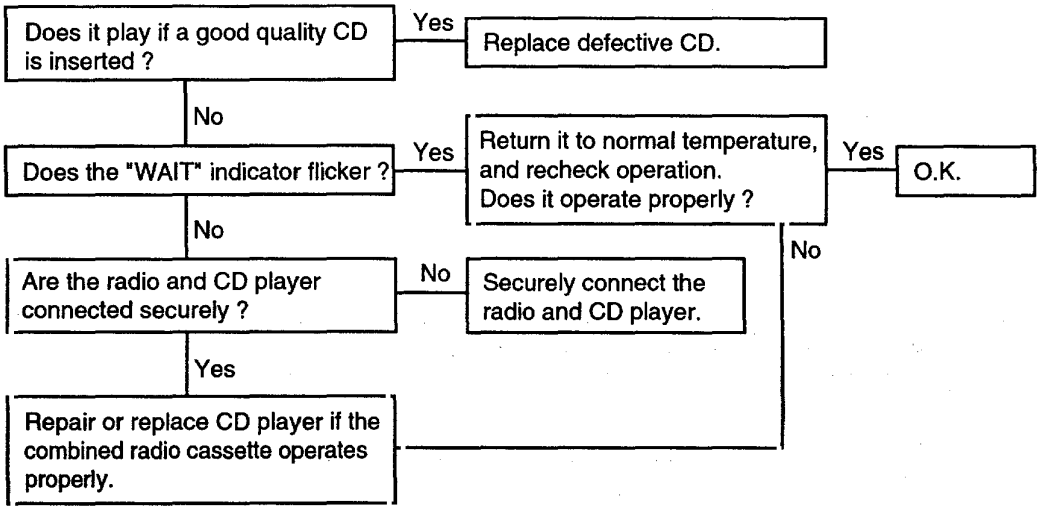
CHART 5

1. CD WILL NOT BE ACCEPTED



ETA9010H

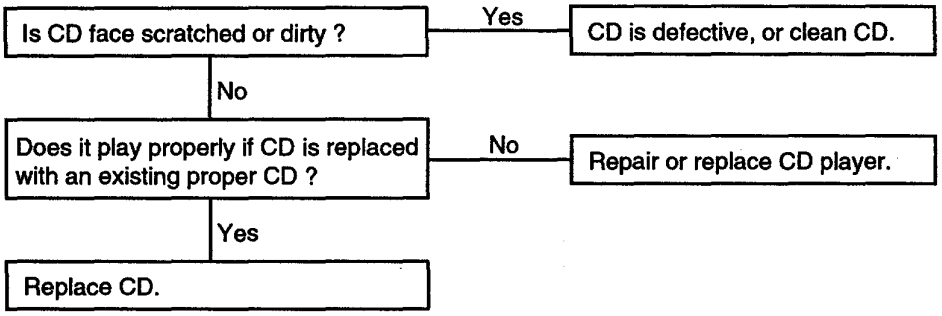
2. NO SOUND



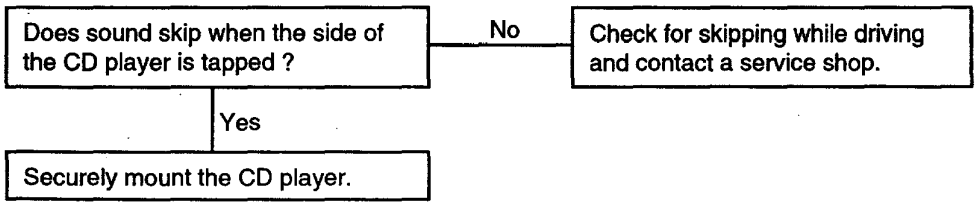
ETA9010O

3. CD SOUND SKIPS

1) Sound sometimes skips when parking.

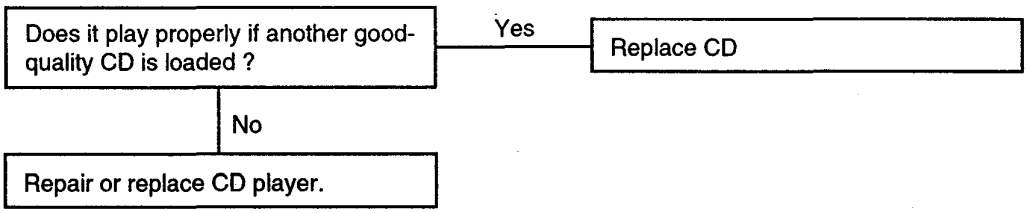


2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)

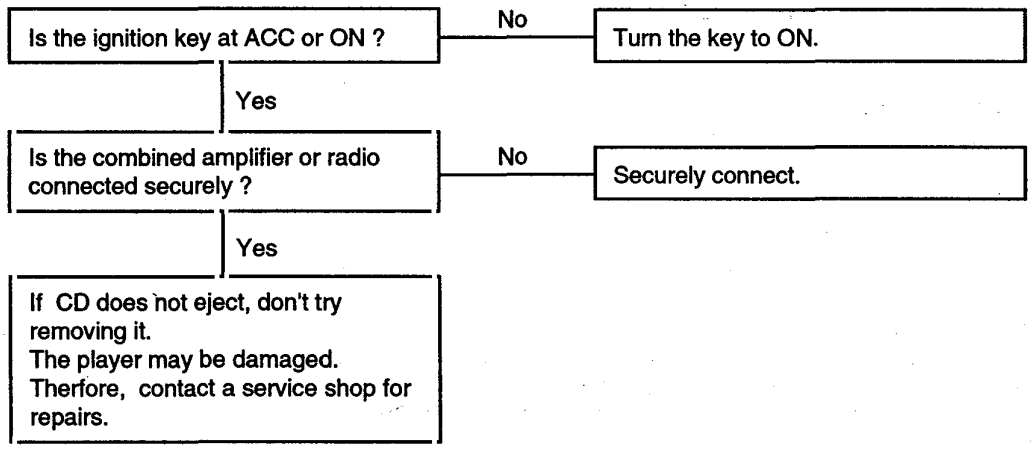


ETA9010I

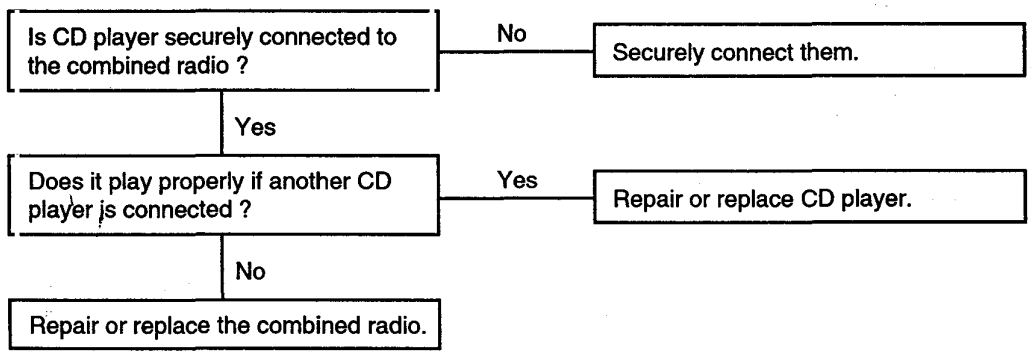
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT

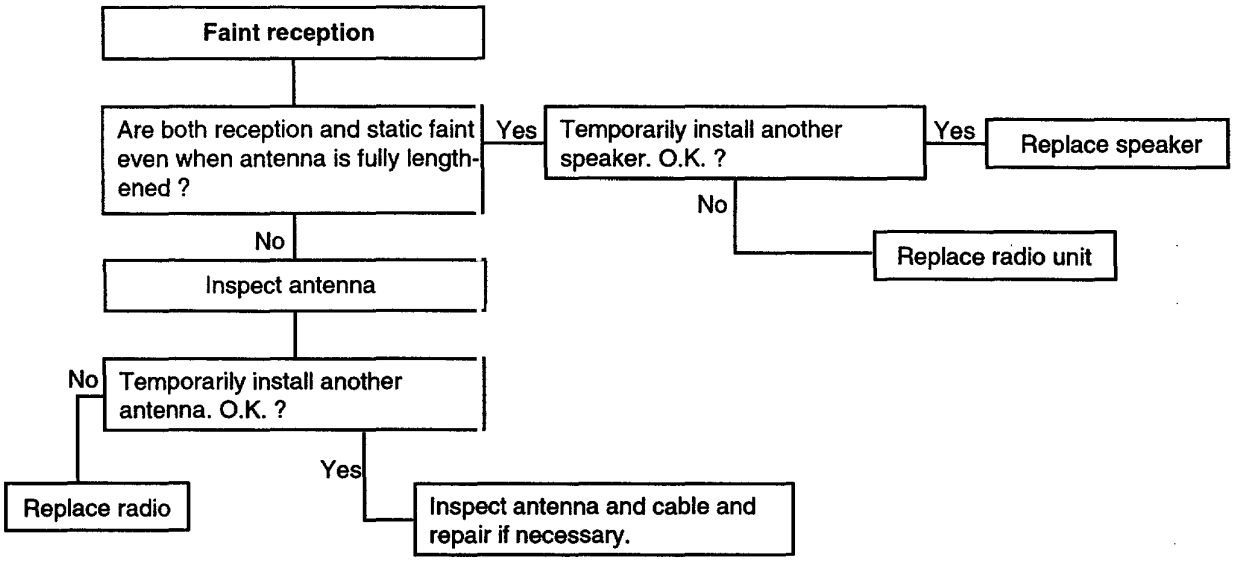


6. NO SOUND FROM ONE SPEAKER



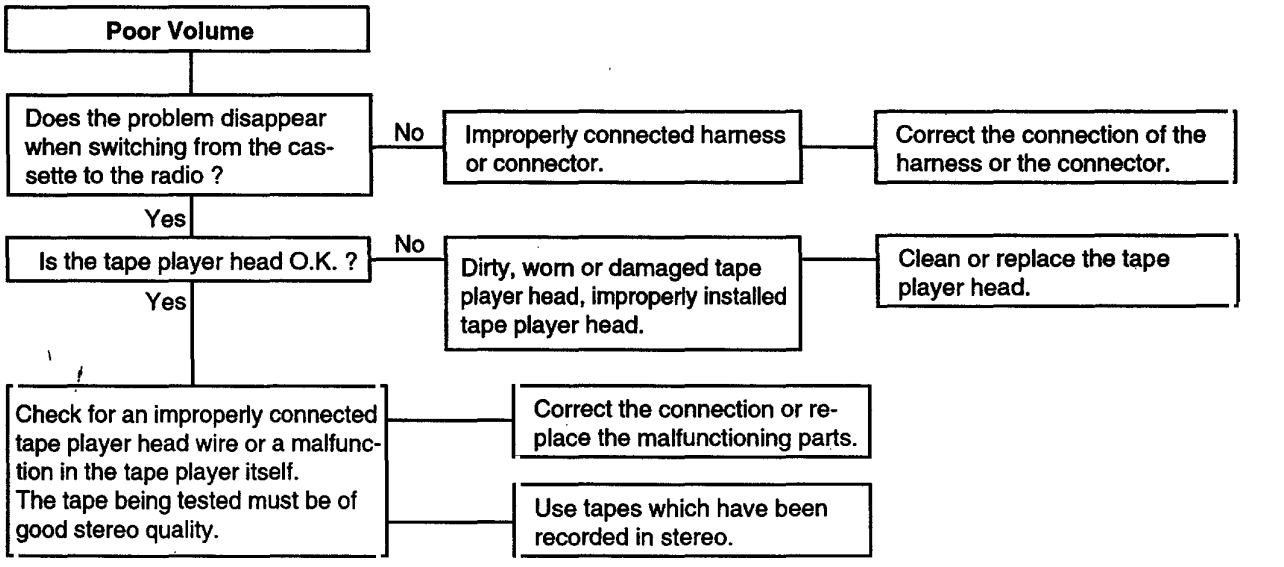
ETA9010J

CHART 6



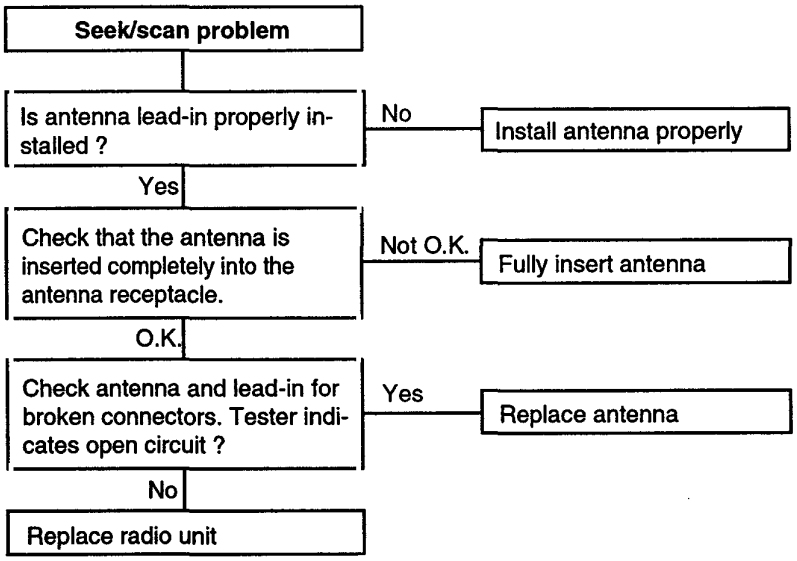
ETA9010K

CHART 7



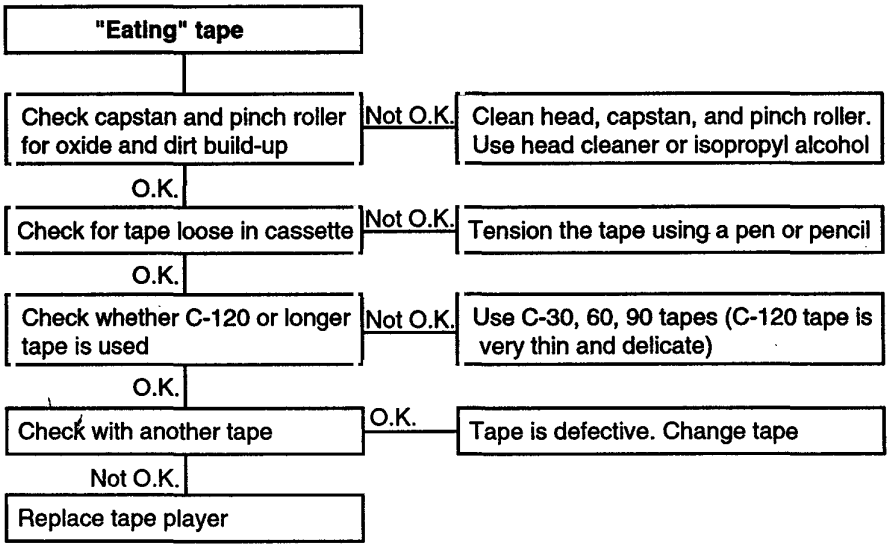
ETA9010L

CHART 8



ETA9010M

CHART 9

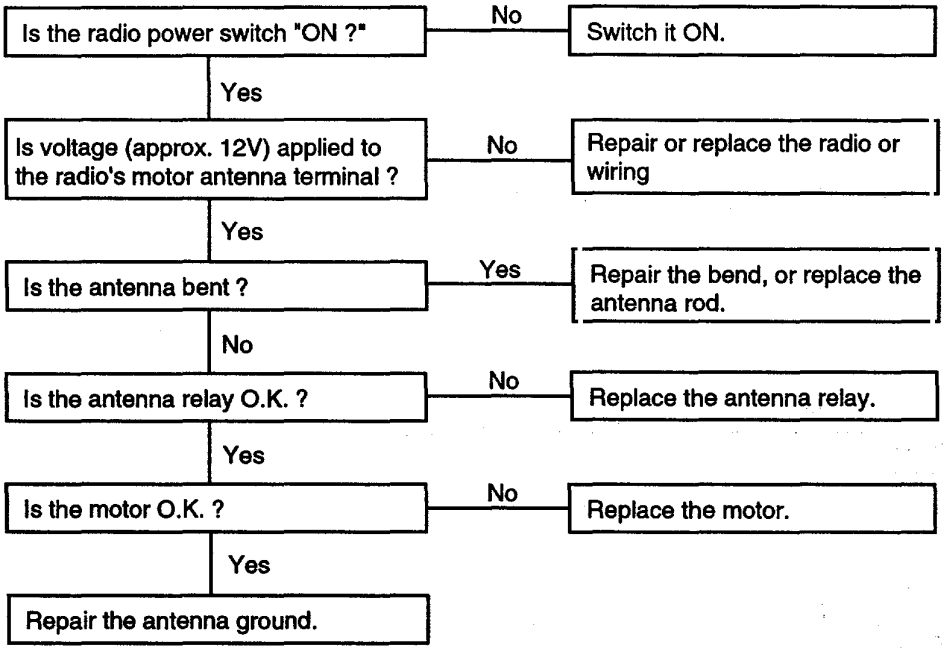


ETA9010N

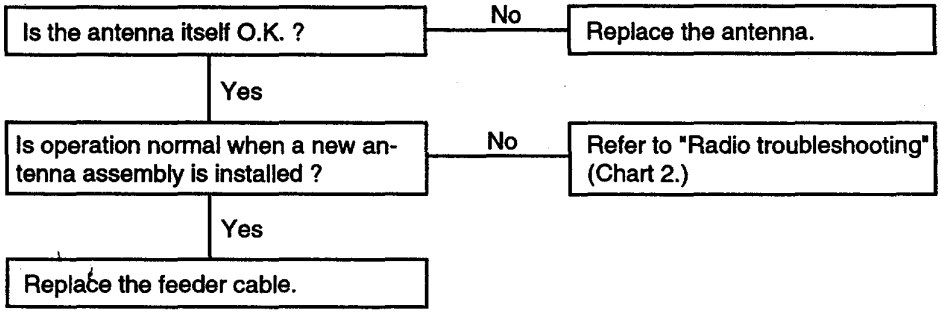
CHART 10

1. MOTOR ANTENNA WON'T EXTEND OR RETRACT

Clean and polish the surface of the antenna rod.



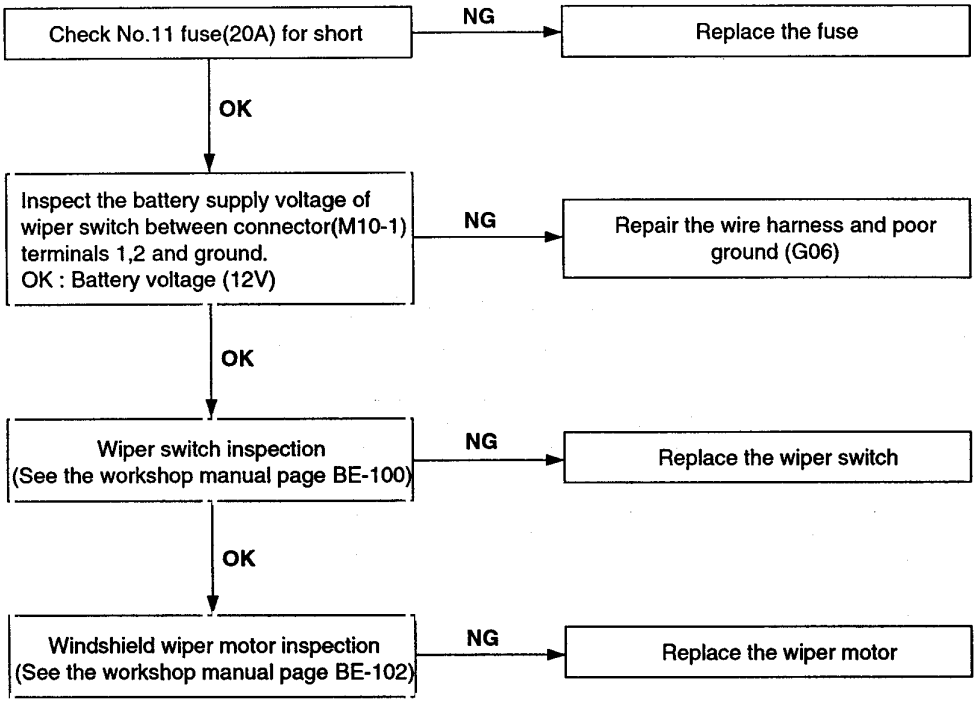
2. MOTOR ANTENNA EXTENDS AND RETRACTS BUT DOES NOT RECEIVE



ETAA010P

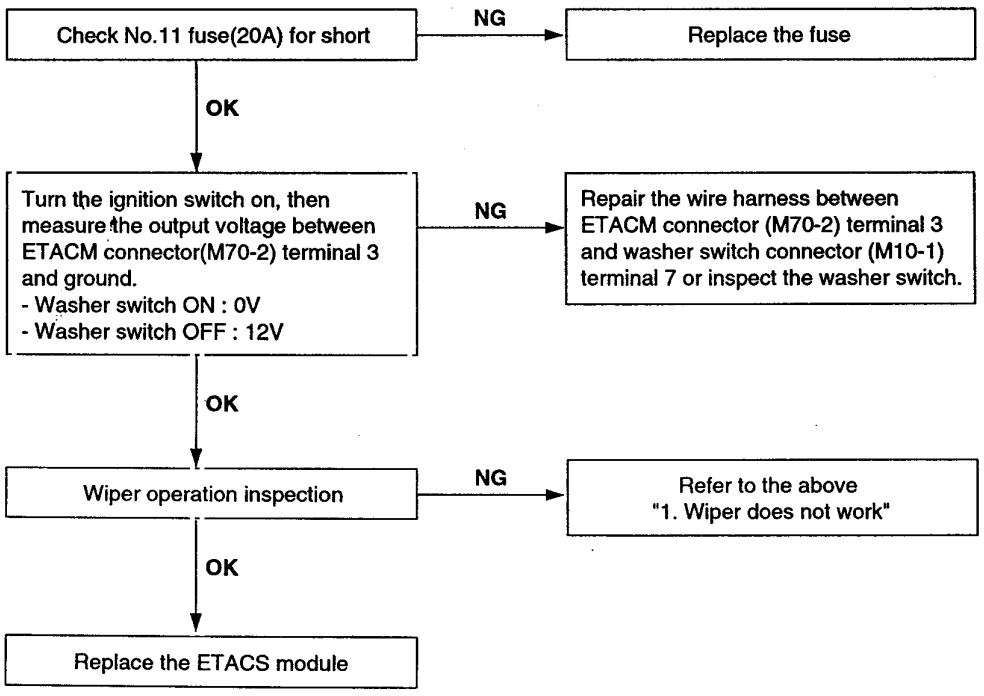
WINDSHIELD WIPER

1. Wiper low and wiper high does not work.



ETDD001E

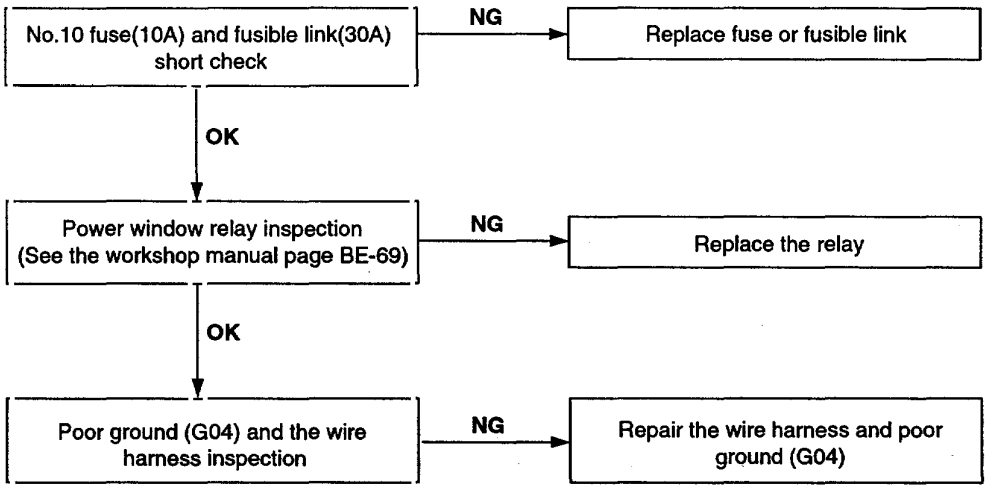
2. When washer switch is on, wiper does not work.



ETDD001F

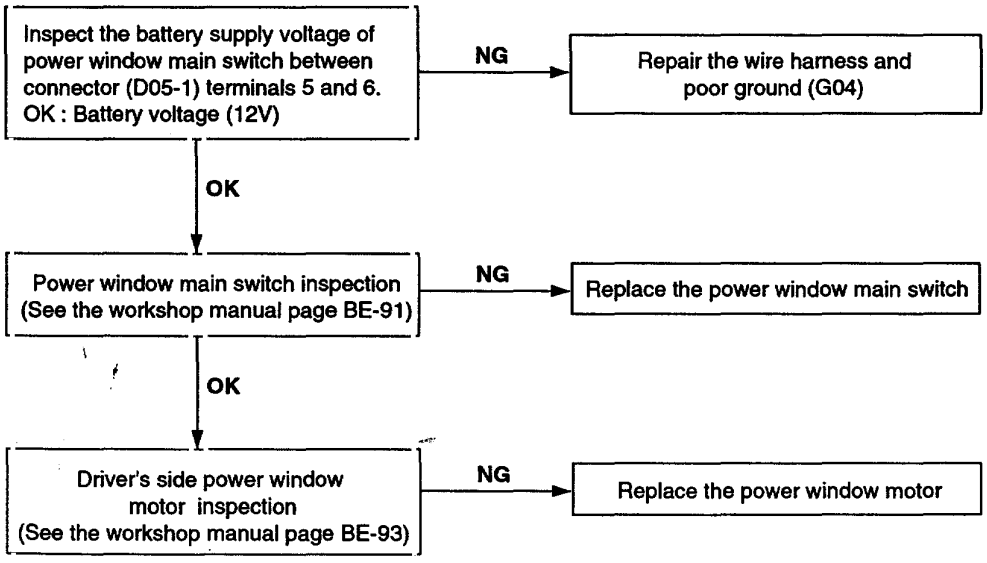
POWER WINDOW

1. No windows operate from the main switch on the driver's door.



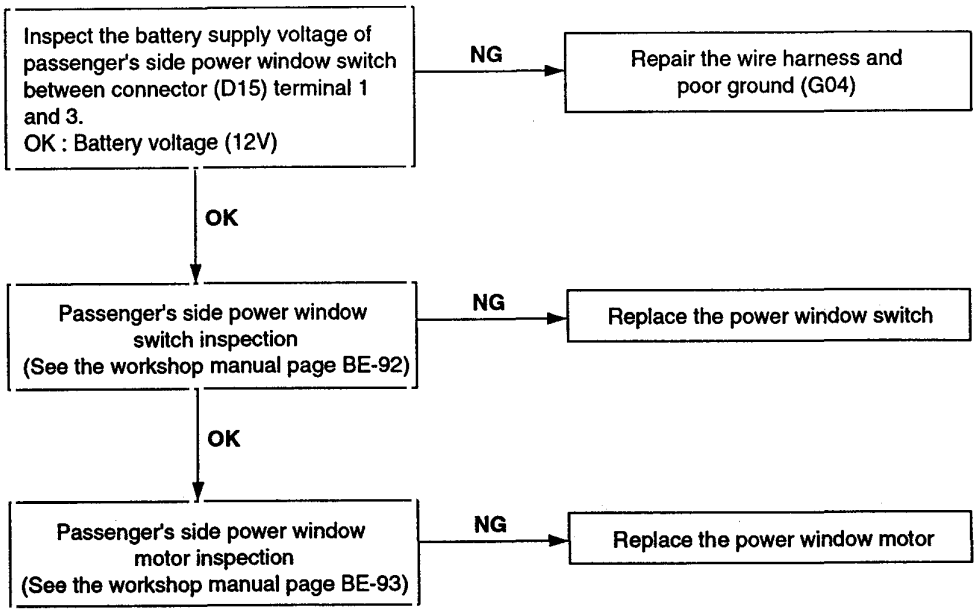
ETDD001G

2. Driver's side window does not operate.



ETDD001H

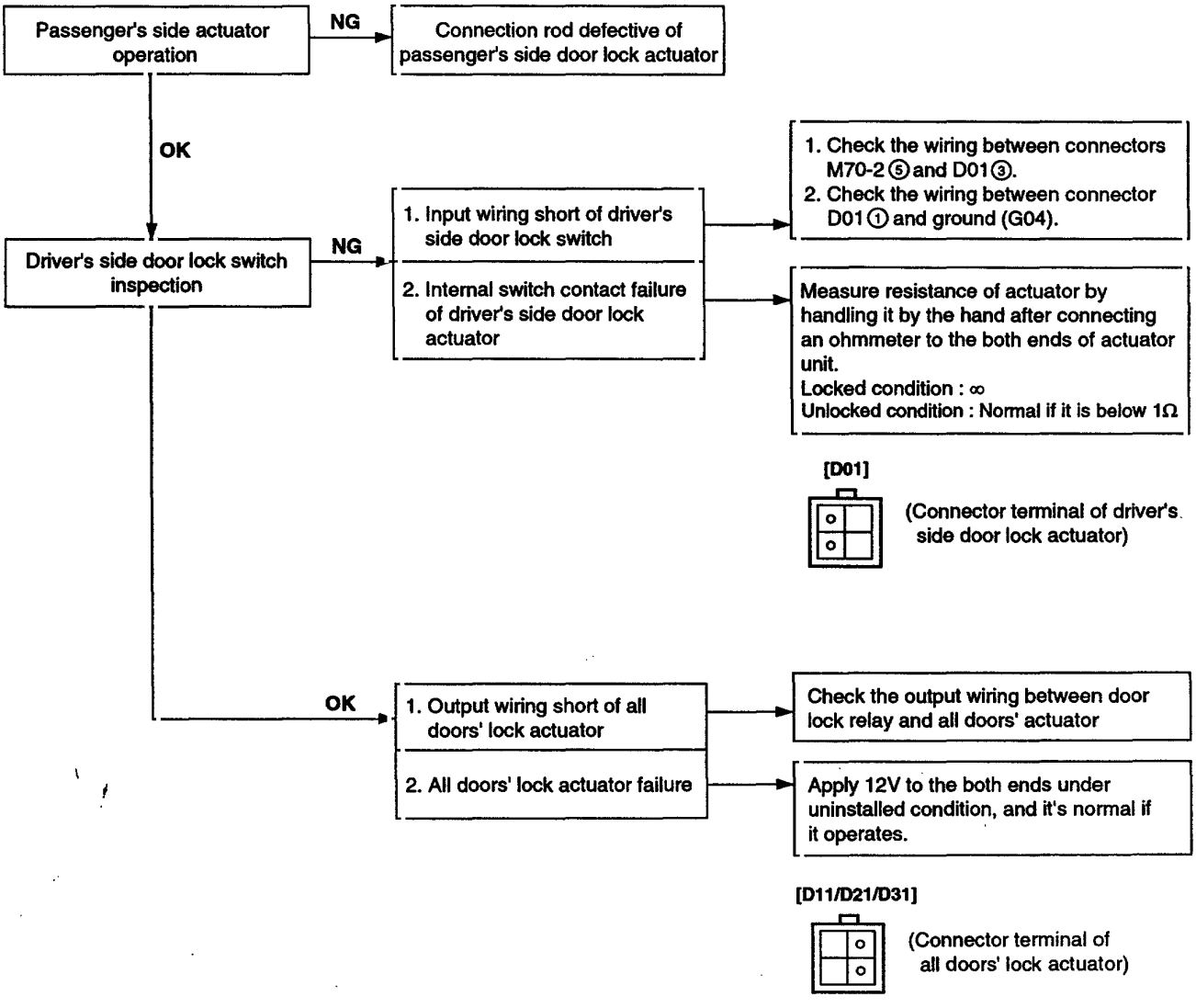
3. Passenger's side window does not operate.



ETDD001I

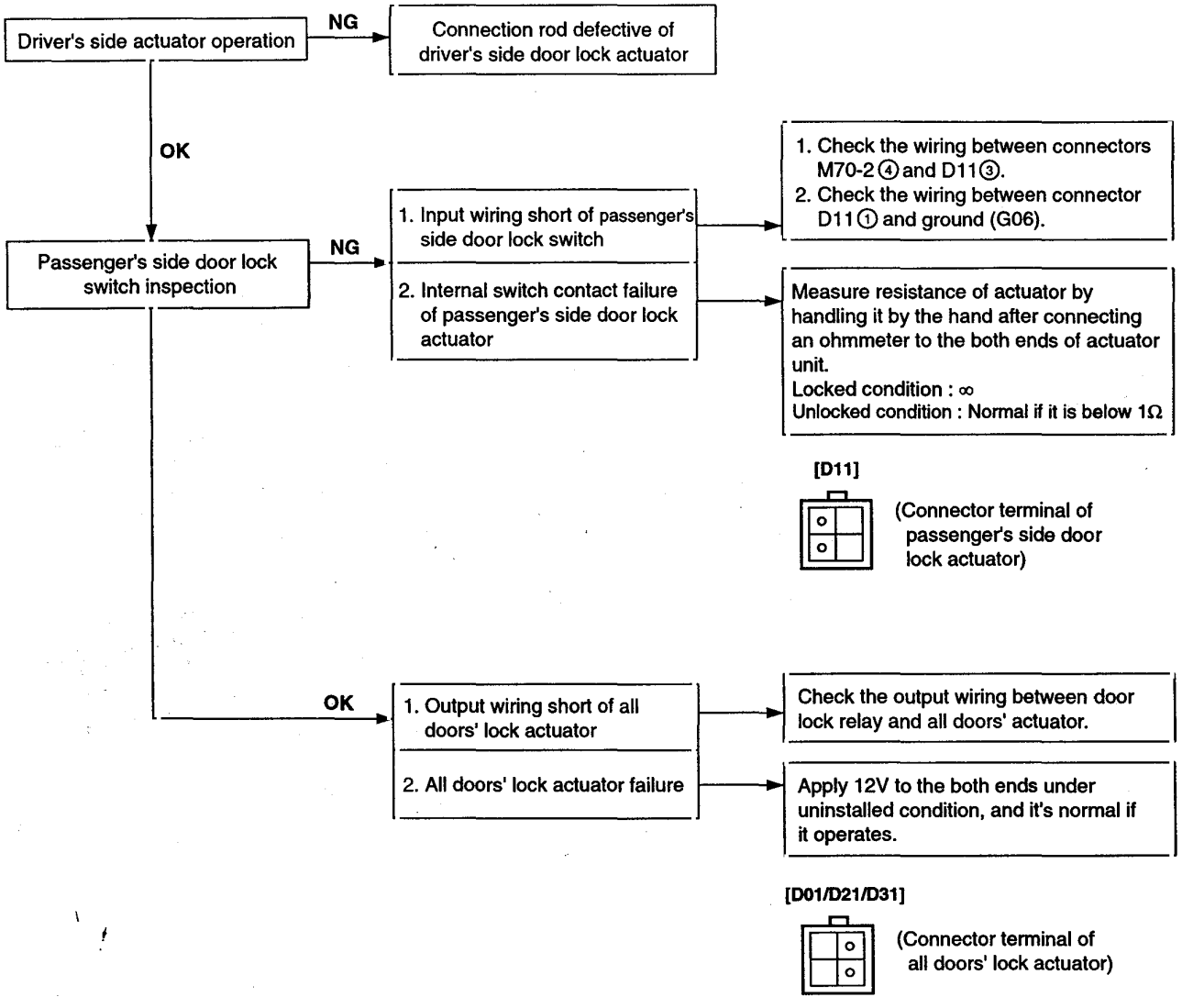
POWER DOOR LOCK

1. Lock function works but unlock function does not interlock.
   ⇒ Since door unlock relay is fail, replace the door unlock relay.
2. Unlock function works but lock function does not interlock.
   ⇒ Since door lock relay is fail, replace the door lock relay.
3. When passenger side knob is controlled, all doors interlocks, but when driver side knob is controlled, all doors do not interlock.



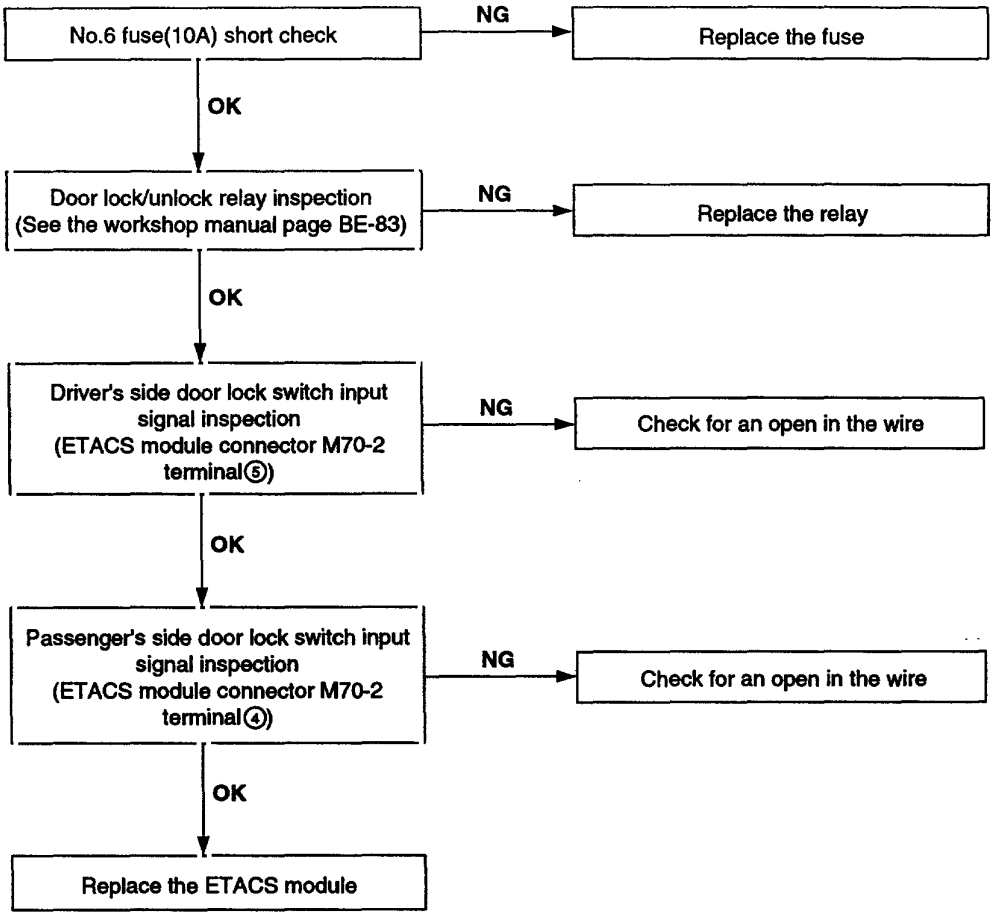
ETDD001J

4. When passenger side knob is controlled. All doors interlocks. But when the driver side knob is controlled, all doors do not interlock.



ETDD001K

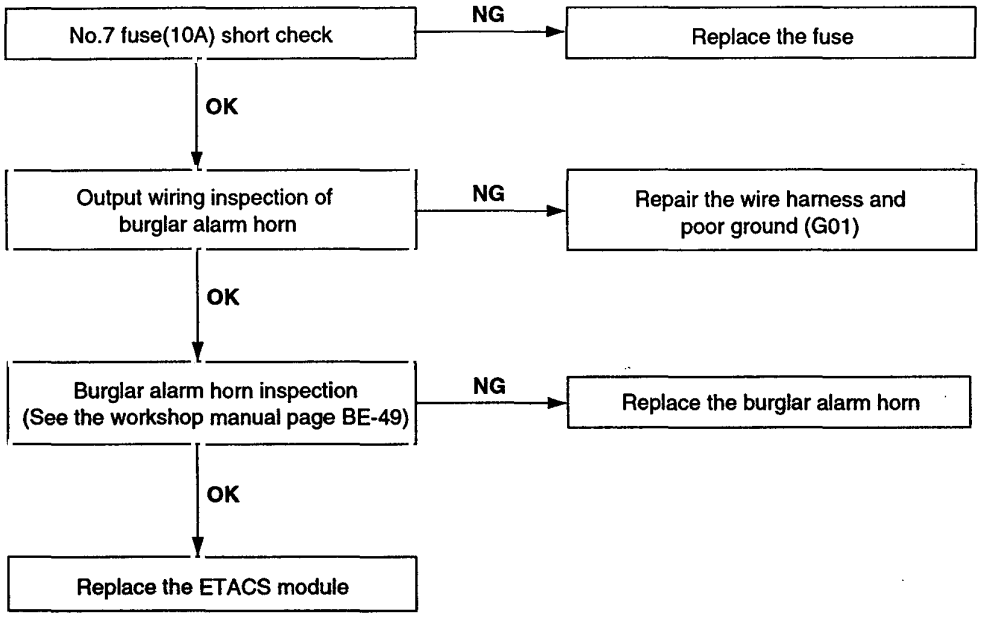
5. Both sides do not interlock either.



ETDD001L

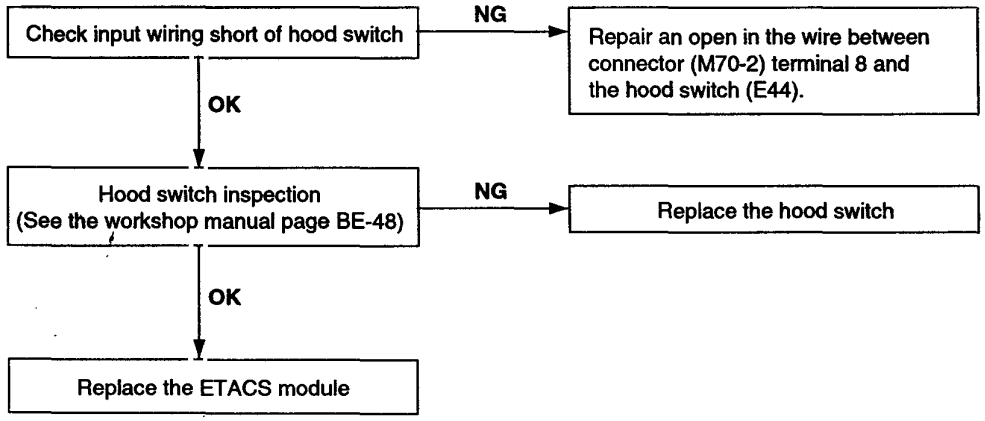
KEYLESS ENTRY & BURGLAR ALARM SYSTEM

1. Alarm does not work. (Hazard lamp works)



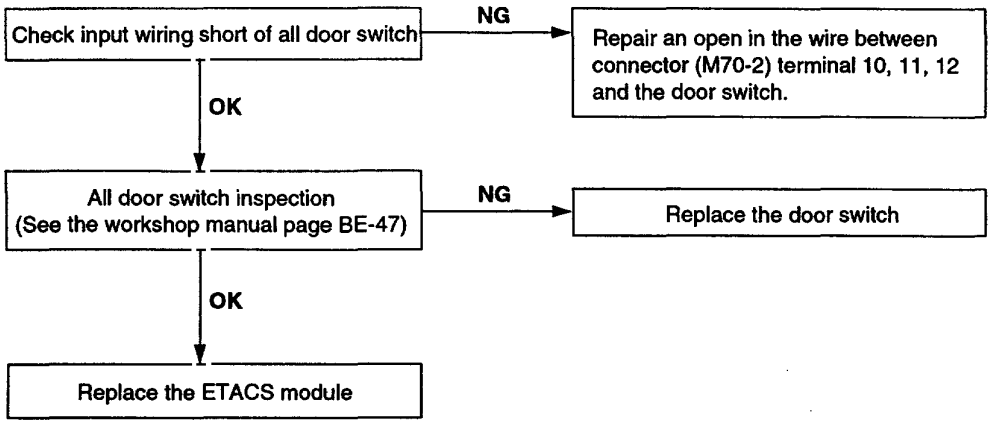
ETDD001M

2. When hood is opened inside the car like alarm test, horn does not work.



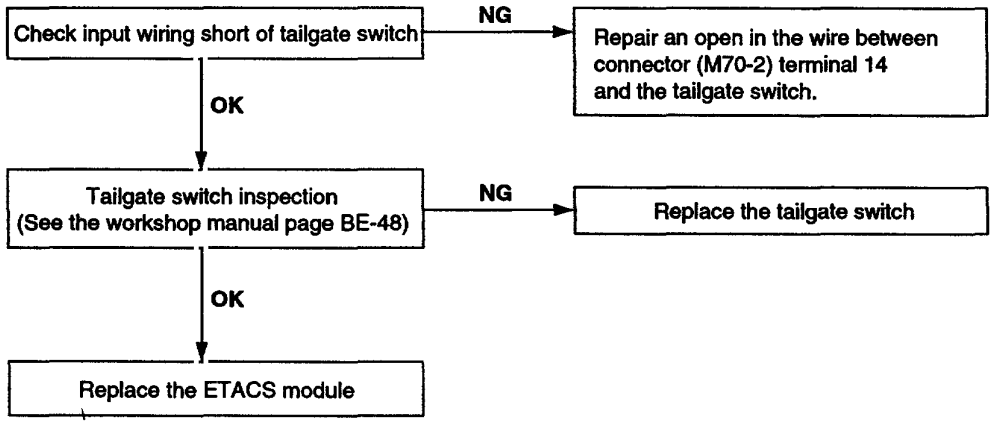
ETDD001N

3. When door is opened inside the car like alarm test, horn does not work (If tailgate and hood is opened, alarm works)



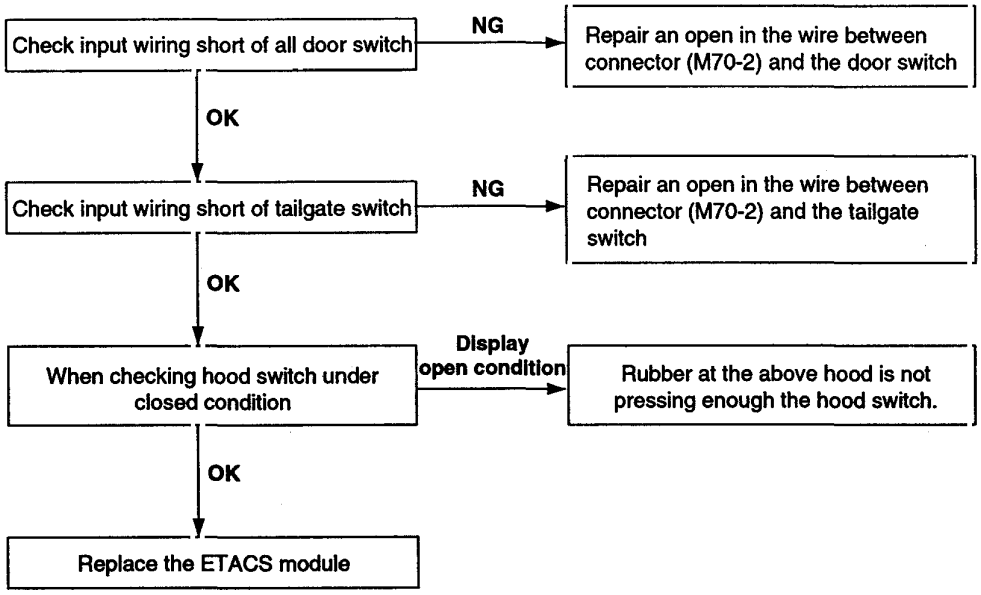
ETDD001O

4. When tailgate is opened inside the car like alarm test, horn does not work.



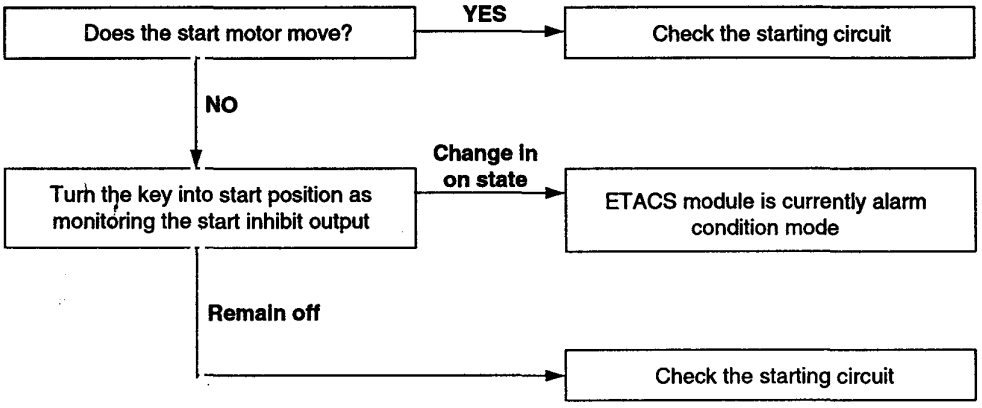
ETDD001P

5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



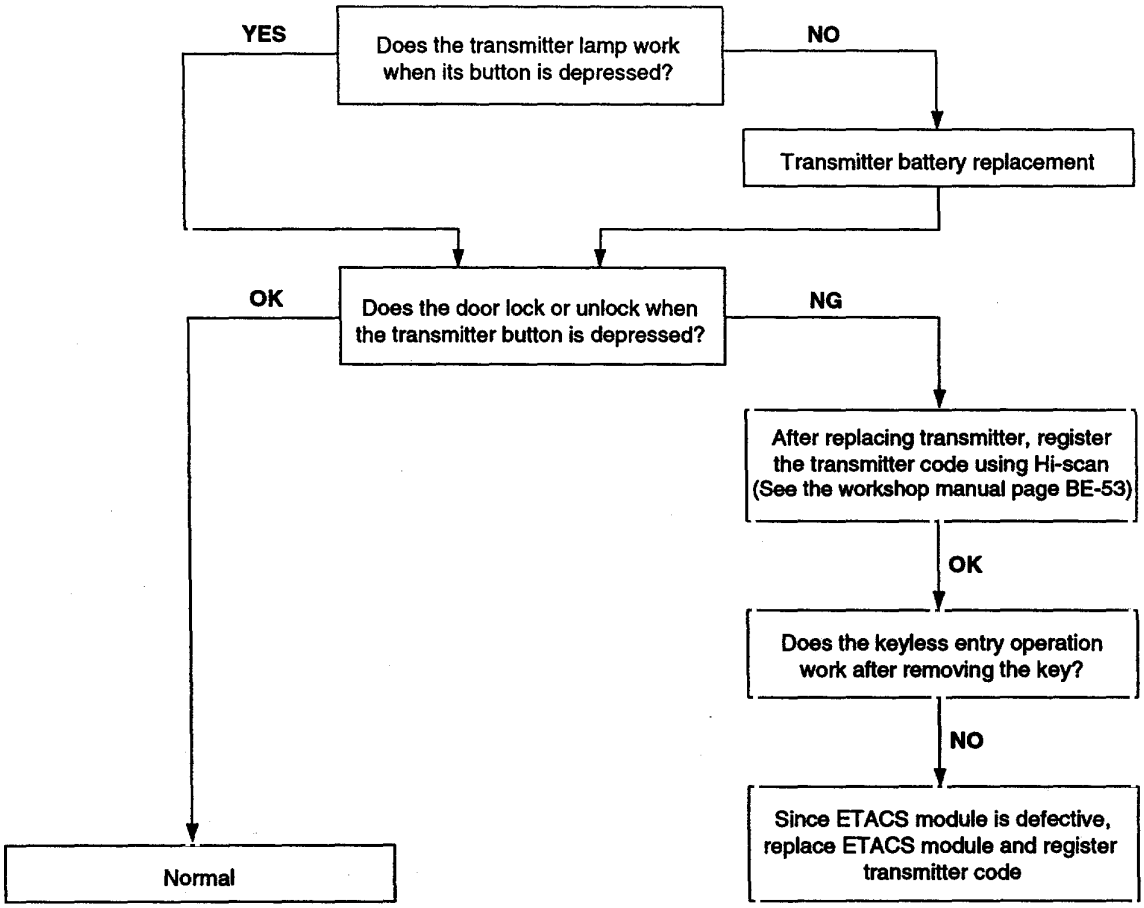
ETDD001Q

6. Engine does not start, when the alarm released condition.



ETPD001R

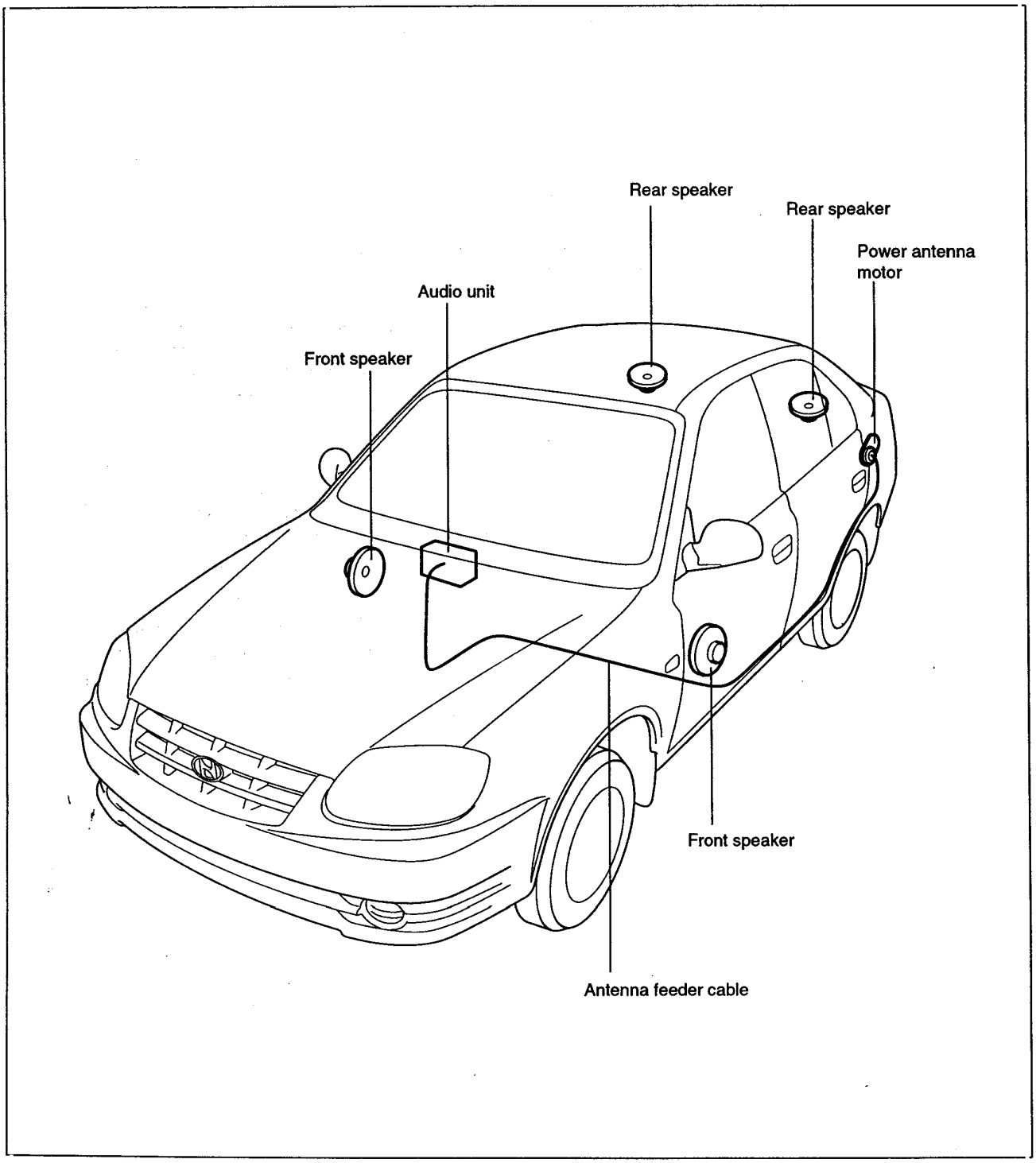
7. Central door lock function works, but keyless entry system does not work.



ETDD001S

AUDIO SYSTEM

COMPONENTS E15C58E9

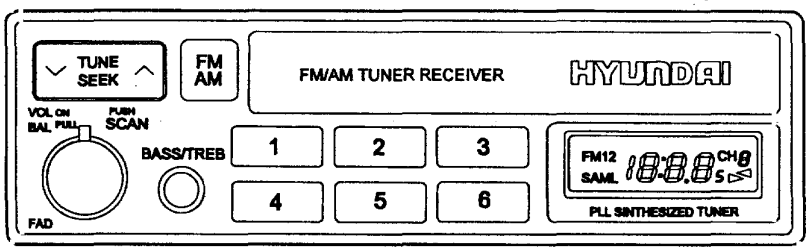


ETDD210A

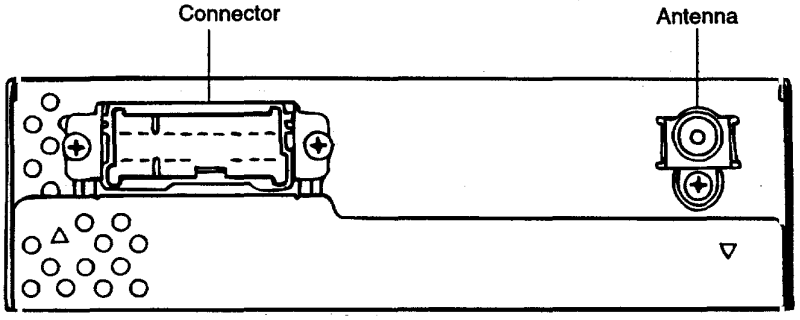
AUDIO UNIT

COMPONENTS E3FE8FD6

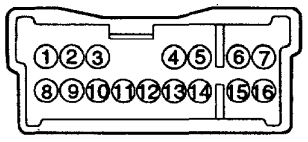
[H210]



ETJA001W



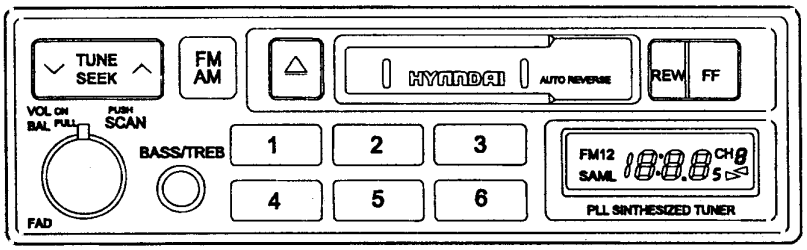
ETJA001X

Connector	Terminal	Description
	1	Antenna
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

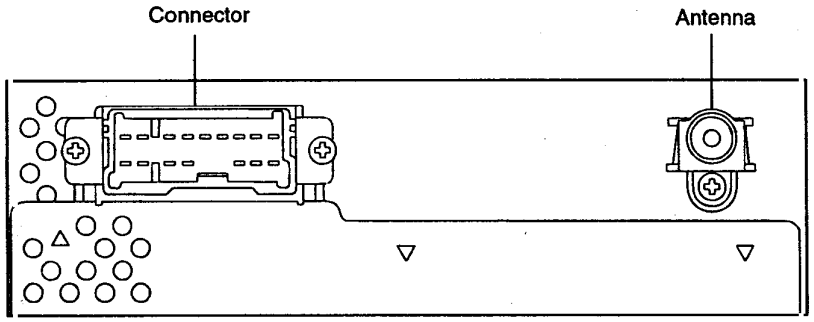
ETJA001C

ETDD520A

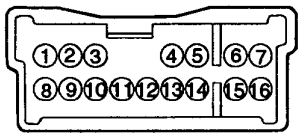
[H220]



ETKA010A



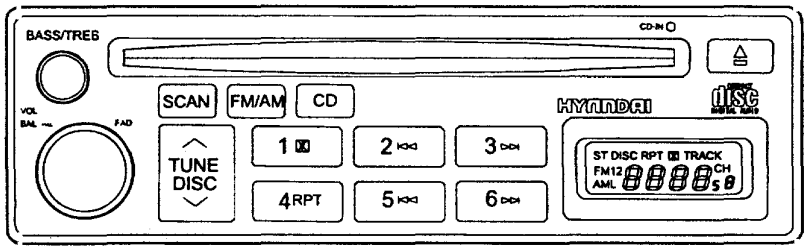
ETKA010B

Connector	Terminal	Description
	1	Antenna
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

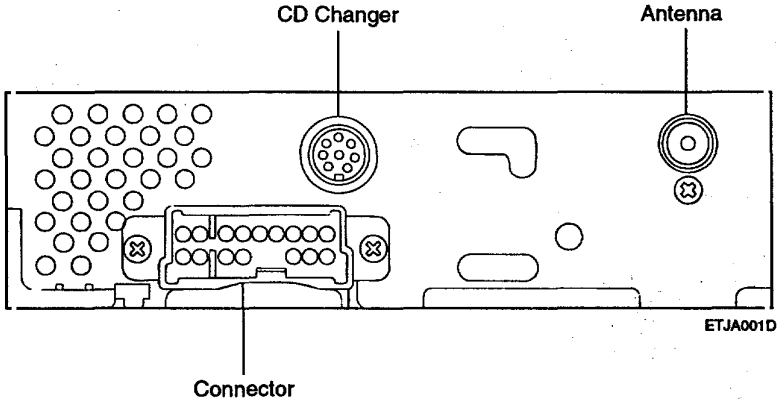
ETJA001C

ETDD520B

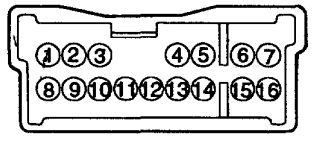
[H260]



ETJA001E



ETJA001D

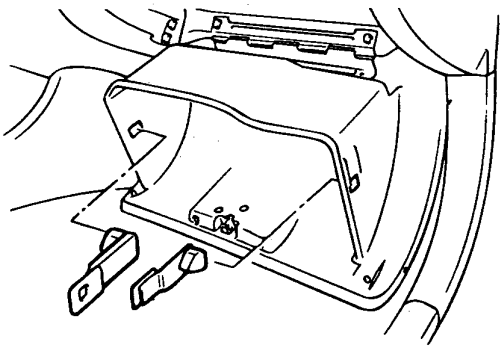
Connector	Terminal	Description
 ETJA001C	1	N.C.
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

Connector	Terminal	Description
(CD Changer)  ETJA001G	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

ETDD520D

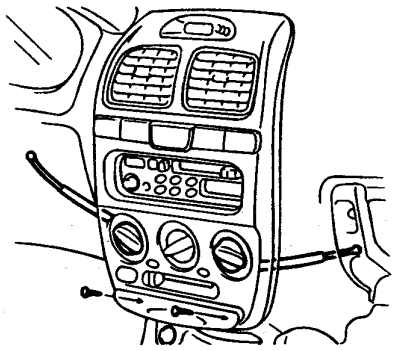
REMOVAL AND INSTALLATION E131AA95

1. Disconnect the negative battery terminal.
2. Remove the glove box.
3. Disconnect the heater control cables under the glove box and lower crashpad.



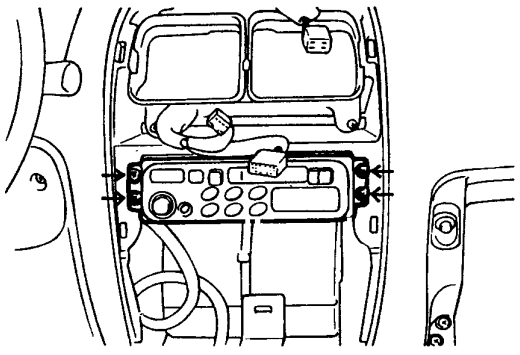
ETDA015B

4. Loosen the screws and remove the center facia panel.



ETDA015C

5. Remove the audio mounting screws (4EA) and the audio system.



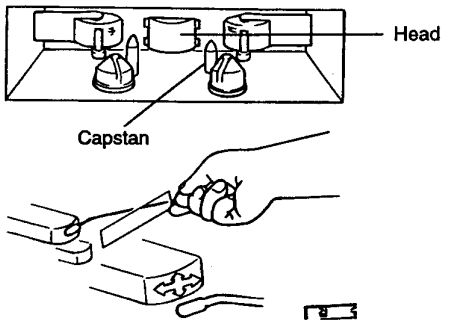
ETDA015D

6. Installation is the reverse of removal.

INSPECTION E12D99FC

TAPE HEAD AND CAPSTAN CLEANING

1. To obtain optimum performance, clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing alcohol. Wipe the head and capstan.



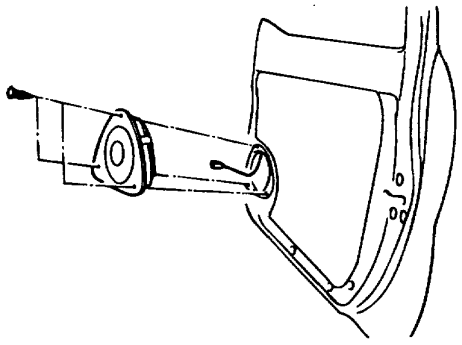
ETA9035A

SPEAKERS

REMOVAL AND INSTALLATION EEB9BA02

FRONT SPEAKER

1. Remove the front door trim panel and front speaker. (Refer to BD section)

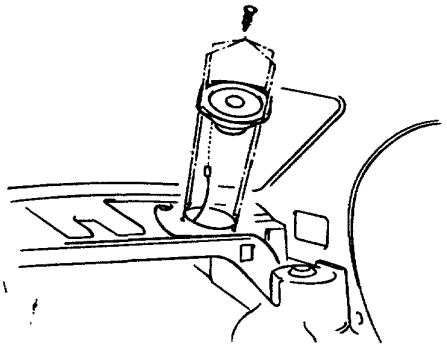


ETDA017A

2. Installation is the reverse of removal.

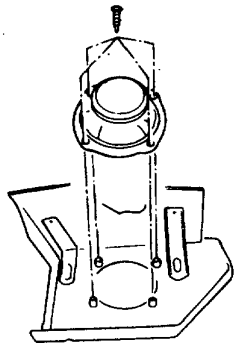
REAR SPEAKER

1. Remove the rear package tray or covering shelf trim. (Refer to BD section)



ETDA017B

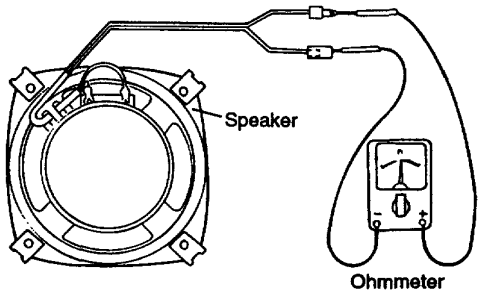
2. Remove the rear speaker.



ETDA017C

INSPECTION EC1BDD7D

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedanceofthe speaker when checking between the speaker (+) and speaker (-) of thesame channel, the speaker is ok.
2. If a clicking sound is emitted from the speaker when the ohmmeter is connectedto the speaker terminals, the speaker is ok.

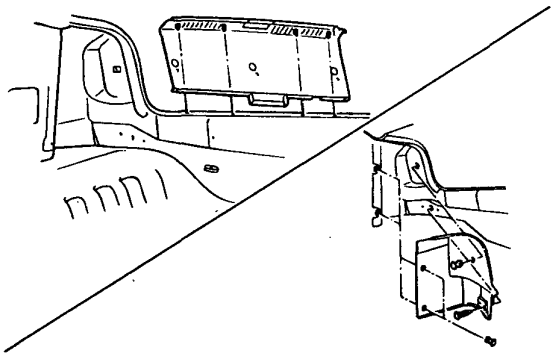


ETA9040A

ANTENNA

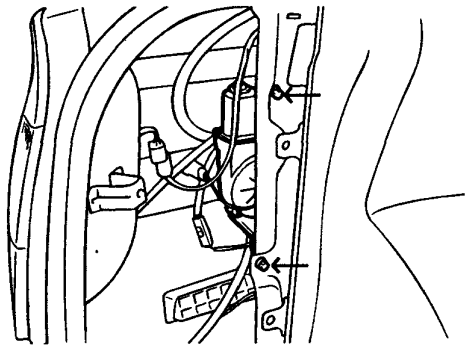
REMOVAL AND INSTALLATION EC0EE7EA

1. Disconnect the negative battery terminal.
2. Remove the rear transverse trim and left side luggage rear trim.



ETDA016A

3. Remove the antenna mounting nut and bolt. Disconnect the wiring connector and the antenna feeder cable.

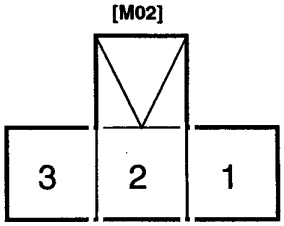


ETDA016C

4. Installation is the reverse of removal.

INSPECTION EBF9AE5A

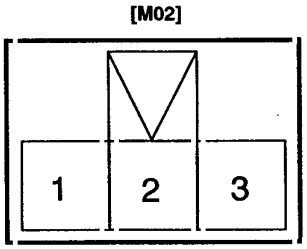
1. Disconnect the connector from the antenna assembly.
2. Check if the battery voltage is measured between terminal 1 and 3 of harnessside at all time.
3. Check if the battery voltage is measured between terminal 1 and 2 of the harnessside when the ignition switch and audio switch are turned on.



Harness side

ETFA020C

4. After connecting battery source to terminal 2 and 3 of the component side,check if the motor operates properly (Antenna moves up.)
5. Check if the motor operates (antenna moves down) when terminal 2 is disconnectedfrom battery source.



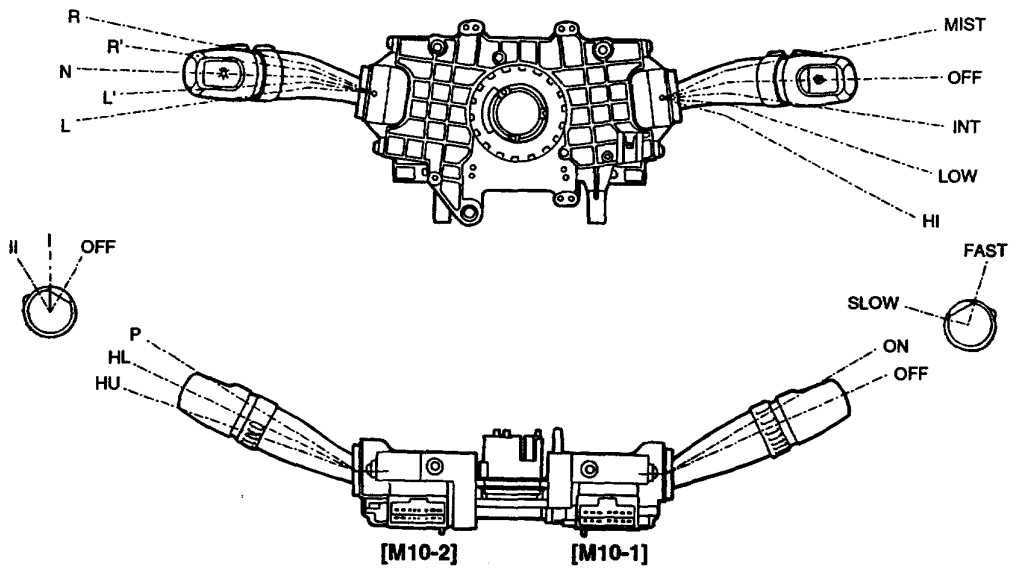
Component side

ETFA020D

MULTI FUNCTION SWITCH

COMPONENTS ECC6D2D2

[WITHOUT AIR BAG]



M10-2

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

M10-1

1	2	3	4	5	6	7
8	9	10	11	12	13	14

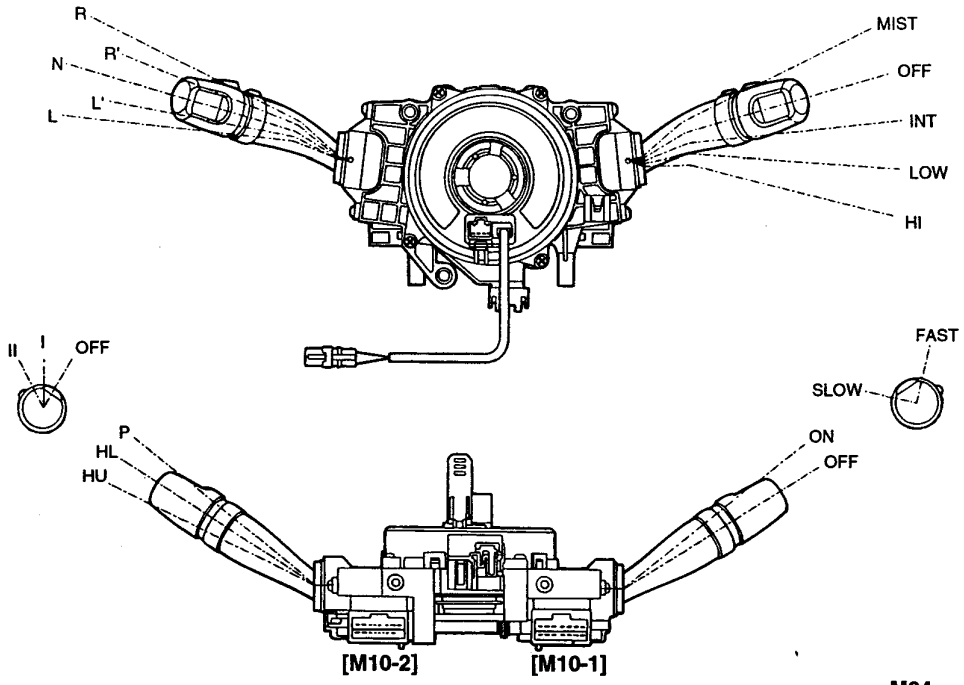
Circuit connection

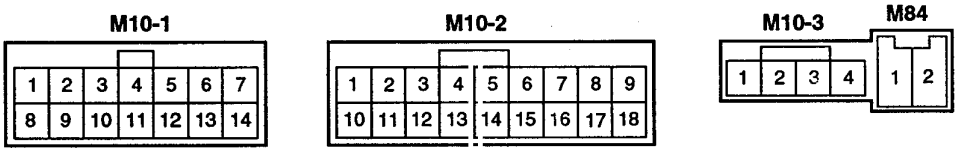
Connector No.	Terminal No.	Description
M10-2	1	Head lamp passing
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp
	8	Flasher unit power
	9	Turn signal LH lamp
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	-
	13	-
	14	Tail lamp switch
	15	Head lamp switch
	16	Rear fog lamp
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M10-1	1	Wiper high speed
	2	Wiper low speed
	3	Wiper parking
	4	Mist switch
	5	Wiper & washer ground
	6	Intermittent wiper
	7	Front washer switch
	8	Horn
	9	-
	10	-
	11	-
	12	-
	13	Intermittent wiper volume
	14	Intermittent wiper ground

ETDD030Z

[WITH AIR BAG]





Circuit connection

Connector No.	Terminal No.	Description
M10-2	1	Head lamp passing
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp
	8	Flasher unit power
	9	Turn signal LH lamp
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	-
	13	-
	14	Tail lamp switch
	15	Head lamp switch
	16	Rear fog lamp
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M10-1	1	Wiper high speed
	2	Wiper low speed
	3	Wiper parking
	4	Mist switch
	5	Wiper & washer ground
	6	Intermittent wiper
	7	Front washer switch
	8	-
	9	-
	10	-
	11	-
	12	-
	13	Intermittent wiper
	14	Intermittent wiper ground
M84	1	Driver initiator low
	2	Driver initiator high
M10-3	1	Horn (B+)
	2	-
	3	-
	4	-

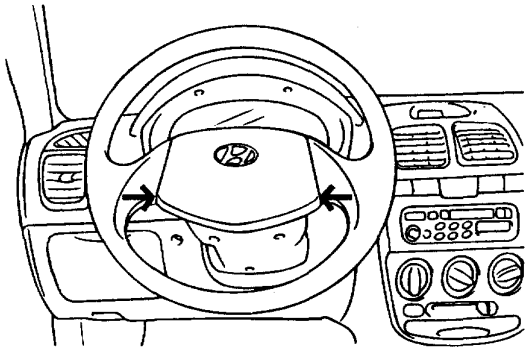
ETDD030Y

MULTI FUNCTION SWITCH

REMOVAL AND INSTALLATION E664A584

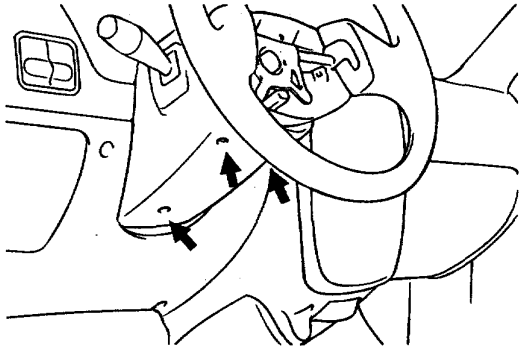
WITHOUT AIR BAG

1. Remove the horn pad and steering wheel.



ETDA035A

2. Remove the upper and lower steering column shrouds.



ETDA035B

3. Remove the multifunction switch assembly mounting screws and remove the multifunction switch assembly.
4. Installation is the reverse of removal.

WITH AIR BAG

Prior to removing of the multifunction switch assembly in vehicles equipped with air bags, be careful to keep the following items.

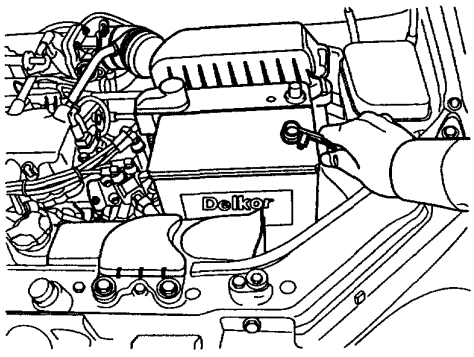
⚠ CAUTION

- ***Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.***
- ***Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust are detected.***
- ***The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.***
- ***Do not expose the air bag module to temperatures over 93°C (200°F).***
- ***After deployment of an air bag, replace the clock spring with a new one.***
- ***Wear gloves and safety glasses when handling an air bag that has already been deployed.***
- ***An undeployed air bag module should only be disposed of in accordance with the procedures. mentioned in the Restraints section.***
- ***When you disconnect the air bag module-clock spring connector, take care not to apply excesive force to it.***
- ***The removed air bag module should be stored in a clean, dry place.***
- ***Prior to installing the clock spring, align the mating mark and "NEUTRAL" position indicator of the clock spring, and, after turning the front wheels to the straight-ahead position, install the clock spring to the column switch. If the mating mark of the clock spring is not properly aligned, the steering wheel may not completely rotate during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver. To inspect the clock spring, refer to the Restraints section.***

1. Disconnect the negative battery terminal.

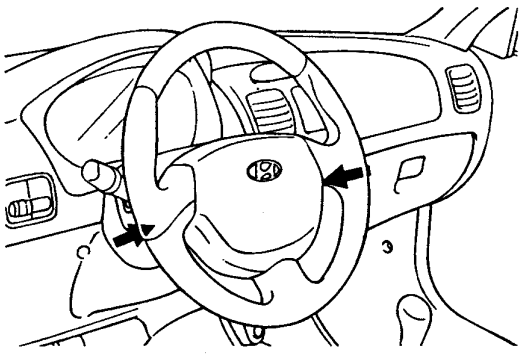
NOTE

Prior to doing any further work after disconnection of the battery cable, wait at least 30 seconds.



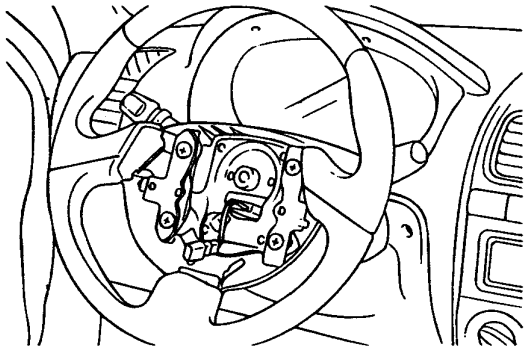
KPPD004A

2. Remove the air bag module mounting bolts (2EA) with an asterix wrench. (Tor-x socket)
Disconnect the horn connector and the air bag module connector, and remove the air bag module.



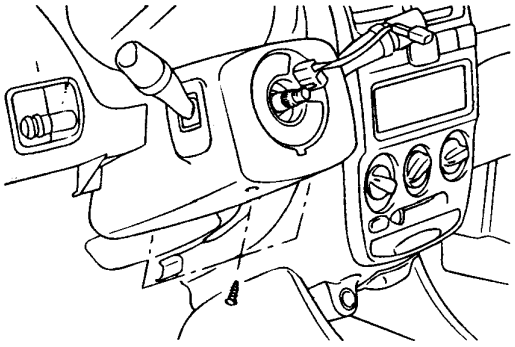
ETDA035D

3. Remove the steering wheel after removing a nut.



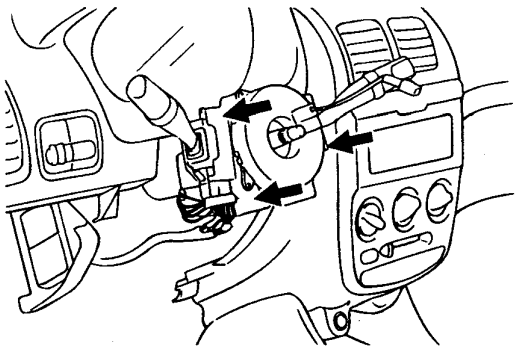
ETDA035E

4. Remove the steering column upper and lower shrouds using a phillips screwdriver.



ETDA035G

5. Remove the multifunction switch assembly mounting screws (3EA) and multifunction switch assembly after removal of the connectors.



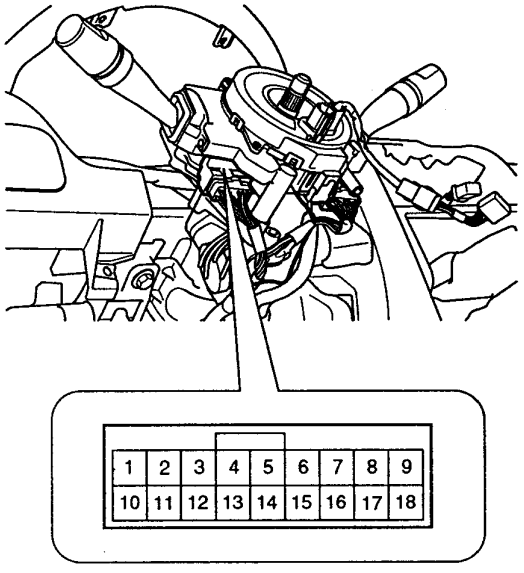
ETDA035H

6. Installation is the reverse of removal.

INSPECTION E2517BFD

LIGHTING SWITCH INSPECTION

With the multifunction switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



KTDD075G

LIGHTING SWITCH (CONNECTOR NO. : M10-2)

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	○	○

ETFA040A

DIMMER AND PASSING SWITCH (CONNECTOR NO. : M10-2)

Position \ Terminal	1	2	10	11
HU		○	—	○
HL			○	○
P	○	○	—	○

HU : Head lamp high beam
HL : Head lamp low beam
P : Head lamp passing switch

ETFA040B

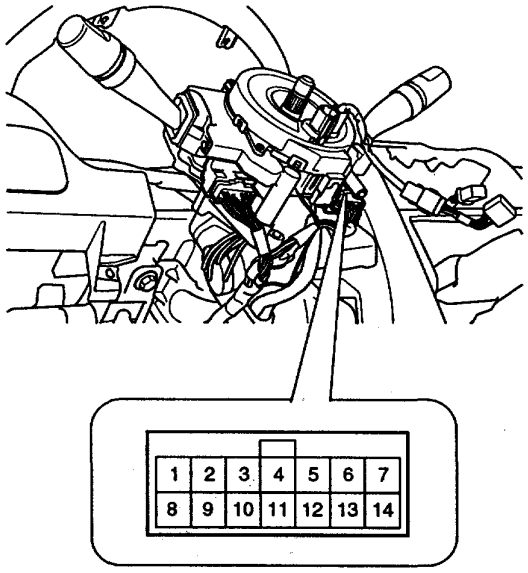
TURN SIGNAL SWITCH (CONNECTOR NO. : M10-2)

Hazard switch \ Terminal / Turn signal switch	7	8	9
OFF — L		○	○
OFF — N			
OFF — R	○	—	○

ETFA040C

WIPER AND WASHER SWITCH INSPECTION

With the multifunction switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



KTDD075I

WIPER SWITCH (CONNECTOR NO. : M10-1)

Position \ Terminal	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○	—	—	○			
HI	○	—	—	—	○			

ETFA040D

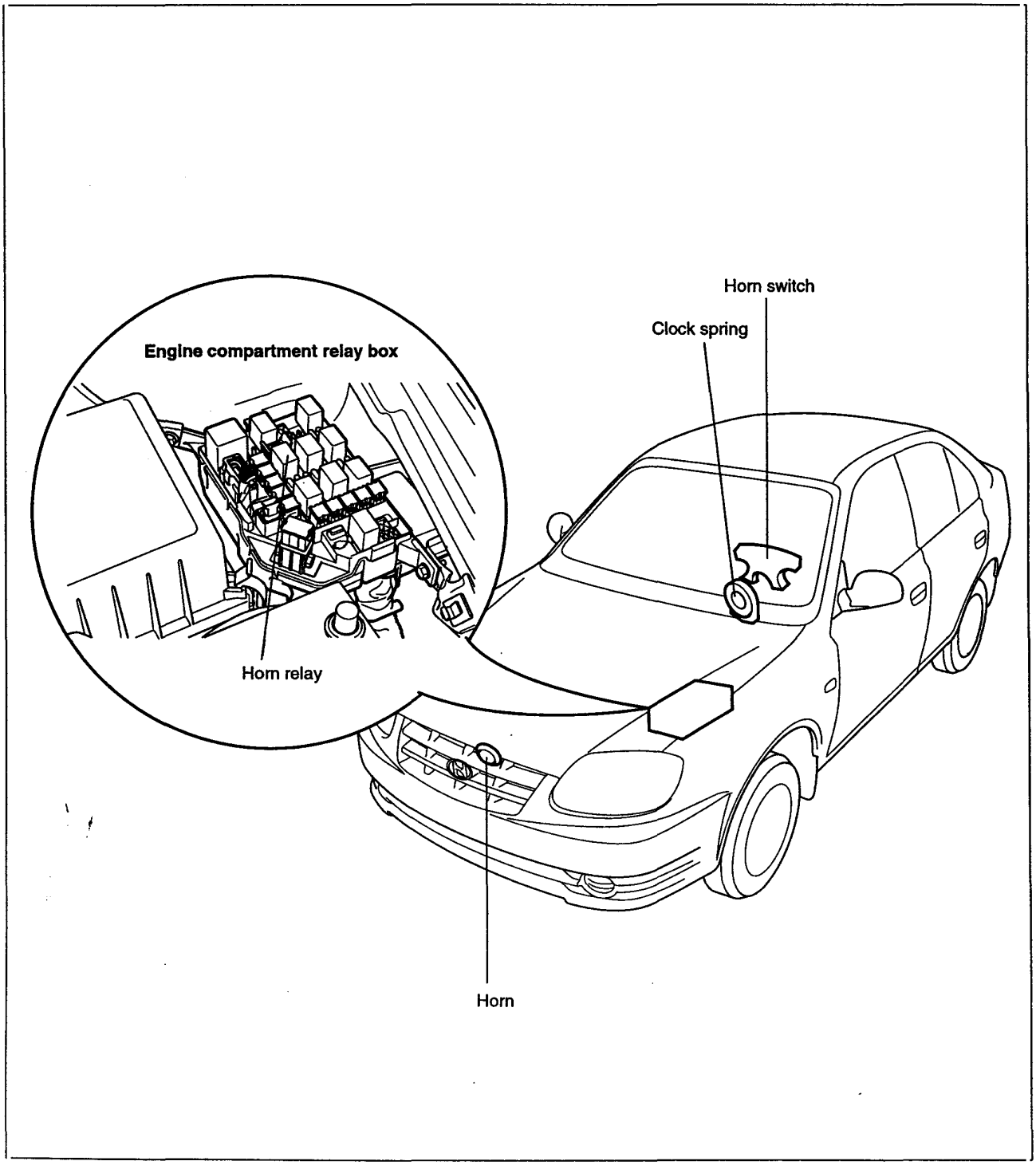
WASHER SWITCH (CONNECTOR NO. : M10-1)

Position \ Terminal	5	7
OFF		
ON	○	○

ETFA040E

HORNS

COMPONENTS EDA8909E

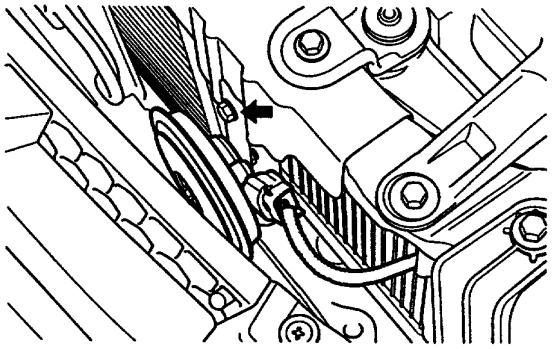


ETDD210B

HORN

REMOVAL AND INSTALLATION E9B2280E

1. Remove the bolt and disconnect the horn connector, then remove the horn.



KTDC003C

2. Installation is the reverse of removal.

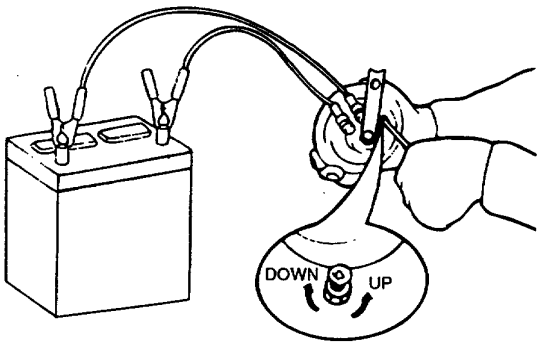
INSPECTION E44B76AB

1. Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

ADJUSTMENT

Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

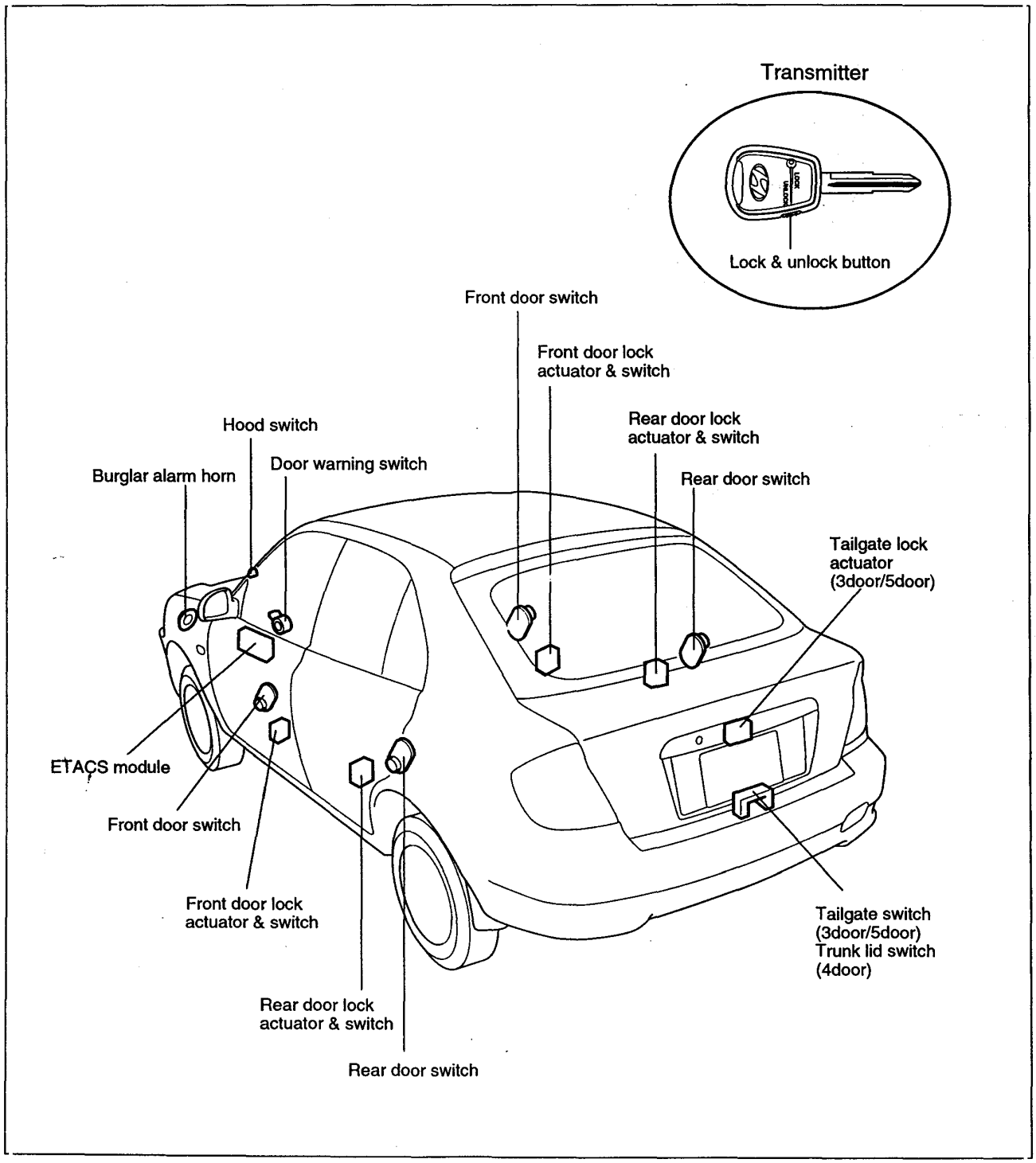
> **NOTE**
> *After adjustment, apply a small amount of paint around the screw head to keepit from loosening.*



ETDA050A

KEYLESS ENTRY AND BURGLAR ALARM

COMPONENTS EACF4CA2

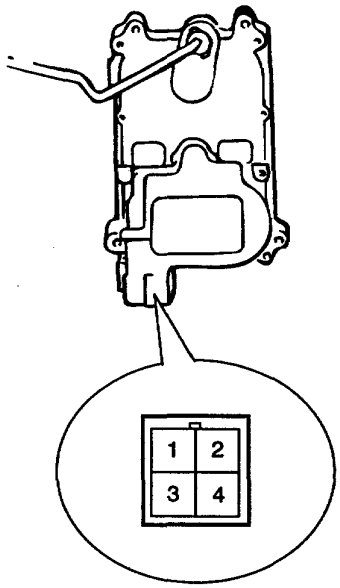


ETDD210C

INSPECTION E713CA2F

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Front door)
2. Disconnect the 4P connector from the actuator.



KTDD270A

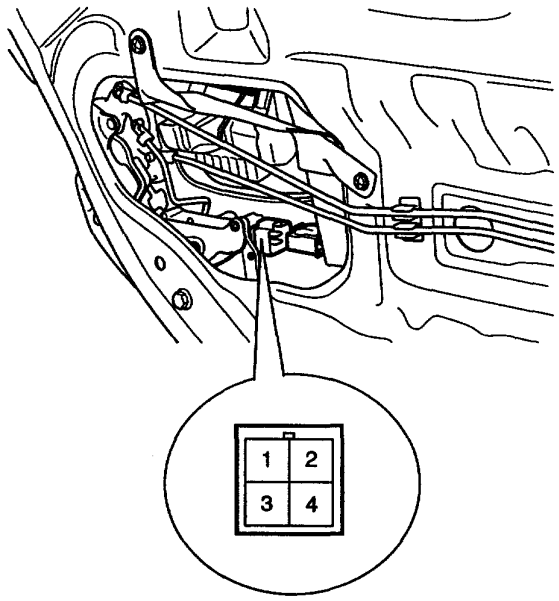
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Front left	Unlock	⊖	⊕
	Lock	⊕	⊖
Front right	Unlock	⊕	⊖
	Lock	⊖	⊕

ETDD270B

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Rear door)
2. Disconnect the 4P connector from the actuator.



KTDD275A

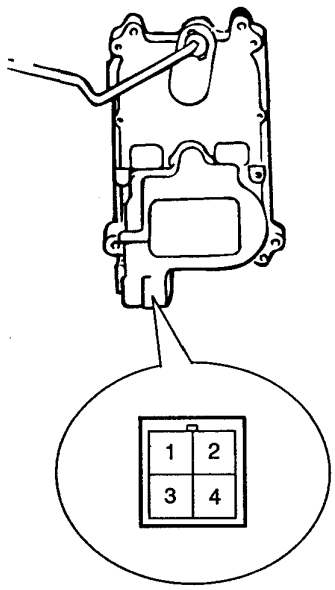
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Rear left	Lock	⊖	⊕
	Unlock	⊕	⊖
Rear right	Lock	⊕	⊖
	Unlock	⊖	⊕

ETDD275B

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Front door)
2. Disconnect the 4P connector from the actuator.



KTDD270A

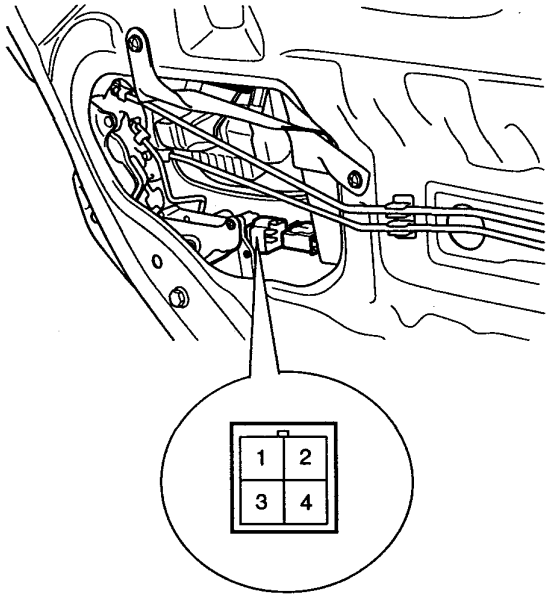
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	3
Front left	Lock		
	Unlock	○	○
Front right	Lock		
	Unlock	○	○

ETDD280B

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to BD group- Rear door)
2. Disconnect the 4P connector from the actuator.



KTDD275A

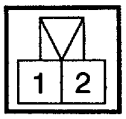
3. Check for continuity between the terminals in each switch position according to the table.

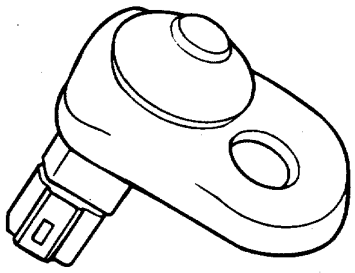
Position \ Terminal		1	3
Rear left	Lock		
	Unlock	○	○
Rear right	Lock		
	Unlock	○	○

ETDD285B

DOOR SWITCH INSPECTION

Remove the door switch and check for continuity between the terminals.





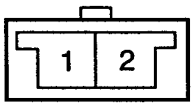
V5BE060P

Position \ Terminal	Ground(Body)	1	2
Free(Door open)	○	○	○
Push(Door close)			

ETPD305C

TAILGATE LOCK ACTUATOR INSPECTION (3/5 DOOR)

1. Remove the tailgate trim panel. (Refer to BD group- Tailgate)
2. Disconnect the 2P connector from the actuator.



KTDD165A

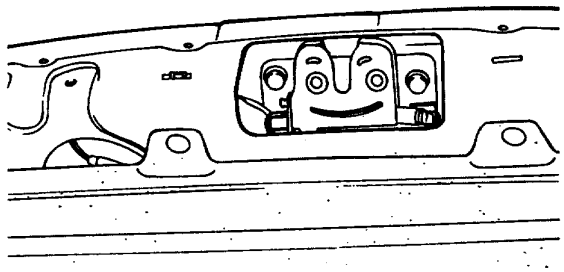
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only memontarily.

Position \ Terminal	1	2
LOCK→UNLOCK	⊖	⊕
UNLOCK→LOCK	⊕	⊖

ETDD165B

TRUNK LID SWITCH INSPECTION (4DOOR)

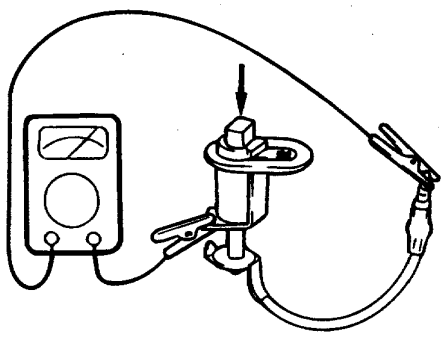
1. Disconnect the negative battery terminal.
2. After opening the trunk, disconnect the connector from the rear harness.



ETDA215A

3. Check for continuity between the terminal and body while pushing the rod.

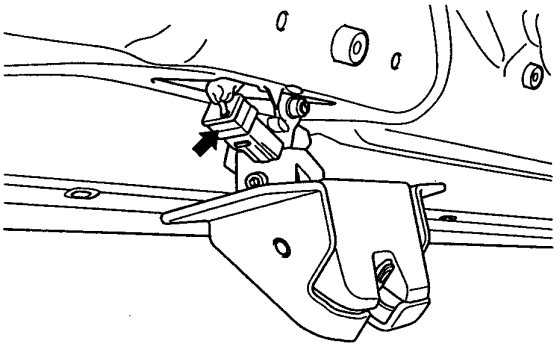
Switch rod condition	Continuity
Push (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)



ETDA215B

TAILGATE SWITCH INSPECTION (3/5 DOOR)

1. Remove the tailgate trim panel. (Refer to BD group-Tailgate)
2. Remove the tailgate latch after removing 3 bolts and disconnect the 1P connector from the tailgate switch.



KTDD008A

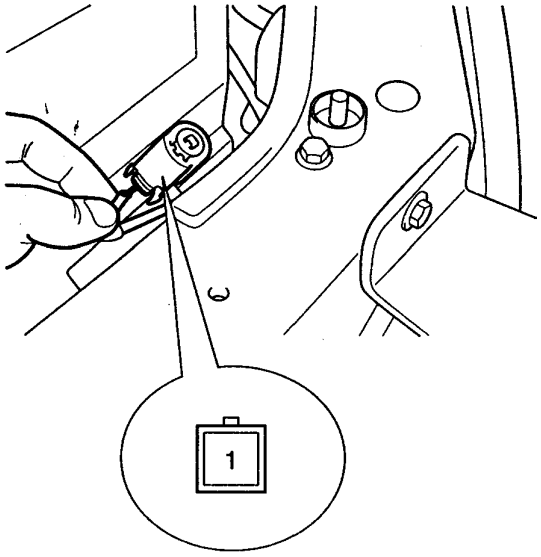
3. Check for continuity between the terminal and ground according to the table.

Position \ Terminal	Ground (Body)	1
Tailgate open	○———	———○
Tailgate close		

ETPD175B

HOOD SWITCH INSPECTION

1. Disconnect the 1P connector from the hood switch.



KTPC180A

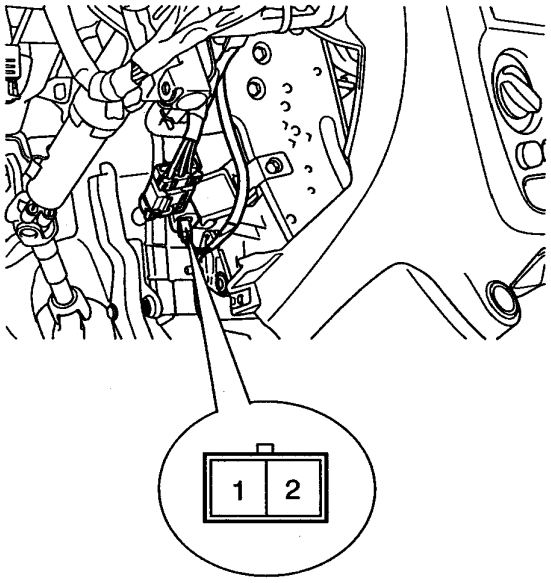
2. Check for continuity between the terminal and ground according to the table.

Position \ Terminal	Ground (Body)	1
Hood open (Free)	○———	———○
Hood close (Push)		

ETPD180B

DOOR WARNING SWITCH INSPECTION

1. Remove the driver's crash pad lower panel. (Refer to BD group-Crash pad)
2. Disconnect the 2P connector from the door warning switch.



KTDD185A

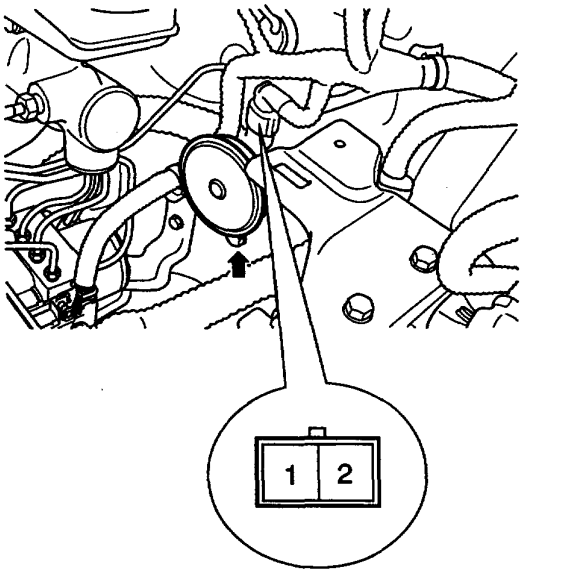
3. Check for continuity between the terminals in each position according to the table.

Key position \ Terminal	1	2
Insert	○———	———○
Removal		

ETDD185B

BURGLAR ALARM HORN INSPECTION

1. Remove the horn after removing a bolt and disconnect the 2P connector from the horn.



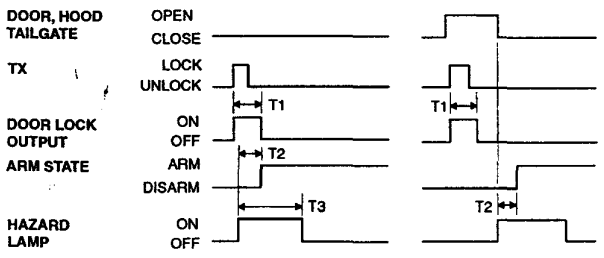
KTPC190A

2. Test the horn by connecting battery power to the terminal 1 and ground the terminal 2.
   The horn should make a sound. If the horn fails to make a sound replace it.

ETACS MODULE

ANTI-THEFT FUNCTION E4E8D4E8

1. **ARM FUNCTION**
   Pressing the remote key lock button will result in a 0.5-second pulse issued to lock all doors.
   Pressing the remote keypad unlock button once will result in a 0.5-second unlock pulse issued to unlock all doors.
   As part of the arming sequence the alarm first enters a pre-armed state before falling into the armed state. During this pre-armed state alarm triggers are ignored. Pre-armed state can be reached from the alarmed state, the start inhibit state or the disarmed state. Pre-Arming of the alarm can be achieved by a press of the lock button on the remote key.
   In the pre-armed state the visible and audible warnings are disabled.
   This system enters the armed state if it is in the pre-armed state and, after 0.6 sec, check actuator lock and each door, hood and tail gate close, and no door warning switch (no key in ignition).
   On entering the arm state, a single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.
   If TX lock signal is received when a door, tail gate or hood is open, then lock output is given and a flash of hazard is not given.
   After the armed state is entered, if a lock signal is received then a single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.
   The armed state cannot be reached by locking the car with the keys.

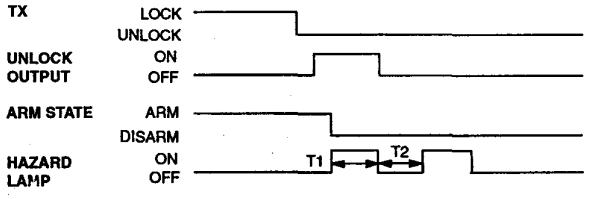


ETHA115Q

Time specification
T1 : 0.5 sec.
T2 : Max. 2 sec.
T3 : 1.0 ± 0.2 sec.

2. **DISARM FUNCTION**
   Disarming can be performed while the alarm is armed, or alarming, or after alarming. The alarm can be disarmed by the following methods :
   - Pressing the unlock button on the TX key. The hazard lamps shall be flashed twice for 1sec period (of cycle), 50% duty rate.
   - If door warning switch is on, IGN1 and IGN2 are on in arm state, then arm state should be immediately cancelled. This means that the driver is inside the vehicle before pushing TX lock, so system should not arm.

   In the disarm state the visible and audible warnings are disabled and start is enabled.
   In the disarm state, if TX key unlock command is received, then the hazard lamps shall be flashed twice for period of cycle 1 sec, 50% duty rate.
   Disarm state cannot be reached using the door locks by key.



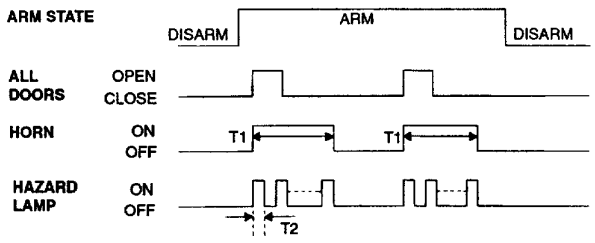
ETHA115R

Time specification
T1, T2 : 0.5 ± 0.1 sec.

3. **ALARM FUNCTION**

   1) European countries
      Once armed, should any door, hood or the tailgate be opened, then :
      - Start relay drive output is disabled, so starting is inhibited.
      - Audible (horn) and visual (hazard lamp) warnings are issued, for 27seconds duration. The horn warning is continuously occurring in this period. The hazard lamps operate with 1 sec period, 50 % duty rate.

      The alarm is given in the case where a door is opened with a key.

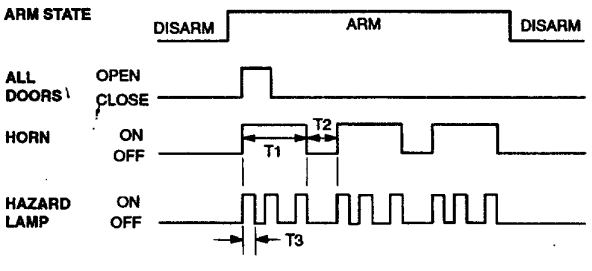


ETOC100C

Time specification
T1 : 27 ± 2 sec.
T2 : 0.4~0.5 sec.

2) Non European countries
Once armed, should any door, hood or the tailgate be opened, then.
- Start relay drive output is disabled, so starting is inhibited.
- Audible (horn) and visual (hazard lamp) warnings are issued, for three cycles, each cycle 27±2 sec. duration on, 10±1 sec. off. The horn warning is continuously occurring during the on period. The hazard lamps operate with 1 sec period, 50 % duty rate during the on period.

The alarm is given in the case where a door is opened with a key.
After this time, the system maintains the start inhibit state, where no audible and visual warnings are issued but engine starting is not possible.



ETOC100D

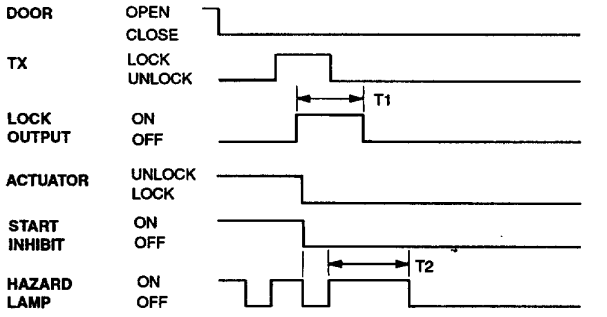
Time specification
T1 : 27 ± 2 sec.
T2 : 10 ± 1sec.
T3 : 0.4~0.5 sec.

4. OPERATION DURING ALARM CONDITIONS

1) Cancelling audible alarm with the remote transmitter

CASE 1 : Door closed

During or after alarming and then closing all doors and a TX lock signal is received Then
- The lock command is executed with 0.5 sec. ON
- Horn and start inhibition are OFF
- Hazard lamp is flashed one time (period : 2 sec., duty: 50%, within 2 sec.)
- The state goes to arming mode (after a lock state check)
- The start is enabled



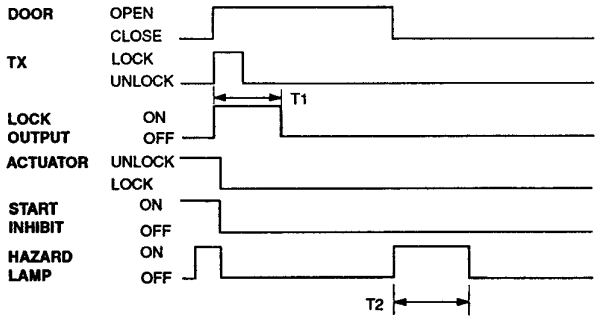
ETHA115V

Time specification
T1 : 0.5 sec.
T2 : 1.0 ± 0.2 sec.

CASE 2 : Door Open

During or after alarming, with a door open and a TX lock signal is received Then
- The lock command is executed with 0.5 sec. ON
- Horn is disabled and start is enabled after confirmation of actuator lock

At this time, when the door is closed,
- Hazard lamp is flashed one time (period : 2 sec., duty 50%)
- The state goes to arming mode

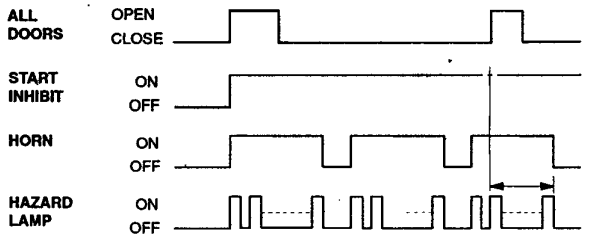


ETHA115W

Time specification
T1 : 0.5 sec.
T2 : 1.0 ± 0.2 sec.

2) New alarm conditions
Second alarm condition during alarming.
When another alarm occurs during alarming, the starting is disabled, and the alarm continues to sound for the remained time of warning signal. The alarm continues to sound after the second alarm condition is removed.
New alarm condition occurs after alarming (with all entrances closed)
If any entrance is opened again then
- The horn is ON 3 times (EC area : one time for 27sec.)
- Start is disabled
- Hazard lamps flash during the ON time of horn

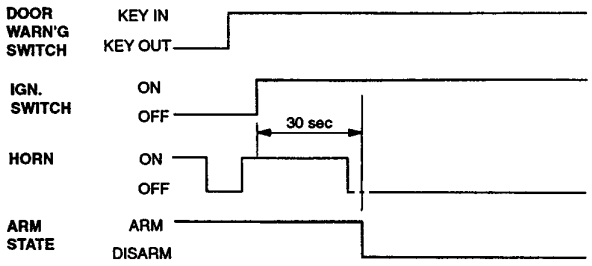
New alarm condition occur after alarming (with any entrance open).
If another entrance is opened, the ETACS module keeps start disabled and there is no horn output.



ETOC100N

3) Key operation during alarm
After the alarm state or start inhibit state are entered, if door warning switch on (key in ignition) &IGN 2 ON, if IGN 2 state is changed to OFF within 30sec, remain in alarm state.

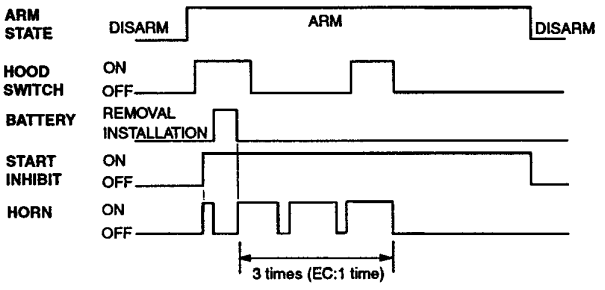
4) Disarming using the key
During alarming, in case that door warning switch (key in) is ON and then IGN1 and IGN2 are both ON for 30 sec continuously, the alarm is cancelled, and the system enters the disarm state.
After alarming, in case that door warning switch (key in) is ON and then IGN1 and IGN2 are both ON for 30 sec continuously, the alarm is cancelled, and the system enters the disarm state.



ETOC100O

5. **ALARM STATE IN POWER DOWN**
If the battery is disconnected to the ETACS module in the following states:
- Alarm
- After alarming

Upon restoring the battery, the alarm state shall be entered and the alarm cycle shall restarted (timer reset to 0).
Upon restoring the battery, the alarm state shall be entered and the alarm cycle shall restarted (timer reset to 0).



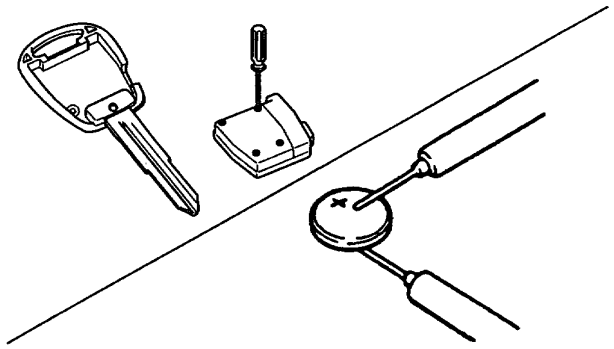
ETHA115Z

TRANSMITTER

INSPECTION E7AA0DB2

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V

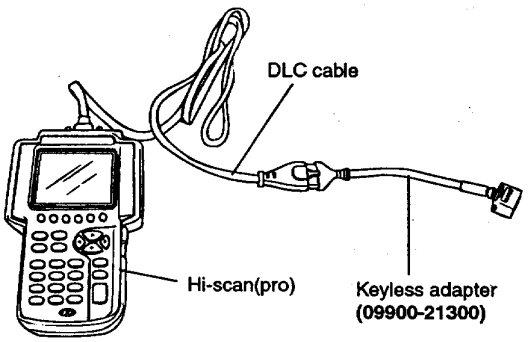


KTPC195A

3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors (See the workshop manual page BE-29)
5. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitter.

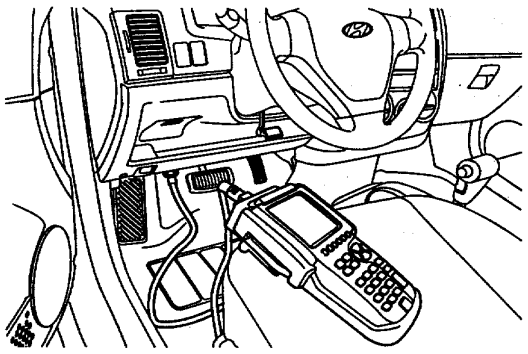
TRANSMITTER CODE REGISTRATION E2B15C37

1. To register transmitter code, first connect keyless adapter (09900-21300) to DLC(Data Link Connector) cable of hi-scan as shown in the illustration.



ETAC065J

2. After connecting keyless adapter to the multi purpose check connector (10pins) beside data link connector in driver side crash pad lower panel, turn the power on hi-scan.



KTPC200A

3. Select the vehicle model and then do "CODE SAVING".

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : ALL

02. ENGINE
03. AUTOMATIC TRANSAXLE
04. ANTI-LOCK BRAKE SYSTEM
:
:
:
07. CODE SAVING

ETPD700I

4. After selecting "CODE SAVING" menu, button "ENTER" key, then the screen will be shown as below.

KEYLESS ENTRY CODE SAVING
1. REMOVE THE IG.KEY FROM KEY CYLINDER. 2. CONNECT THE DLC CABLE AND 16 PIN CONNECTOR OF THE KEYLESS ADAPTER. 3. CONNECT THE 10 PIN CONNECTOR OF THE KEYLESS ADAPER INTO THE MULTIPURPOSE CHECK CONNECTOR. 4. AFTER PRESSING [ENTER], FINISH CODE SAVING WITHIN 10 SECONDS. 5. PRESS [ENTER], IF YOU ARE READY!

ETAC065M

5. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving.

KEYLESS ENTRY CODE SAVING
1. PRESS THE TRANSMITTER [LOCK] BUTTON FOR 1 SECOND. 2. IF SAVE ONE MORE PRESS OTHER TRANSMITTER [LOCK] BUTTON FOR 1 SECOND. 3. PRESS [ESC] AND DISCONNECT KEYLESS ADAPTER FROM VEHICLE AND CHECK THE KEYLESS ENTRY SYSTEM.

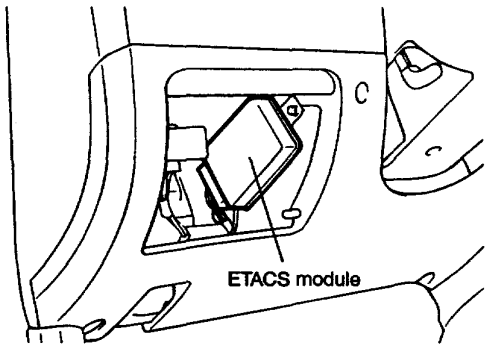
ETAC065N

6. Follow steps 1 to 3 and then code saving is completed.
7. Disconnect keyless adapter (09900-21300) from DLC cable and then proceed toself-diagnosis with DLC cable connected.

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)

DESCRIPTION EB4768BE

ETACS module receives various input switch signals, and controls time and alarm such as intermittent wiper timer, washer timer, rear defogger timer, seat belts warning, decayed out room lamp, central door lock, ignition key reminder, power window timer, door warning, tail lamp auto cut, crash door unlock and keyless entry & burglar alarm automatically.



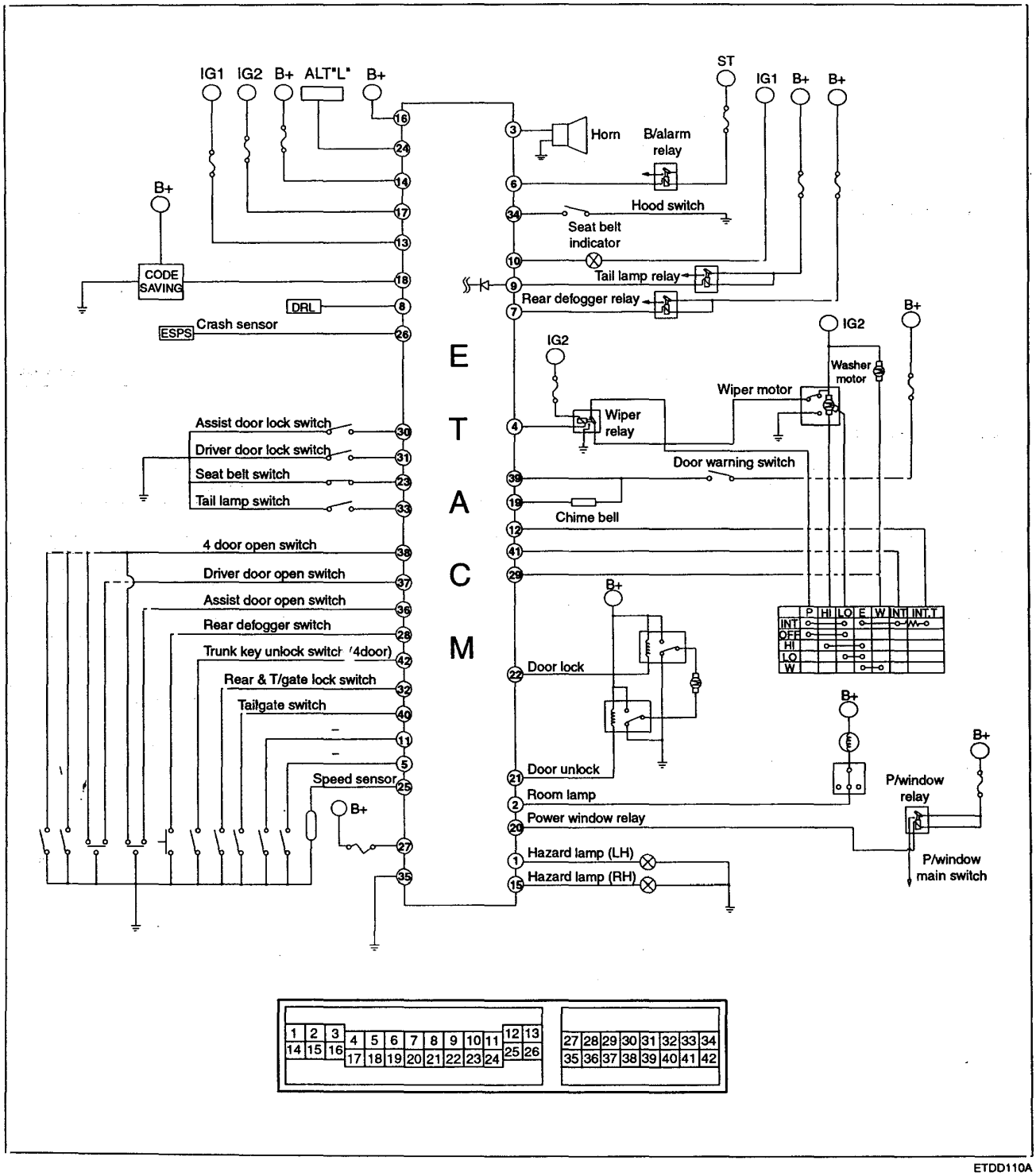
ETDA060A

SPECIFICATIONS EEDE1D32

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 80°C
Insulation resistance	100MΩ or more
Rated load	
Horn relay	DC 12V, 200mA (Inductance load)
Chime bell	DC 12V, 350mA (Inductance load)
Rear defogger relay	DC 12V, 200mA (Inductance load)
Hazard lamp relay	DC 12V, 200mA (Inductance load)
Tail lamp relay	DC 12V, 200mA (Inductance load)
Seat belt warning indicator	DC 12V, 1.2W (Lamp load)
Room lamp	DC 12V, 10W (Lamp load)
Door lock relay	DC 12V, 200mA (Inductance load)
Door unlock relay	DC 12V, 200mA (Inductance load)
Burglar alarm relay	DC 12V, 200mA (Inductance load)

ELECTRONIC TIME AND ALARM CONTROL MODULE

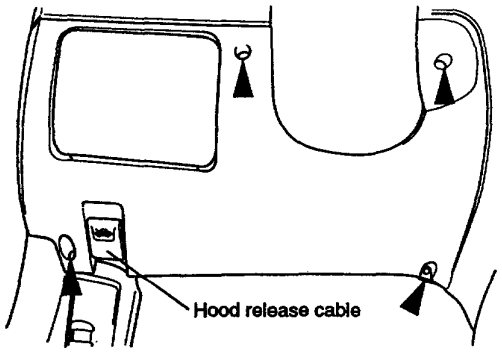
CIRCUIT DIAGRAM E3DD824B



ETDD110A

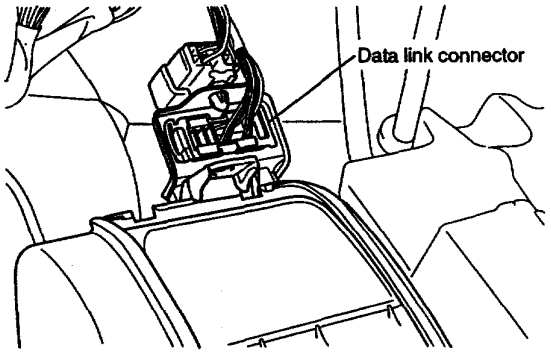
REMOVAL AND INSTALLATION E69B00C6

1. Disconnect the negative(-) battery terminal.
2. Remove the 2 screws and 2 bolts holding the driver's crash pad lower panel.



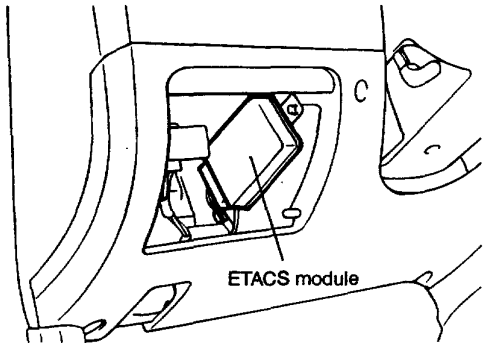
ESDC113S

3. Disconnect the hood release cable and the data link connector from the beneath driver's crash pad lower panel.



ETPD062B

4. Remove the ETACS module from the bracket after removing bolts.



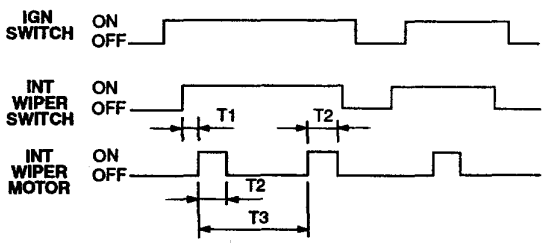
ETDA080A

5. Installation is the reverse of removal.

INSPECTION E0BDC855

While operating the components, check whether the operations are normal as shown in the timing chart.

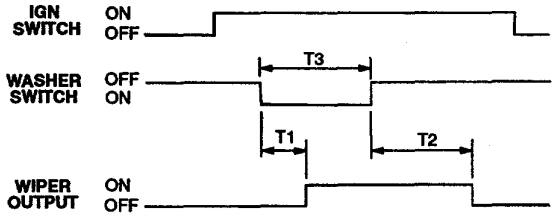
1. VEHICLE SPEED SENSING INTERMITTENT WIPER



ETHA115C

Time specification
T1 : Max. 0.5sec.
T2 : 0.6~0.7 sec. (Time of wiper motor 1 rotation)
T3 : At vehicle speed : 0km/h.
2.6±0.7 sec. (VR=0kΩ)~18.0±1sec. (VR=50kΩ)
At vehicle speed = 100km/h or more.
1.0±0.2sec. (VR=0kΩ)~10.0±1 sec. (VR=50kΩ)

2. WASHER



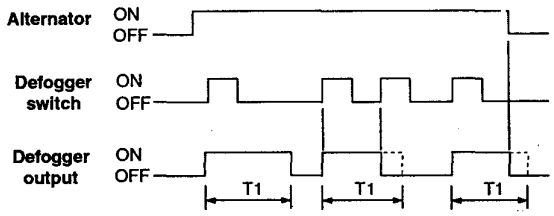
ETHA115D

a. Time specification
T1 : 0.3 sec.
T2 : 0.6~0.8 sec.
T3 : 0.2~0.6 sec.
b. Time specification
T1 : 0.3 sec.
T2 : 2.5~3.8 sec.
T3 : 0.6 sec. or more
c. This function should be operated preferentially event though the variable intermittent wiper is operating.

3. DEFOGGER TIMER (Including Outside Mirror Demister)

1) After ALT "L" ON, if the defogger is switched ON, the defogger output is ON for 20 minutes duration.

2) If the defogger switch is pressed again, or if the ignition is switched OFF during this time, the defogger output is OFF.



ETMB180C

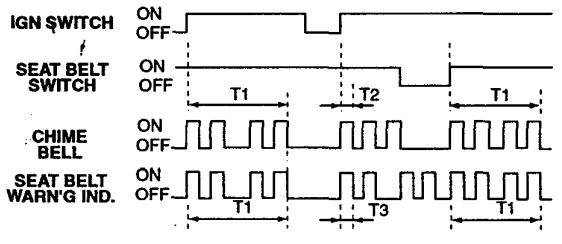
T1 : 20 ± 1min.

4. SEAT BELT WARNING TIMER

1) Since the ignition is switched ON, the seat belt warning indicator is illuminated (with period : 0.6 sec., duty rate : 50%) and the chime bell is sounded (with period : 0.9 sec., duty rate : 50%) for total time 6 seconds.

2) If the ignition is swithced off during the indicator and the chime bell output, the indicator and the chime bell are switched OFF.
If the seat belt is sensed as fastened during the indicator and the chime bell output, the chime bell is switched OFF immediately and the seat belt warning indicator is illuminated for the remained seconds.

3) When the ignition is already switched ON, if the seat belt is removed, the warning indicator and the chime bell are output for total time 6 seconds.



ETMB902B

T1 : 6±1 sec., T2 : 0.45 ± 0.1 sec., T3 : 0.3 ± 0.1 sec.

5. DECAYED ROOM LAMP & KEYLESS UNLOCK TIMER

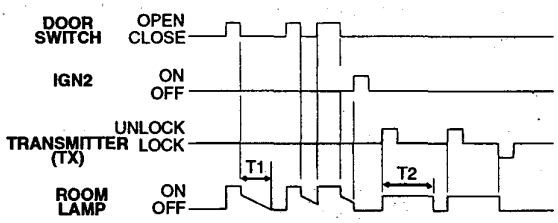
1) When the first door (driver's or assist) is opened, the room lamp shall brighten. When the last door is closed, the room lamp will drop to 75% intensity, then fade out over 5-6 seconds.

2) If the door switch is ON for less than 0.1 sec., then no illumination occurs.

3) The fade resolution is over 32 steps.

4) The room lamp must not flicker during fade operation, if the ignition is switched ON.

5) With keyless UNLOCK, when the door is closed, the room lamp is turned ON, then OFF after about 30 seconds. While the room lamp is ON due to keyless UNLOCK, if another UNLOCK is received, the room lamp is again ON for 30 seconds.
While the room lamp is ON, If the door is opened, the lamp is continued to ON. If the door is closed, the lamp follows as the above step 1.
If keyless LOCK (ARM state) is received during fade out, the room lamp is switched off immediately.



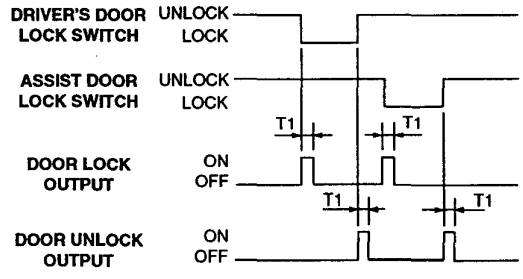
ETMB003K

T1 : 5.5 ± 0.5 sec., T2 : 30 ± 3 sec.

6. CENTRAL DOOR LOCK/UNLOCK

1) The driver's door lock, assist door lock, or the inside door lock knob is switched LOCK to UNLOCK or UNLOCK to LOCK, the all doors lock and unlock outputs will follow.

2) Battery connecting would not change the LOCK/UNLOCK states.

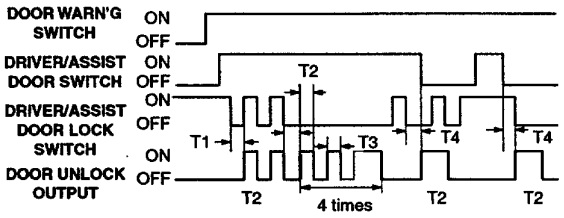


ETNB110A

T1 : 0.5 ± 0.1 sec.

7. IGNITION KEY REMINDER

If the key is in the ignition and the driver's door or assist door is opened and the vehicle is locked using driver's knob or assist knob, then the central locking system will issue an unlock pulse of 1 second duration to the all doors thus preventing locking of the vehicle. (With a knob remains locked, if the switch in the actuator is not changed, the central locking shall issue 1 pulse of 1 seconds duration and 3 pulses of 0.5 second duration to unlock the vehicle.)



ETPD120A

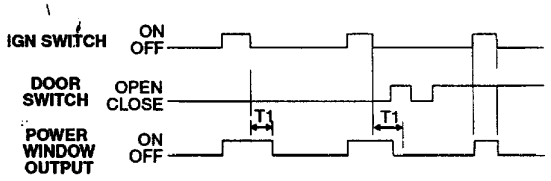
T1,T3 : 0.5 sec., T2 : 1 sec., T4 : Max.0.5 sec.

8. POWER WINDOW TIMER

1) When the ignition is switched ON, the power window relay output is turned ON.

2) When the ignition is switched OFF, the power window output is maintained ON for 30 seconds and then turned OFF.

3) With the state of step 2, if the driver's door or assist door is opened, the output shall be turned OFF immediately.



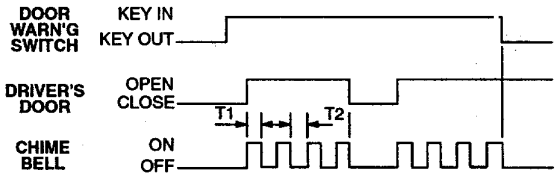
ETMB003L

T1 : 30 ± 3 sec.

9. DOOR OPEN WARNING

1) If the key is in the ignition key cylinder and the driver's door is opened, the chime bell sounds continually (period:0.9 sec. Duty rate:50%).

2) If the door is closed or the key is removed, the chime stops immediately.



ETMB180G

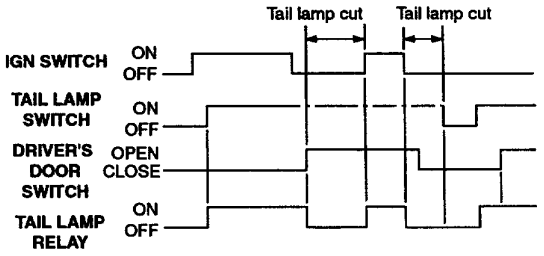
T1,T2 : 0.45 ± 0.1 sec.

10. TAIL LAMP AUTO CUT

1) When the tail lamp is switched ON, if the ignition is switched OFF and the driver's door is opened, the tail lamp should be automatically OFF.

2) With the ignition switched ON, if the driver's door is opened and the ignition is switched OFF, the tail lamp should be automatically OFF.

3) When the tail lamp is cut automatically, if the tail lamp switch is turned OFF and ON, the tail lamp is illuminated and auto cut function is cancelled.

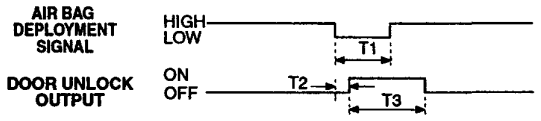


ETMB180H

11. CRASH DOOR UNLOCK

1) With the ignition turned ON, if the air bag is deployed, a crash signal is received and send an UNLOCK output to all doors UNLOCK.

2) After UNLOCK output, when LOCK is set, UNLOCK pulse is output for 5 second period again.



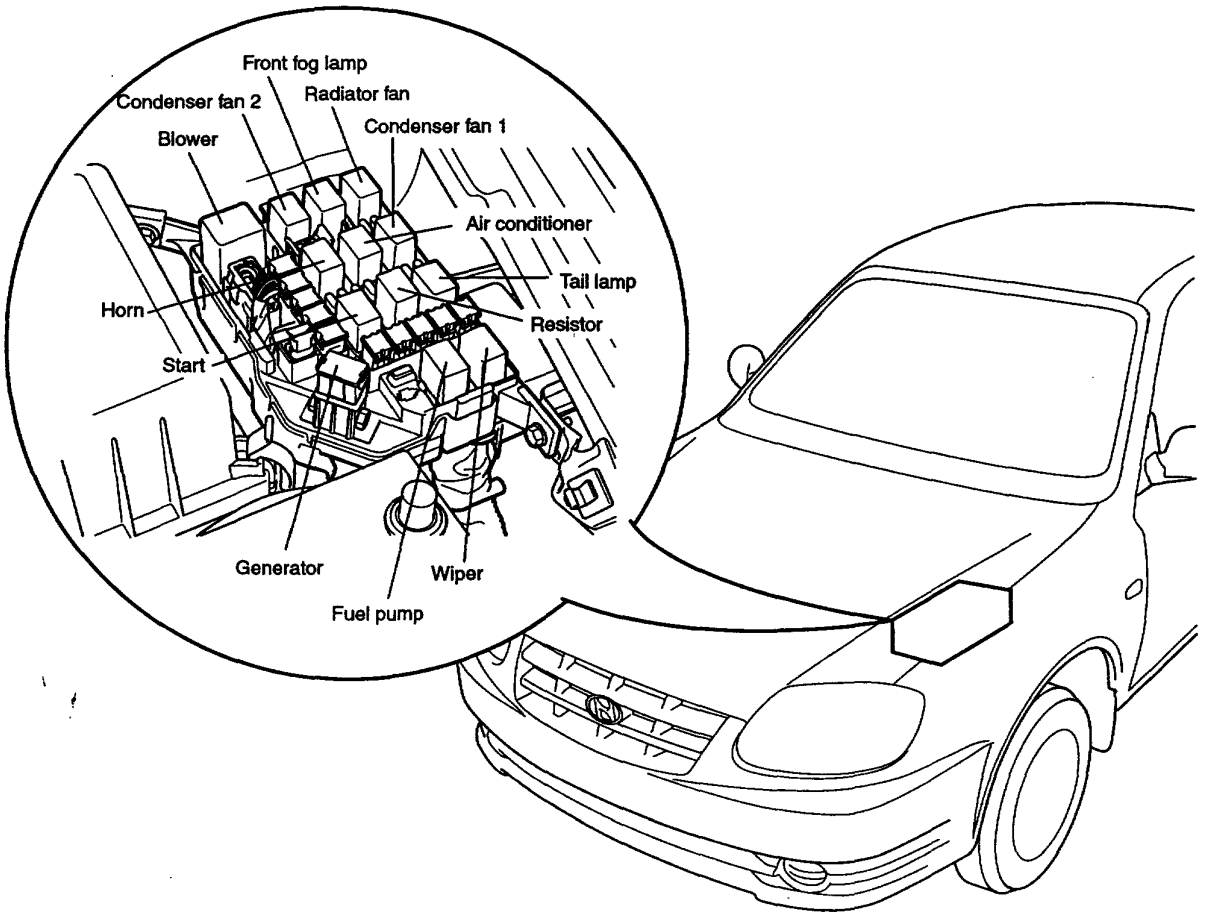
ETJA020F

T1 : 200 msec.
T2 : 40 msec.
T3 : 5±0.5sec.

FUSES AND RELAYS

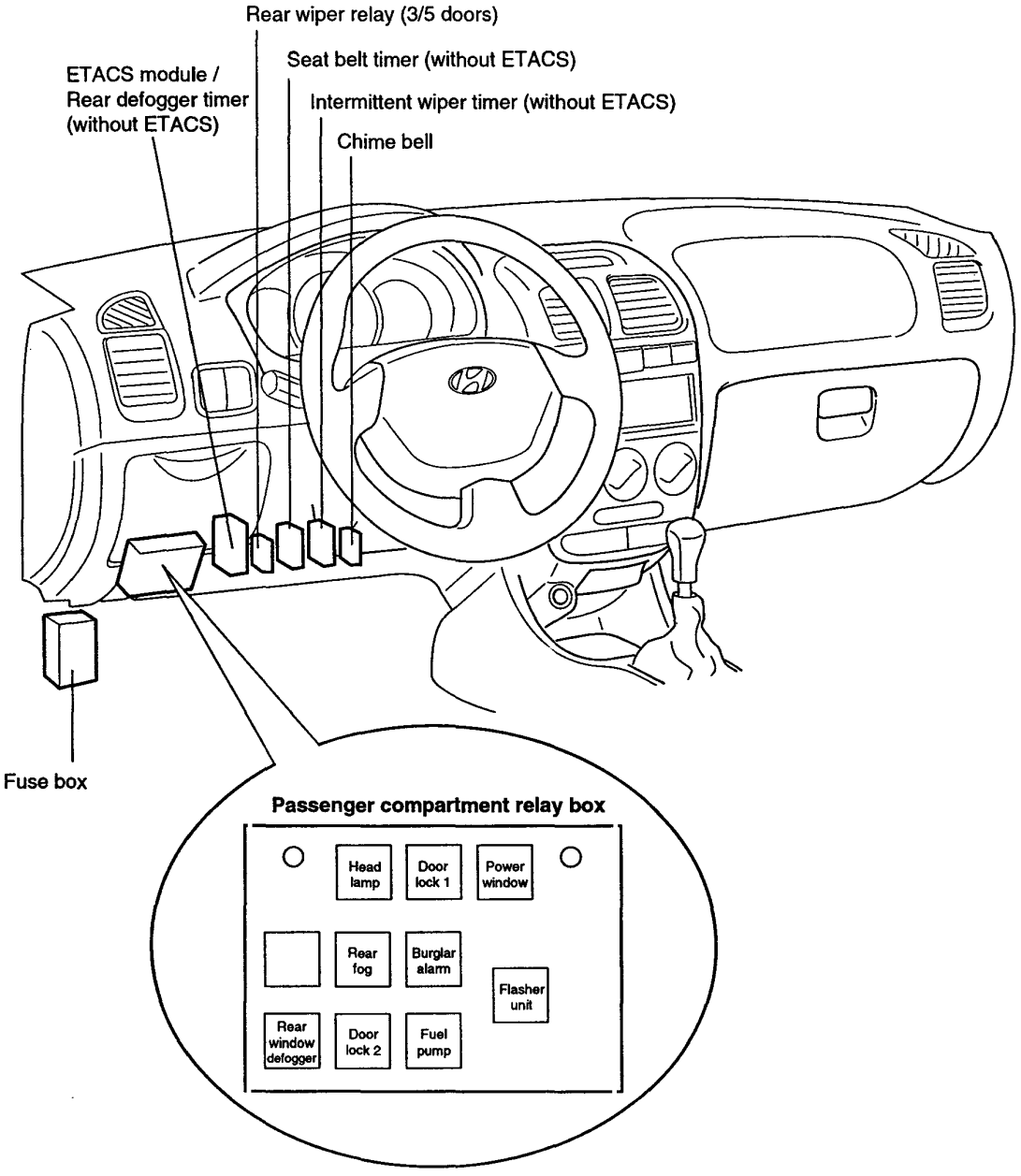
COMPONENTS E53685D9

[ENGINE COMPARTMENT RELAY BOX]



ETDD210D

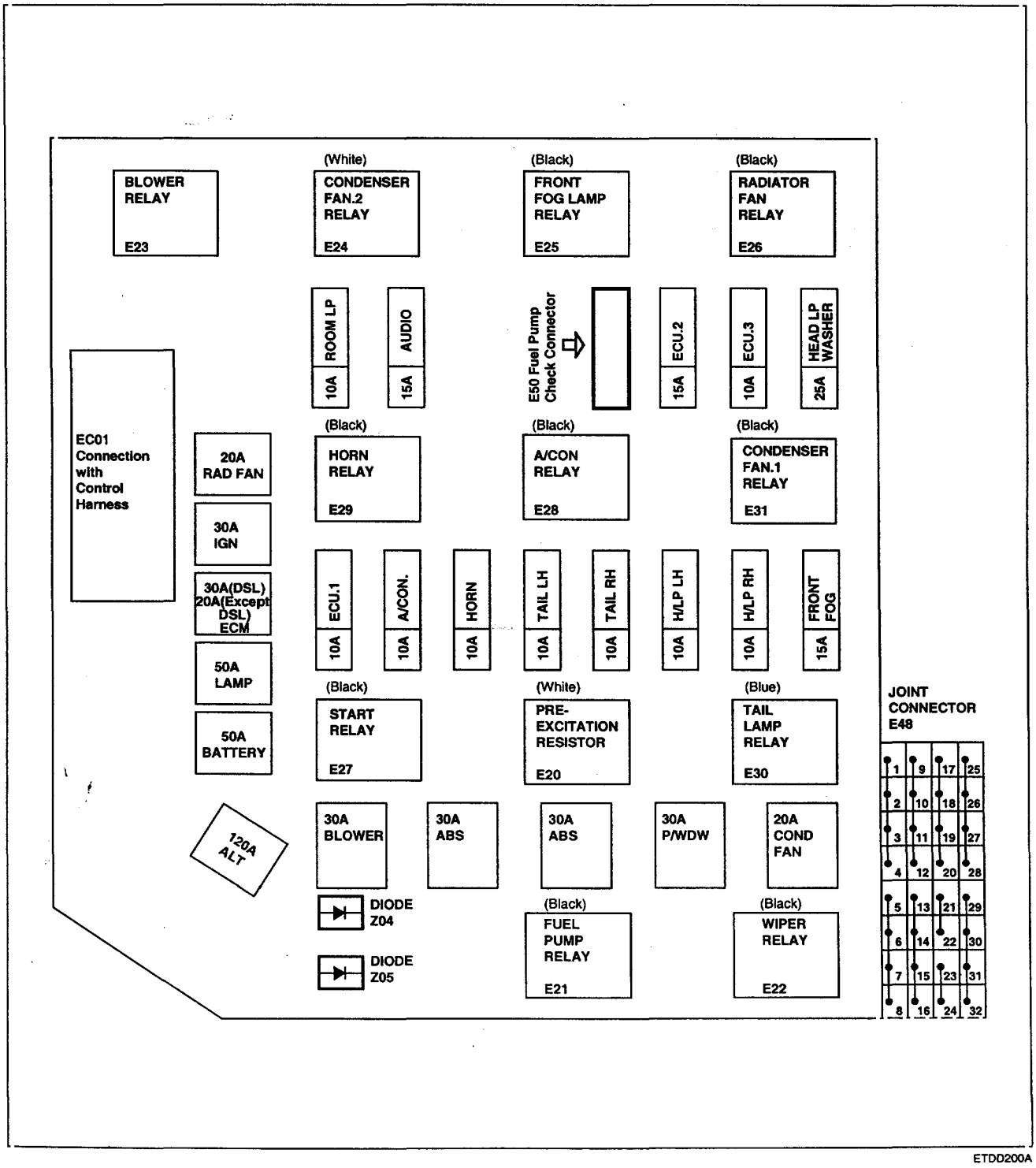
[PASSENGER COMPARTMENT RELAY BOX]



ETDD210E

RELAY BOX (ENGINE COMPARTMENT)

COMPONENTS E133DBDA



ETD0200A

FUSE AND RELAY INFORMATION

DESCRIPTION		(A)	RELATED CIRCUIT
FUSIBLE LINK	ALT	120	Charging (Generator)
	BATTERY	50	Fuse 6,7,8,9, Horn Fuse, Room Lamp Fuse
	LAMP	50	Head Lamp Fuse, Front Fog Lamp Fuse, Tail Lamp Fuse
	ECM	20	Engine Control Relay, Generator, Fuel Pump Relay, ECU.3 Fuse
	IGN	30	Ignition Power Source, Start Relay
	RAD FAN	20	Radiator Fan Control
	BLOWER	30	Blower Fan Control
	ABS	30	ABS Control, ABS Bleeding Connector
	ABS	30	ABS Control, ABS Bleeding Connector
	P/WDW	30	Power Window Relay
	COND FAN	20	Condenser Fan Control
FUSE	ECU.1	10	Radiator Fan, Condenser Fan, ECM, Heated Oxygen Sensor, DMTL
	A/CON.1	10	A/C Relay
	HORN	10	Horn Relay
	TAIL LH	10	Left Rear Combination Lamp, License Laps, Illumination Lamps
	TAIL RH	10	Right Rear Combination Lamp, License Lamp, Illumination Lamps
	H/LP LH	10	Left Head Lamp
	H/LP RH	10	Right Head Lamp
	FRONT FOG	15	Front Fog Lamp Relay
	ROOM LP	10	Trunk Room lamp, Instrument Cluster, Courtesy Lamp, ETACM, DLC
	AUDIO	15	Audio, Digital Clock, Power Antenna
	ECU.2	15	Idle Speed Actuator, ECM
	ECU.3	10	ECM
F/PUMP CHK (E50)			Fuel Pump Relay, Fuel Pump Motor

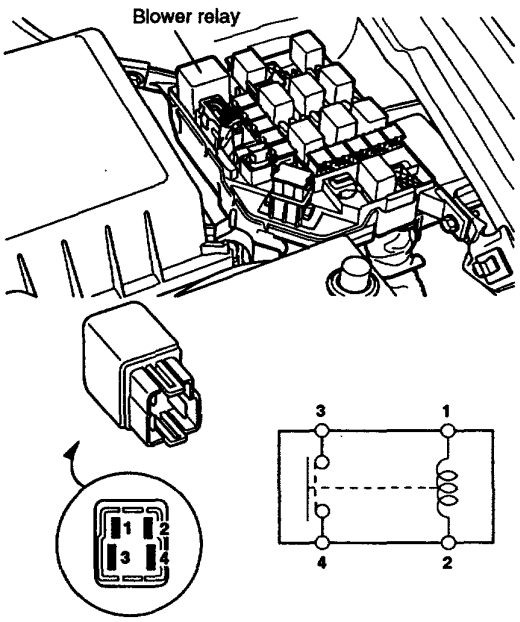
ETDD200C

INSPECTION EEAE4A7D

POWER RELAY TEST (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.4 terminals when power and ground are connected to the No.1 and No.2 terminals.
2. There should be no continuity between the No.3 and No.4 terminals when power is disconnected.



ETDD200B

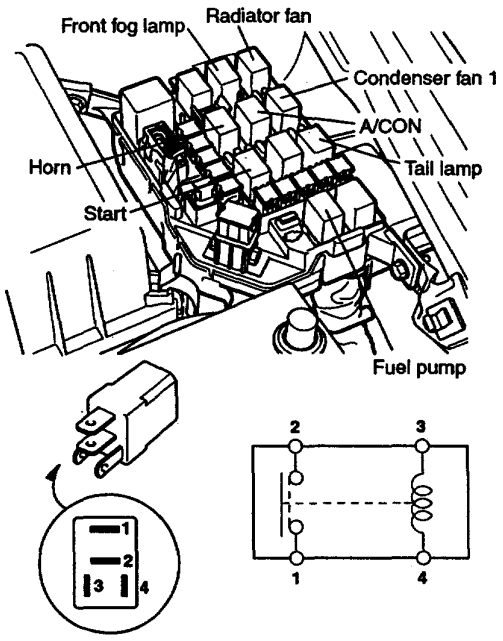
Terminal / Power (No.1-No.2)	1	2	3	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

ETDD215B

POWER RELAY TEST (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.4 and No.3 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



ETDD215D

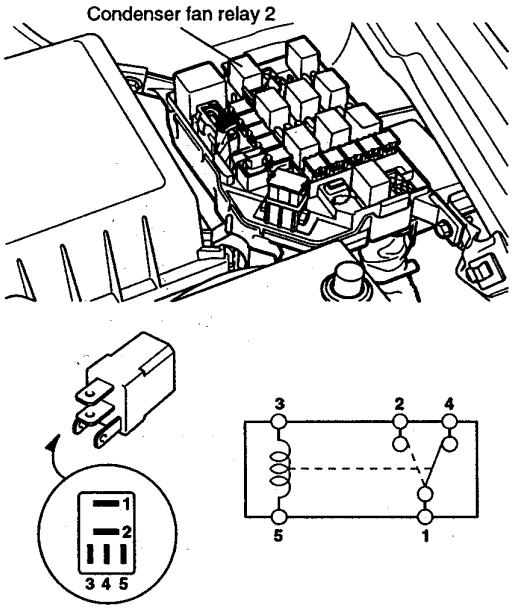
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ETPD215E

POWER RELAY TEST (TYPE C)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.



ETDD215G

Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

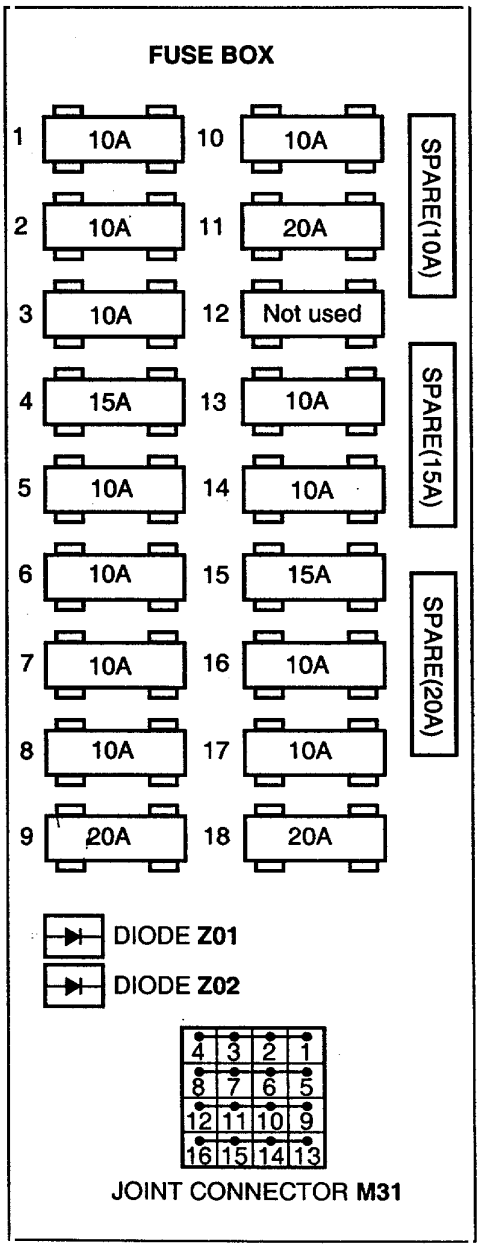
ETPD215H

RELAY BOX (PASSENGER COMPARTMENT)

COMPONENTS EB3A7E7D

[DASH FUSE BOX]

LAYOUT

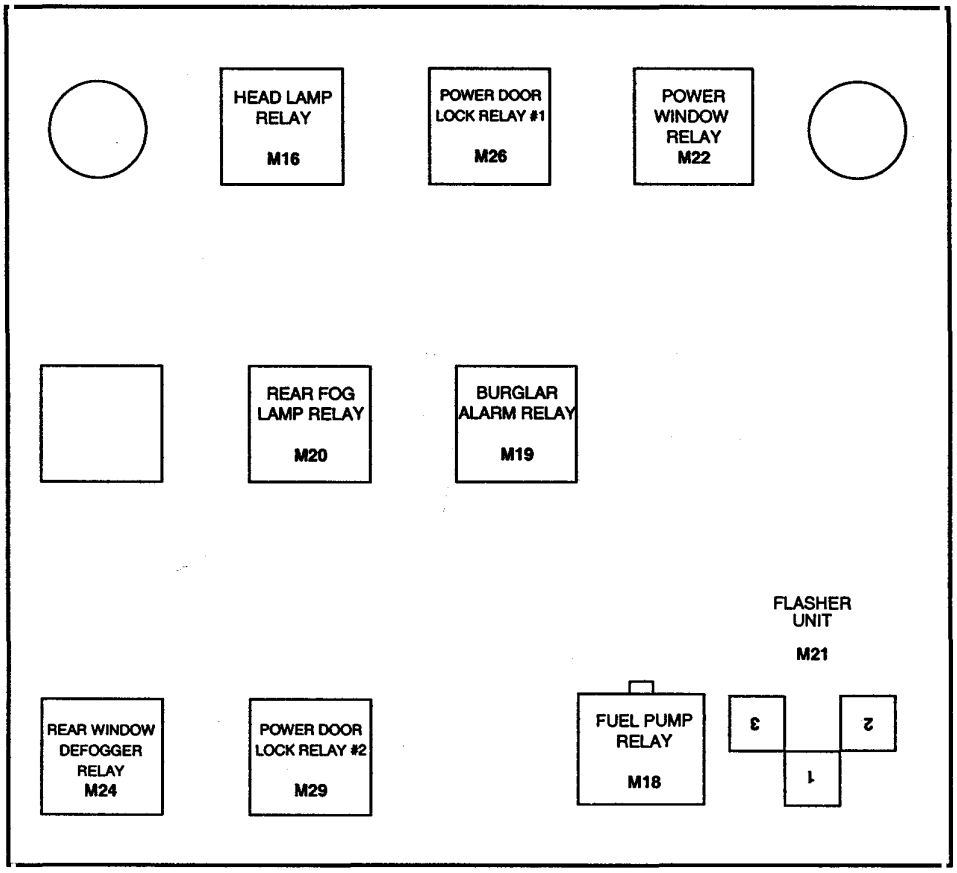


CIRCUIT

FUSE	AMPERAGES	RELATED CIRCUIT
1	10A	Hazard Warning, Back-up Lamp Switch, A/T Shift & Key Lock Control Module
2	10A	ETACM, Generator Resistor, Instrument Cluster
3	10A	Instrument Cluster
4	15A	Air Bag
5	10A	ECM, TCM, A/T Shift Lever
6	10A	Power Door Lock
7	10A	Hazard Warning, ETACM
8	10A	Stop Lamp, A/T Shift Lever, A/T Key Interlock Solenoid
9	20A	Rear Window Defogger
10	10A	Head Lamp, Power Window, ETACM, Front Fog Lamp, Blower Control, Wiper
11	20A	Front Wiper & Washer
12		(Not used)
13	10A	ABS Control, ABS Bleeding
14	10A	Clock, Audio
15	15A	Cigarette Lighter
16	10A	Power Door Mirror Switch
17	10A	Power Door Mirror Motor & Defogger
18	20A	Rear Wiper

ETDD220A

[PASSENGER COMPARTMENT RELAY BOX]



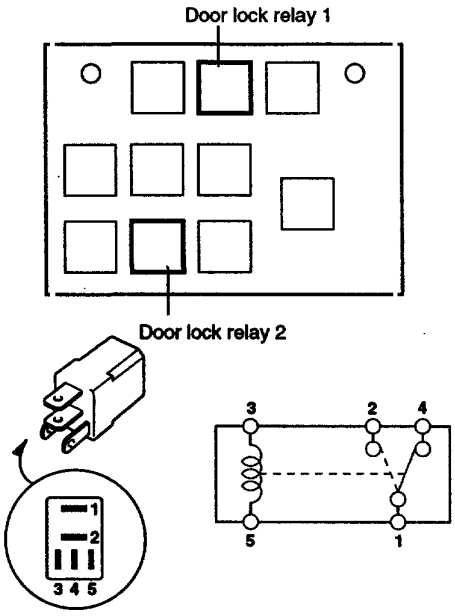
ETDD220B

INSPECTION E7C12DFA

POWER RELAY TEST (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.



ETDD224A

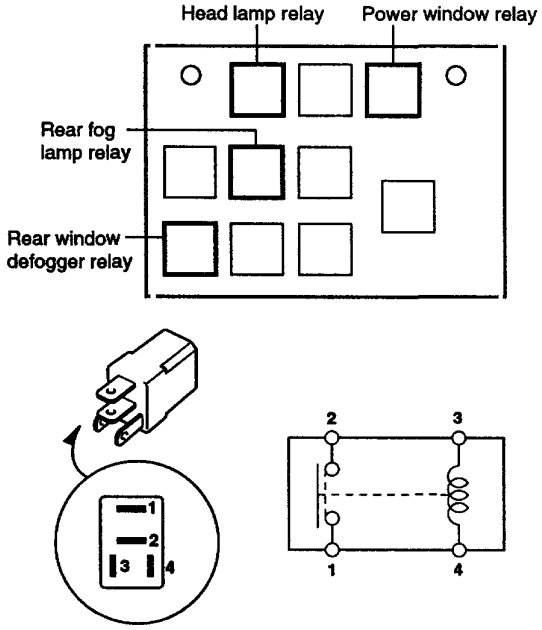
Terminal / Position	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

ETDD215H

POWER RELAY TEST (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



ETDD224B

Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

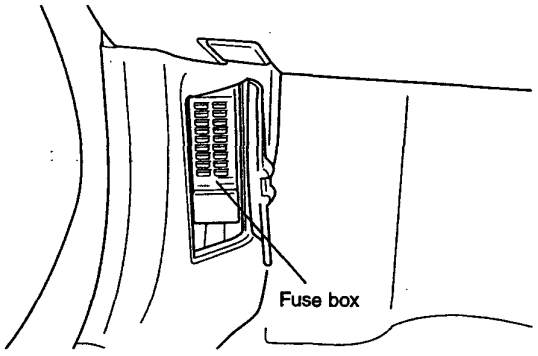
ETPD215E

FUSE INSPECTION

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew and completely eliminate the problem before installing a new fuse.

⚠ ***CAUTION***

Never use a fuse of higher capacity than specified.



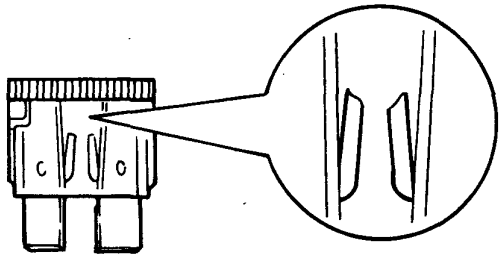
ETDD031E

FUSES

When a fuse is blown, there are two probable causes. The two causescan easily be determined by a visual check after removing the fuses.

1. **Fuse blown due to over-current.**
   Prior to replacing the fuse with a new one, check the circuit for a short and the related parts for abnormal conditions. Only after the correction of a short or replacement of abnormal parts, should a fuse with the same ampere rating be installed.

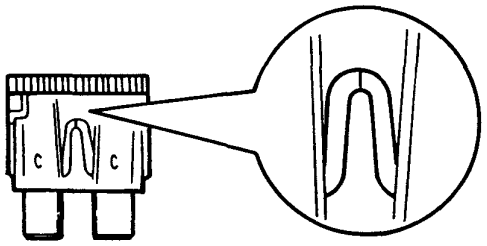
Blown fuse due to overcurrent



ETDA086A

2. **Fuse blown due to repeated on-off current.**
   Normally, this type of problem occurs after a fairly long period of use, and is less frequent than #1 above. In this case, you may simply replace with a new fuse of the same capacity.

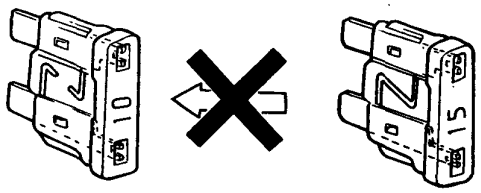
Blown fuse due to thermal fatigue



ETDA086B

⚠ ***CAUTION***

A blade type fuse is identified by the numbered value in amperes. If the fuse is blown, be sure to replace a fuse with the same ampere rating.If a fuse of higher capacity than specified is used, parts may be damaged and a danger of fire exists. To remove or insert a fuse, use the fuse puller in the fuse box.

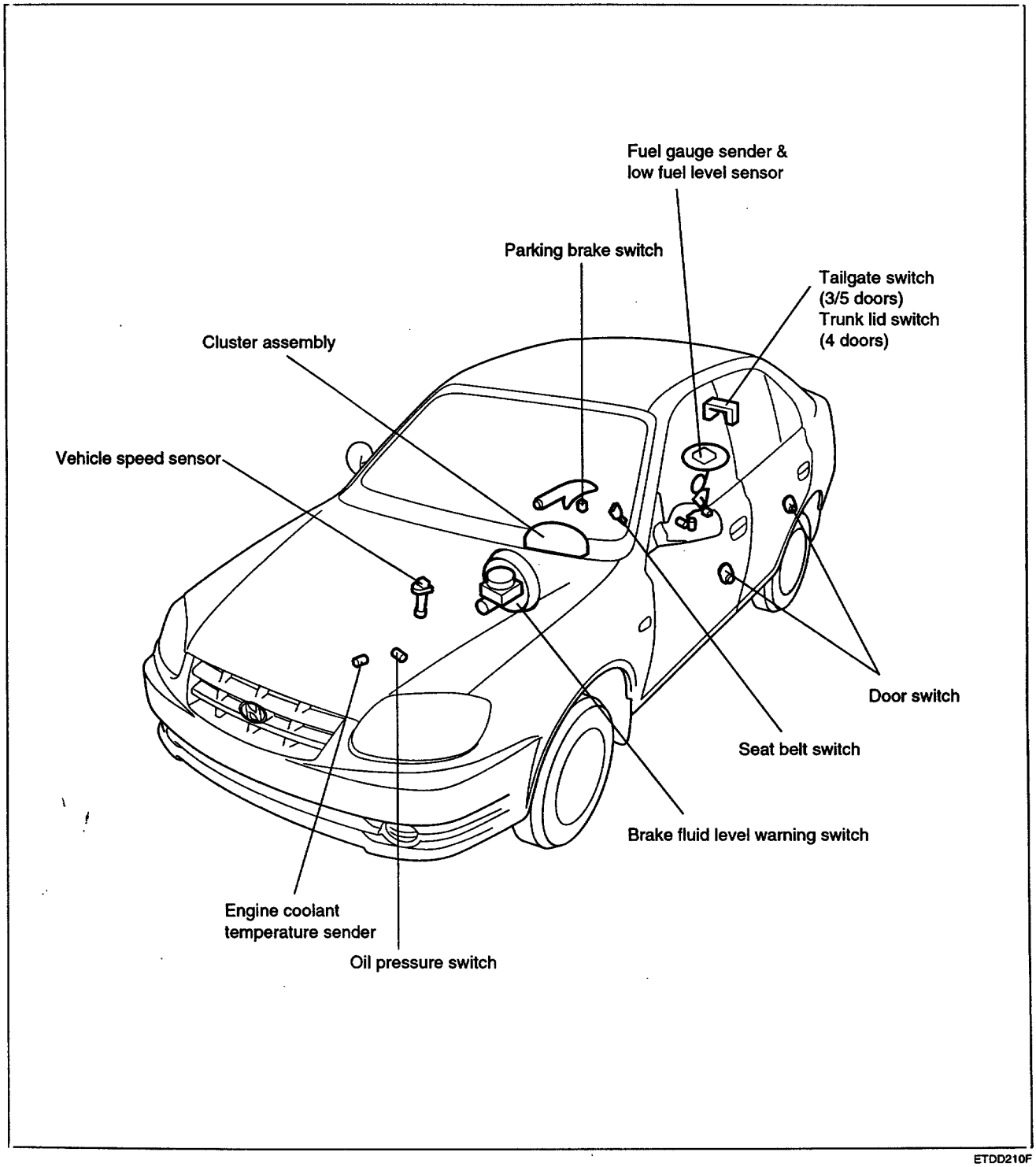


10A **15 A**

ETDA086C

INDICATORS AND GAUGES

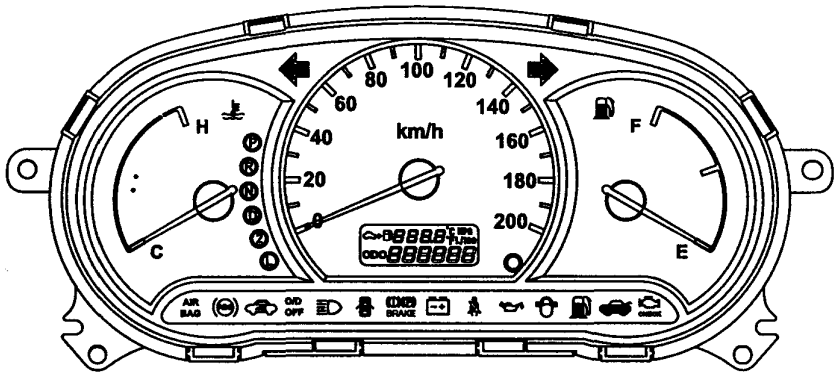
COMPONENTS ED3010AA



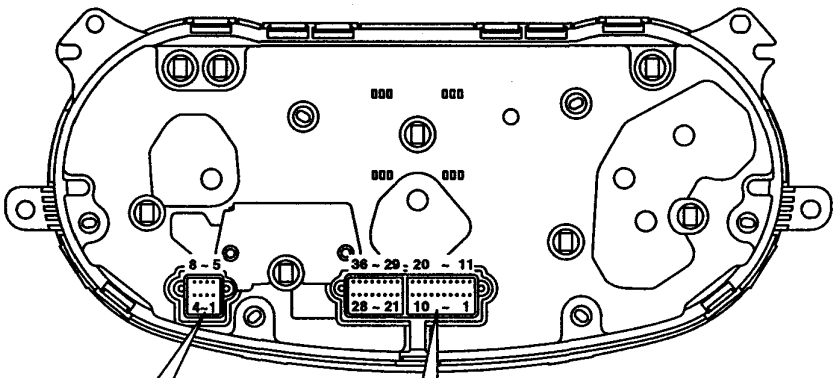
ETDD210F

INSTRUMENT CLUSTER

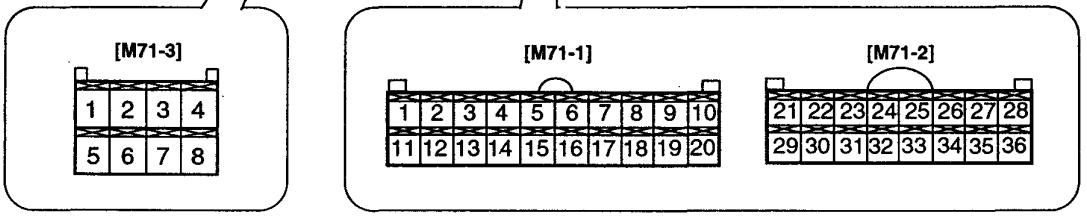
COMPONENTS E2ACA717



KTDD004A



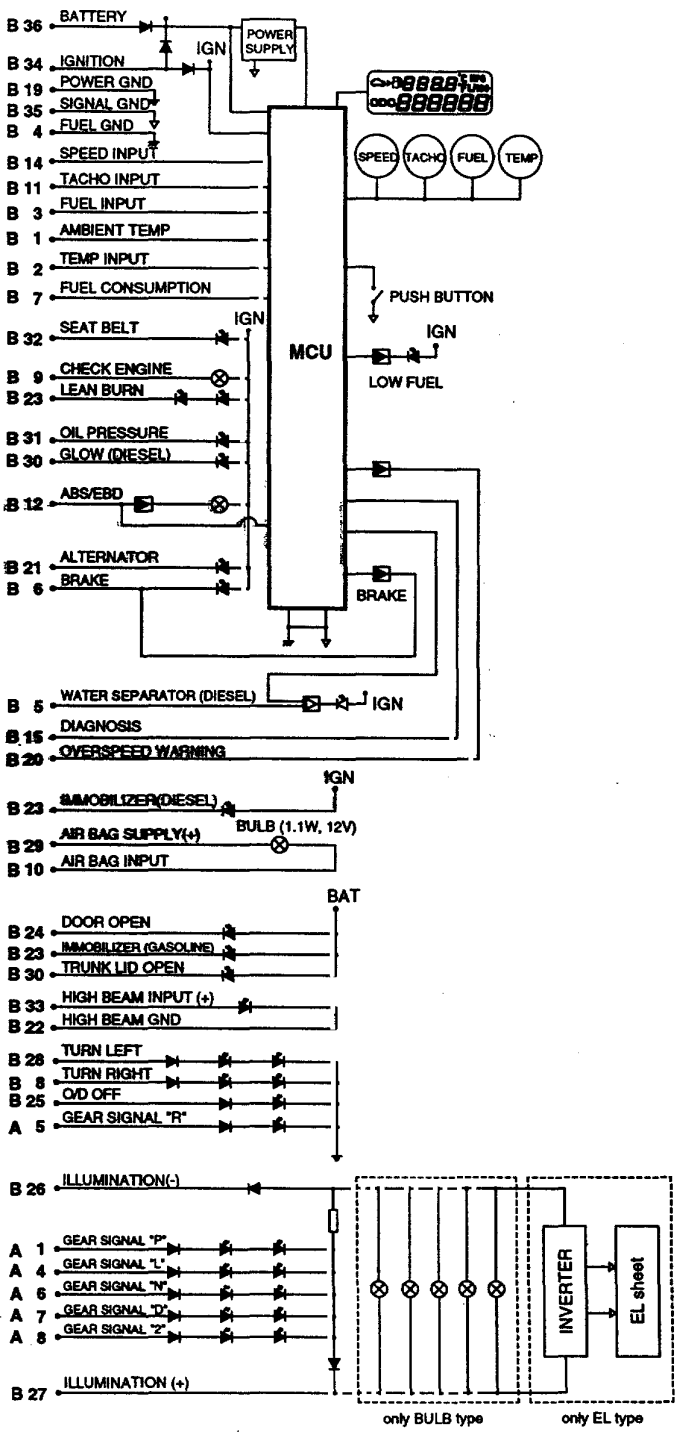
KTDD004B



CONNECTOR **A** CONNECTOR **B**

ETDD235A

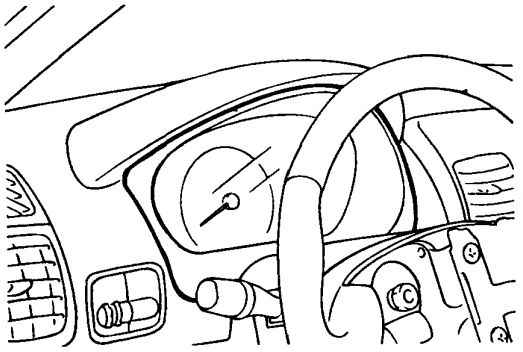
CIRCUIT DIAGRAM EECECD25



ETDD004C

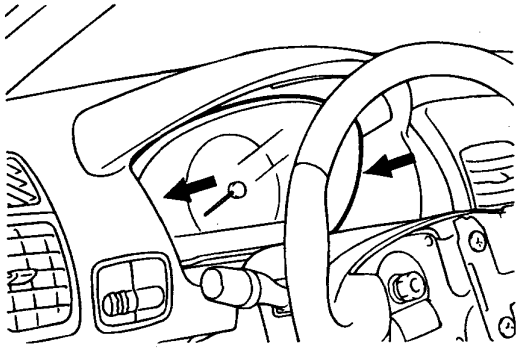
REMOVAL AND INSTALLATION EBDFFBBA

1. Disconnect the negative(-) battery terminal.
2. Remove the cluster facia panel.



ETDA100A

3. Remove the cluster from the housing after removing screws.



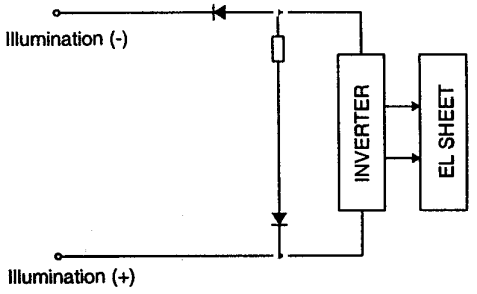
ETDA100B

4. Disconnect the wire connectors from the cluster.
5. Installation is the reverse of removal.

INSPECTION E7C5D031

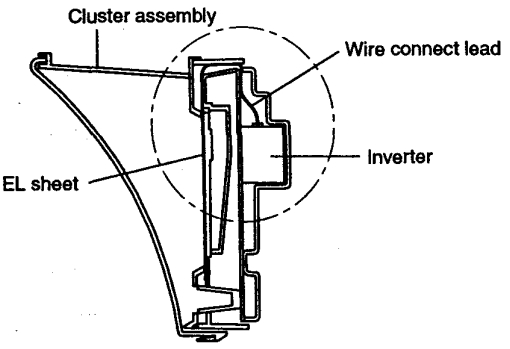
INVERTER (WITH EL TYPE CLUSTER)

The inverter is located in the instrument cluster and it converts the direct current (DC) into the alternating current (AC).
Illumination power applied to inverter in the cluster is converted into the alternating current (AC), which is supplied EL (Electroluminescent Lamp) sheets to be illuminated.



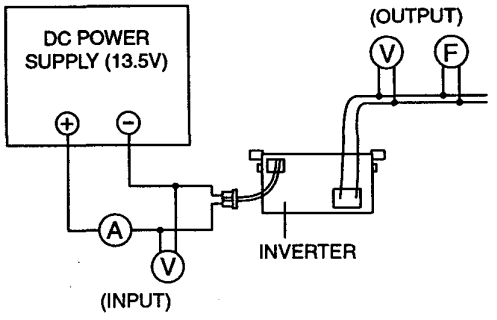
ETDD810B

1. Remove the front cover from the cluster and disconnect wire lead connector from EL sheet.



ETDD810D

2. Apply battery voltage (DC 13.5V) to the inverter in the cluster and measure the output voltage between terminal 1 and 2.
3. Also measure the output frequency between the terminals.



ETDD810C

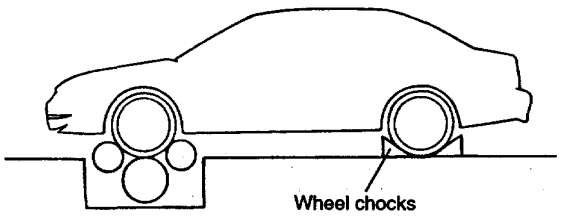
4. If the value is not as shown in the table, replace the inverter.

Input voltage	Input current	Output voltage	Output frequency	EL sheet luminosity
DC 13.5V ±1%	DC 30mA ±10%	40 Vrms ±20%	520Hz ±15%	11cd/m² ±8%

NOTE

If the inverter is normal, connect the EL and inverter, supply power to the cluster, and check the EL illuminates at the dark.
If EL illumination is too dark, the EL is should be replaced.

SPEEDOMETER



ETA9100A

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly whiletesting.

NOTE

Tire wear and tire over or under inflation will increase the indication error.

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	20-24.4	40-44.4	61-65.4	81-86.5	102-107.5
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	123-128.5	144-149.5	165-170.5	185-191.5	207-212.5

Velocity (MPH)	10	20	40	60	80	100	120	Remark
Tolerance (MPH)	10-13	20-22	40-43	60-63.8	80.3-84.1	100.3-104.1	120.3-124.1	Except U.S.A
Tolerance (MPH)	10±1.5	20±1.5	40±1.5	60±1.7	80±1.7	100±1.7	120±1.7	U.S.A

TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

CAUTION

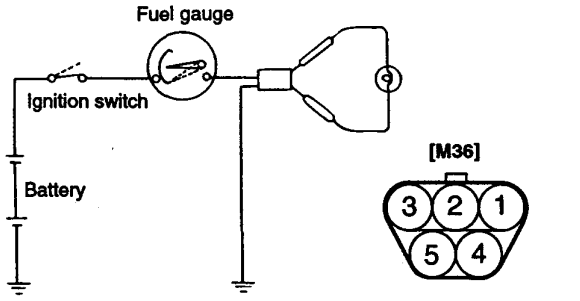
1. ***Reversing the connections of the tachometer will damage the transistor and diodes inside.***
2. ***When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.***

Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remark
Tolerance (RPM)	±100	±125	±150	±170	±200	±240	±280	Gasoline
Tolerance (RPM)	±100	±125	±150	±170	±200	-	-	Diesel

FUEL GAUGE

OPERATION CHECK

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 2 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.

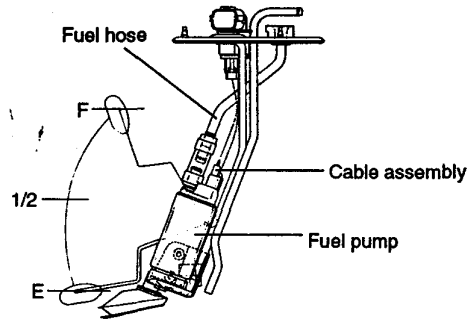


ETDD260A

FUEL SENDER

1. Using an ohmmeter, measure the resistance between terminals 2 and 3 at each float level.

Float position	F	1/2	E
Resistance (Ω)	8	66	200



ETPD260D

2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

LOW FUEL LEVEL SENSOR

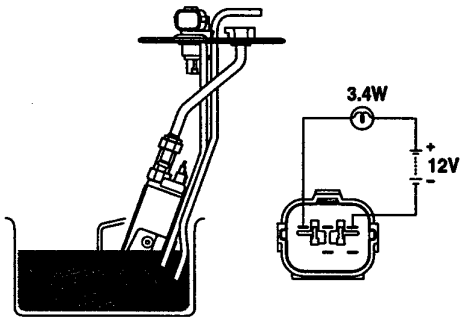
1. Connect a test lamp (12V, 3.4W) and the battery to the sender terminals 1 and 3. Immerse the sender in water.
2. The lamp should be off while the thermister is submerged in the water, and should illuminate when the sender is taken out of the water.

NOTE

If there is a malfunction, replace the fuel sender as an assembly.

CAUTION

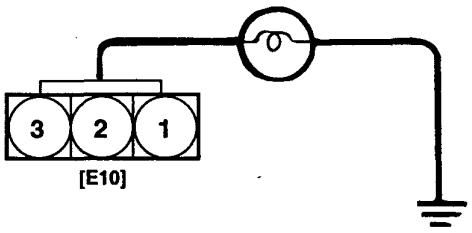
After completing this test, wipe the sender dry and reinstall it in the fuel tank.



ETPD260B

ENGINE COOLANT TEMPERATURE GAUGE

1. Disconnect the wiring connector from the engine coolant temperature sender in the engine compartment.
2. Turn the ignition switch ON. Check that the gauge needle indicates cool. Turn the ignition switch OFF.
3. Connect a 12V, 3.4 watt test bulb between the harness side connector and ground.



ETFB110H

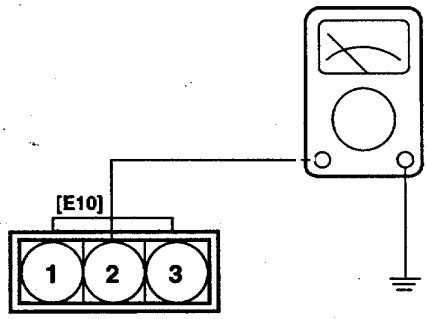
4. Turn the ignition switch ON.

5. Verify that the test bulb flashes and that the indicator moves to HOT.

If operation is not as specified, replace the engine coolant temperature gauge. Then recheck the system.

ENGINE COOLANT TEMPERATURE SENDER

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.



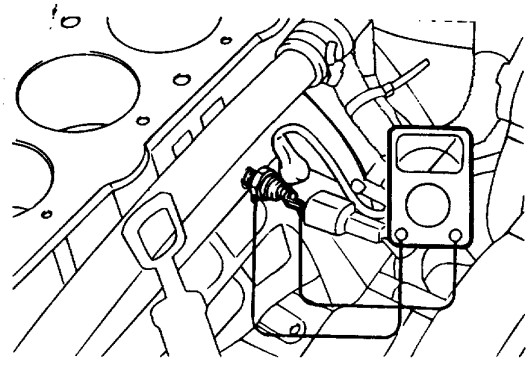
ETFB110I

2. If the resistance value is not as shown in the table, replace the temperature sender.

Temperature (°C)	55	85	110	125
Resistance (Ω)	160.3	70.3	27.9	18.6

OIL PRESSURE SWITCH

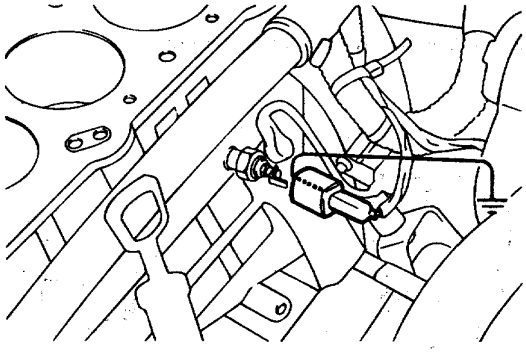
1. Check that there is continuity between the terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



V5BE060K

OIL PRESSURE WARNING LAMP

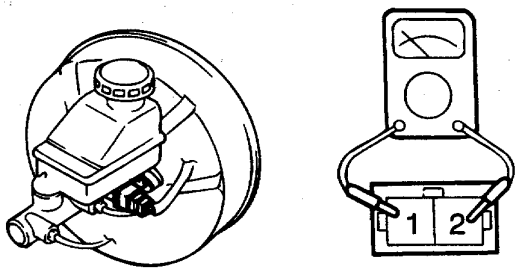
1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up.If the warning lamp doesn't light, test the bulb or inspect the wire harness.



V5BE060L

BRAKE FLUID LEVEL WARNING SWITCH

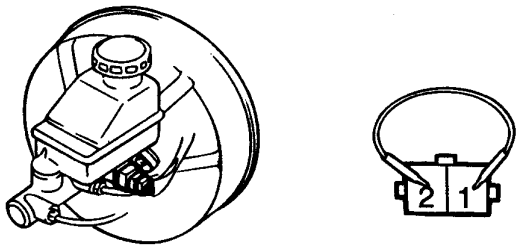
1. Remove the connector from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



V5BE060M

BRAKE FLUID LEVEL WARNING LAMP

1. Start the engine.
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.



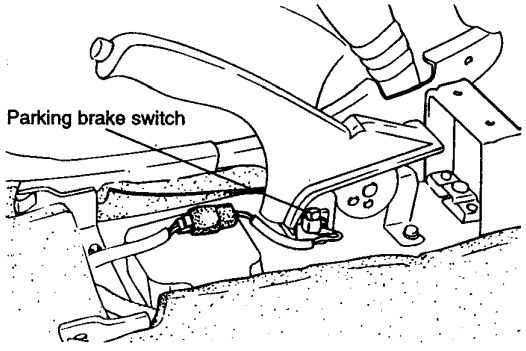
V5BE060N

PARKING BRAKE SWITCH

The parking brake switch is a push type located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch bodywith the switch OFF (Lever is released).

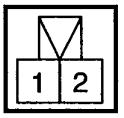
If continuity is not as specified, replace the switch or inspect its ground connection.

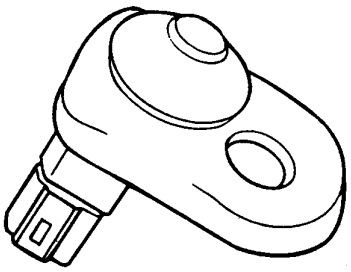


V5BE060O

DOOR SWITCH

Remove the door switch and check for continuity between the terminals.





V5BE060P

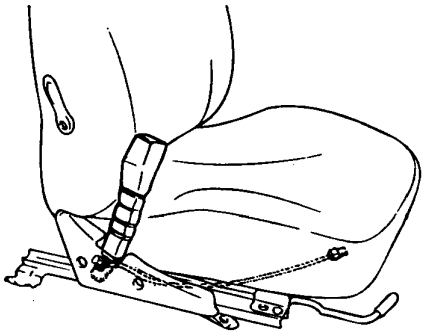
Position \ Terminal	Ground(Body)	1	2
Free (Door open)	○	○	○
Push(Door close)			

ETNC150A

SEAT BELT SWITCH

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



V5BE060Q

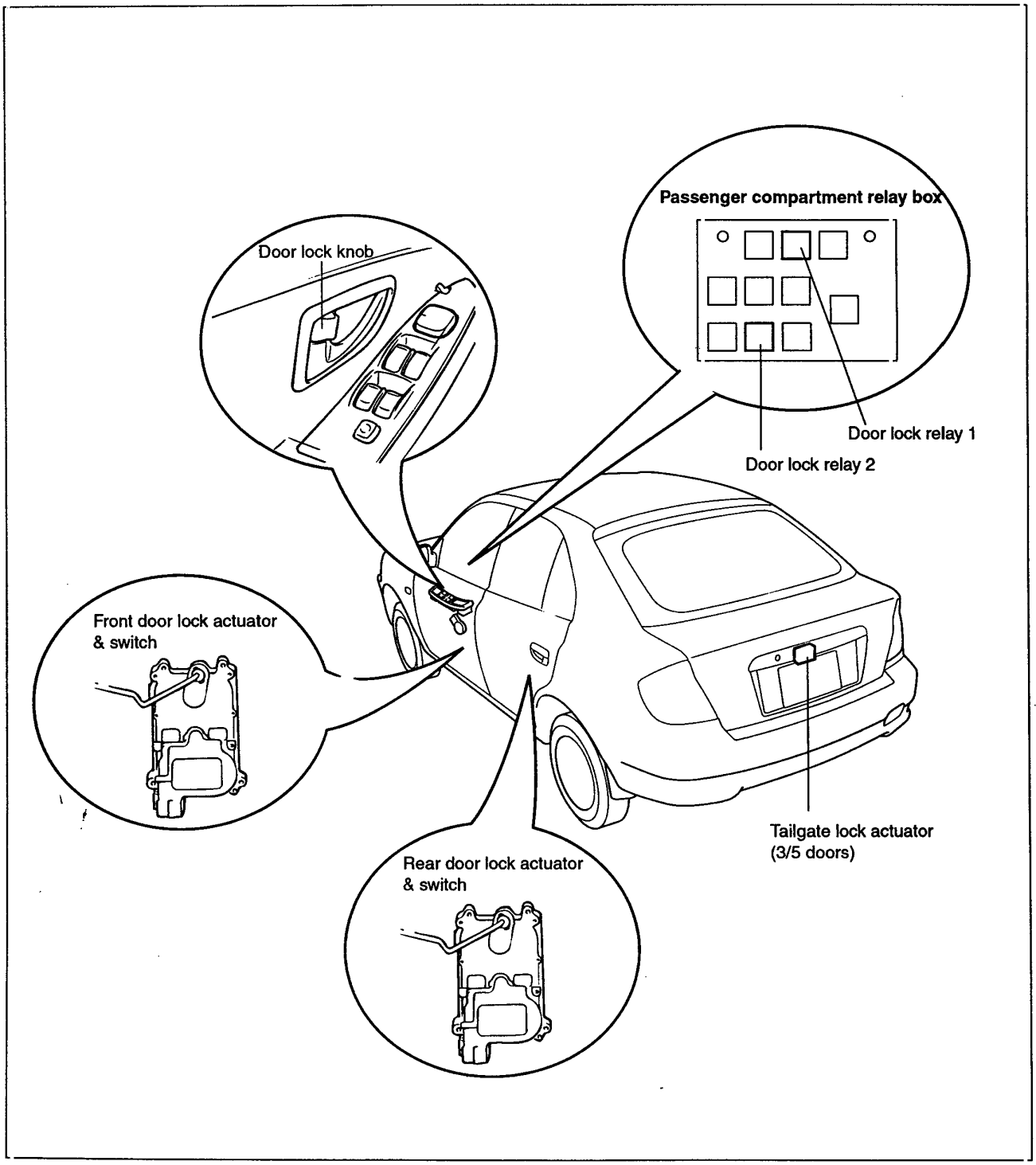
SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

POWER DOOR LOCKS

COMPONENTS E192EECC



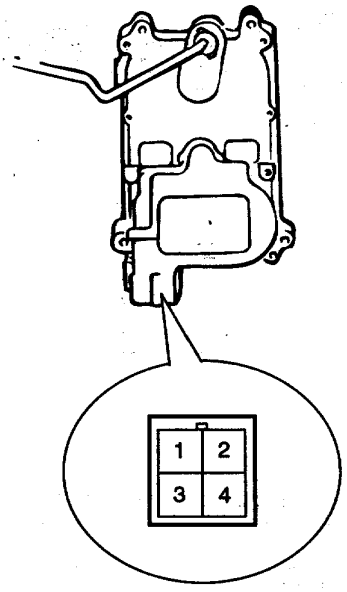
ETDD210G

POWER DOOR LOCK ACTUATORS

INSPECTION E95CE5CD

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Front door)
2. Disconnect the 4P connector from the actuator.



KTDD270A

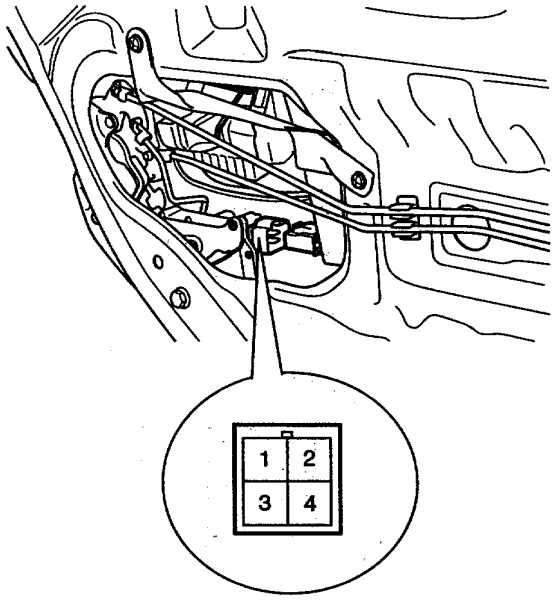
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Front left	Unlock	⊖	⊕
	Lock	⊕	⊖
Front right	Unlock	⊕	⊖
	Lock	⊖	⊕

ETDD270B

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to BD group- Rear door)
2. Disconnect the 4P connector from the actuator.



KTDD275A

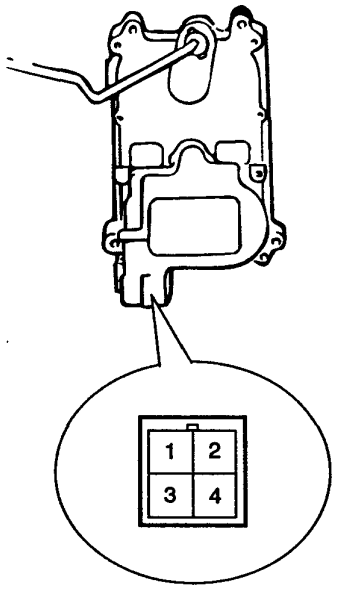
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Rear left	Lock	⊖	⊕
	Unlock	⊕	⊖
Rear right	Lock	⊕	⊖
	Unlock	⊖	⊕

ETDD275B

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Front door)
2. Disconnect the 4P connector from the actuator.



KTDD270A

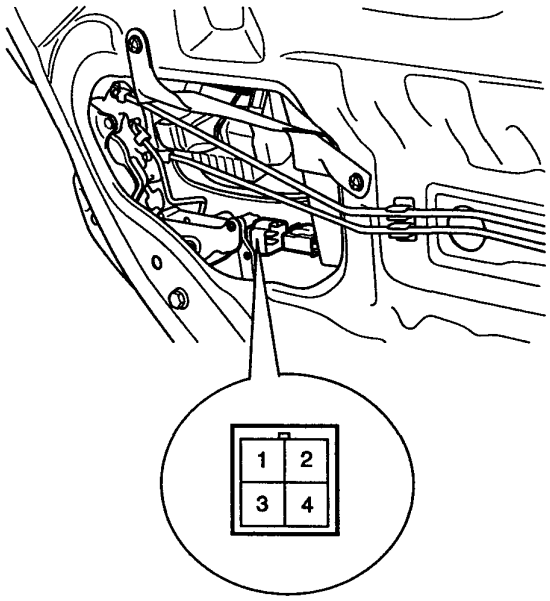
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	3
Front left	Lock		
	Unlock	○	○
Front right	Lock		
	Unlock	○	○

ETDD280B

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to BD group- Rear door)
2. Disconnect the 4P connector from the actuator.



KTDD275A

3. Check for continuity between the terminals in each switch position according to the table.

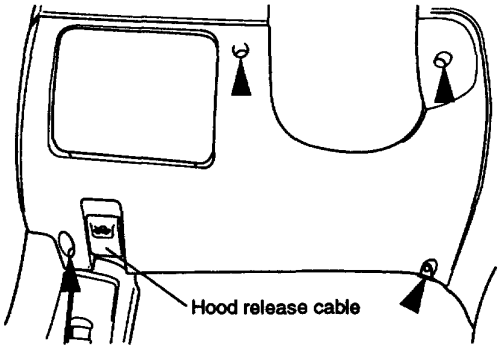
Position \ Terminal		1	3
Rear left	Lock		
	Unlock	○	○
Rear right	Lock		
	Unlock	○	○

ETDD285B

POWER DOOR LOCK RELAY

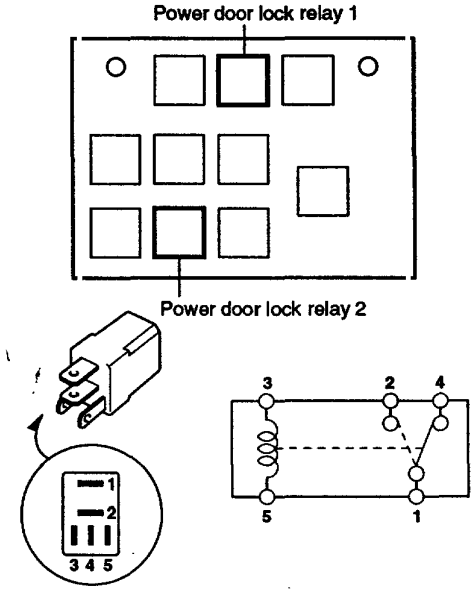
INSPECTION E463B25A

1. Remove the negative(-) battery terminal.
2. Remove the driver's side crash pad lower panel. (Refer to BD group)



ESDC113S

3. Remove the door lock relay in the passenger compartment relay box, then check for continuity between the terminals.



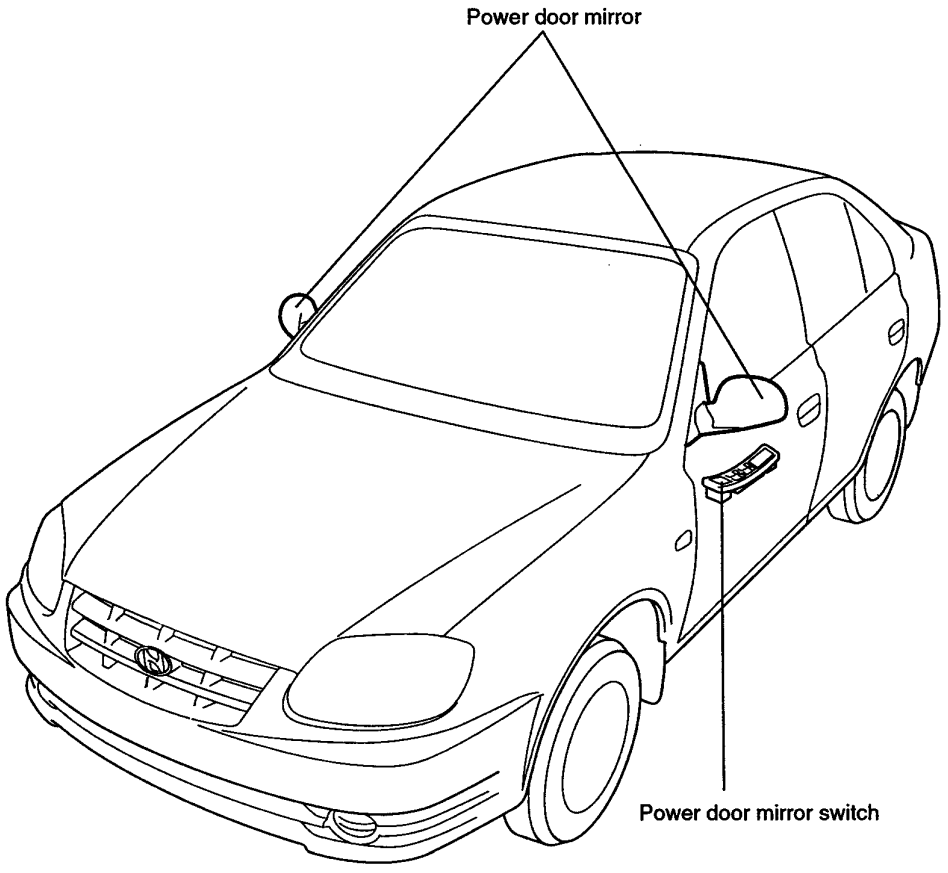
ETDD290A

Terminal / Position	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

ETDD215H

POWER DOOR MIRRORS

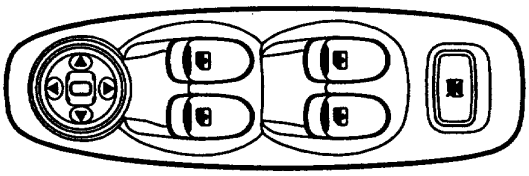
COMPONENTS E62C2058



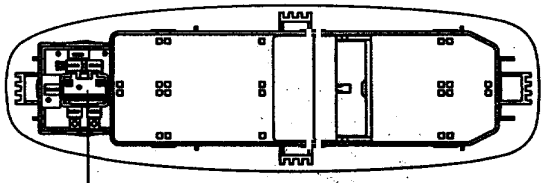
ETDD210H

POWER DOOR MIRROR SWITCH

CIRCUIT DIAGRAM EBA8A7D4

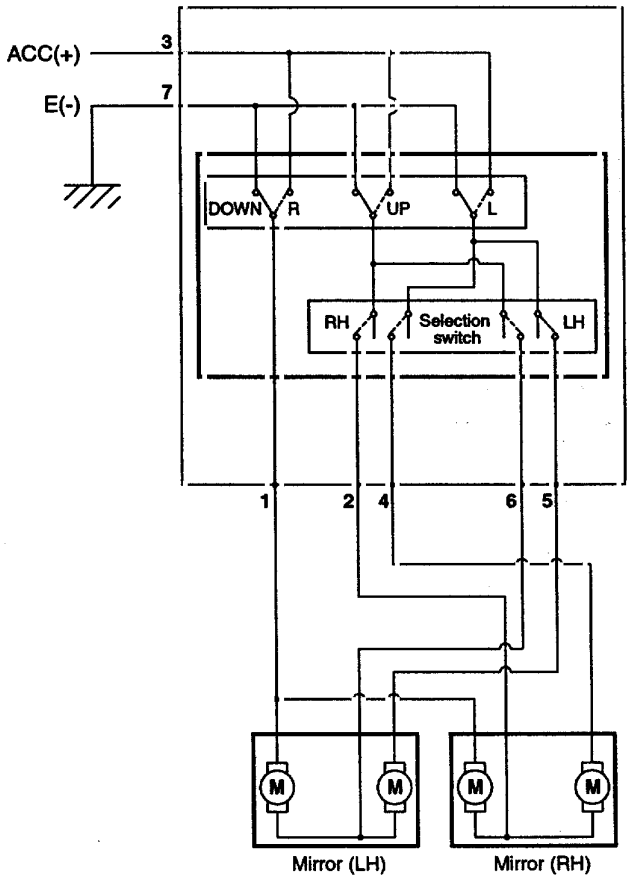


ktdd004j

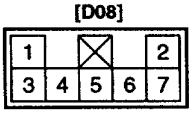


[D08]

ktdd004k



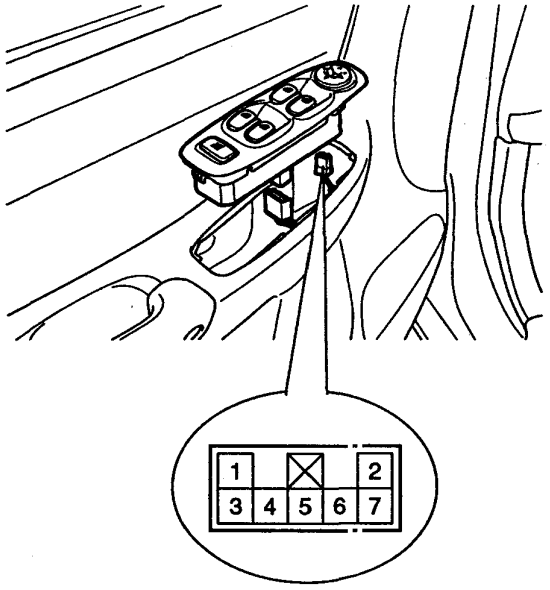
[D08]



ETDD300A

INSPECTION E7B14D7C

1. Remove the power door mirror switch from the door trim panel.
2. Check for continuity between the terminals in each switch position according to the table.



KTDD305A

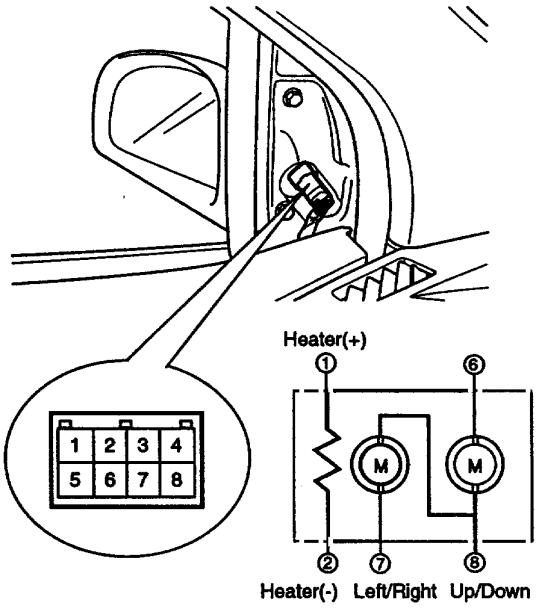
Class	Terminal / Direction	1	2	3	4	5	6	7
LEFT HAND	UP	○		○		○	○	○
	DOWN	○		○		○	○	○
	OFF	○		○		○	○	
	LEFT	○		○		○	○	○
	RIGHT	○		○		○	○	○
RIGHT HAND	UP	○	○	○	○			○
	DOWN	○	○	○	○			○
	OFF	○	○	○	○			
	LEFT	○	○	○	○			○
	RIGHT	○	○	○	○			○

ETDD305B

POWER DOOR MIRROR ACTUATOR

INSPECTION E24BF3E8

1. Disconnect the power door mirror connector from the harness.
2. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



ETPD310A

[D06]

Terminal / Position	6	7	8
UP	⊖	⊕	⊕
DOWN	⊕	⊖	⊖
OFF	⊕	⊕	⊕
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

ETDD195B

MIRROR HEATER INSPECTION

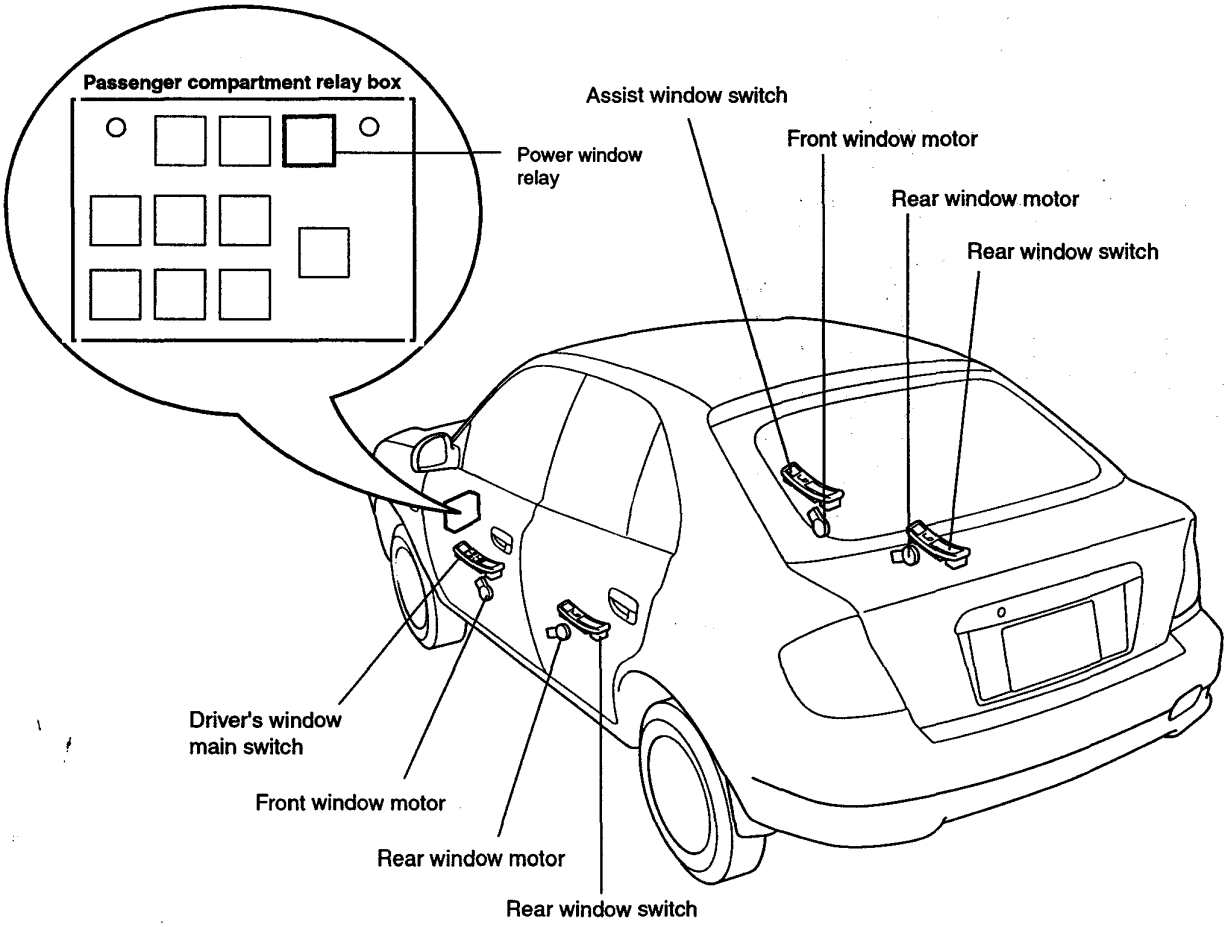
[D06]

Terminal / Position	1	2
Heater	○———	———○

ETOC195D

POWER WINDOWS

COMPONENTS EFCF6AFF



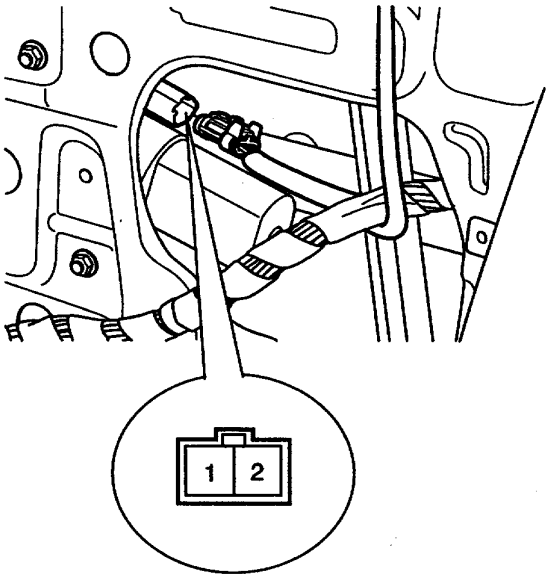
ETDD210I

POWER WINDOW MOTOR

INSPECTION EA8D7882

FRONT POWER WINDOW MOTOR INSPECTION

1. Remove the front door trim panel. (Refer to BD group- Front door)
2. Disconnect the 2P connector from the motor.



KTDD320B

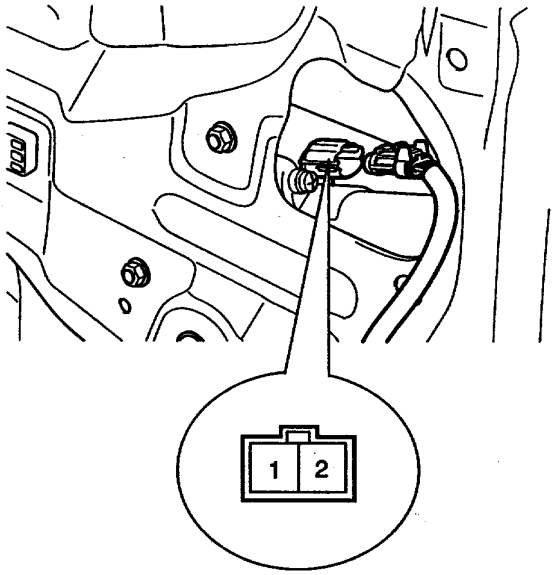
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Terminal / Direction	1	2
UP (Clockwise)	⊕	⊖
DOWN (Counter-clockwise)	⊖	⊕

ETPD320A

REAR POWER WINDOW MOTOR INSPECTION

1. Remove the rear door trim panel. (Refer to BD group- Rear door)
2. Disconnect the 2P connector from the motor.



KTDD325A

3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

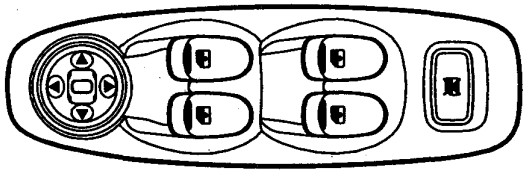
Terminal / Direction	1	2
UP (Clockwise)	⊕	⊖
DOWN (Counter-clockwise)	⊖	⊕

ETPD320A

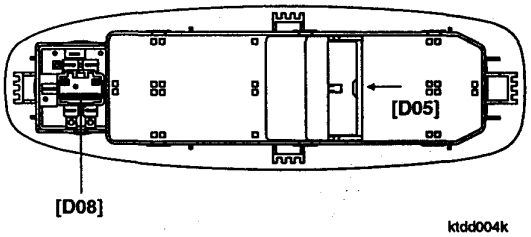
POWER WINDOW SWITCH

CIRCUIT DIAGRAM ED1FADF1

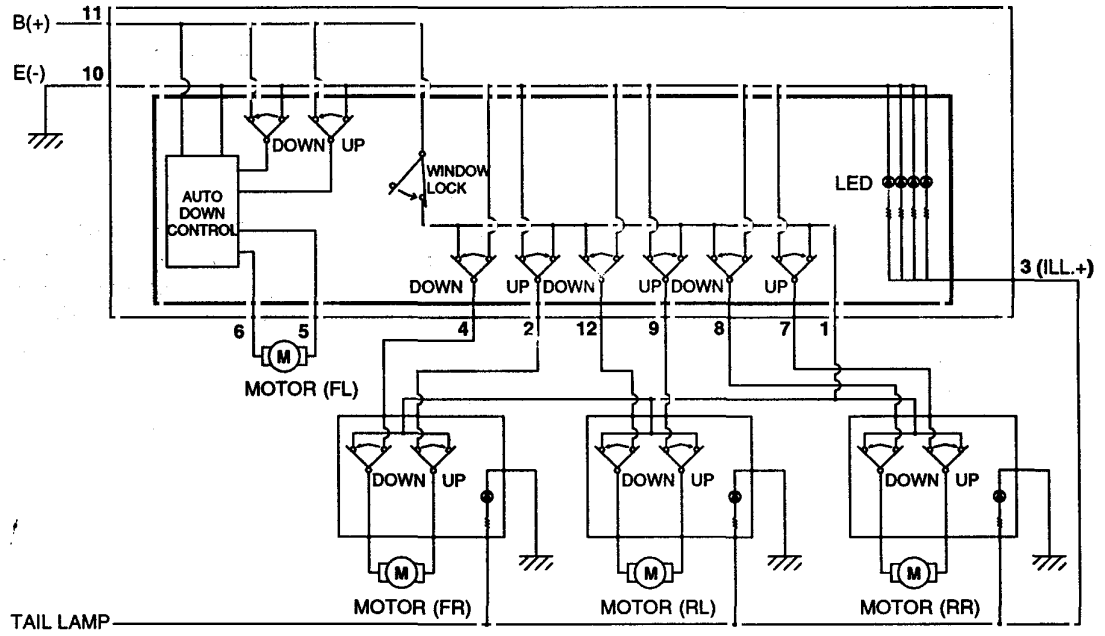
[POWER WINDOW MAIN SWITCH]



ktdd004j



ktdd004k



KTDD004L

[D05]

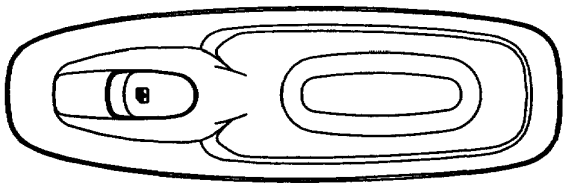
1	2	3		4	5	6	
7	8	9	10	11	12	13	14

[D08]

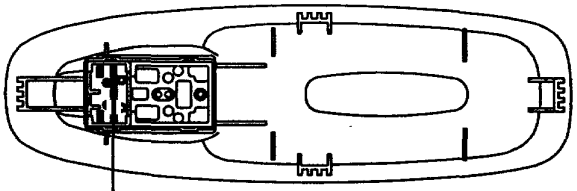
1				2
3	4	5	6	7

ETDD330A

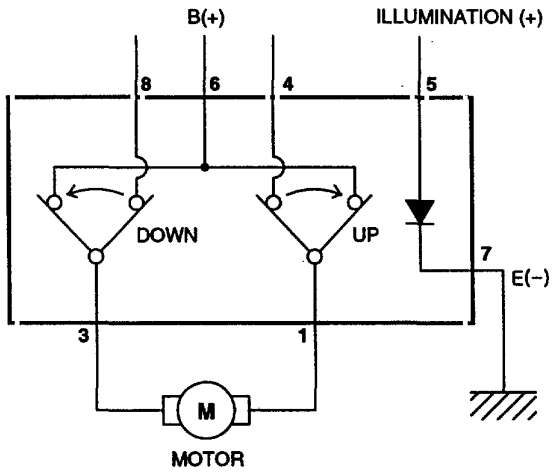
[POWER WINDOW SUB SWITCH]



KTDD004N

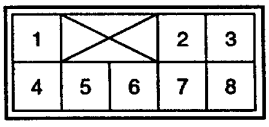


KTDD004P



KTDD004Q

[D15]

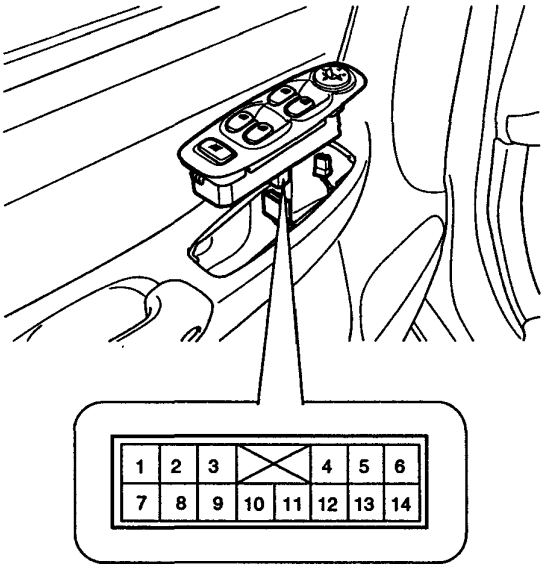


ETDD330B

INSPECTION EAB06C9D

POWER WINDOW MAIN SWITCH

1. Remove the power window main switch from the driver's door trim panel.



KTDD335A

2. Check for continuity between the terminals.

[D05]

Terminal / Position	Front left				Front right				Rear left				Rear right			
	11	5	6	10	11	2	4	10	11	9	12	10	11	7	8	10
UP	○—○		○—○		○—○		○—○		○—○		○—○		○—○		○—○	
OFF		○—○	○—○			○—○	○—○			○—○	○—○			○—○	○—○	
DOWN	○—○		○—○		○—○		○—○		○—○		○—○		○—○		○—○	

ETDD335B

POWER WINDOW LOCK SWITCH

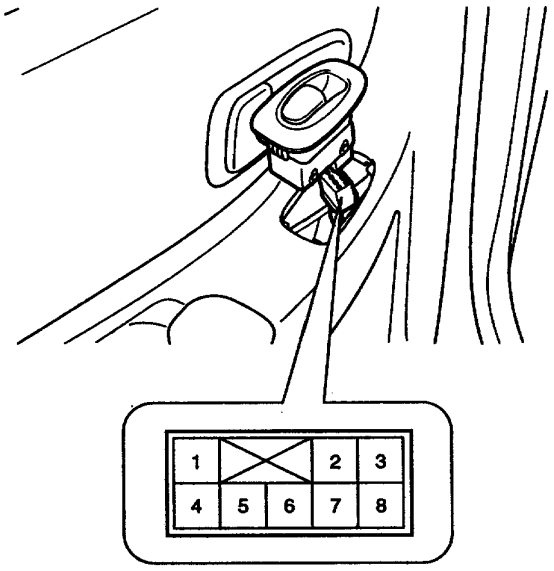
[D05]

Terminal / Position	1	11
NORMAL	○—○	
LOCK		

ETDD335C

POWER WINDOW SUB SWITCH

1. Remove the power window sub switch from the rear door trim panel.



KTDD335D

2. Check for continuity between the terminals.
   If continuity is not as specified in the table, replace the power window sub switch.

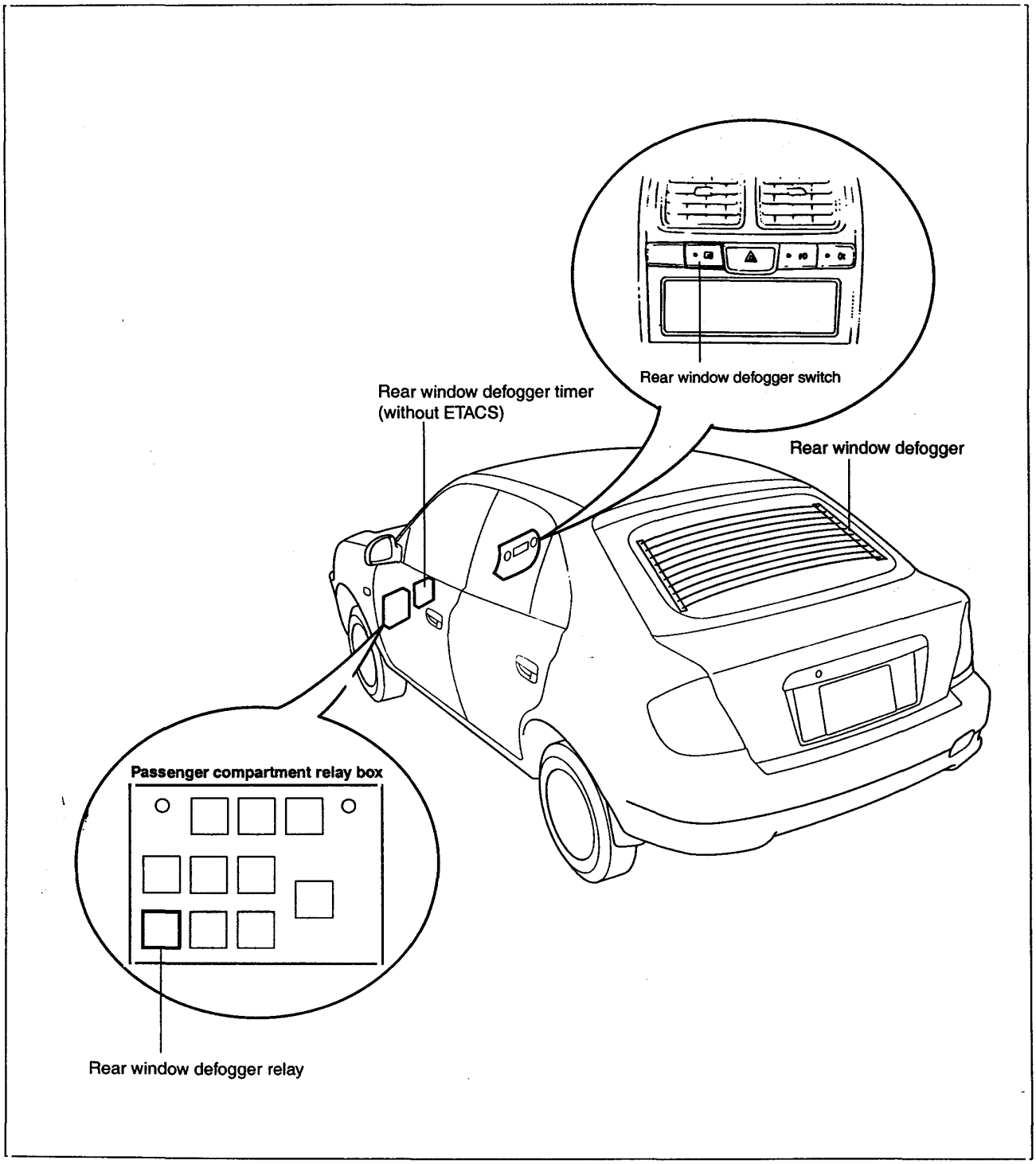
[D15]

Terminal / Position	1	3	4	6	8
UP	○	○		○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

ETDD335E

REAR WINDOW DEFOGGER

COMPONENTS EEB7300D



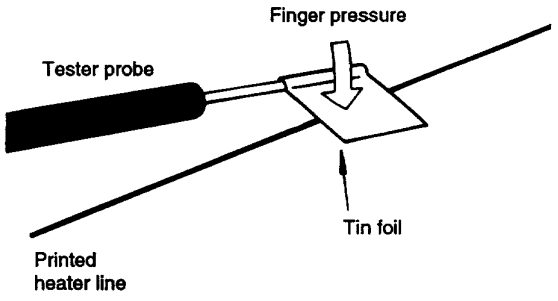
ETDD210J

REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION E39AB7AB

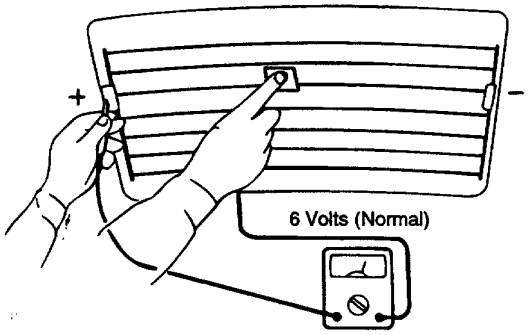
⚠ ***CAUTION***

Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



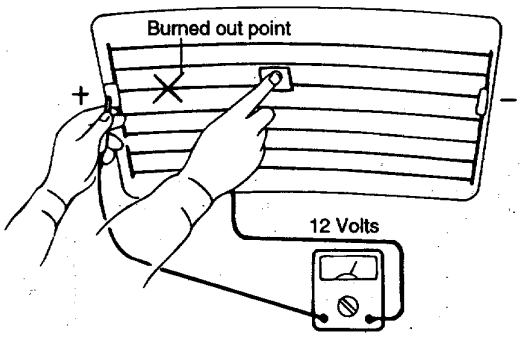
ETA9165A

1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



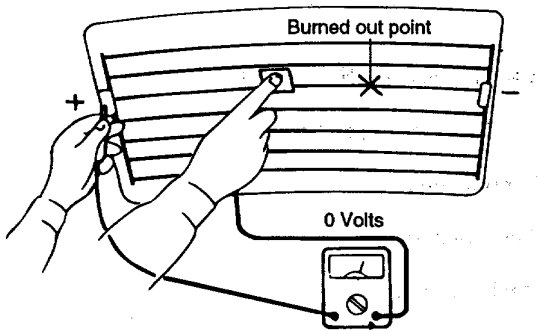
ETA9165B

2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



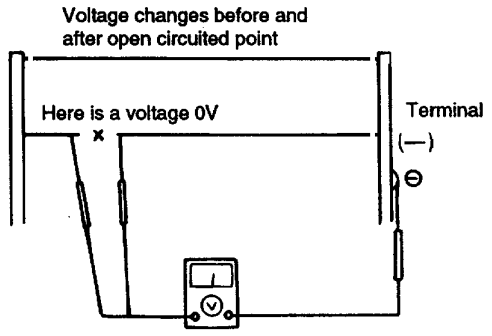
ETA9165C

3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



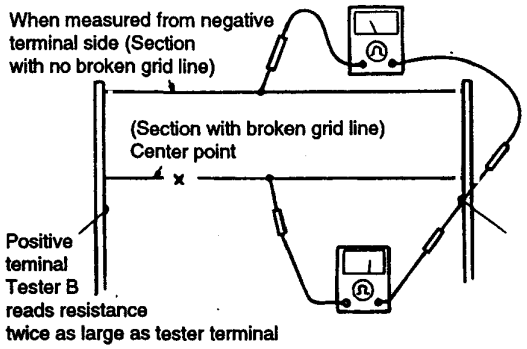
ETA9165D

4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



ETA9165E

5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

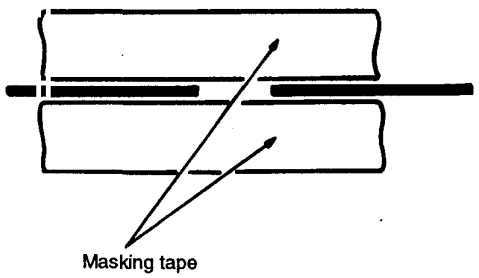


ETA9165F

REPAIR OF BROKEN HEATER LINE

Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).

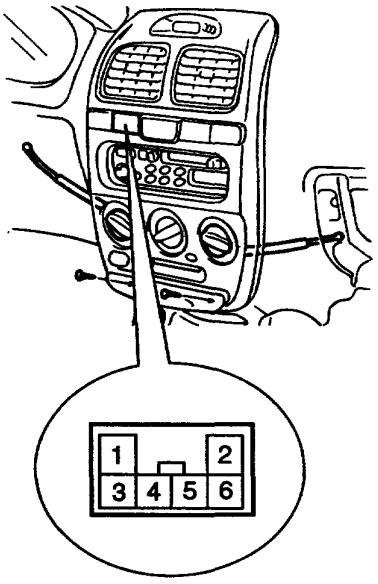


ETA9165G

REAR WINDOW DEFOGGER SWITCH

INSPECTION E7BD55BB

1. Remove the negative(-) battery terminal.
2. Disconnect the switch connector after removing the center facia panel.



KTDD341A

3. Check for continuity between the terminals. If continuity is not as specified in the table, replace the defogger switch.

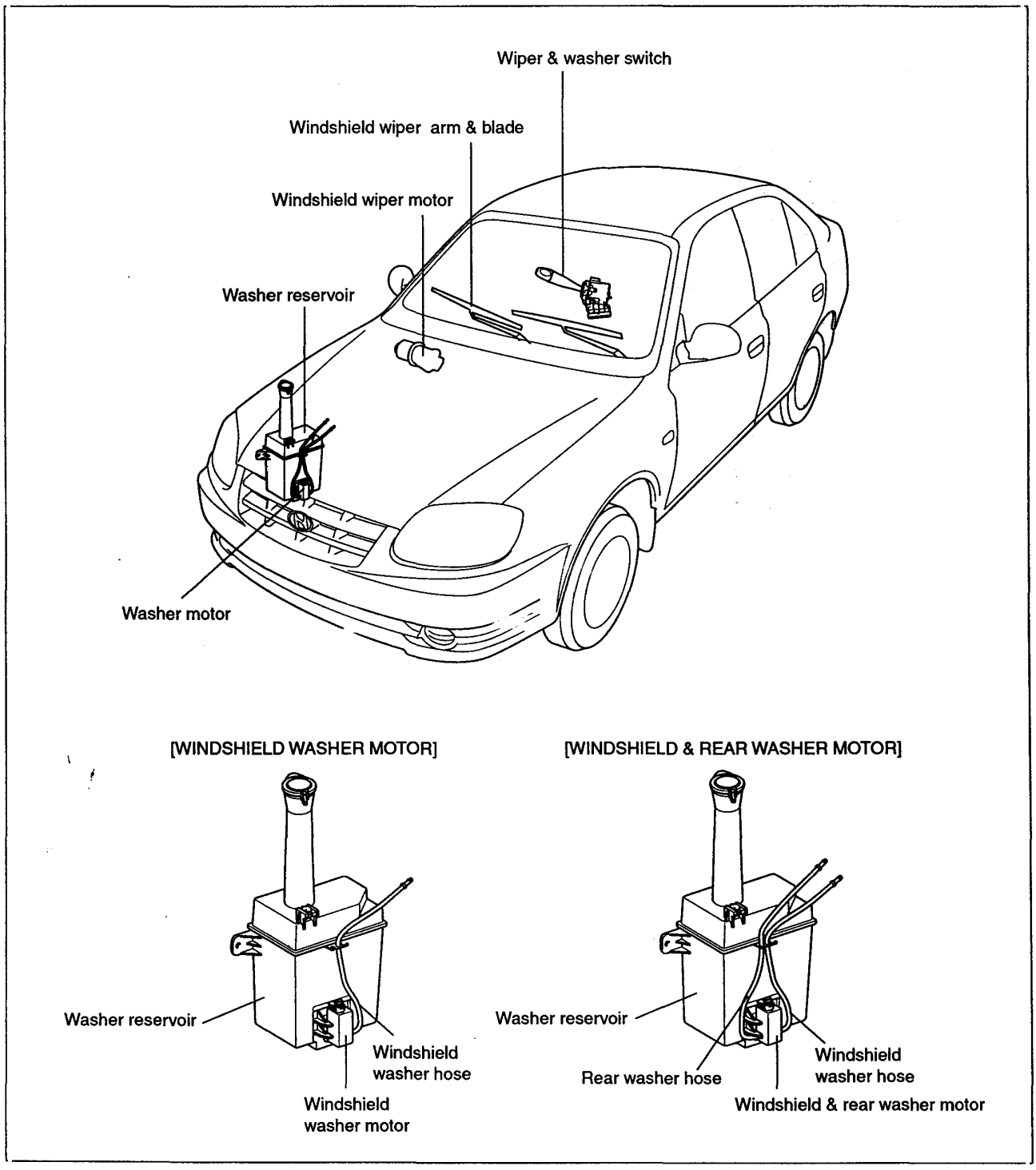
[I10]

Terminal / Position	3	4	1	5	2
ON	○	○	○	○	○
OFF		○	○		ILL.

ETDD341B

WINDSHIELD WIPER / WASHER

COMPONENTS E235022D

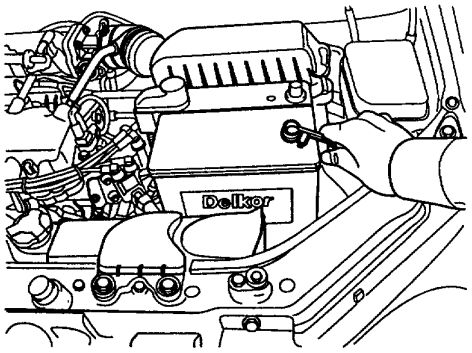


ETDD345A

WINDSHIELD WIPER / WASHER SWITCH

REMOVAL AND INSTALLATION E9327AC7

1. Disconnect the negative(-) battery terminal.

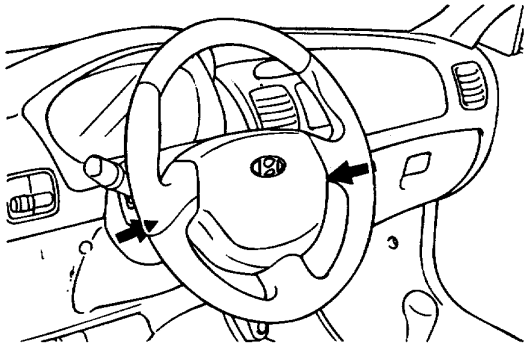


KPPD004A

2. Remove the 2 bolts and disconnect the airbag connector and the horn connector, then remove the airbag module.

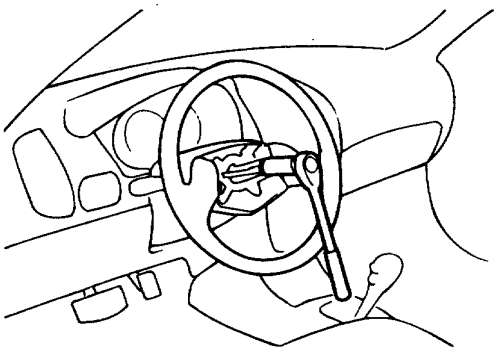
⚠ ***CAUTION***

Remove the horn pad only for vehicle without airbag.



ETDA035D

3. Remove the steering wheel lock nut.

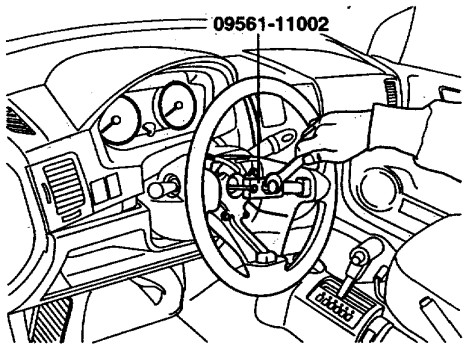


EPDA015B

4. Remove the steering wheel with special tool (09561-11002).

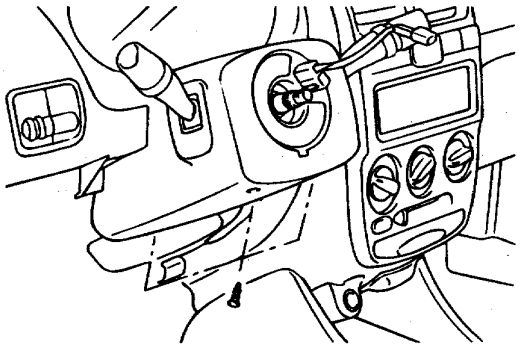
⚠ ***CAUTION***

Do not hammer on the steering wheel to remove it. Doing so may damage the collapsible mechanism.



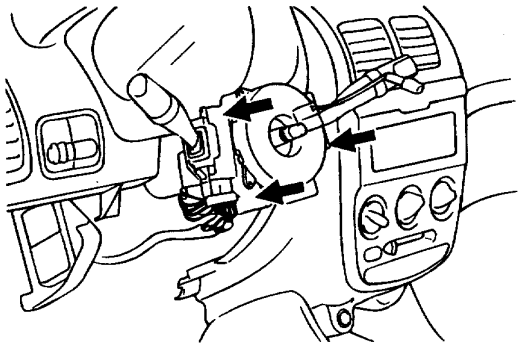
KPPD007A

5. Remove the steering column shroud after removing 3 screws.



ETDA035G

6. Disconnect the wire connectors and remove the multi-function switch after removing the screws.

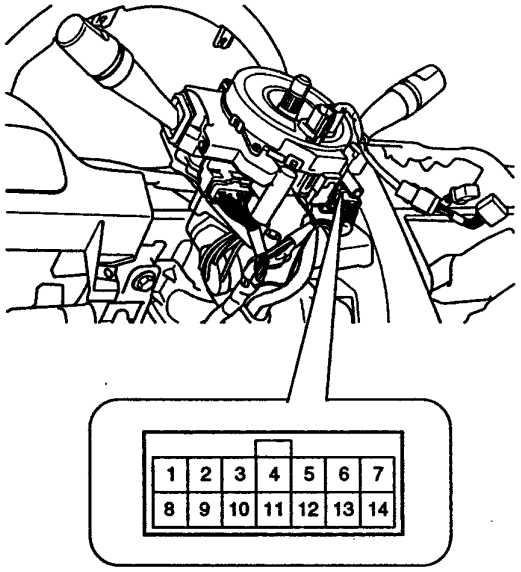


ETDA035H

7. Installation is the reverse of removal.

INSPECTION EBE9883A

Check for continuity between the terminals while operating the wiper and washer switch.



KTDD075I

WIPER SWITCH [M10-1]

Terminal / Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

ETDD075C

WASHER SWITCH [M10-1]

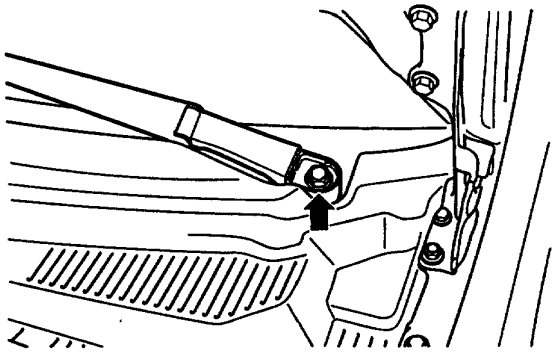
Terminal / Position	5	7
OFF		
ON	○	○

ETDD075D

FRONT WIPER MOTOR

REMOVAL E6A3BD4F

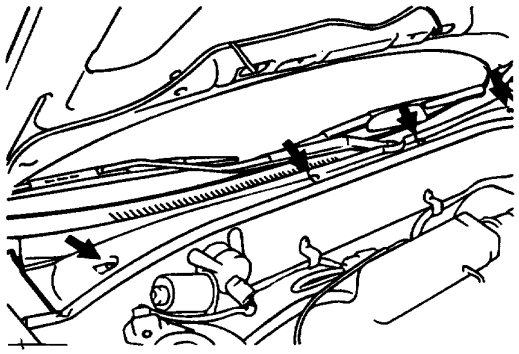
1. Remove the windshield wiper arm and blade after removing a nut.



KTPC365A

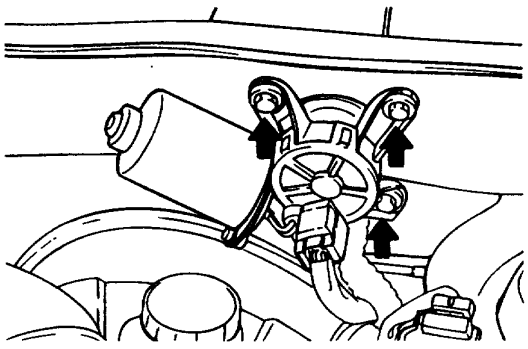
Tightening torque
18~23 Nm (180~230 kg·cm, 13.1~16.8 lb·ft)

2. Remove the weatherstrip and cowl top cover after removing 4 clips.



ETDA150B

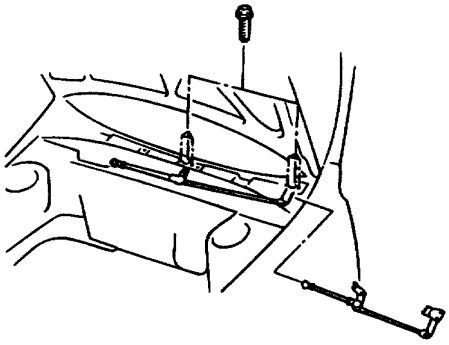
3. Remove the windshield wiper motor after removing 3 bolts.



ETDA150D

Tightening torque
7~11 Nm (70~110 kg·cm, 5.1~8.0 lb·ft)

4. Remove the wiper link mounting bolts and take out the wiper link assembly from the cowl top panel.



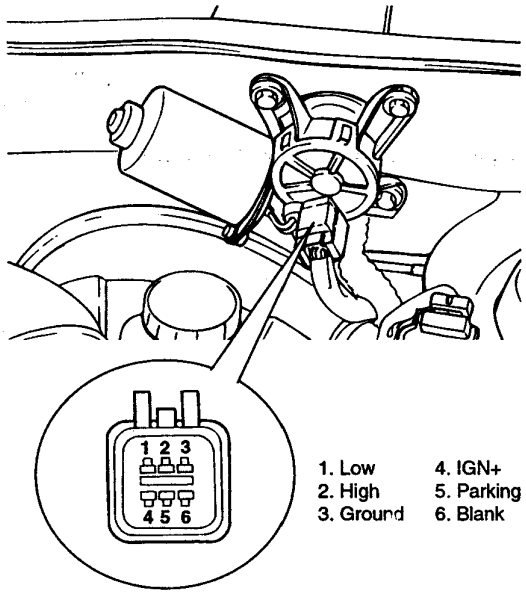
ETDA150C

5. Installation is the reverse of removal.

INSPECTION EEAACADC

SPEED OPERATION CHECK

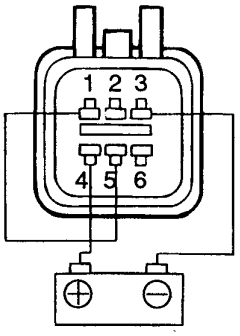
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 3.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
5. Check that the motor operates at high speed.



ETDD370A

AUTOMATIC STOP OPERATION CHECK

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 1
3. Connect terminals 1and 5.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 3.
5. Check that the motor stops running at the off position.

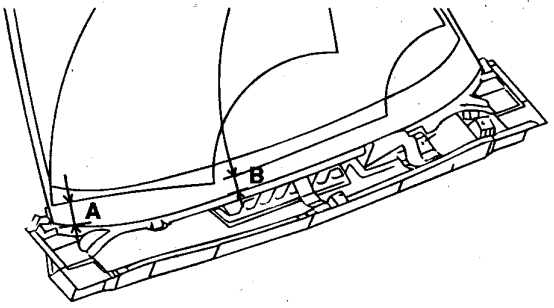


ETAC190B

INSTALLATION E11C73D3

1. Install the wiper arm and blade to the specified position.

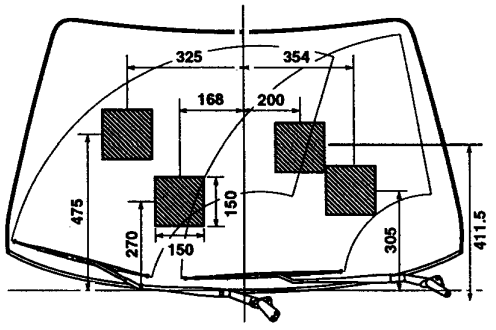
Specified position	A	B
Distance (mm)	25~35	25~35



ETJA060I

2. Set the washer nozzle on the specified spray position.

unit:mm

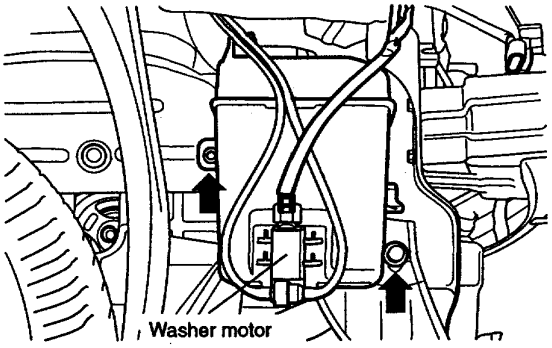


ETDD004G

FRONT WASHER MOTOR

REMOVAL AND INSTALLATION E4842E60

1. Disconnect the negative(-) battery terminal.
2. Remove the front bumper cover. (Refer to BD group)
3. Remove the washer hose and the washer motor connector.
4. Remove the washer reservoir after removing 2 bolts.

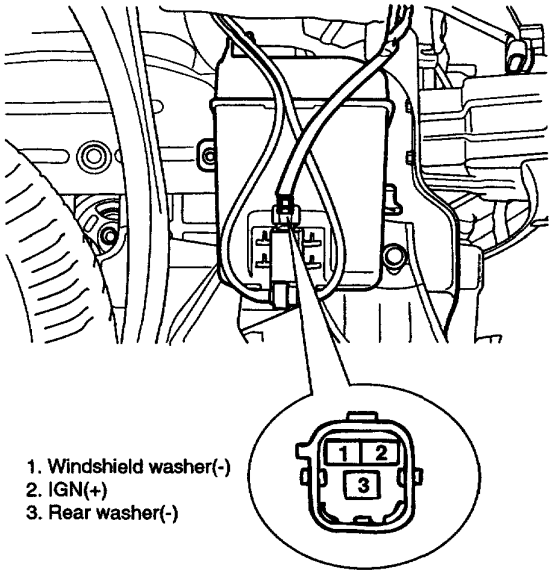


ETDD008C

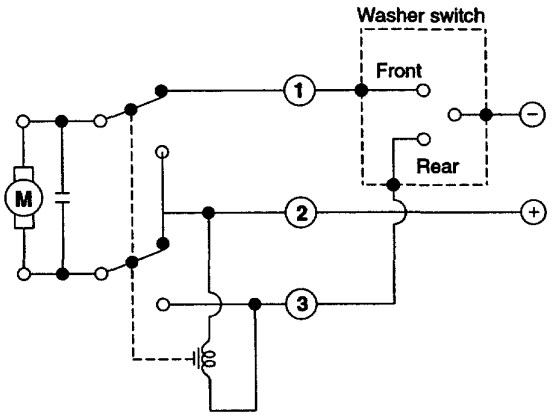
5. Installation is the reverse of removal.

INSPECTION EF18D5E9

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) and negative (-) battery cables to terminals 2 and 1 respectively to see that the washer motor runs and water sprays from the front nozzles.
3. Check that the motor operates normally.

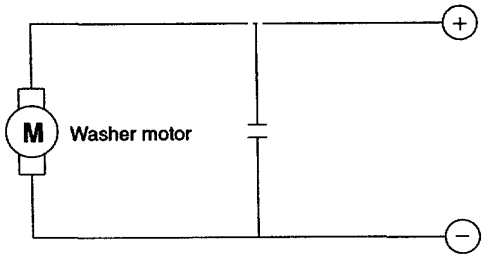


ETDD390A



<Windshield & rear washer motor>

ETDD390B



<Windshield washer motor>

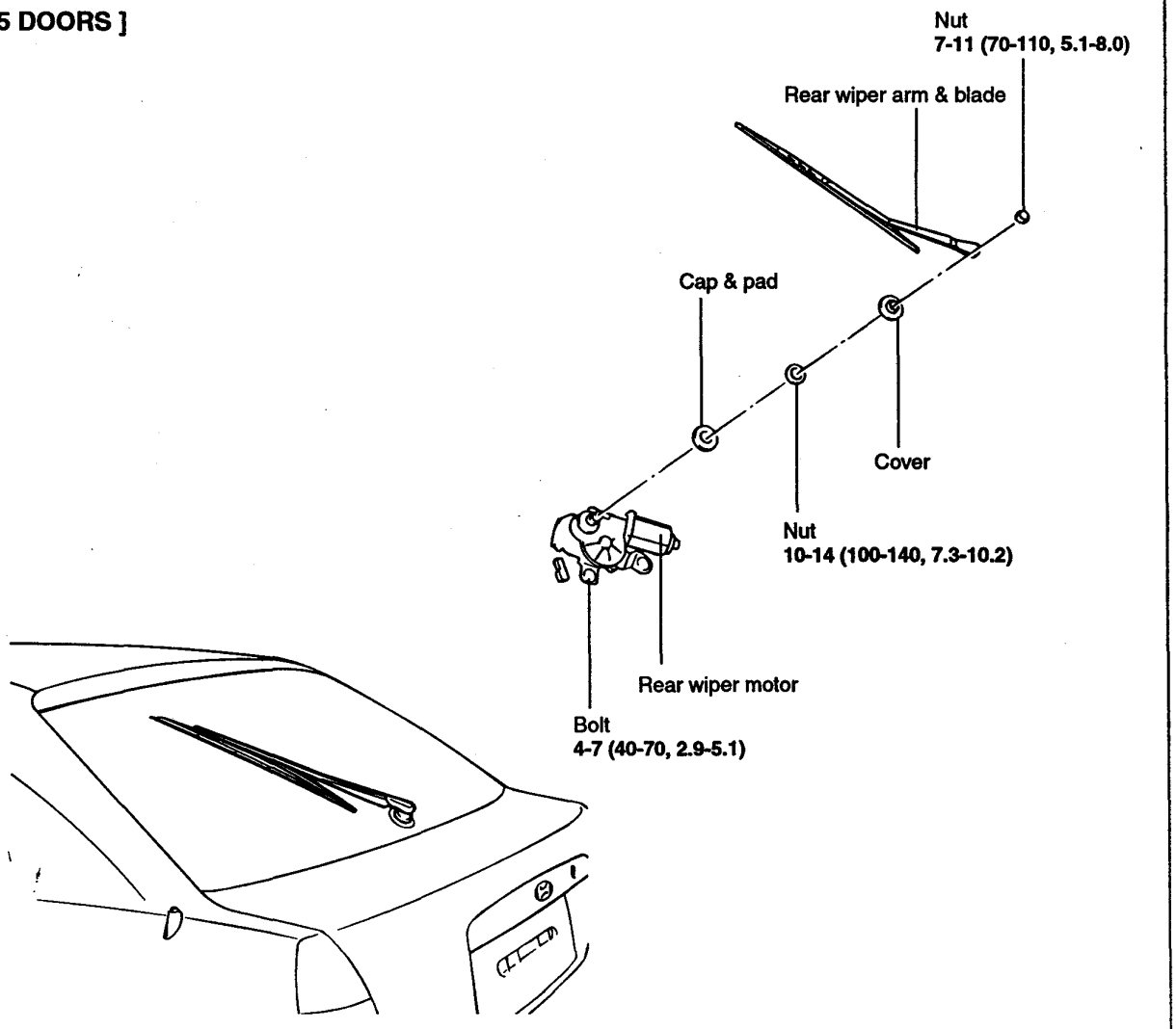
ETPD390C

REAR WIPER / WASHER

REAR WIPER MOTOR

COMPONENTS ECBF1B74

[3/5 DOORS]

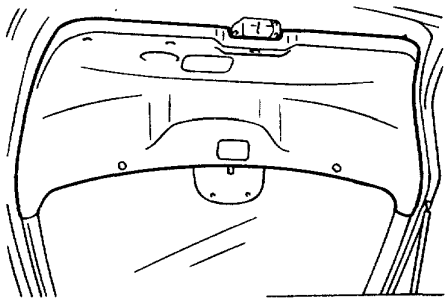


TORQUE : Nm (kg·cm, lb·ft)

ETDD160A

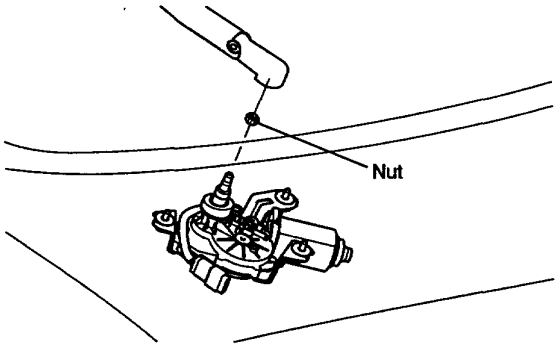
REMOVAL EF26E08C

1. Remove the tailgate trim panel.



ETDA165A

2. Remove the rear wiper arm after removing a nut.

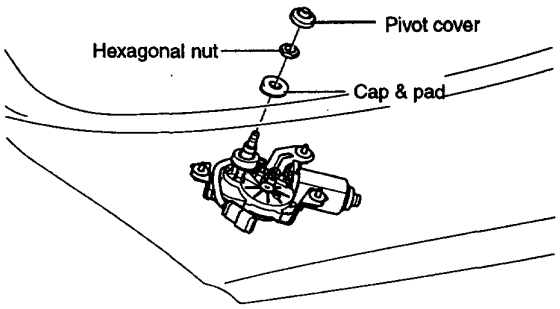


ETOB004I

Tightening torque
7~11 Nm (70~110 kg·cm, 5.1~8.0 lb·ft)

3. Remove a hexagonal nut after removing a pivot cover.

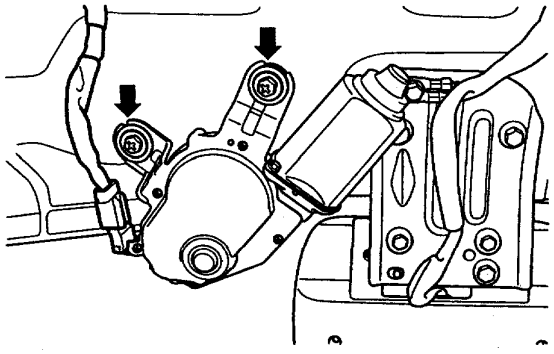
NOTE
When installing cap & pad, the arrow mark should be indicated upward.



ETPD400A

Tightening torque
10~14 Nm (100~140 kg·cm, 7.3~10.2 lb·ft)

4. Remove the rear wiper motor after removing 2 bolts and disconnect the wire connector.



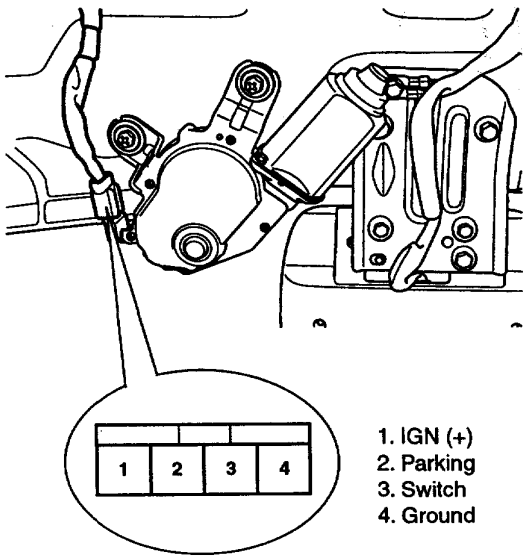
KTDD008D

Tightening torque
4~7 Nm (40~70 kg·cm, 2.9~5.1 lb·ft)

5. Installation is the reverse of removal.

INSPECTION EDFDB59E

1. Remove the connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 1 and 4 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.



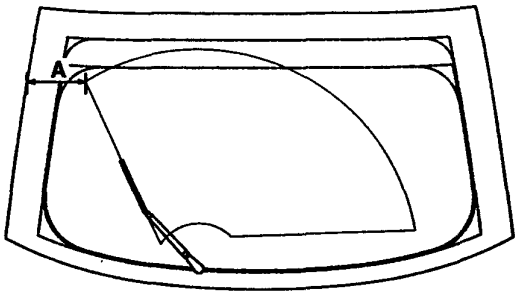
1. IGN (+)
2. Parking
3. Switch
4. Ground

ETDD405A

INSTALLATION E2EBF8FE

1. Install the rear wiper arm and blade to the specified position.

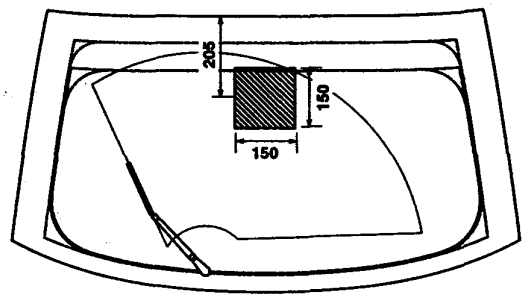
Specified position	A
Distance	150±10 mm



KTDD004I

2. Set the rear washer nozzle on the specified spray position.

unit : mm

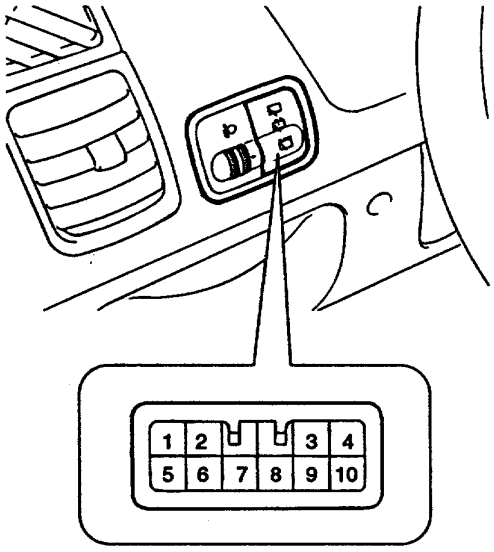


ETDD004H

REAR WASHER SWITCH

INSPECTION EA06E3AB

1. Disconnect the connector from the rear wiper and washer switch.
2. Check for continuity between the terminals.



ETDD075H

[I17]

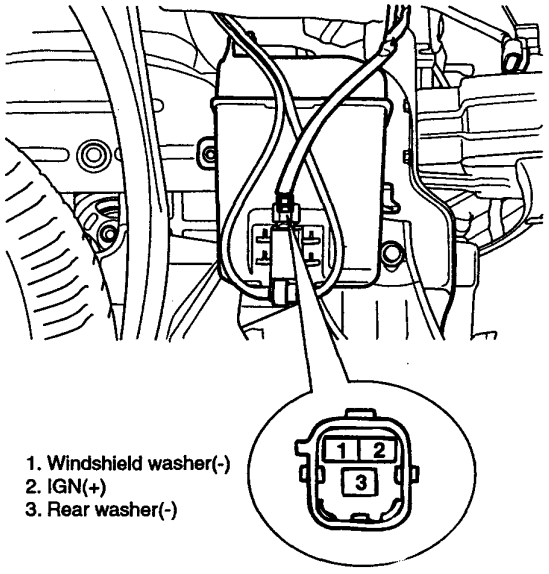
Position		Terminal 3	4	6	9	10	1	2
Wiper switch	ON		○		○			
	OFF						○	○
	INT		○	○			○	ILL.
Washer switch	ON		○			○		
	OFF							

ETDD415B

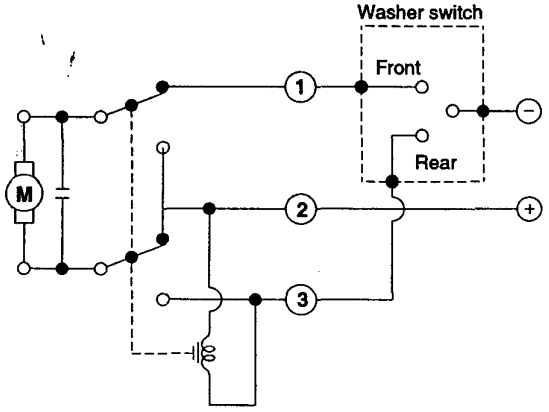
REAR WASHER MOTOR

INSPECTION E70CDAA2

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive(+) and negative(-) battery cables to terminals 2 and 3 respectively to see that the washer motor runs and water is pumped.
3. Check that the motor operates normally.
   Replace the motor if it operates abnormally.



ETDD390A

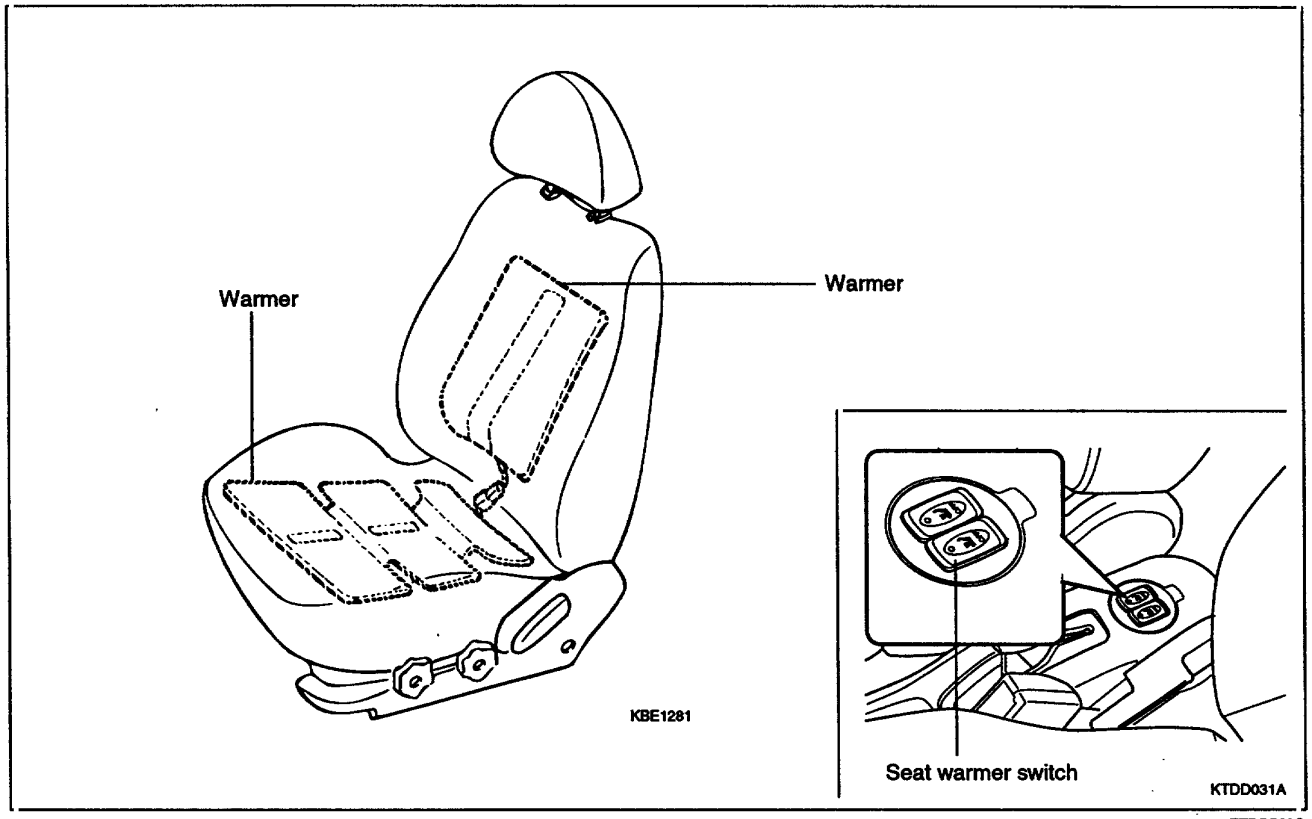


<Windshield & rear washer motor>

ETDD390B

SEAT WARMER

COMPONENTS EAC0D81D

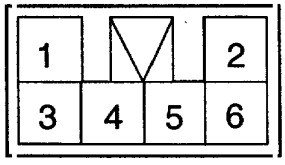


ETDD700G

SEAT WARMER SWITCH

INSPECTION E801ED2E

1. Disconnect the negative (-) battery terminal.
2. Remove the seat warmer switch from the floor console panel.



3. Check for continuity between the terminals.

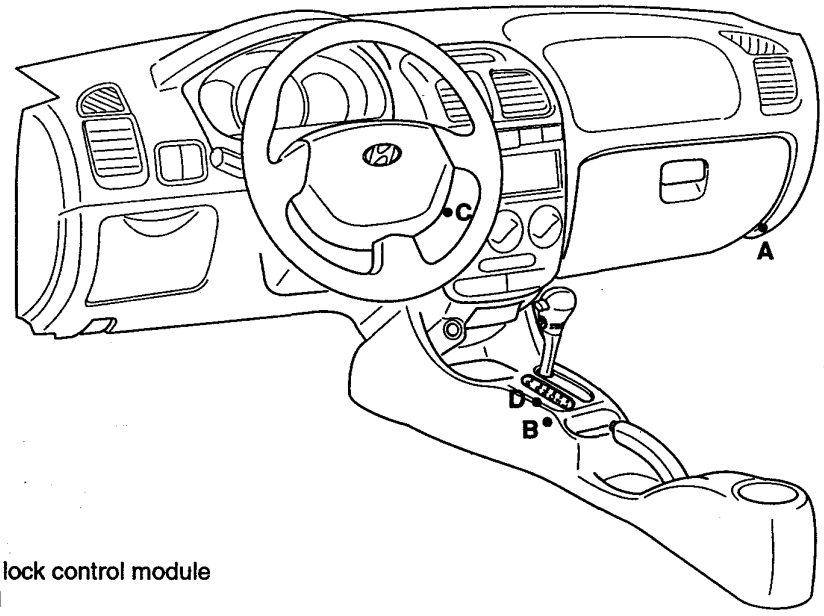
Position \ Terminal	1	3	2	6	4	5
ON				IND.		
OFF		ILL.		IND.		

ETPD700F

ETPD700C

SHIFT AND KEY LOCK CONTROL SYSTEM

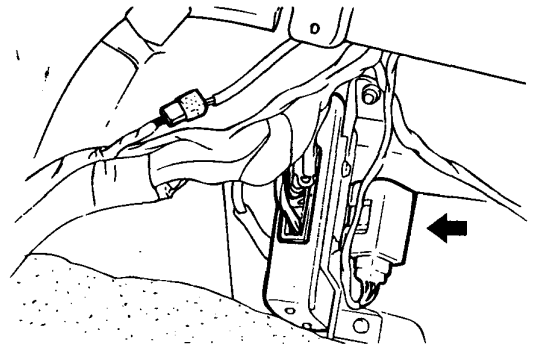
COMPONENTS E3B2BBB2



A. A/T and key lock control module
B. A/T solenoid
C. Key lock solenoid
D. P/position switch

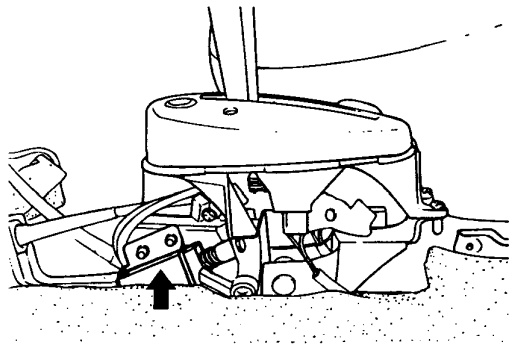
ETDD115E

A. A/T and key lock control module



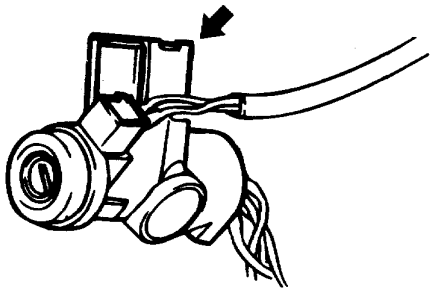
ETFB115A

B. A/T solenoid



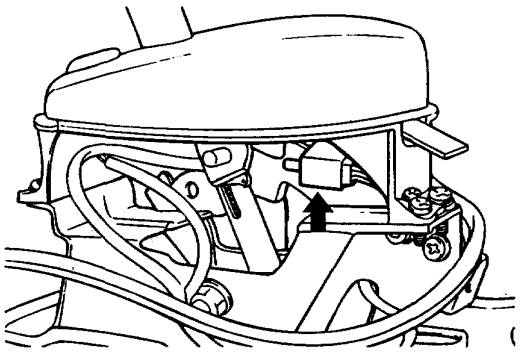
ETFB115B

C. Key lock solenoid



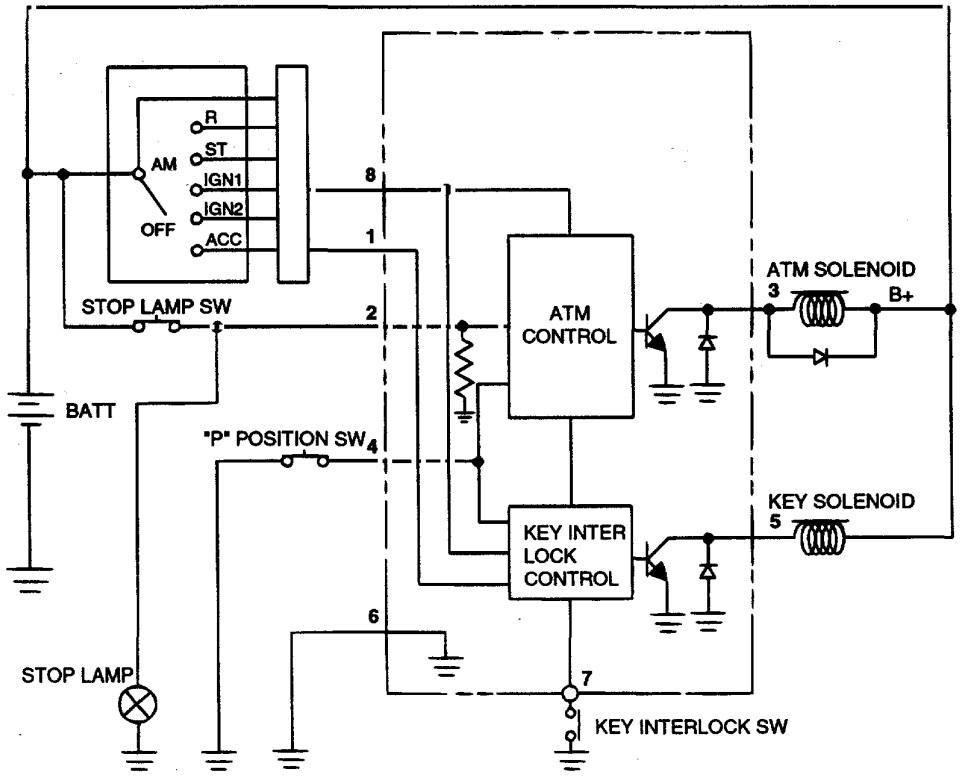
ETFB115C

D. P/position switch



ETFB115D

CIRCUIT DIAGRAM E5E21A3F



[M03]

1			2	3
4	5	6	7	8

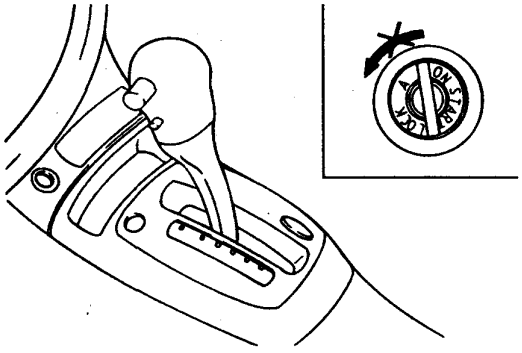
(A/T shift & key lock control module)

ETFB120A

SYSTEM CHECK EB5DAEC5

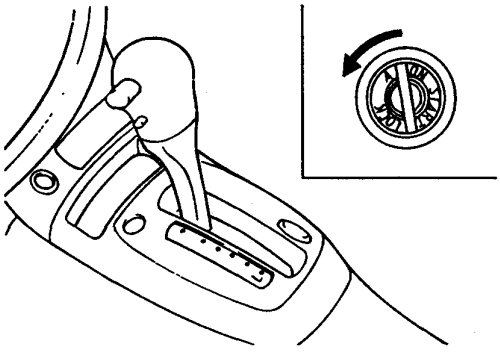
KEY LOCK SYSTEM

1. Check that the ignition key cannot be turned to "LOCK (OFF)" position, when the position of the shift lever is not in "P" position.



ETFB125A

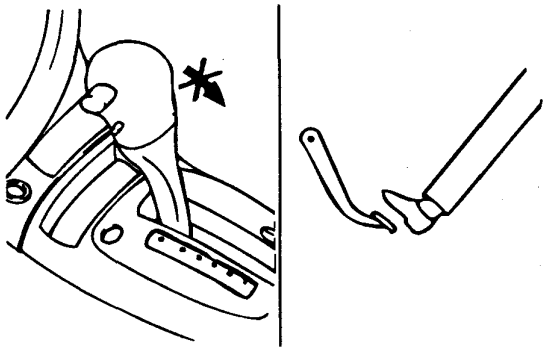
2. Check that the ignition key turns to the "LOCK (OFF)" position, when the shift lever is set to the "P" position.



ETFB125B

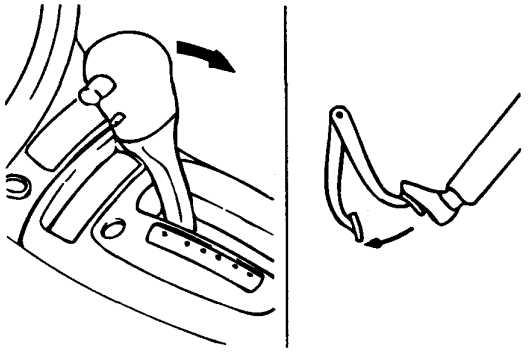
SHIFT LOCK SYSTEM

1. Check that under the following conditions, the shift lever cannot be movedfrom the "P" position to any other position.
   IGNITION KEY POSITION : "ON"
   BRAKE PEDAL : NOT DEPRESSED
   BUTTON : PRESSED



ETFB125C

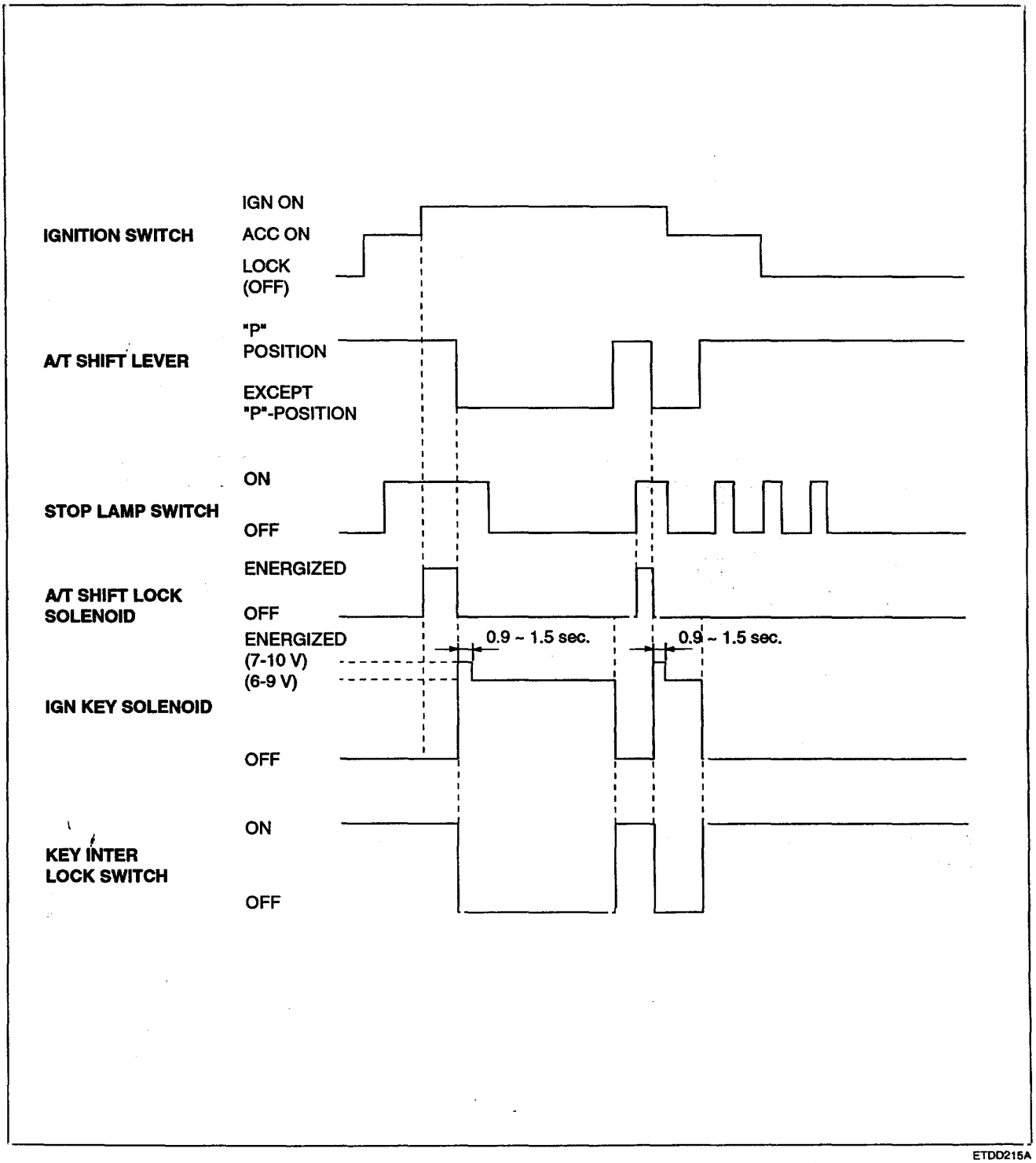
2. Check that under the following conditions, the shift lever can be moved fromthe "P" position to other position.
   IGNITION KEY POSITION : "ON"
   BRAKE PEDAL : DEPRESSED
   BUTTON : PRESSED



ETFB125D

INSPECTION EE8F35C4

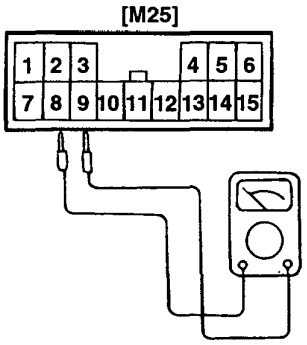
TIMMING CHART



ETDD215A

A/T SHIFT LOCK SOLENOID

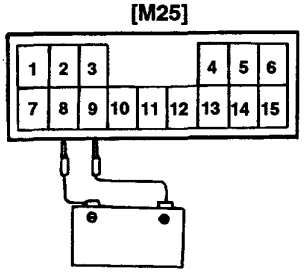
1. Remove the solenoid connector.
2. Using an ohmmeter, measure the resistance between terminals.



ETFB130B

Standard resistance : 12-16Ω

3. Attach the positive (+) lead from the battery to terminal #9. and the negative (-) lead to terminal #8.

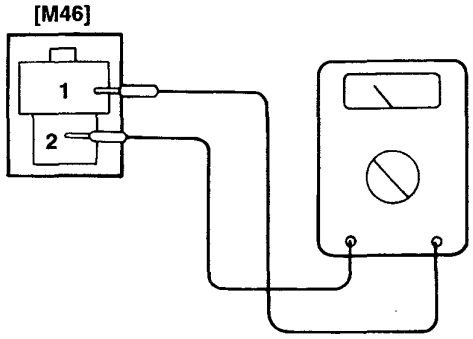


ETFB130C

4. Check that an operation noise can be heard from the solenoid.

A/T KEY INTERLOCK SOLENOID

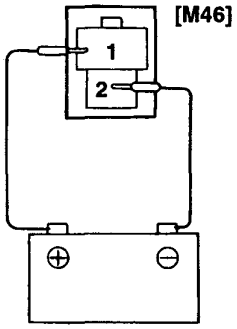
1. Remove the solenoid connector.
2. Using an ohmmeter, measure the resistance between terminals.



ETFB130D

Standard resistance : 12-16Ω

3. Attach the positive (+) lead from the battery to terminal #2. and the negative (-) lead to terminal #1.

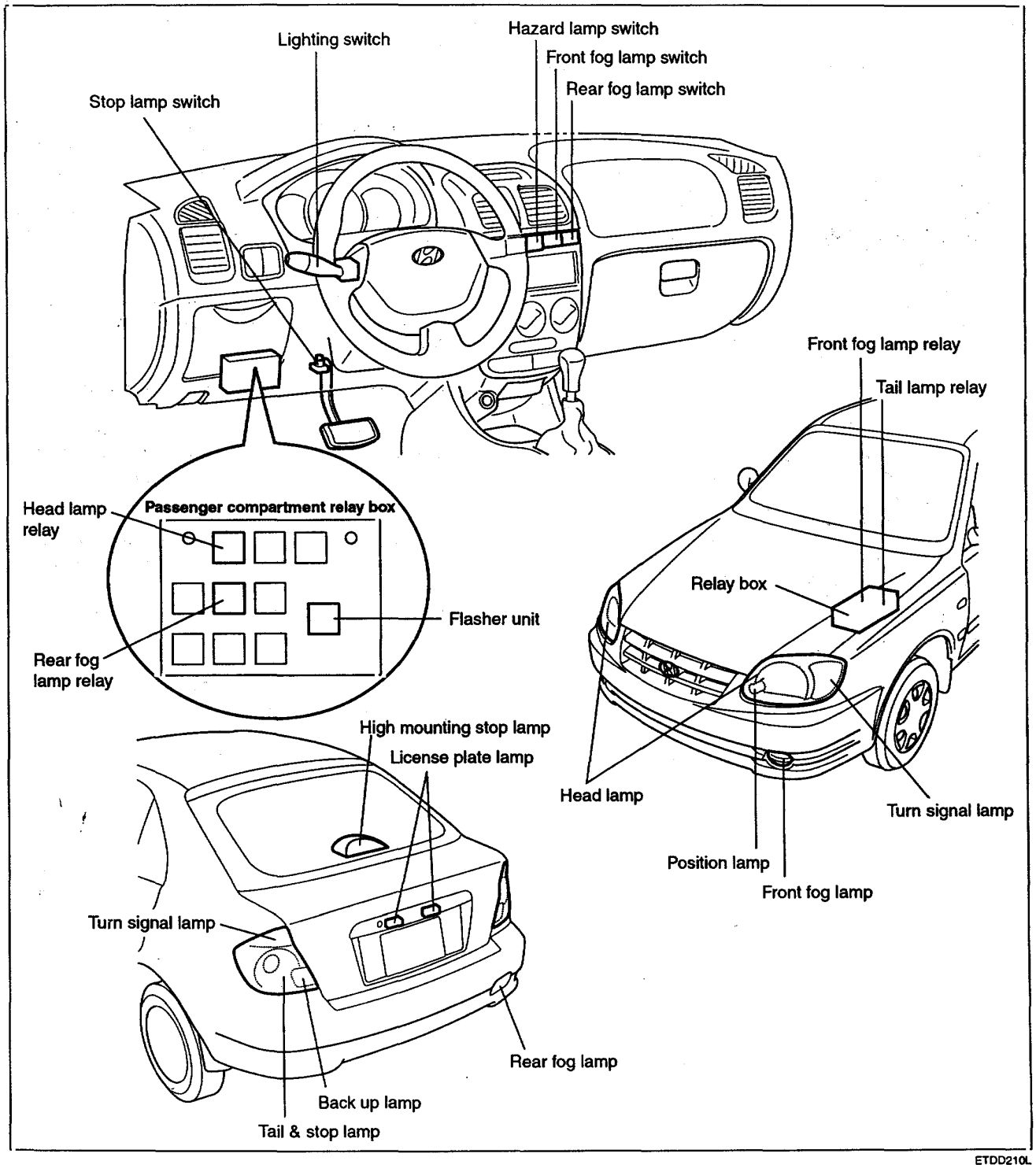


ETDD130E

4. Check that an operation noise can be heard from the solenoid.

LIGHTING SYSTEM

COMPONENTS EBFAFB59

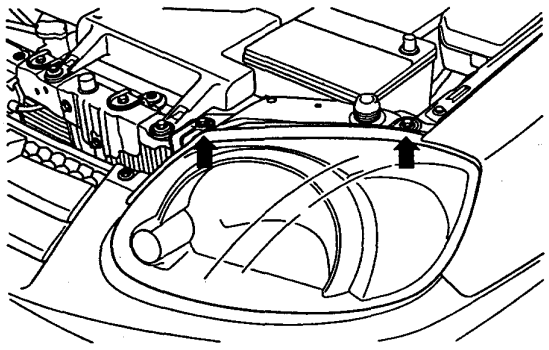


ETDD210L

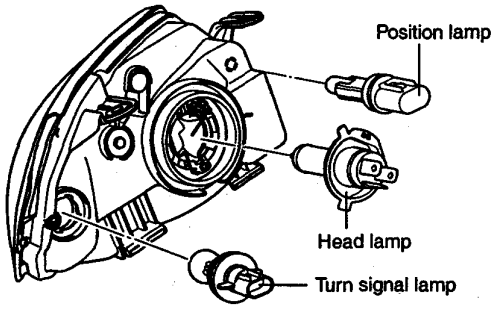
HEAD LAMPS

REMOVAL AND INSTALLATION EE97505A

1. Disconnect the negative(-) battery terminal.
2. Remove the head lamp mounting bolts (2EA), then disconnect the lamp connectors.



KTDD445B



ETDD003H

3. Installation is the reverse of removal.

AIMING INSTRUCTIONS E1C4786B

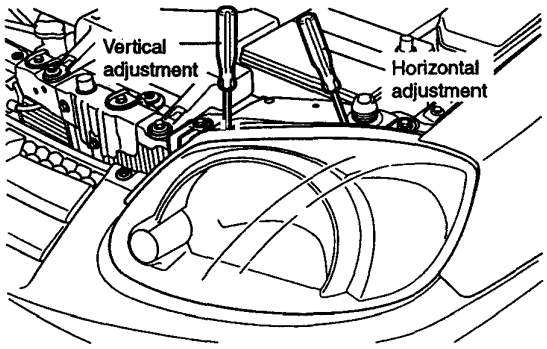
HEAD LAMP AIMING

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

> **NOTE**
>
> *If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.*

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

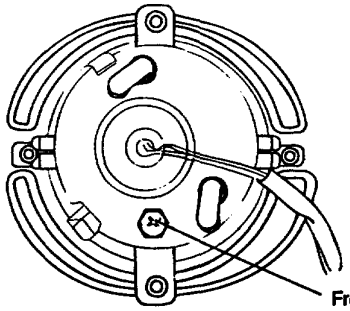
1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical and horizontal adjustments to the lower beam using the adjusting wheel.



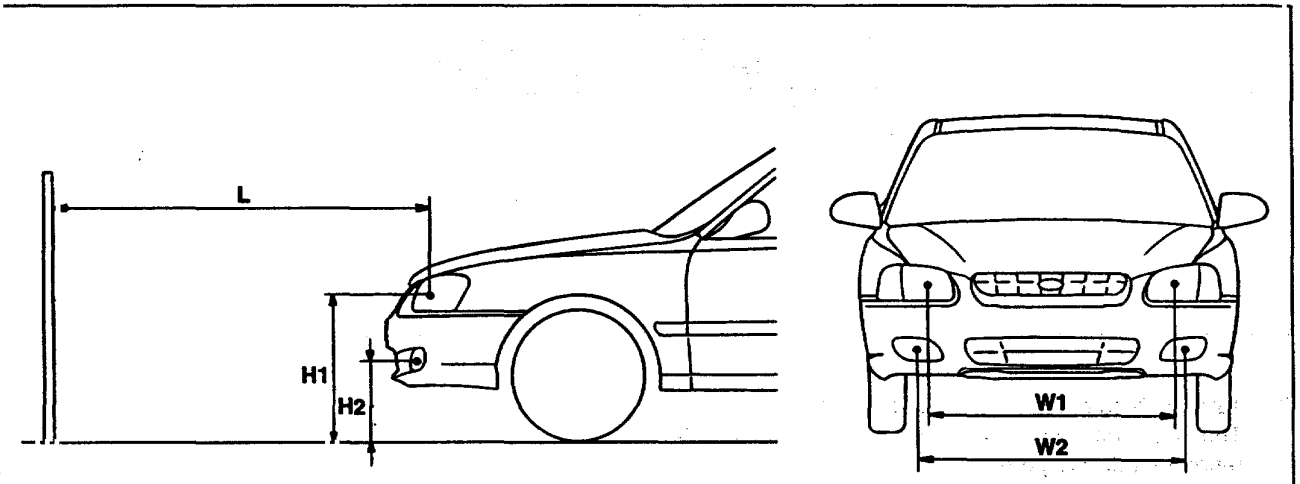
ETDC003M

FRONT FOG LAMP AIMING

The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear.



ETMB280A



H1 : Height between the head lamp bulb center and ground
H2 : Height between the fog lamp bulb center and ground

W1 : Distance between the head lamp bulb center
W2 : Distance between the fog lamp bulb center

L : Distance between the head lamp bulb center and screen

ETDD505B

HEAD LAMP AND FOG LAMP AIMING POINT

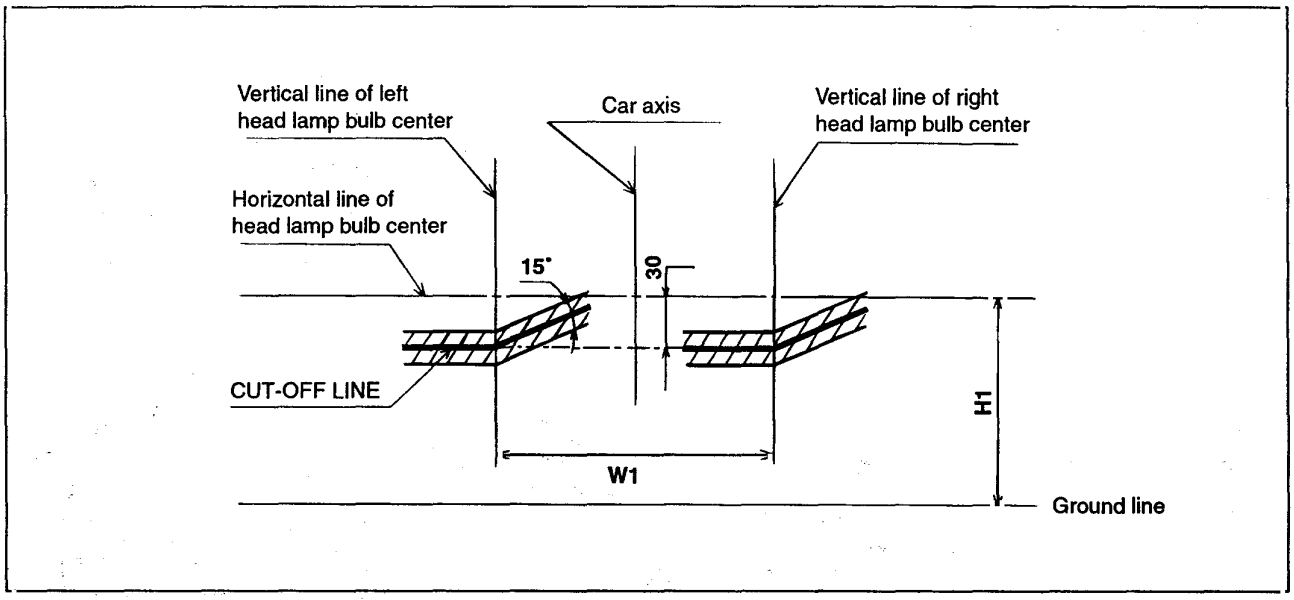
Unit : mm

Vehicle condition		H1	H2	W1	W2	L
Without driver	Gasoline engine	665	340	1,078	1,134	3,000
	Diesel engine	673	348			
With driver	Gasoline engine	656	331			
	Diesel engine	664	339			

ETDD505C

1. Turn the low beam on without driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).

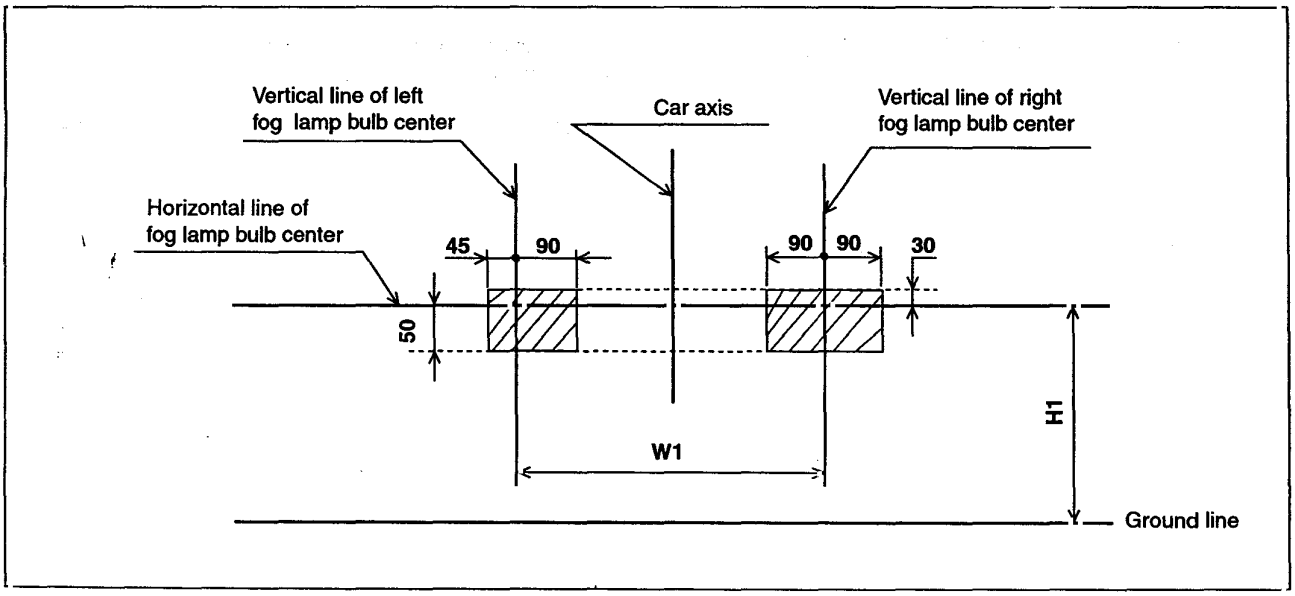
Unit : mm



ETOC310D

2. Turn the high beam on without driver aboard.
   The hot-zone should be projected in the allowable range (shaded region).

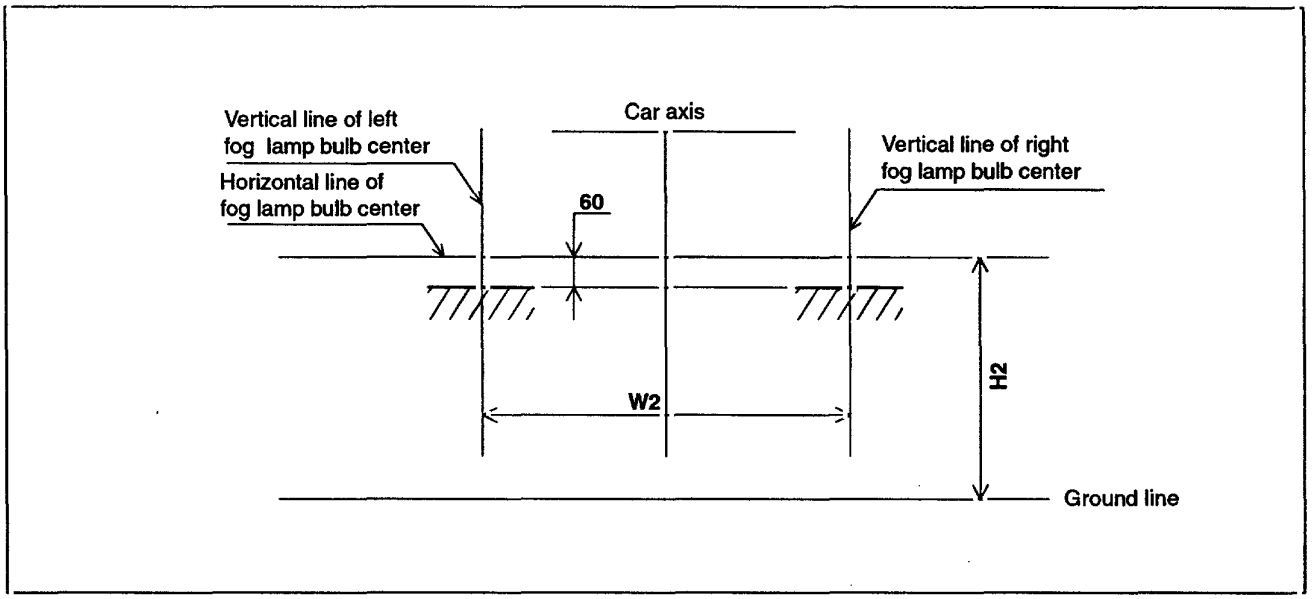
Unit : mm



ETDD505D

3. Turn the front fog lamp on without driver aboard. The cut-off line should be projected in the allowable range (shaded region).

Unit : mm

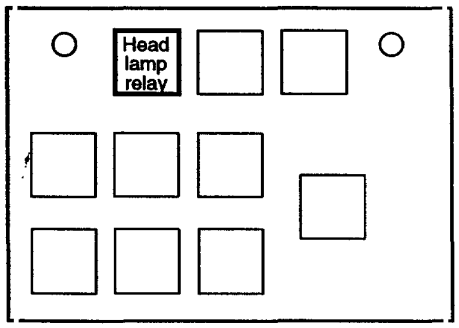


ETPD505G

INSPECTION E9FDED75

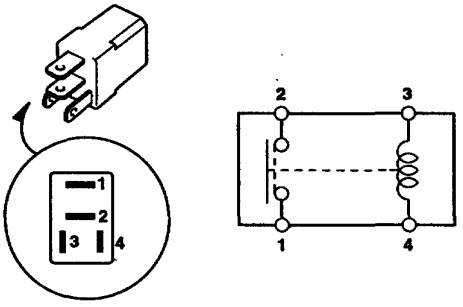
HEAD LAMP RELAY

1. Pull out the headlamp relay from the relay box in the passenger compartment.



ETDD009Z

2. Check for continuity between terminals.



KTDD224C

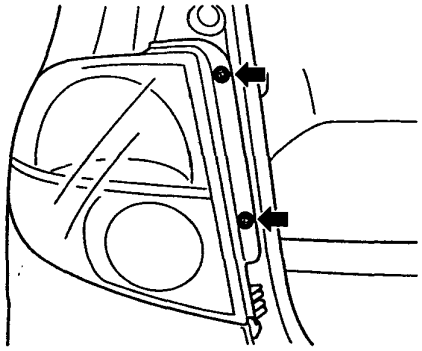
Terminal / Position	1	2	3	4
When de-energized			○	○
When energized	○	○	⊖	⊕

ETPC215E

TURN SIGNAL LAMP

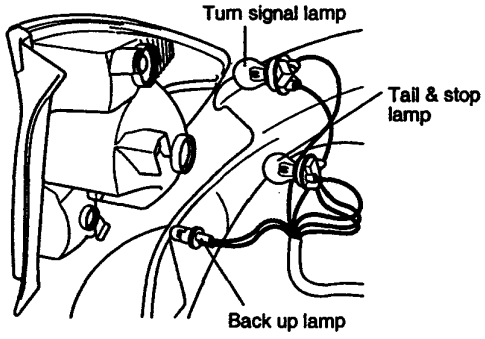
REMOVAL AND INSTALLATION E41DB8EA

1. Disconnect the negative(-) battery terminal.
2. Remove the 2 screws holding the rear combination lamp.



KTPC455A

3. Disconnect the wire connector from the rear combination lamp.



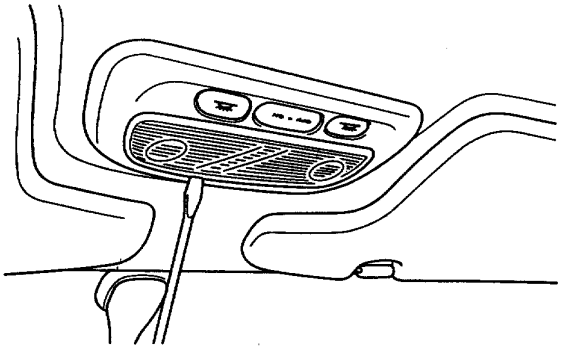
KTDC003J

4. Installation is the reverse of removal.

ROOM LAMP

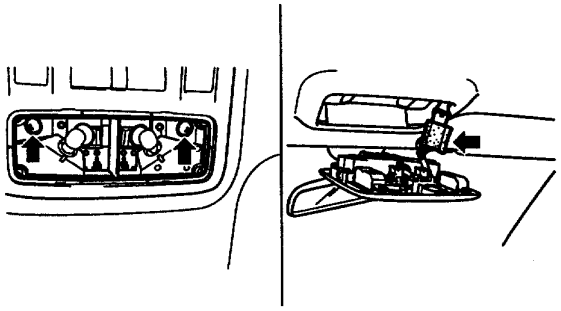
REMOVAL AND INSTALLATION E67D2AE7

1. Disconnect the negative(-) battery terminal.
2. Detach the lamp lens from the room lamp with a flat-tip screwdriver.



ETDD009E

3. Remove the mounting screws (2EA) and disconnect the wire connector, then remove the room lamp assembly.

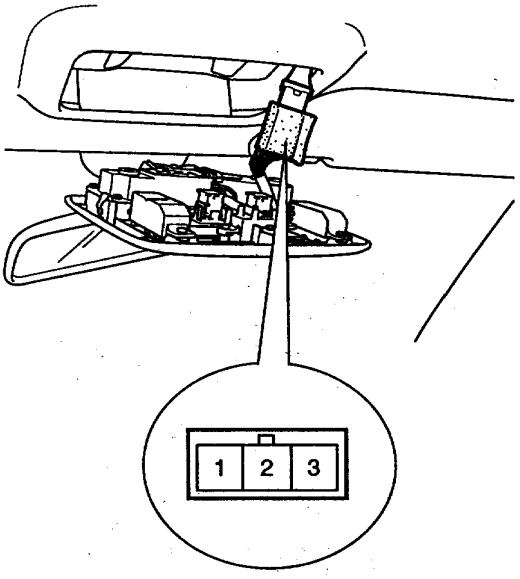


KTPC470A

4. Installation is the reverse of removal.

INSPECTION EC59AE9C

Remove the overhead console lamp switch then operate the switch and check for continuity between the terminals with an ohmmeter.



KTDD425B

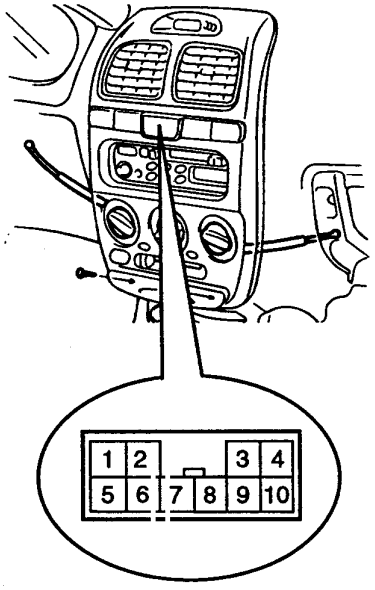
Position \ Terminal	1	2	3
ON	○	○	○
DOOR		○	○
OFF			

ETDD490B

TURN / HAZARD LAMPS

INSPECTION E7734D9B

1. Disconnect the negative(-) battery terminal.
2. Remove the center facia panel with a flat-tip screw-driver, then disconnect the switch connector.



KTDD485A

3. Operate the switch and check for continuity between terminals with an ohmmeter.

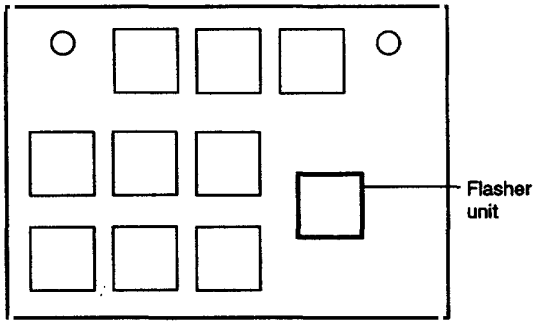
Terminal / Position	2	3	6	9	10	8	7	5
OFF						○	○	
ON		ILL.	○	○	○	○	○	

ETDD485B

FLASHER UNIT

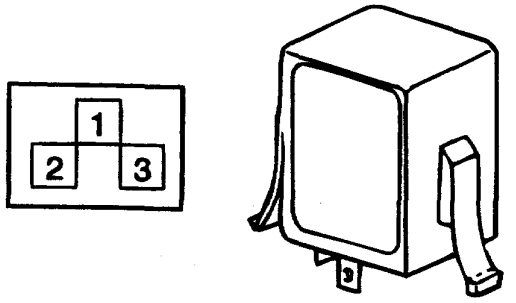
INSPECTION E2F39B0E

1. Remove the flasher unit from the passenger compartment relay box.



ETDD502A

2. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.



KTDA212A

3. Connect the two turn signal lamps in parallel to terminal 1. Check that the bulbs turn on and off.

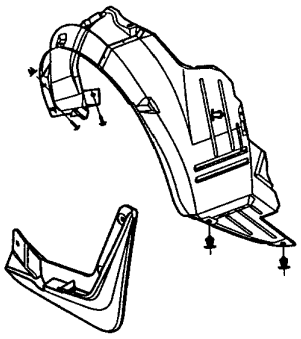
NOTE

The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flasher unit.

FRONT FOG LAMPS

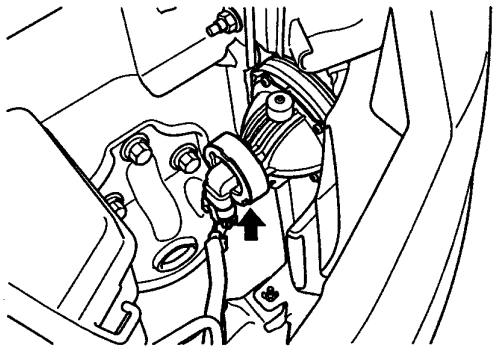
REMOVAL AND INSTALLATION E8FA6008

1. Disconnect the negative(-) battery terminal.
2. Remove the front wheel guard.



KSDC201A

3. Remove the front fog lamp assembly after removing the screws, then disconnect the wire connector.



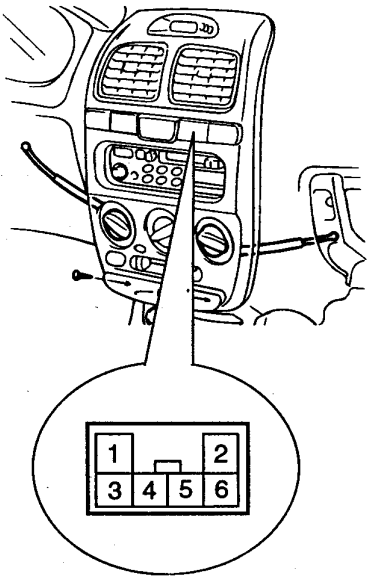
KTOB007H

4. Installation is the reverse of removal.

INSPECTION EE5E753C

FRONT FOG LAMP SWITCH

1. Disconnect the negative(-) battery terminal.
2. Remove the center facia panel with a flat-tip screwdriver, then disconnect the switch connector.



KTDD495A

3. Operate the switch and check for continuity between terminals with an ohmmeter.

Terminal / Position	2	5	1	4	3
ON				IND.	
OFF		ILL.		IND.	

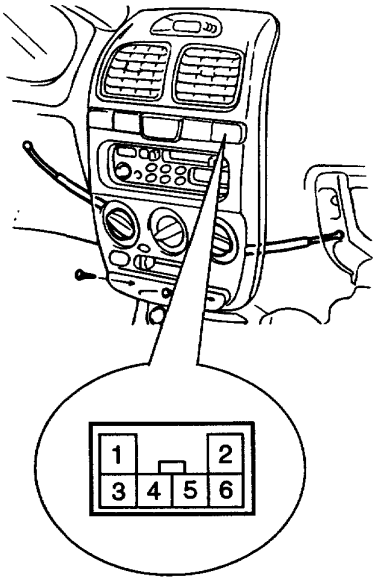
ETDD495B

REAR FOG LAMPS

INSPECTION EB8AABCB

REAR FOG LAMP SWITCH

1. Disconnect the negative(-) battery terminal.
2. Remove the center facia panel with a flat-tip screwdriver, then disconnect the switch connector.



ETDD495A

3. Operate the switch and check for continuity between terminals with an ohmmeter.

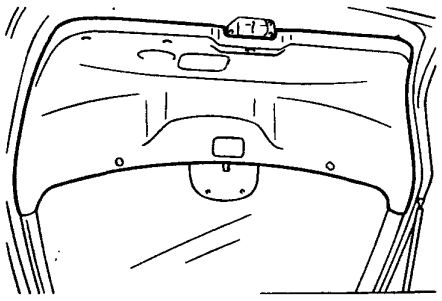
Terminal / Position	2	5	1	4	3	6
ON			IND.			
OFF	ILL.		IND.			

ETDD495C

TAIL, PARKING AND LICENSE LAMPS

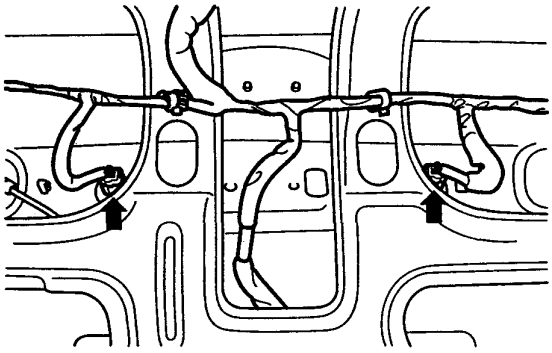
REMOVAL AND INSTALLATION E7F1DA4E

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.



ETDA165A

3. Remove the license plate lamp and disconnect the wire connector.



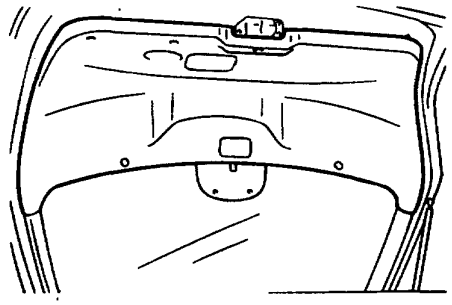
KTDD008F

4. Installation is the reverse of removal.

STOP LAMPS

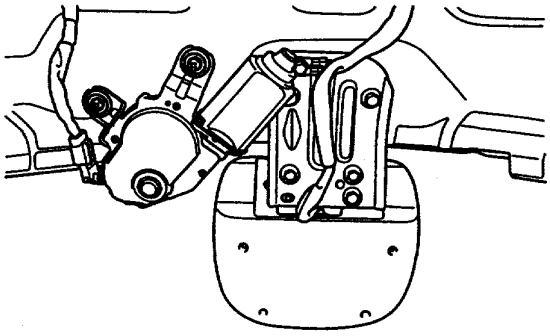
REMOVAL AND INSTALLATION EBF8B758

1. Disconnect the negative(-) battery terminal.
2. Remove the tailgate trim.



ETDA165A

3. Remove the 5 bolts, disconnect the wire connector and then remove the center high mounted stop lamp.



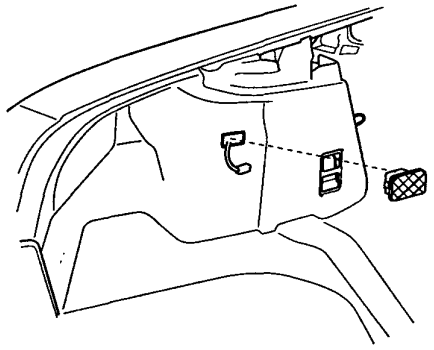
KTDD008G

4. Installation is the reverse of removal.

COURTESY AND TRUNK LAMPS

REMOVAL AND INSTALLATION E0EB15DC

1. Disconnect the negative battery terminal.
2. Detach the luggage lamp assembly from the luggage side trim with a flat-tip screwdriver.



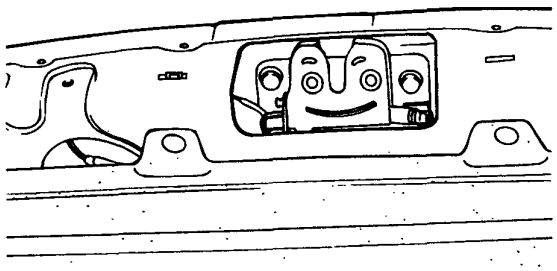
KTOB007J

3. Installation is the reverse of removal.

INSPECTION ECFDC2DC

TRUNK ROOM LAMP SWITCH

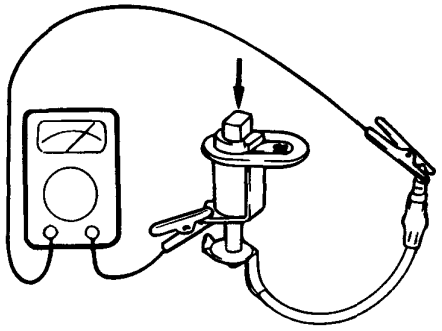
1. Disconnect the negative battery terminal.
2. After opening the trunk, disconnect the connector from the rear harness.



ETDA215A

3. Check for continuity between the terminal and body while pushing the rod.

Switch rod condition	Continuity
Pushed (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)

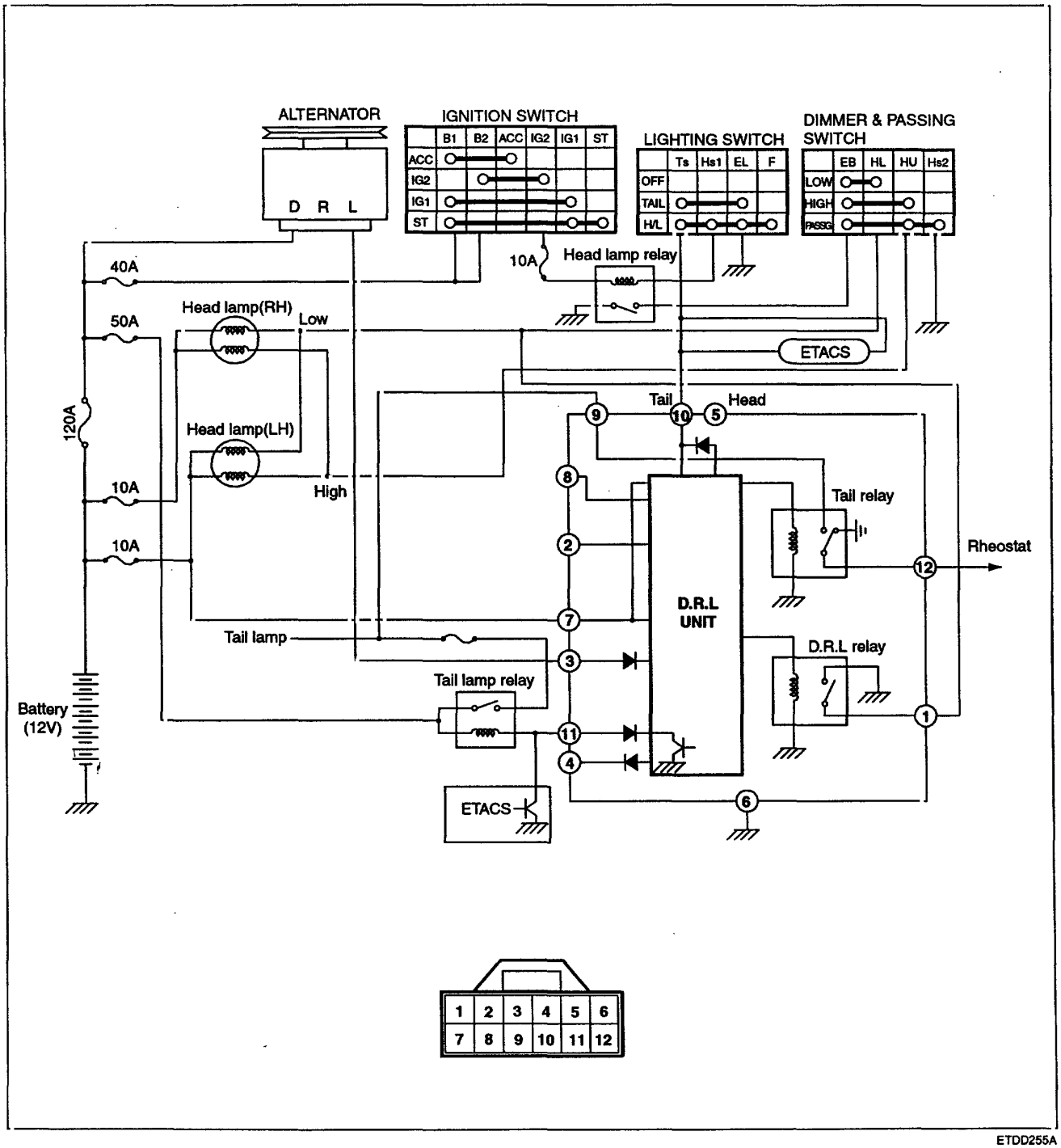


ETDA215B

DAYTIME RUNNING LIGHTS

DRL CONTROL MODULE

CIRCUIT DIAGRAM EF069078

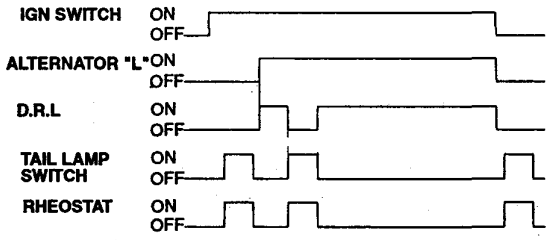


ETDD255A

INSPECTION E50CEEEF

OPERATION CHECK

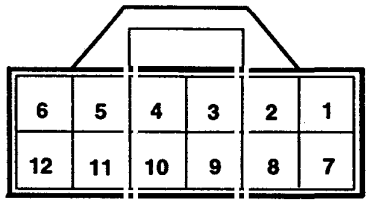
Check that the lights operate according to the following timing chart.



ETMB711B

INSPECT CIRCUITS FOR DAYTIME RUNNING LIGHT SYSTEM

1. Disconnect the wire connector to DRL module from engine compartment.
2. Inspect the connector on wire harness side as shown.



Harness side

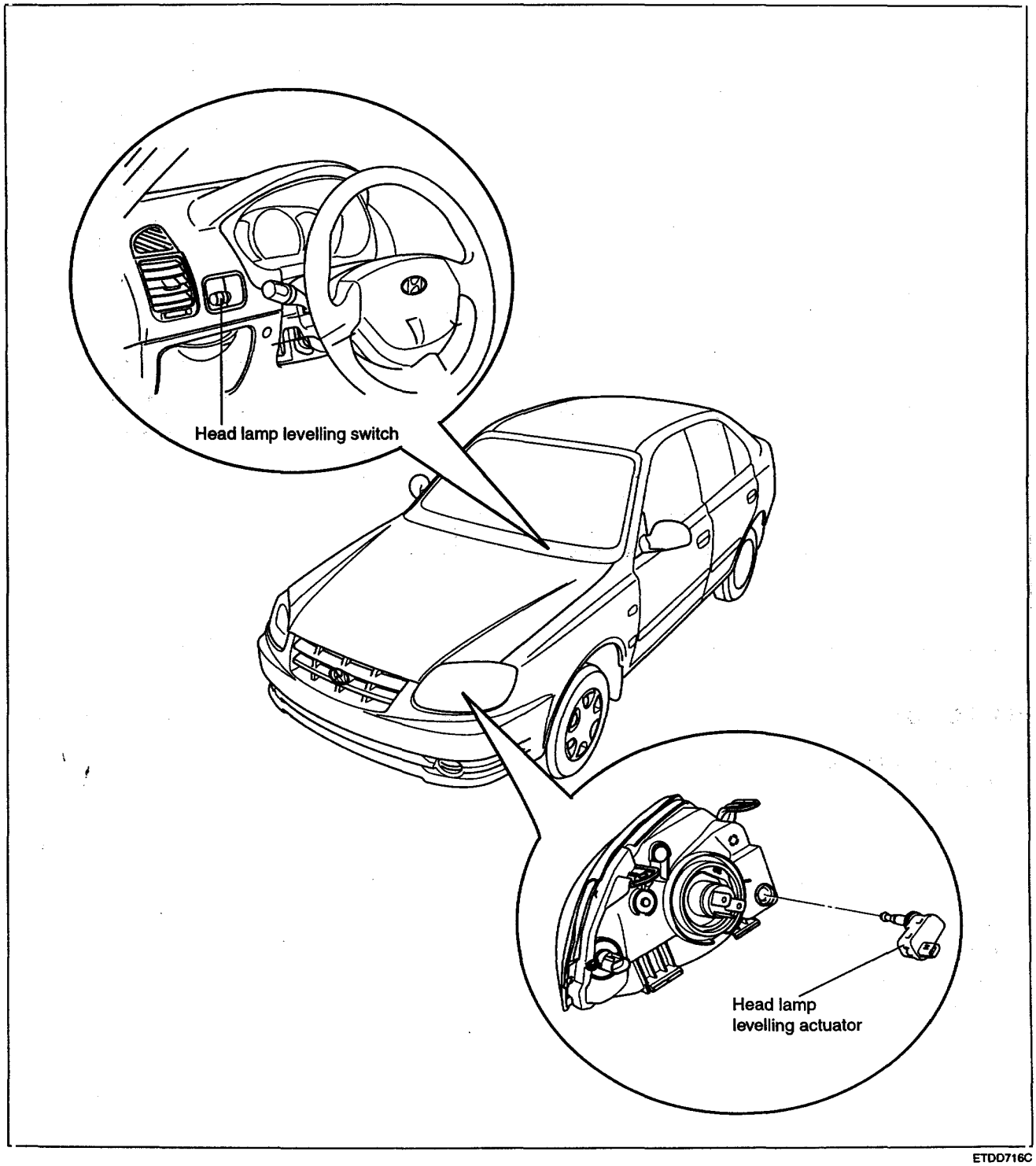
ETAC260A

Check for	Test connection	Condition		Test Specification
Continuity	10-Ground	Tail lamp switch	OFF	No continuity
			ON	Continuity
	9-Ground	Constant		Continuity
	6-Ground	Constant		Continuity
Voltage	7-Ground	Head lamp switch	OFF	Battery voltage
			ON	No voltage
	1-Ground	Head lamp switch	OFF	Battery voltage
			ON	No voltage
	11-Ground	Constant		Battery voltage
	3-Ground	Engine	Stop	No voltage
			Running	Battery voltage

If circuit is not as specified, refer to schematic diagram and inspect short or circuits.

HEAD LAMP LEVELLING DEVICE

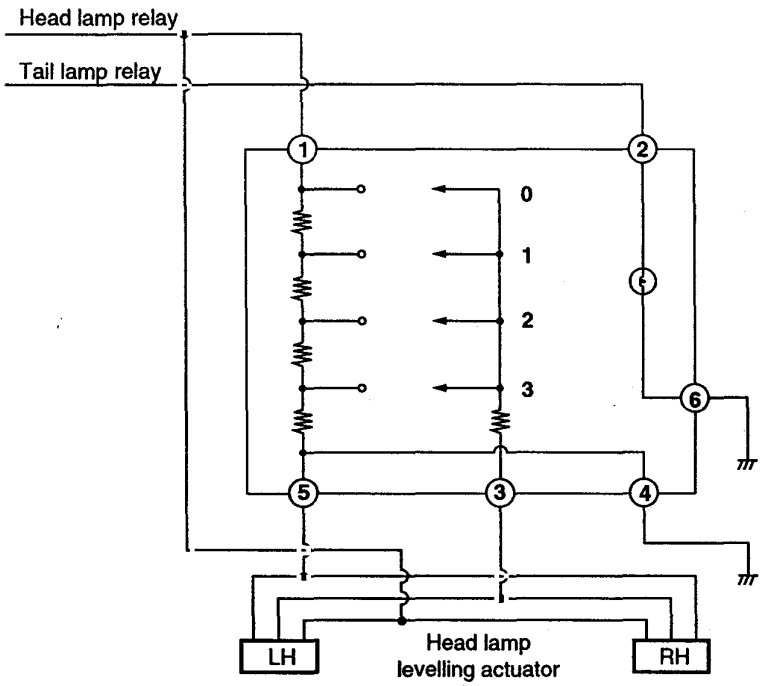
COMPONENTS EFC0E582



ETDD716C

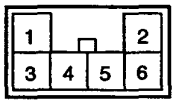
HEAD LAMP LEVELING SWITCH

CIRCUIT DIAGRAM E2E3AB81



PIN CONNECTION

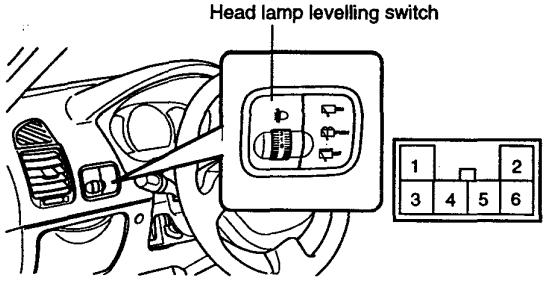
PIN NO	Description
1	IGN (+)
2	Illumination(+)
3	Actuator (+)
4	Ground
5	Actuator (-)
6	Illumination (-)



ETDD700A

INSPECTION E7FCE0F5

1. Disconnect the switch connector from the crash pad lower panel.



ETDD700H

2. Connect the battery voltage between terminals 1 and 4(Reference voltage=V_B)
3. Measure the voltage between terminals 3 and 4(V).

4. Check the percent ratio(V/V_B x 100%) between voltages V_B and V at each position.

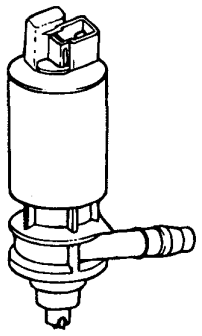
Position No.	Rotation	Ratio(±5%)	Voltage (V)
0	0°	90%	10.8 ± 0.6V
1	20°	73.5%	8.82 ± 0.6V
2	40°	67.5%	8.1 ± 0.6V
3	60°	56%	6.72 ± 0.6V

5. If the voltage is not as specified, replace the head lamp levelling switch.

HEAD LAMP WASHER

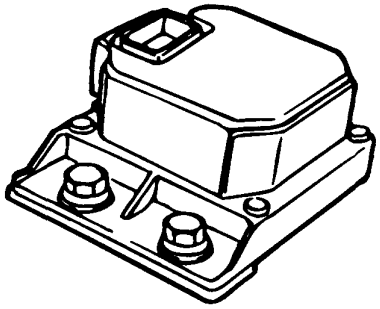
COMPONENTS E3E1CEAD

A. HEAD LAMP WASHER MOTOR



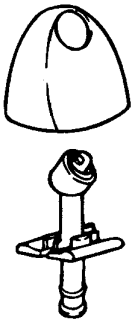
ETKA275A

B. HEAD LAMP WASHER RELAY



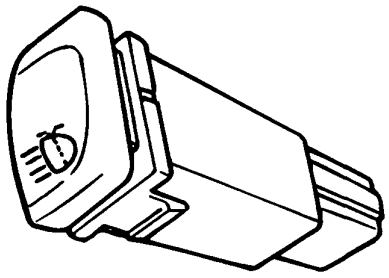
ETKA275B

C. HEAD LAMP WASHER NOZZLE



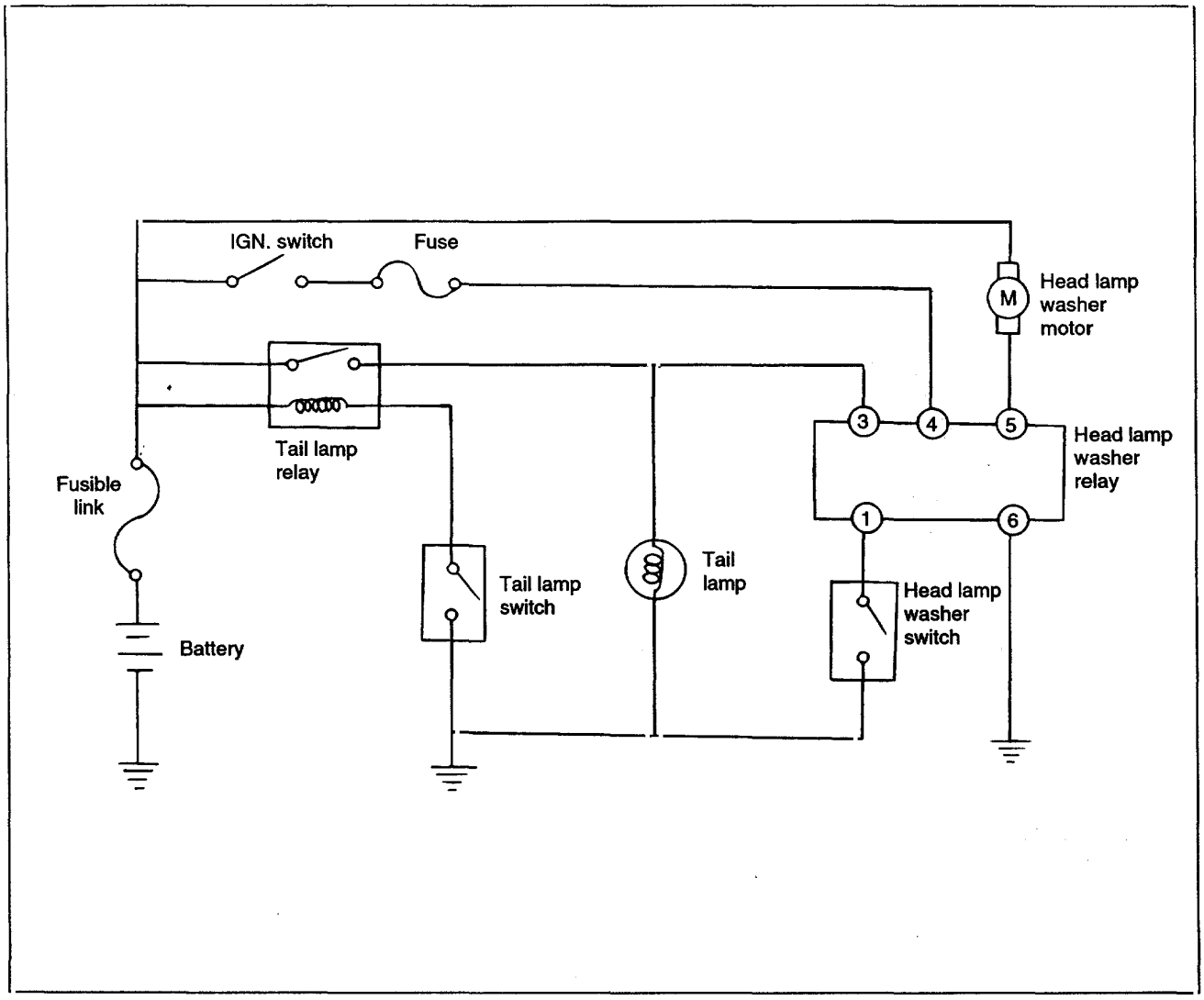
ETKA275C

D. HEAD LAMP WASHER SWITCH



ETKA275D

CIRCUIT DIAGRAM E05D2C1B

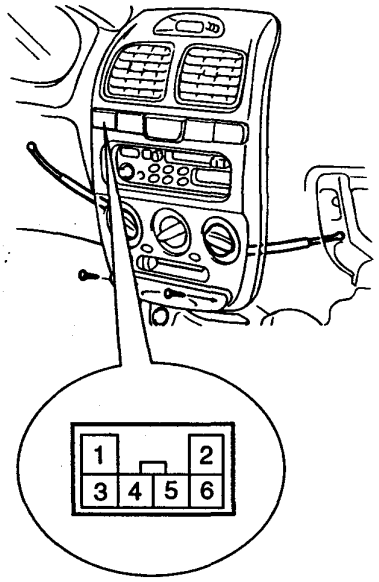


ETDD280A

HEAD LAMP WASHER SWITCH

INSPECTION EFFFA02D

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel with a flat-tip screwdriver, then disconnect the switch connector.



ETDD341A

3. Check for continuity between the terminals.

Terminal / Position	3	4	2	5
ON(PUSH)	○—○			
OFF(FREE)			○ ○ (ILL.)	

NOTE

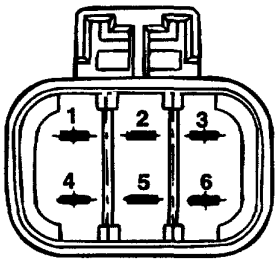
②—Ⓦ—⑤ : Indicates that the illumination lamp lights up when tail lamp switch is turned on.

ETDD280D

HEAD LAMP WASHER RELAY

INSPECTION EBDF0823

1. Connect the battery positive (+) lead to terminals 3 and 4, and ground terminal 1.

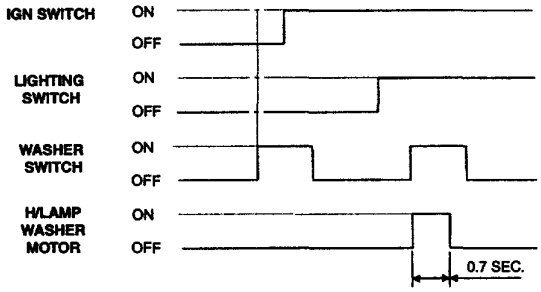


ETDD280E

2. Check for continuity between terminals 5 and 6.

OPERATING CHARACTERISTIC

Check that components operate according to the following timing chart.

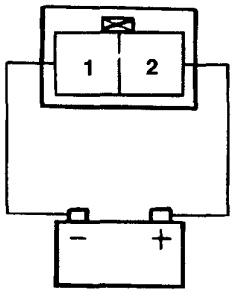


ETDD280F

HEAD LAMP WASHER MOTOR

INSPECTION EC8FD2AB

1. Disconnect the head lamp washer motor connector from the reservoir tank.
2. Connect battery positive (+) lead and negative (-) lead to terminals 2 and 1.
3. Check that the motor operates and washer fluid is ejected.



ETDD280C

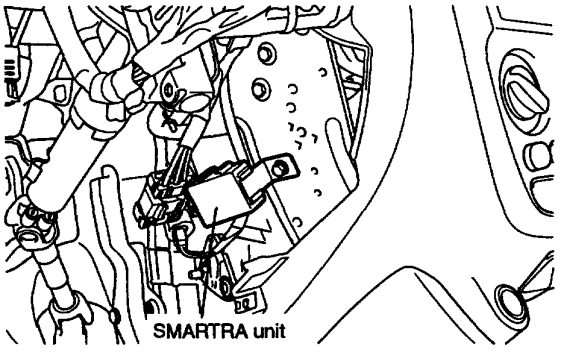
IMMOBILIZER CONTROL SYSTEM

DESCRIPTION E9C3F5CA

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head and the SMARTRA (SMARt TRansponder Antenna) unit.

The SMARTRA unit contains an integrated inductive antenna and electronics around the lock assembly. The SMARTRA communicates to the ECM (Engine Control Module) via a dedicated communications line.

Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.



ETDD009D

SYSTEM OVERVIEW

The vehicle immobilizer system consists of the ECM, the SMARTRA and ignition keys with built-in transponder.
The ECM carries out the check of ignition key by special encryption algorithm, which runs in the transponder and in the ECM in parallel. Only if the results are equal, the engine can be started. The data of all transponder, which are valid for the vehicle, are stored in the ECM.
The ECM and the SMARTRA communicate by dedicated line. During this communication of ECM and SMARTRA the K line of ECM cannot be used for communication. The ECM controls the communication either to SMARTRA or to other devices (e.g. service tester) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of ECM hardware.The SMARTRA carries out the communication with the built-in transponder of the ignition key. This wireless communication runs by RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into the RF signal, which is transmitted, to the transponder by antenna.
The SMARTRA does not carry out the check of validity of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of transponder into serial communication to ECM and vice versa.
The transponder is of Hitag2 type with advanced encryption algorithm. During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer. The transponder memory is split into two strings called authenticator and key password.
After this programming the transponder memory is locked and the data cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt".
Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value.
The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device. This can be the manufacturer' s service tester, which is in use at service station. The protocol of communication is the K line of ECM.

TEACHING PROCEDURES

1. KEY TEACHING PROCEDURE

Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle owner.

The procedure starts with an ECM request for vehicle specific data from the tester. The "virgin" ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can procede.

If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

The key teaching is done by ignition on with the key and additional tester commands. The ECM stores the relevant data in the EEPROM and in the transponder. Then the ECM runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the ECM from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM. This rejects the key and a message is sent to the tester.

The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.

The maximum number of taught keys is 4

If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault code is stored.

If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.

2. USER PASSWORD TEACHING PROCEDURE

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

User password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin". No limp home function is possible.

The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt".

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If incorrect user passwords or wrong vehicle specific data have been sent to the ECM three times, the ECM will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

THE USER PASSWARD CAN BE IN THE STATUS

00. NOT YET CHECKED

The status is stored in the EEPROM. In case of incorrect or no plausible data from this circuit, the ECM cannot check the status and the ECM sends 00.

01. LEARNT

The password has been taught successfully to the ECM.

02. VIRGIN

This is the status at the end of the ECM production line before delivery to the final customer.

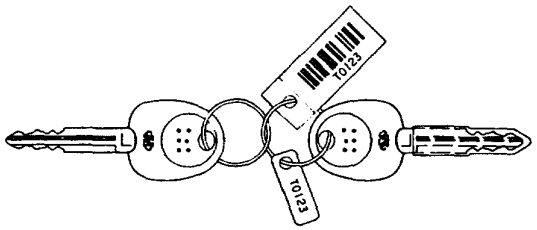
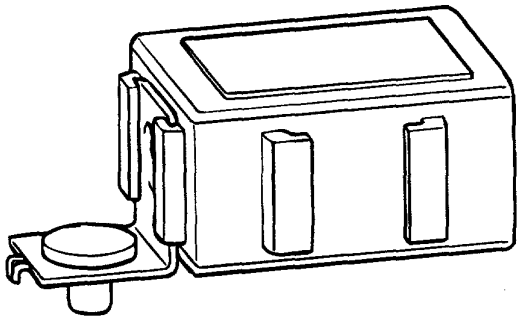
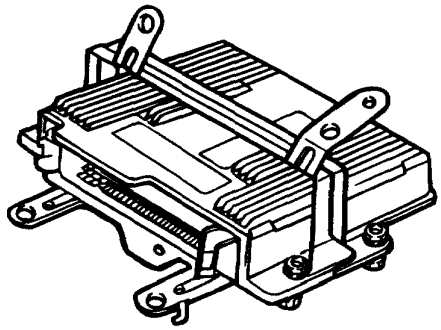
04. LOCKED BY TIMER

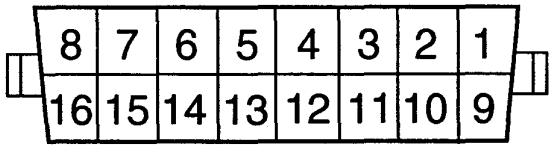
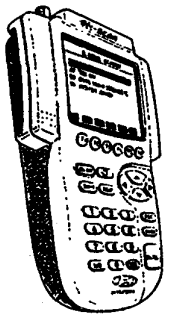
After a certain number of incorrect inputs, the ECM is locked for one hour and no inputs are accepted during this time.

05. TEACHING NOT ACCEPTED

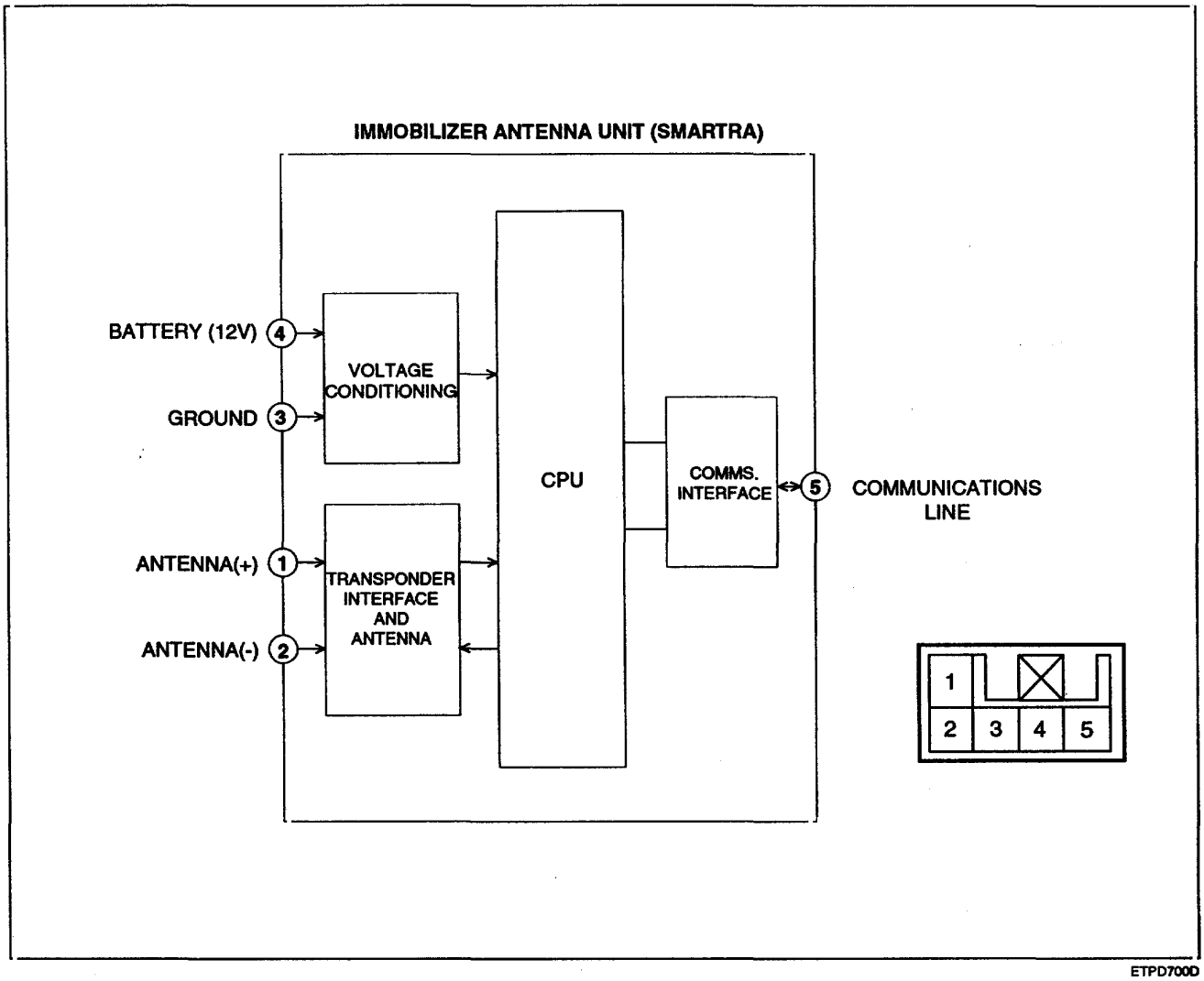
This status is set if, for example, the ECM is in neutral status.

COMPONENTS E47D4EDC

COMPONENTS	DESCRIPTION
TRANSPONDER (Built-in keys)  ETKA470C	When ignition is ON, the coil supplies energy to the transponder, whichin turn accumulates energy in the condenser. Once the energy supplied from the coil has stopped, using the stored energy in the condenser, the transponder transmits the secret data. The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.
IMMOBILIZER ANTENNA UNIT (SMARTRA)  ETNB291C	The SMARTRA carries out communication with the built - in transponderin the ignition key. This wireless communication runs on RF (Radio frequencyof 125 kHz). The SMARTRA is mounted around the ignition lock close to theantenna coil for RF transmission and receiving. The RF signal from the transponder,received by the antenna coil, is converted into messages for serial communicationby the SMARTRA device. And, the received messages from the ECM are convertedinto an RF signal, which is transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of the transponderor the calculation of encryption algorithm. This device is only an advancedinterface, which converts the RF data flow of the transponder into serialcommunication to the ECM and vice versa.
ENGINE CONTROL MODULE (ECM)  B6BE710E	The ECM carries out a check of the ignition key using a special encryption algorithm, whichis programmed into the transponder as well as the ECM simultaneously. Only if the results are equal can the engine be started. The data of all transponders,which are valid for the vehicle, are stored in the ECM

COMPONENTS	DESCRIPTION
DATA LINK CONNECTOR (DLC)  B6BE710F	By connecting the voltmeter or Hi-scan, the control module diagnosticcode can be read.
DIAGNOSTIC TESTER (HI-SCAN)  ETHB001T	Has the function ICM (SMARTRA), ECM, and key diagnosis and change

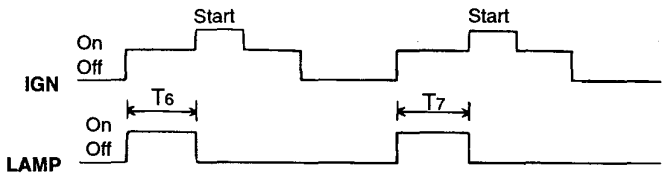
BLOCK DIAGRAM EE77E0C3



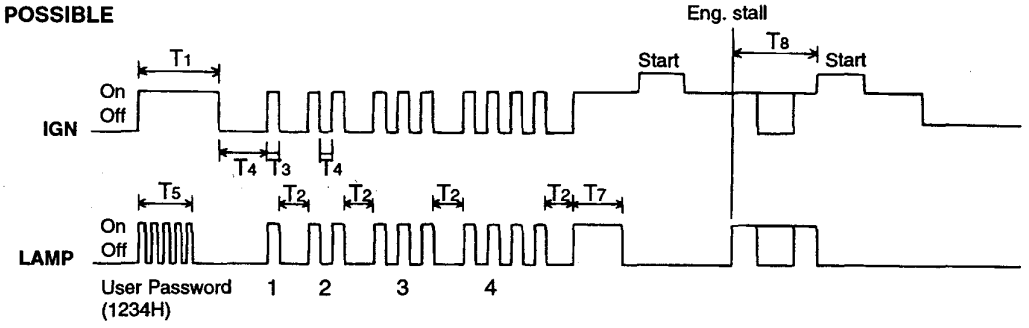
ETPD700D

LIMP HOME FUNCTION EBE722CF

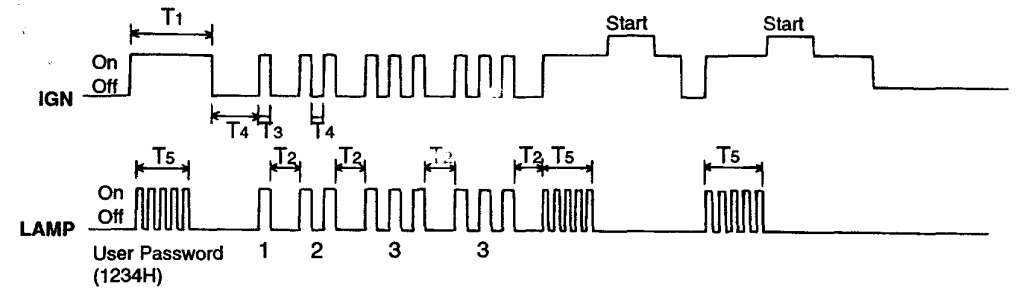
o NORMAL CONDITION



o START POSSIBLE



o START IMPOSSIBLE



NOTE

T1 > 5 sec

3 sec <T2 < 10 sec

0.2 sec <T3 < 5 sec

0.2 sec <T4 < 3 sec

T5 = 5 sec

T6 < 5 sec

T7 < 30 sec

T8 < 8 sec

ETPD700E

1. **LIMP HOME BY TESTER**
   If the ECM detects the fault of the SMARTRA or transponder, the ECM will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the ECM via the special tester menu.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After econnecting the battery to the ECM, the timer starts again for one hour.

2. **LIMP HOME BY IGNITION KEY**
   The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.
   After ignition off, the ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.

DIAGNOSIS OF IMMOBILIZER FAULTS E7BB6557

THE DIAGNOSIS MONITORS :

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM) related to the immobilizer function.

There are four different faults that are assigned to the immobilizer system. Every fault is broken down into four different types (circuit malfunction, circuit range / performance problem, low input, high input). The following table shows the assignment of immobilizer related faults to each type :

Immobilizer Related Faults	Fault types	Diagnostic codes
Transponder Fault	Invalid transponder data	P1801
	Transponder not in password mode or transport data has been changed	
	Programming error	
SMARTRA Fault	Antenna error	P1800
	Invalid request from ECM or corrupted data	P1803
	No answer from SMARTRA	P1610
	Invalid message from SMARTRA to ECM	
EEPROM	Inconsistent data of EEPROM	P1805
	Invalid write operation to EEPROM	
Immobilizer indicator or ECM Faults	Not plausible immobilizer indicator stored at ECM	P1805
	No valid data from SMARTRA after 3 attempts by ECM	
	Invalid tester message or unexpected requests by tester	

REPLACEMENT OF ECM AND SMARTRA

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, there is no special procedure required. A new SMARTRA device simply replaces the old one. There are no transponder-related data stored in this device.

NEUTRALISING OF ECM

The ECM can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode". After successfully receiving the data, the ECM is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.

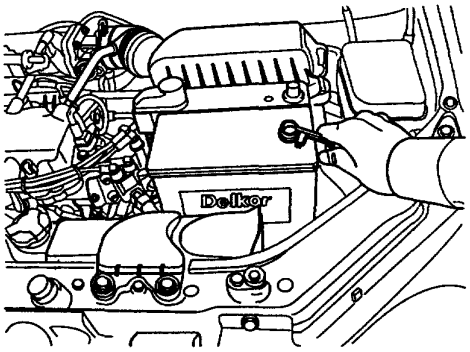
The teaching of keys follows the procedure described for the virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

IGNITION SYSTEM

IGNITION SWITCH

REMOVAL AND INSTALLATION E5726B69

1. Disconnect the negative(-) battery terminal.

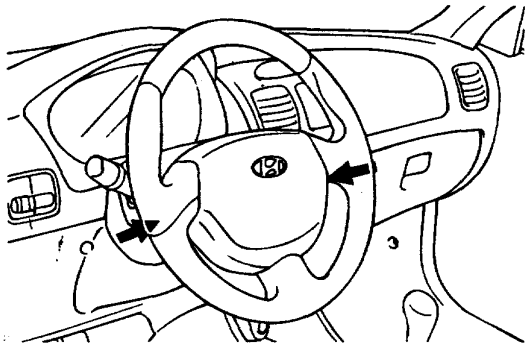


KPPD004A

2. Remove the 2 bolts and disconnect the airbag connector and the horn connector, then remove the airbag module.

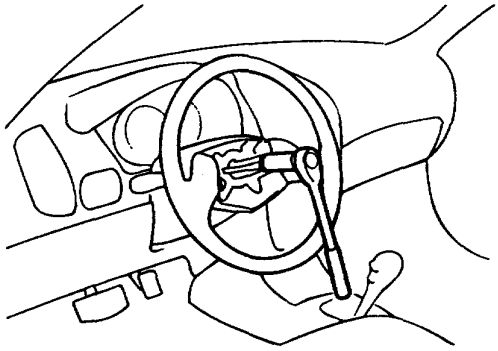
⚠ ***CAUTION***

Remove the horn pad only for vehicle without airbag.



ETDA035D

3. Remove the steering wheel lock nut.

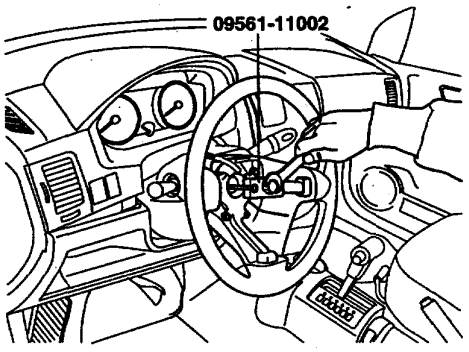


EPDA015B

4. Remove the steering wheel with special tool (09561-11002).

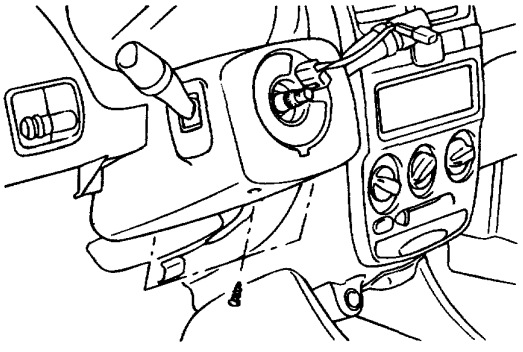
⚠ ***CAUTION***

Do not hammer on the steering wheel to remove it. Doing so may damage the collapsible mechanism.



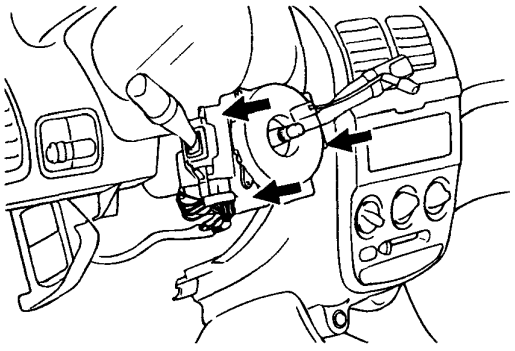
KPPD007A

5. Remove the steering column shroud after removing 3 screws.



ETDA035G

6. Remove the screws holding the multi-function switch, then disconnect the wire connector.
   Remove the multi-function switch assembly.



ETDA035H

7. Remove the steering column mounting bolts.



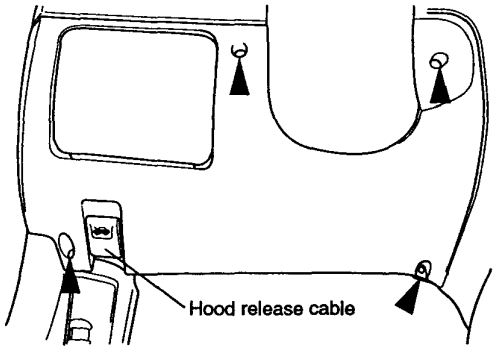
EPDA015G

8. Remove the key lock assembly from the steering column shaft. (Refer to ST group)

9. Installation is the reverse of removal.

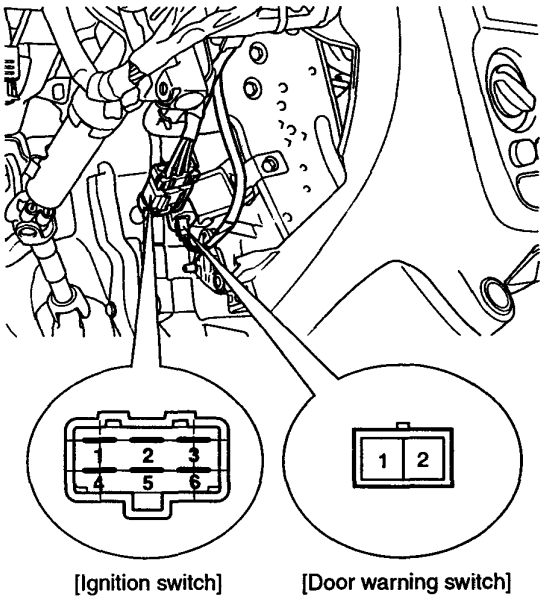
INSPECTION E0F3BAE4

1. Remove the driver's side crash pad lower panel.



ESDC113S

2. Disconnect the ignition switch connector and the door warning switch connector under the steering column.



[Ignition switch] [Door warning switch]

ETDD605C

3. Check for continuity between the terminals.

4. If continuity is not as specified, replace the switch.

TERMINAL / POSITION	KEY	IGNITION SWITCH 6	3	2	4	1	5	STEERING LOCK TRAVEL	TRAVEL	DOOR WARNING SWITCH 1	2
LOCK	REMOVAL							LOCK			
	INSERT							LOCK	UNLOCK		
ACC		○	○					UNLOCK		○	○
ON		○	○	○	○						
START		○	○	○	○	○	○				

ETDD605A

Brake System

GENERAL
- SPECIFICATIONS ..... BR -2
- SPECIAL TOOLS ..... BR -3
- TOUBLESHOOTING ..... BR -4
- ADJUSTMENT PROCEDURE ..... BR -5

BRAKE SYSTEM
- BRAKE BOOSTER
  - COMPONENTS ..... BR -9
  - REMOVAL ..... BR -9
  - INSPECTION ..... BR -10
  - INSTALLATION ..... BR -11
- MASTER CYLINDER
  - COMPONENTS ..... BR -12
  - REMOVAL ..... BR -12
  - DISASSEMBLY ..... BR -13
  - INSPECTION ..... BR -13
  - REASSEMBLY ..... BR -14
  - INSTALLATION ..... BR -14
- FRONT DISC BRAKE
  - COMPONENTS ..... BR -15
  - REPLACEMENT ..... BR -15
  - REMOVAL ..... BR -17
  - DISASSEMBLY ..... BR -17
  - INSPECTION ..... BR -18
  - REASSEMBLY ..... BR -18
  - INSTALLATION ..... BR -19
- REAR DRUM BRAKE
  - COMPONENTS ..... BR -20
  - REMOVAL ..... BR -20
  - INSPECTION ..... BR -21
  - REPLACEMENT ..... BR -22
  - INSTALLATION ..... BR -23
- BRAKE PEDAL
  - COMPONENTS ..... BR -24
  - REMOVAL ..... BR -25
  - INSPECTION ..... BR -25
  - INSTALLATION ..... BR -25
- BRAKE LINE
  - COMPONENTS ..... BR -26
  - REMOVAL ..... BR -27
  - INSPECTION ..... BR -27
  - INSTALLATION ..... BR -27
- PROPORTIONING VALVE
  - DESCRIPTION ..... BR -28
  - REMOVAL AND INSPECTION ..... BR -28
  - INSTALLATION ..... BR -28

PARKING BRAKE SYSTEM
- PARKING BRAKE
  - COMPONENTS ..... BR -29
  - REMOVAL ..... BR -29
  - INSPECTION ..... BR -30
  - INSTALLATION ..... BR -30

ABS (ANTI-LOCK BRAKE SYSTEM)
- DESCRIPTION ..... BR -31
- COMPONENTS ..... BR -32
- HYDRAULIC SYSTEM DIAGRAM ..... BR -33
- ABS CONTROL ..... BR -34
- CIRCUIT DIAGRAM ..... BR -38
- INSPECTION FOR TROUBLE SYMPTOMS .... BR -40
- ANTI-LOCK BRAKING SYSTEM CONTROL MODULE
  - REMOVAL ..... BR -55
  - INSTALLATION ..... BR -56
  - INSPECTION ..... BR -56
  - HECU TERMINALS INSPECTION ..... BR -57
  - CIRCUIT DIAGRAM ..... BR -58
- ANTI-LOCK BRAKING SYSTEM WHEEL SPEED SENSOR
  - COMPONENTS ..... BR -59
  - REMOVAL ..... BR -59
  - INSPECTION ..... BR -60
  - BLEEDING OF BRAKE SYSTEM ..... BR -61

GENERAL

SPECIFICATIONS EACD3FFF

ITEMS	SPECIFICATIONS
Master cylinder	
Type	Tandem type
I.D. mm (in.)	22.222 (0.875)
Fluid level warning sensor	Provided
Brake booster	
Type	Vacuum type with tandem booster
Effective dia. mm (in.)	228.6 (9)
Boosting ratio	5.1 : 1
Proportioning valve	
Cut-in pressure (Split point)	2.94 MPa (30 kg/cm², 427 psi)
Decompression ratio	0.27 : 1
Front brake	
Type	Floating type with ventilated disc
Disc O.D. mm (in.)	241 (9.49)
Disc thickness mm (in.)	19 (0.75)
Pad thickness mm (in.)	9 (0.35)
Cylinder I.D. mm (in.)	54 (2.13)
Rear brake (Drum)	
Type	Leading trailing drum
Drum I.D. mm (in.)	180 (7.09)
Wheel cylinder I.D. mm (in.)	17.78 (0.7)
Clearance adjustment	Automatic
Parking brake	
Actuation	Mechanical brake acting on rear wheels
Type	Lever
Cable arrangement	V type
Anti-lock Brake System (ABS)	
HECU (HU+ECU)	
ECU type	Motor, valve relay integrated type
Motor power	Max.150W
Accumulator volume	3.0cc
Inlet valve (Front/Rear) mm (in.)	0.5 (0.019)/0.315 (0.012)
Outlet valve (Front/Rear) mm (in.)	0.56 (0.022)/0.355 (0.014)
Wheel speed sensor	
Output frequency	20 ~ 2,000Hz
Output voltage	Min.130mVp.p
Internal resistance	1,385 ± 110Ω
Tone wheel teeth	44 teeth
Air gap mm (in.)	0.2 ~ 1.1 (0.008 ~ 0.043)
ABS & EBD warning lamp	
Type	Active warning lamp module
Operating voltage	12V
Current	80mA

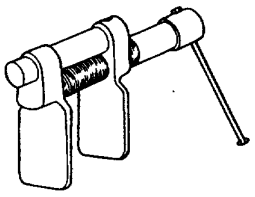
SERVICE STANDARD

ITEM	STANDARD VALUE	SERVICE LIMIT
Brake pedal height	157.1 (+5,0) mm [6.19 (+0.2, 0) in.]	
Brake pedal stroke	125.6 mm (4.95 in.) or more	
Stop lamp switch outer case to pedal stopper clearance	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	
Brake pedal free play	3~8 mm(0.11~0.31in.)	
Booster push rod to master cylinder piston clearance	0 (at 500mmHg vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N(20kg, 44lb force)	6~7 clicks	
Front disc brake pad thickness	9 mm (0.354 in.)	2 mm (0.0787in.)
Front disc thickness(minimum)	19 mm (0.75 in.)	17 mm (0.67 in)
Front disc abrasion	-	0.05 mm (0.002 in.)
Drum brake lining thickness	4.8mm (0.19 in.)	1 mm (0.04 in.)
Brake drum I.D.(maximum)	180mm (7.09in.)	182 mm(7.17 in.)
Wheel cylinder to piston clearance	-	0.15 mm (0.006 in.)

TIGHTENING TORQUE

	Nm	kgf·cm	lb·ft
Master cylinder to booster mounting nut	8 ~ 12	80 ~ 120	6 ~ 9
Brake booster mounting nut	8 ~ 10	80 ~ 100	6 ~ 7.3
Brake booster vacuum hose fitting to surge tank	8 ~ 12	80 ~ 120	6 ~ 9
Bleeder screw	7 ~ 13	70 ~130	5 ~ 9.5
Brake tube flare nut, brake hose	13 ~ 17	130 ~ 170	10 ~ 12
Proportioning valve mounting	35 ~ 55	350 ~ 550	26 ~ 41
Caliper guide rod bolt	22 ~ 32	220 ~ 320	16 ~ 24
Caliper pin bolt	35 ~ 45	350 ~ 450	26 ~ 33
Caliper assembly to knuckle	65 ~ 75	650 ~ 750	48 ~ 55
Brake hose to front caliper	25 ~ 30	250 ~ 300	18 ~ 22
Brake tube mounting nut	13 ~ 17	130 ~ 170	10 ~ 12
HECU mounting bolt	8 ~ 10	80 ~ 100	6 ~ 7.3
Wheel sensor mounting bolt	8 ~ 10	80 ~ 100	6 ~ 7.3

SPECIAL TOOLS E9BBD0E7

TOOL (Number and name)	ILLUSTRATION	USE
09581 ~ 11000 Piston expander	 EJDA043A	Spreading the front disc brake piston.

TROUBLESHOOTING ECDE8EE5

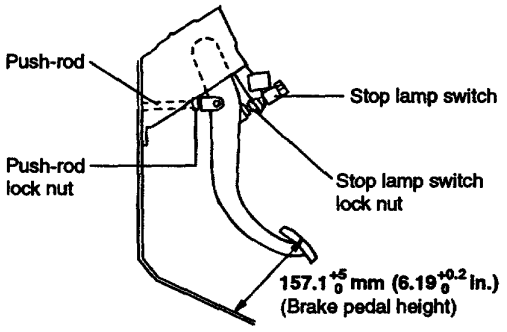
SYMPTOM	PROBABLE CAUSE	REMEDY
Noise or vibration when brakes are applied	Backing plate or caliper improperly mounted	Correct
	Loose backing plate or caliper mounting bolts	Retighten
	Unevenly worn or cracked brake drum or brake disc	Replace
	Foreign material in brake drum	Clean
	Seized pad or lining contact surface	Replace
	Excessive caliper to pad assembly clearance	Correct
	Uneven pad contact	Correct
	Lack of lubrication in sliding parts	Lubricate
	Loose suspension parts	Retighten
Vehicle pulls to one side when brakes are applied	Difference between left and right tire inflation pressure	Adjust
	Improper front wheel alignment	Adjust
	Inadequate contact of pad or lining	Correct
	Grease or oil on pad or lining surface	Replace
	Drum warpage or uneven wear	Replace
	Incorrect wheel cylinder installation	Correct
	Auto adjuster malfunction	Correct
Insufficient braking power	Low or deteriorated brake fluid	Refill or change
	Air in the brake system	Bleed the system
	Brake booster malfunction	Correct
	Inadequate contact of pad or lining	Correct
	Grease or oil on pad or lining surface	Replace
	Auto adjuster malfunction	Correct
	Overheated brake rotor due to dragging of pad or lining	Correct
	Restricted brake line	Replace
	Proportioning valve malfunction	Replace
Increased pedal stroke required (Reduced pedal to floorboard clearance)	Air in the system	Bleed the system
	Brake fluid leakage	Correct
	Auto adjuster malfunction	Correct
	Excessive push rod to master cylinder clearance	Adjust
Brake drag	Incomplete release of parking brake	Adjust
	Incorrect parking brake adjustment	Adjust
	Worn brake pedal return spring	Replace
	Restricted master cylinder return port	Correct
	Broken rear drum brake shoe return spring	Replace
	Lack of lubrication in sliding parts	Lubricate
	Defective master cylinder check valve or piston return spring	Replace
	Insufficient push rod to master cylinder clearance	Replace
Insufficient parking brake function	Worn brake lining or pad	Replace
	Grease or oil on lining or pad surface	Replace
	Parking brake cable sticking	Replace
	Auto adjuster malfunction	Adjust
	Excessive parking brake lever stroke	Adjust the parking brake lever stroke or check the parking brake cable routing

ADJUSTMENT PROCEDURE EF6EC570

BRAKE PEDAL HEIGHT ADJUSTMENT

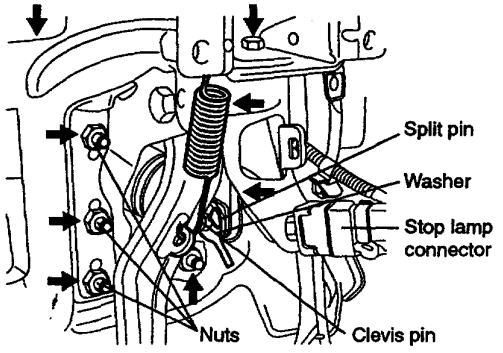
1. Remove the carpet and measure the brake pedal height. If the height is over the standard value, adjust it as the following procedures.

Standard value: 157.1(+5, 0) mm [6.19 (+0.2, 0) in.]



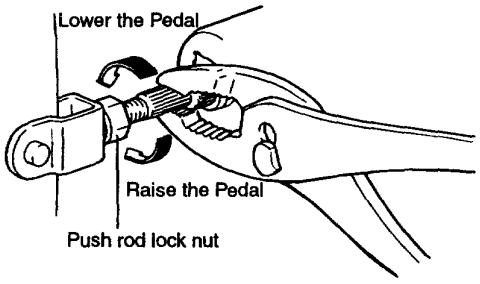
EJDD010A

1) Disconnect the stop lamp switch connector, loosen the stop lamp switch lock nut, and back off the stop switch until it doesn't reach the brake pedal arm.



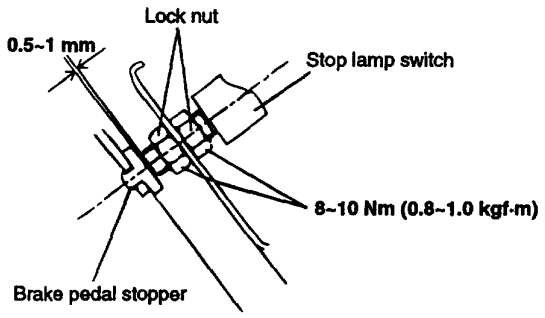
ETBBR08A

2) Loosen the push rod lock nut, and screw the push rod in or out with pliers until the standard pedal height from the floor is reached.



EJMB065B

3) Turn the stop lamp switch until clearance between the stop lamp switch outer case and stopper becomes 0.5~1.0mm.
Tighten the lock nut firmly.



EJDD020A

NOTE

Brake pedal stroke should be 125.6mm (4.95 in.) or more. If the brake pedal stroke is not 125.6mm or more, readust the brake pedal height and stop lamp switch clearance.

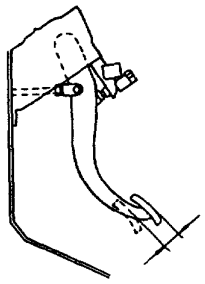
4) Connect the stop lamp switch connector.

5) Make sure that the stop lamps go off when the brake pedal is released.

6) With the engine off, depress the pedal 2~3 time to get rid of pressure, and then inspect the play on the pedal by pushing it by hand.

Standard value: 3 ~ 8 mm (0.11 ~ 0.31 in.)

If the play is below the standard value, check on the fact that the clearance between the stop lamp switch outer case and the brake pedal is within the standard value.
If the play is over the standard value, clearance between the clevis pin and the brake pedal arm is over the standard value. Inspect the defective parts and replace them if required.



H7BR204A

BRAKE LINE INSPECTION

With the engine running, depress the brake pedal with a force of about 120 kgf. Check the master cylinder, brake line and each connector for leaks and repair.

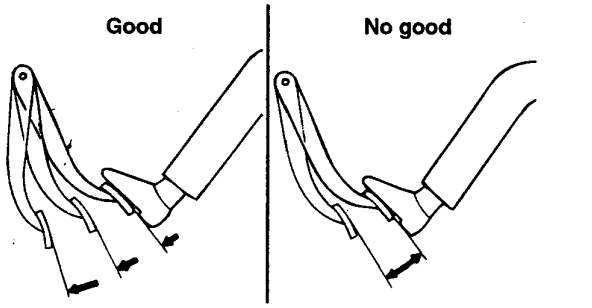
BRAKE BOOSTER OPERATION TEST WITHOUT A TESTER

For a simple check of brake booster operation, perform the following tests.

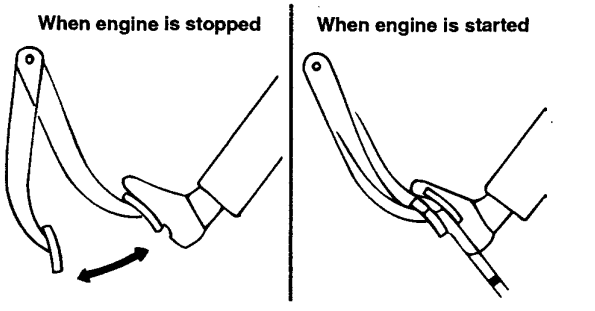
1. Run the engine for one or two minutes, and then shut it off. Depress the brake pedal several times at normal foot pressure. If the pedal goes down further at first but rises gradually after the second or third time, the brake booster is functioning properly. If the pedal height doesn't change, the booster is damaged.

2. With the engine off, depress the brake pedal several times and check on the pedal height change. After that, with the pedal depressed, start the engine. If the pedal goes down slightly, the booster is in good condition. If the pedal height doesn't change, the booster is damaged.

3. With the engine running, depress the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition. if the pedal goes up, the booster is damaged.
   If one of the above three tests is not okay, check the vacuum hoses and the brake booster and make any necessary corrections. If all tests are OK, the booster is good.



EJDA021A



EJDA022A

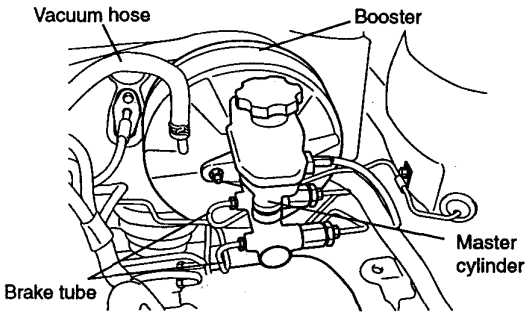
CHECK VALVE OPERATION CHECK

When checking the check valve, keep the check valve fit in the vacuum hose.

1. Remove the vacuum hose.

   NOTE

   The check valve is press-fitted inside the vacuum hose at the position of the marking.



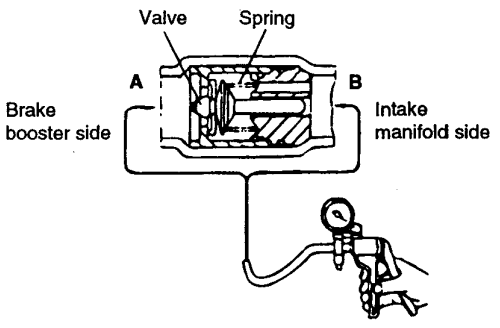
EJDD028A

2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/Reject criteria
Connection at the brake booster side (A)	A negative pressure (vacuum) is created and held
Connection at the intake manifold side (B)	A negative pressure (vacuum) is not created

CAUTION

If the check valve is defective, replace it if an assembly unit together with the vacuum hose.



EGKBR30A

BLEEDING THE BRAKE SYSTEM

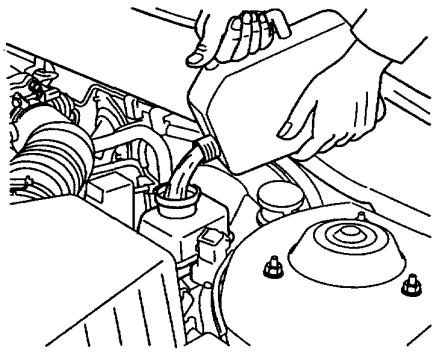
1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

   ⚠ ***CAUTION***

   If there is any brake fluid on any painted surface, wash it off immediately.

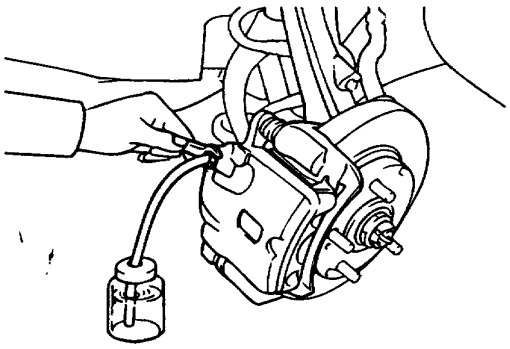
   📖 ***NOTE***

   When bleeding pressurized fluid, do not depress the brake pedal.



KJDD090A

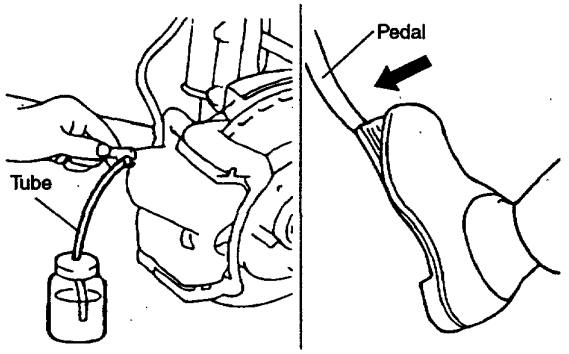
2. Connect a vinyl tube to the wheel cylinder bleeder plug, and insert the other end of tube in the container of brake fluid.



EJDD090C

3. Depress the brake pedal several times.

4. While depressing the brake pedal fully, loosen the bleeder plug until the fluid starts to run out. Then close the bleeder plug.



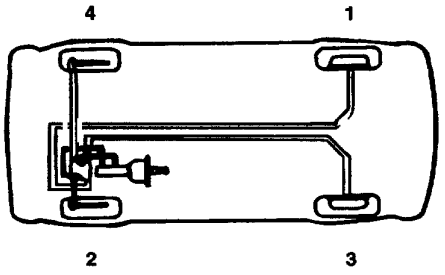
EJDD090B

5. Repeat the steps 3 and 4 until there are no more bubbles in the fluid.

6. Tighten the bleeder plug screw.

Bleeder screw tightening torque :
7~9 Nm (70~90 kgf·cm, 5.2~6.6 lb·ft)

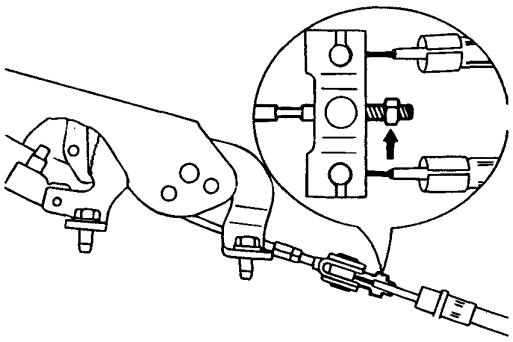
7. Repeat the above procedure for each wheel in the sequence shown in the illustration.



EJDA047B

ADJUSTMENT OF PARKING BRAKE STROKE

1. After bleeding, depress the brake pedal 20 times with a force of over 10 kgf.
2. Pull the brake lever to full stroke more than 3 times.
3. When pulling the lever (pulling point : at 25mm (0.98 in.) from the lever assembly end as shown in the illustration), it should be locked at 6~7 clicks.
   Adjust the parking brake if the lever clicks are out of standard value.



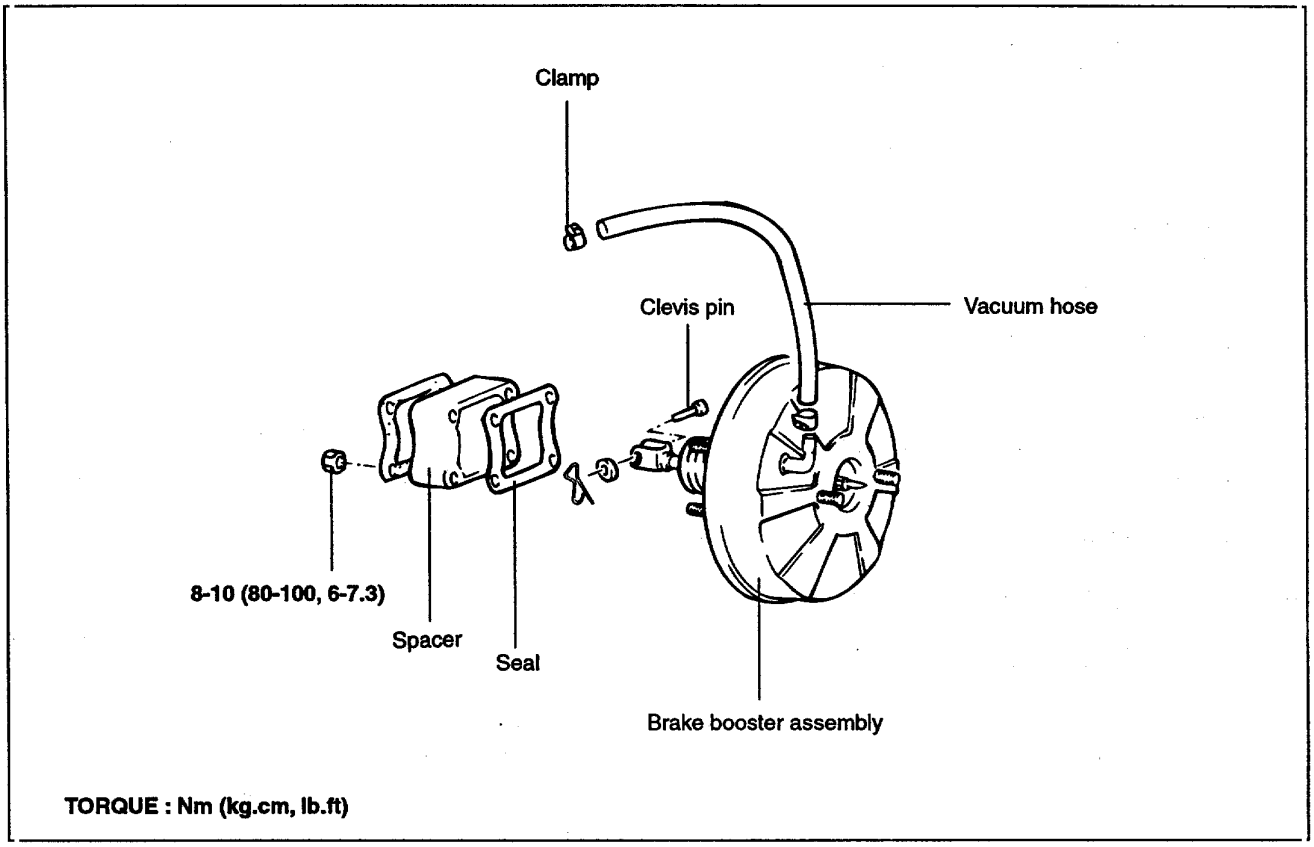
EJDA023A

4. The indicator light will go out when the brake lever is fully released, and will light up with the lever pulled one notch. If it does not operate properly, replace it.
5. After adjustment, check that the rear brakes do not drag with the parking brake lever released.

BRAKE SYSTEM

BRAKE BOOSTER

COMPONENTS EADDADC2



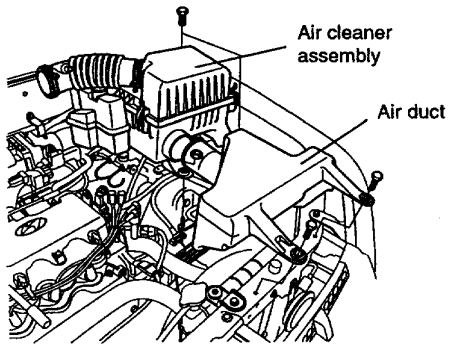
EJDD011A

REMOVAL ED6DD25E

⚠ *CAUTION*

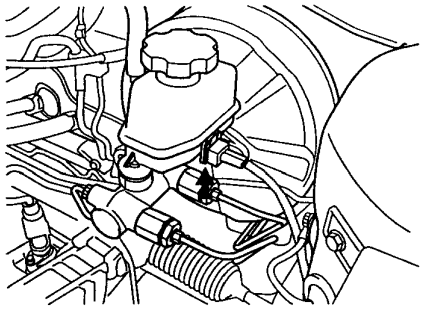
- ***Be careful not to bend or damage the brake lines when removing the master cylinder.***
- ***Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.***
- ***To prevent spills, cover the hose joints with rags or shop towels.***

1. Remove the air cleaner and the air duct.



EJDD026A

2. Remove the brake fluid level switch connector.



EJDD027A

3. After removing the brake reservoir cap, suck out the brake fluid in the reservoir using a syringe or equivalent.

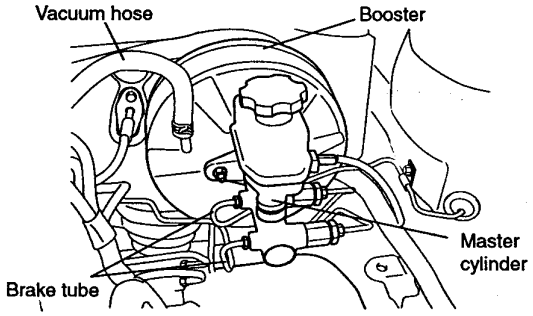
4. Disconnect the brake tube from the master cylinder.

⚠ CAUTION

Take care not to contaminate the brake fluid by other parts.

5. Remove the master cylinder from the brake booster.

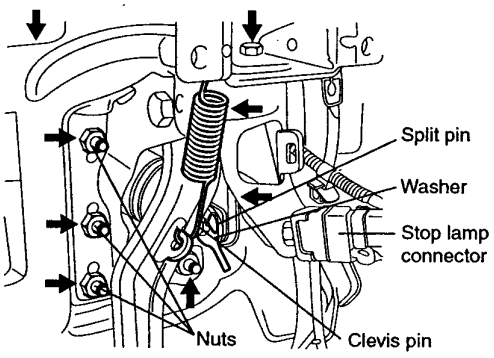
6. Remove the vacuum hose from the booster.



EJDD028A

7. Remove the push rod from the brake pedal.

8. Remove the booster mounting nuts.



ETBBR08A

INSPECTION ED00CEDA

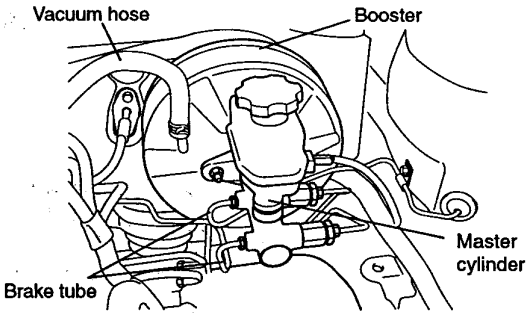
CHECK VALVE OPERATION CHECK

When checking the check valve, keep the check valve fit in the vacuum hose.

1. Remove the vacuum hose.

NOTE

The check valve is press-fitted inside the vacuum hose at the position of the marking.



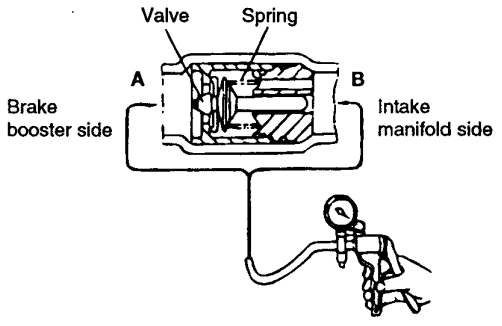
EJDD028A

2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/Reject criteria
Connection at the brake booster side (A)	A negative pressure (vacuum) is created and held
Connection at the intake manifold side (B)	A negative pressure (vacuum) is not created

⚠ CAUTION

If the check valve is defective, replace it if an assembly unit together with the vacuum hose.

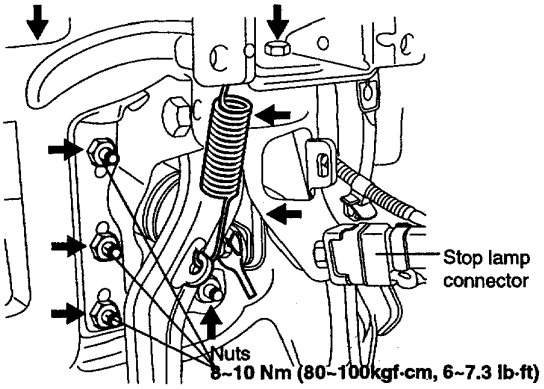


EGKBR30A

INSTALLATION EF2D5054

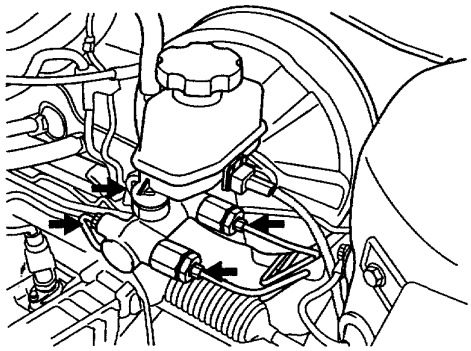
1. Install the brake booster and tighten mounting nut.

Tightening torque Nm (kgf·cm, lb·ft)
Brake booster mounting nut : 8~10 (80~100, 6~7.3)



EJDD077A

2. Apply grease to the contact points of the brake pedal and the push rod.
3. Connect the brake pedal and the clevis with a clevis pin and install the split pin to the clevis pin.
4. After installing the master cylinder, install the brake tube to the master cylinder.

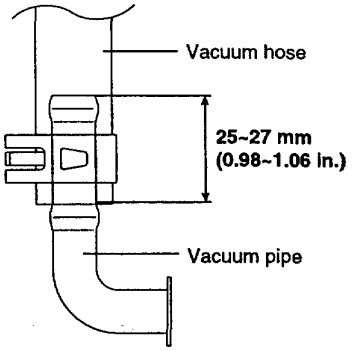


KJDD033A

5. Connect the vacuum hose to the brake booster.

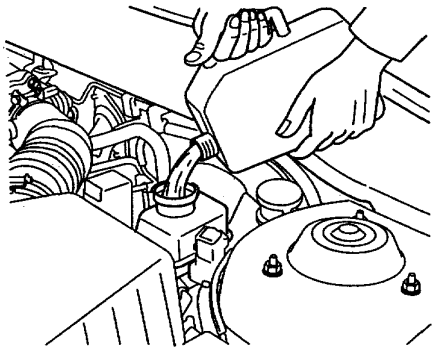
⚠ ***CAUTION***

- ***Make sure that there are no bend, twist, or leaks in the vacuum hose.***
- ***When installing the vacuum hose to the vacuum pipe, the vacuum pipe should be inserted to the depth of 25~27mm (0.98~1.06 in.) as shown in the illustration.***



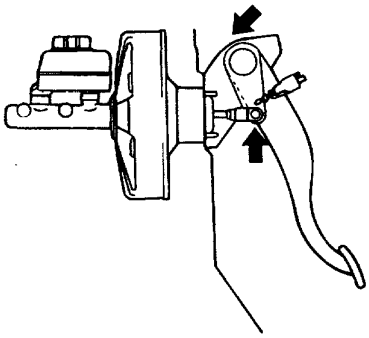
ETBBB01A

6. Fill the brake reservoir with brake fluid, and bleed the system. (Refer to "Air bleeding" in adjustment procedure)



KJDD090A

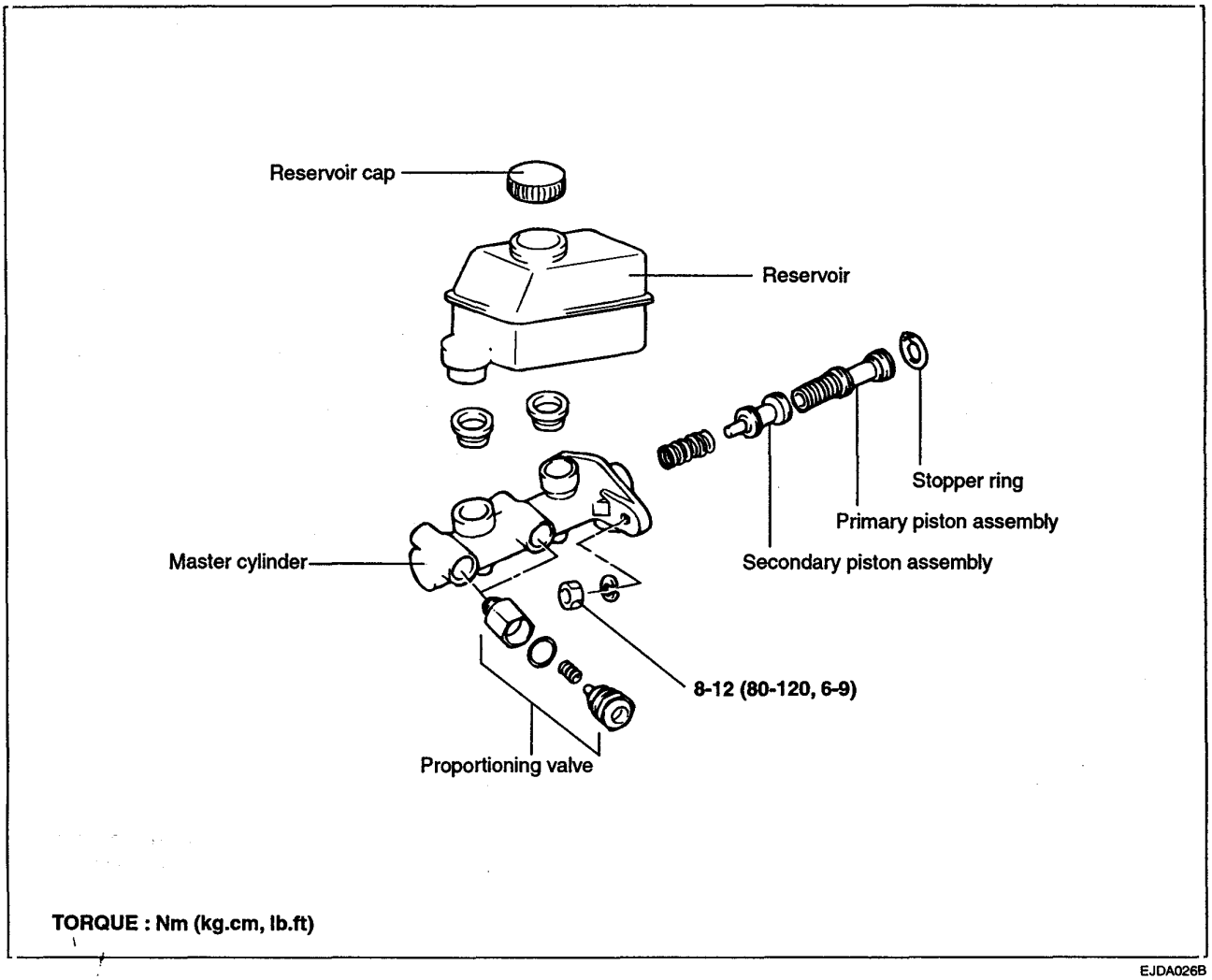
7. Check for brake fluid leaks.
8. Inspect and adjust the brake pedal. (Refer to "Brake pedal height adjustment" in adjustment procedure)
9. After installation, apply grease to the contact points of the clevis and brake pedal sufficiently.



EJKB020A

MASTER CYLINDER

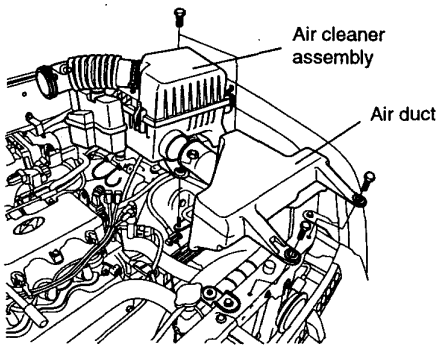
COMPONENTS E9347DEA



EJDA026B

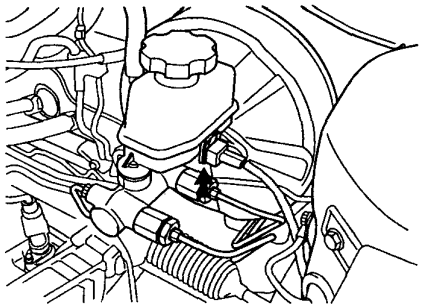
REMOVAL E4C4BBEC

1. Remove the air cleaner and the air duct.



EJDD026A

2. Remove the brake fluid level switch connector.



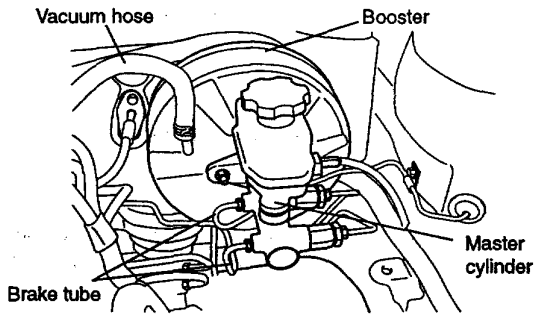
KJDD027A

3. Disconnect the brake tube from the master cylinder and install the plug.

⚠ CAUTION

- ***Be careful not to bend or damage the brake lines when removing the master cylinder.***
- ***Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.***
- ***To prevent spills, cover the hose joints with rags or shop towels.***

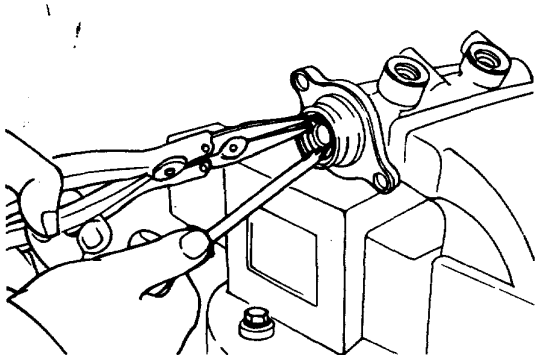
4. Remove master cylinder mounting nuts and then lift out the master cylinder.



EJDD028A

DISASSEMBLY EC8F0E88

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. After disconnecting the mounting screws, pry the reservoir free from the master cylinder.
3. Using snap ring pliers, remove the retainer ring.

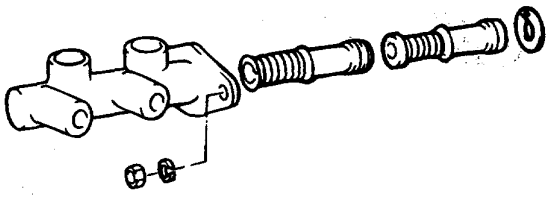


X580012C

4. Remove the primary piston and the secondary piston from the master cylinder body.

NOTE

Do not disassemble the primary and secondary piston assembly.



N00158ZR0230

INSPECTION EBC9A590

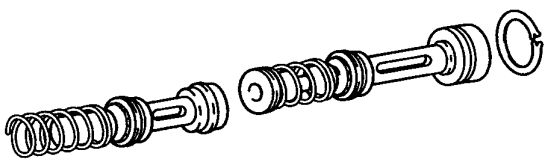
1. Check the master cylinder bore for rust or scoring.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

NOTE

1. *If the cylinder bore is damaged, replace the master cylinder assembly.*
2. *Wash the contaminated parts in alchohol.*

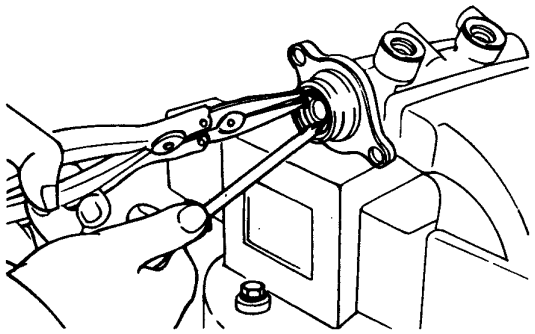
REASSEMBLY EE5FD2A5

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.



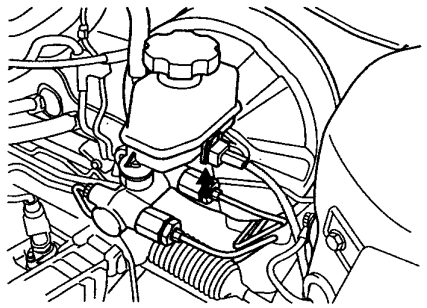
KFW8016A

2. Carefully insert the springs and pistons in the proper direction.
3. Press against the pistons with a screwdriver and install the retainer ring.



X580012C

4. Mount two grommets.
5. Install the reservoir on the cylinder.



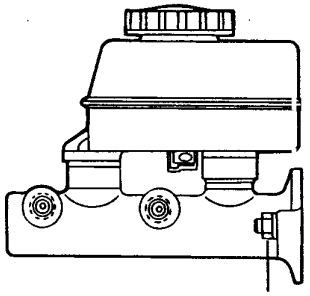
KJDD027A

INSTALLATION E0CB90E5

1. Install the master cylinder to the brake booster.
2. Connect the brake tubes to the master cylinder.

⚠ ***CAUTION***

Check the brake tube for bend and twist.



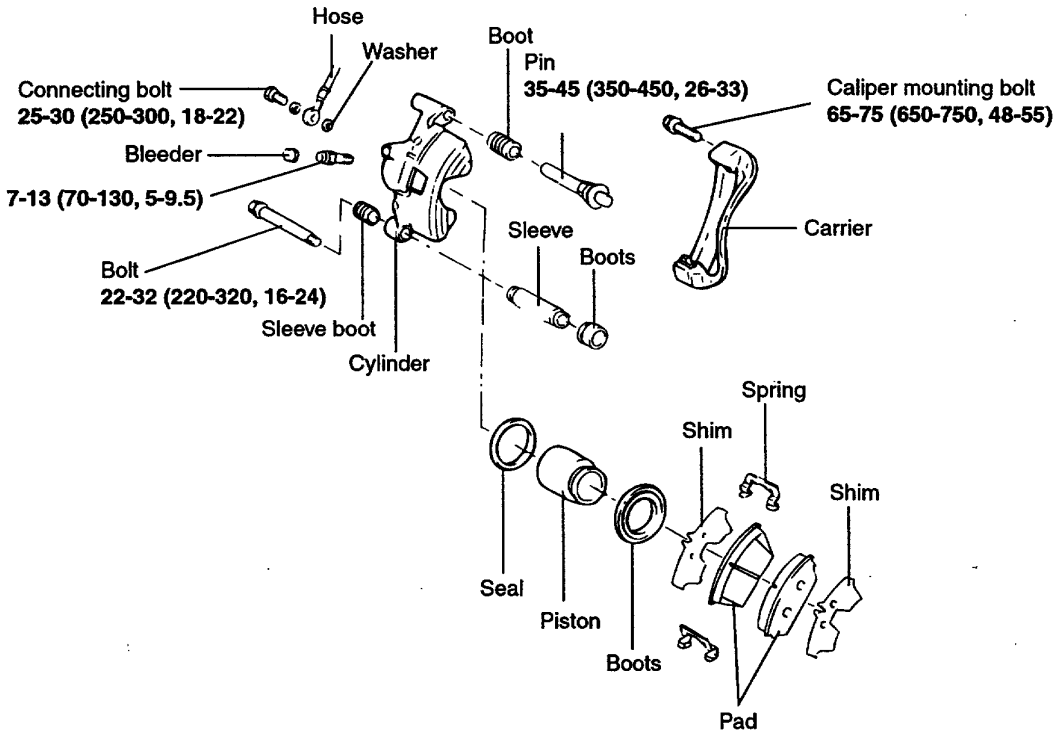
8-12 Nm(80-120 kg·cm, 6-9 lb·ft)

EJDD040B

3. After filling the brake reservoir with brake fluid, bleed the system. (Refer to "Air bleeding in adjustment procedure)

FRONT DISC BRAKE

COMPONENTS E52A4270

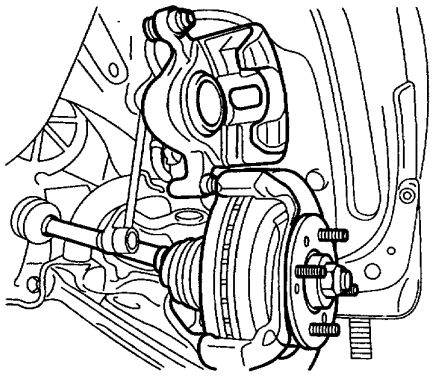


EJDA031A

REPLACEMENT EB2F0A8A

REMOVAL

1. Remove the lower bolt and lift the caliper assembly up and secure it with a wire or some other retaining method.

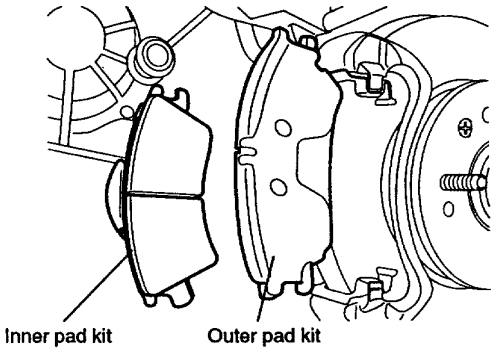


KTBBR16A

2. Remove the pads.

⚠ ***CAUTION***

Do not depress the brake pedal while disassembling the pads.



ETBBR18A

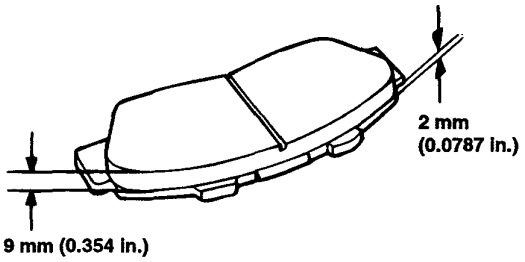
INSPECTION

1. Check the pads for wear or oil contamination and replace, if necessary.

> ⚠ ***CAUTION***
>
> - ***The pads for the right and left wheels should be replaced at the same time. Never "drop" or intermix brake pad sets.***
> - ***All four pads must be replaced as a complete set.***
> - ***When replacing the brake pad, check for deformation. When replacing the guide spring, use a new one or the used one after cleaning away foreign material.***

2. Check the pad for damage or deformation.

Brake pad thickness :
Standard value : 9 mm (0.354 in.)
Service limited value : 2 mm (0.0787 in.)

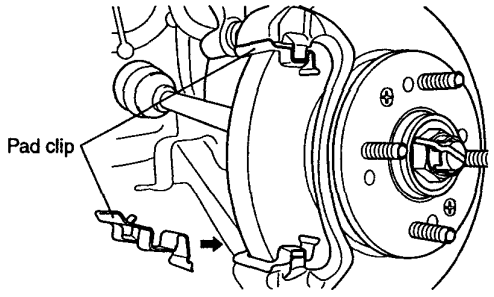


EJDD040A

INSTALLATION

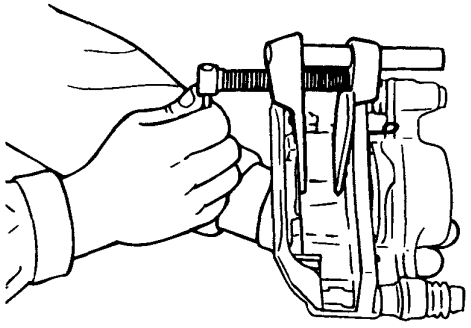
1. Install the pad clips.
2. Install the pads onto each pad clip.

> 🛈 ***NOTE***
>
> *Position the pad with its pad wear indicator upward on the piston side.*



ETBBR19A

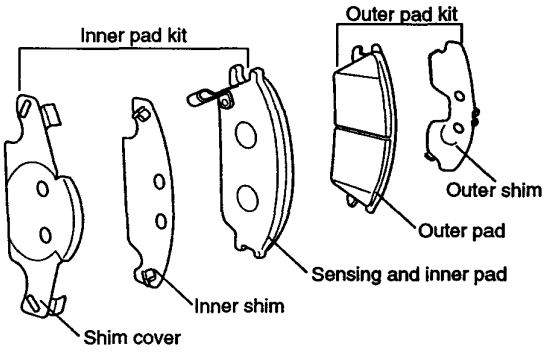
3. Insert the piston in the cylinder using the Special Tool (09581-11000).



EJDA033B

4. Install the new pads. The shims are attached to the each pad as illustrated.

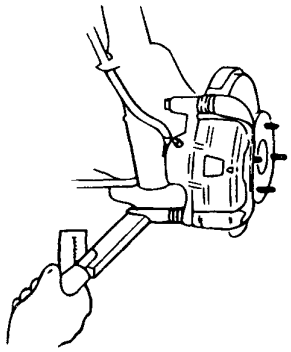
> ⚠ ***CAUTION***
>
> ***Be careful so that the disc or pad isn't contaminated by grease.***



ETBBR20A

5. Install the bolt and tighten to the specified value.

Tightening torque
Guide rod bolt : 22~32 Nm(220~320 kgf·cm, 16~24 lb·ft)

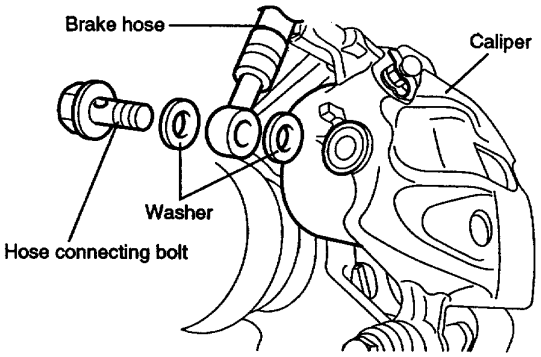


EJDA033D

REMOVAL E4ED28F4

CALIPER ASSEMBLY

1. Remove the wheel and tire.
2. Disconnect the brake hose.

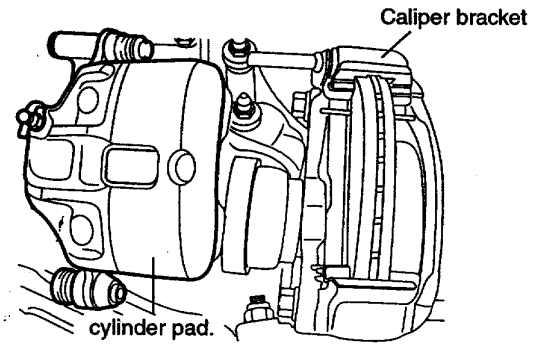


ETBBR21A

⚠ CAUTION

- ***Do not spell brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.***
- ***To prevent spills, plug the hose inlets with rags or shop towels.***

3. Remove the cylinder mounting bolt.
4. Remove cylinder and pads from the caliper bracket.



ETBBR22A

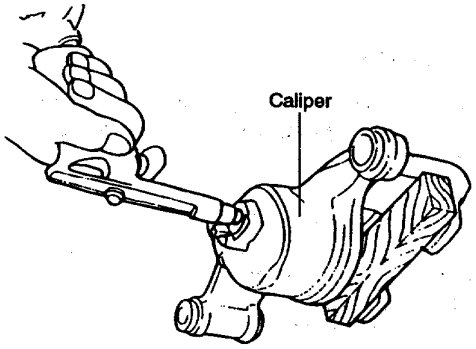
5. Remove the caliper mounting bolts from the knuckle.
6. Remove the caliper mounting bracket.

DISASSEMBLY EFA6EAAF

1. Remove the piston boot.
2. Remove the piston using compressed air.

NOTE

1. *Do not put your fingers in front of the piston when using compressed air.*
2. *Be careful not to splatter the brake fluid.*

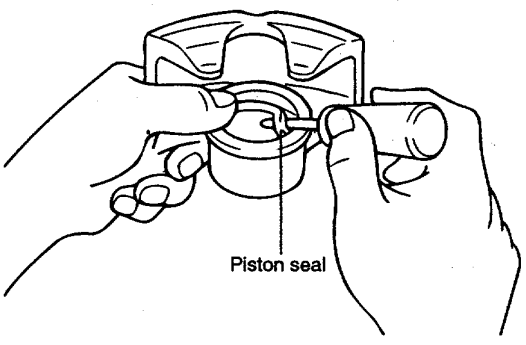


ETBBR23A

3. Remove the piston seal from the caliper by using a screwdriver.

⚠ CAUTION

Take care not to damage the piston wall surface.



EJDA034B

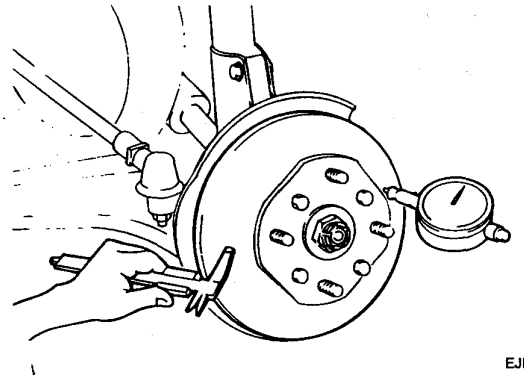
INSPECTION ECA9A39E

1. Check the caliper for wear, damage, cracks and dust.
2. Check the piston for dust, damage, cracks and wear on the outer surface.
3. Check the sleeve and pin for damage and dust.
4. Check the pad spring and boots for damage.
5. Check the carrier for damage, dust, wear and cracks.

> ⚠ ***CAUTION***
>
> ***1. Do not use sand paper on the piston surface.***
> ***2. All rubber parts must be replaced with new parts.***

6. Inspect the disc by using a caliper and a dial gauge.

Thickness of disc mm (in.)
Standard value : 19 (0.75)
Service limit : 17 (0.67)
Runout of the disc mm (in.) : 0.04 (0.002)
Difference of thickness mm (in) : 0.01 (0.0004)



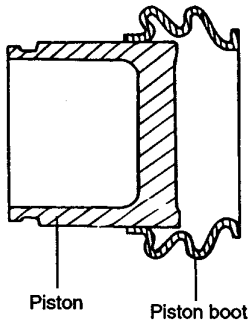
EJKB029A

> 📖 ***NOTE***
>
> *1. Using a micrometer, measure the disc thickness at eight positions approximately 10mm from the outer edge of the disc and at 45° intervals.*
> *If you substract the minimum of measurements from the maximum, you get the difference of the disc thickness.*
> *2. When measuring the disc runout, fix a dial gauge approximately 5mm from the outer edge of the disc, and rotate the disc 360°.*
> *At this time, if you subtract the minimum of measurements from the maximum, you get the disc runout.*

7. If necessary, replace the brake disc.

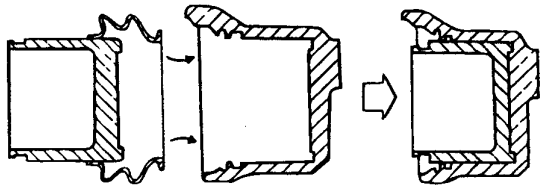
REASSEMBLY E0DA7091

1. Clean all components except the pads and shims with isopropyl alcohol.
2. Apply rubber grease on the piston seal and install the piston seal in the cylinder.



EJDA035A

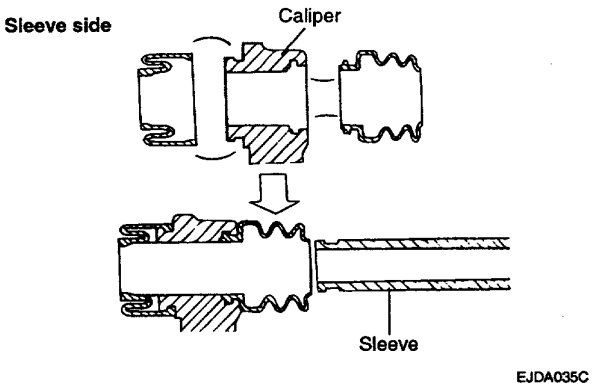
3. Assemble the piston and piston boots according to the following procedure.
   1) Apply rubber grease to the caliper bore, the outside surface of the piston and the piston boot.
   2) Install the piston boot on the piston as illustrated.
   3) Insert the piston boot in the inner groove of the caliper and push the piston into the caliper.



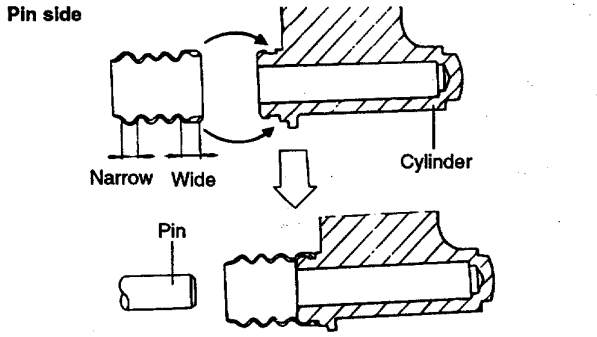
EJDA035B

4. Assemble the sliding parts according to the following procedure.
   1) Apply rubber grease to the outside surface of the sleeve and pin, pin and sleeve bore of the caliper, pin boot and sleeve boot.

2) Insert the boot into the groove of the caliper.



EJDA035C

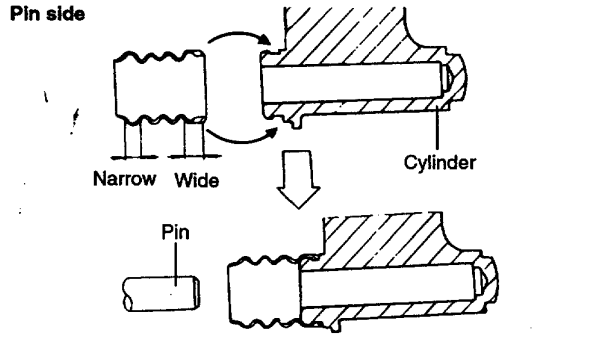


EJDA035D

5. Install the pads.

NOTE

Be careful so that the disc or pad is not contaminated by grease.



EJDA035D

6. Tighten the brake hose connecting bolt.

Tightening toque	Nm (kg·cm, lb·ft)
Sliding pin	34 - 44 (350-450, 26-33)
Sliding bolt	22 - 31 (220-320, 16-23)
Carrier mounting bolt	64 - 74 (650-750, 48-54)
Brake hose mounting oil bolt	25 - 29 (250-300, 18-22)

NOTE

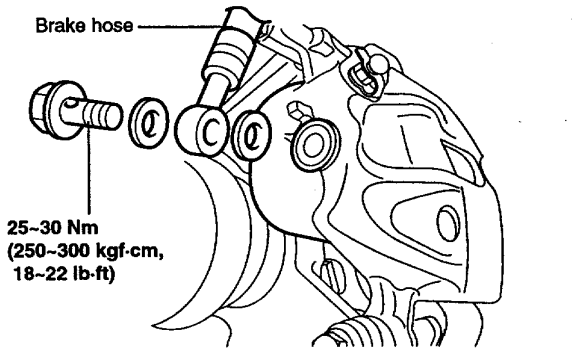
1. *Check that the surface of the pin and bolts are not damaged before tightening.*
2. *Bleed the system. Depress the pedal several times and check for fluid leakage from all connecting parts.*

INSTALLATION EFFFDDF3

CALIPER ASSEMBLY

Installation is the reverse of removal.

1. Be careful not to spill grease or oil on the pad and brake disc contact surface.
2. Tighten the caliper mounting bolt to the specified torque.
3. Install the brake hose.

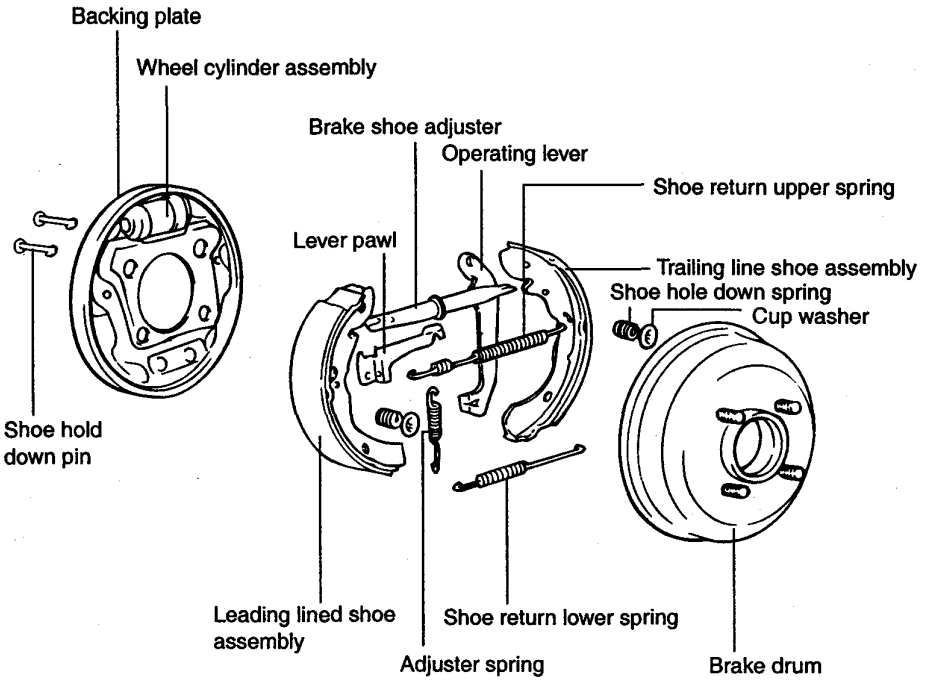


ETBBR44A

4. Bleed the system. (Refer to "Air bleeding" in adjustment procedure)

REAR DRUM BRAKE

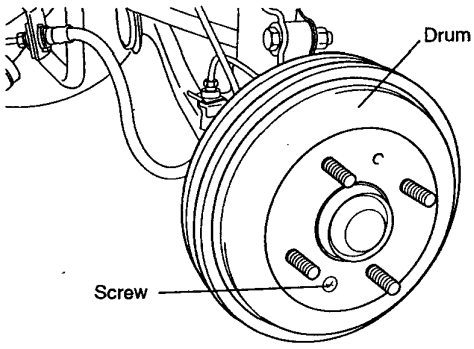
COMPONENTS E4FD0EF0



EJDA036A

REMOVAL E99D5505

1. Release the parking brake.
2. After removing the wheel, remove the brake drum.



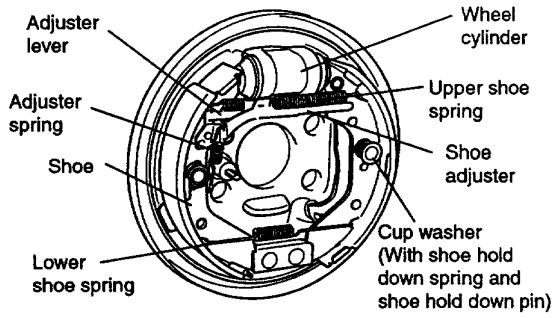
EJDD037A

NOTE

When removing the brake drum, remove the screw.

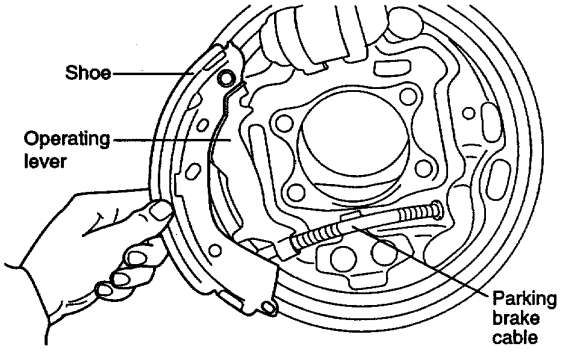
3. Remove the adjuster spring and adjuster lever.
4. Remove the cup washer, shoe hold down spring, shoe hold down pin.

5. Move the shoe and remove the shoe adjuster.



EJDD030A

6. Remove the lower shoe spring and upper shoe spring and disconnect the parking cable from the operating lever.



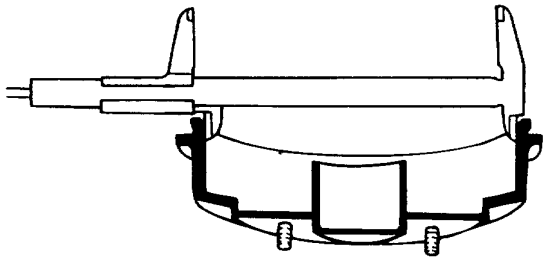
ETBBR28A

INSPECTION E363EFB8

1. Measure the inside diameter of the brake drum. Check the runout of the brake drum by using a dial indicator.

Inside diameter mm (in.)
Standard value : 180 (7.09)
Service limit : 182 (7.17)

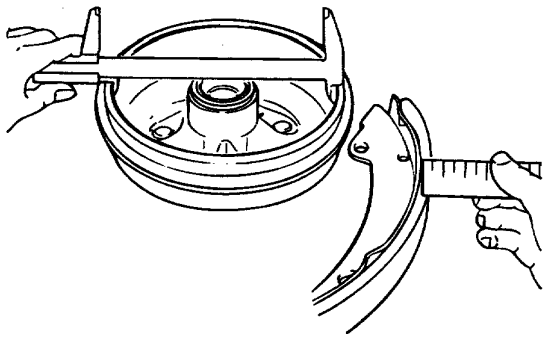
Out-of-round (brake drum) mm (in.)
Service limit : 0.05 (0.002)



EJDA038A

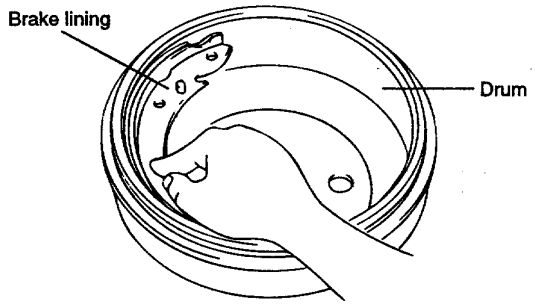
2. Measure the brake shoe lining thickness.

Lining thickness mm (in.)
Standard value : 4.8 (0.19)
Service limit : 1 (0.04)



EJDA038B

3. Inspect the brake lining and drum for proper contact.



EJDA038C

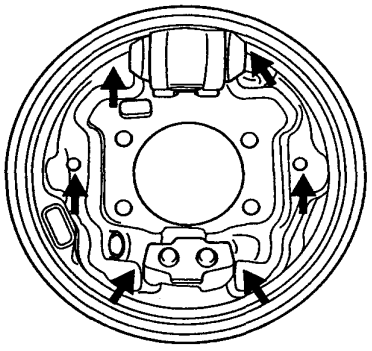
4. Inspect the wheel cylinder outside for excessive wear and damage.

5. Inspect the backing plate for wear or damage.

INSTALLTION E5822B1D

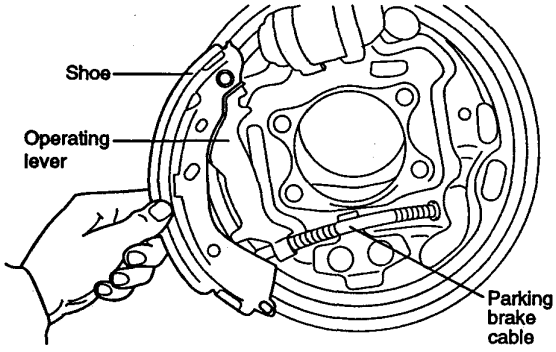
1. Apply the specified grease to the locations indicated in the illustration and to each component.
   - Shoe and backing plate contact surfaces.
   - Shoe and anchor plate contact surfaces.

Recommended grease :
Multipurpose grease SAE J310, NLGI No.2



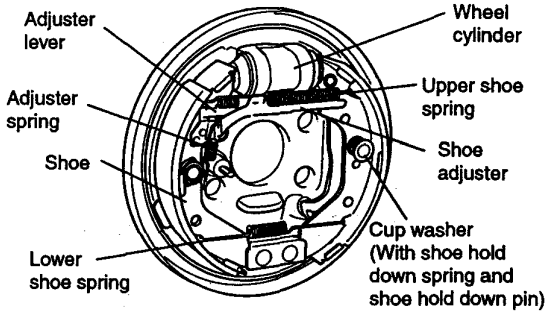
KTBBR29A

2. Connect the operating lever to the parking cable.



ETBBR28A

3. Install the shoe hold-down pin.
4. Install the shoe adjuster and assemble the return spring.
5. Assemble the adjuster lever and adjuster spring.



EJDD030A

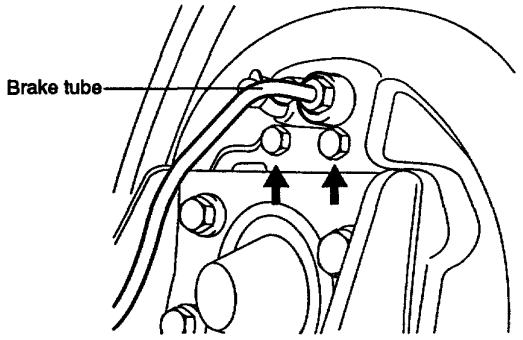
6. Assemble the drum and pull the parking brake lever to full stroke several times.

⚠ ***CAUTION***

Be sure that the inside surface of drum is not contaminated by grease or other materials.

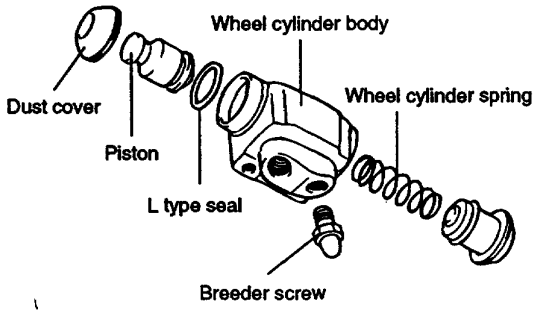
REPLACMENT OF WHEEL CYLINDER EFC940B9

1. Remove the brake shoe.
2. Disconnect the brake tube.
3. Remove the wheel cylinder assembly.



ETBBR31A

4. Remove the dust boot.
5. Remove the piston and piston cup.
6. Remove the return spring.



EJDA039B

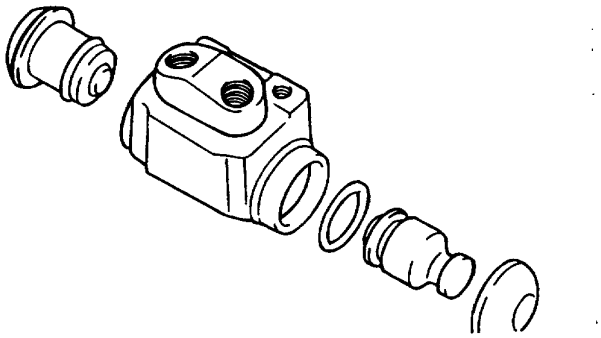
7. Before assembling the wheel cylinder, inspect the following.
   1) Check the cylinder and piston for wear, damage and dust.
   2) Check the cylinder body for damage and cracks.
   3) Check the contact surface of the piston and shoes for wear.
   4) Check the piston spring for looseness.
8. Assembly is the reverse of removal.

NOTE

1. *Clean the cylinder and inner parts with isopropyl alcohol before assembly.*
2. *Apply enough brake fluid to the piston cups and cylinder.*
3. *Be sure to use new piston cups and dust boots.*

CAUTION

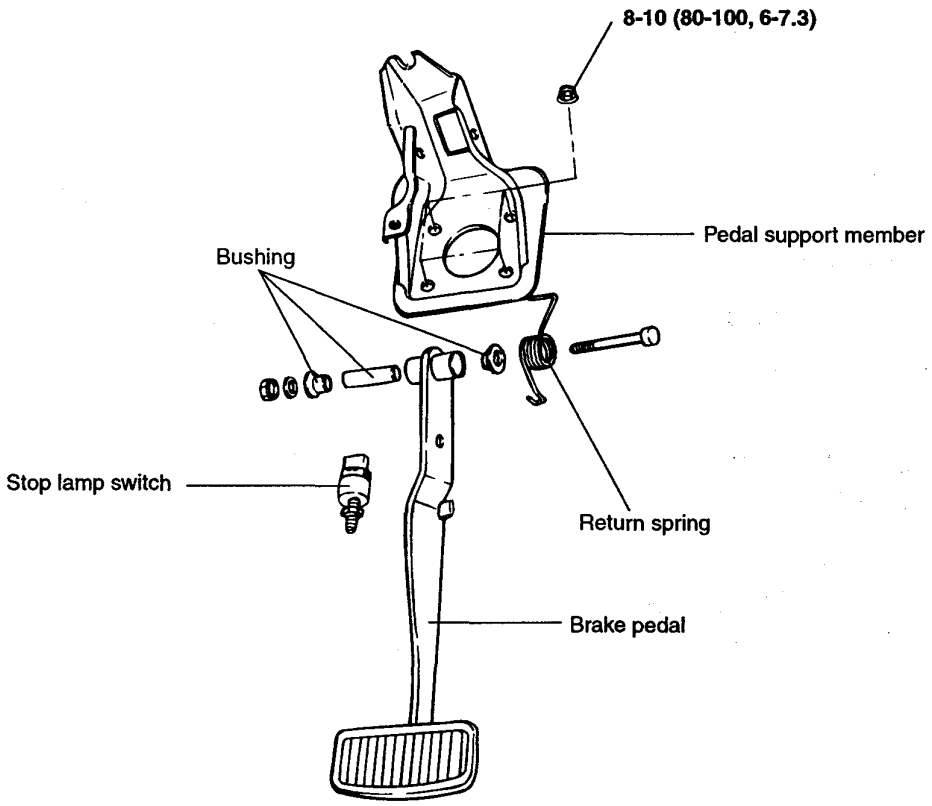
Be careful not to lose the steel ball in the bleeder.



EJDA039C

BRAKE PEDAL

COMPONENTS ECBD9CCA

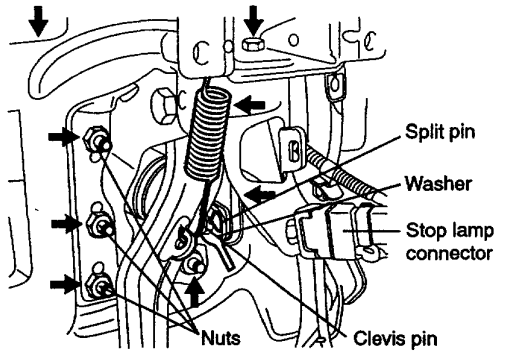


TORQUE : Nm (kgf·cm, lb·ft)

EJDA024A

REMOVAL E9ACE0D0

1. Remove the stop lamp switch.

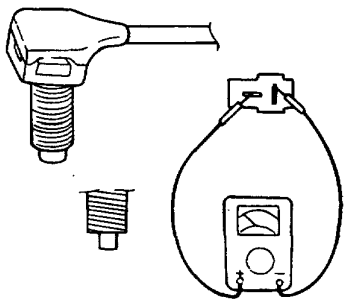


ETBBR08A

2. Remove the split pin and clevis pin.
3. Remove the brake pedal assembly mounting nut.
4. Remove the brake pedal assembly.

INSPECTION E0B1F56D

1. Check the bushing for wear.
2. Check the brake pedal for distortion.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
   1) With an ohmmeter connected to the stop lamp switch terminals, check for continuity.
   2) If there is no continuity when the plunger is depressed and there is continuity when the plunger is released, the stop lamp switch is normal.



Brake switch check

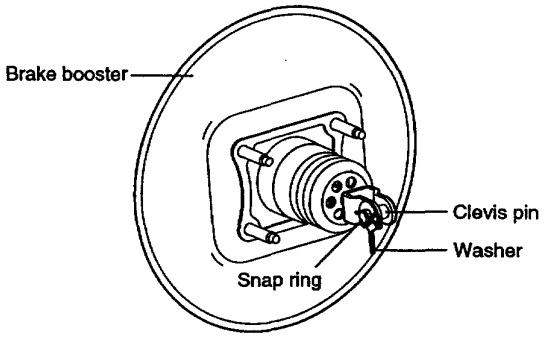
EJDA026A

INSTALLATION EDF75766

1. Installation is the reverse of removal.

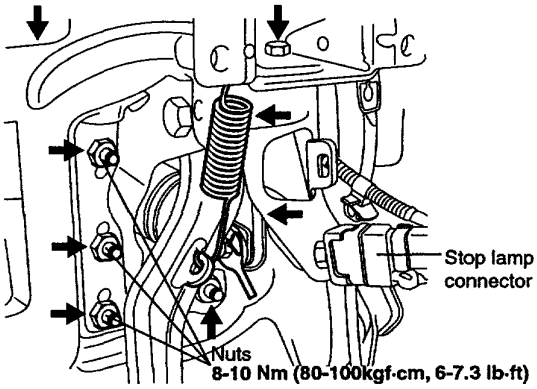
NOTE

Be sure to install the split pin on the operating rod clevis pin. Apply the grease (NLGI No.2)



ETBBB10A

2. Install the brake pedal assembly and tighten the flange nuts (booster mounting nuts) and bolt.



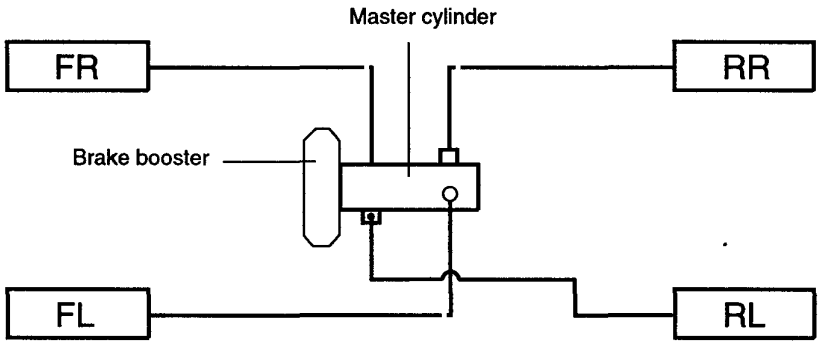
EJDD070A

3. Install the stop lamp switch.
4. Adjust the brake pedal height and free play. (Refer to "adjustment procedure")

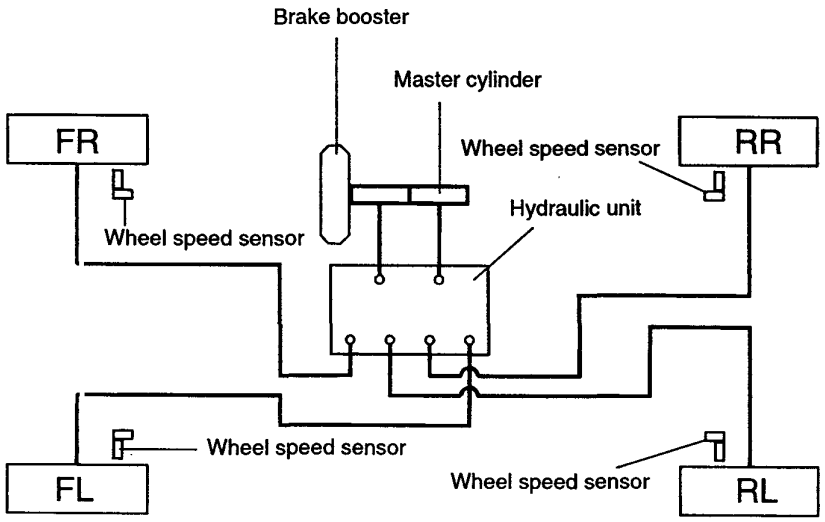
BRAKE LINE

COMPONENTS ED38332B

[NON ABS SYSTEM]



[ABS SYSTEM]



EJDA062A

REMOVAL E1B50A33

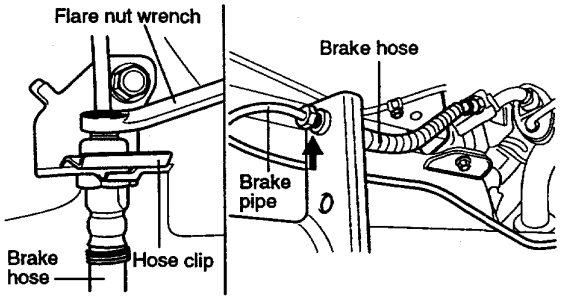
⚠ CAUTION

Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash if off immediately with water.

NOTE

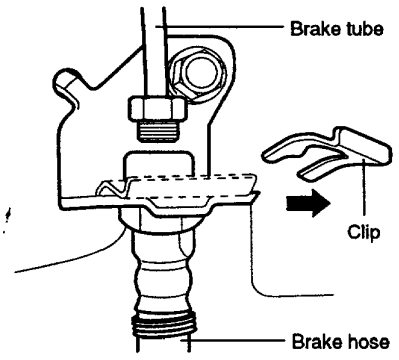
Before reassembling, check that all parts are free of dust and other foreign particles.

1. Replace the brake hose if the hose is twisted, cracked, or if it leaks.
2. Disconnect the brake hose from the brake pipe using a flare nut wrench.



ETBBR12A

3. Remove the brake hose clip from the brake hose using a plier or hammer.



ETBBR13A

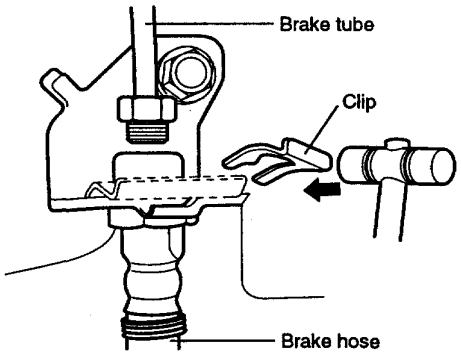
4. Remove the brake hose.

INSPECTION EE05CD4D

1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and leakage.
3. Check the brake tube flare nuts for damage and leakage.

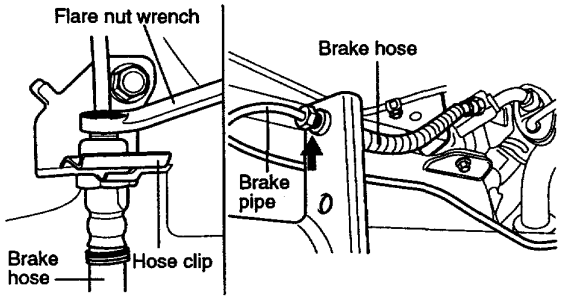
INSTALLATION E4721ECD

1. Install the brake hoses so as they do not twist.
2. The brake tubes should be installed away from edges, weld beads or moving parts.
   1) Align the brake hose connector to the bracket groove.
   2) Install the brake hose clip.



ETBBR14A

   3) Tighten the brake hose connecting flare nut.



ETBBR12A

3. Tighten the connections to the specified torque.

Flare nuts : 13-17 Nm (130-170 kgf·cm, 10-12 lb·ft)
Brake hose to front caliper :
25-30 Nm (250-300 kgf·cm, 18-22 lb·ft)

4. After replacing the brake hose, bleed the system. (Refer to "Air bleeding" of adjustment procedure)

PROPORTIONING VALVE

DESCRIPTION EF29500B

The proportioning valve distributes the proper fluid pressure to the front and rear wheels to obtain greater braking efficiency and prevents premature rear wheel lock-up. You should not disassemble it because the performance of the valve is closely connected with the mounting tension of the spring.

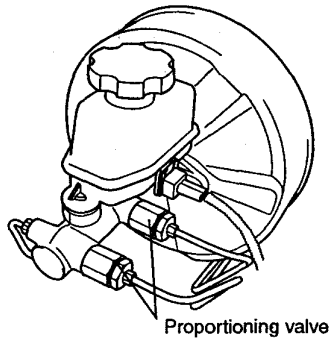
REMOVAL AND INSPECTION E6FCC7A9

1. Remove the proportioning valve from the master cylinder.
2. Connect two pressure gauges; one to the input side, and one to the output side.

   NOTE

   Be sure to bleed the system after connecting the pressure gauges.

3. With the brakes applied, measure the input pressure and the output pressure. If the measured pressures are within the specified range, the proportioning valve is good.

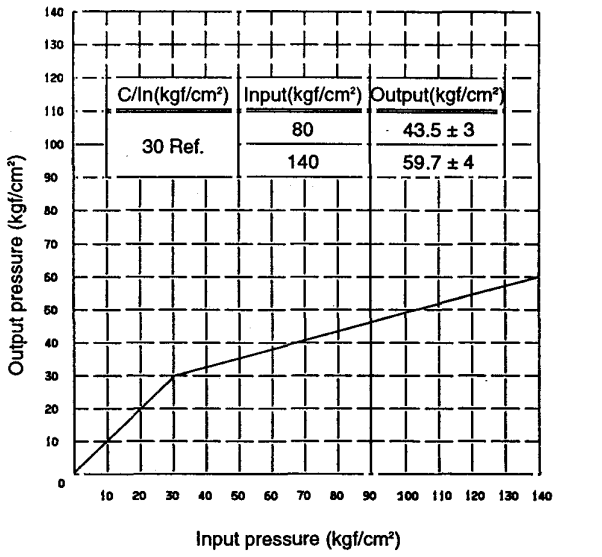


EJDD067A

4. Reconnect the brake lines in their original positions and bleed the system.

   NOTE

   This figure shows characteristics of the proportioning valve as the pressure increase.

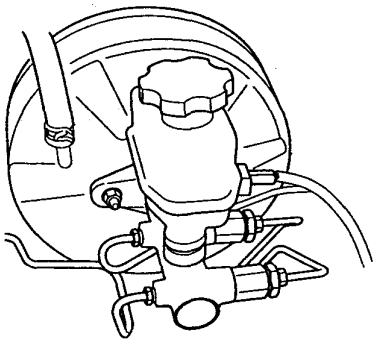


EJDD170A

INSTALLATION EABE8DB7

1. Install the propotioning valve to the master cylinder.
2. Tighten the flare nuts and bleed the system.

Tightening torque
Brake tube flare nut :
13~17 Nm (130~170 kgf·cm, 10~12 lb·ft)
Proportioning valve mounting nut :
35~55 Nm (350~550 kgf·cm, 26~41 lb·ft)

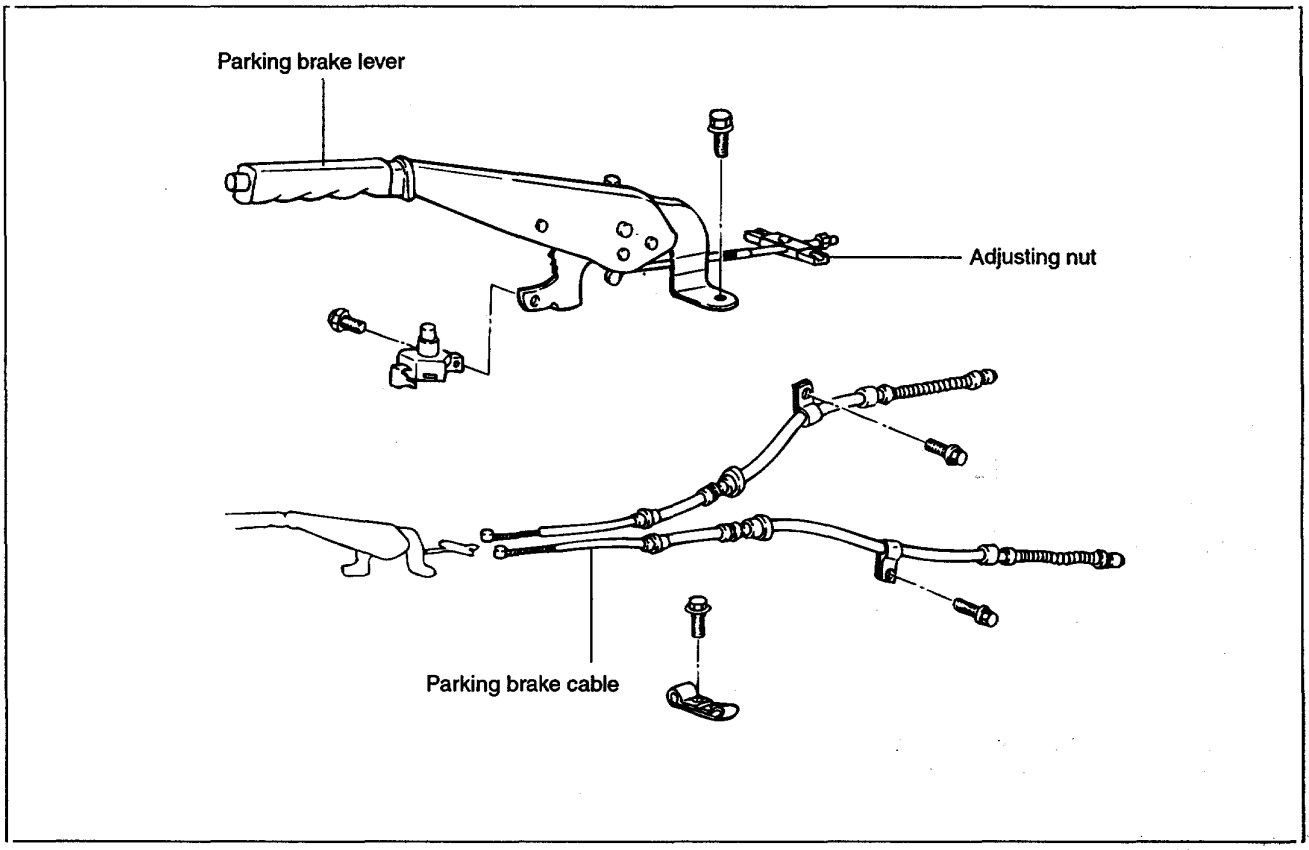


KJDD010A

PARKING BRAKE SYSTEM

PARKING BRAKE

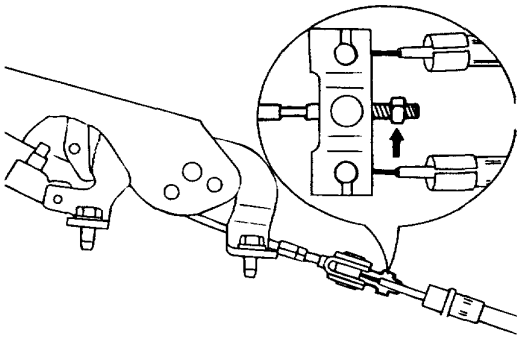
COMPONENTS E8E3BDBB



EJDA040A

REMOVAL E4EAF3C3

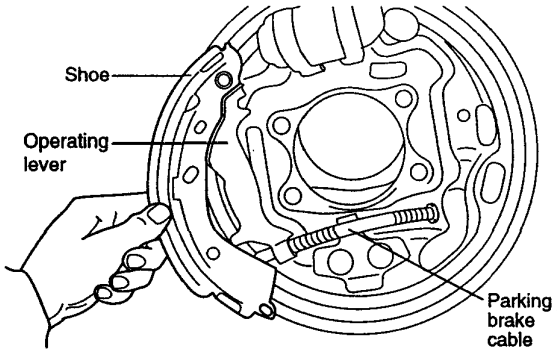
1. Remove the console.
2. Loosen the adjusting nut and detach the parking brake cable.



EJDA023A

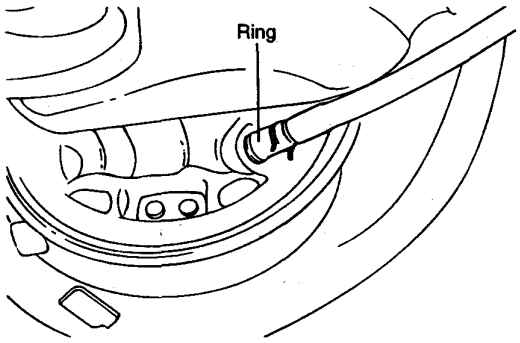
3. Detach the parking brake switch assembly.
4. Remove the parking brake lever assembly.
5. Remove the rear wheel.
6. Remove the brake drum.
7. Remove the rear hub assembly.
8. Remove the brake shoe.

9. Disconnect the parking brake cable from the brake shoe operating lever.



ETBBR28A

10. Remove the parking brake cable retaining ring in the rear of the backing plate.



EJDA041C

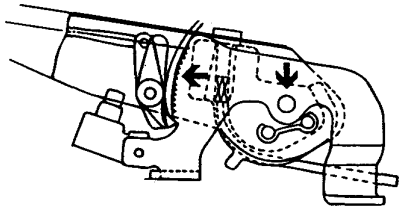
11. Loosen the parking brake cable clamp and remove the parking brake cable assembly.

INSPECTION ED78B85F

1. Check the parking brake switch operation.
2. Check the parking brake lever ratchet for wear.
3. Check the parking brake cable for wear or damage.

INSTALLATION EE1EAA4D

1. Installation is the reverse of removal.
2. Parking brake cable adjustment
   1) Depress and release the brake pedal 20 times with a force of 10 kgf.
   2) Pull the parking brake lever to full stroke more than 3 times.
   3) When pulling up the point where is at a distance of 25mm (0.98 in.) from the end of the lever with a force of 20 kgf, adjust the adjusting nut to the lever assembly so that lever is fixed to 6~7 notches.



EJDA042B

ABS (ANTI-LOCK BRAKE SYSTEM)

DESCRIPTION EA9FA5EA

The Anti-Lock Brake System (ABS) controls the hydraulic brake pressure of all four wheels during braking on hazardous road surfaces, preventing the wheels fron locking up. ABS provides the following benefits.

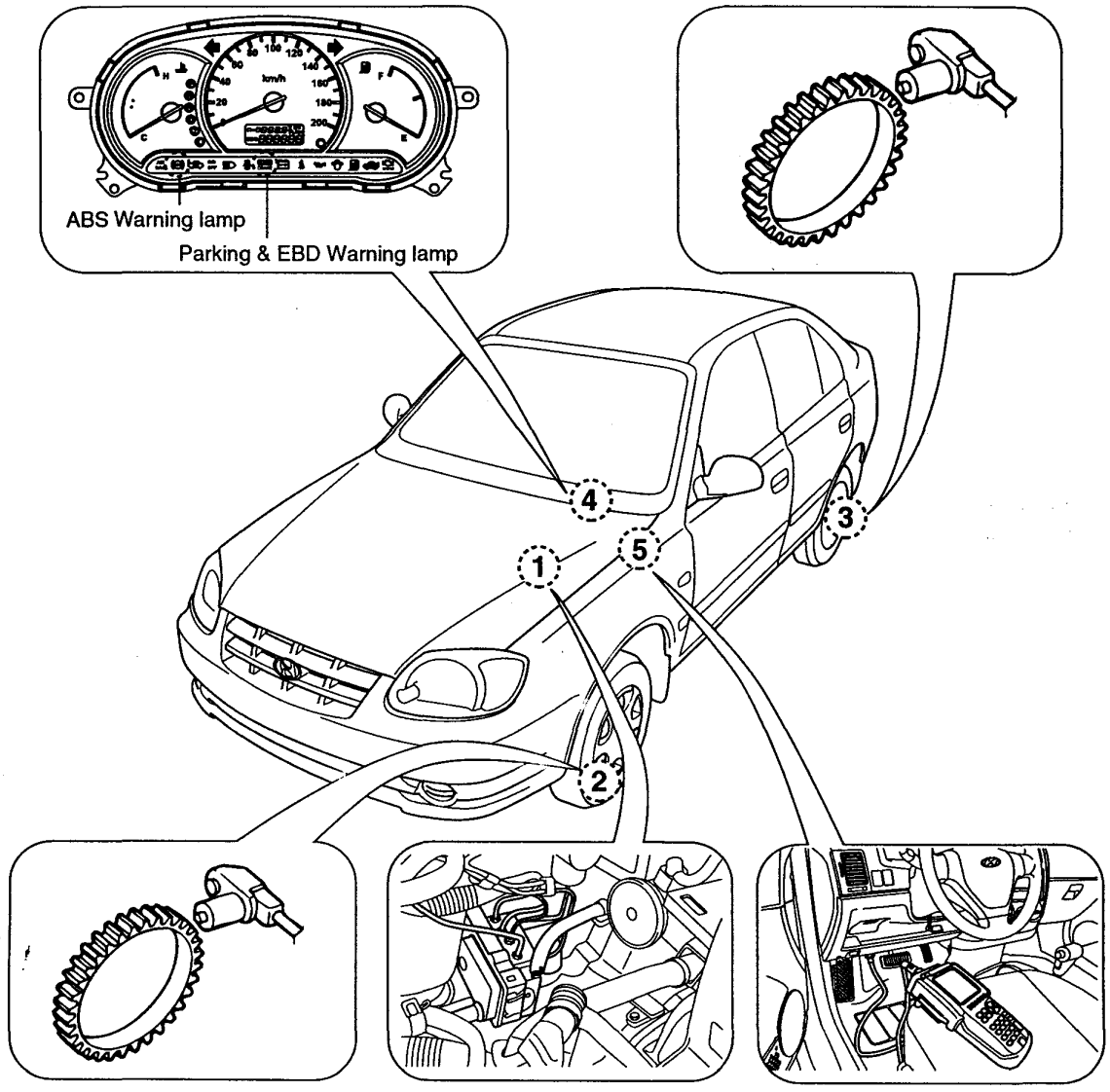
1. Enables steering around obstacles with a greater degree of certainty, even during emergency braking.
2. Enables stopping during emergency braking while keeping stability and steerability even on curves.

If a malfunction occurs, a diagnosis function and fail-safe system are included for serviceability.

The Hydraulic and Electronic Control Unit (HECU) receives signals about the vehicle's speed, direction and road conditions from sensors at the wheels.

Based on these signals, the control unit will determine the optimum amount of wheel spin.

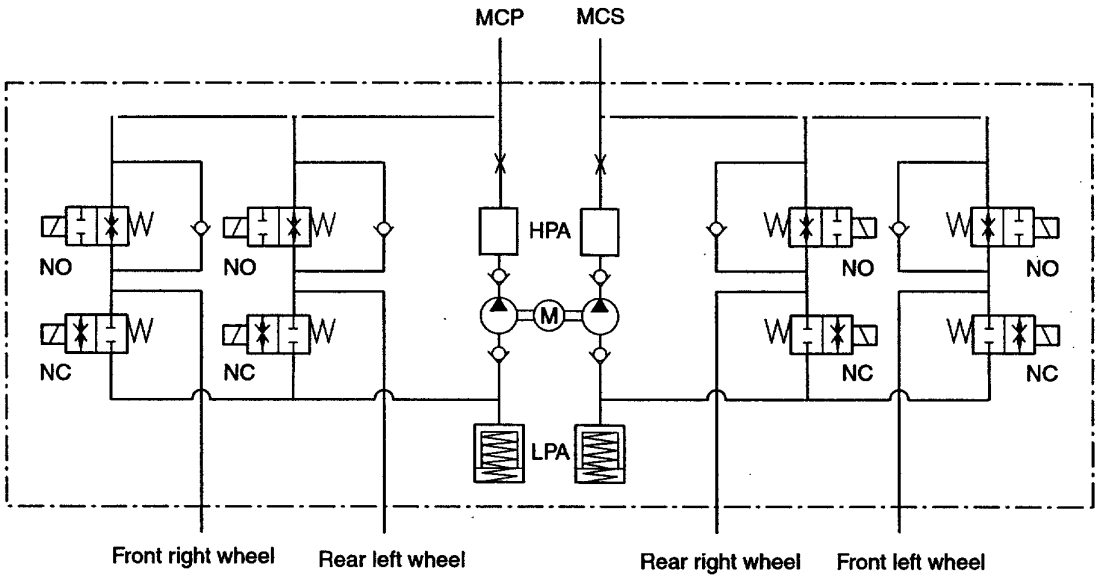
COMPONENTS E99C45C2



1. ABS Control module (HECU)
2. Front wheel speed sensor
3. Rear wheel speed sensor
4. ABS/EBD Warning lamp
5. Diagnosis

EJDD515A

HYDRAULIC SYSTEM DIAGRAM E5C761F7



HPA : High Pressure Accumulator
LPA : Low Pressure Accumulator
M : Pump Motor

NO : Normal Open Valve
NC : Normal Close Valve
MCP : Master Cylinder Primary
MCS : Master Cylinder Secondary

EJDD525A

ABS CONTROL E6AA6B7D

1. NORMAL BRAKING

Solenoid valve	State	Valve	Passage	Pump motor
IN (NO)	OFF	OPEN	Master cylinder ⇔ Wheel cylinder	OFF
OUT (NC)	OFF	CLOSE	Wheel cylinder ⇔ Reservoir	

Under the normal braking, voltage is not supplied to solenoid valve, inlet valve is opened and outlet valve is closed. When the brake is depressed, brake fluid is supplied to the wheel cylinder via solenoid valve to activate the brake. When the brake is released, brake fluid is back to the master cylinder via inlet valve and check valve.

2. DUMP MODE

Solenoid valve	State	Valve	Passage	Pump motor
IN (NO)	ON	CLOSE	Master cylinder ⇔ Wheel cylinder	ON
OUT (NC)	ON	OPEN	Wheel cylinder ⇔ Reservoir	

Under the emergency braking, if the wheels start to lock up, HECU sends a signal to the solenoid valve to decrease the brake fluid, then voltage is supplied to each solenoid. At this time inlet valve is closed and brake fluid is blocked from the master cylinder. Conversely outlet valve is opened and brake fluid passes through wheel cylinder to reservoir, resulting in pressure decrease.

3. HOLD MODE

Solenoid valve	State	Valve	Passage	Pump motor
IN (NO)	ON	CLOSE	Master cylinder ⇔ Wheel cylinder	ON
OUT (NC)	OFF	CLOSE	Wheel cylinder ⇔ Reservoir	

When the brake fluid pressure is maximally decreased in wheel cylinder, HECU sends a signal to solenoid valve to keep the fluid pressure, voltage is supplied to inlet valve but it is not supplied to outlet valve. At this time inlet and outlet valves are closed and brake fluid is kept in wheel cylinder.

4. INCREASE MODE

Solenoid valve	State	Valve	Passage	Pump motor
IN (NO)	OFF	OPEN	Master cylinder ⇔ Wheel cylinder	ON
OUT (NC)	OFF	CLOSE	Wheel cylinder ⇔ Reservoir	

If HECU determines there's no lock-up in the wheel, HECU cuts voltage to solenoid valve. So voltage is not supplied to each solenoid valve, brake fluid passes through the inlet valve to wheel cylinder, resulting in pressure increase.

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION) SYSTEM

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.

The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution to the rear wheels as Well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.

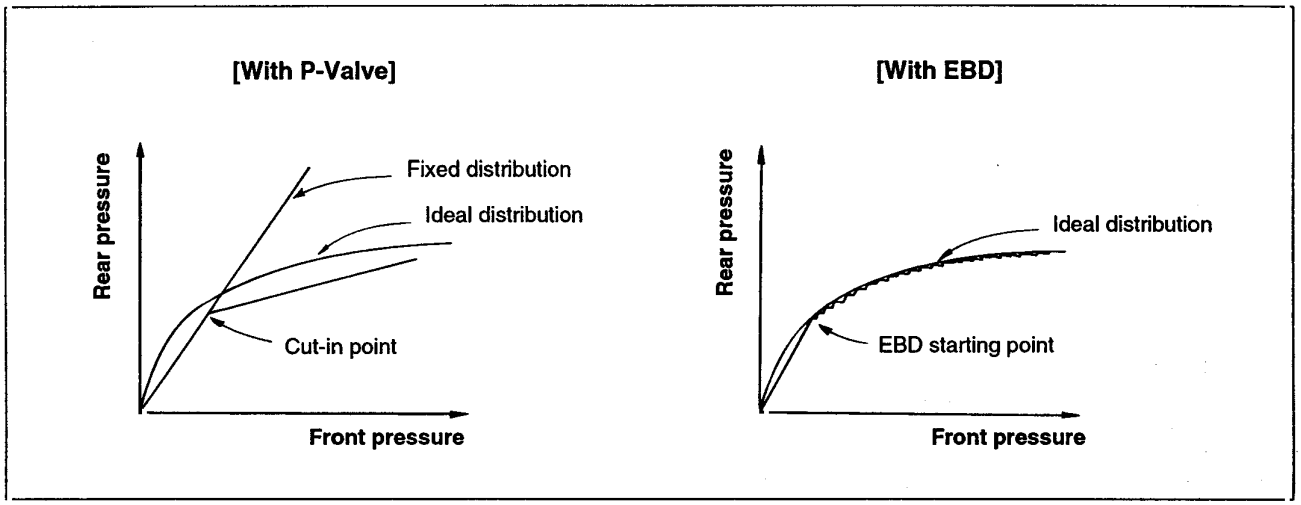
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

ADVANTAGES

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

COMPARISON BETWEEN PROPORTIONING VALVE AND EBD

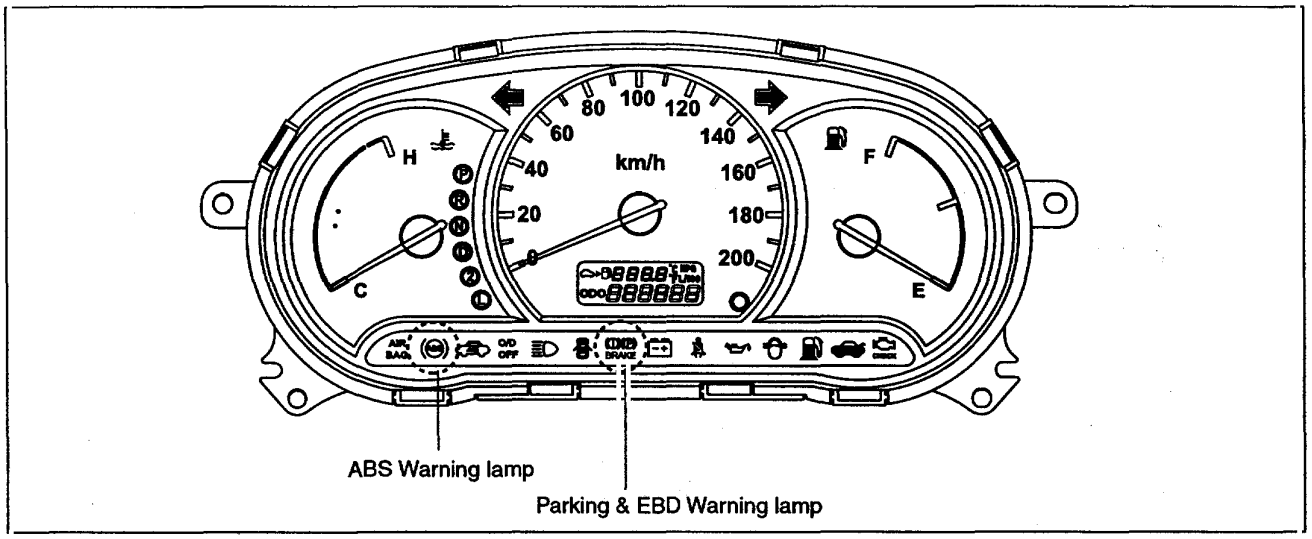


EJA0032A

FAIL SAFE

FAIL CAUSE	SYSTEM		WARNING LAMP	
	ABS	EBD	ABS	EBD
None	ON	ON	OFF	OFF
Stop lamp switch failure	ON	ON	OFF	OFF
One wheel speed sensor failure	OFF	ON	ON	OFF
Pump malfunction	OFF	ON	ON	OFF
Low voltage	OFF	ON	ON	OFF
Two or more wheel speed sensor failure Solenoid valve failure HECU malfunction Over voltage Valve relay failure Other failure	OFF	OFF	ON	ON

WARNING LAMP CONTROL



KTDD004A

1. ABS warning lamp module
   The active ABS warning lamp module indicates the operating condition of the ABS.

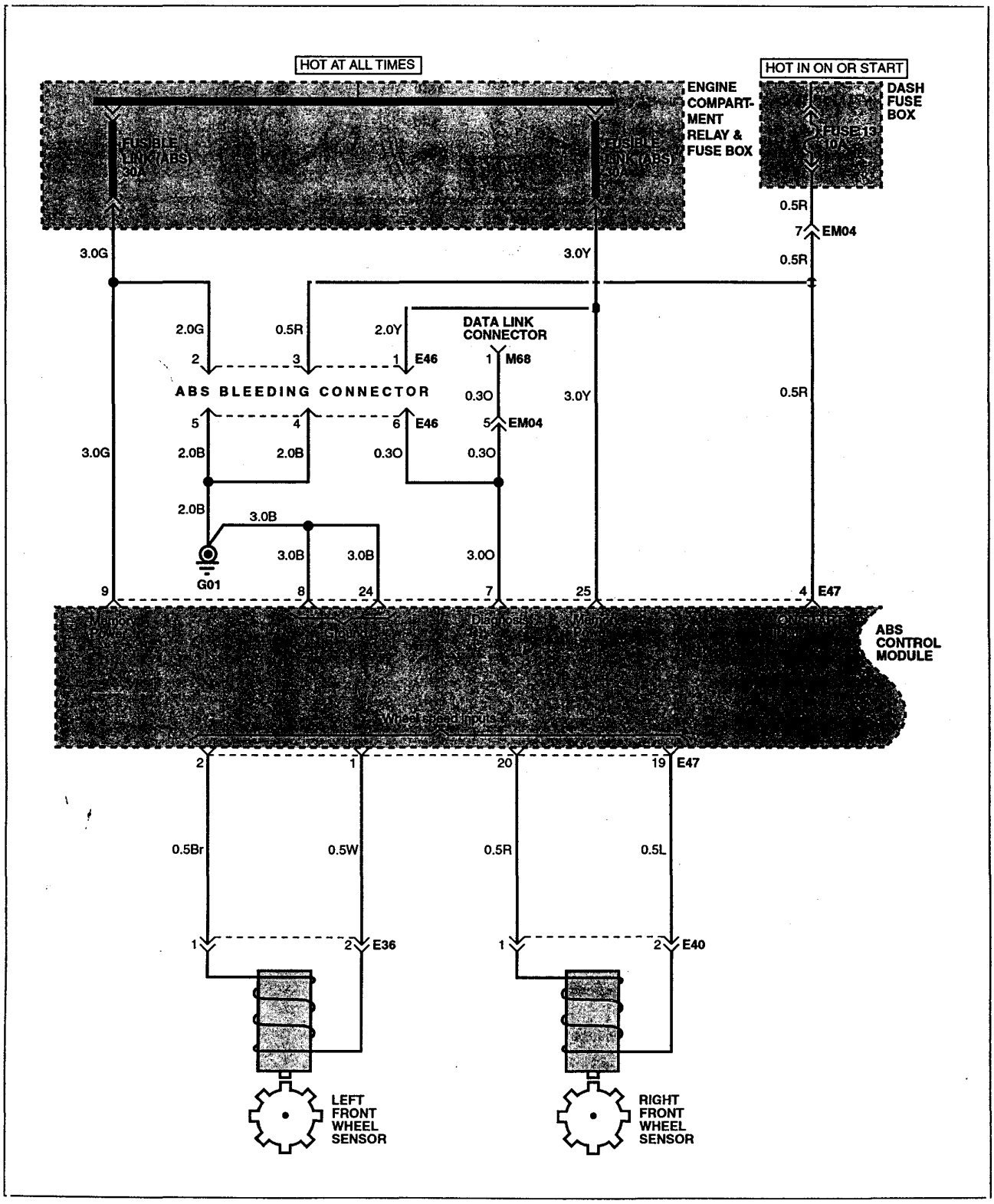
   The ABS warning lamp is turned on under the following conditions.
   - During the initialization phase after ignition switch ON. (3 seconds)
   - In the event of inhibition of ABS functions by failure.
   - When the system ECU is shut down even though ignition power is applied.
   - During diagnostic mode.

2. EBD warning lamp module
   The active EBD warning lamp module indicates the operating condition of the EBD. However, in case the parking brake switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.

   The EBD warning lamp is turned on under the following conditions.
   - During the initialization phase after ignition switch ON. (3 seconds)
   - In the event of inhibition of EBD functions by failure.
   - When the system ECU is shut down even though ignition power is applied.
   - When the parking brake switch is ON or brake fluid is low level.

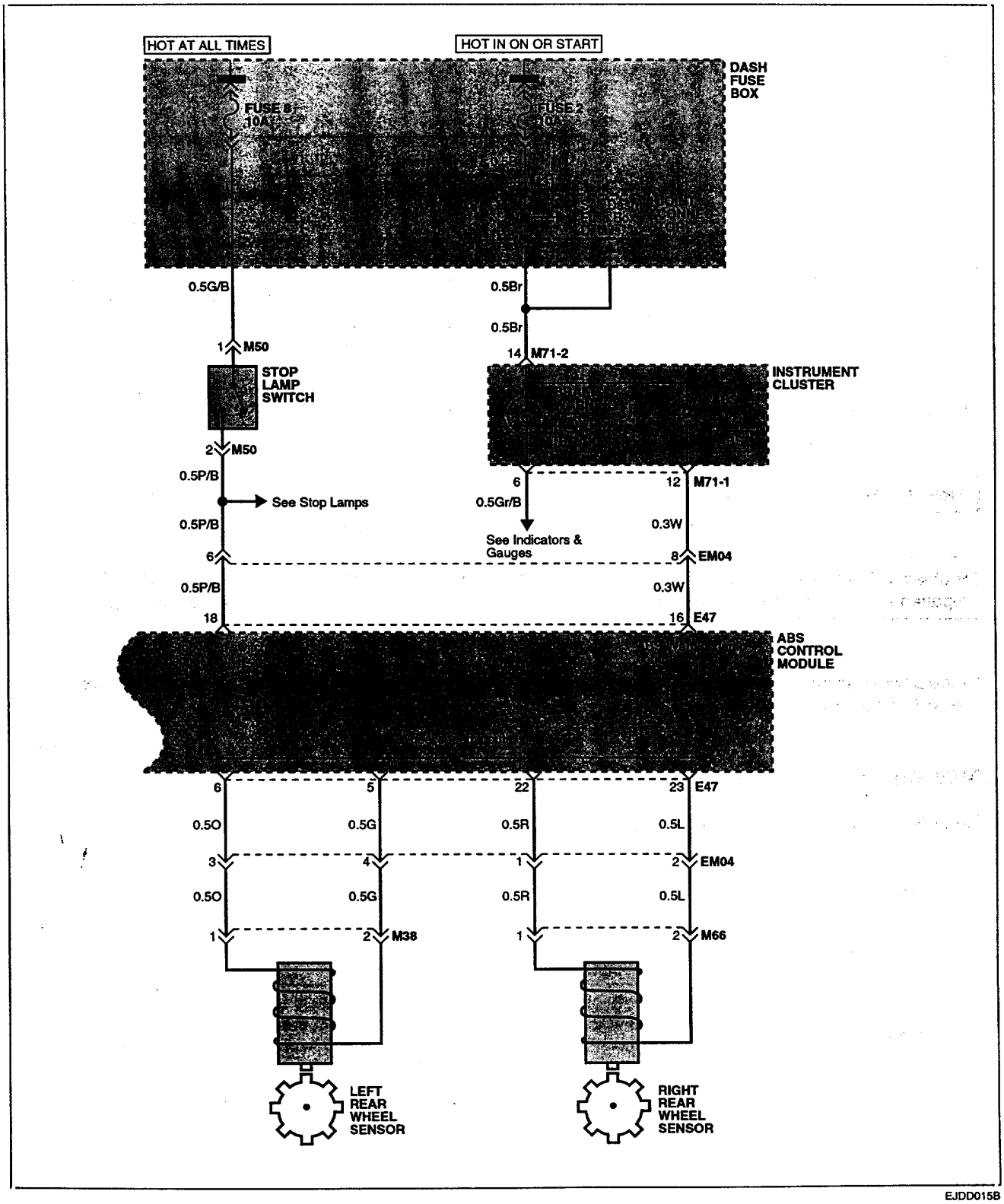
CIRCUIT DIAGRAM EADA09F6

CIRCUIT DIAGRAM (1)



EJDD015A

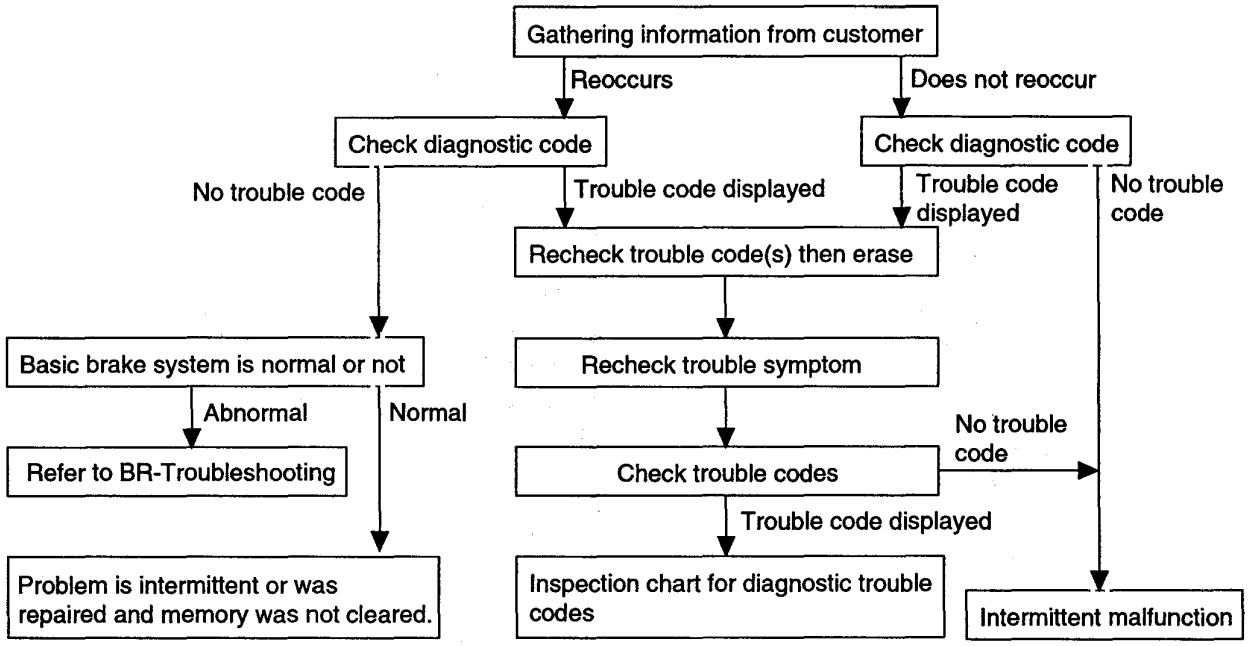
CIRCUIT DIAGRAM (2)



EJDD015B

INSPECTION FOR TROUBLE SYMPTOMS EA79AF9B

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



*** Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.**

EJKB055A

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

PHENOMENON	EXPLANATION
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation. (whine) 2. Sound is generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Pedal kick back	Pedal kick back is normal operation.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS CHECK SHEET

ABS Check Sheet

Inspector's Name _____

Customer's Name		**Registration No.**	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	**Odometer**	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

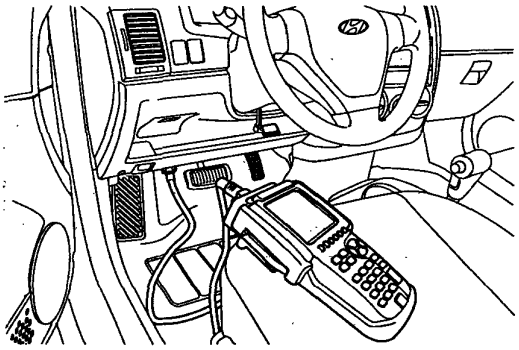
Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	**1st Time**	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

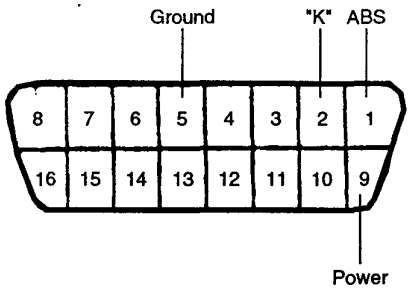
EJDA017A

HI-SCAN (PRO) CHECK

1. Turn the ignition OFF.
2. Connect the hi-scan (pro) to the data link connector located underneath the lower crash pad panel.
3. Turn the ignition ON.
4. Use the hi-scan (pro) to check for diagnostic trouble codes.
5. After completion of the repair or correction of the problem, erase the stored fault codes using the clear key on the hi-scan (pro).
6. Disconnect the hi-scan (pro).



EJPC550A



DATA LINK CONNECTOR

EJOC545A

INSPECTION CHART FOR TROUBLE SYMPTOMS

Find out the symptom and check according to the inspection procedure chart.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE NO.
Communication with hi-scan (pro) is not possible.	Communication with any system is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned to "ON" (engine OFF), the ABS warning lamp does not illuminate.		3
After the engine starts, the lamp remains illuminated.		4
Faulty ABS operation.	Unequal braking power on both sides.	5
	Insufficient braking power.	
	ABS operates under normal braking conditions.	
	ABS operates before vehicle stops under normal braking conditions.	
	Large brake pedal vibration. (See Caution)	

⚠ ***CAUTION***

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality

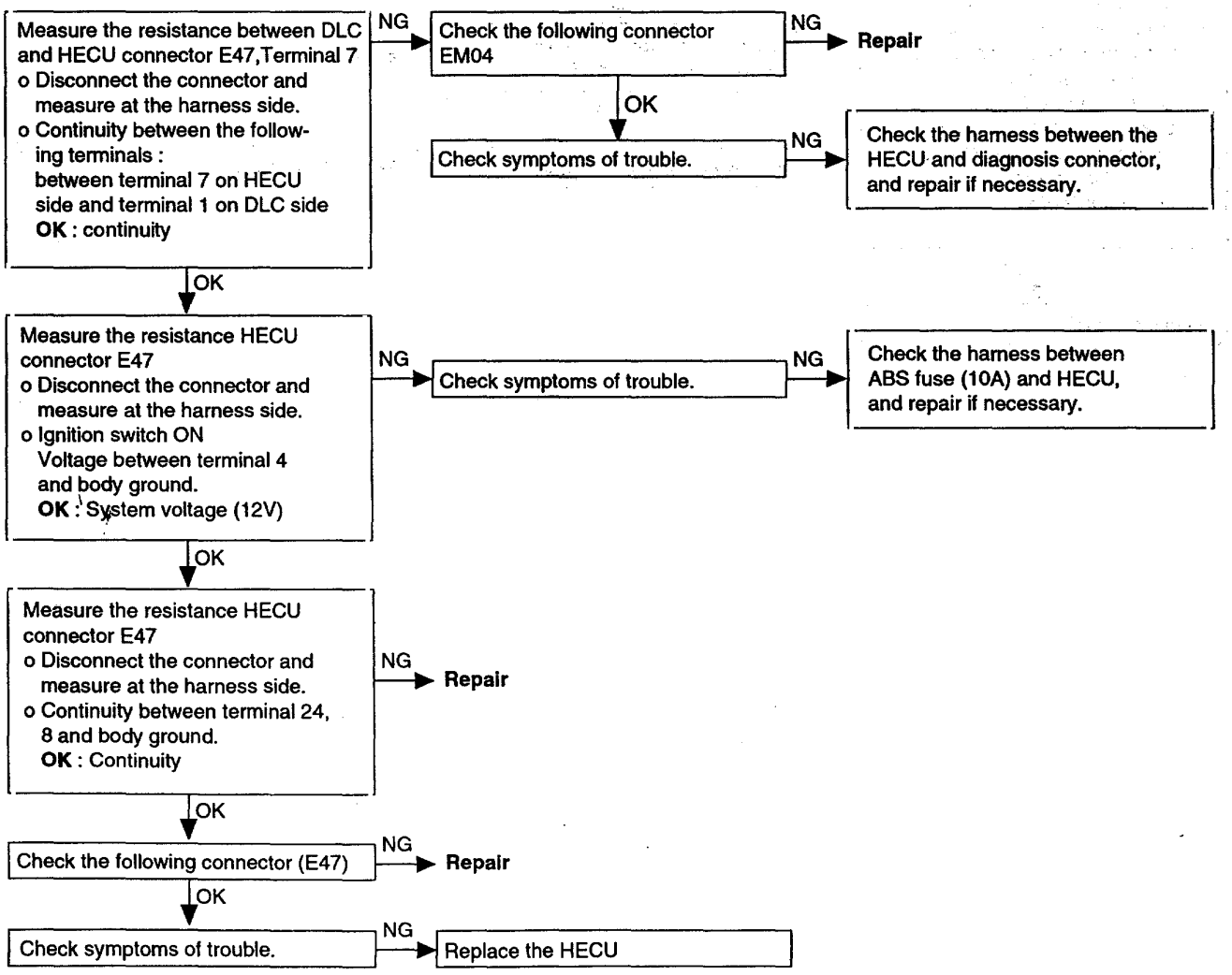
INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with Hi-Scan (Pro) is not possible. (Communication with all systems is not possible.)	Probable cause
Possible defect in the power supply system (including ground) for the diagnosis line.	• Malfunction of connector. • Malfunction of wiring harness.

INSPECTION PROCEDURE 2

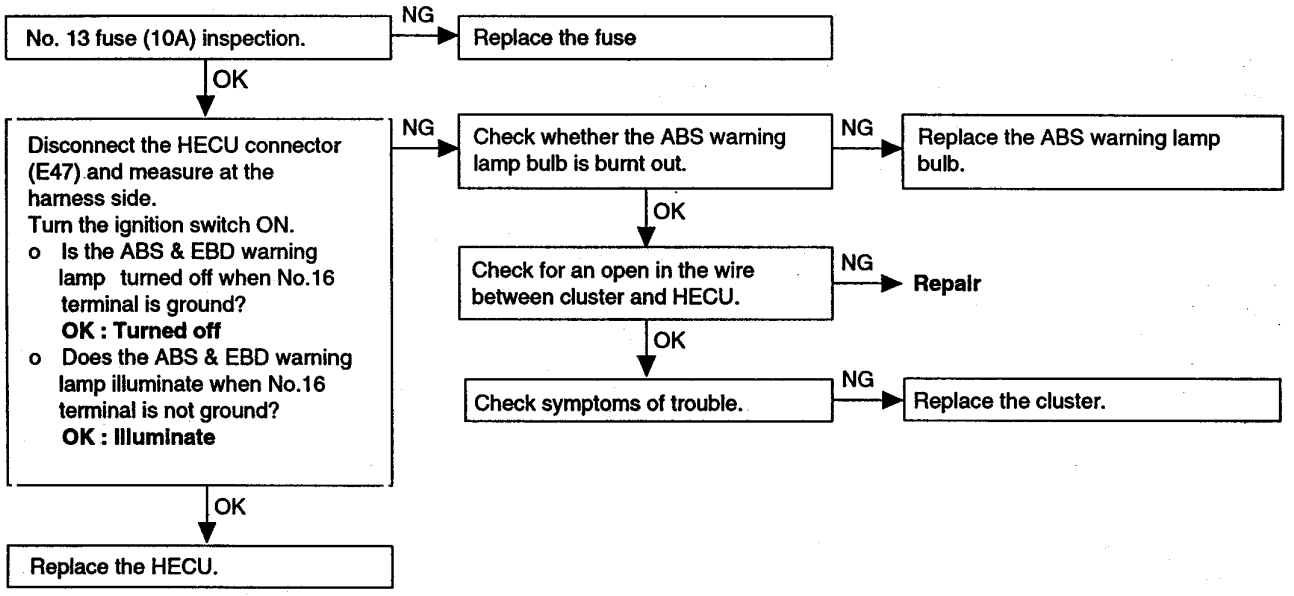
Communication with Hi-Scan (Pro) is not possible. (Communication with ABS only is not possible.)	Probable cause
When communication with Hi-Scan (Pro) is not possible, the cause may be probably an open circuit in the HECU power circuit or an open circuit in the diagnosis output circuit.	• Blown fuse. • Malfunction of wiring harness or connector. • Malfunction of HECU.



EJDD575A

INSPECTION PROCEDURE 3

When ignition key is turned "ON" (engine OFF), the ABS warning lamp does not illuminate.	Probable cause
When current flows in the HECU, the ABS warning lamp turns from on to off as the initial check. Therefore, if the lamp does not illuminate, the cause may be an open circuit in the lamp power supply circuit, a blown bulb, an open circuit in both the circuits between the ABS warning lamp and the HECU, and the malfunction of HECU.	• Blown fuse. • Burnt out ABS warning lamp bulb. • Malfunction of wiring harness or connector. • Malfunction of active warning lamp module. • Malfunction of HECU.



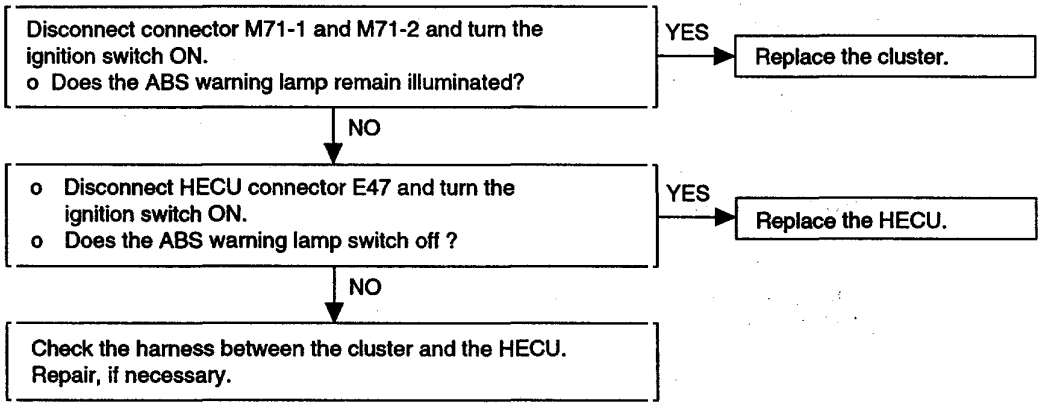
EJDD575B

INSPECTION PROCEDURE 4

Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
A possible short-circuit in the ABS warning lamp illumination circuit.	• Malfunction of cluster. • Malfunction of HECU. • Malfunction of wiring harness.

NOTE

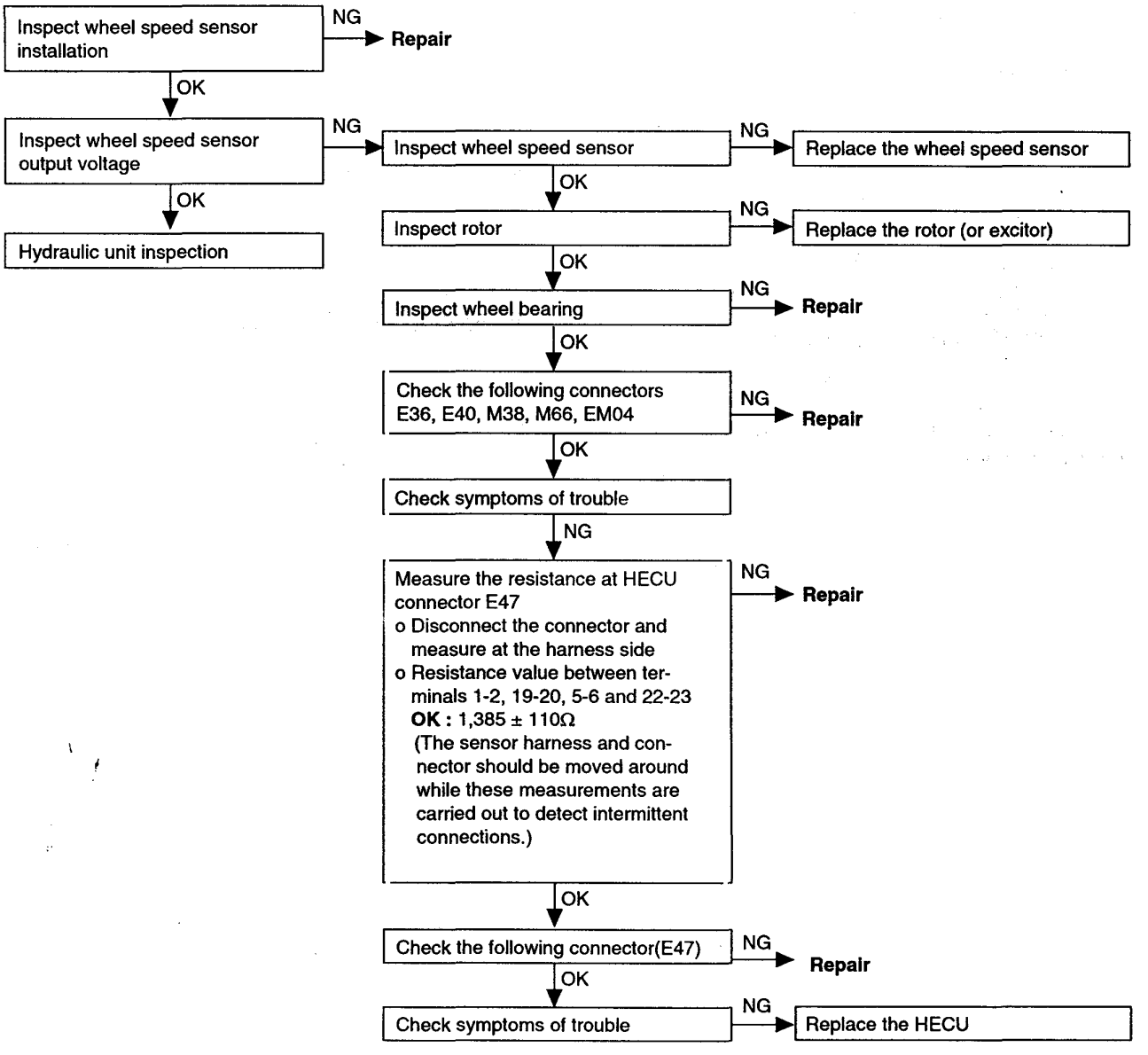
This trouble symptom is limited to cases where communication with the hi-scan (pro) is possible (HECU power supply is normal) and DTC is normal.



EJDD575C

INSPECTION PROCEDURE 5

Brake operation is abnormal.	Probable cause	
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However, if a normal DTC is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Incorrect sensor harness contact. • Foreign material on wheel speed sensor.	• Malfunction of wheel speed sensor. • Malfunction of rotor. • Malfunction of wheel bearing. • Malfunction of HECU.



EJDD575D

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

Inspect according to the inspection chart that is appropriate for the malfunction code.

DTC	Trouble Location	Remarks
C1101	Battery voltage over volt : 18V or more	
C1102	Battery voltage low volt : 9.5V or less	
C1200	FL wheel sensor : open or short to ground	
C1201	- Range/Performance : speed jump or damaged exciter	
C1202	- No signal : air-gap error or wrong exciter	
C1203	FR wheel sensor : open or short to ground	
C1204	- Range/Performance : speed jump or damaged exciter	
C1205	- No signal : air-gap error or wrong exciter	
C1206	RL wheel sensor : open or short to ground	
C1207	- Range/Performance : speed jump or damaged exciter	
C1208	- No signal : air-gap error or wrong exciter	
C1209	RR wheel sensor : open or short to ground	
C1210	- Range/Performance : speed jump or damaged exciter	
C1211	- No signal : air-gap error or wrong exciter	
C1604	ECU hardware : ECU internal or valve failure	
C2112	Valve relay : valve relay or fuse failure	
C2402	Motor-Electrical : open or short to battery, motor relay, fuse or motor lock fail	

ACTUATOR DRIVING

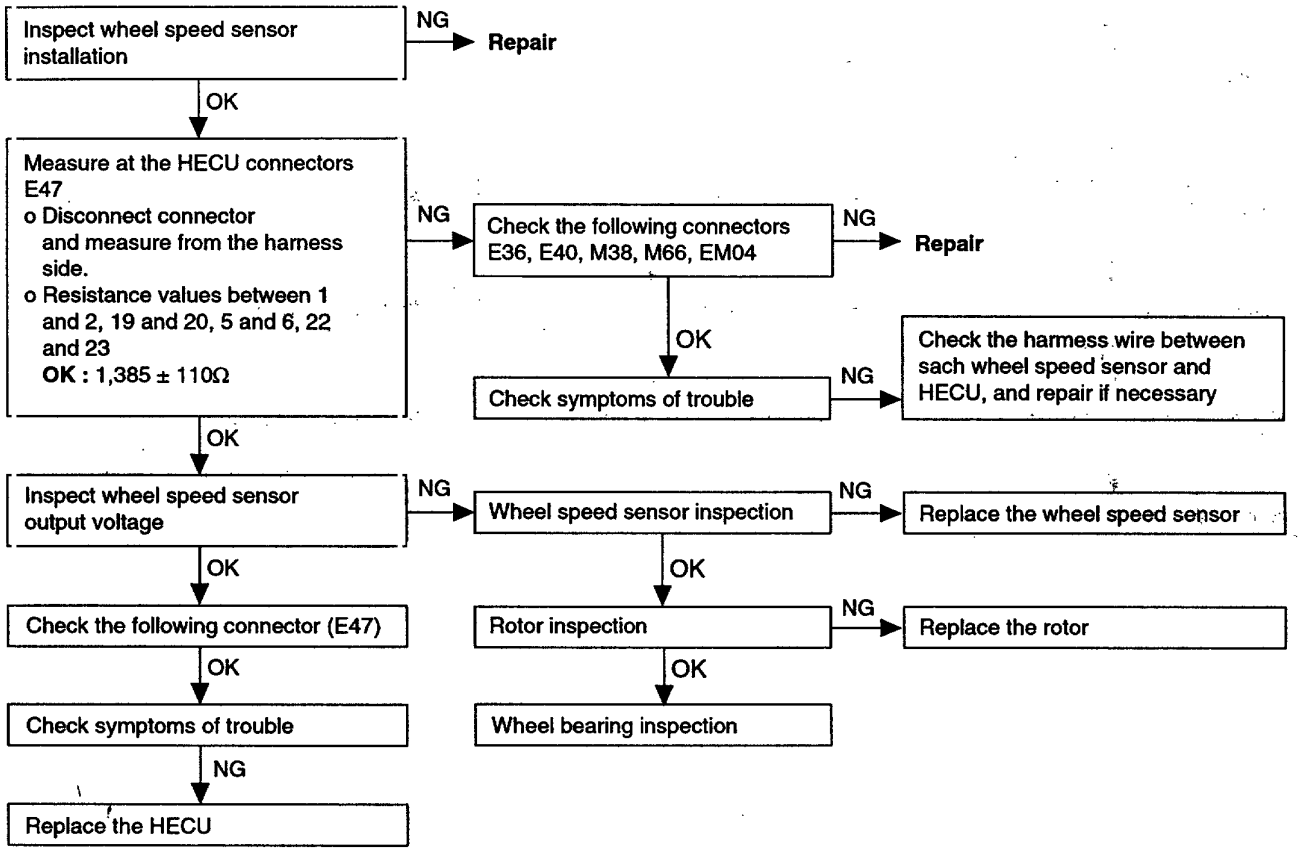
NO.	Description	Condition	Recognition	Time
01	Motor	KEY ON ENG. OFF	Motor pump relay operation (Click sounds)	2 seconds
02	Front left valve (In)		Front left solenoid valve operation (Click sounds)	
03	Front right valve (In)		Front right solenoid valve operation (Click sounds)	
04	Rear left valve (In)		Rear left solenoid valve operation (Click sounds)	
05	Rear right valve (In)		Rear right solenoid valve operation (Click sounds)	
06	Front left valve (Out)		Front left solenoid valve operation (Click sounds)	
07	Front right valve (Out)		Front right solenoid valve operation (Click sounds)	
08	Rear left valve (Out)		Rear left solenoid valve operation (Click sounds)	
09	Rear right valve (Out)		Rear right solenoid valve operation (Click sounds)	

CURRENT DATA

NO.	Description	Recognition	Unit
1	Battery	Battery	Voltage
2	FL wheel speed SNSR	Front left wheel speed sensor	km/h
3	FR wheel speed SNSR	Front right wheel speed sensor	
4	RL wheel speed SNSR	Rear left wheel speed sensor	
5	RR wheel speed SNSR	Rear right wheel speed sensor	
6	ABS SRI status	Warning lamp	ON/OFF
7	Brake SW	Brake switch	
8	Motor pump relay	Motor relay	
9	Valve relay	Valve relay	
10	Motor pump status	Motor	
11	FL valve (In)	Front left valve (In)	
12	FR valve (In)	Front right valve (In)	
13	RL valve (In)	Rear left valve (In)	
14	RR valve (In)	Rear right valve (In)	
15	FL valve (Out)	Front left valve (Out)	
16	FR valve (Out)	Front right valve (Out)	
17	RL valve (Out)	Rear left valve (Out)	
18	RR valve (Out)	Rear right valve (Out)	

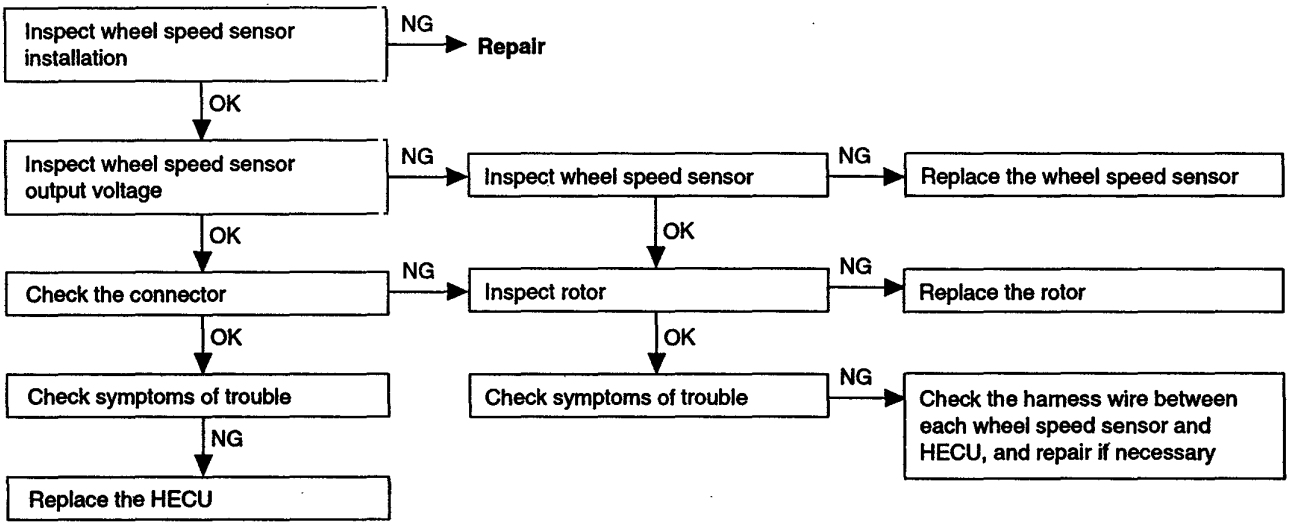
INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

DTC No. C1200, C1203, C1206, C1209 Wheel speed sensor open or short to GND circuit	Probable cause
The HECU determines that an open or short circuit has occurred in more than one wire of a wheel speed sensor.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of HECU



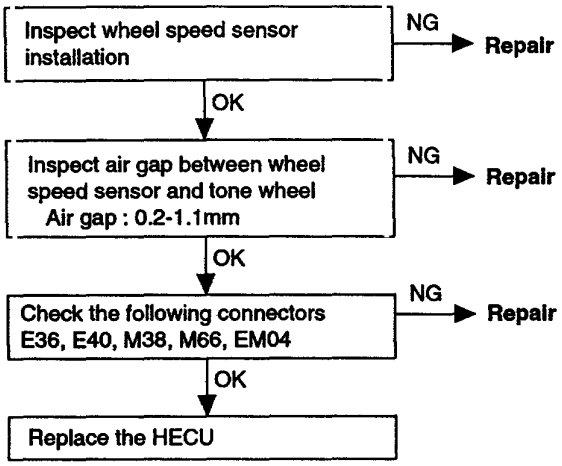
EJDD565A

DTC No C1201, C1204, C1207, C1210 Wheel speed sensor signal error	Probable cause
Abnormal output signal from a wheel speed sensor other than an open or short circuit.	• Improper installation of wheel speed sensor. • Malfunction of wheel speed sensor. • Malfunction of rotor • Malfunction of wheel bearing. • Malfunction of siring harness or connector. • Malfunction of HECU.



EJPC565B

DTC No. C1202, C1205, C1208, C1211 (Large air gap)	Probable cause
No wheel speed sensor output signal.	• Malfunction of wheel speed sensor • Improper installation of wheel speed sensor • Malfunction of rotor (excitor) • Malfunction of wiring harness or connector • Malfunction of HECU

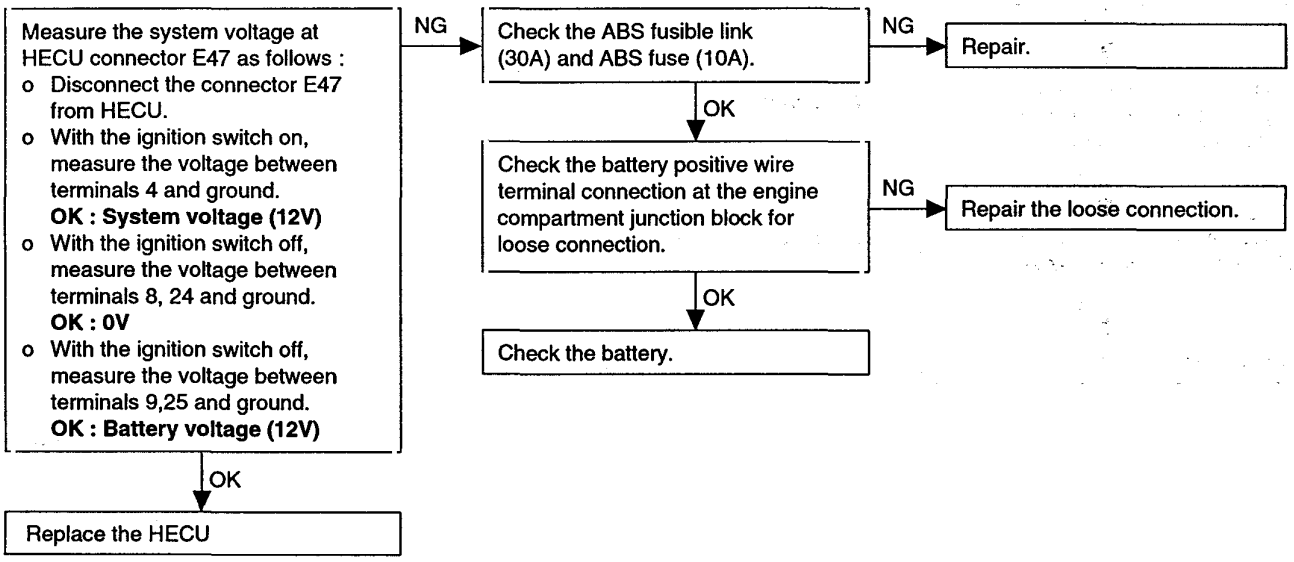


EJDD565B

DTC No. C1101, C1102 Voltage out of range. (Over and under voltage)	Probable cause
The voltage of the HECU power supply drops lower than or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	• Malfunction of wiring harness or connector. • Malfunction of HECU • Blown ABS fuse.

⚠ ***CAUTION***

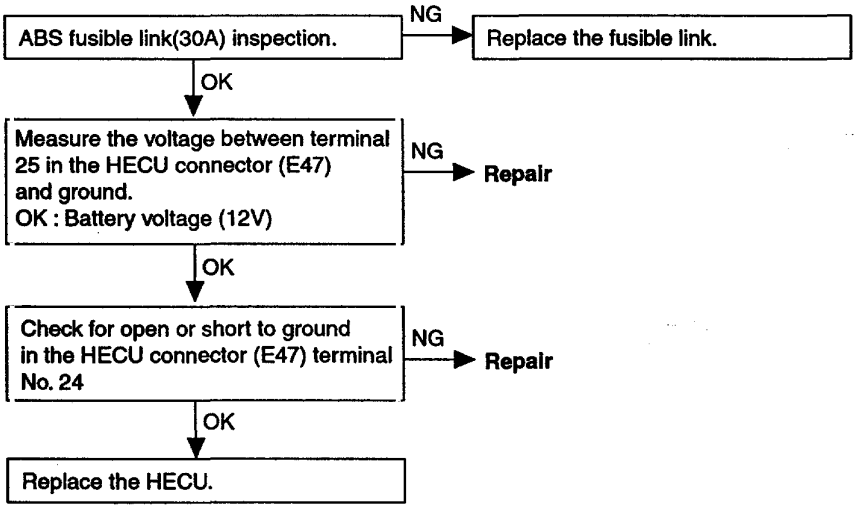
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to the standard value, the code is no longer output. Before carrying out the following inspection, check the battery level, and refill if necessary.



EJDD565D

DTC No. C1604 HECU Hardware. HECU hardware error. (EEPROM and ECU failure)	Probable cause
The HECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness even if no current flows in the solenoid or through the HECU.	• Malfunction of wiring harness or connector. • Malfunction of HECU.

DTC No. C2112 Valve relay error. (Including fuse failure)	Probable cause
When the ignition switch is turned ON, the HECU switches the valve relay on and off during its initial check. During this time, voltage sent to the valve relay is compared to the voltage in the valve power monitor line. If no current is detected in the valve power monitor line, the HECU determines that there is an open circuit and DTC C2112 is recorded.	• Malfunction of wiring harness or connector. • Malfunction of HECU. • Malfunction of valve relay • Poor ground.

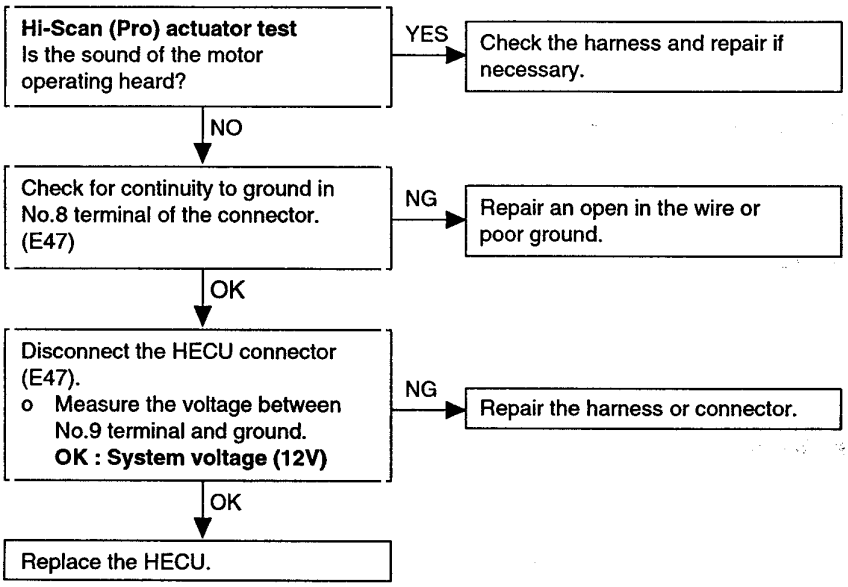


EJDD565E

DTC No. C2402 Motor pump error.	Probable cause
When the motor power line is normal but no signal is in detected in the motor monitor line.	• Malfunction of wiring harness or connector. • Malfunction of HECU. • Poor ground.

⚠ ***CAUTION***

Powering the motor with the Hi-Scan(Pro) will discharge the battery. Start and run the engine for a while after testing is complete.

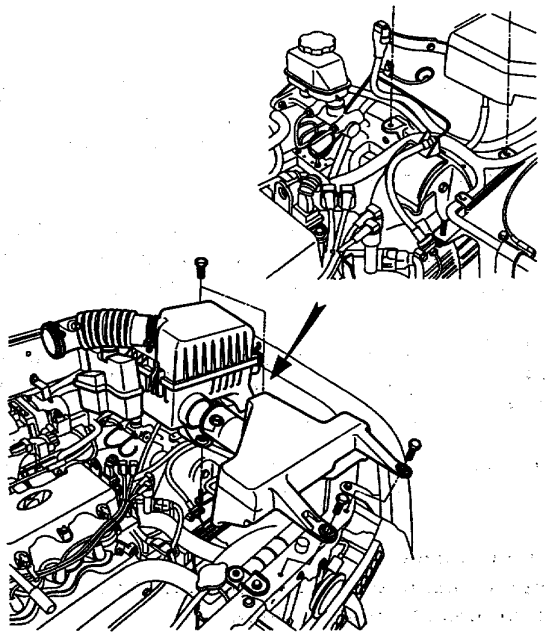


EJDD565F

ANTI-LOCK BRAKING SYSTEM CONTROL MODULE

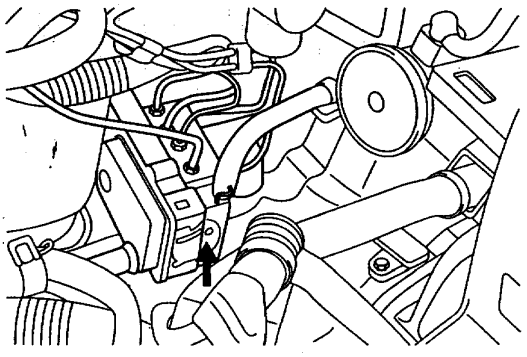
REMOVAL EFEBC9FD

1. Remove the air-cleaner and the intake hose.



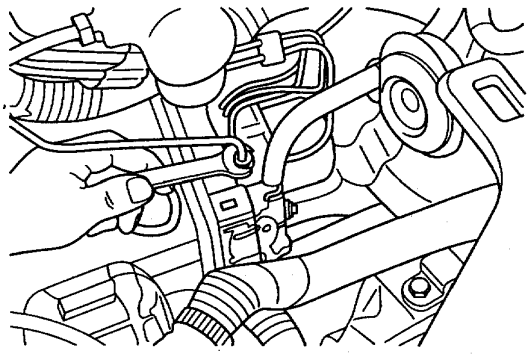
KDDC010B

2. Disconnect the double lock connector from the HECU.



EJPC590A

3. Disconnect the brake tubes from the HECU.



EJPC590B

NOTE

- *Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid gets on the paint, wash it off immediately with water.*
- *Take care not to damage or deform the brake lines during removal and installation.*
- *To prevent the brake fluid from flowing, plug and cover the hose ends and joints with a shop towel or equivalent material.*

4. Remove the HECU bracket mounting bolts and remove the HECU.

CAUTION

1. ***Never attempt to disassemble the HECU.***
2. ***The HECU must be transported and stored in an upright position and with the ports sealed. The HECU must not be drained.***

Tightening torque
HECU bracket mounting bolt :
8 ~ 10 Nm (80 ~ 100 kg cm, 6 ~ 7.3 lb ft)

INSTALLATION E0C4241F

1. Install the HECU, then connect the brake lines.

   Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tightening torque
HECU mounting bolt :
8 ~ 10 Nm (80 ~ 100 kg·cm, 6 ~ 7.3 lb·ft)
Brake tube nut :
13 ~ 17 Nm (130 ~ 170 kg·cm, 10~12 lb·ft)

2. Connect the HECU connector.
3. Bleed the brake system.
4. Start the engine, and check that the ABS indicator goes off.
5. Test-drive the vehicle, and check that the ABS indicator does not come on.

INSPECTION EFA77A26

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Raise the vehicle and release the parking brake.
2. Disconnect the HECU harness connector's and measure from the harness side connector.

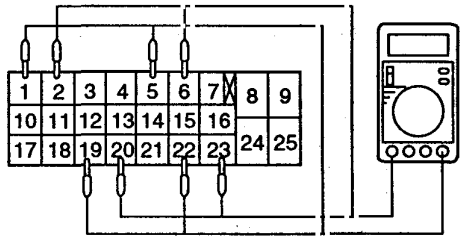
   ⚠ ***CAUTION***

   Be sure to remove the connector's double lock and insert the probe into the harness side (back-probe). Inserting it into the terminal side may result in a bad connection.

3. Rotate the wheel to be measured approximately 1/2 to 1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

Wheel Speed Sensor	Front left	Front right	Rear left	Rear right
Terminal	1	19	5	22
	2	20	6	23

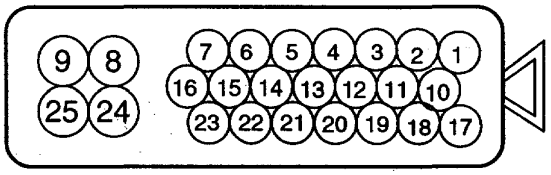
Output voltage :
When measuring with an oscilloscope :
130mV peak-to-peak or more



KGX8074A

HECU TERMINALS INSPECTION EAC2FAB3

(HECU WIRING HARNESS SIDE CONNECTOR)

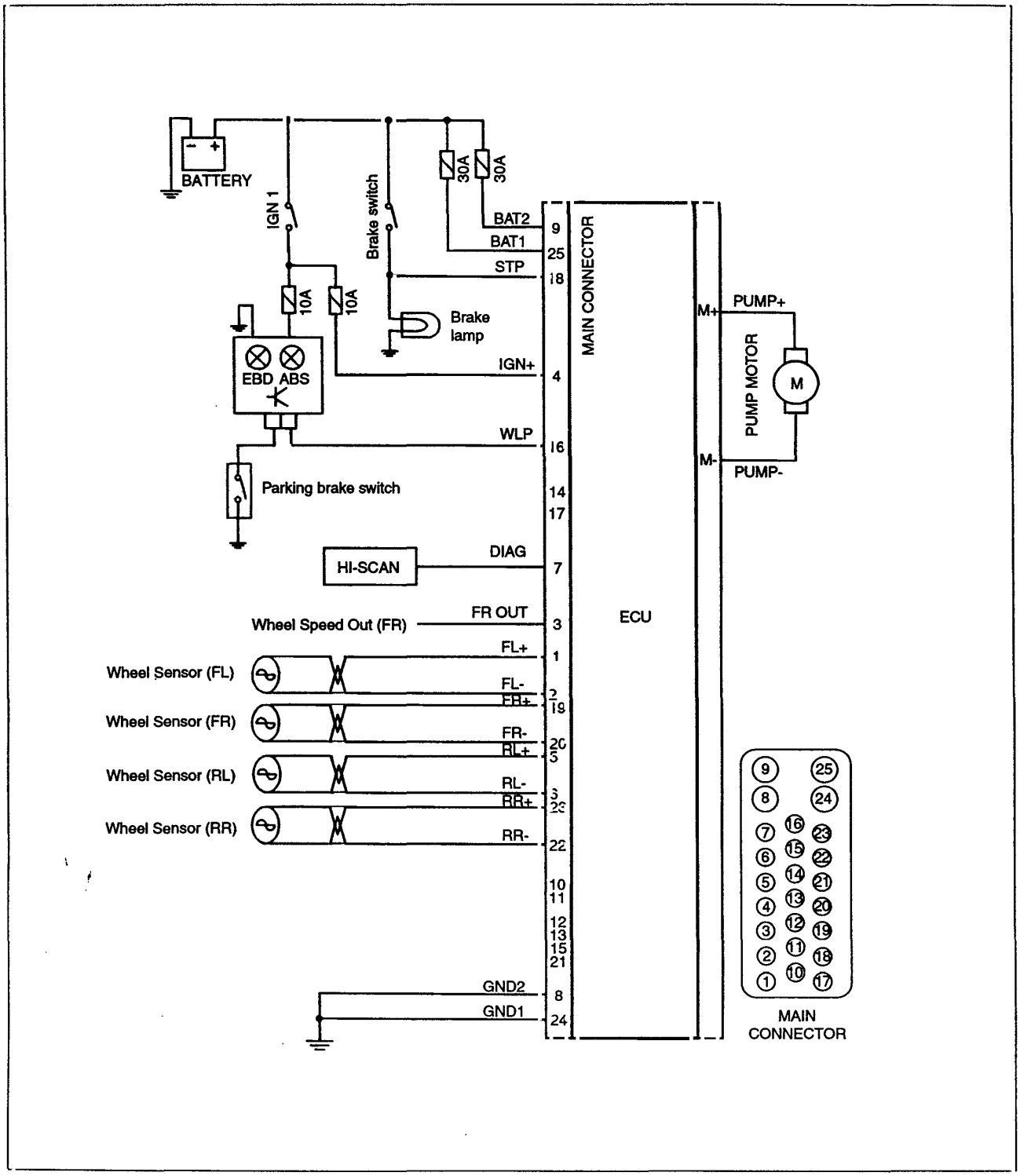


EJKB052A

Connector terminal			Specification	Note
No.	Mark	Terminal name		
4	IGN+	Power source via ignition switch terminal	Over voltage range : 16.5 ± 0.5V < V < 20V Operating voltage range : 9.5 ± 0.5V < V < 16.5 ± 0.5V Low voltage range : 8.0V < V <9.5 ± 0.5V System down range : V < 7.5 ± 0.5V Max. current : I < 300mA	
8 24	GND1 GND2	Ground terminal	Max. current (Total of 2 terminals) : I < 60A	In ABS control
18	BRAKE	Brake lamp switch input terminal	Input voltage (Low) : 1.00 V < V_{IL} < 2.00V Input voltage (High) : 7.00V < V_{IH} <16.00V	
1 19 5 23 2 20 6 22	FL+ FR+ RL+ RR+ FL- FR- RL- RR-	Wheel sensor input terminal	Min. sensor voltage : V_S > 130mV_{PP} Resistance : 1,385 ±110Ω Input range : 20 - 2000Hz Inductance : 0.7H ± 50% Permissible offset voltage range : 2.15V < V_{offset} <3.5V	
16	WLP	ABS and EBD warning lamp output terminal	Max. current : 1 < 200mA Saturation voltage, at I = 200mA : V_{sat} < 1.5V	
7	Diag.	Diagnosis interface terminal	Input voltage : V_{IL}< 0.3 V_BV, V_{IH} > 0.7 V_BV Output voltage : V_{OL}< 0.2 V_BV, V_{OH}> 0.8 V_BV	V_B: Ignition voltage
3	FR-out	Wheel speed output terminal	Max. current : 1 < 10mA External pull up resistance : above 10kΩ (open collector type)	
25	BAT1	Battery power Source 1 terminal (Valve power source)	Max. current (inside control) : 1 < 30A Max. current (Outside control) : 1 < 20mA	
9	BAT2	Battery power Source 2 terminal (Motor power source)	In ABS contol Max. rush current : I < 100A (t < 100 msec) Max. current : I < 30A (t > 100 msec) At IGN off Dark current : I < 0.5mA	t : The running time of motor

EJDD610A

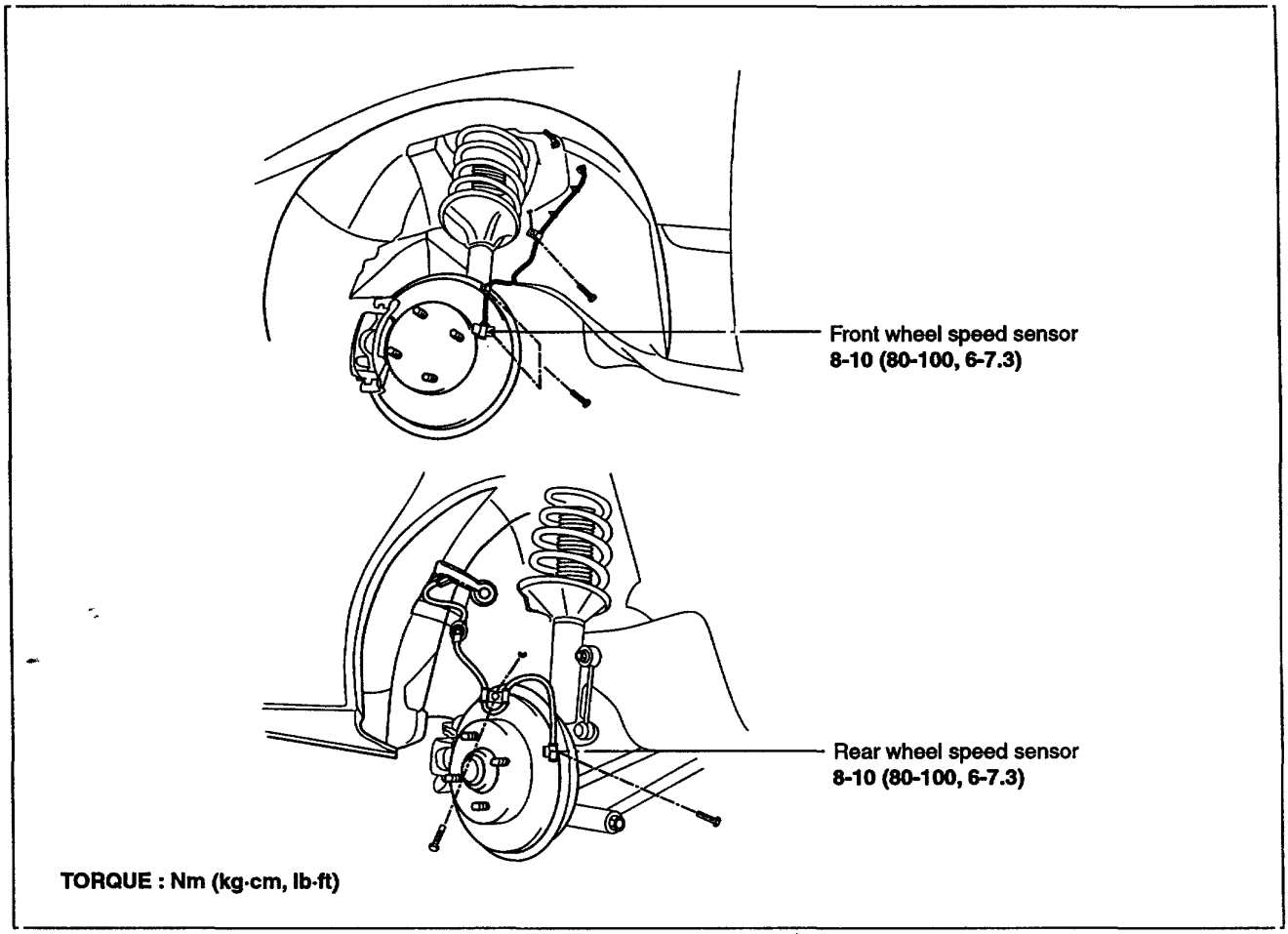
CIRCUIT DIAGRAM E9AABAB9



EJNC505A

ANTI-LOCK BRAKING SYSTEM
WHEEL SPEED SENSOR

COMPONENTS EFBDB106

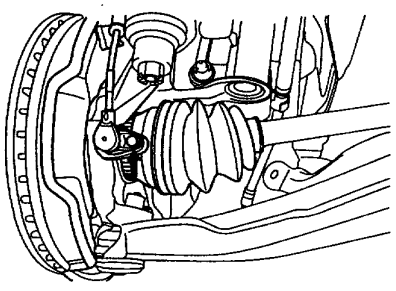


EJDD620A

REMOVAL E589C2A8

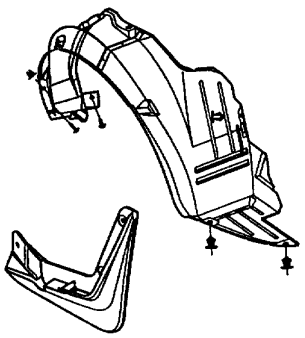
FRONT WHEEL SPEED SENSOR

1. Remove the front wheel speed sensor mounting bolt.



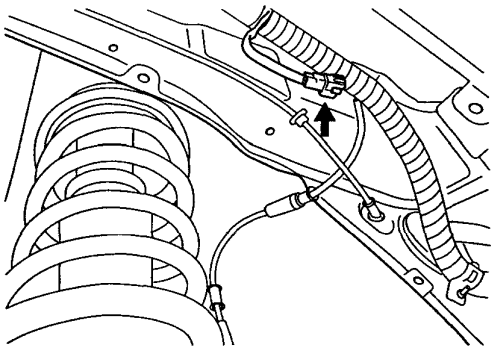
KJOC002D

2. Remove the front wheel guard.



KSDC201A

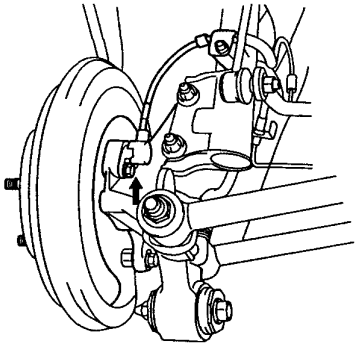
3. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector.



KJDD002A

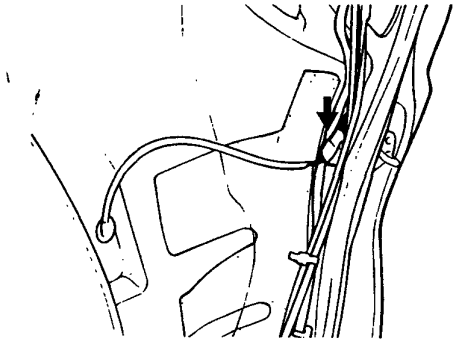
REAR WHEEL SPEED SENSOR

1. Remove the rear wheel speed sensor mounting bolt.



KJOC002G

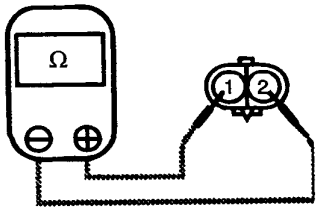
2. Remove the luggage trim and disconnect the wire connector from the rear wheel speed sensor.



EJDA012A

INSPECTION EED2AB14

1. Connect an ohmmeter between the wheel speed sensor terminals and measure the resistance.



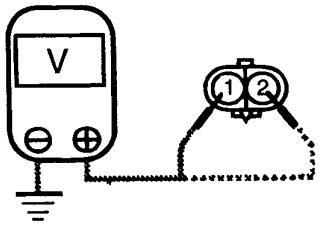
EJKB071A

Service standard
Front, Rear : 1,385 ± 110Ω

2. Connect a voltmeter between the wheel speed sensor terminals and measure the voltage by turning the wheel.

NOTE

Set the voltmeter to measure AC voltage.
Service standard : AC voltage detected.



EJKB071B

Service standard
Output voltage : Min.130mVp.p

BLEEDING OF BRAKE SYSTEM EF7AEEE9

This procedure should be followed to ensure adequate bleeding of air and filling of the ABS unit, brake lines and master cylinder with brake fluid.

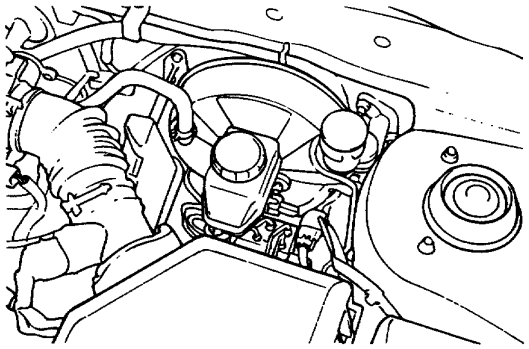
1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

⚠ CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

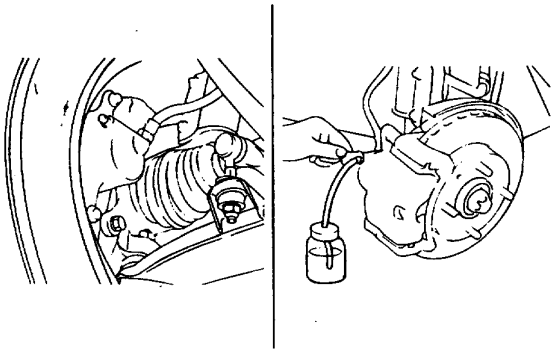
NOTE

When pressure bleeding, do not depress the brake pedal.
Recommended fluid ..... DOT3 or DOT4



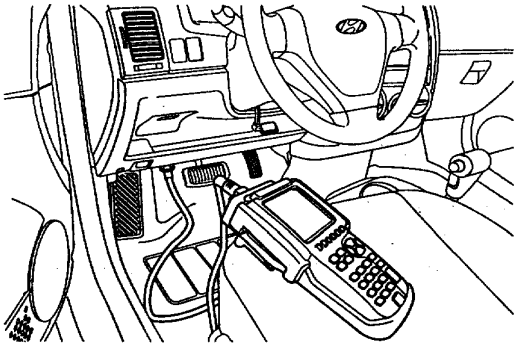
EJDA014A

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



EJDA014I

3. Connect the hi-scan (Pro) to the data link connector located underneath the dash panel.



KJPC620A

4. Select and operate according to the instructions on the hi-scan (Pro) screen.

⚠ CAUTION

You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

1) Select hyundai vehicle diagnosis.

0. INITIAL SCREEN
01. HYUNDAI VEHICLE DIAGNOSIS
02. TOOL BOX
03. CARB OBD-II DIAGNOSIS
04. FLIGHT RECORD REVIEW
05. SYSTEM SETUP

EJDA014C

2) Select vehicle name.

3) Select Anti-Lock Brake system.

4) Select air bleeding mode.

5) Press 'YES' to operate motor pump and solenoid valve.

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	CLOSE
02. MOTOR PUMP STATUS	OFF
DO YOU WANT TO START ?	
(PRESS [YES] KEY)	

EJDA014F

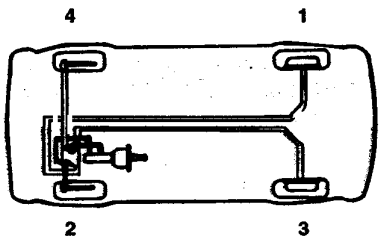
6) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	OPEN
02. MOTOR PUMP STATUS	ON
TIME : AUTOMATIC COUNT (1-60 SEC.)	

EJDA014G

5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.

6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



EJDA014H

7. Tighten the bleeder screw.

Bleed screw tightening torque :
7 ~ 13 Nm (70 ~130 kg·cm, 5 ~ 9.5 lb·ft)

Clutch System

GENERAL

GENERAL ..... CH - 2
LUBRICANTS ..... CH - 3
SPECIAL TOOLS ..... CH - 3
TROUBLESHOOTING ..... CH - 4

CLUTCH SYSTEM

COMPONENTS ..... CH - 5
BLEEDING ..... CH - 6
CLUTCH MASTER CYLINDER
COMPONENTS ..... CH - 7
REMOVAL ..... CH - 7
INSPECTION ..... CH - 9
INSTALLATION ..... CH - 9
DISASSEMBLY ..... CH - 9
INSPECTION ..... CH - 9
REASSEMBLY ..... CH -10
CLUTCH PEDAL
COMPONENTS ..... CH -11
REMOVAL ..... CH -12
INSPECTION ..... CH -12
INSTALLATION ..... CH -13
CLUTCH COVER AND DISC
COMPONENTS ..... CH -14
REMOVAL ..... CH -14
INSPECTION ..... CH -15
INSTALLATION ..... CH -15
CLUTCH RELEASE CYLINDER
COMPONENTS ..... CH -17
REMOVAL ..... CH -17
INSPECTION ..... CH -18
DISASSEMBLY ..... CH -18
INSPECTION ..... CH -18
REASSEMBLY ..... CH -18
INSTALLATION ..... CH -19

GENERAL

GENERAL K54E8CAA

SPECIFICATIONS

Item	Specifications
Clutch operating method	Hydraulic type
Clutch disc Type Facing diameter (Outside x Inside) mm	 Single dry with diaphragm. 1.3SOHC, 1.5Diesel : 184 x 127.5 1.5SOHC, 1.5DOHC : 200 x 130 1.6DOHC : 215 x 145
Clutch cover assembly Type	 Diaphragm spring strap
Clutch release cylinder * I.D. mm (in.)	 20.64 (0.81)
Clutch master cylinder * I.D. mm (in.)	 15.57 (0.62)

* I.D. : Inside Diameter

SERVICE STANDARD

Item	Standard value
Clutch disc thickness [When free]	1.3SOHC, 1.5Diesel ; 8.4 ± 0.3 mm 1.5SOHC, 1.5 DOHC, 1.6DOHC ; 8.5 ± 0.3 mm
Clutch pedal free play	6 ~ 13 (0.24 ~ 0.52)
Clutch pedal height	166.7 (6.6)
Clutch pedal stroke	145 (5.6)

Unit : mm (inch)

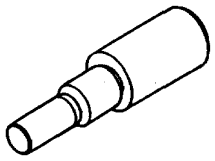
TIGHTENING TORQUE

Item	Nm	kg·cm	lb·ft
Clutch pedal to pedal support member	19 ~ 28	180 ~ 280	13 ~ 20
Clutch pedal support member to master cylinder	8 ~ 10	80 ~ 100	6 ~ 7
Clutch tube flare nut	13 ~ 17	130 ~ 170	9 ~ 13
Clutch tube bracket	4 ~ 6	40 ~ 60	3 ~ 4
Clutch release cylinder mounting bolt	15 ~ 22	150 ~ 220	11 ~ 16
Clutch release cylinder union bolt	25	250	18
Clutch cover assembly	15 ~ 22	150 ~ 220	11 ~ 16
Clutch master cylinder push rod nut	9 ~ 14	90 ~ 140	6 ~ 10
Ignition lock nut	8 ~ 10	80 ~ 100	6 ~ 7
Master cylinder reservior band	5 ~ 7	50 ~ 70	3 ~ 5

LUBRICANTS K2F7A2C8

Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L9508	As required
Inner surface of clutch release bearing	CASMOLY L9508	As required
Inner surface of clutch release cylinder and outer circumference of piston and cup	Brake fluid DOT3 or DOT4	As required
Inner surface of clutch disc spline	CASMOLY L9508	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly	Brake fluid DOT3 or DOT4	As required
Clutch master cylinder push rod, clevis pin and washer	Wheel bearing grease SAE J310a, NLGI No.2	As required
Clutch pedal shaft and bushings	SAE J310a, Chassis grease, NLGI-No.1	As required
Contact portion of release fork to release cylinder push rod	CASMOLY L9508	As required

SPECIAL TOOLS K67DA1D5

Tool (Number and name)	Illustration	Use
09411-25000 Clutch disc guide	 EODA003A	Installation of the clutch disc

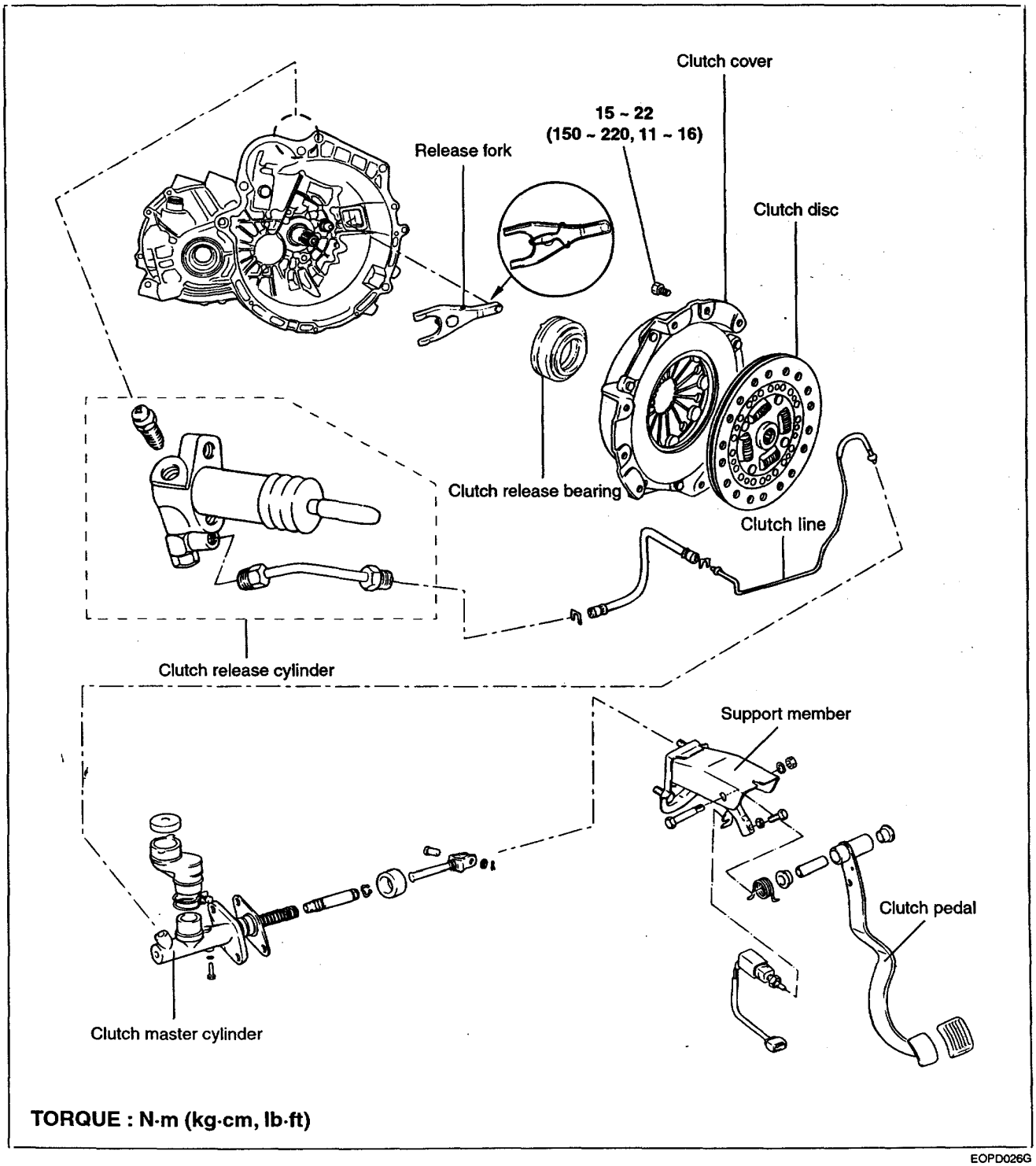
TROUBLESHOOTING KF224B6E

Symptom		Probable cause	Remedy
Clutch slipping • Car will not respond to engine speed during acceleration • Insufficient vehicle speed • Lack of power during uphill driving		Insufficient clutch pedal free play Clogged hydraulic system Excessive wear of clutch disc facing Hardened clutch disc facing, or oil on surface Damaged pressure plate or flywheel Weak or broken pressure spring	Adjust Correct or replace parts Replace Replace Replace Replace
Difficult gear shifting (gear noise during shifting)		Excessive pedal free play Hydraulic system fluid leaks, air trapping or clogging Unusual wear or corrosion of clutch disc spline Excessive vibration (distortion) of clutch disc	Adjust Repair or replace parts Replace Replace
Clutch noisy	When clutch is not used	Insufficient play of clutch pedal	Adjust
		Excessive wear of clutch disc facing	Replace
	A noise is heard after clutch is disengaged	Unusual wear and/or damage of release bearing	Replace
	A noise is heard when clutch is disengaged	Insuffcient grease on the sliding surface of bearing sleeve	Repair
		Improperly installed clutch assembly or bearing	Repair
	A noise is heard when car is suddenly rolled with clutch partially engaged	Damaged pilot bushing	Replace
Difficult to depress clutch pedal		Insufficient lubrication of clutch pedal Insufficient lubrication of the clutch disc spline Insufficient lubrication of the clutch release lever shaft Insufficient lubrication of front bearing retainer	Repair Repair Repair Repair
Difficult to shift gear or cannot shift at all		Excessive clutch pedal free play excessive Clutch release cylinder faulty Clutch disc out of true, runout is excessive or lining broken Spline on input shaft or clutch disc dirty or burred Clutch pressure plate faulty	Adjust pedal free play Repair release cylinder Inspect clutch disc Repair as necessary Replace clutch cover
Clutch slips		Clutch pedal free play insufficient Clogged hydraulic system Clutch disc lining oily or worn out Pressure plate faulty Release fork binding	Adjust pedal free play Repair or replace parts Inspect clutch disc Replace clutch cover Inspect release fork
Clutch grabs/chatters		Clutch disc lining oily or worn out Pressure plate faulty Clutch diaphragm spring bent Worn or broken torsion spring Engine mounts loose	Inspect clutch disc Replace clutch cover Replace clutch cover Replace clutch disc Repair as necessary
Clutch noisy		Damaged clutch pedal bushing Loose part inside housing Release bearing worn or dirty Release fork or linkage sticks	Replace clutch pedal bushing Repair as necessary Replace release bearing Repair as necessary

CLUTCH SYSTEM

CLUTCH CONTROL E2801931

COMPONENTS



TORQUE : N·m (kg·cm, lb·ft)

EOPD026G

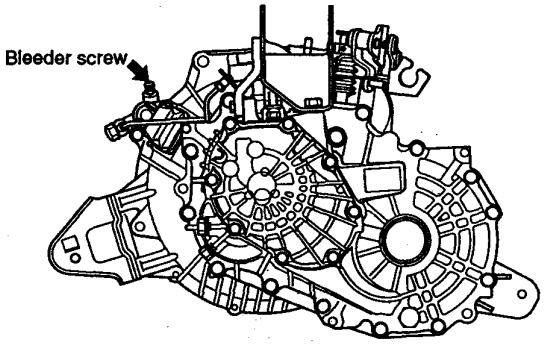
INSPECTION ED72A4C9

BLEEDING

Whenever the clutch tube, the clutch hose, and/or the clutch master cylinder have been removed, or if the clutch pedal is spongy, bleed the system.

⚠ ***CAUTION***

Use the specified fluid. Avoid mixing different brands of fluid. Specified fluid : SAE J1703 (DOT 3 or DOT 4).

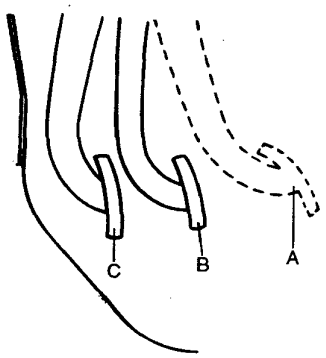


EOPC011B

1. Loosen the bleeder screw at the clutch release cylinder.
2. Push the clutch pedal down slowly until all is expelled.
3. Hold the clutch pedal down until the bleeder is retightened.
4. Refill the clutch master cylinder with the specified fluid.

⚠ ***CAUTION***

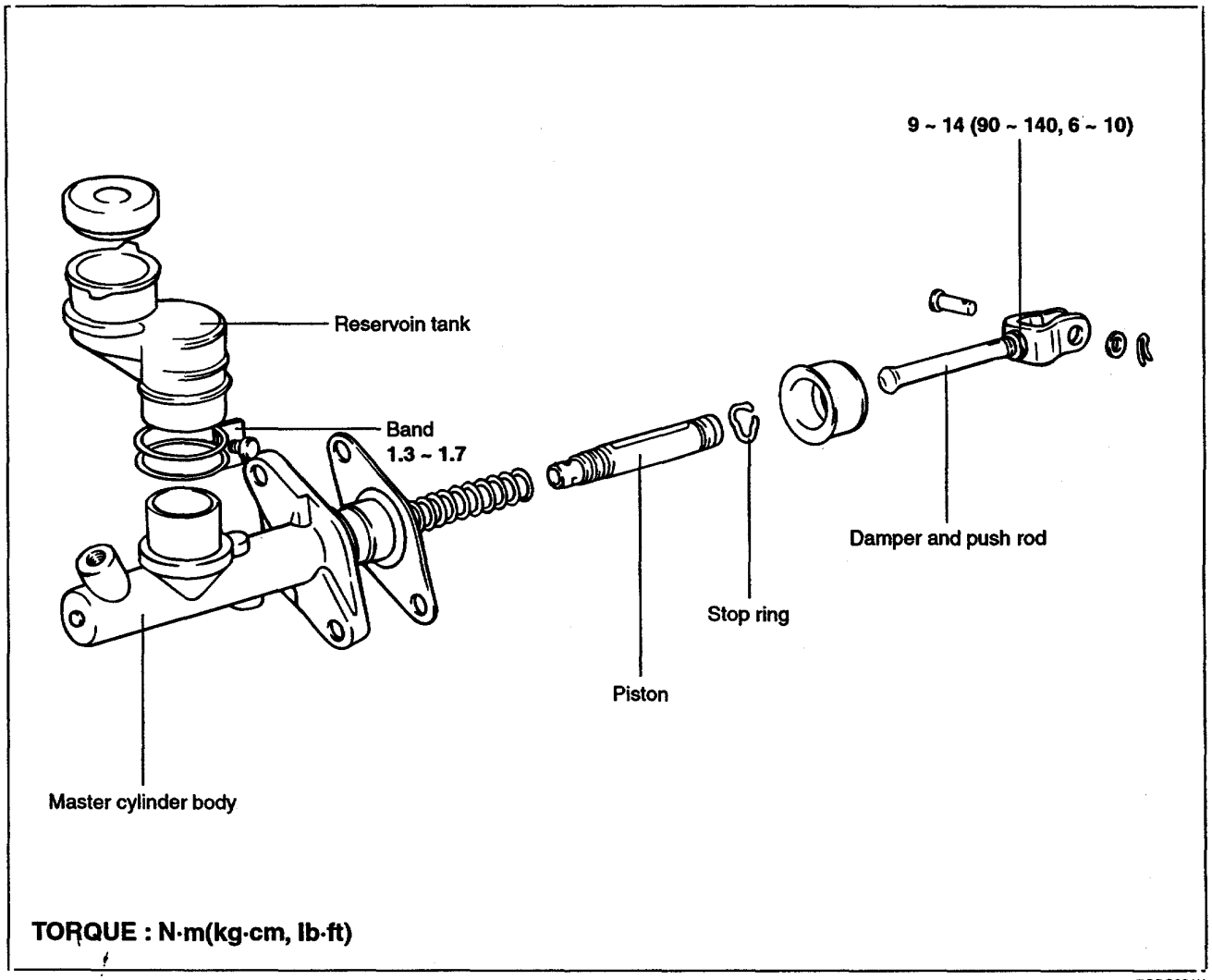
The rapidly-repeated operation of the clutch pedal in B-C range may cause the release cylinder's position to be forced out from the release cylinder body during air bleeding. Repress the clutch pedal after it returns to the "A" point completely.



EODA007C

CLUTCH MASTER CYLINDER

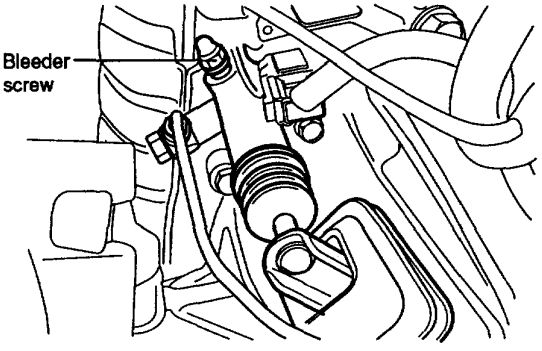
COMPONENTS EC0B853D



EOPC021K

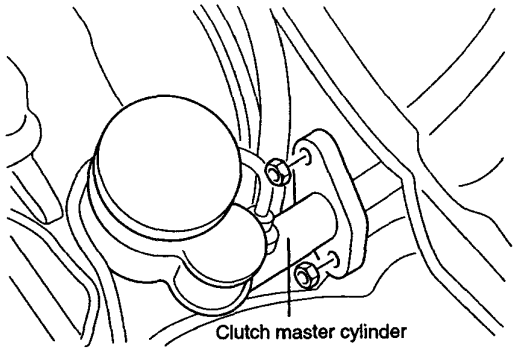
REMOVAL K53BFB5E

1. Drain the clutch fluid through the bleeder screw.



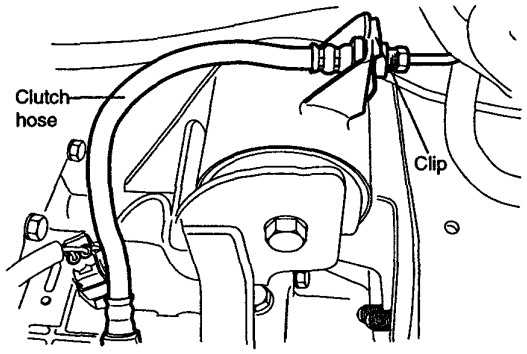
EOPC702B

2. Remove the master cylinder mounting nut.

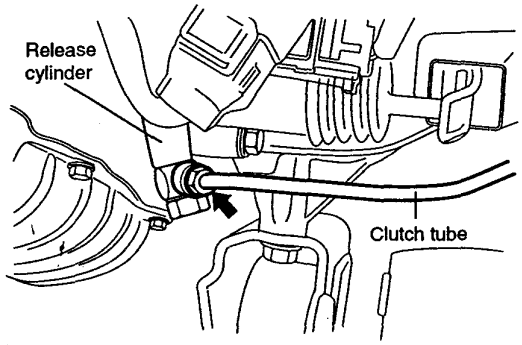


EODD072E

3. Separate the clutch line.

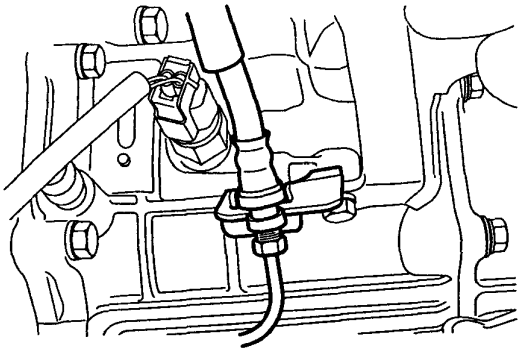


EOPC702C

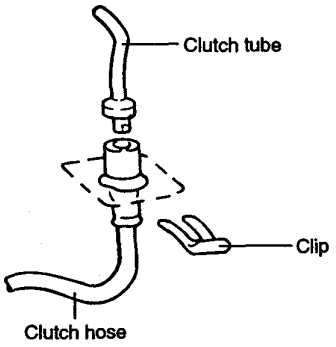


EOPC673A

4. Remove the clutch line clip of the transaxle side.



KOPC672A



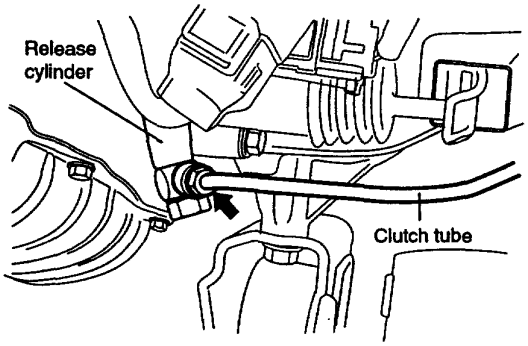
EOKB012D

INSPECTION KBA68FDC

Check the rust, pitting and scoring of the clutch hose and tube.

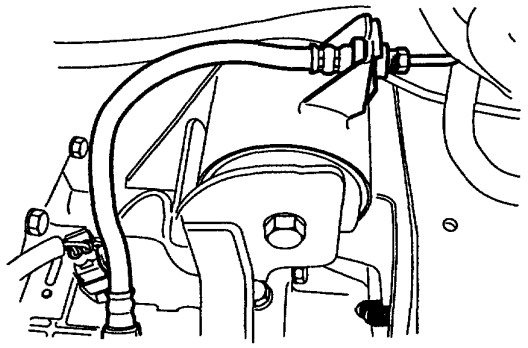
INSTALLATION K6C0AEEB

1. Install the clutch tube (clutch release cylinder side).

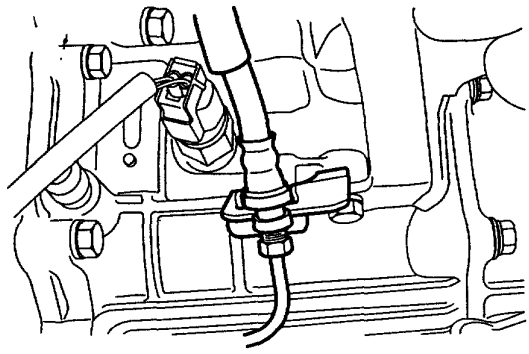


EOPC673A

2. Install the clutch line and the clip.

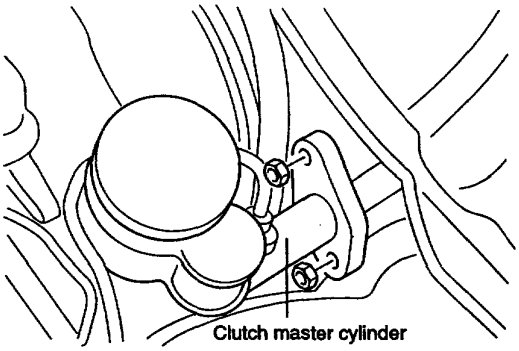


KMPC684B



KOPC672A

3. Install the clutch master cylinder.



EODD072E

4. Install the push rod to the clutch pedal.
5. Bleed the system.

DISASSEMBLY E7F86AB3

1. Remove the piston stop ring.
   (Refer to the components of the master cylinder)
2. Pull out the push rod and piston assembly.

> **NOTE**
> *Be careful not to damage the master cylinder body and piston assembly.*

INSPECTION E4EACABC

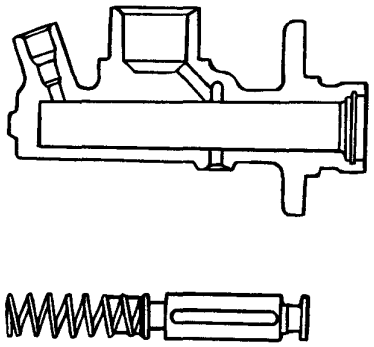
1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check the clutch tube line for obstructions.
5. Measure the clutch master cylinder inside diameter with a cylinder gauge, and the piston outside diameter with a micrometer.

REASSEMBLY EBBCF048

1. Apply the specified fluid to the inner surface of the cylinder body and to the outside of the piston assembly.

Specified fluid : BRAKE FLUID DOT 3 or DOT4

2. Install the piston assembly.
3. Install the piston stop ring
4. Install the push rod assembly. (Refer to the components of the clutch master cylinder.)

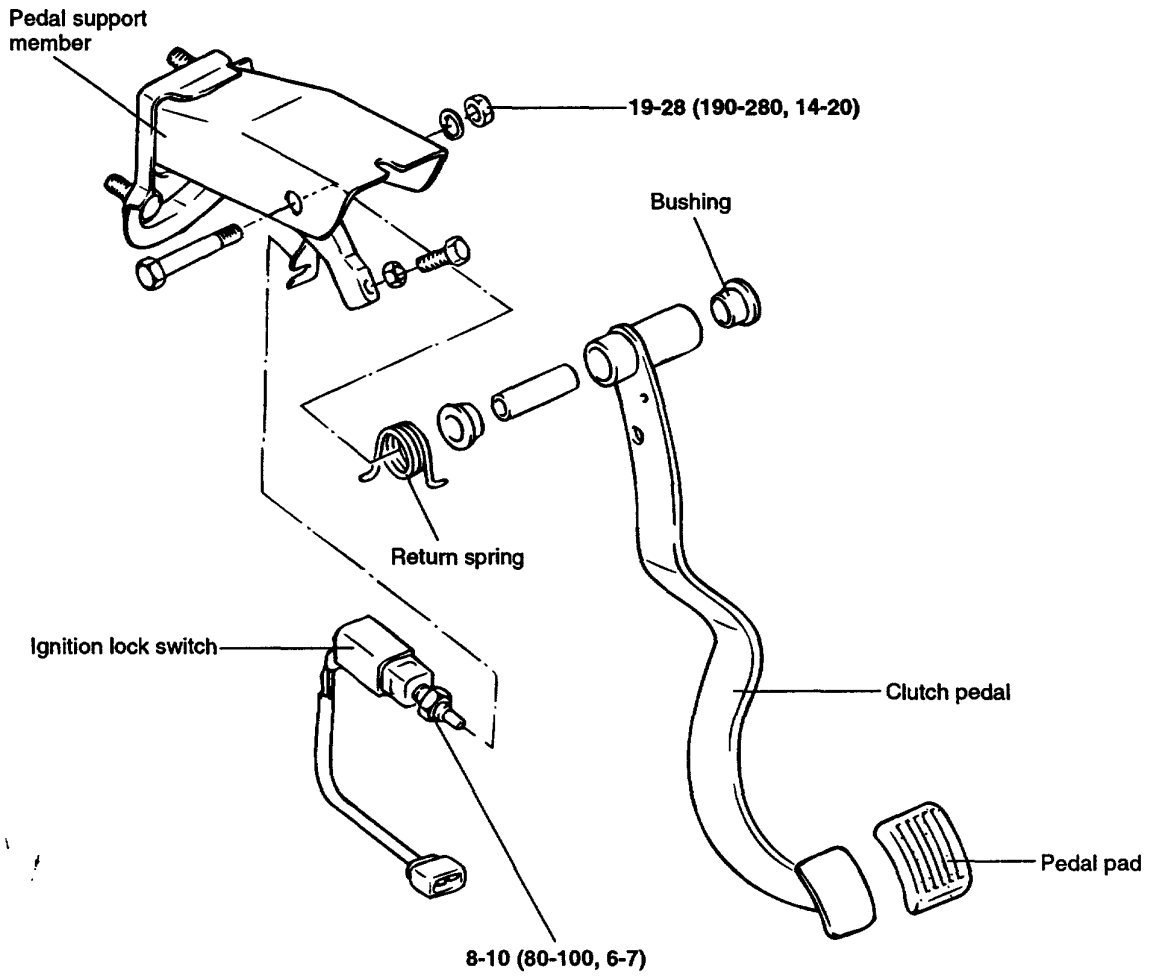


EODA014B

5. Install the clutch hose on the cylinder body.

CLUTCH PEDAL

COMPONENTS E6E0219B

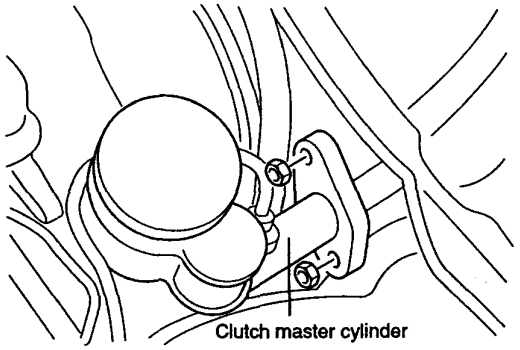


TORQUE : Nm (kg·cm, lb·ft)

EODA008A

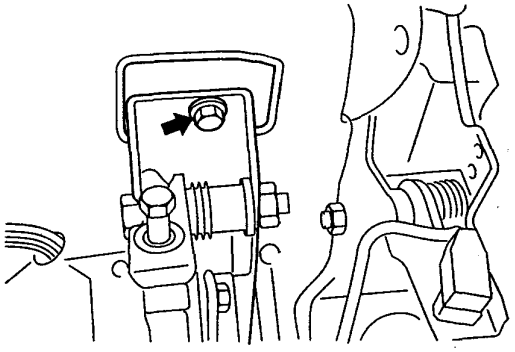
REMOVAL K5265A9E

1. Remove the master cylinder mounting nut.



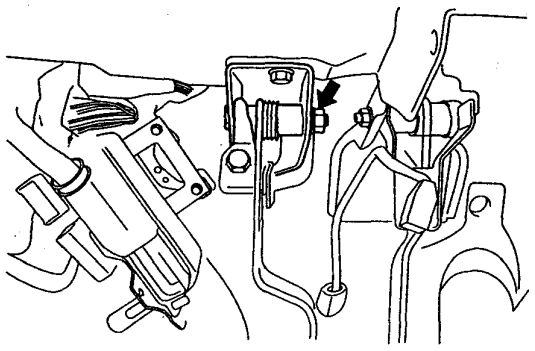
EODD072E

2. Remove the pedal support member mounting bolt.



EODD072B

3. Remove the pedal support bolt.

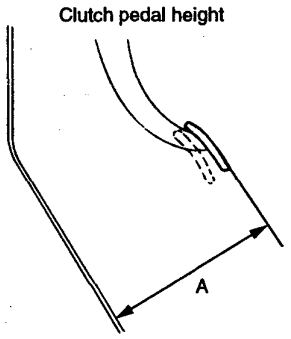


EODD072C

INSPECTION K0C6089B

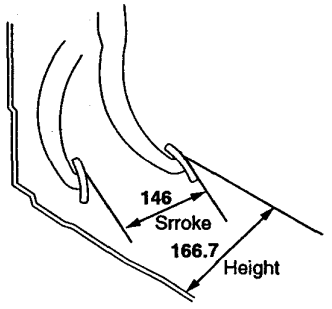
1. Check the clutch pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or distortion.
3. Check the return spring for damage or deterioration.
4. Check the clutch pedal pad for damage or wear.
5. Measure the clutch pedal height (from the face of the pedal pad to the floorboard).

Standard value : (A) 166.7 mm (6.6 in.)



EOPC007A

6. If the clutch pedal height is not within the standard value range, adjust as follows :
   - Turn and adjust the bolt, then secure by tightening the lock nut.



EODD072D

⚠ ***CAUTION***

After the adjustment, tighten the bolt until it reaches the pedal stopper, and then tighten the lock nut.

   - Turn the push rod to agree with the standard value and then secure the push rod with the lock nut.

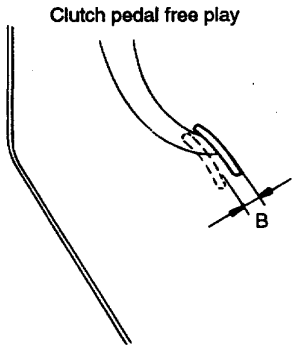
⚠ *CAUTION*

When adjusting the clutch pedal height, be careful not to push the push rod toward the master cylinder.

7. After completing the adjustments, check that the clutch pedal free play (measured at the face of the pedal pad) is within the standard value ranges.

Standard value : (B) 6-13 mm (0.24-0.52 in.)

8. If the clutch pedal free play do not meet with the standard values, it may be the result of either air in the hydraulic system or a faulty clutch master cylinder. Bleed the air or disassemble and inspect the master cylinder or clutch.



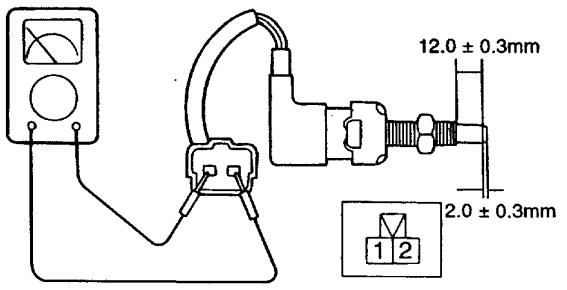
EONC007B

IGNITION LOCK SWITCH INSPECTION

Check for continuity between terminals.

Terminal / Condition	1	2
Pushed	○———	———○
Free		

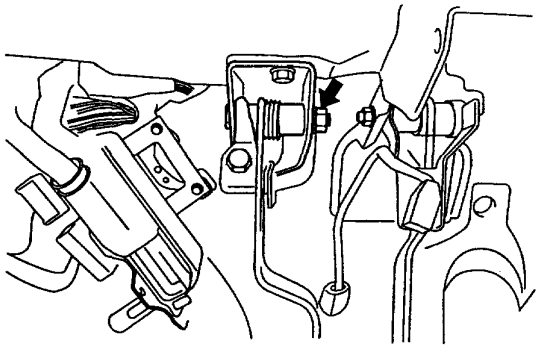
EODA009A



EONC010A

INSTALLATION K6BC7D03

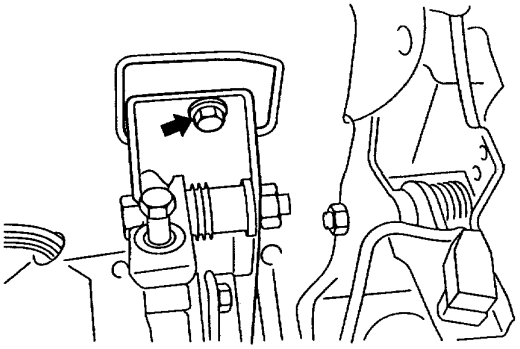
1. Apply the multi-purpose grease and install the pedal support bolt.



EODD072C

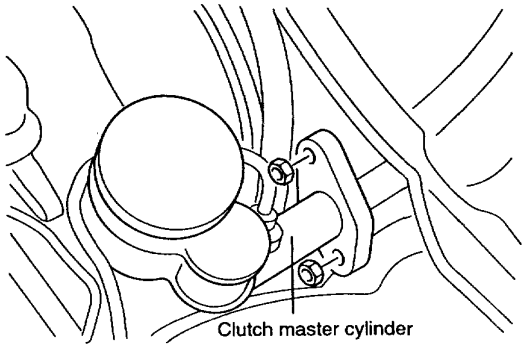
Specified lubricants :
SAE J310a, Chassis grease, NLGI-No.1

2. Install the pedal supprot member mounting bolt.



EODD072B

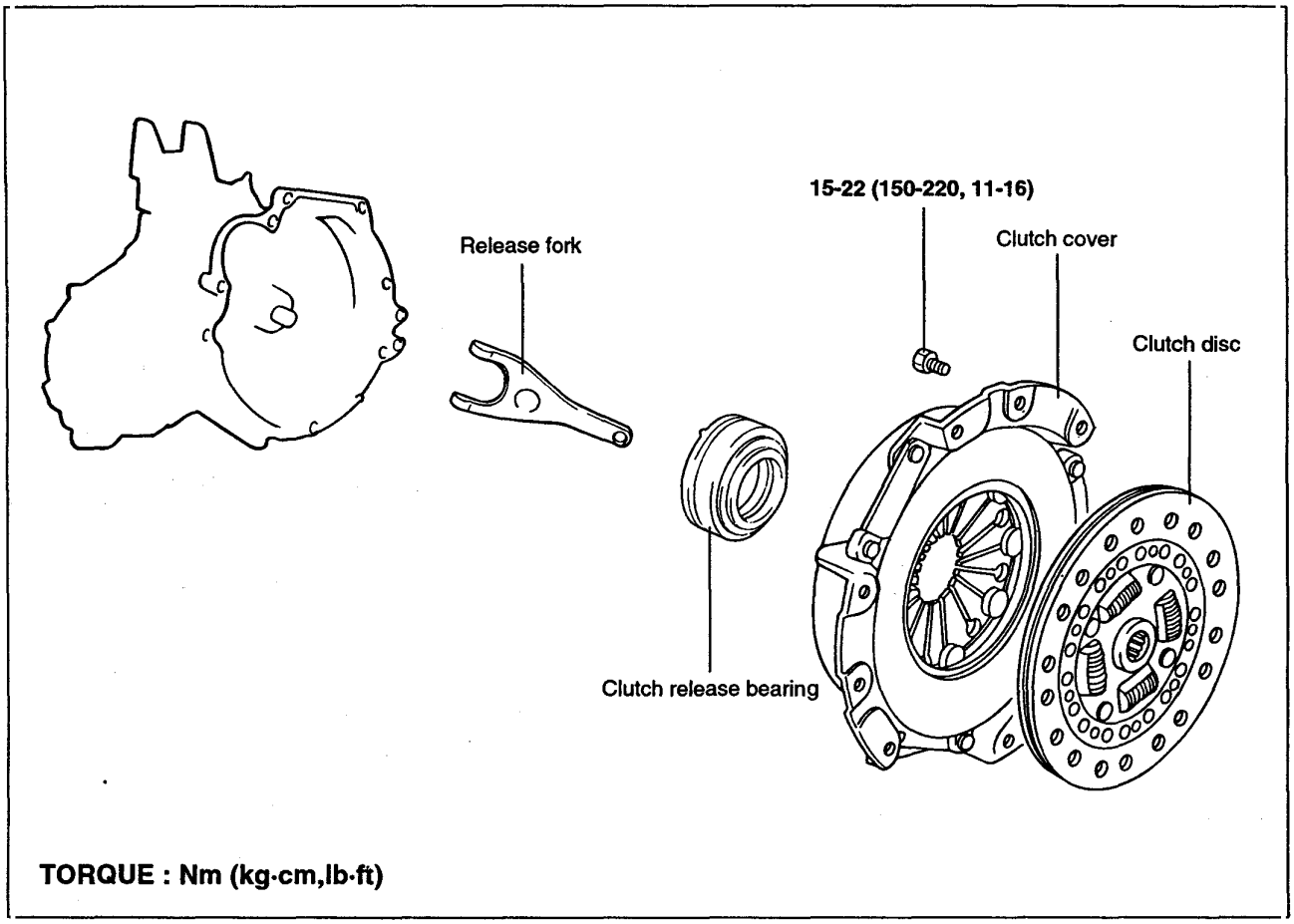
3. Install the master cylinder mounting nut.



EODD072E

CLUTCH COVER AND DISC

COMPONENTS EC2BE42F

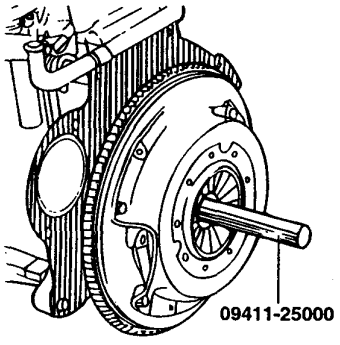


TORQUE : Nm (kg·cm,lb·ft)

EODA017A

REMOVAL K7AD2AB0

1. Drain the clutch fluid and transaxle gear oil.
2. Remove the transaxle assembly. (Refer to the "TR" group)
3. Insert the special tool (09411-25000) in the clutch disc to prevent the disc from falling.

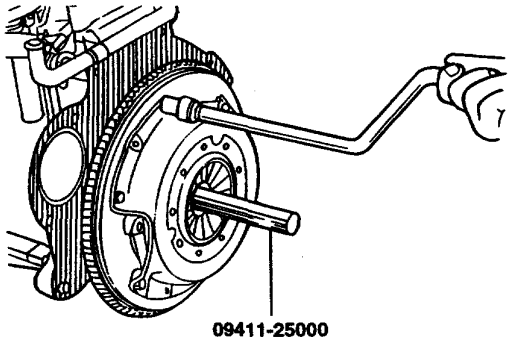


KOPC027B

4. Loosen the bolts that attach the clutch cover to the flywheel in a star pattern.
5. Loosen the bolts in succession, one or two turns at a time, to avoid bending the cover flange.

⚠ ***CAUTION***

DO NOT clean the clutch disc or release bearing with cleaning solvent.



EODA117B

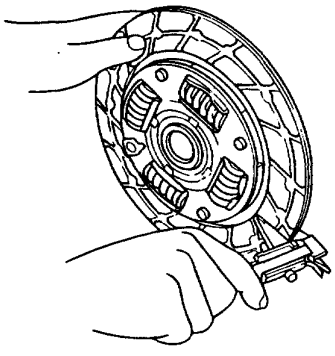
INSPECTION KC80AE3D

CLUTCH COVER ASSEMBLY

1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

CLUTCH DISC

1. Check the clutch facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil, or grease, and replace the clutch disc if defective.
2. Measure the thickness of the disc when free.



KOPC029C

3. Check for the torsion spring play and damage and if defective, replace the clutch disc.
4. Clean the splines on the input shaft and install the clutch disc.
   If the disc does not slide smoothly or if play is excessive, replace the clutch disc and/or the input shaft.

CLUTCH RELEASE BEARING

⚠ ***CAUTION***

The release bearing is packed with grease. Do not use cleaning solvent or oil.

1. Check the bearing for seizure, damage or abnormal noise. Also check the diaphragm spring contacting points for wear.
2. Replace the bearing if the release fork contacting points are worn abnormally.

CLUTCH RELEASE FORK

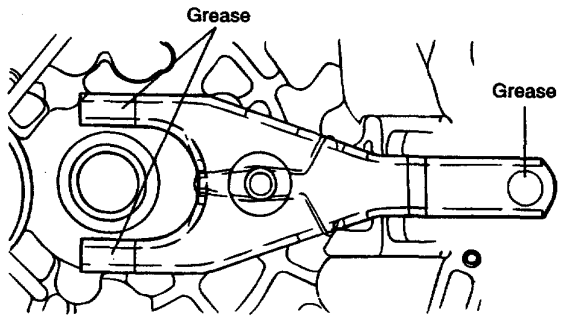
If there is abnormal wear at the point of contact with the bearing, replace the release fork assembly.

INSTALLATION KF1445CD

1. Apply multipurpose grease to the release bearing contact surfaces and the release cylinder contact surface of the clutch release fork assembly.

⚠ ***CAUTION***

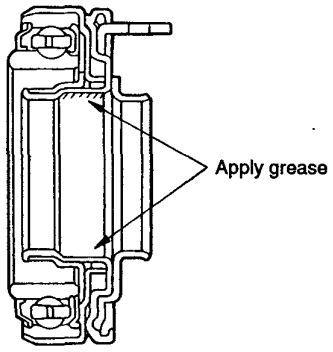
When installing the clutch, apply grease to each part, but be careful not to apply excessive grease. It can cause clutch slippage and judder.



EODA019B

2. Apply multipurpose grease into the groove of the release bearing.

Grease : CASMOLY L9508



EODA019A

3. Apply multipurpose grease to the clutch release lever fulcrum contact surface of the clutch release fork assembly.

Grease : CASMOLY L9508

4. Clean the surfaces of the flywheel and pressure plate thoroughly with fine sandpaper or crocus cloth, and make certain that all oil or grease has been removed.

5. Apply a small amount of multipurpose grease to the clutch disc splines and input shaft splines.

Grease : CASMOLY L9508

⚠ ***CAUTION***

Do not apply more grease than necessary. Too much grease could cause clutch slip or judder.

6. Using the special tool (09411-25000), install the clutch disc to the flywheel. When installing the clutch disc, be sure that the surface having the manufactures stamp is towards the pressure plate side.

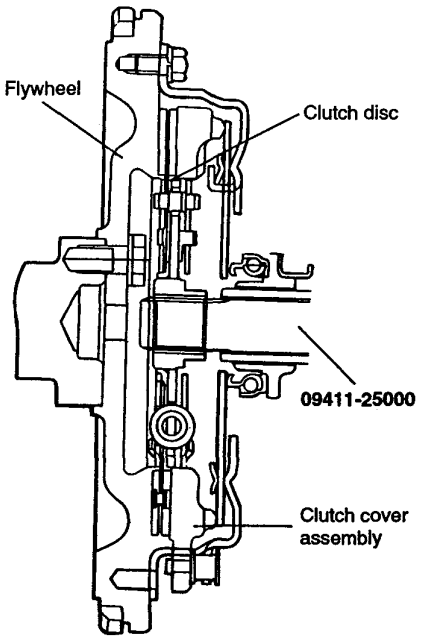
7. Install the the clutch cover assembly onto the flywheel and install the six (6) bolts through the clutch cover into the flywheel.

8. Diagonally tighten the bolts 15-22 Nm (150-220 kg·cm, 11-15 lb·ft).
Tighten the bolts by one or two turns at a time, in succession, to avoid bending the cover flange.

9. Remove the special tool.

10. Install the transaxle. (Refer to the "TR" group.)

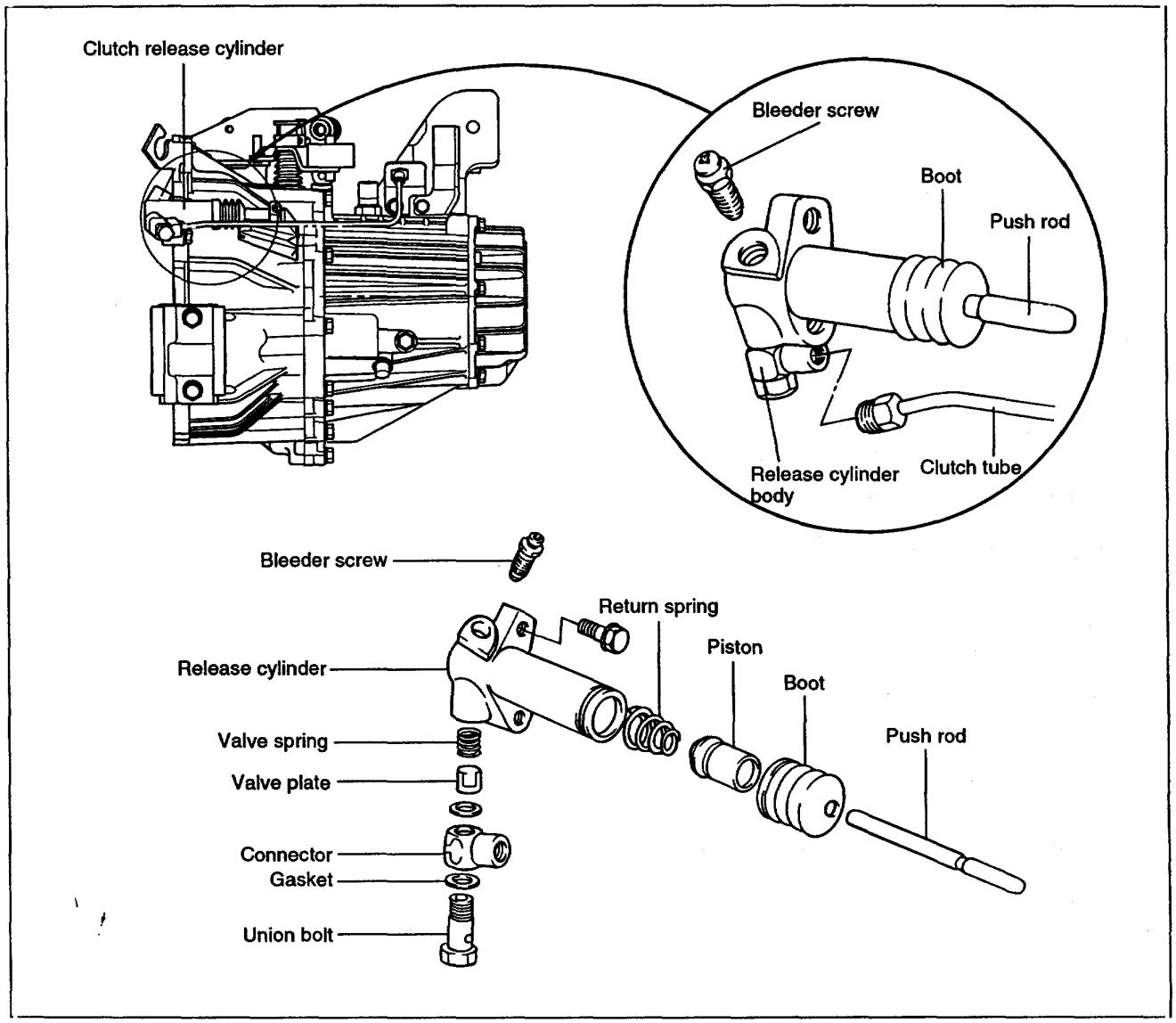
11. Adjust the clutch pedal free-play.



EODA120A

CLUTCH RELEASE CYLINDER

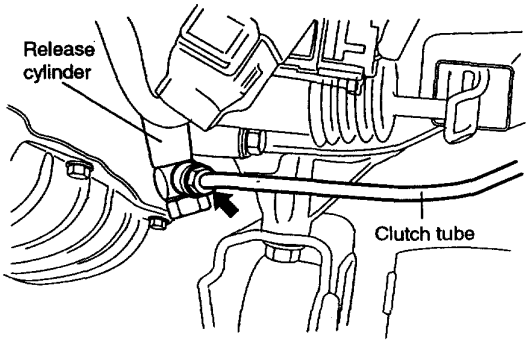
COMPONENTS EFA284C0



EOPC011A

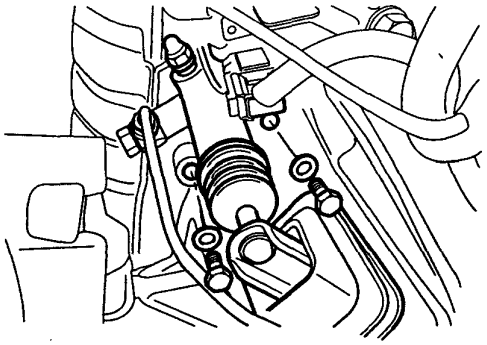
REMOVAL KA8CDB9D

1. Disconnect the clutch tube.



EOPC673A

2. Remove the clutch release cylinder mounting bolt.



KMPC677A

INSPECTION KDF500F0

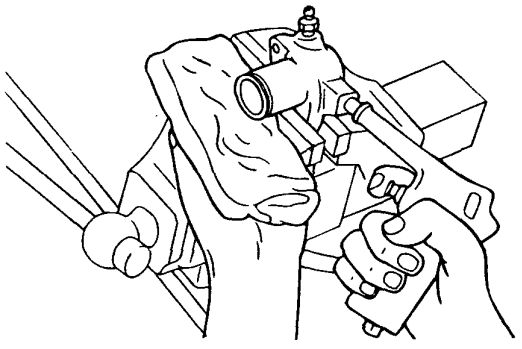
1. Check the clutch release cylinder for fluid leakage.
2. Check the clutch release cylinder boots for damage.

DISASSEMBLY K31BDFBA

1. Remove the clutch hose, valve plate, spring, push rod and boot.
2. Remove any dirt from the piston bore opening of the release cylinder.
3. Remove the piston from the release cylinder using compressed air.

⚠ ***CAUTION***

1. ***Cover the release cylinder with rags to prevent the piston from popping out and causing injury.***
2. ***Apply compressed air slowly to prevent the fluid from splashing in your eyes or on your skin.***

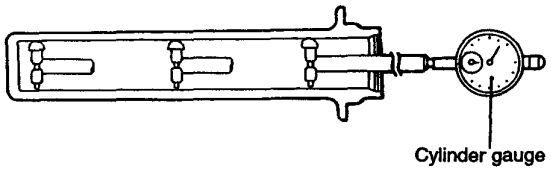


EODA016A

INSPECTION K900273A

1. Check the release cylinder bore for rust and damage.
2. Measure the release cylinder bore at three locations (bottom, middle and top) with a cylinder gauge and replace the release cylinder assembly if the bore-to-piston clearance exceeds the limit.

Limit : 0.15 mm (0.006 in.)



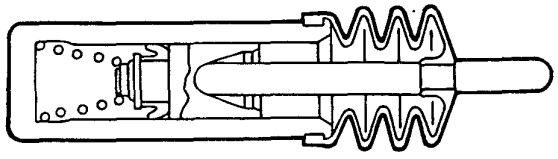
EODA016B

REASSEMBLY KBDE3DCC

1. Apply specified brake fluid to the release cylinder bore and the outer surface of the piston and piston cup, and push the piston cup assembly into the cylinder.

Use the specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the valve plate, push rod and boot.

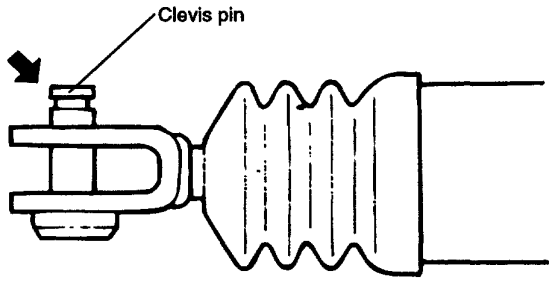


EODA016C

INSTALLATION K1F2EEA1

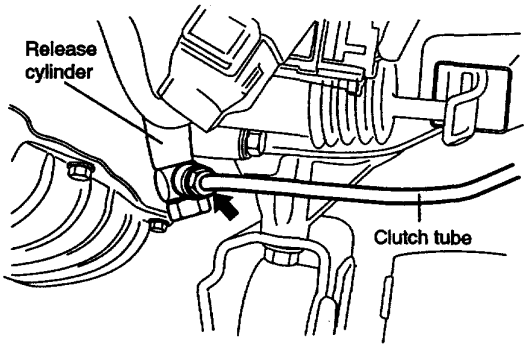
1. Coat the clevis pin with the specified grease.

Specified grease : CASMOLY L9508



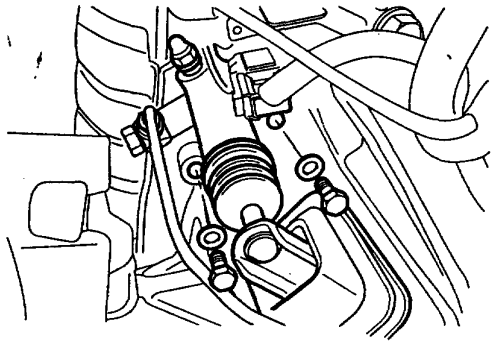
EOKB025A

2. Install the clutch release cylinder, and the clutch tube.



EOPC673A

3. Install the clutch release cylinder mounting bolt.



KMPC677A

COMPONENT LOCATIONS

CONTROL HARNESS CL-18

DIODES CL-30

DOOR HARNESS CL-26

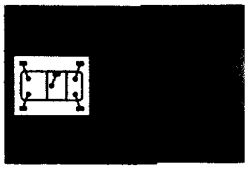
ENGINE HARNESS CL-12

GROUNDS CL-28

INSTRUMENT HARNESS CL-17

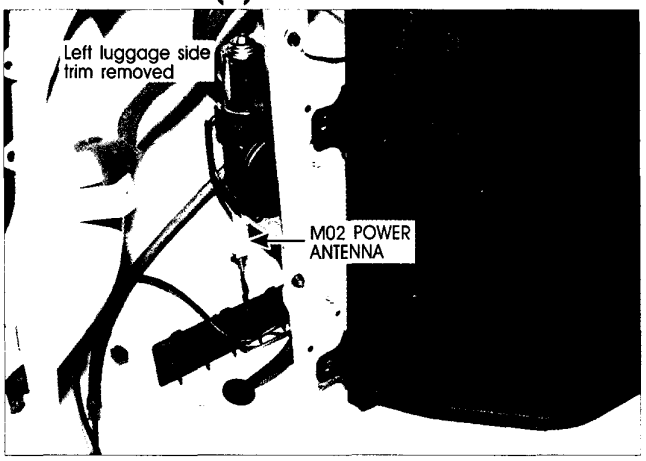
MAIN HARNESS CL-2

TAIL GATE HARNESS CL-27

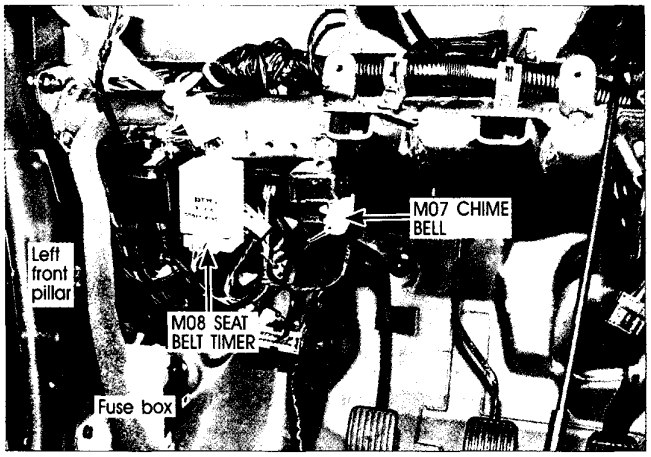


MAIN HARNESS

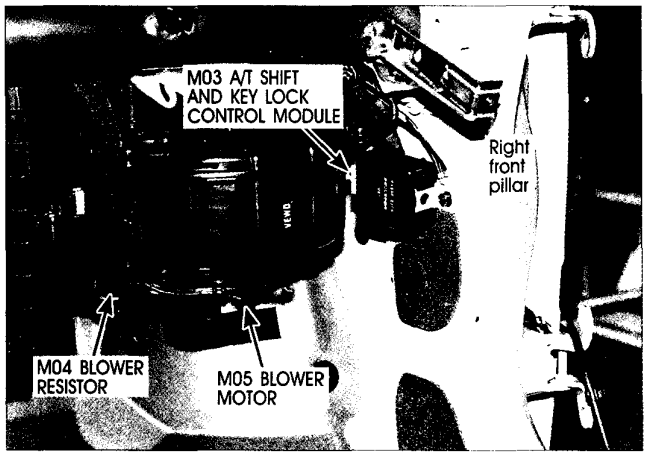
MAIN HARNESS(1)



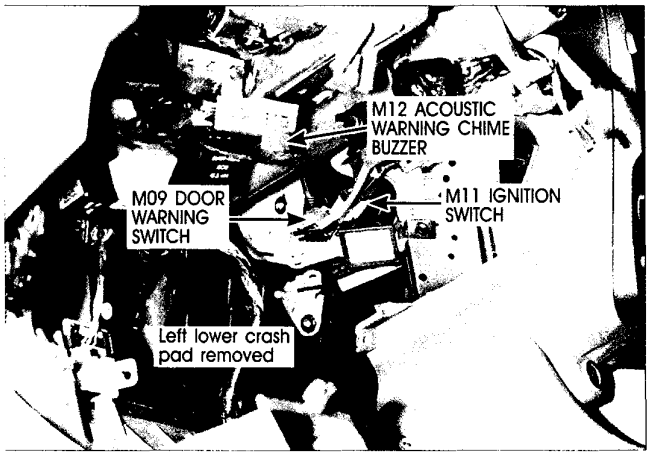
M02 E3DD001A



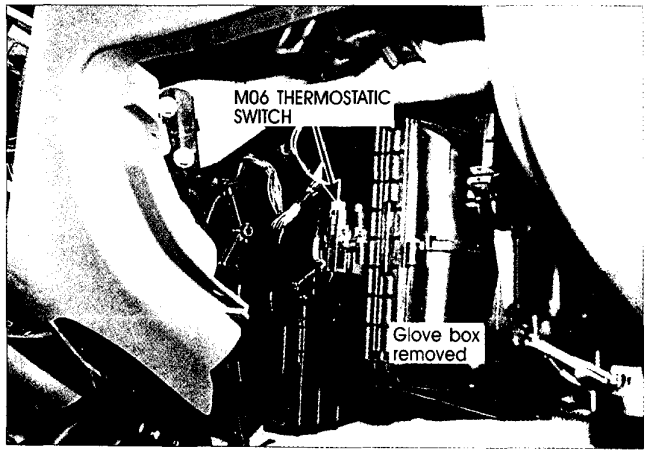
M07,M08 E3DD001D



M03,M04,M05 E3DD001B



M09,M11,M12 E3DD001E

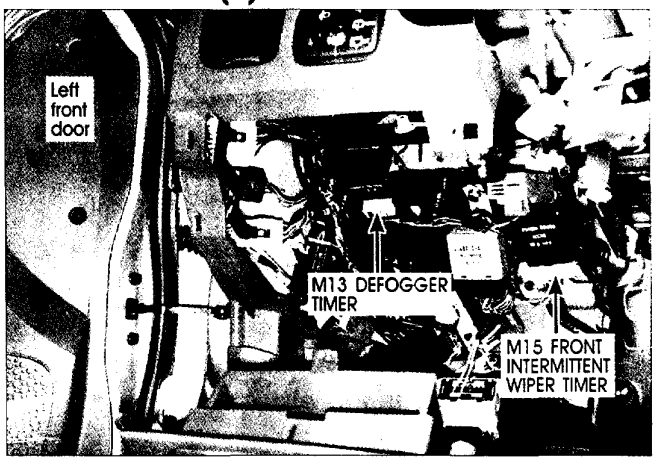


M06 E3DD001C

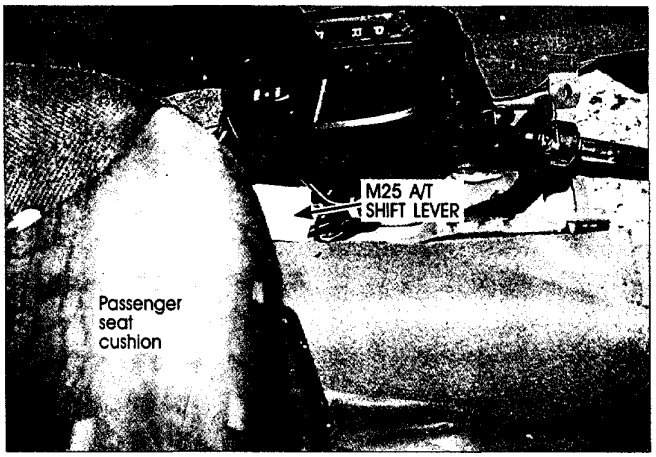


M10-1,M10-2,M10-3,M10-4 E3DD001F

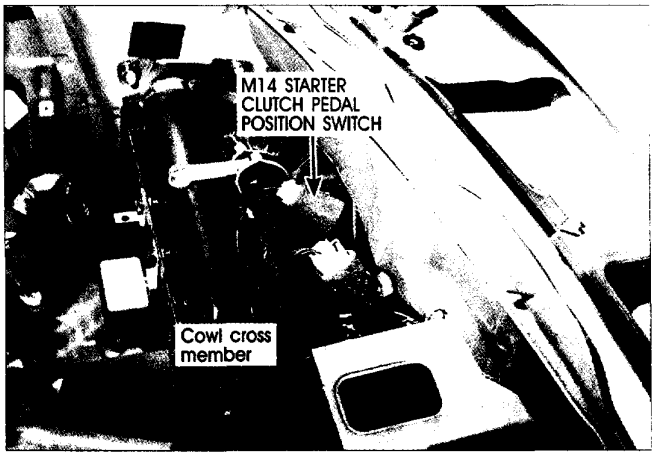
MAIN HARNESS(2)



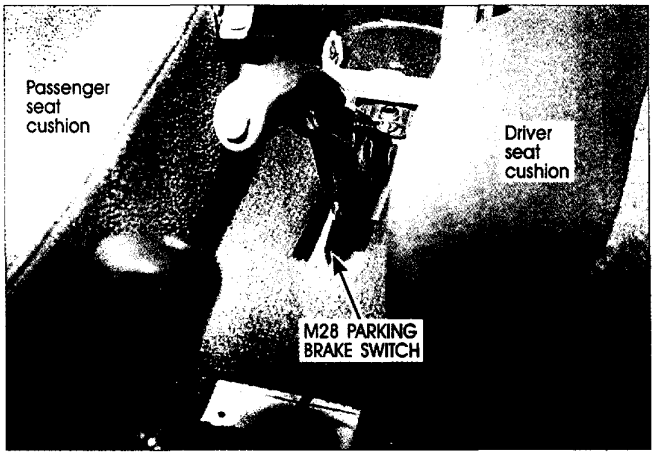
M13,M15 E3DD001G



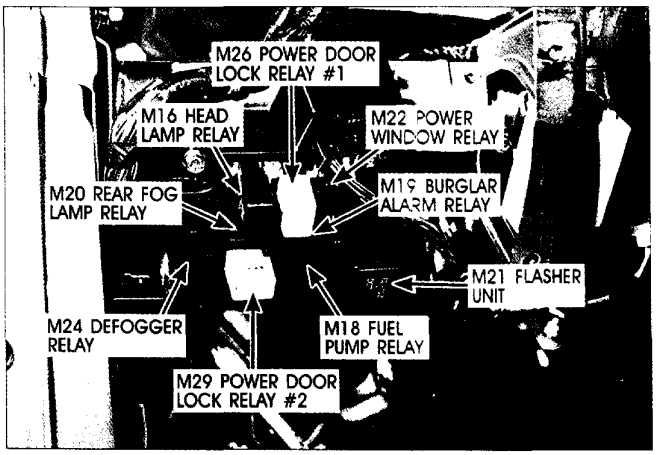
M25 E3DD001K



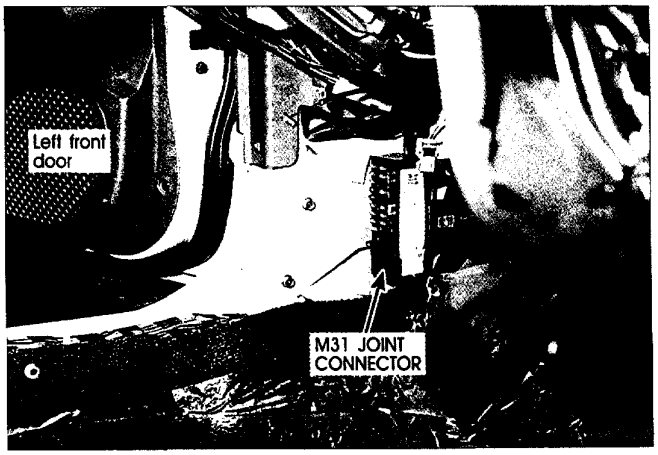
M14 E3DD001H



M28 E3DD001L

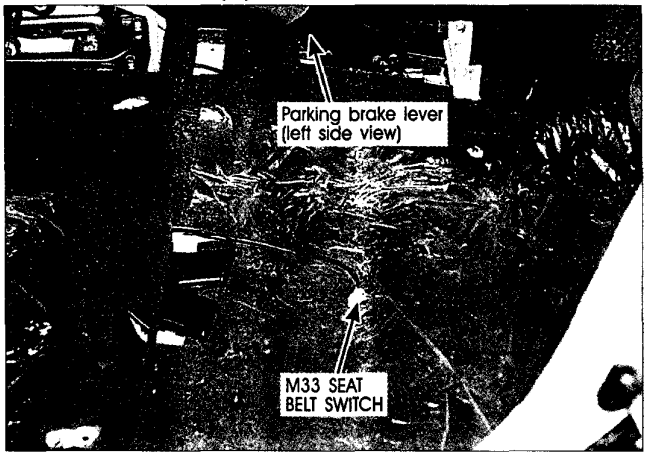


M16,M18,M19,M20,M21
M22,M24,M26,M29 E3DD001J

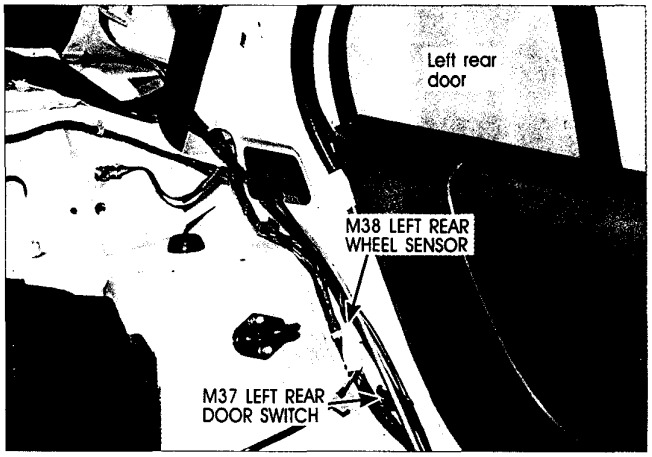


M31 E3DD001M

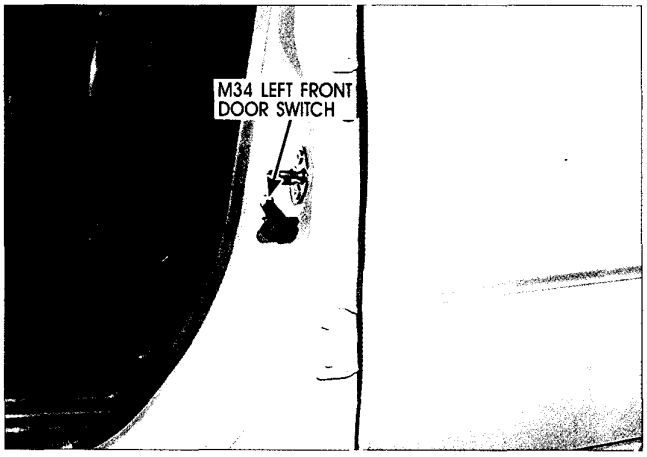
MAIN HARNESS(3)



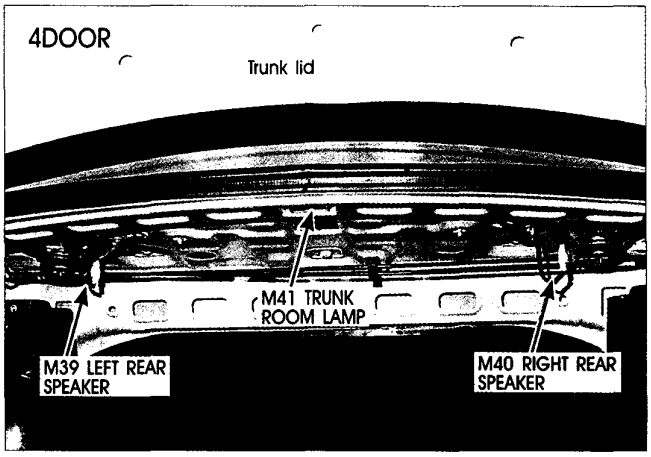
M33 E3DD001N



M37,M38 E3DD001R



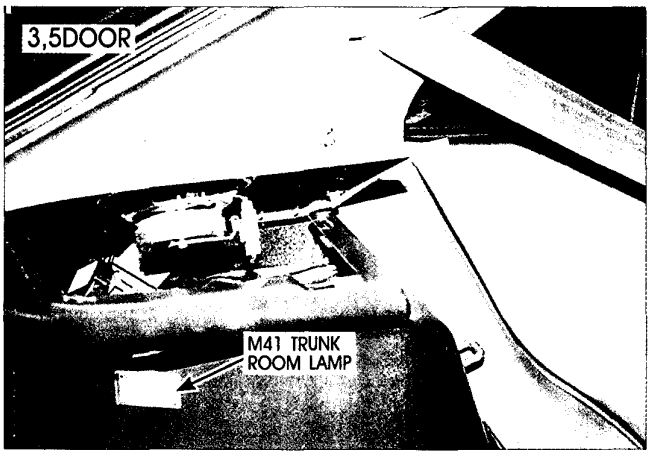
M34 E3DD001P



M39,M40,M41 E3DD001S

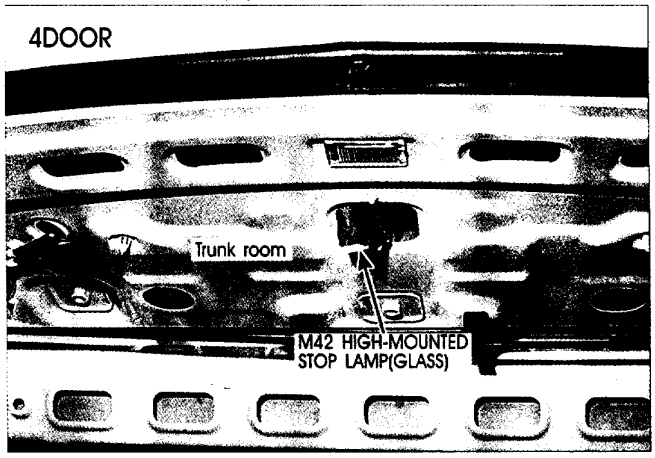


M36,M36-1,M36-2 E3DD001Q

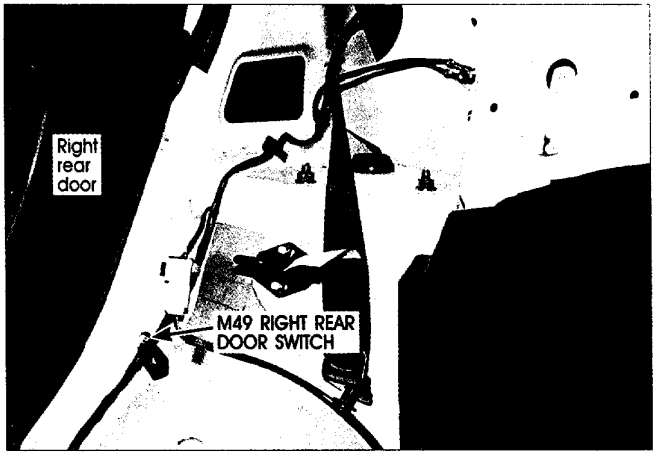


M41 E3DD001T

MAIN HARNESS(4)



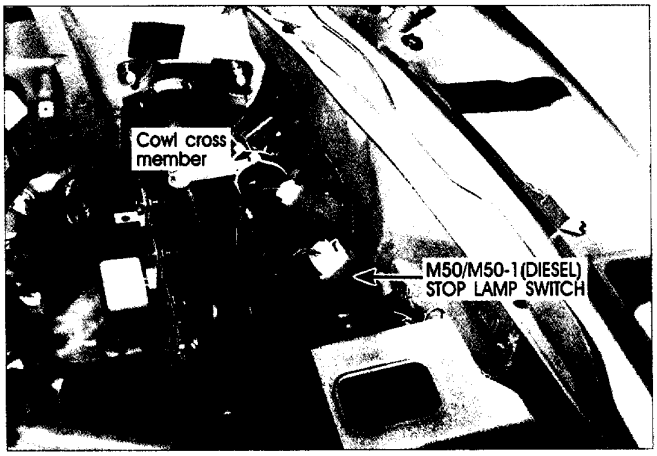
M42 E3DD001U



M49 E3DD001X



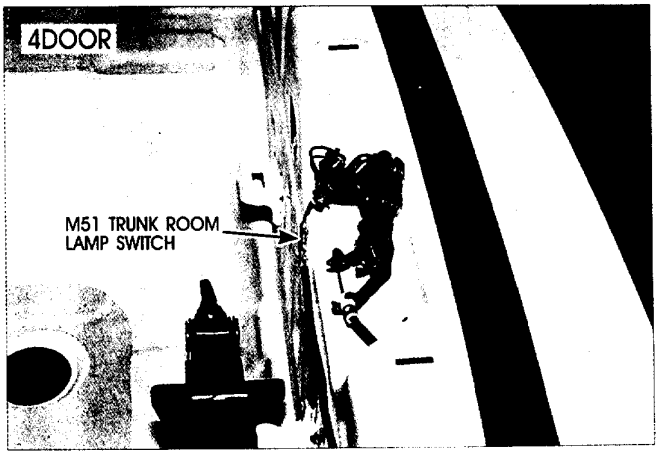
M44,M45 E3DD001V



M50,M50-1 E3DD001Y



M46 E3DD001W

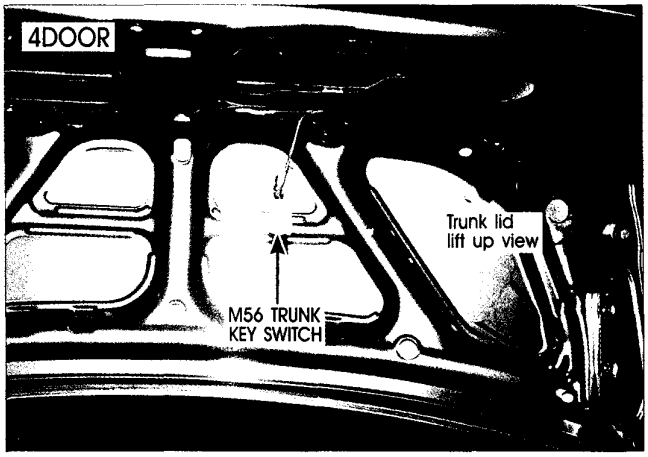


M51 E3DD001Z

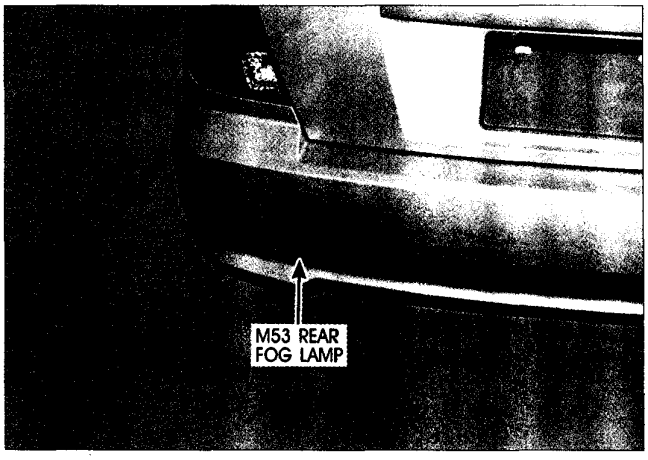
MAIN HARNESS(5)



M52 E3DD0A1A



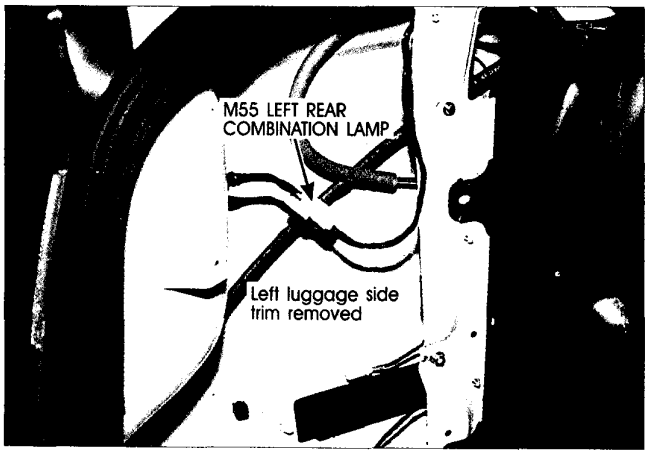
M56 E3DD0A1D



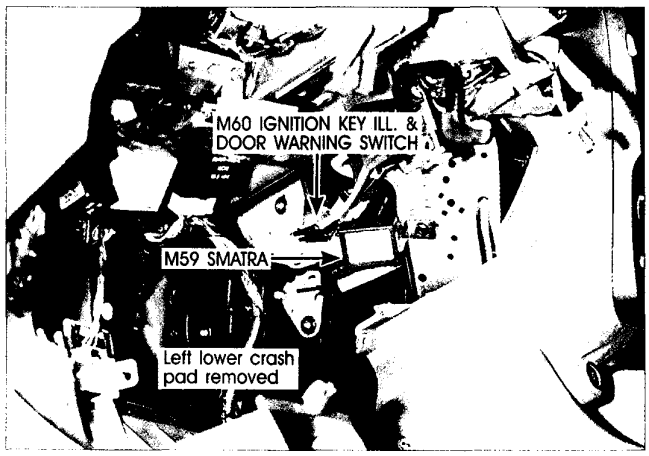
M53 E3DD0A1B



M57 E3DD0A1E

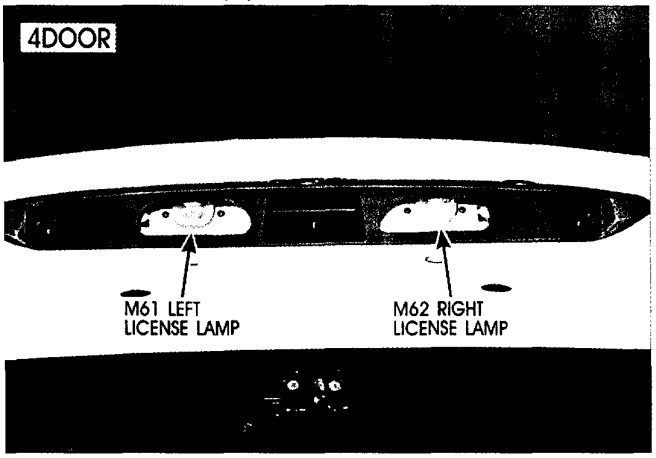


M55 E3DD0A1C

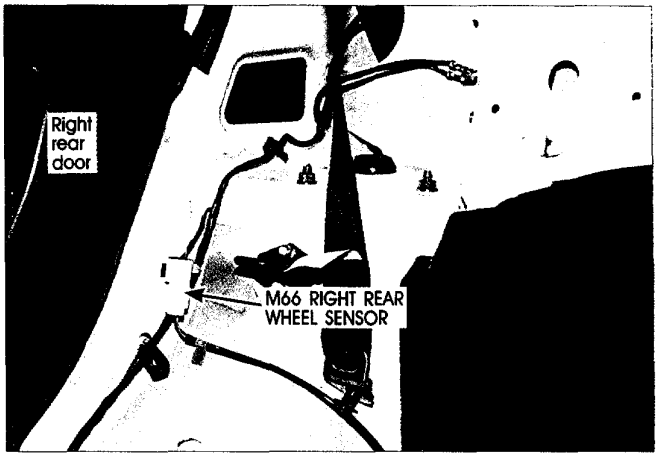


M59,M60 E3DD0A1F

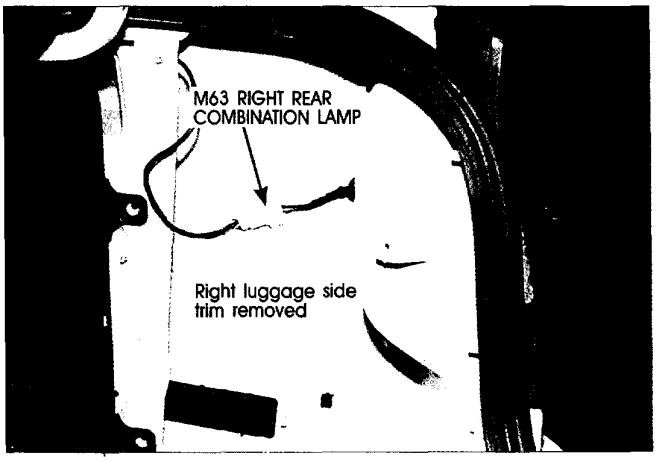
MAIN HARNESS(6)



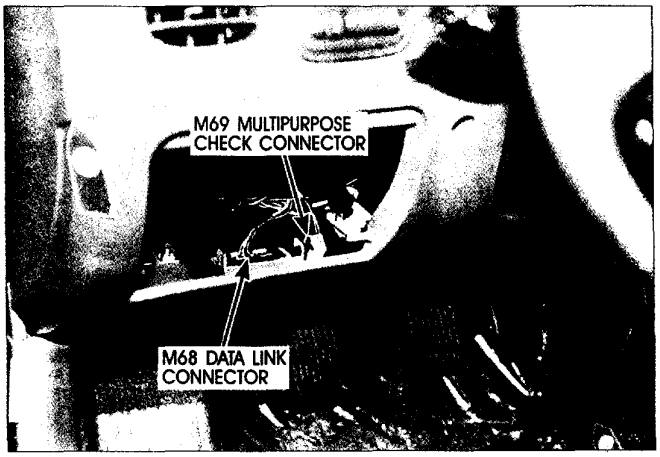
M61,M62 E3DD0A1G



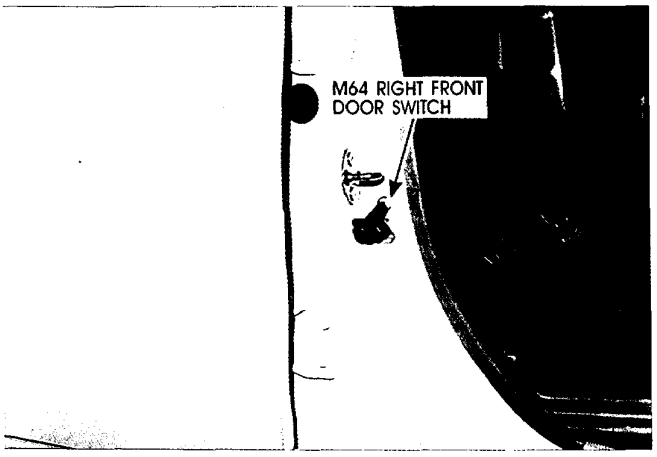
M66 E3DD0A1K



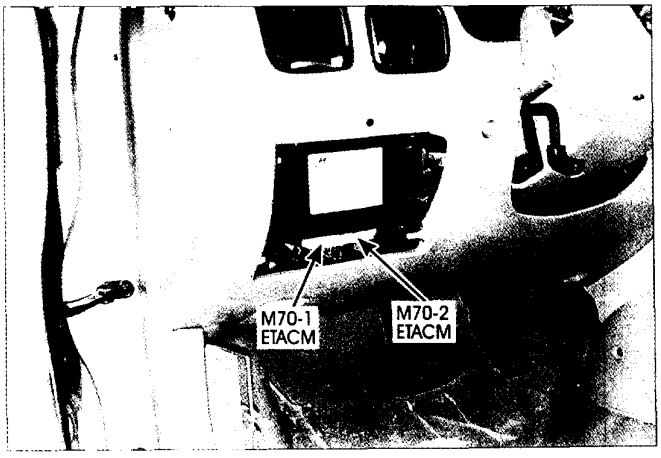
M63 E3DD0A1H



M68,M69 E3DD0A1L

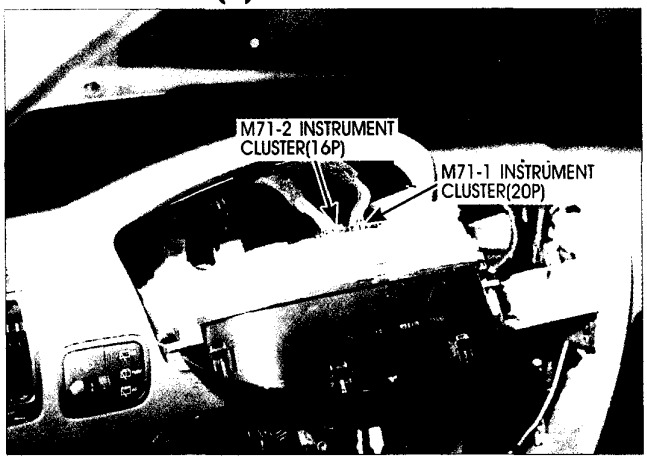


M64 E3DD0A1J

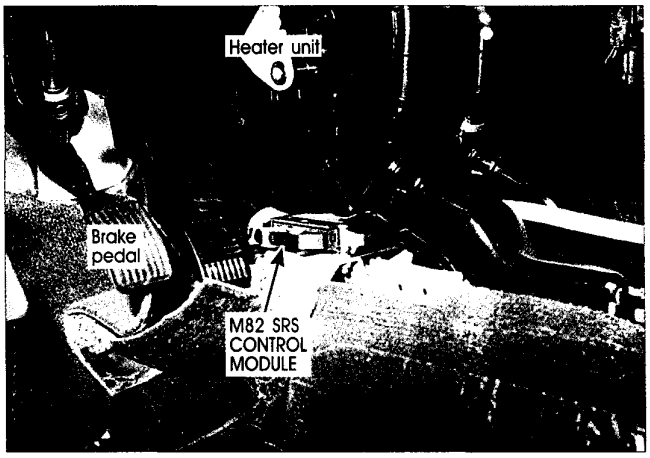


M70-1,M70-2 E3DD0A1M

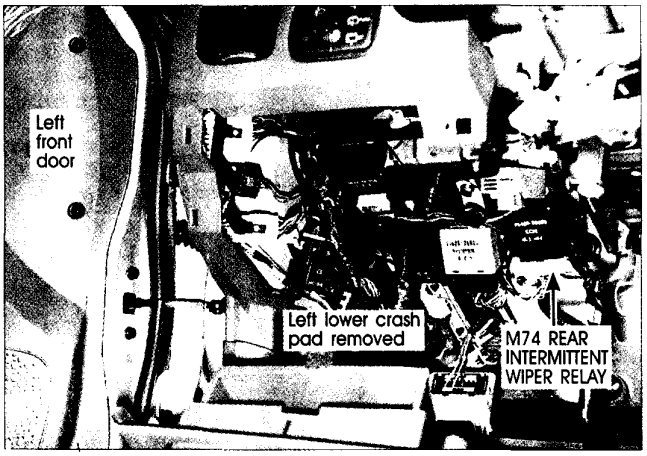
MAIN HARNESS(7)



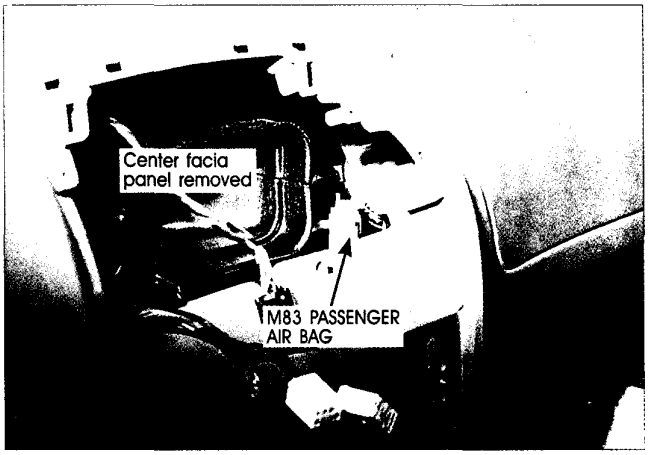
M71-1,M71-2 E3DD0A1N



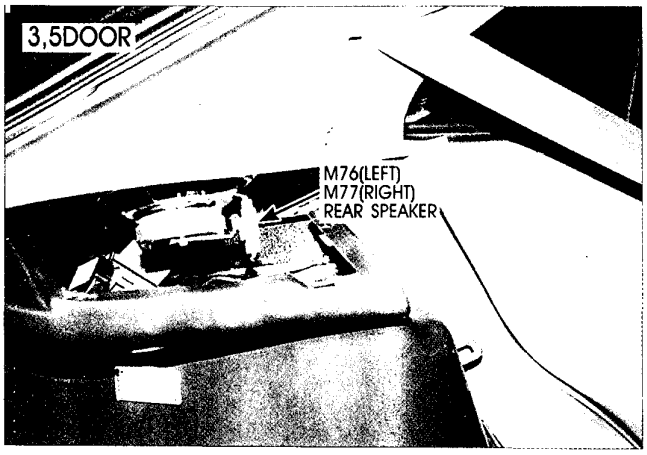
M82 E3DD0A1R



M74 E3DD0A1P



M83 E3DD0A1S

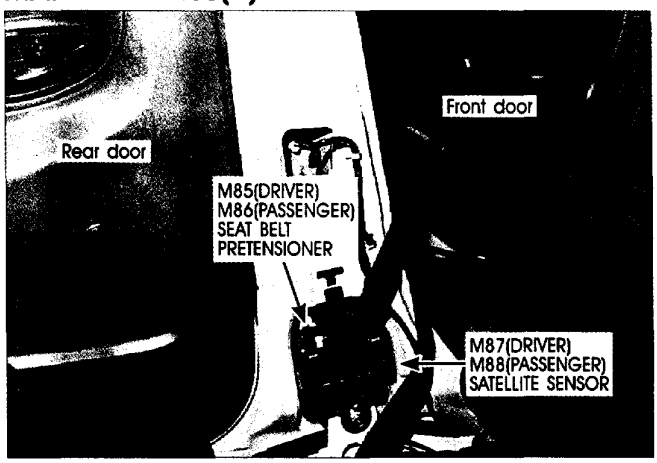


M76,M77 E3DD0A1Q

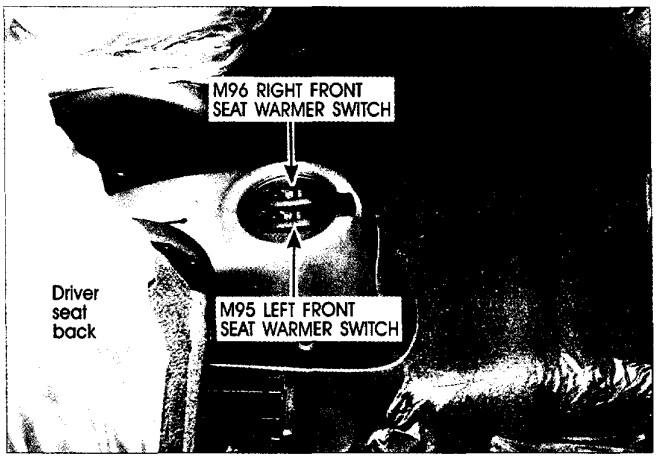


M84 E3DD0A1T

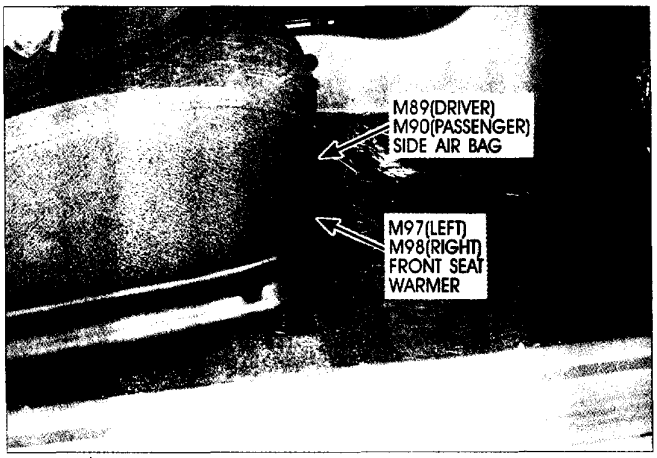
MAIN HARNESS(8)



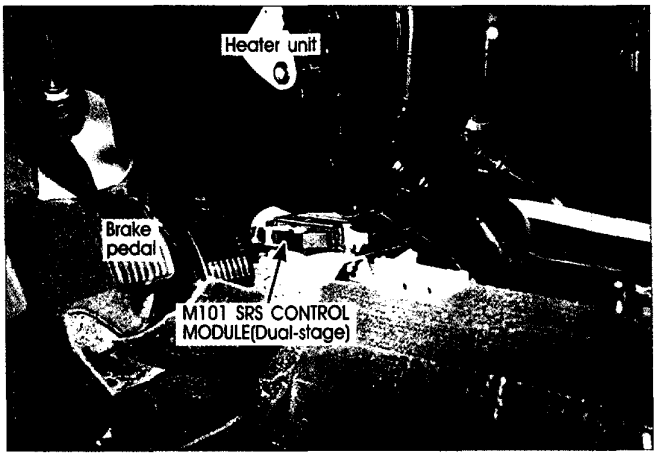
M85,M86,M87,M88 E3DD0A1U



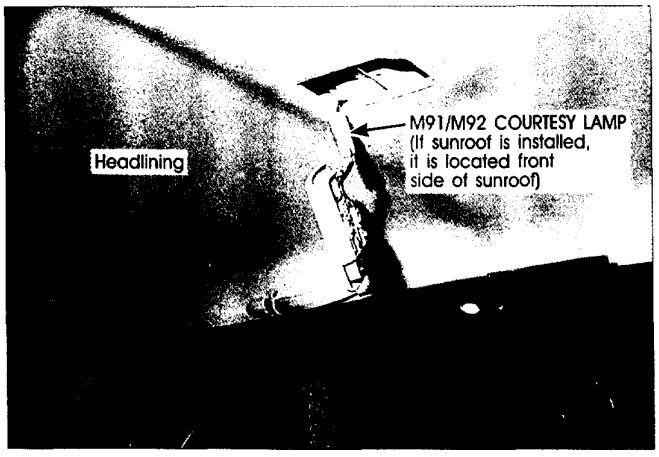
M95,M96 E3DD0A1X



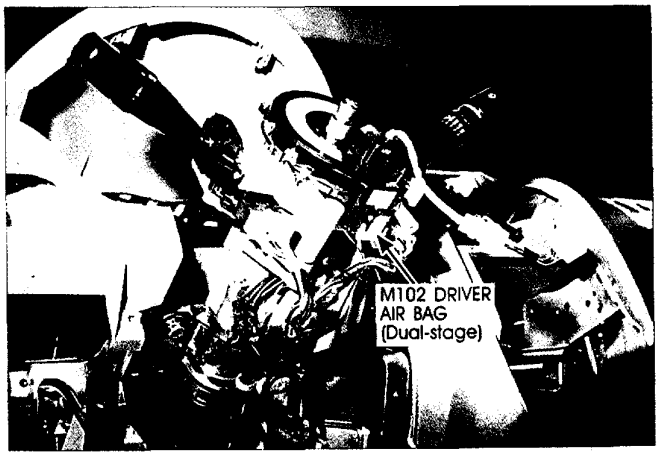
M89,M90,M97,M98 E3DD0A1V



M101 E3DD0A1Y

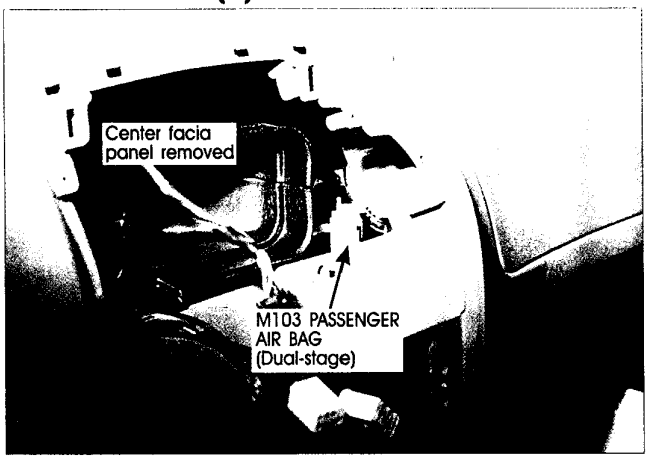


M91,M92 E3DD0A1W

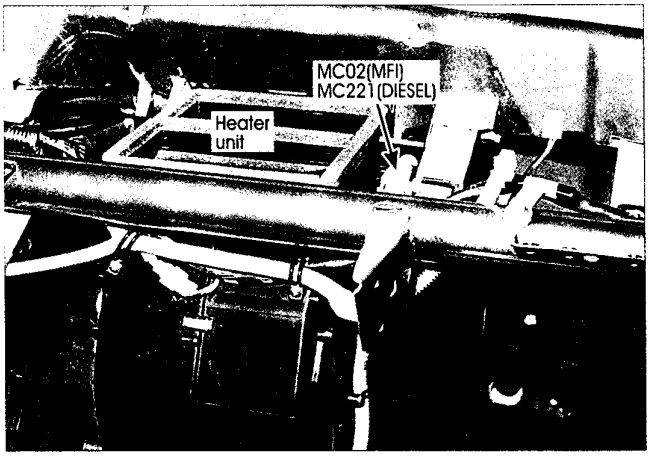


M102 E3DD0A1Z

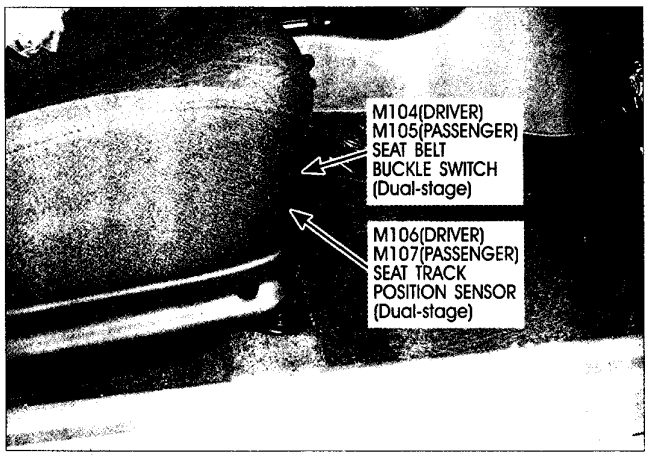
MAIN HARNESS(9)



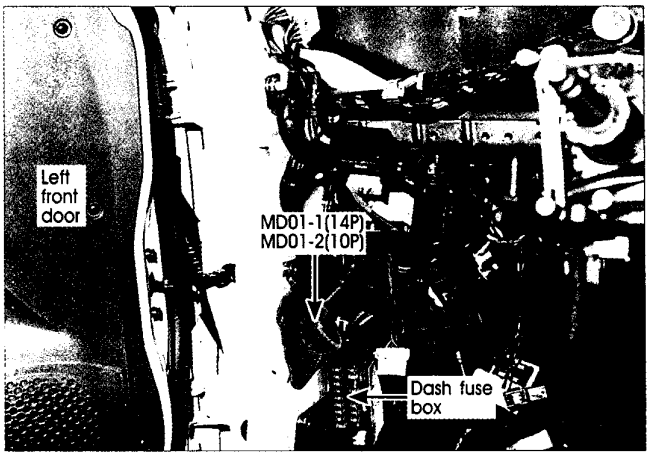
M103 E3DD0B1A



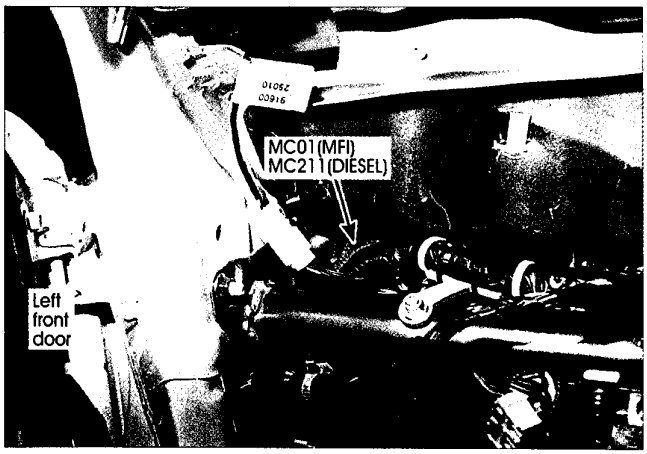
MC02,MC221 E3DD0B1D



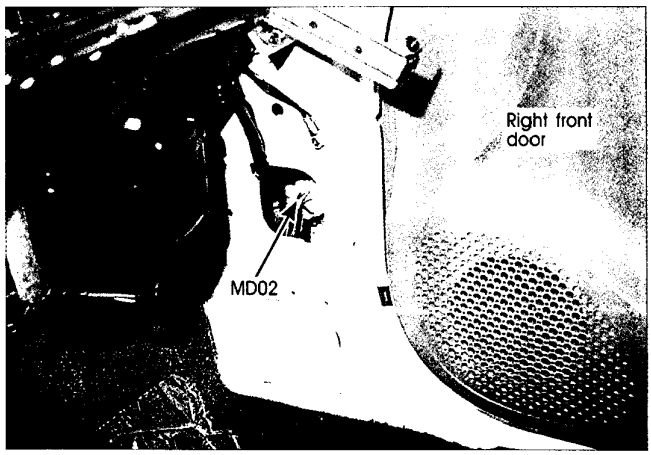
M104,M105,M106,M107 E3DD0B1B



MD01-1,MD01-2 E3DD0B1E

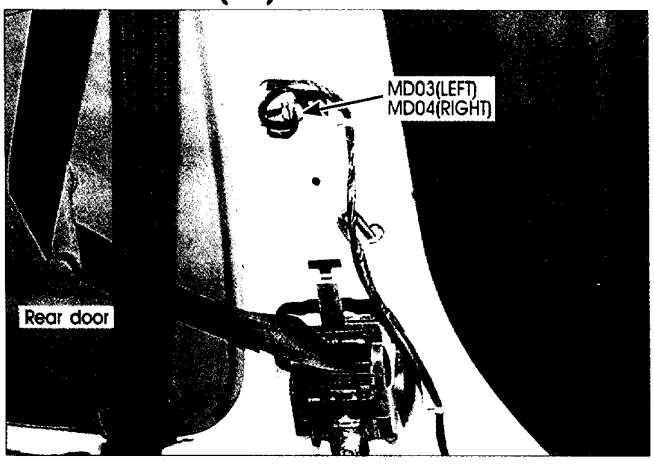


MC01,MC211 E3DD0B1C

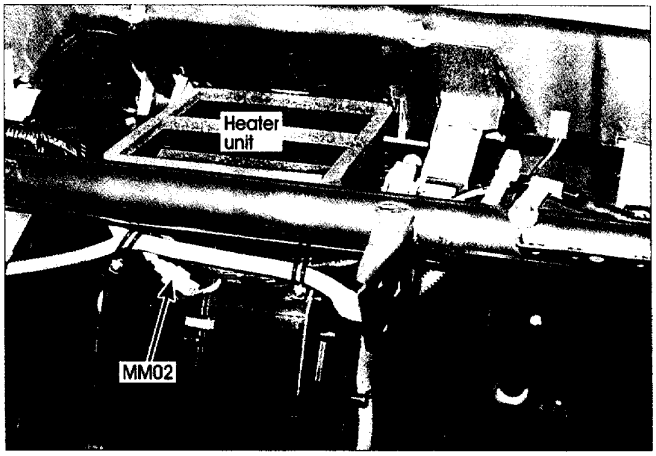


MD02 E3DD0B1F

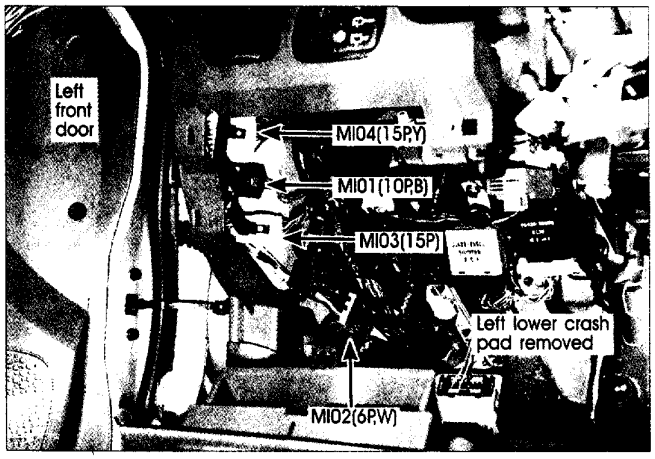
MAIN HARNESS(10)



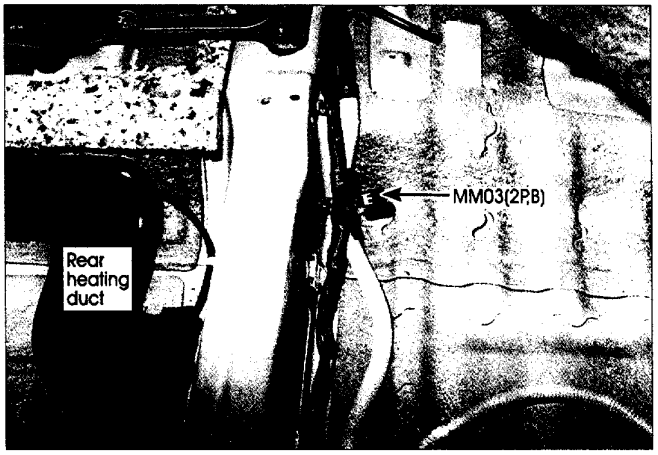
MD03,MD04 E3DD0B1G



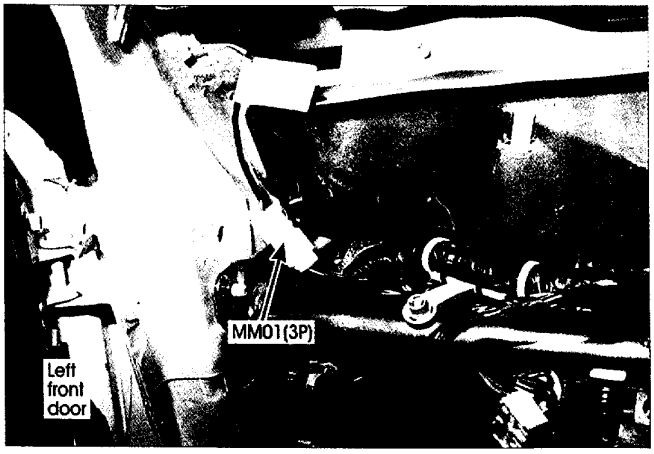
MM02 E3DD0B1K



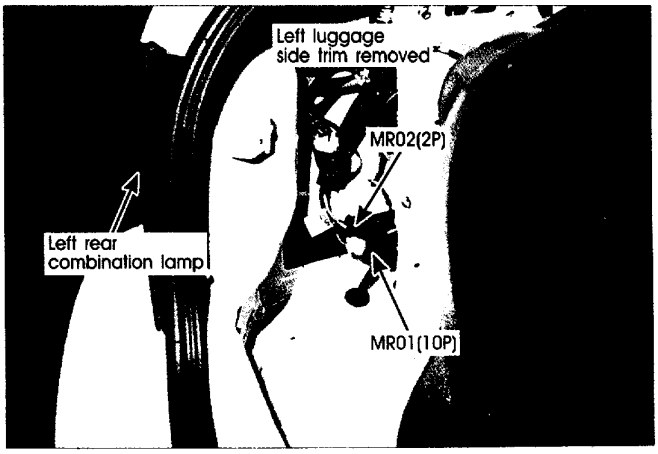
MI01,MI02,MI03,MI04 E3DD0B1H



MM03 E3DD0B1L



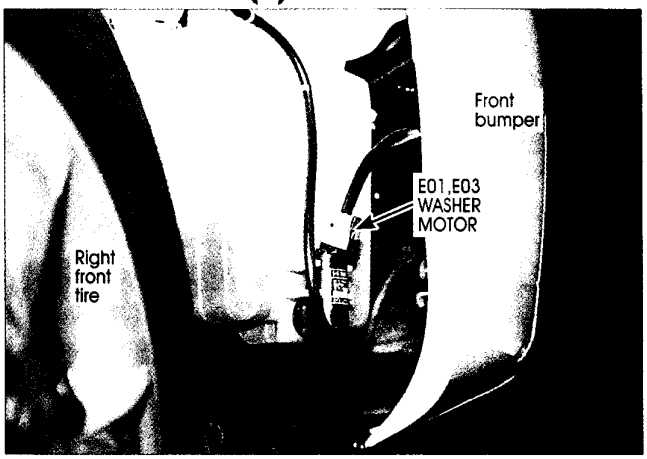
MM01 E3DD0B1J



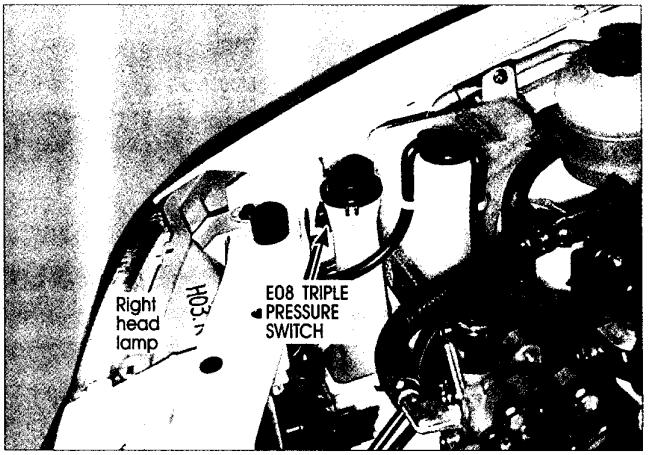
MR01,MR02 E3DD0B1M

ENGINE HARNESS

ENGINE HARNESS(1)



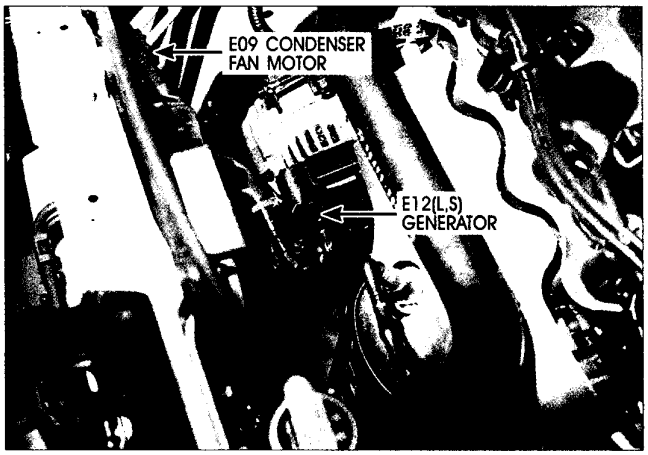
E01,E03 E3DD002A



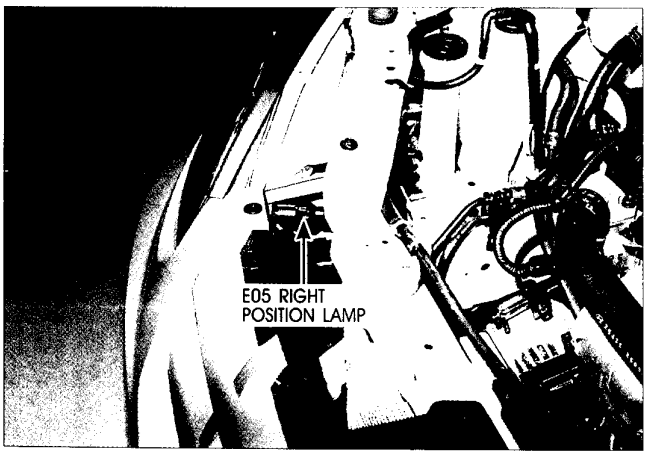
E08 E3DD002D



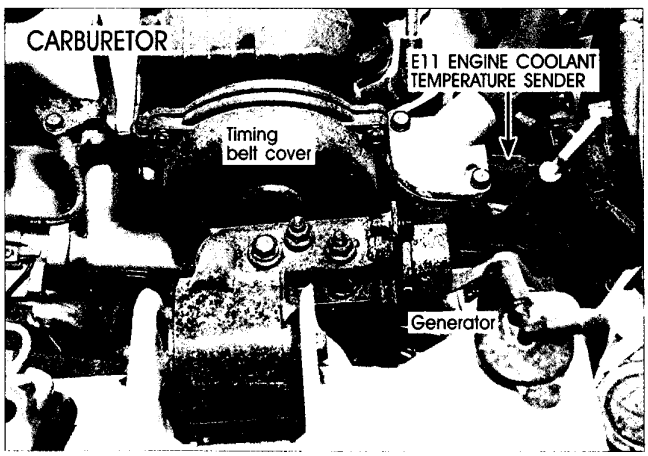
E04,E06,E07 E3DD002B



E09,E12 E3DD002E

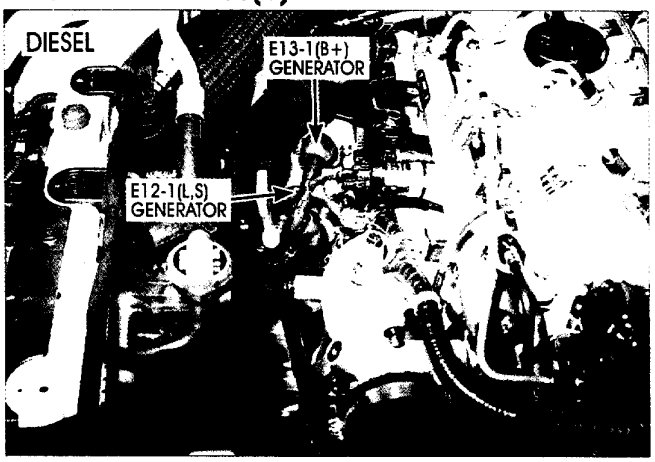


E05 E3DD002C

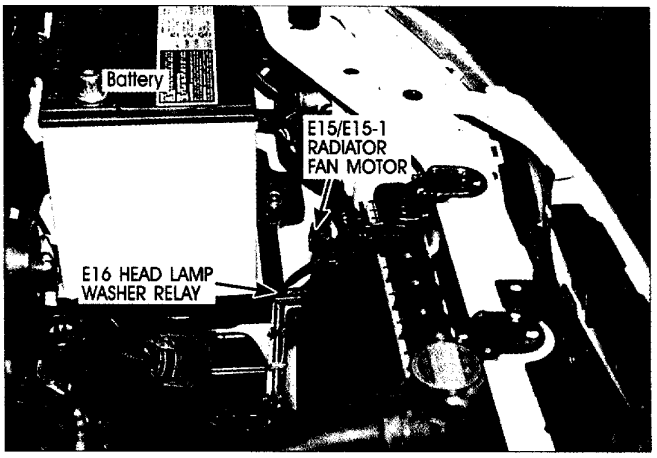


E11 E3DD002F

ENGINE HARNESS(2)



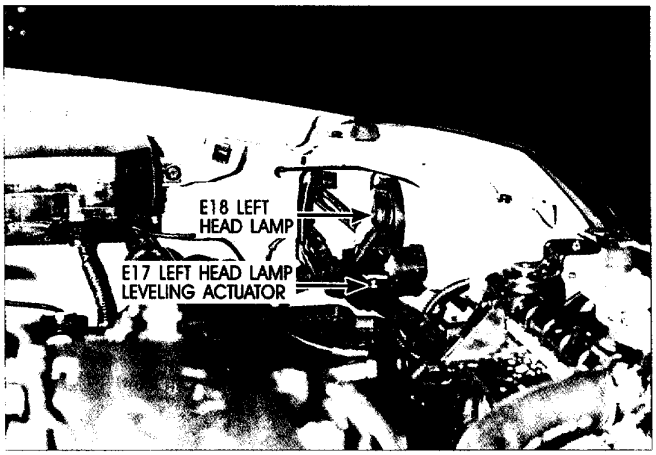
E12-1,E13-1 E3DD002G



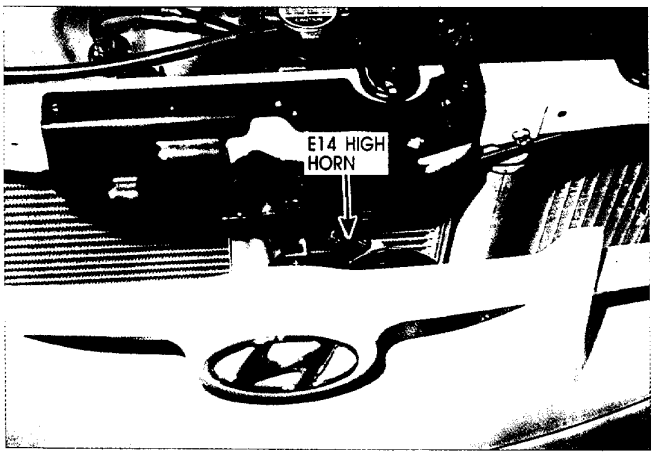
E15,E15-1,E16 E3DD002K



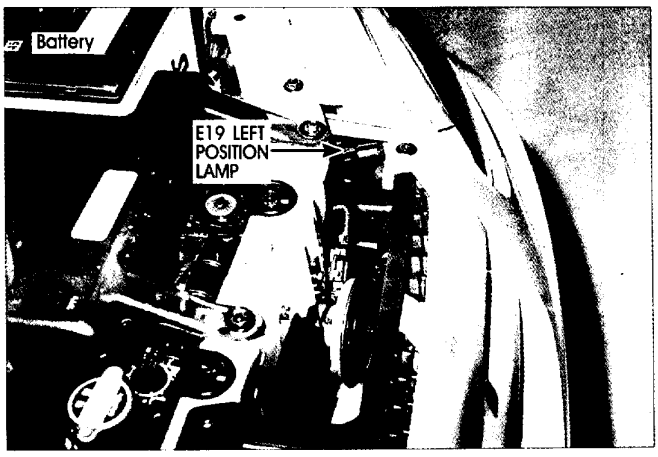
E13 E3DD002H



E17,E18 E3DD002L

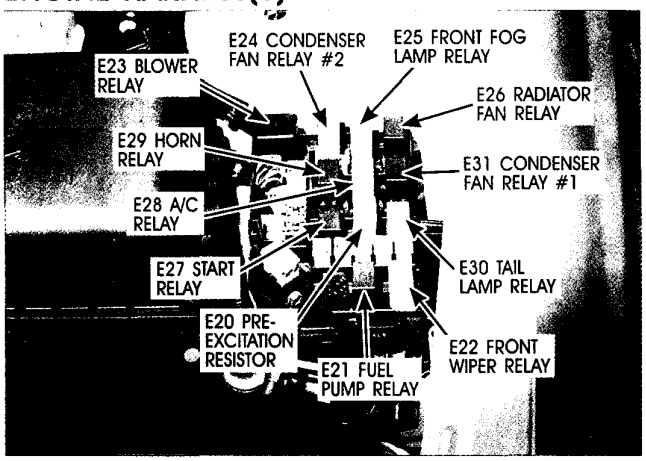


E14 E3DD002J

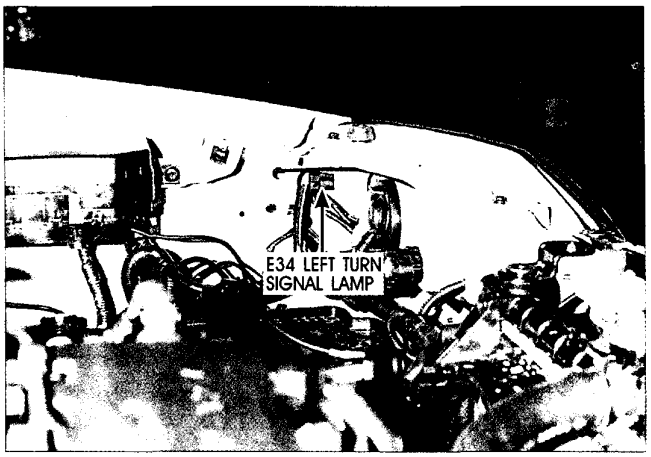


E19 E3DD002M

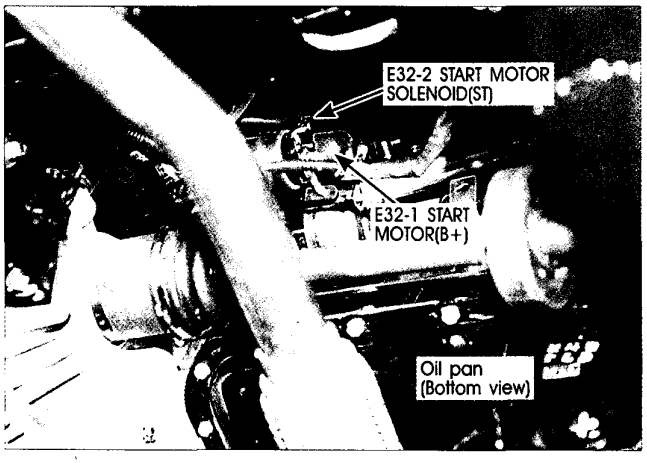
ENGINE HARNESS(3)



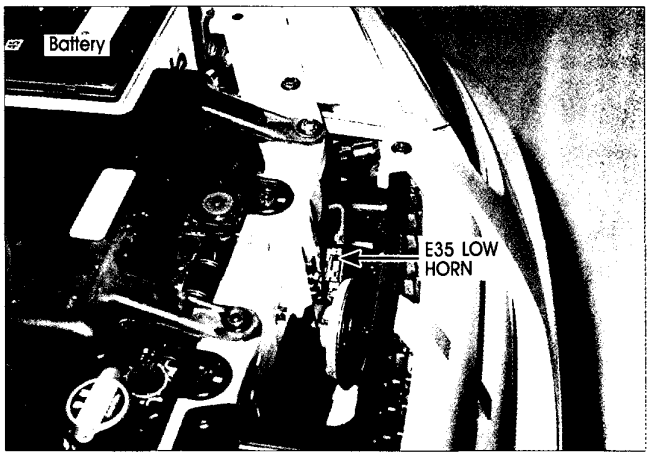
E20,E21,E22,E23,E24,E25 E26,E27,E28,E29,E30,E31 E3DD002N



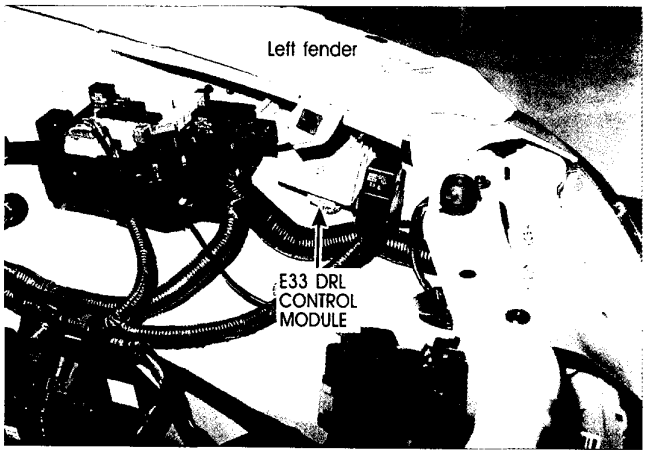
E34 E3DD002R



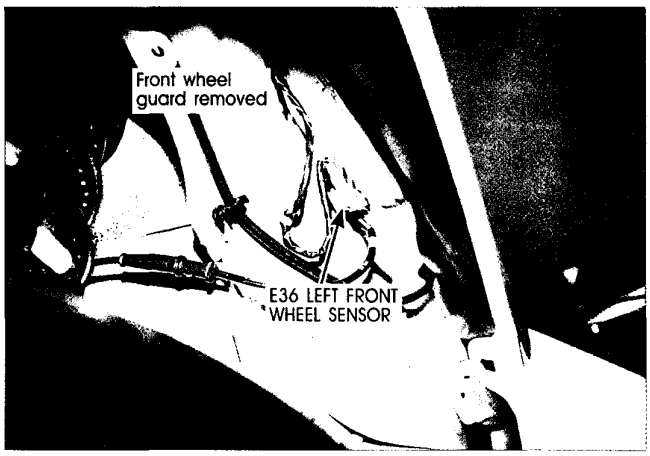
E32-1,E32-2 E3DD002P



E35 E3DD002S

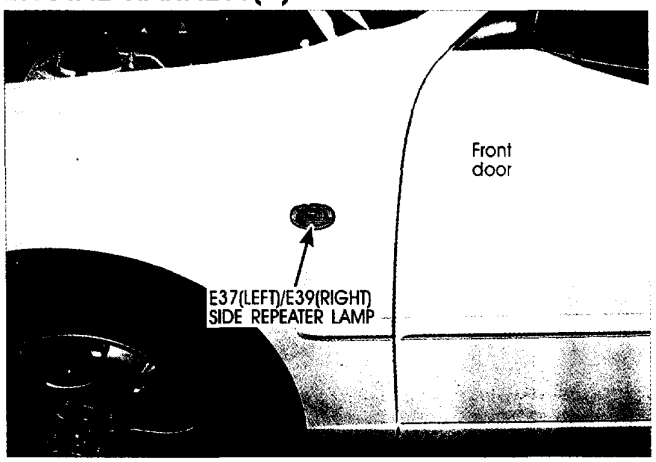


E33 E3DD002Q

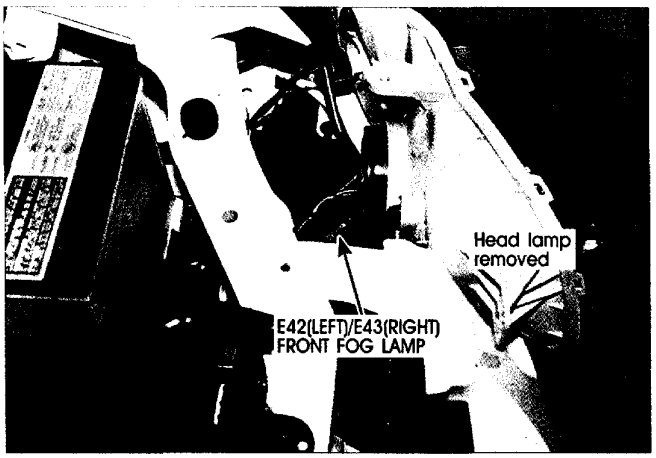


E36 E3DD002T

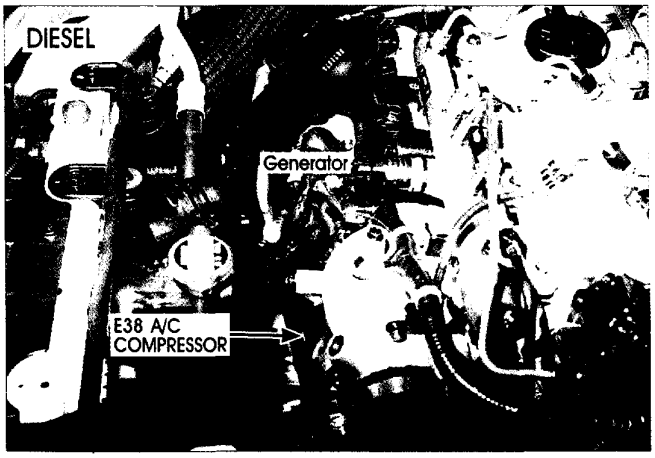
ENGINE HARNESS(4)



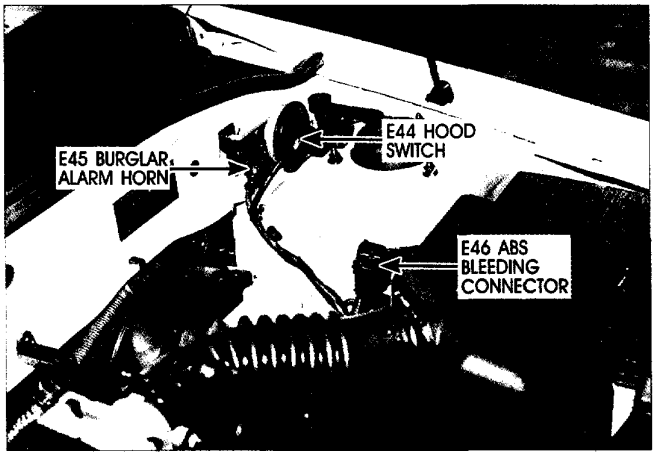
E37,E39 E3DD002U



E42,E43 E3DD002X



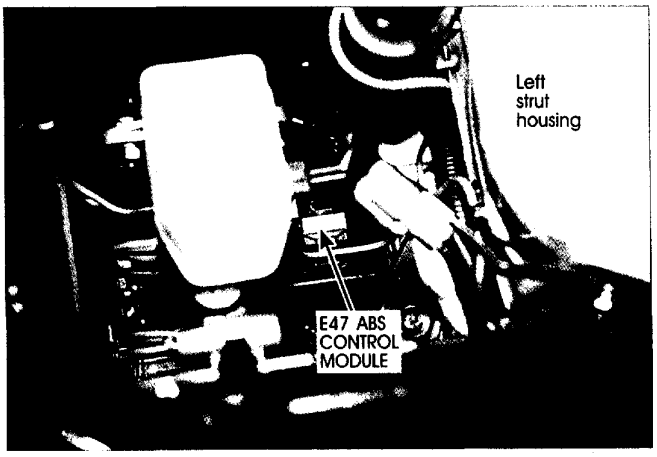
E38 E3DD002V



E44,E45,E46 E3DD002Y

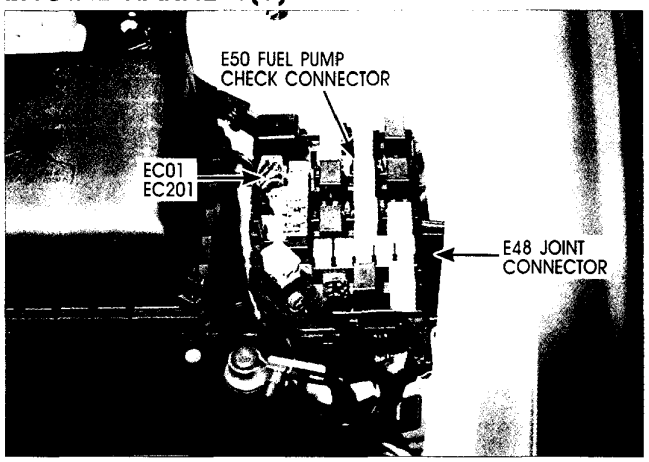


E40 E3DD002W

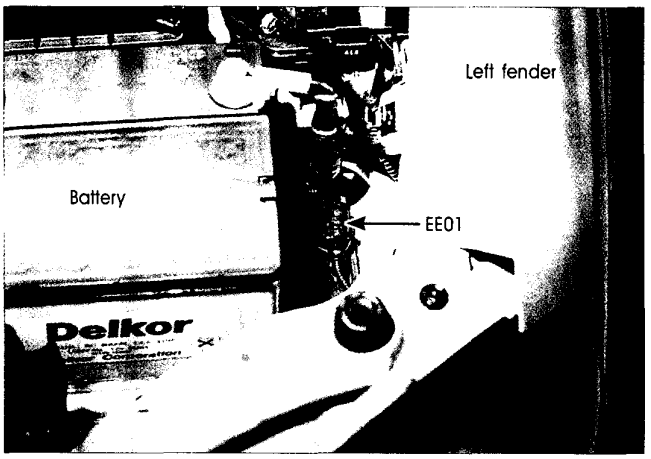


E47 E3DD002Z

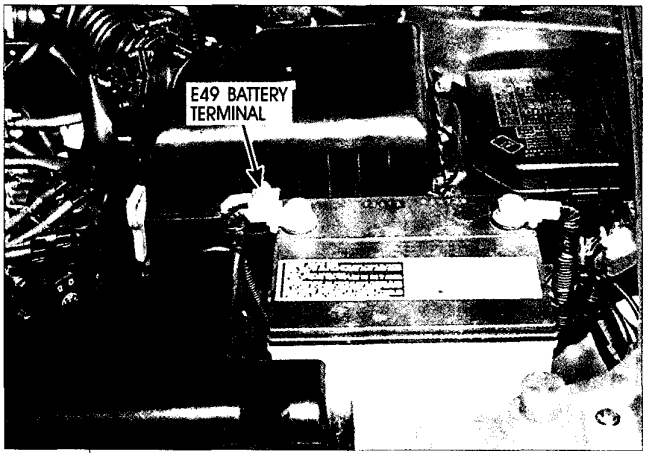
ENGINE HARNESS(5)



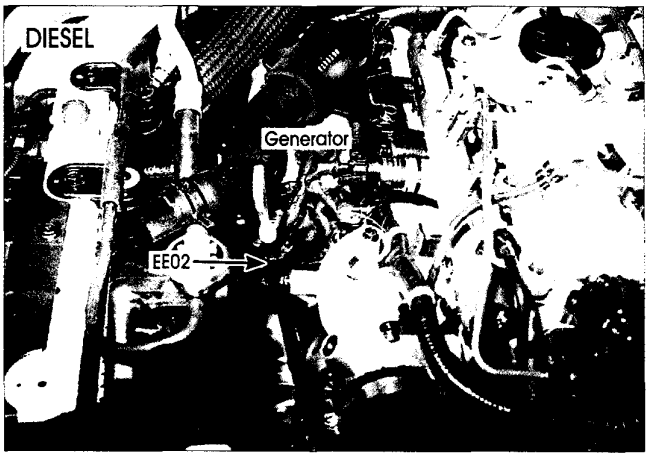
E48,E50,EC01,EC201 E3DD0A2A



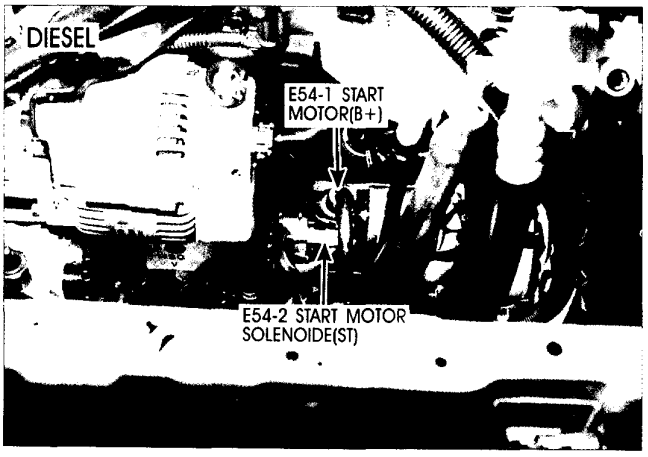
EE01 E3DD0A2D



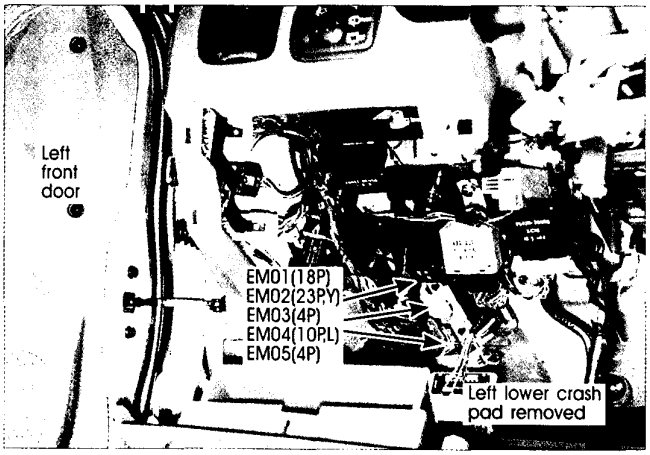
E49 E3DD0A2B



EE02 E3DD0A2E



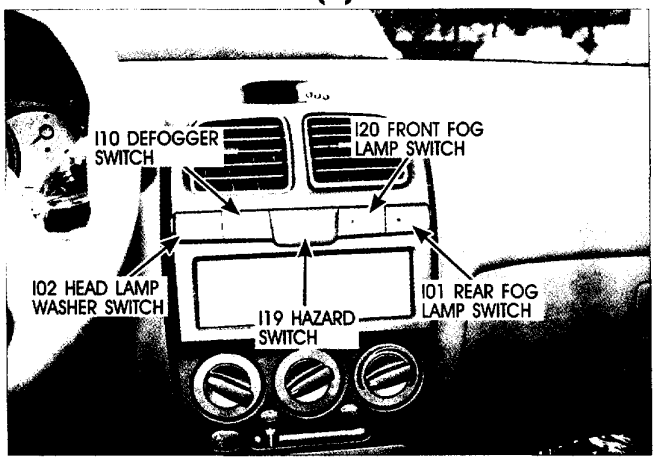
E54-1,E54-2 E3DD0A2C



EM01,EM02,EM03,EM04,EM05 E3DD0A2F

INSTRUMENT HARNESS

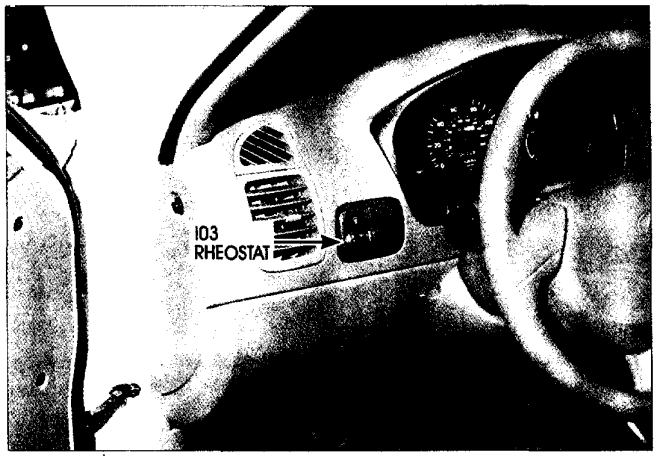
INSTRUMENT HARNESS(1)



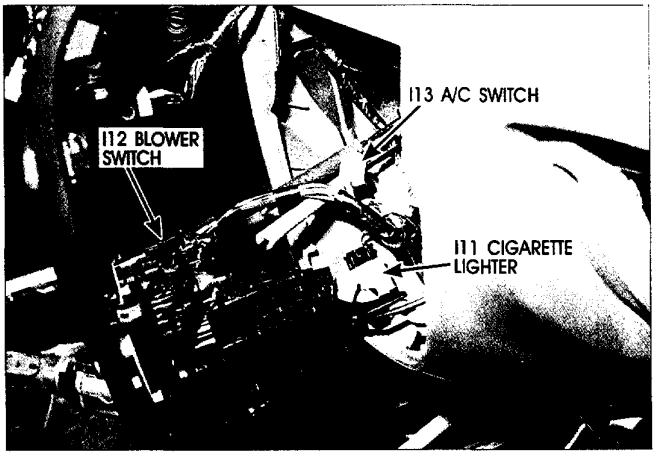
I01,I02,I10,I19,I20 E3DD003A



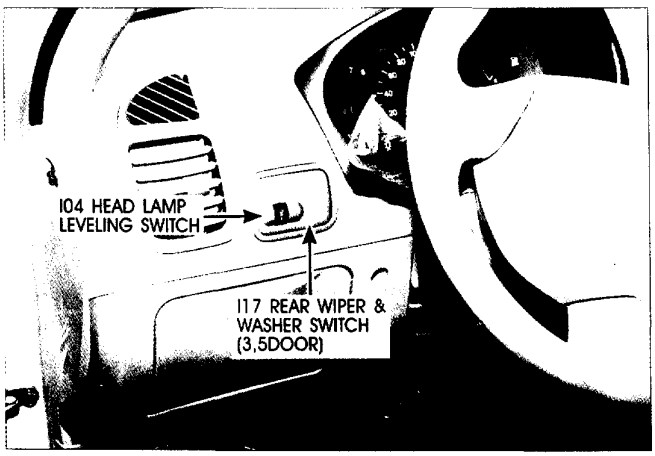
I06-1,I06-2,I16,I18 E3DD003D



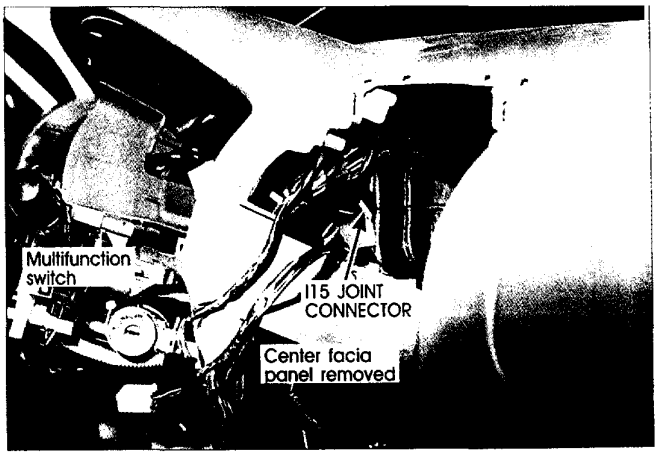
I03 E3DD003B



I11,I12,I13 E3DD003E



I04,I17 E3DD003C



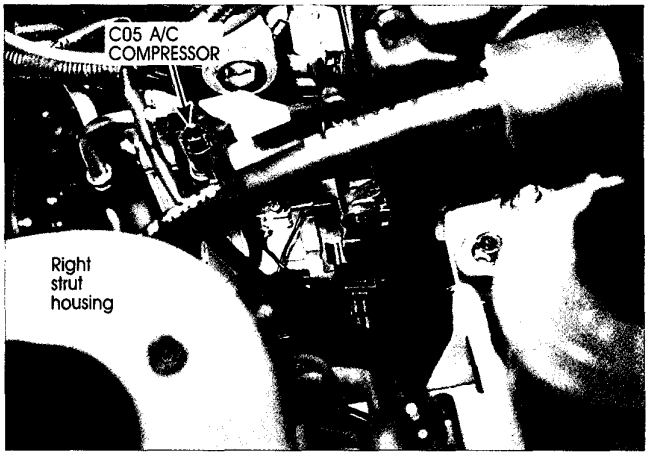
I15 E3DD003F

CONTROL HARNESS

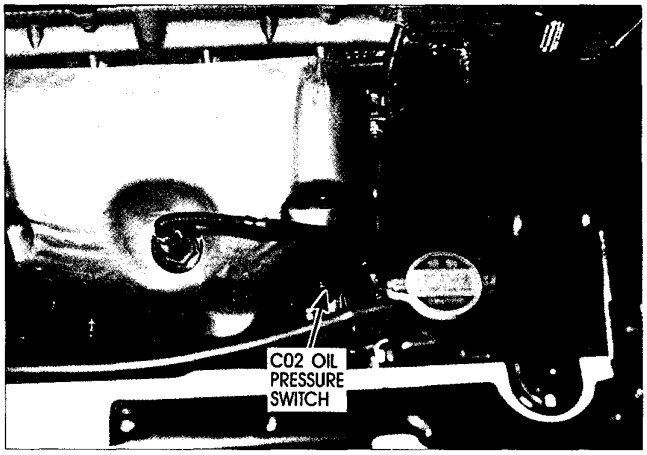
CONTROL HARNESS(1)



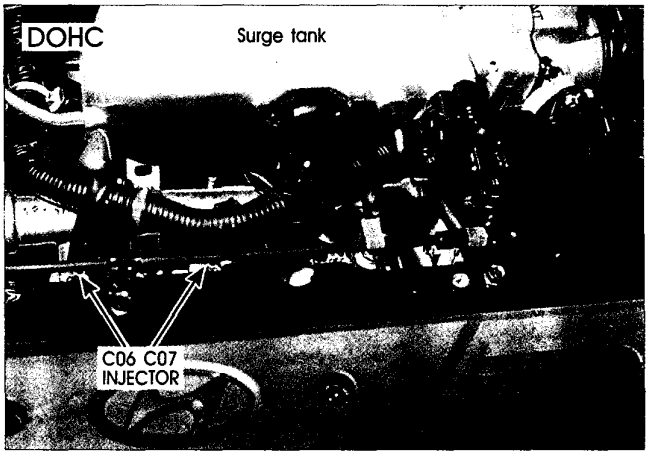
C01 E3DD004A



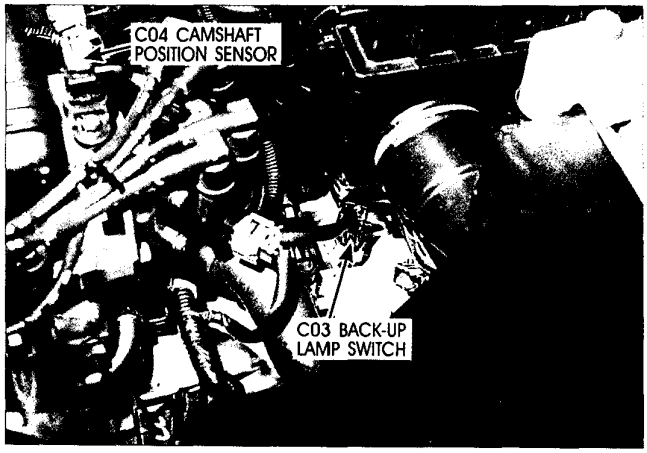
C05 E3DD004D



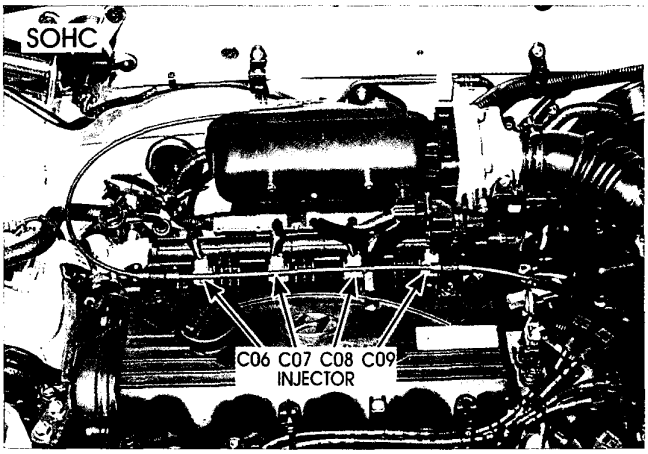
C02 E3DD004B



C06,C07 E3DD004E

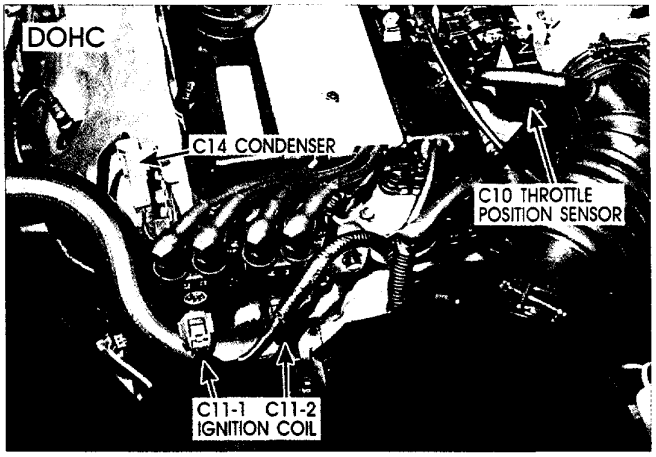


C03,C04 E3DD004C

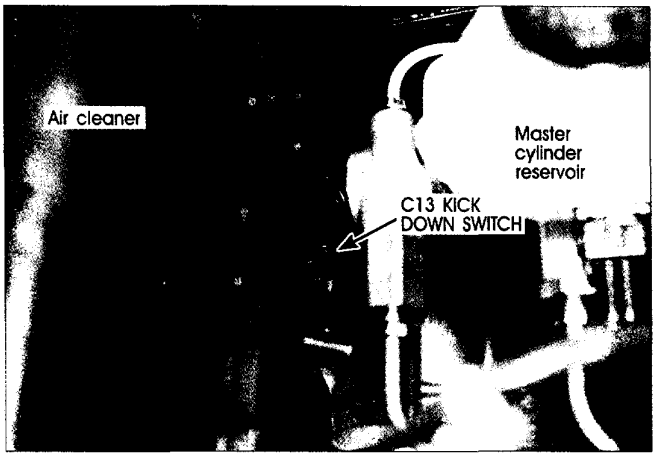


C06,C07,C08,C09 E3DD004F

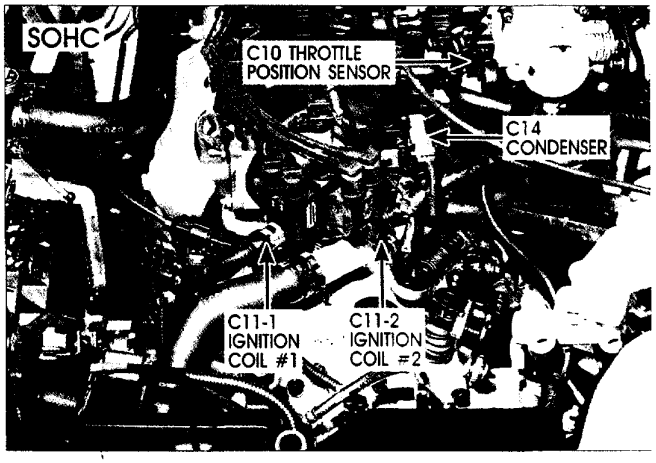
CONTROL HARNESS(2)



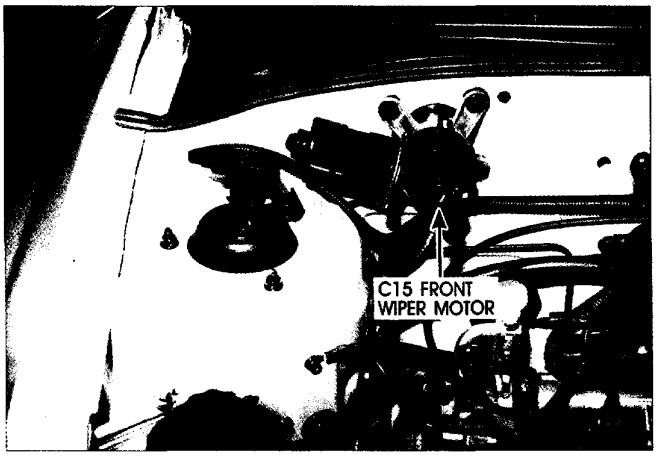
C10,C11-1,C11-2,C14 E3DD004G



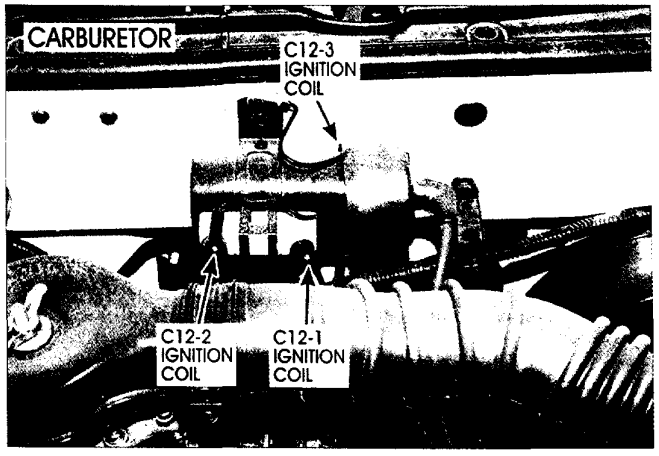
C13 E3DD004K



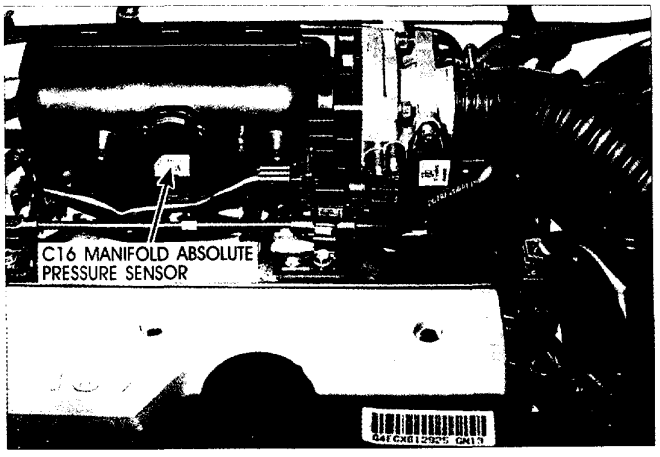
C10,C11-1,C11-2,C14 E3DD004H



C15 E3DD004L

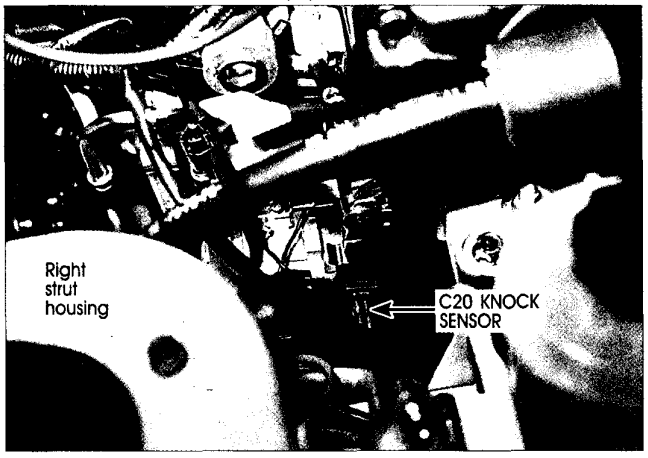


C12-1,C12-2,C12-3 E3DD004J

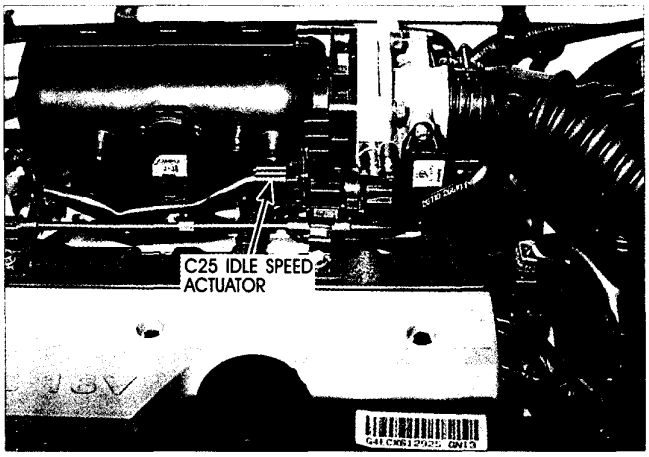


C16 E3DD004M

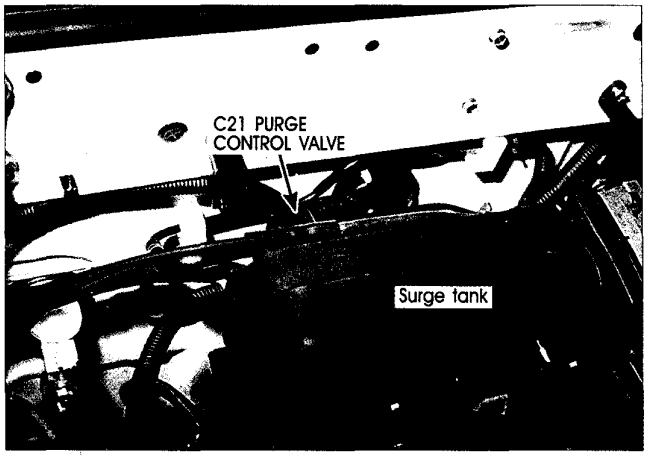
CONTROL HARNESS(3)



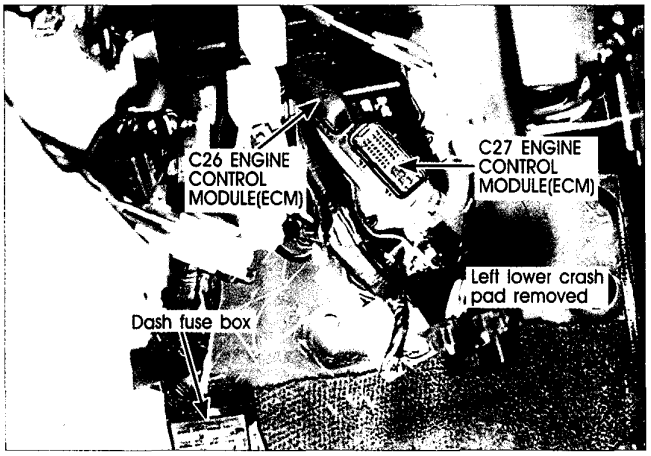
C20 E3DD004N



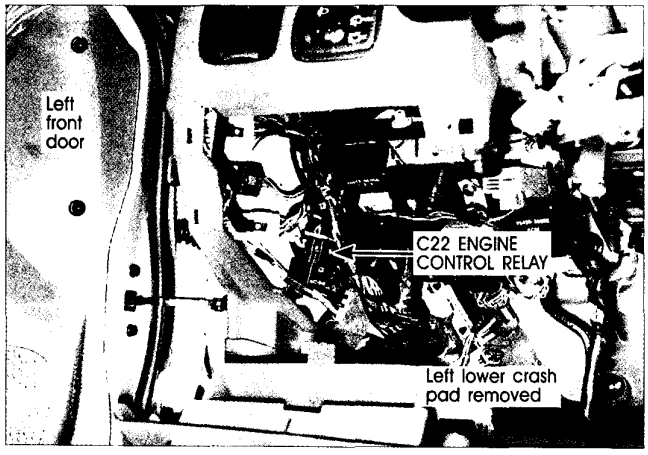
C25 E3DD004R



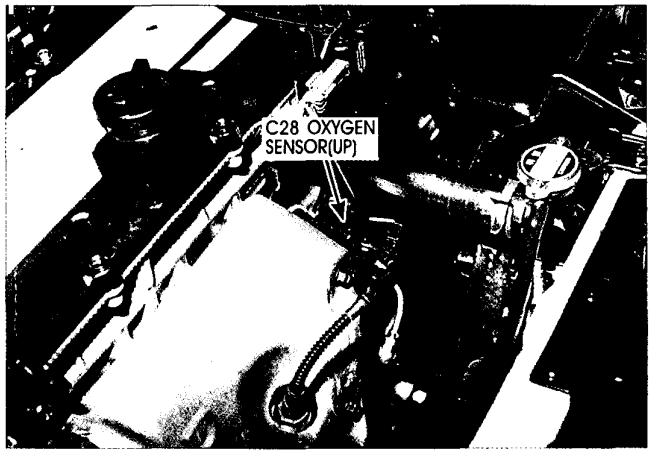
C21 E3DD004P



C26,C27 E3DD004S

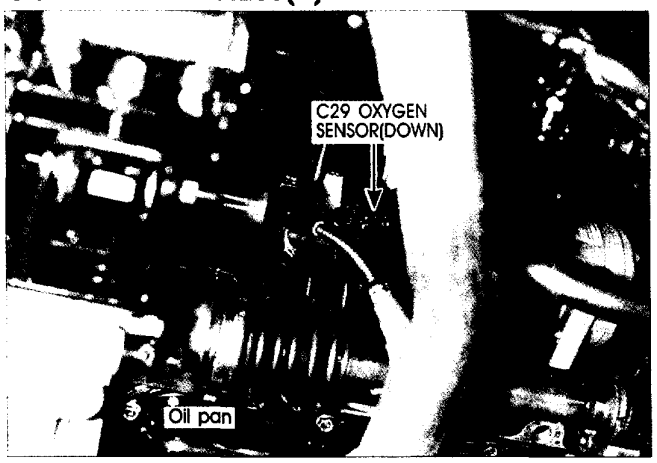


C22 E3DD004Q

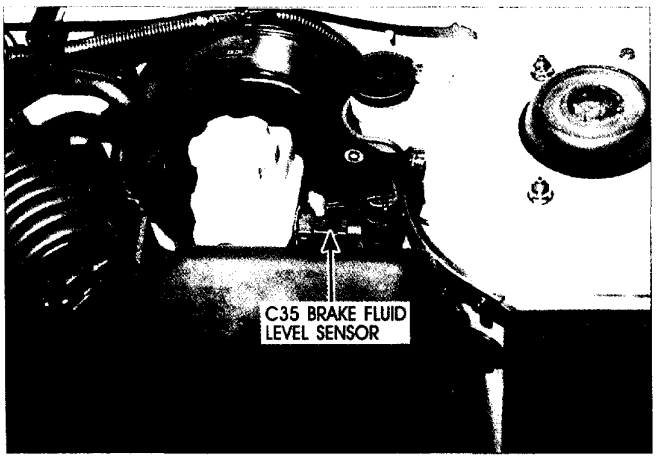


C28 E3DD004T

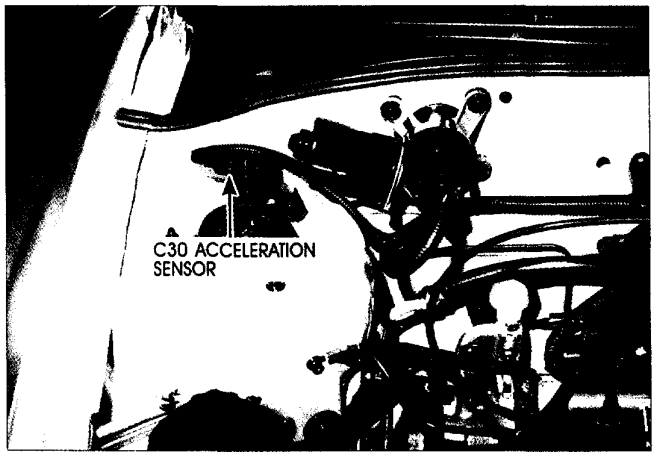
CONTROL HARNESS(4)



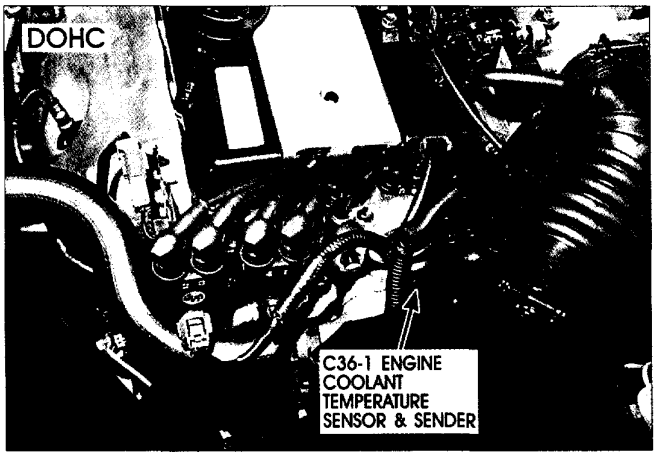
C29 E3DD004U



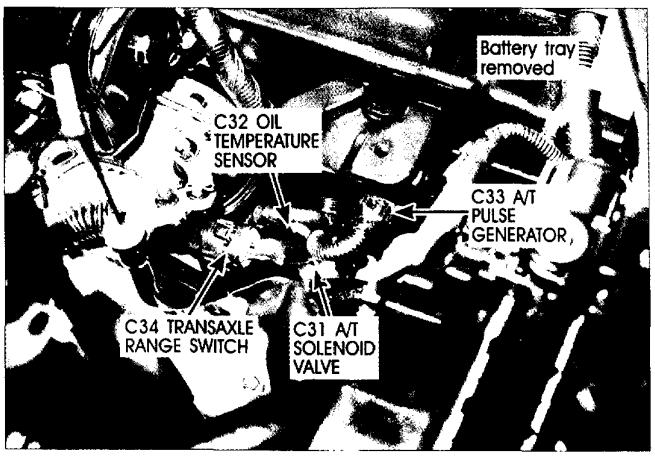
C35 E3DD004X



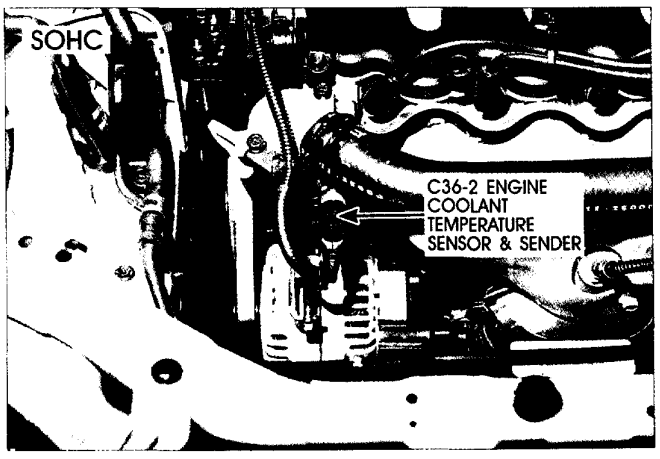
C30 E3DD004V



C36-1 E3DD004Y

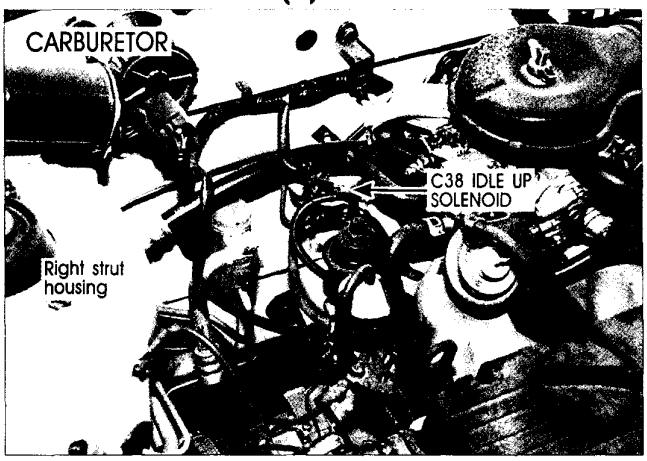


C31,C32,C33,C34 E3DD004W

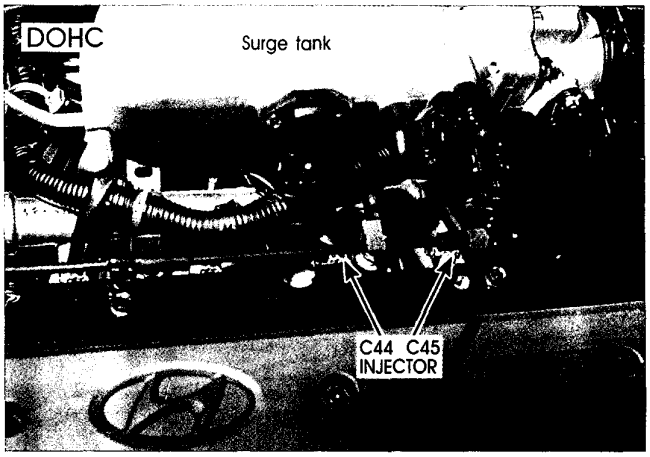


C36-2 E3DD004Z

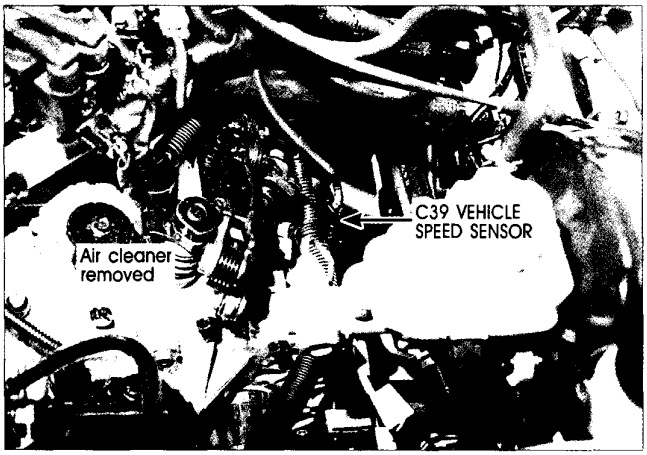
CONTROL HARNESS(5)



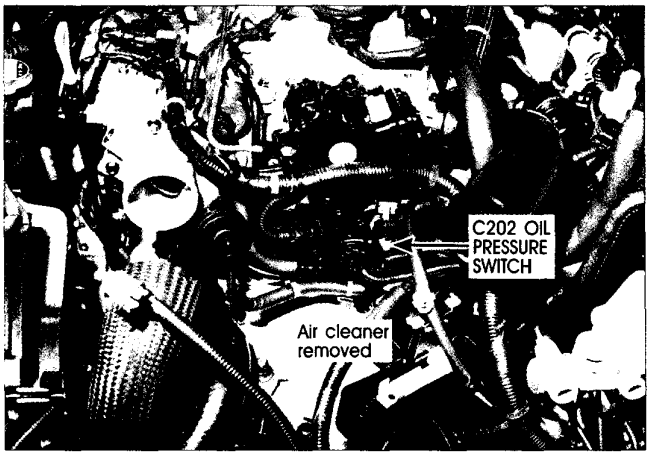
C38 E3DD0A4A



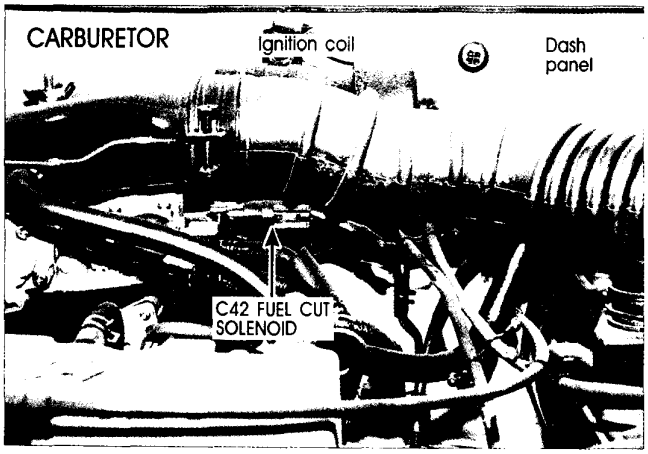
C44,C45 E3DD0A4D



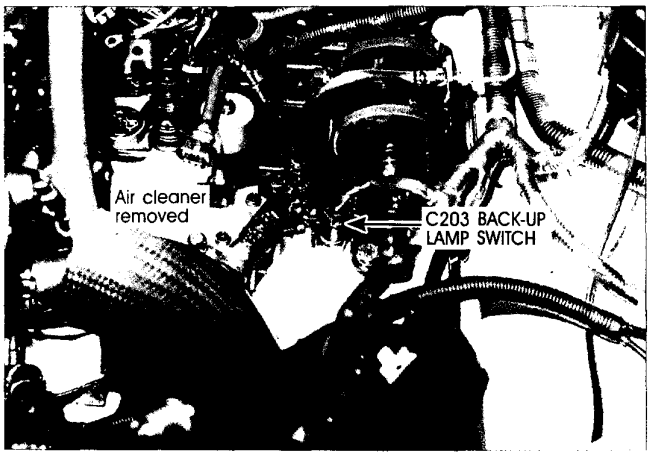
C39 E3DD0A4B



C202 E3DD0A4E

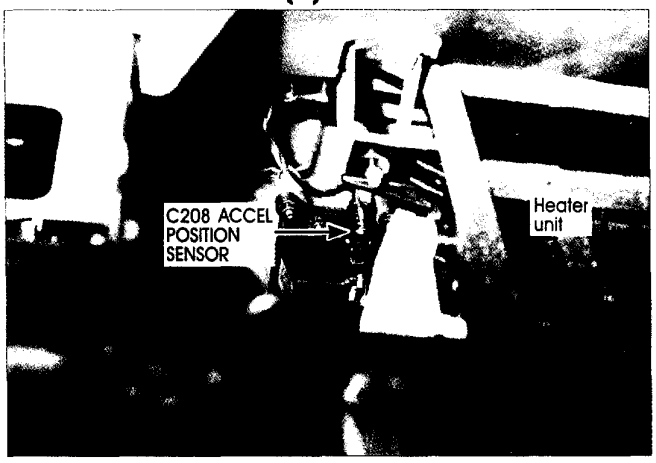


C42 E3DD0A4C

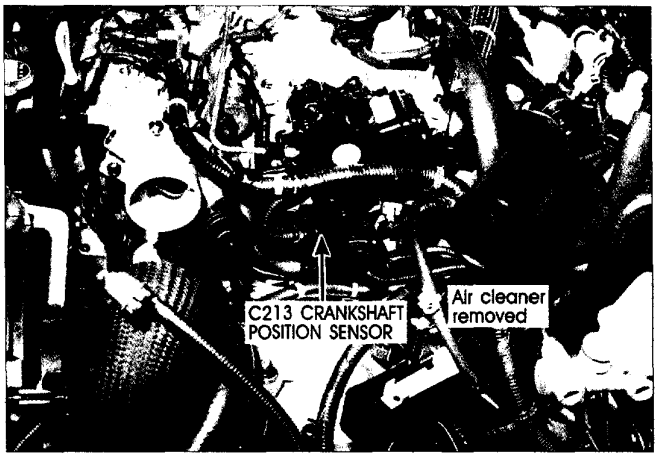


C203 E3DD0A4F

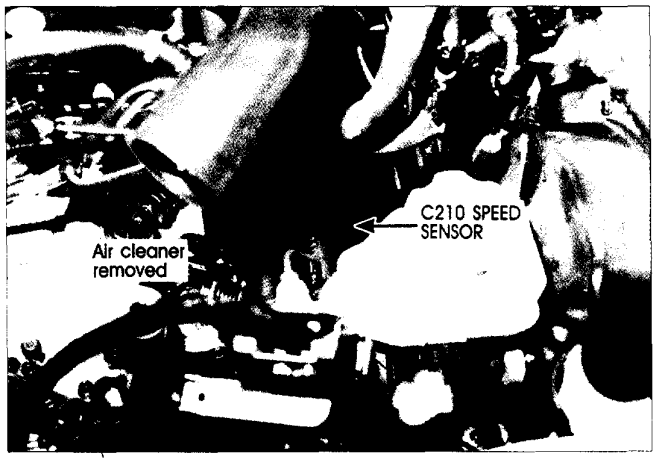
CONTROL HARNESS(6)



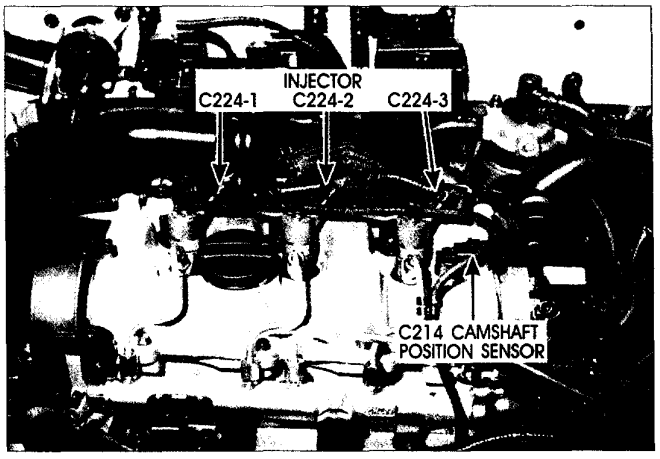
C208 E3DD0A4G



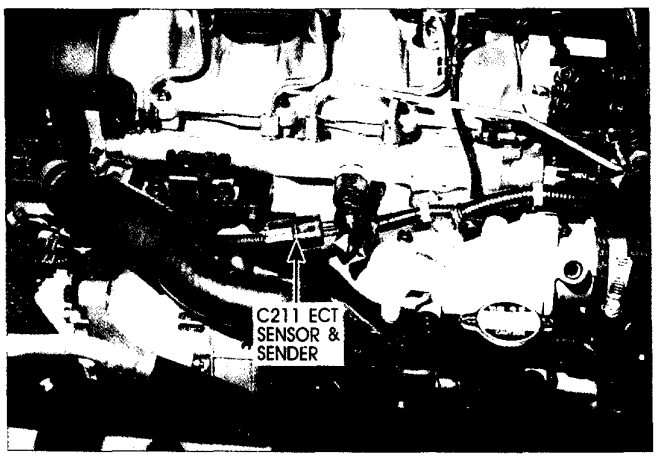
C213 E3DD0A4K



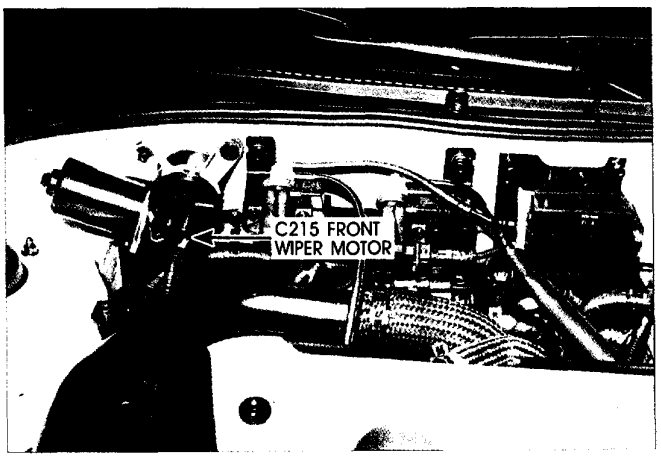
C210 E3DD0A4H



C214,C224-1,C224-2,C224-3 E3DD0A4L

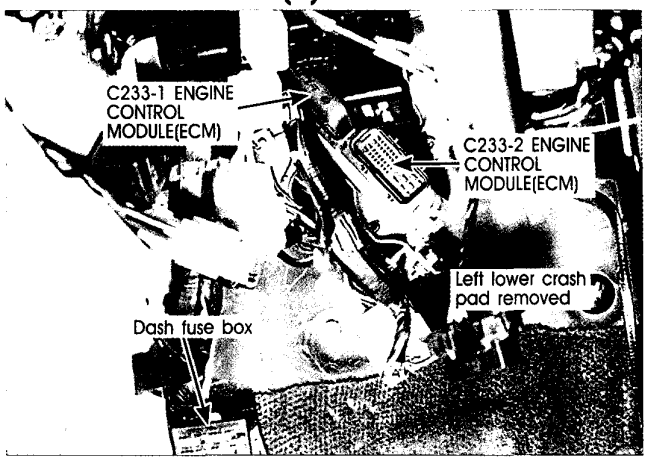


C211 E3DD0A4J

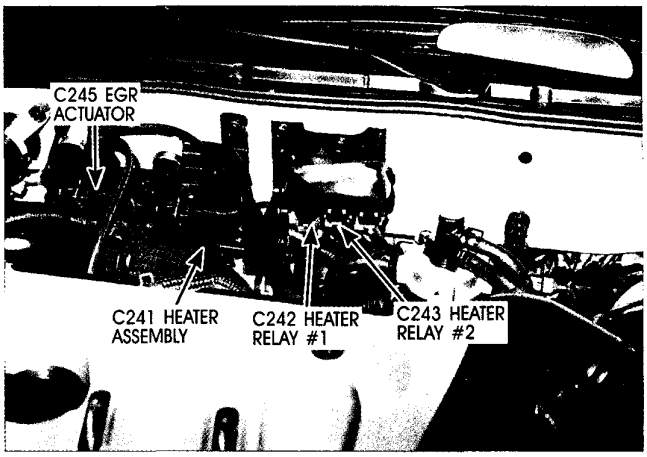


C215 E3DD0A4M

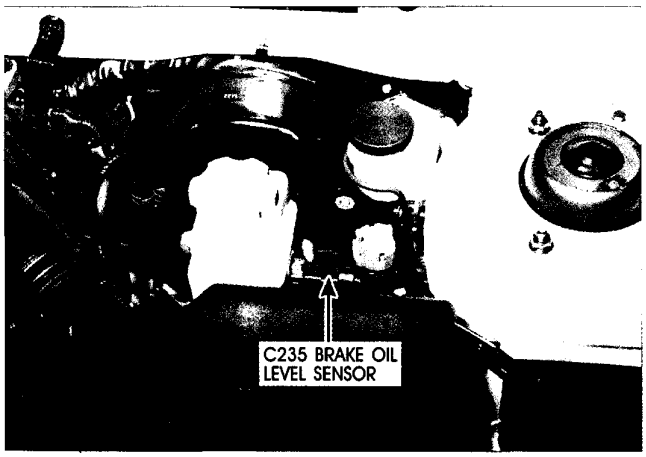
CONTROL HARNESS(7)



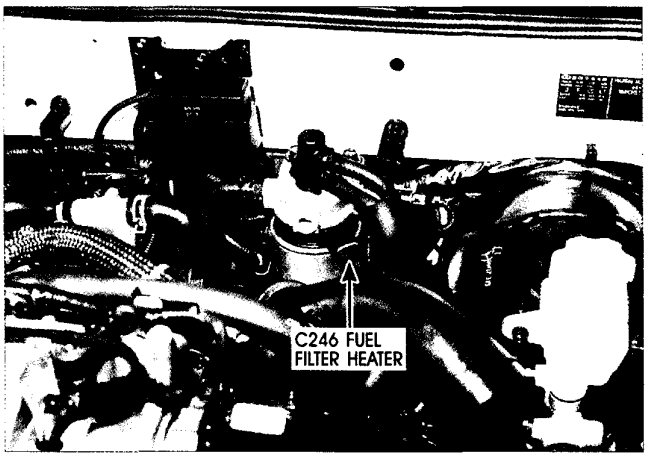
C233-1,C233-2 E3DD0A4N



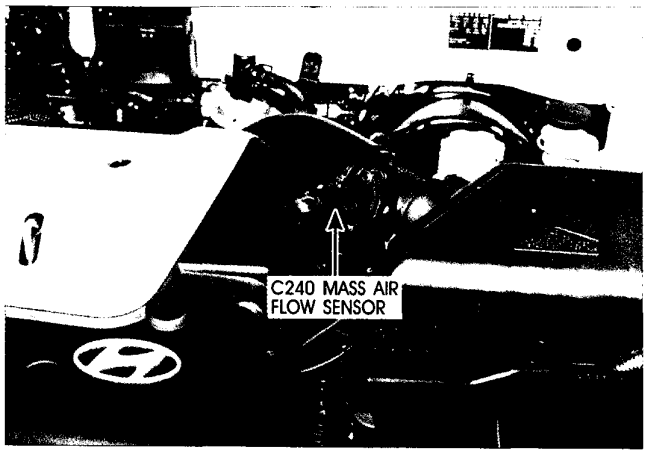
C241,C242,C243,C245 E3DD0A4R



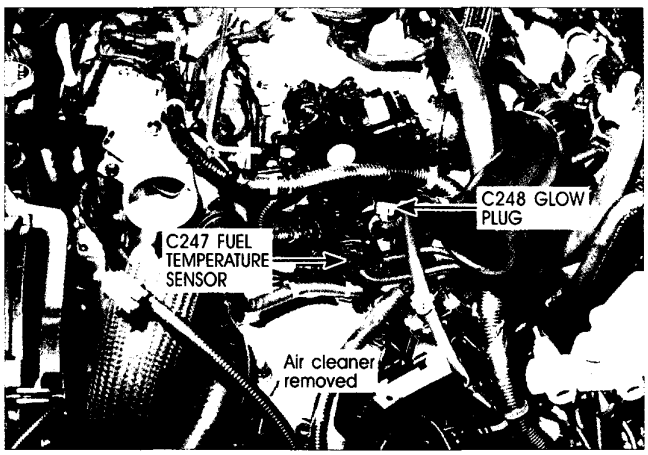
C235 E3DD0A4P



C246 E3DD0A4S

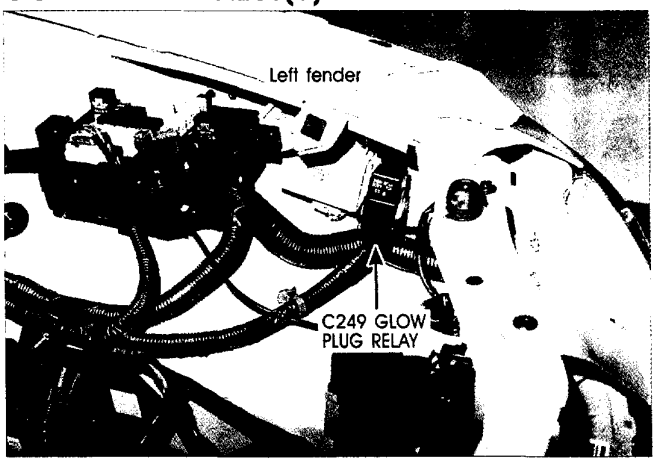


C240 E3DD0A4Q

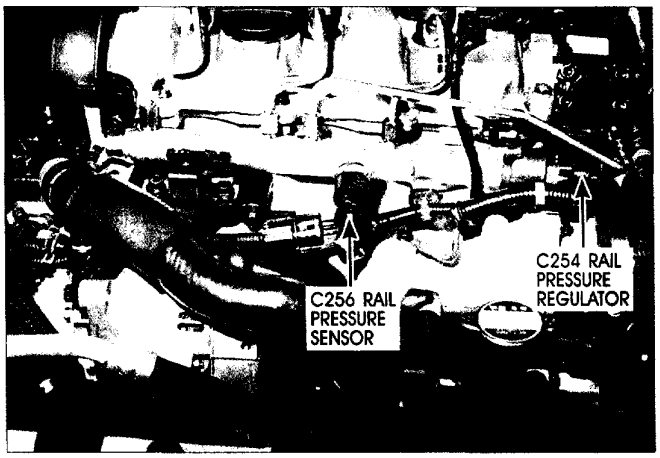


C247,C248 E3DD0A4T

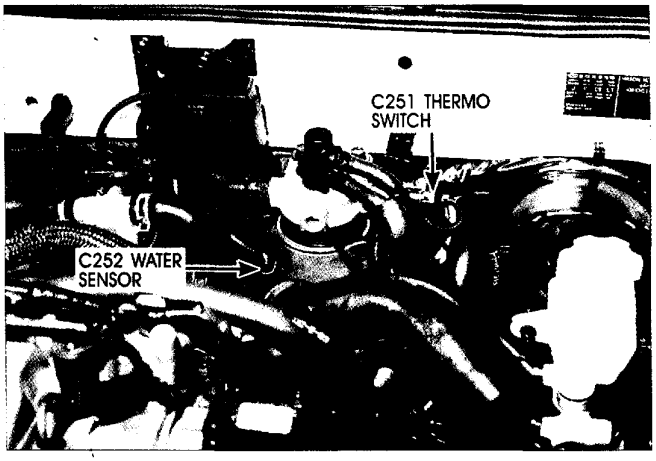
CONTROL HARNESS(8)



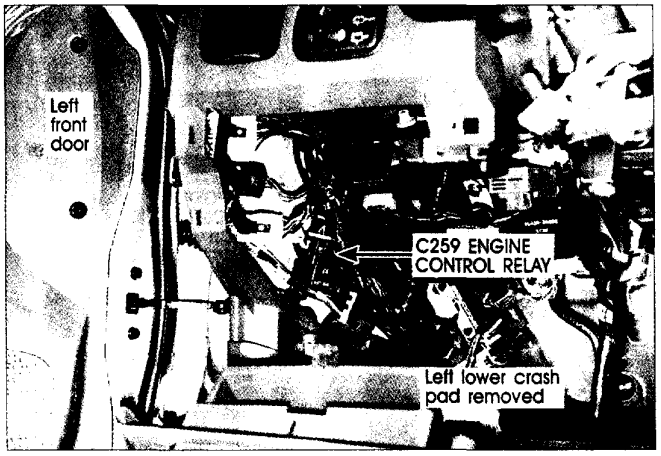
C249 E3DD0A4U



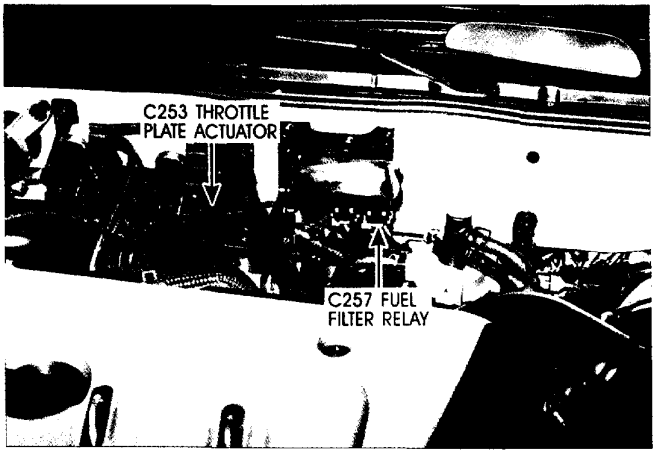
C254,C256 E3DD0A4X



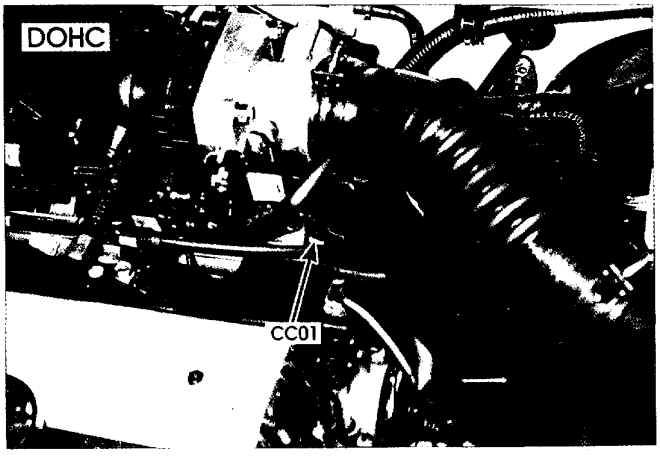
C251,C252 E3DD0A4V



C259 E3DD0A4Y



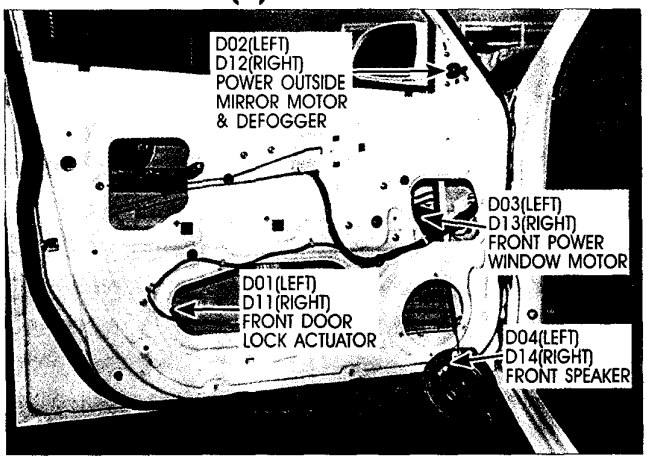
C253,C257 E3DD0A4W



CC01 E3DD0A4Z

DOOR HARNESS

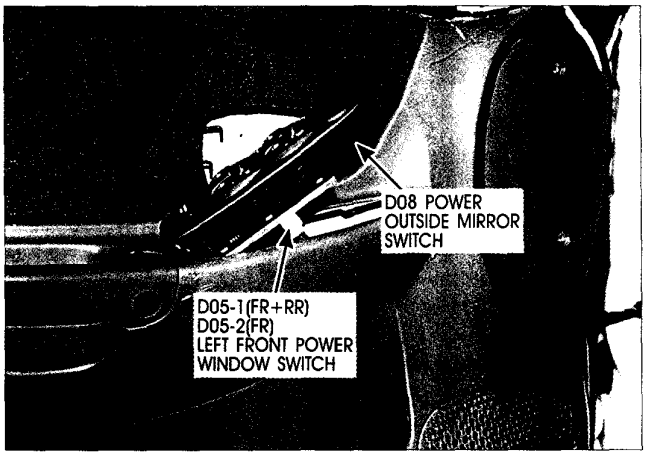
DOOR HARNESS(1)



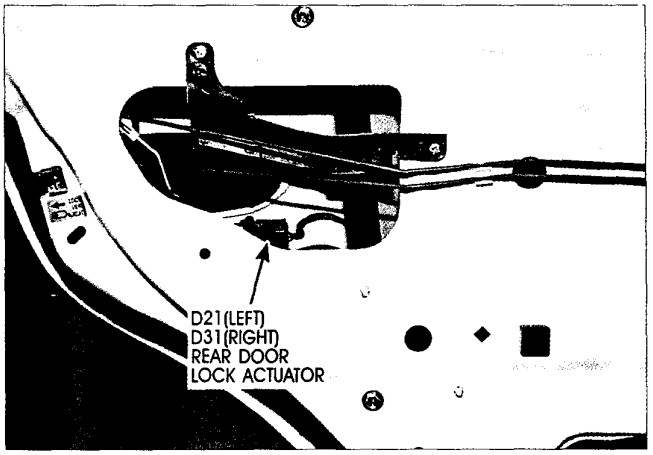
D01,D02,D03,D04,D11,D12,D13,D14 E3DD005A



D15 E3DD005D



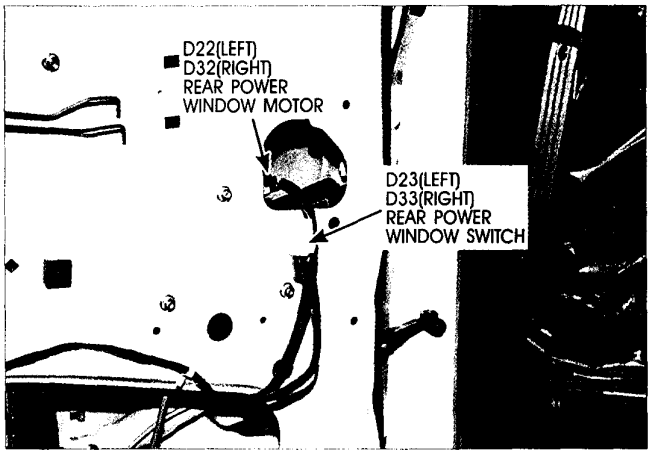
D05-1,D05-2,D08 E3DD005B



D21,D31 E3DD005E



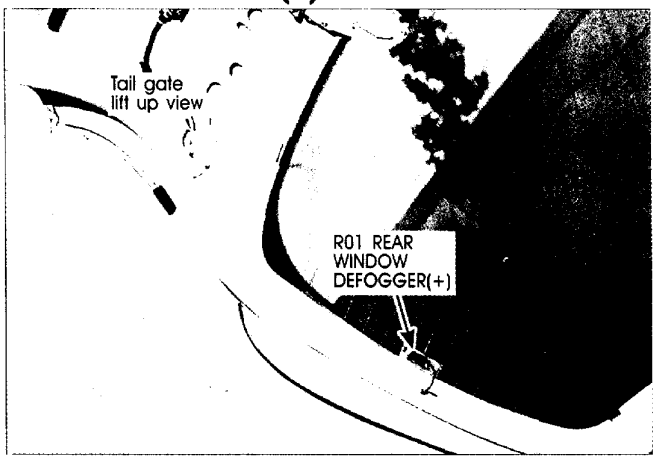
D07,D17 E3DD005C



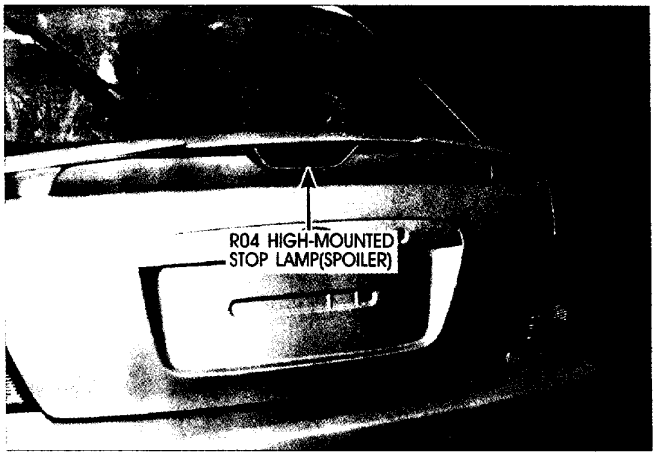
D22,D23,D32,D33 E3DD005F

TAIL GATE HARNESS

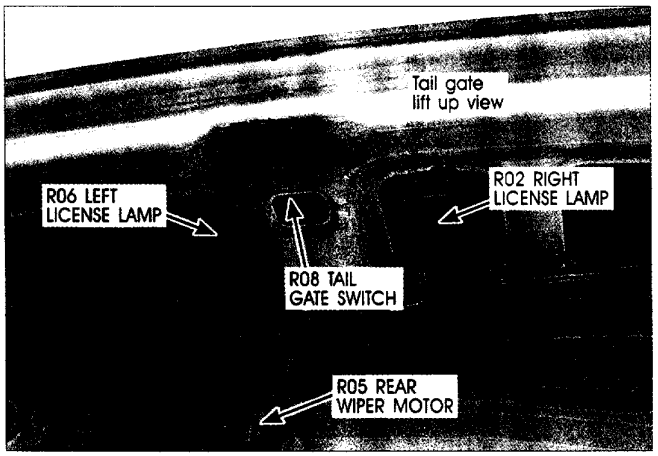
TAIL GATE HARNESS(1)



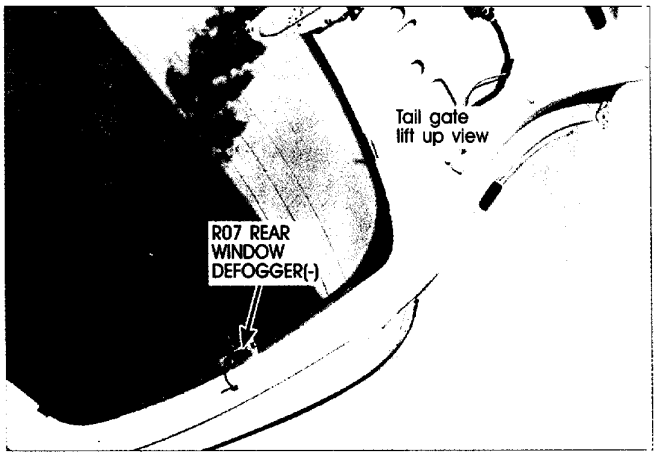
R01 E3DD006A



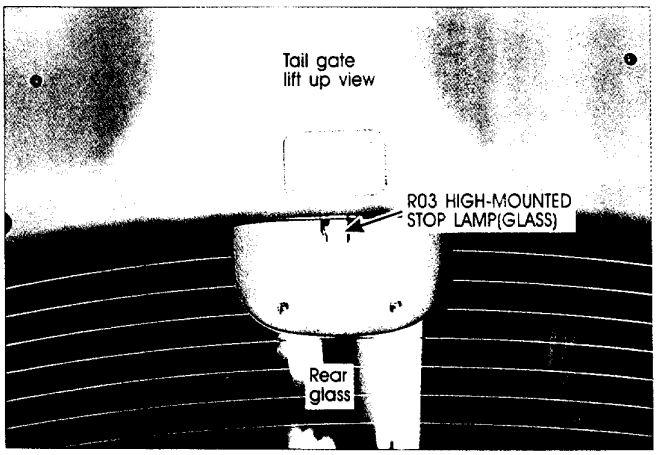
R04 E3DD006D



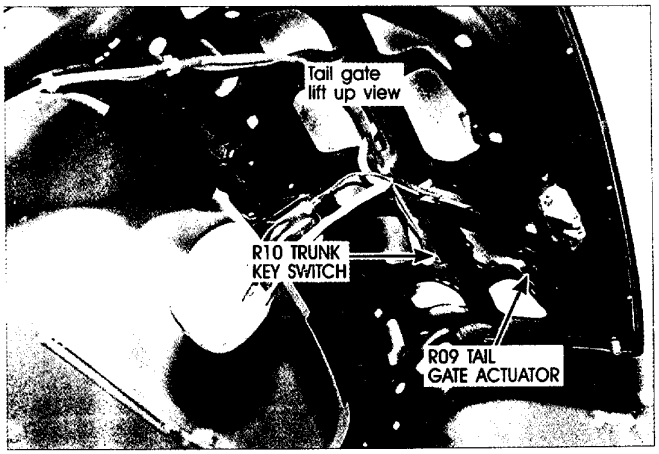
R02,R05,R06,R08 E3DD006B



R07 E3DD006E



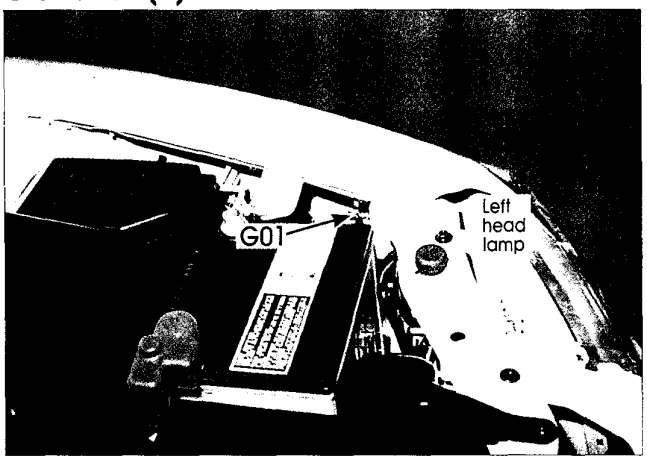
R03 E3DD006C



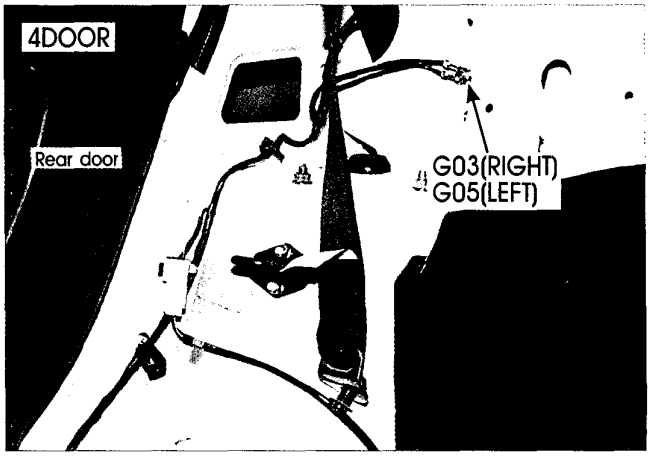
R09,R10 E3DD006F

GROUNDS

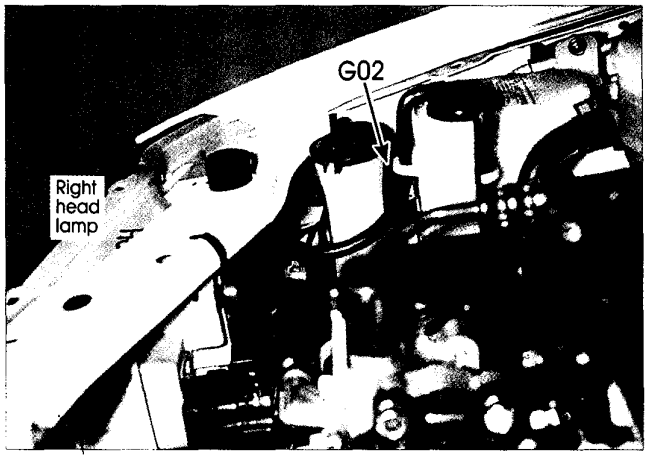
GROUNDS(1)



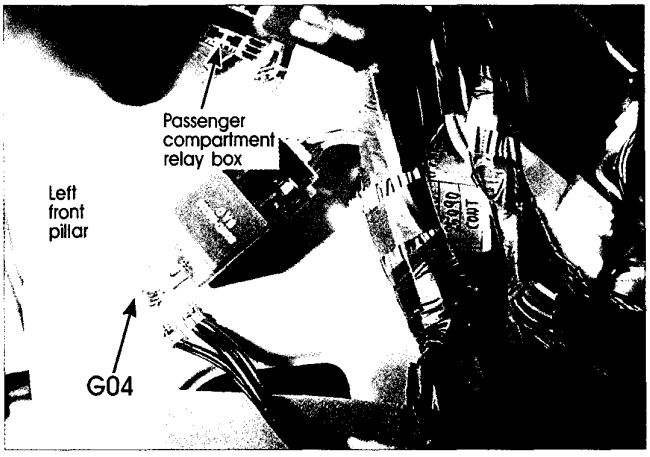
G01 E3DD007A



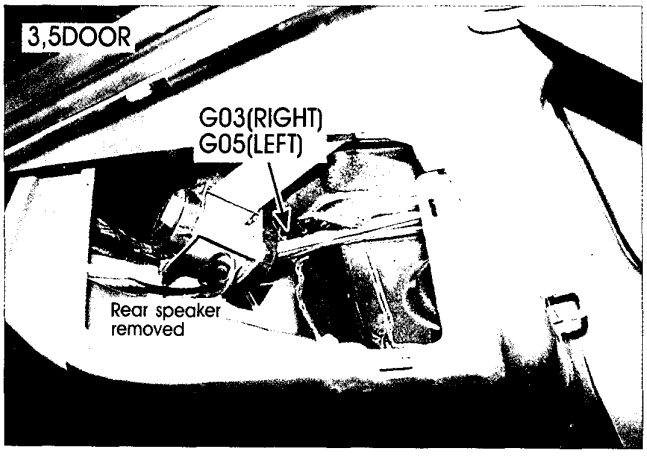
G03,G05 E3DD007D



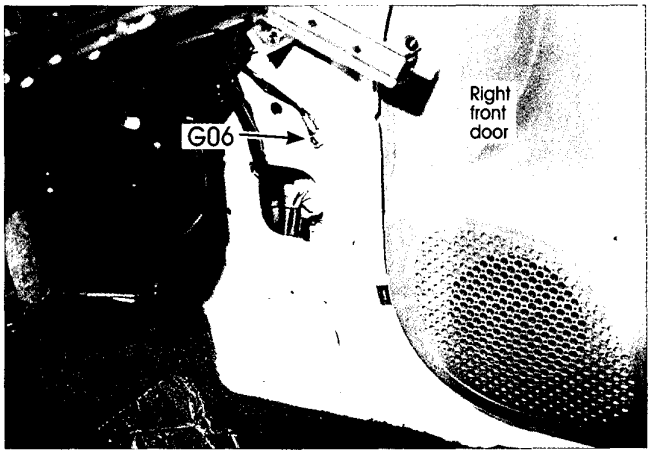
G02 E3DD007B



G04 E3DD007E



G03,G05 E3DD007C

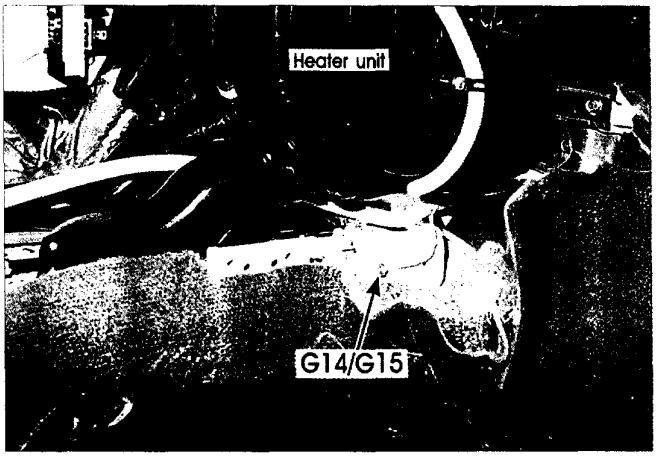


G06 E3DD007F

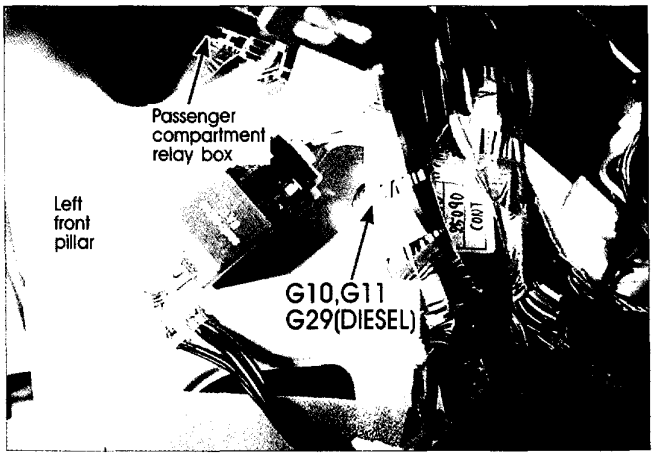
GROUNDS(2)



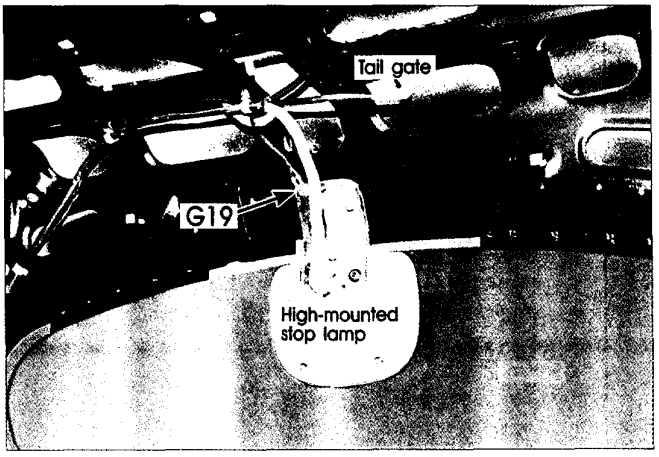
G07 E3DD007G



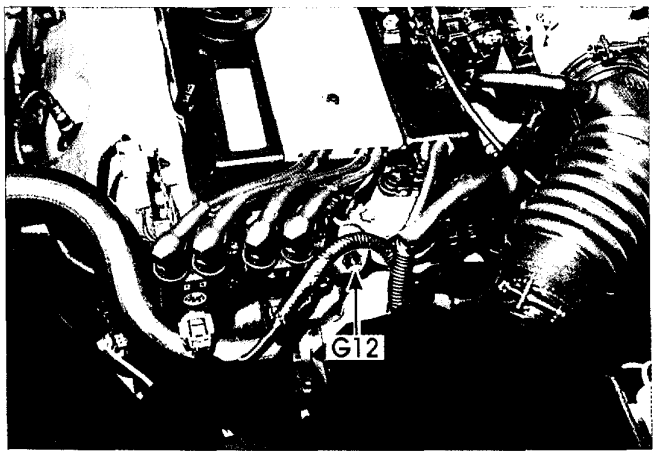
G14,G15 E3DD007K



G10,G11,G29 E3DD007H



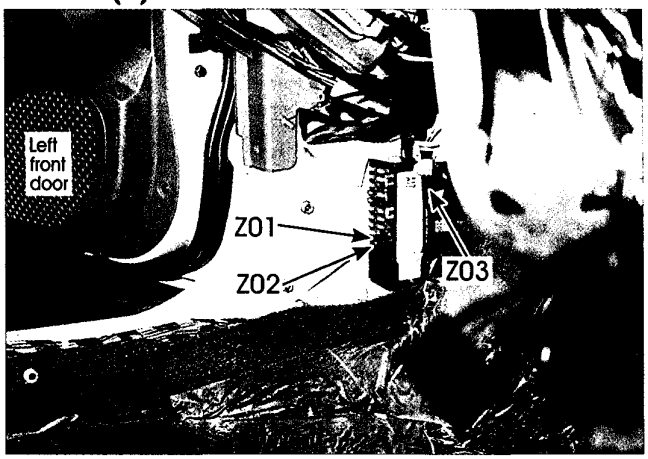
G19 E3DD007L



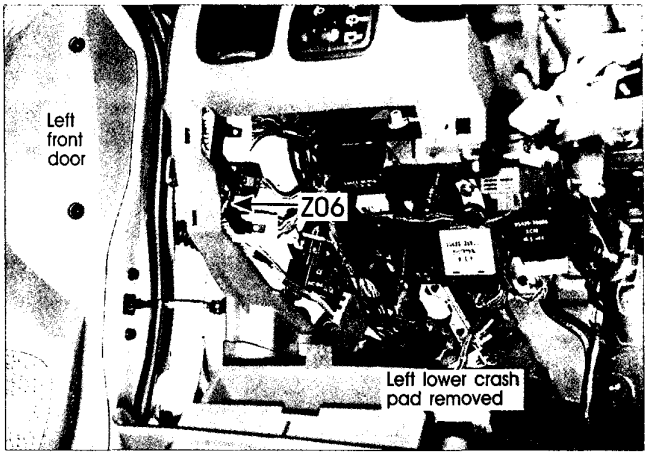
G12 E3DD007J

DIODES

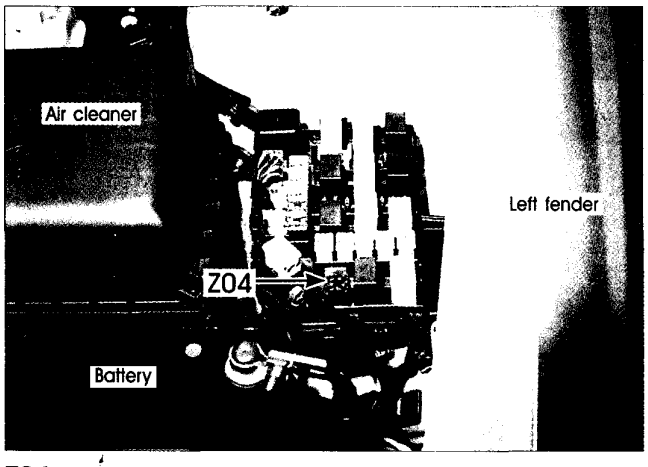
DIODES(1)



Z01,Z02,Z03 E3DD008A



Z06 E3DD008C



Z04 E3DD008B

CONNECTOR CONFIGURATIONS

CONTROL HARNESS CC-14

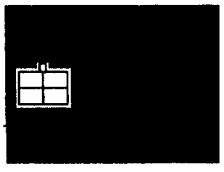
DOOR HARNESS CC-20

ENGINE HARNESS CC-9

INSTRUMENT HARNESS CC-13

MAIN HARNESS CC-2

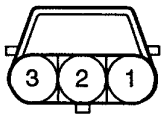
TAIL GATE HARNESS CC-21



MAIN HARNESS E0B51188

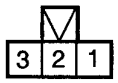
MAIN HARNESS (1)

M01



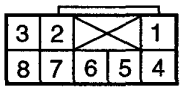
CR03F031

M02



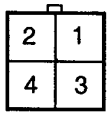
CR03F007

M03



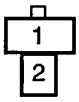
CR08F005

M04



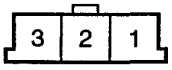
CR04F001

M05



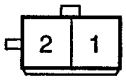
CR02F012

M06



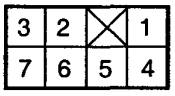
CR03F011

M07



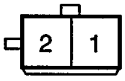
CR02F046

M08



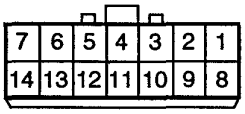
CR07F002

M09



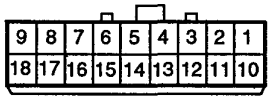
CR02F046

M10-1



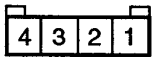
CR14F010

M10-2



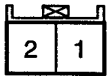
CR18F004

M10-3



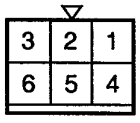
CR04F052

M10-4



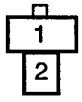
CR02F047

M11



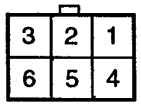
CR06F037

M12



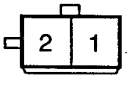
CR02F012

M13



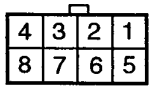
CR06F002

M14



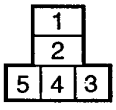
CR02F046

M15



CR08F003

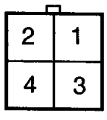
M16



CR05F011

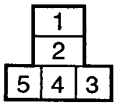
BLANK

M18



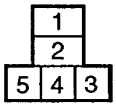
CR04F001

M19



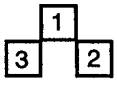
CR05F011

M20



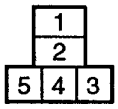
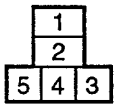
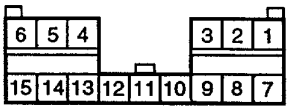
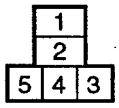
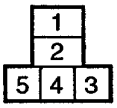
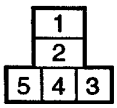
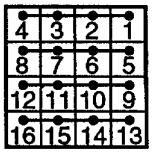
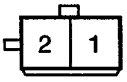
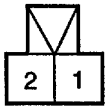
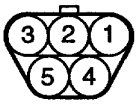
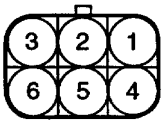
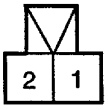
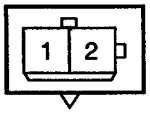
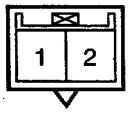
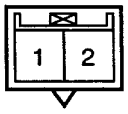
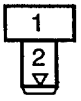
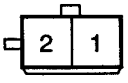
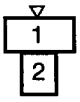
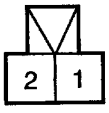
CR05F011

M21



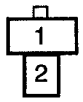
CR03F006

MAIN HARNESS (2)

M22  CR05F011	**BLANK**	**M24**  CR05F011	**M25**  CR15F001
M26  CR05F011	**M27**  CR05F011	**M28**  CR01F006	**M29**  CR05F011
M31  CR16F026	**M33**  CR02F046	**M34**  CR02F011	**M36**  CR05F023
M36-1  CR06F011	**M36-2**  CR04F014	**M37**  CR02F011	**M38**  CR02M020
M39  CR02M037	**M40**  CR02M037	**M41**  CR02F015	**M42**  CR02F046
M44  CR01F006	**M45**  CR01F006	**M46**  CR02F007	**M49**  CR02F011

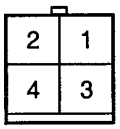
MAIN HARNESS (3)

M50



CR02F012

M50-1



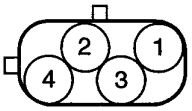
CR04F016

M51



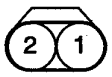
CR01F043

M52



CR04F070

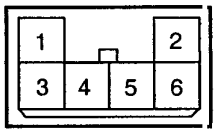
M53



CR02F006

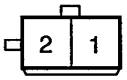
BLANK

M55



CR06M002

M56



CR02F046

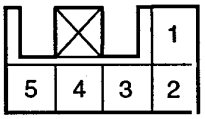
M57



CR01F006

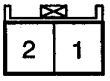
BLANK

M59



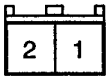
CR05F013

M60



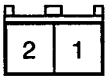
CR02F047

M61



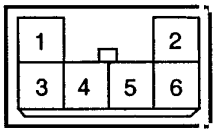
CR02F129

M62



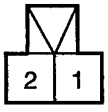
CR02F129

M63



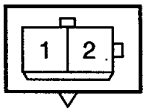
CR06M002

M64



CR02F011

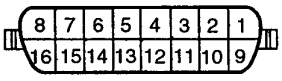
M66



CR02M020

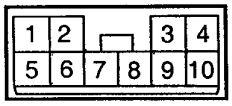
BLANK

M68



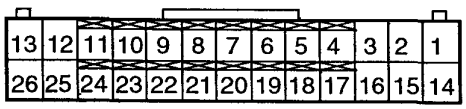
CR16F022

M69



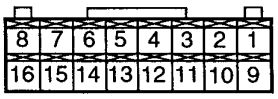
CR10M003

M70-1



CR26F003

M70-2

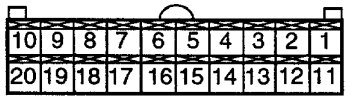


CR16F008

BLANK

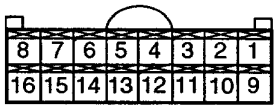
MAIN HARNESS (4)

M71-1



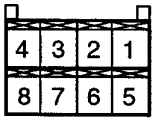
CR20F021

M71-2



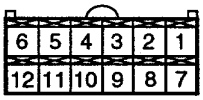
CR16F017

M71-3



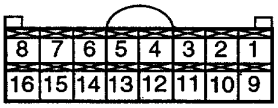
CR08F026

M72-1



CR12F015

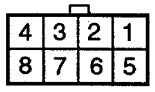
M72-2



CR16F017

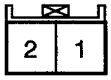
BLANK

M74



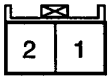
CR08F003

M76



CR02F047

M77

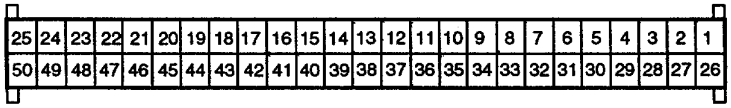


CR02F047

BLANK

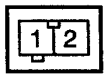
BLANK

M82



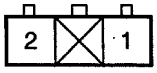
CR50F002

M83



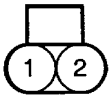
CR02M046

M84



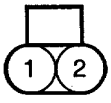
CR02F048

M85



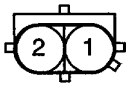
CR02F027

M86



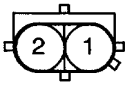
CR02F027

M87



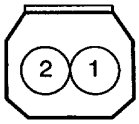
CR02F113

M88



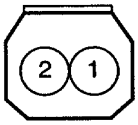
CR02F113

M89



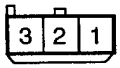
CR02F058

M90



CR02F058

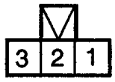
M91



CR03F026

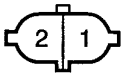
MAIN HARNESS (5)

M92



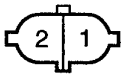
CR03F007

M93



CR02F034

M94



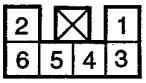
CR02F034

M95



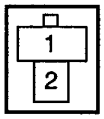
CR06F010

M96



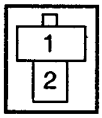
CR06F010

M97



CR02M006

M98



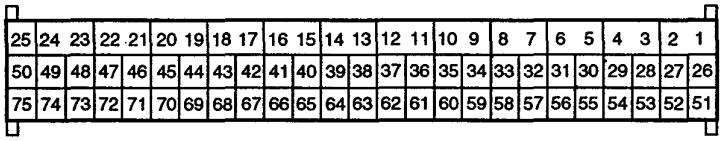
CR02M006

M100



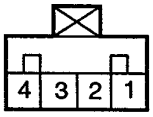
CR20F006

M101



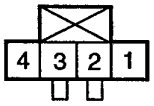
CR75F006

M102



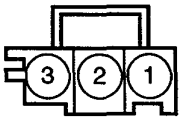
CR04F006

M103



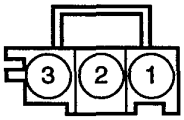
CR04F008

M104



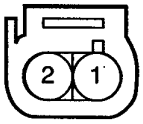
CR03F069

M105



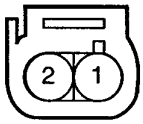
CR03F069

M106



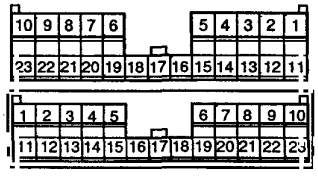
CR02F031

M107



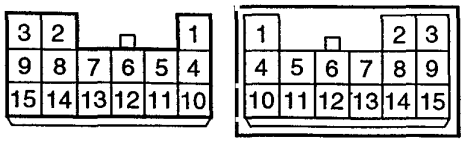
CR02F031

MC01



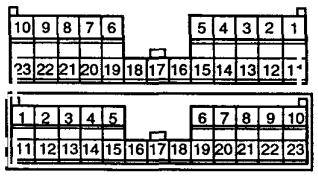
CR23B003

MC02



CR15B002

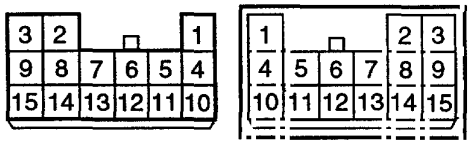
MC03



CR23B003

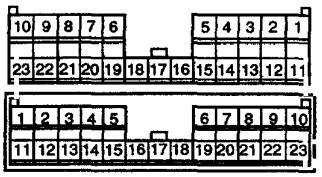
MAIN HARNESS (6)

MC04



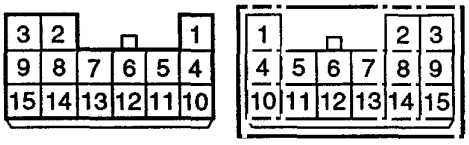
CR15B002

MC211



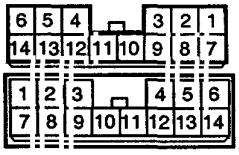
CR23B003

MC221



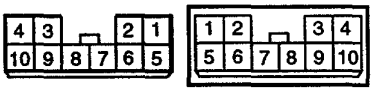
CR15B002

MD01-1



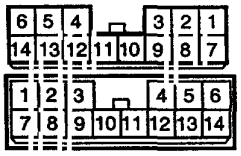
CR14B011

MD01-2



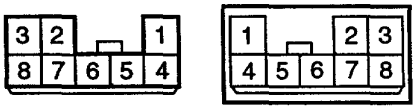
CR10B006

MD02



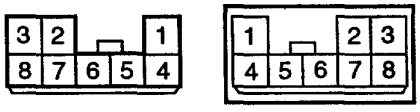
CR14B011

MD03



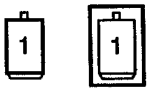
CR08B006

MD04



CR08B006

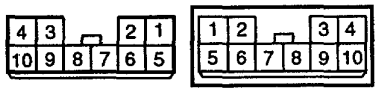
MD05



CR01B005

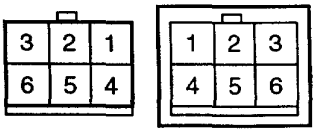
BLANK

MI01



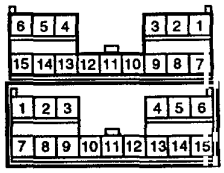
CR10B006

MI02



CR06B009

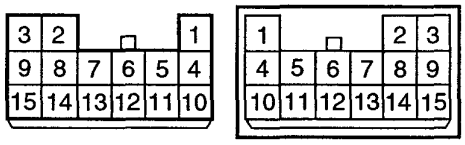
MI03



CR15B003

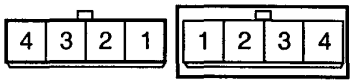
MAIN HARNESS (7)

MI04



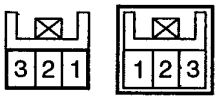
CR15B002

MM01



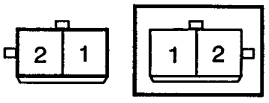
CR04B016

MM02



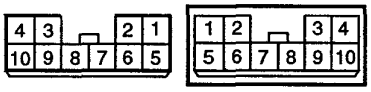
CR03B006

MM03



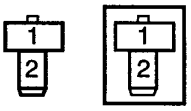
CR02B012

MR01



CR10B006

MR02



CR02B002

MR03



CR01B005

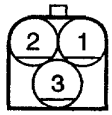
BLANK

BLANK

ENGINE HARNESS E8F7E2A5

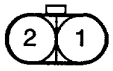
ENGINE HARNESS (1)

E01



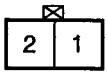
CR03F062

E02



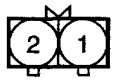
CR02F001

E03



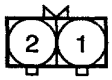
CR02F019

E04



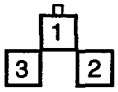
CR02F040

E05



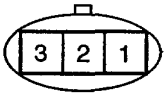
CR02F040

E06



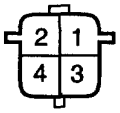
CR03F057

E07



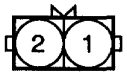
CR03F063

E08



CR04F026

E09



CR02F018

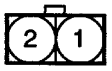
BLANK

E11



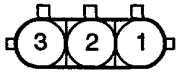
CR01F006

E12



CR02F002

E12-1



CR03F102

E13



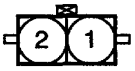
CR01F002

E13-1



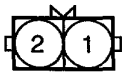
CR01F002

E14



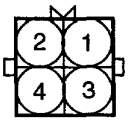
CR02F091

E15



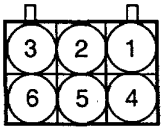
CR02F018

E15-1



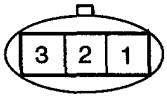
CR04F013

E16



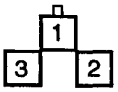
CR06F009

E17



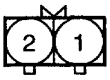
CR03F063

E18



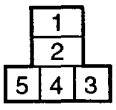
CR03F057

E19



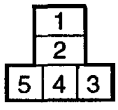
CR02F040

E20



CR05F011

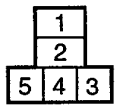
E21



CR05F011

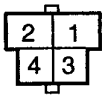
ENGINE HARNESS (2)

E22



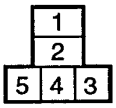
CR05F011

E23



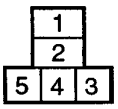
CR04F003

E24



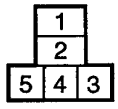
CR05F011

E25



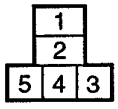
CR05F011

E26



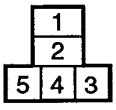
CR05F011

E27



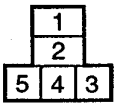
CR05F011

E28



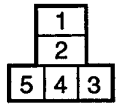
CR05F011

E29



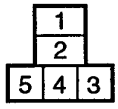
CR05F011

E30



CR05F011

E31



CR05F011

E32-1



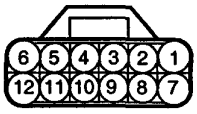
CR01F002

E32-2



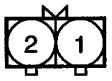
CR01F006

E33



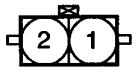
CR12F012

E34



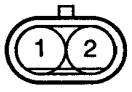
CR02F040

E35



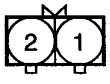
CR02F091

E36



CR02M021

E37



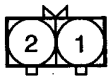
CR02F040

E38



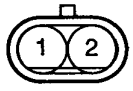
CR01F020

E39



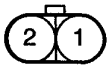
CR02F040

E40



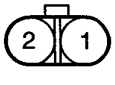
CR02M021

E41



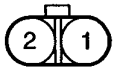
CR02F001

E42



CR02F078

E43



CR02F078

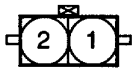
E44



CR01F020

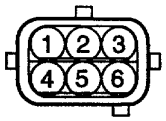
ENGINE HARNESS (3)

E45



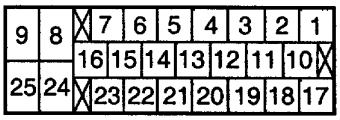
CR02F091

E46



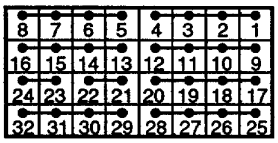
CR06M006

E47



CR25F001

E48



CR32F001

E49

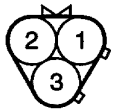


CR01F002

E50

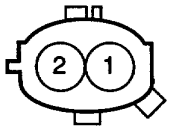
엔진 룸 릴레이 &
퓨즈 박스 내부에
위치함

E51



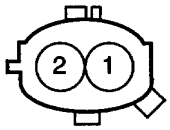
CR03F020

E52



CR02F032

E53



CR02F032

E54



CR02F001

E54-1



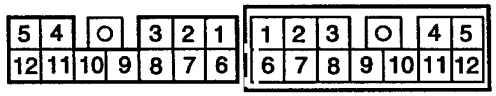
CR01F002

E54-2



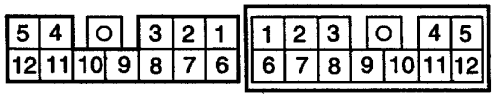
CR01F005

EC01



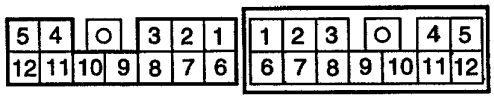
CR12B009

EC02



CR12B009

EC201



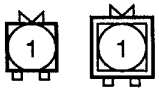
CR12B009

EE01



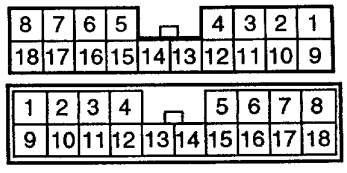
CR01B002

EE02



CR01B002

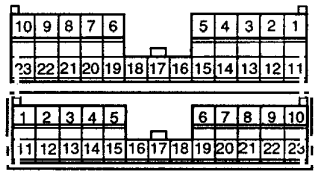
EM01



CR18B004

ENGINE HARNESS (4)

EM02



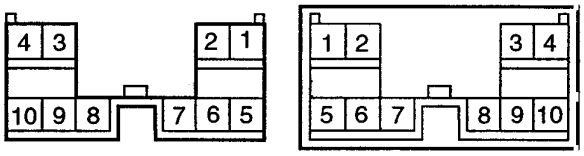
CR23B003

EM03



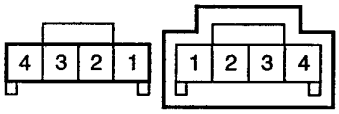
CR04B011

EM04



CR10B009

EM05

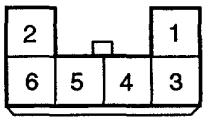


CR04B019

INSTRUMENT HARNESS E7FE1B71

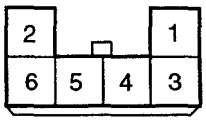
INSTRUMENT HARNESS (1)

I01



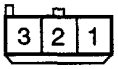
CR06F017

I02



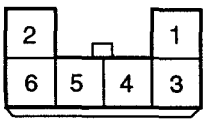
CR06F017

I03



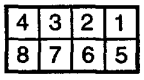
CR03F026

I04



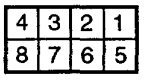
CR06F017

I06-1



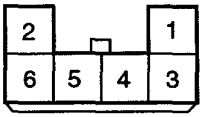
CR08F023

I06-2



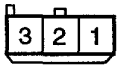
CR08F023

I10



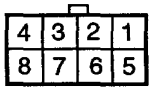
CR06F017

I11



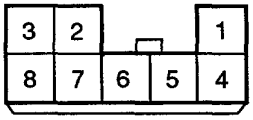
CR03F026

I12



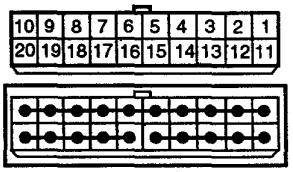
CR08F003

I13



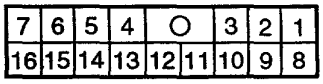
CR08F010

I15



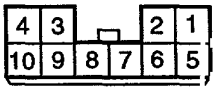
CR20F039

I16



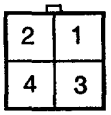
CR16F025

I17



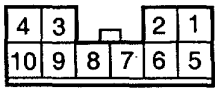
CR10F014

I18



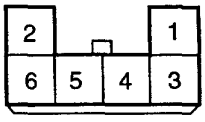
CR04F001

I19



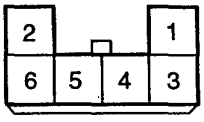
CR10F009

I20



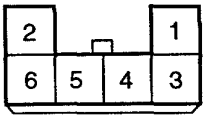
CR06F017

I100



CR06F017

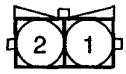
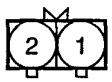
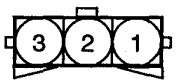
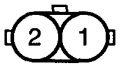
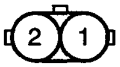
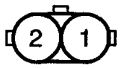
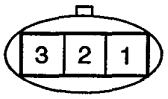
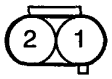
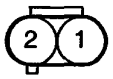
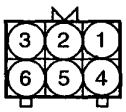
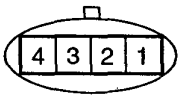
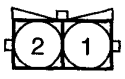
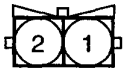
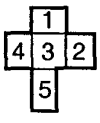
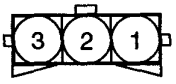
I101



CR06F017

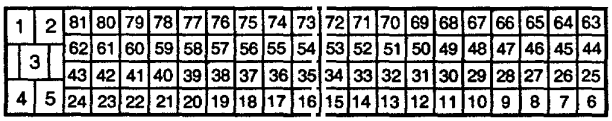
CONTROL HARNESS E00BA7B9

CONTROL HARNESS (1)

C01  CR02F041	**C02**  CR01F006	**C03**  CR02F040	**C04**  CR03F029
C05  CR01F020	**C06**  CR02F073	**C07**  CR02F073	**C08**  CR02F073
C09  CR02F073	**C10**  CR03F063	**C11-1**  CR02F081	**C11-2**  CR02F043
C12-1  CR01F002	**C12-2**  CR01F002	**C12-3**  CR01F002	**C13**  CR01F020
C14  CR01F029	**C15**  CR06F016	**C16**  CR04F053	**BLANK**
C20  CR02F041	**C21**  CR02F041	**C22**  CR05F007	**C25**  CR03F029

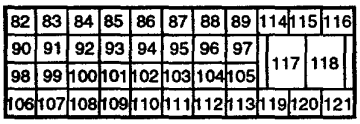
CONTROL HARNESS (2)

C26



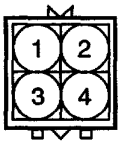
CR81F001

C27



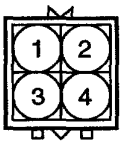
CR40F005

C28



CR04M008

C29



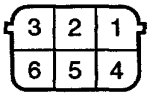
CR04M008

C30



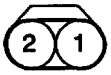
CR03F003

C31



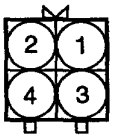
CR06F033

C32



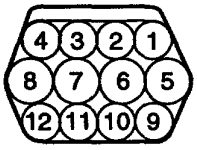
CR02F006

C33



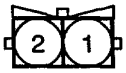
CR04F027

C34



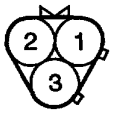
CR12F005

C35



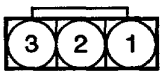
CR02F041

C36-1



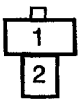
CR03F020

C36-2



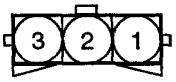
CR03F071

C38



CR02F012

C39



CR03F029

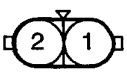
BLANK

C42



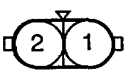
CR02F024

C44



CR02F066

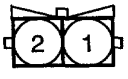
C45



CR02F066

BLANK

C61



CR02F041

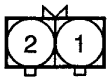
CONTROL HARNESS (3)

C62



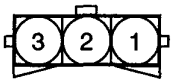
CR01F006

C63



CR02F040

C64



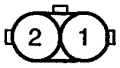
CR03F029

C65



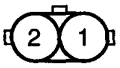
CR01F020

C66



CR02F073

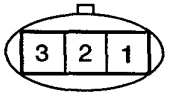
C67



CR02F073

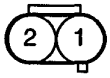
BLANK

C70



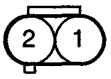
CR03F063

C71-1



CR02F081

C71-2



CR02F043

C73



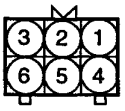
CR01F020

C74



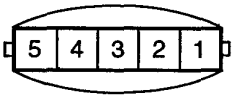
CR01F029

C75



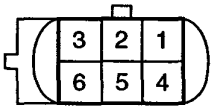
CR06F016

C76



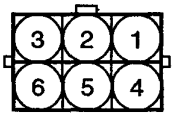
CR05F030

C77



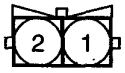
CR06F004

C78



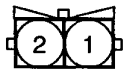
CR06F034

C80



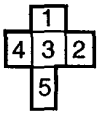
CR02F041

C81



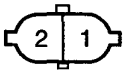
CR02F041

C82



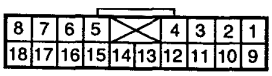
CR05F007

C83



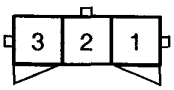
CR02F061

C84



CR18F003

C85



CR03F091

BLANK

BLANK

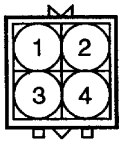
CONTROL HARNESS (4)

C86

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

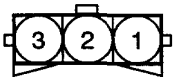
CR81F002

C88



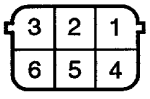
CR04M008

C90



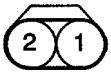
CR03F029

C91



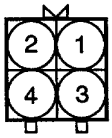
CR06F033

C92



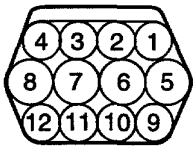
CR02F006

C93



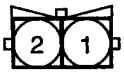
CR04F027

C94



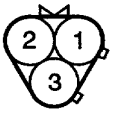
CR12F005

C95



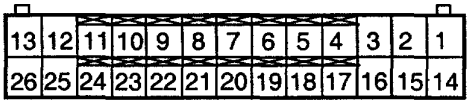
CR02F041

C96



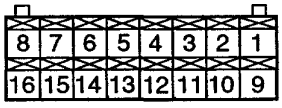
CR03F020

C97-1



CR26F011

C97-2



CR16F028

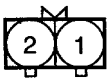
BLANK

C202



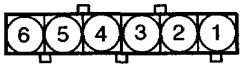
CR01F020

C203



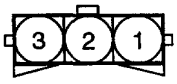
CR02F040

C208



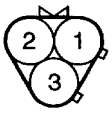
CR06F049

C210



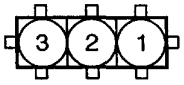
CR03F029

C211



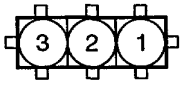
CR03F020

C213



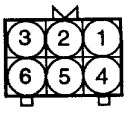
CR03F082

C214



CR03F082

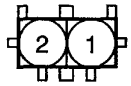
C215



CR06F016

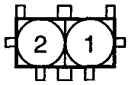
CONTROL HARNESS (5)

C224-1



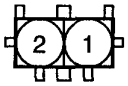
CR02F121

C224-2



CR02F121

C224-3



CR02F121

BLANK

C233-1

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

CR81F002

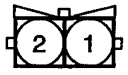
C233-2

40	39	38	32	31	30	29	28	27	26	25
37		36	24	23	22	21	20	19	18	17
			16	15	14	13	12	11	10	9
35	34	33	8	7	6	5	4	3	2	1

CR40F003

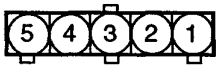
BLANK

C235



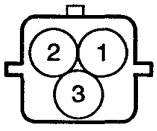
CR02F041

C240



CR05F032

C241



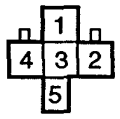
CR03F096

C242



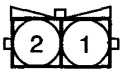
CR04F067

C243



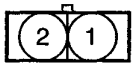
CR05F022

C245



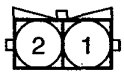
CR02F041

C246



CR02F138

C247



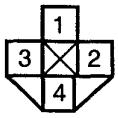
CR02F041

C248



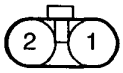
CR01F039

C249



CR04F067

C251



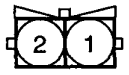
CR02F139

C252



CR03F097

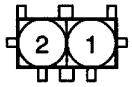
C253



CR02F041

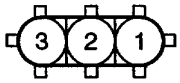
CONTROL HARNESS (6)

C254



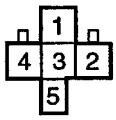
CR02F121

C256



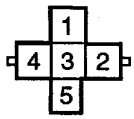
CR03F084

C257



CR05F022

C259



CR05F001

CC01



CR03B007

CC02

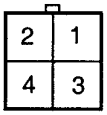


CR03B007

DOOR HARNESS EA3579BF

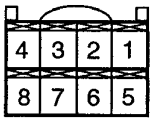
DOOR HARNESS (1)

D01



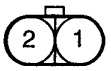
CR04F001

D02



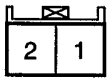
CR08F032

D03



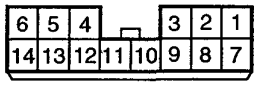
CR02F001

D04



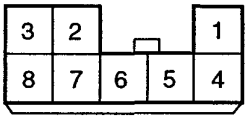
CR02F047

D05-1



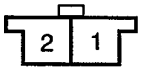
CR14F005

D05-2



CR08F010

D06



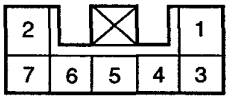
CR02F010

D07



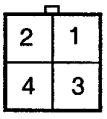
CR02M018

D08



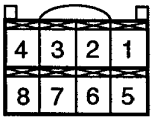
CR07F005

D11



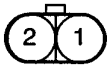
CR04F001

D12



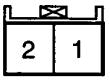
CR08F032

D13



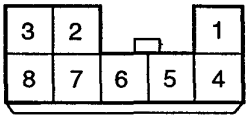
CR02F001

D14



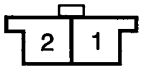
CR02F047

D15



CR08F010

D16



CR02F010

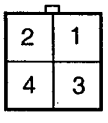
D17



CR02M018

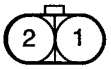
BLANK

D21



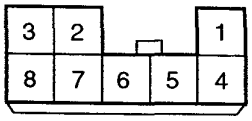
CR04F001

D22



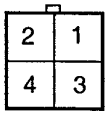
CR02F001

D23



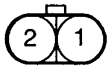
CR08F010

D31



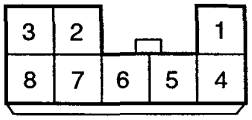
CR04F001

D32



CR02F001

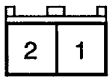
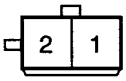
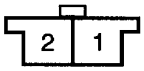
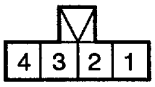
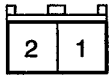
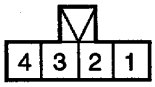
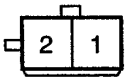
D33



CR08F010

TAIL GATE HARNESS E6602FDE

TAIL GATE HARNESS (1)

R01  CR01F040	**R02**  CR02F129	**R03**  CR02F046	**R04**  CR02F010
R05  CR04F010	**R06**  CR02F129	**R07**  CR01F040	**R08**  CR01F006
R09  CR04F010	**R10**  CR02F046	**BLANK**	**BLANK**

일반지역용

HYUNDAI 2003 Accent EXCEL Shop Manual

HYUNDAI

Accent EXCEL

2003 Shop Manual

MPANY

Printing : JUL. 2, 2002
Publication No. :A25S-EG27B
Printed in Korea

HYUNDAI

Accent

EXCEL

Shop Manual

FOREWORD

This shop manual is intended for use by service technicians of authorized Hyundai dealers to help them provide efficient and correct service and maintenance on Hyundai vehicle.

To ensure customer satisfaction with Hyundai products, proper service and maintenance by Hyundai technicians is essential. Consequently, it is important that service personnel fully understand the contents of this manual, which should be kept in a handy place for quick and easy reference.

All the contents of this manual, including photographs, drawings, and specifications, are the latest available at the time of printing. As modifications affecting service occur, dealers will be provided technical service bulletins or supplementary volumes. This manual should be kept carefully up-to date upon receipt of the new information.

Hyundai Motor Company reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

A25E-EG27B JUL. 2002, Printed in Korea

CAUTION :
Severe engine and transaxle damage may result from the use of poor quality fuels and lubricants that do not meet Hyundai specifications. You must always use high quality fuels and lubricants that meet the specifications listed in the Recommended Lubricants and Capacities Chart on Page GI-10 in the General Information Section of the Shop Manual.

NOTE : Regarding the groups in small characters, refer to Electrical Troubleshooting Manual. (Pub. No : A25E-EG27B)

CONTENTS

TITLE	GROUP
General Information	GI
Engine DOHC	EM
Engine SOHC	EMA
Engine [DIESEL]	EMB
Engine Electrical System	EE
Emissions Control System	EC
Fuel System	FL
Fuel System [DIESEL]	FLA
Clutch System	CH
Transaxle/Transmission	TR
Driveshaft and Axle	DS
Suspension System	SS
Steering System	ST
Restraints	RT
Brake System	BR
Body (Interior and Exterior)	BD
Body Electrical System	BE
Heating, Ventilation and Air Conditioning	HA
Electrical Troubleshooting Manual	ETM

All rights reserved. No part of this publication may be reproduced, stored in any retrieval system or transmitted in any form or by any means without the prior written permission of Hyundai Motor Company.

IMPORTANT SAFETY NOTICE

Proper service methods and repair procedures are essential for safe, reliable operation of all motor vehicles as well as the personal safety of the operator. The service procedures and descriptions in this shop manual provide general directions for a sevice and repair using the proper techniques.

Procedures, techniques, tools, and parts for service including the skill of the technician vary.
It is impossible to provide advice or caution as to each case in this manual.
Accordingly, anyone who intends to use a replacement part, service procedure, or tool, which is not recommended by the vehicle manufacturer, must first assure thoroughly that neither their personal safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool they select.

IN THIS MANUAL :

WARNING : Remind you to be especially careful in those areas where carelessness can cause personal injury.

CAUTION : To prevent you from making errors that could damage the vehicle as well as cause personal injury.

NOTE : Give you added information that will help you complete a particular procedure.

The following list contains some general WARNINGS that you should follow during working on a vehicle.

* Always wear safety glasses for eye protection.
* Use safety stands whenever a procedure requires you to be under the vehicle.
* Make sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
* Set the parking brake when working on the vehicle. If you have an automatic transaxle, set in park unless instructed otherwise for a specific operation.
* Place supporters against the front and rear surfaces of the tires to help prevent the vehicle from moving.
* Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide poisoning.
* Keep yourself and your clothing away from moving parts when the engine is running, especially the drive belts.
* To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
* Do not smoke while working on a vehicle.
*To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.
* When it is necessary to work under the hood, keep hands and other objects clear of the radiator fan blades! Your vehicle may be equipped with a cooling fan that may turn on, even though the ignition switch is in the OFF position. For this reason care should be taken to ensure that the radiator fan electric motor is completely disconnected when working under the hood and the engine is not running.

Driveshaft and Axle

GENERAL
- SPECIFICATIONS ..... DS - 2
- LUBRICANTS ..... DS - 3
- SPECIAL TOOLS ..... DS - 3
- TROUBLESHOOTING ..... DS - 5

DRIVESHAFT
- FRONT DRIVESHAFT ASSEMBLY
  - COMPONENTS ..... DS - 6
  - REMOVAL ..... DS - 6
  - INSPECTION ..... DS - 7
  - INSTALLATION ..... DS - 8
- FRONT DRIVESHAFT (T.J.-B.J. TYPE)
  - COMPONENTS ..... DS - 9
  - DISASSEMBLY ..... DS - 9
  - INSPECTION ..... DS -10
  - REASSEMBLY ..... DS -11

FRONT AXLE
- FRONT HUB / KNUCKLE
  - COMPONENTS ..... DS -13
  - REMOVAL ..... DS -13
  - DISASSEMBLY ..... DS -14
  - INSPECTION ..... DS -15
  - REASSEMBLY ..... DS -15
  - INSTALLATION ..... DS -16

REAR AXLE
- REAR AXLE / HUB
  - COMPONENTS ..... DS -17
  - REMOVAL ..... DS -17
  - INSPECTION ..... DS -18
  - INSTALLATION ..... DS -18

GENERAL

SPECIFICATIONS EC1478A5

Driveshaft (1.3L / 1.5L / 1.6L)		
Joint type		
Outer	B.J.	
Inner	T.J.	
Maximum permissible joint angle	Gasoline	Diesel-TCI
B.J.	45° or more	45.8° or more
T.J.	22.5° or more	23° or more
Wheel bearing		
Type	Double row angular contact ball bearing	
Dimension (O.D. x I.D.) mm (in.)	Front : 70 x 38 (2.76 x 1.46)	Rear : 70 x 28 (2.76 x 1.10)

B.J. : Birfield Joint O.D. : Outer Diameter
T.J. : Tripod Joint I.D. : Inner Diameter

EIDD100A

TIGHTENING TORQUE

Item	Nm	Kg·cm	lb·ft
Castle nut	220 ~ 260	2200 ~ 2600	159 ~ 188
Knuckle to strut assembly nut	75 ~ 90	750 ~ 900	54 ~ 65
Lower arm ball joint to knuckle	60 ~ 72	600 ~ 720	43 ~ 52
Wheel nut	90 ~ 110	900 ~ 1100	66 ~ 81
Rear hub bearing flange nut	180 ~ 220	1800 ~ 2200	133 ~ 162
Rear strut to carrier nut	75 ~ 90	750 ~ 900	55 ~ 66
Trailing arm to carrier nut	130 ~ 150	1300 ~ 1500	96 ~ 110
Rear suspension arm to carrier nut	130 ~ 150	1300 ~ 1500	96 ~ 110
Stabilizer bracket nut	17 ~ 26	170 ~ 260	12 ~ 19
Stabilizer assembled nut	35 ~ 45	350 ~ 450	25 ~ 33
Rear suspension arm flange nut	100 ~ 120	1000 ~ 1200	72 ~ 87
Rear suspension arm cam bolt	80 ~ 100	800 ~ 1000	58 ~ 72
Front hub to brake disk screw	10 ~ 20	100 ~ 200	7 ~ 14

⚠ ***CAUTION***

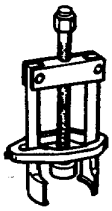
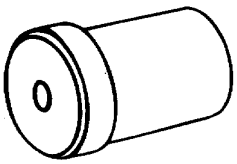
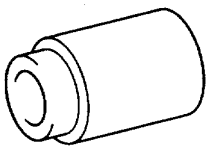
Replace the self-locking nuts with new ones after removal.

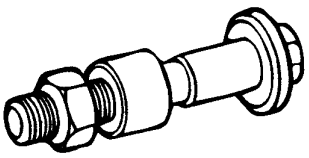
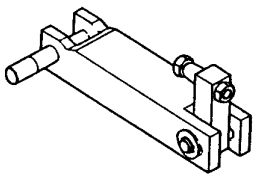
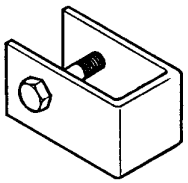
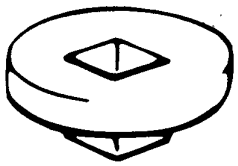
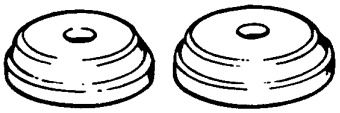
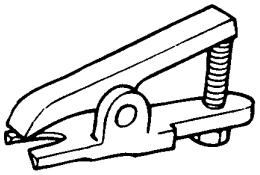
LUBRICANTS ED21922A

T.J. - B.J. type driveshaft (For 1.3L/1.5L/1.6L)	Recommended lubricant	Quantity	
		Gasoline	Diesel-TCI
B.J. boot grease	Centoplex 278M/136K CASMOLY BJ ROLLUBE BJ Sunlight SW-2	85 ± 6gr. - Joint : 40 ± 3gr. - Boot : 45 ± 3gr.	110 ± 6gr. - Joint : 55 ± 3gr. - Boot : 45 ± 3gr.
T.J. boot grease	KLK TJ 41-182 CASMOLY TJ ROLLUBE TJ Oneluber MK	95 ± 6gr. - Joint : 60 ± 3gr. - Boot : 35 ± 3gr.	120 ± 6gr. - Joint : 75 ± 3gr. - Boot : 45 ± 3gr.
Wheel bearing nut grease (India, Turkey only)	RAREMAX AF-1 or equivalent	3.5 ~ 4.5g	

EIDD130A

SPECIAL TOOLS EFBCBD10

Tool (Number and Name)	Illustration	Use
09495-33000 Puller	 D9533000	Removal of wheel bearing inner race from hub.
09495-33100 Center bearing remover and installer	 D9533100	• Removal of wheel bearing from knuckle. (use with 09517-29000) • Installation of hub to knuckle.
09517-21200 Front axle base	 E1721200	• Installation of the rear axle shaft bearing retainer. • Installation of tone wheel and dust cover to B.J.

Tool (Number and Name)	Illustration	Use
09517-21500 Front hub remover and installer	 E1721500	• Removal of front hub from knuckle. (use with 09517-29000) • Measurement of front wheel bearing pre-load. (use with 09532-11600)
09517-29000 Knuckle arm bridge	 EIDA140D	• Removal of front hub from knuckle. (use with 09517-21500) • Removal of wheel bearing outer race from knuckle. (use with 09495-33100)
09517-3A000 Knuckle arm bridge holder	 E173A000	Removal of knuckle arm bridge. (use with 09517-21500, 09517-29000)
09532-11600 Preload socket	 E3211600	Measurement of front wheel bearing pre-load. (use with 09517-21500)
09532-31200A Oil seal installer	 E3211500	Installation of wheel bearing to knuckle.
09568-34000 Ball joint puller	 EIDA140G	Seperation of front lower arm and tie rod end ball joint.

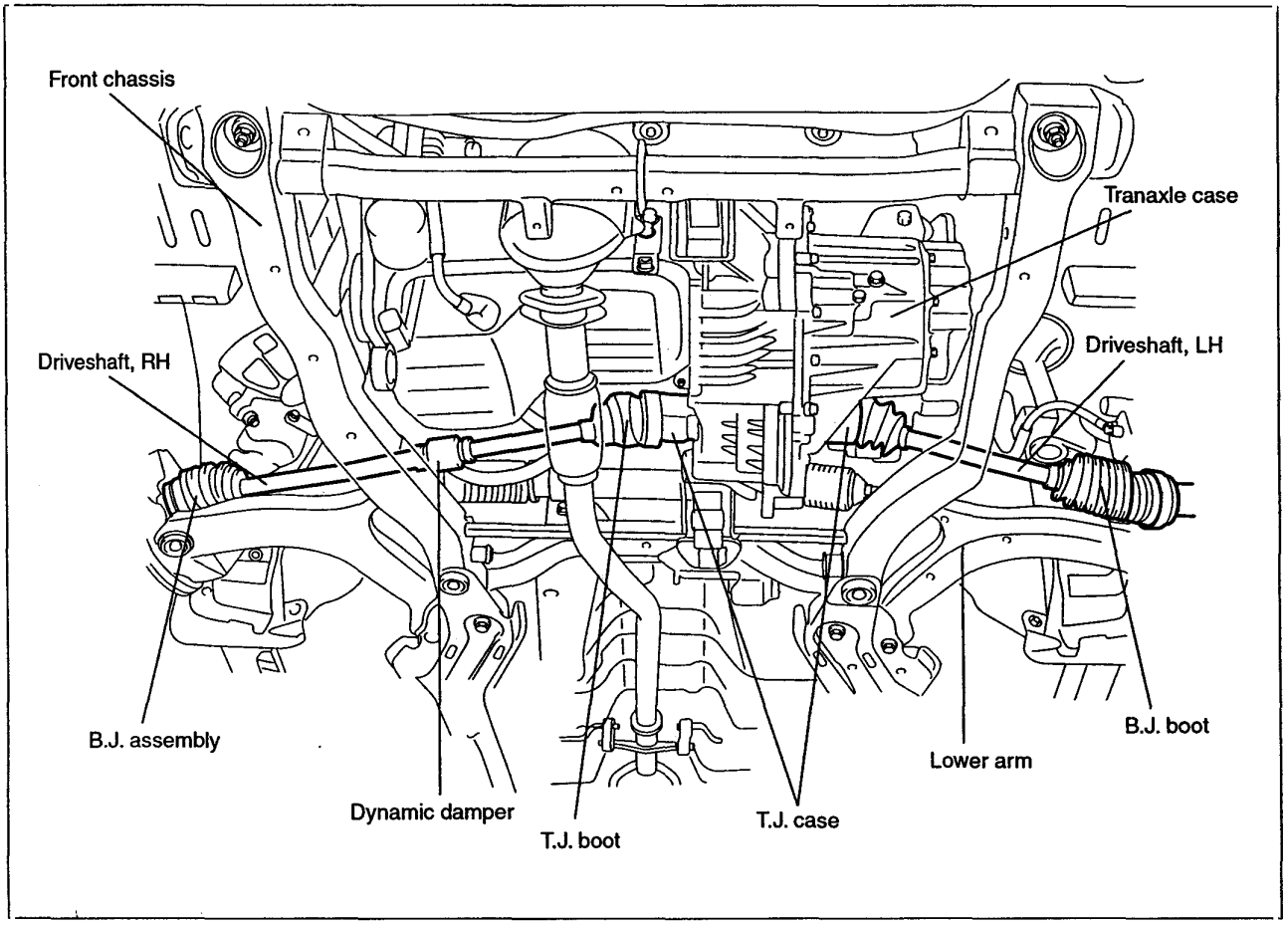
TROUBLESHOOTING E2ADF0C6

Symptom	Possible cause	Remedy
Vehicle pulls to one side	Galling of driveshaft ball joint	Replace
	Wear, rattle or galling of wheel bearing	Replace
	Defective front suspension and steering	Adjust or replace
Vibration	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace
	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Improper wheel balance	Adjust or replace
	Defective front suspension and steering	Adjust or replace
Excessive noise	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace
	Driveshaft rattle and side gear serration	Replace
	Wear, rattle or galling of wheel bearing	Replace
	Loose hub nut	Adjust or replace
	Defective front suspension and steering	Adjust or replace

DRIVESHAFT

FRONT DRIVESHAFT ASSEMBLY

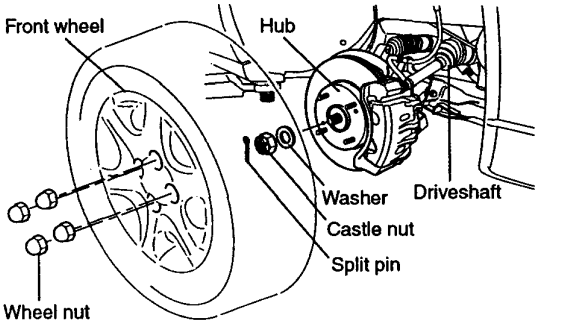
COMPONENTS E6BFBE35



ELCDD01A

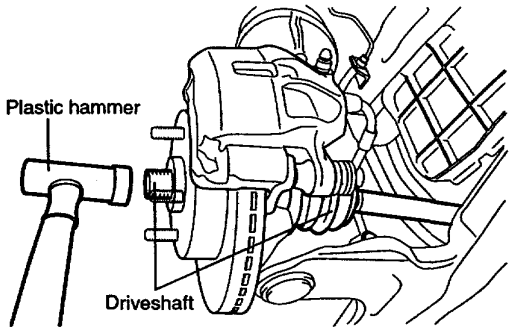
REMOVAL EB4FEDCA

1. Loosen the wheel nuts slightly.
2. Raise the front of the vehicle, and support it with safety stands in a proper location.
3. Remove the wheel nuts and front wheel.



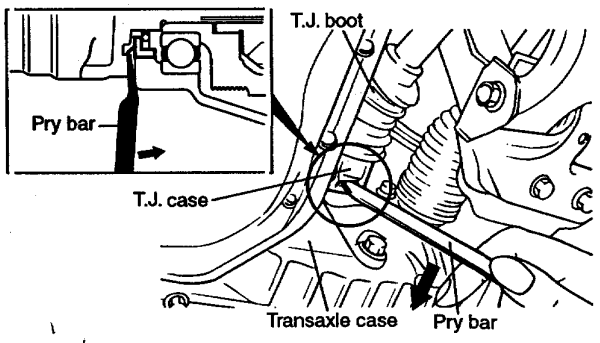
ELCDS02A

4. Remove the split pin, the castle nut and the washer from the front hub.
5. Drain the transmission fluid before the driveshaft is removed.
6. Using a plastic hammer, make the driveshaft disconnected from the axle hub.



ELCDS03A

7. Push the axle hub outward and separate the driveshaft from the axle hub.
8. Insert a pry bar between the transaxle case and the T.J. case, and pry the driveshaft from the transaxle case.



ELCDS04A

⚠ ***CAUTION***

- ***Be sure to apply the pry bar to the rib of the transaxle case.***
- ***Do not insert the pry bar too deeply, as this may cause damage to the oil seal. [max. depth : 7 mm (0.28 in.)]***
- ***For automatic transaxle equipped vehicles, insert a pry bar into the groove of the driveshaft to remove the driveshaft from the transaxle.***
- ***Do not pull on the driveshaft; the joints may come apart. Be sure to use the pry bar.***

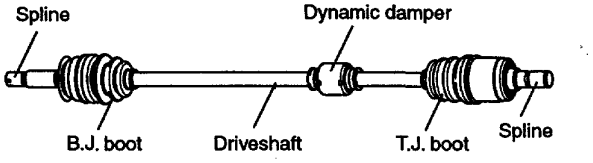
9. Pull out the driveshaft from the transaxle case.

⚠ ***CAUTION***

- ***Place a plug in the hole of the transaxle case to prevent contamination***
- ***Support the driveshaft properly.***
- ***Replace the circlip each time the driveshaft is removed from the transaxle case.***

INSPECTION EA83DA5C

1. Check the boots on the driveshaft for cracks, damage, leaking grease and loose boot bands. If any damage is found, replace the boot and boot bands.
2. Check the joints for wear and operating condition.
3. Turn the driveshaft by hand and make sure the splines and the joints are not excessively loose. If damage is found, replace the joint.

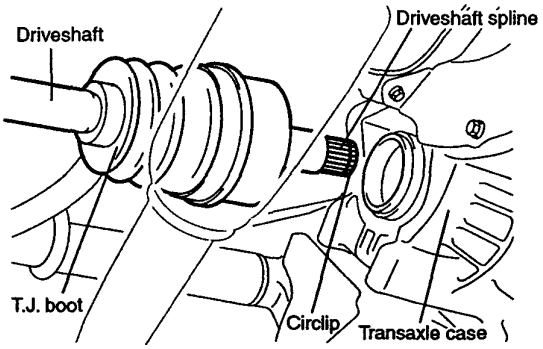


ELCDD05A

4. Check the splines for wear and damage.
5. Make sure the driveshaft is not twisted or cracked. Replace it if necessary.

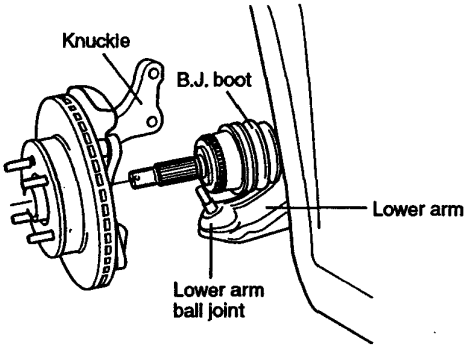
INSTALLATION ED55850C

1. Coat gear oil on the driveshaft splines and transaxle case-sliding surface.



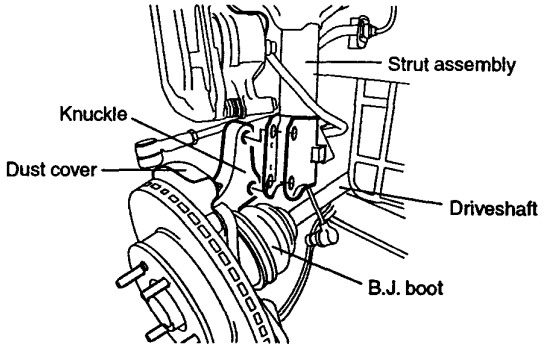
ELCDS06A

2. Before installing the driveshaft, set the opening side of the circlip facing downward.
3. Assemble the dust cover, the hub, the brake disc and the wheel bearing to the knuckle.
4. Install the B.J. into the knuckle.



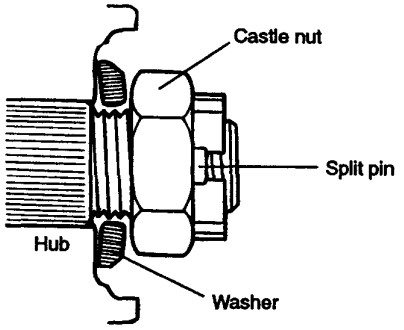
ELCDS07A

5. In practice, the knuckle should be installed in the lower arm the moment the B.J. is installed in the knuckle. Be careful not to damage the boot.
6. Install the knuckle in the strut assembly with the tightening torque, 75~90 Nm (750~900 kg·cm, 54~65 lb·ft).



ELCDD08A

7. Install the lower arm in the knuckle with the tightening torque 60~72 Nm (600~720 kg·cm, 43~52 lb·ft).
8. After the installation, check on the driveshaft for manuever by hand.
9. After installing the washer with convex surface outward, install the castle nut and the split pin.

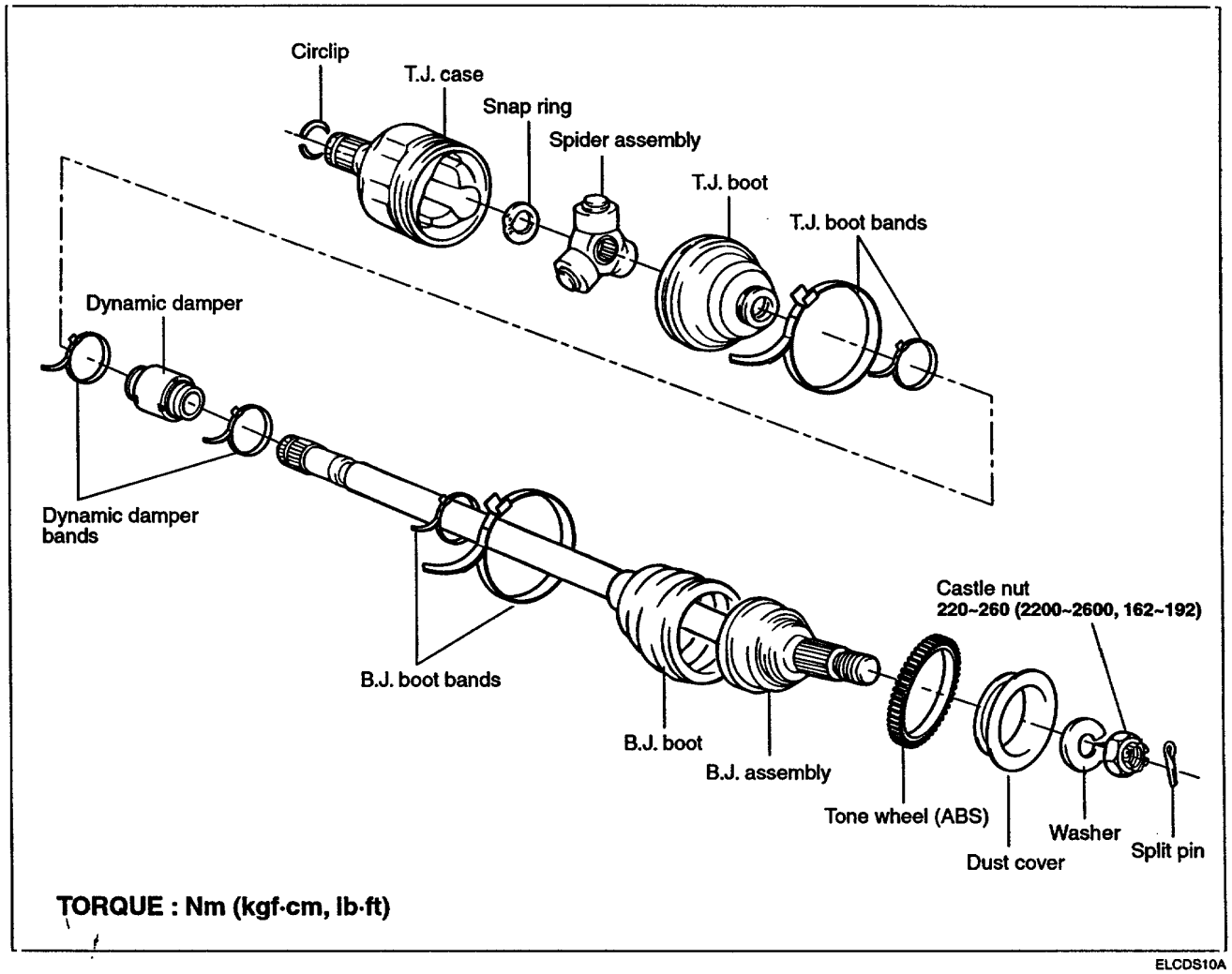


EIDA212A

10. Install the wheel and tire.

FRONT DRIVESHAFT (T.J.-B.J. TYPE)

COMPONENTS E4178E6B



ELCDS10A

DISASSEMBLY E0B83D67

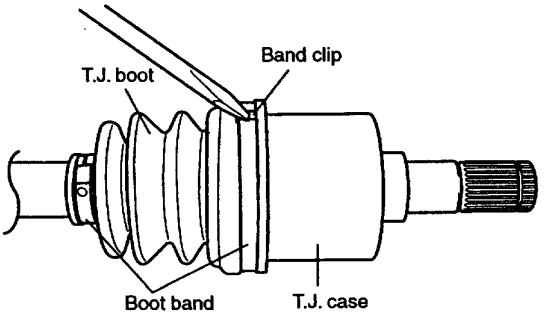
NOTE

- *Do not disassemble the B.J. assembly.*
- *The driveshaft joint uses special grease. Do not substitute with another type of grease. (refer to LUBRICANTS, DS-p.3)*
- *The boot band should be replaced with a new one.*

1. Loosen the T.J. boot bands and pull the T.J. boot from the T.J. case.

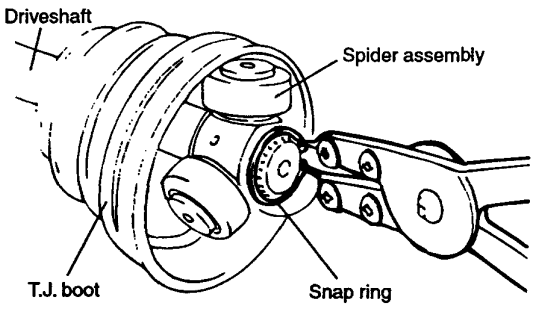
NOTE

Be careful not to damage the boot.



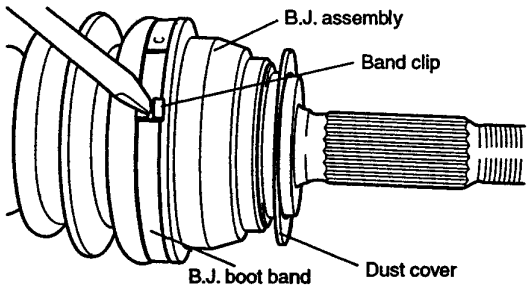
ETBDS04A

2. Seperate the T.J. boot from the T.J. case.
3. Remove the snap ring and spider assembly from the driveshaft.



EIDA301B

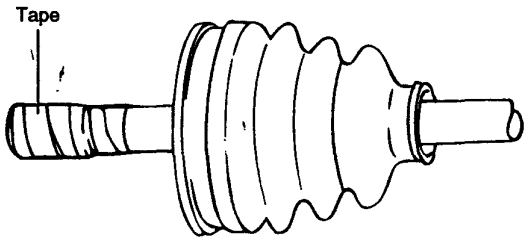
4. Clean the spider assembly.
5. Remove the B.J. boot bands and pull out the B.J. boot.



ETBDS05A

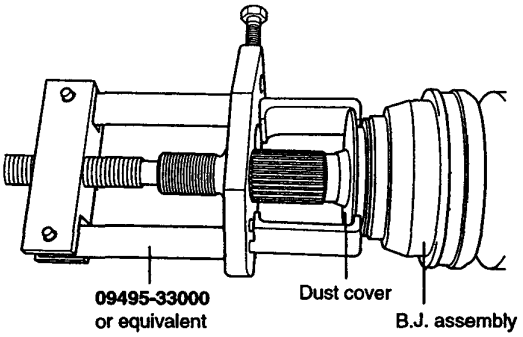
NOTE

If the boot is to be reused, wrap tape around the driveshaft splines to protect the boot.



EIDA251D

6. Remove the dust cover from the B.J. assembly using the special tool(09495-33000) or a proper one.

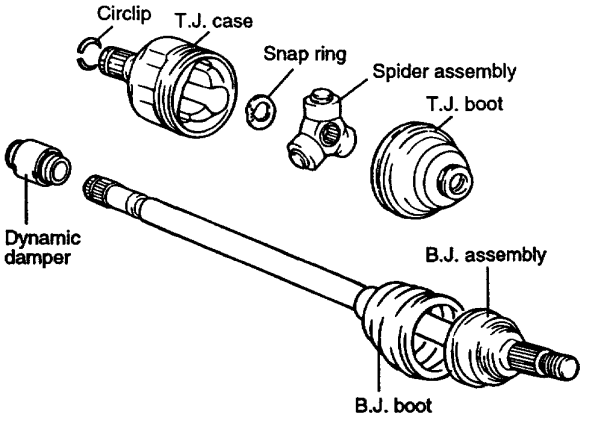


ETBDD01A

INSPECTION E6BD0278

1. Check the driveshaft spline part for wear or damage.
2. Check for entry of water or foreign materials into B.J.
3. Check the spider assembly for roller rotation, wear or corrosion.
4. Check the groove inside T.J. case for wear or corrosion.
5. Check the dynamic damper for damage or cracking.

REASSEMBLY E3F9F0F4

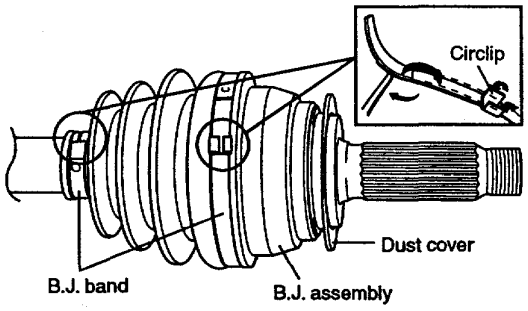


ETBDA01A

NOTE

Clean the disassembled parts with solvent, and dry them thoroughly with compressed air. Do not wash the rubber parts with solvent.

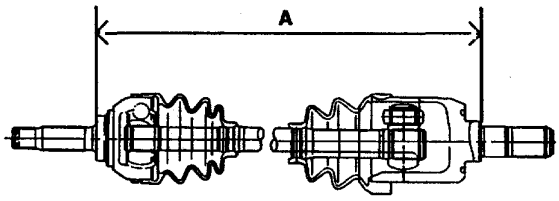
1. Wrap the spline (T.J. side) with vinyl tape to prevent damage to the dynamic damper and boots.
2. Insert the driveshaft in the dynamic damper and boots.
3. Install the T.J. boot to the driveshaft, then remove the vinyl type. Be careful not to damage the boot.
4. Install the spider assembly.
5. Fit the snap ring into the driveshaft groove. Always rotate the snap ring in its groove to make sure it is fully seated.
6. Pack the T.J. with the grease (refer to LUBRICANTS, DS-p.3)
7. Fit the T.J. onto the driveshaft, and hold the driveshaft so the T.J. points up to prevent it from falling off.
8. Add the specified grease to the B.J. as much as wiped away at the time of inspection. (refer to LUBRICANTS, DS-p.3)
9. Install the B.J. boot.
10. Tighten the B.J. boot bands.



ELCDD18A

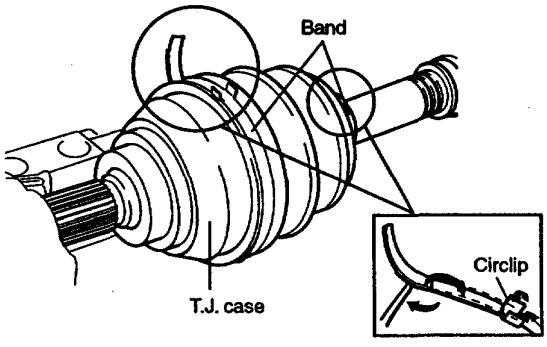
11. To control the air in the T.J. boot, keep the specified distance between the boots when they are tightened.

Standard value (A)	
LH	RH
494.9 mm (M/T) 488.9 mm (A/T) 485.2 mm (Diesel)	779.9 mm (M/T) 774.9 mm (A/T) 480.2 mm (Diesel)



KIKB016B

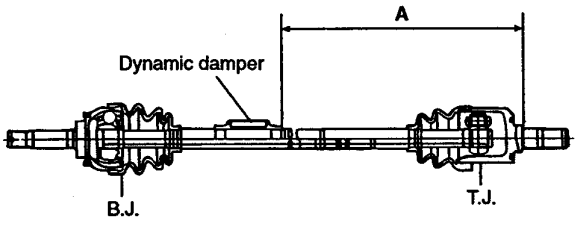
12. Tighten the T.J. boot bands.



ELCDD20A

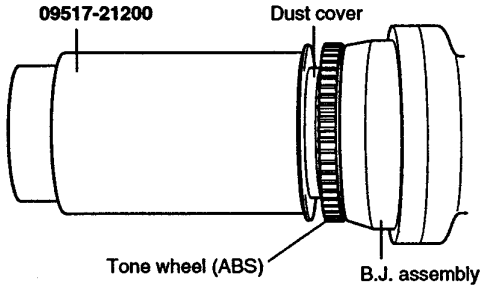
13. To install the dynamic damper, keep the B.J. and shaft in a straight line, secure the dynamic damper in the direction illustrated below and install the dynamic damper bands.

Standard value (A) : 325 ± 2mm (12.8 ± 0.1 in.)

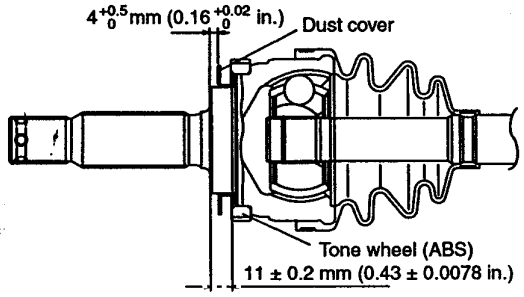


ELCDD17A

14. Installing the tone wheel and the dust cover to the B.J. assembly, use the Special Tool(09517-21200). And pay attention to the specification below. (Press-in the dust cover after the tone wheel)



ETBDD30A

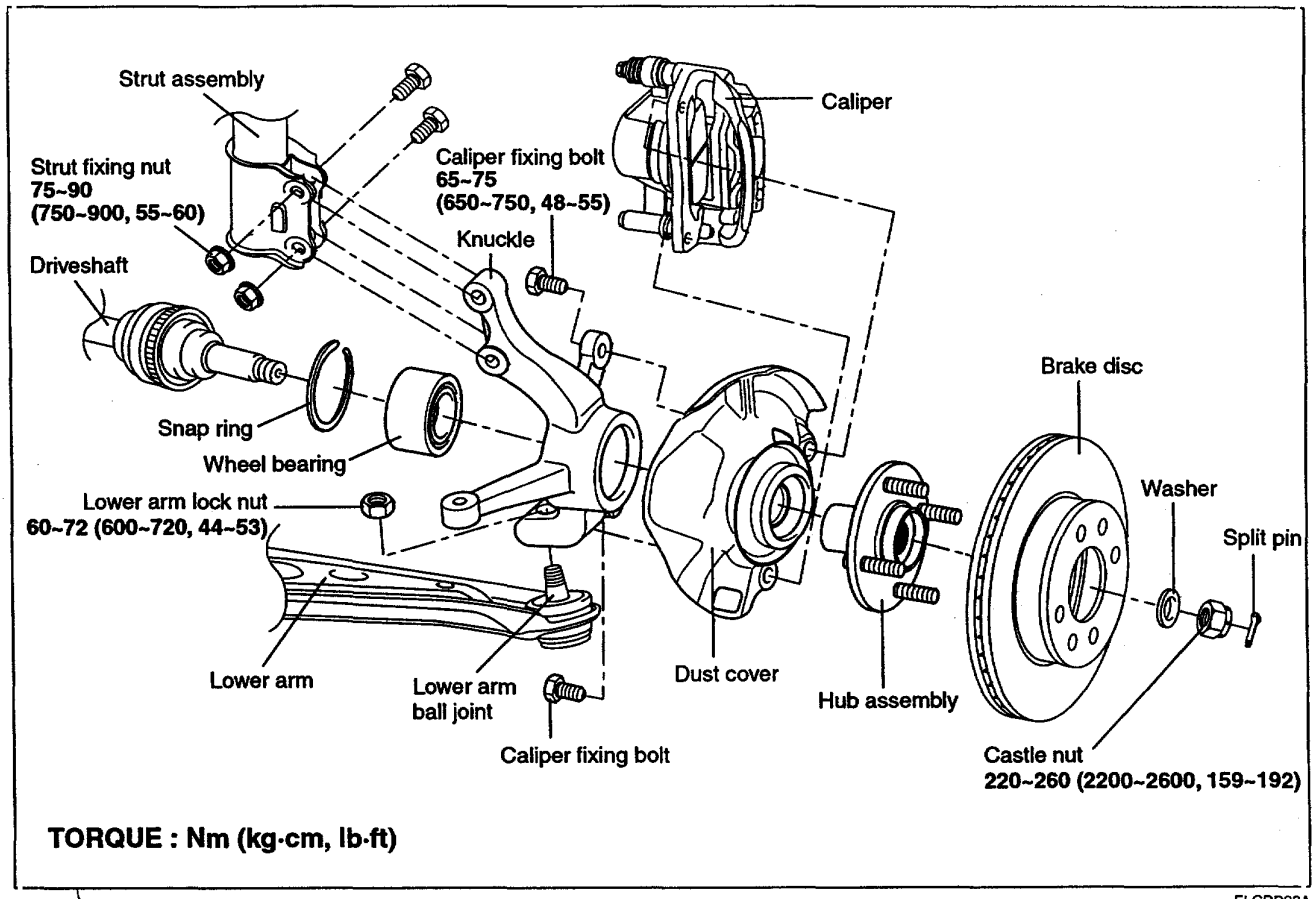


ELCDD21A

FRONT AXLE

FRONT HUB / KNUCKLE

COMPONENTS EEB227F3



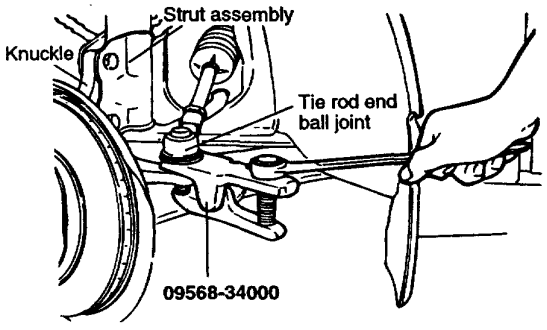
ELCDD23A

REMOVAL EB33E598

1. Raise the vehicle and remove the front wheel.
2. Remove the castle nut.
3. Remove the front caliper assembly from the knuckle and suspend it with a wire.
4. Remove the wheel speed sensor from the knuckle.
5. Disconnect the tie rod end ball joint from the knuckle using the Special Tool (09568-34000).

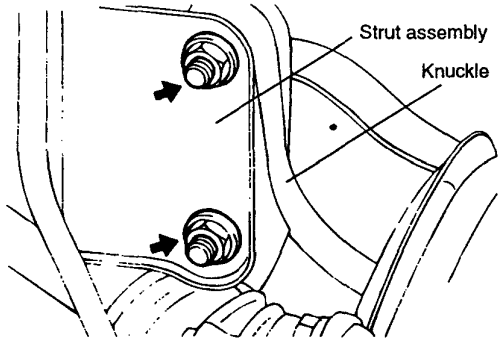
NOTE

- *Be sure to tie the cord of the Special Tool (09568-34000) to the nearby part.*
- *Loosen the nut, but do not remove it.*



EIDD401A

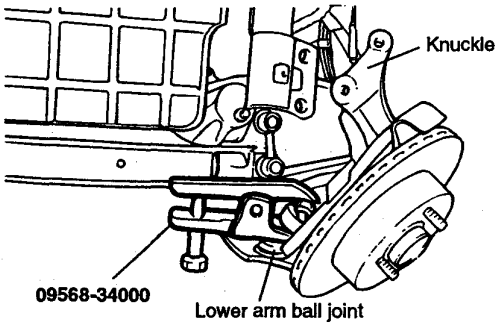
6. Disconnect the strut assembly from the knuckle.



EIDD401B

7. Disconnect the driveshaft from the hub.

8. Disconnect the lower arm ball joint from the knuckle using the Special Tool (09568-34000).

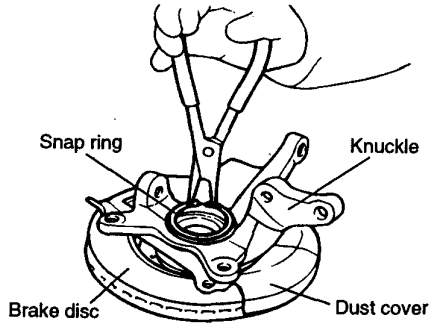


EIDD401C

9. Remove the hub and knuckle as an assembly.

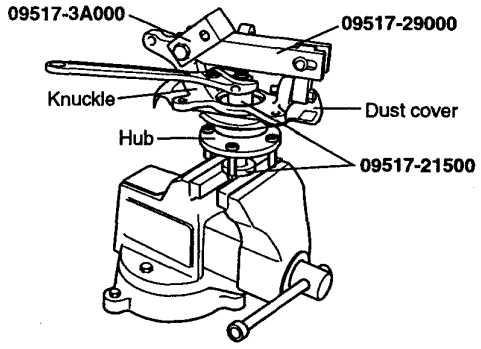
DISASSEMBLY EF2A4B0F

1. Remove the brake disc from the hub.
2. Remove the snap ring.



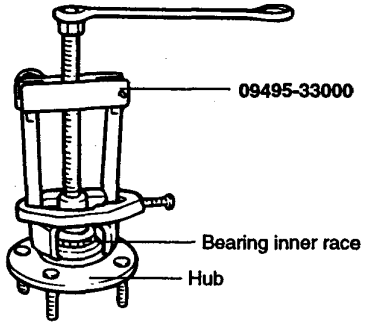
EIDD403A

3. Install the Special Tool(09517-21500, 09517-29000, 09517-3A000) as illustrated.



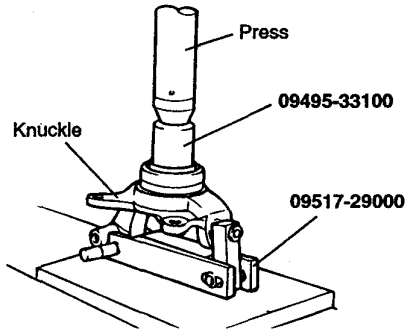
ELCDS27A

4. Remove the hub from the knuckle by turning the nut of the Special Tool (09517-21500).
5. Remove the Special Tool (09517-21500, 09517-29000, 09517-3A000) and the dust cover.
6. Remove the bearing inner race from the hub using the Special Tool (09495-33000).



EIDD403C

7. Using the Special Tool (09495-33100, 09517-29000), remove the wheel bearing outer race from the knuckle.



EIDA403D

INSPECTION E1EE6002

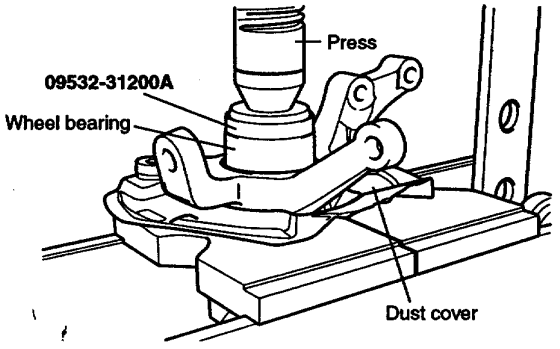
1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks.
4. Check the snap ring for crack or damage.

REASSEMBLY EDAAFE11

1. Apply a thin coat of multi-purpose grease to the knuckle and bearing contact surface.
2. Using the Special Tool (09532-31200A), press the bearing into the knuckle.

   NOTE
   - *Do not press on the inner race of the wheel bearing. That will cause damage to the bearing assembly.*
   - *When installing a bearing assembly, always use a new one.*
   - *Left and right bearing must be from one maker.*

3. Install the dust cover.

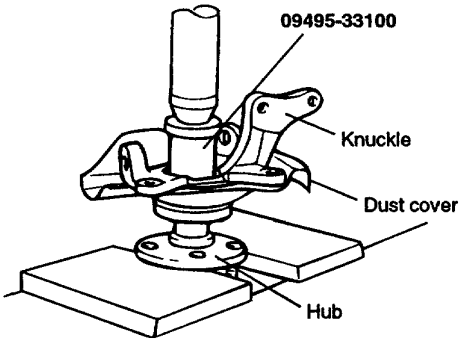


ETBDS12A

4. Using the Special Tooi(09495-33100), press the hub into the knuckle.

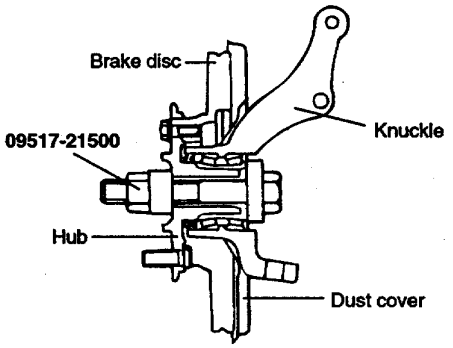
   NOTE

   Do not press on the outer race of the wheel bearing. That will cause damage to the bearing assembly.



EIDD405B

5. Install the brake disc.
6. Tighten the hub to the knuckle to 220~260 Nm (2200~2600 kg·cm, 159~188 lb·ft) with the Special Tool (09517-21500).

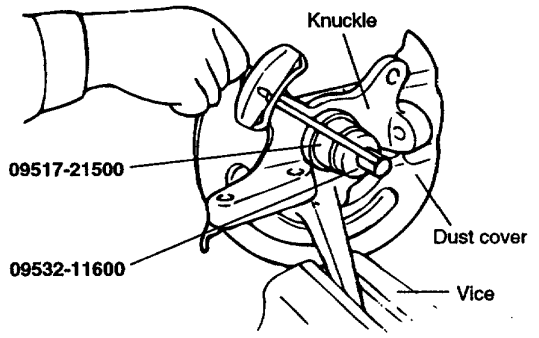


EIDD405C

7. Rotate the hub several times to have the bearing seated.
8. Measure the hub bearing starting torque.

Hub bearing starting torque [Limit] :
1.8 Nm (18 kgf·cm, 1.33 lbf·ft) or less

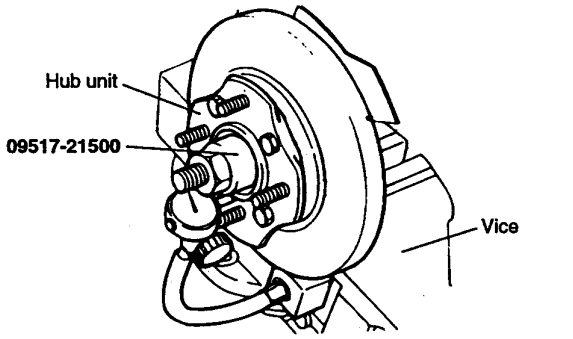
9. If the starting torque is 0 Nm (0 lb·ft), measure the hub bearing axial end play.



EIDD405D

10. If the hub bearing axial end play exceeds the limit while the nut is tightened to 220~260 Nm (2200~2600 kg·cm, 159~188 lb·ft), the bearing, hub and knuckle have not been installed correctly. Repeat the disassembly and assembly procedure.

Hub bearing axial end play [Limit] :
0.064 ~ 0.088 mm (0.0025 ~ 0.0035 in.) or less



EIDD405E

11. Remove the Special Tool. (09517-21500)

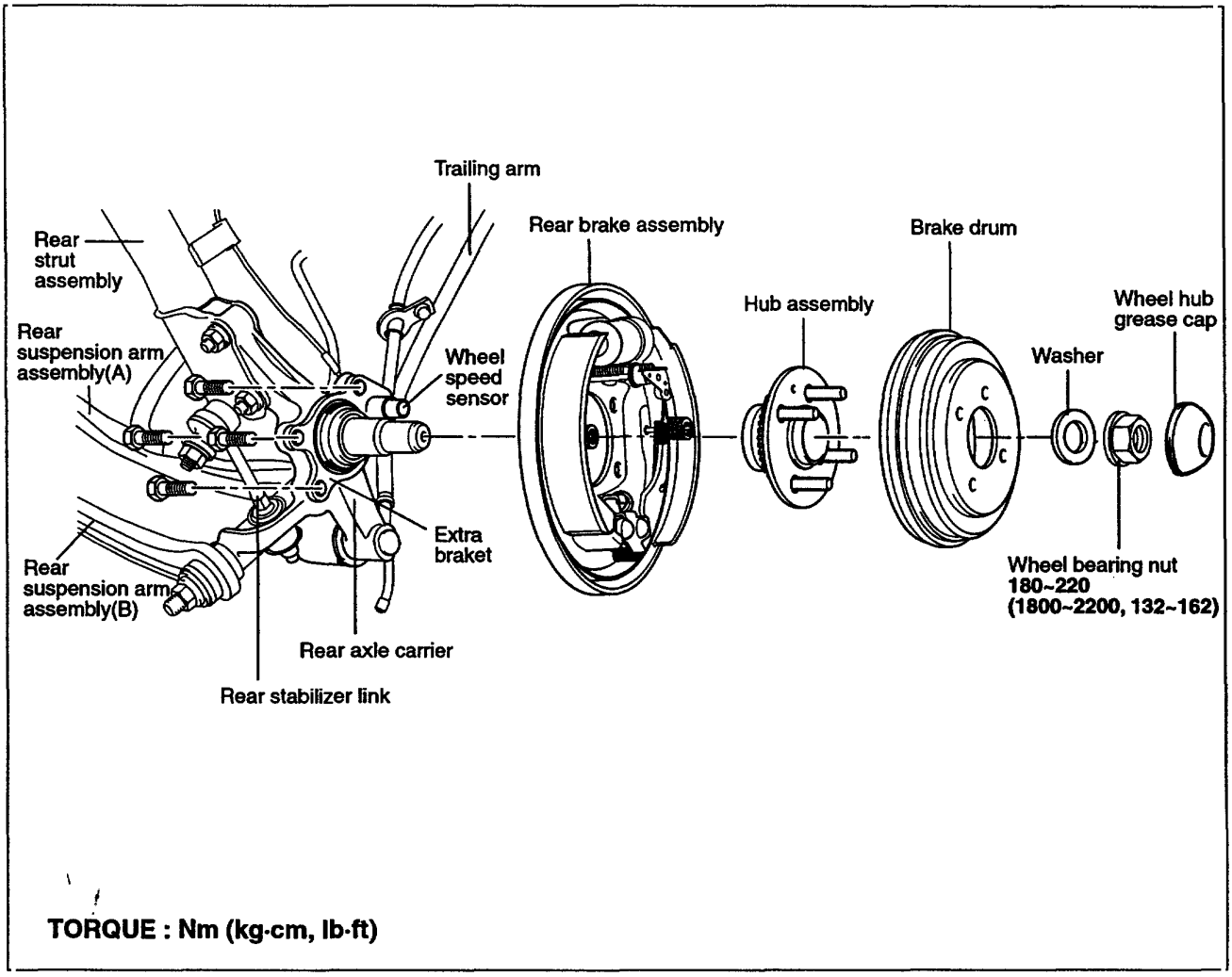
INSTALLATION EEEBF2C1

Installation is in the reverse order of removal. (See page DS-13.)

REAR AXLE

REAR AXLE / HUB

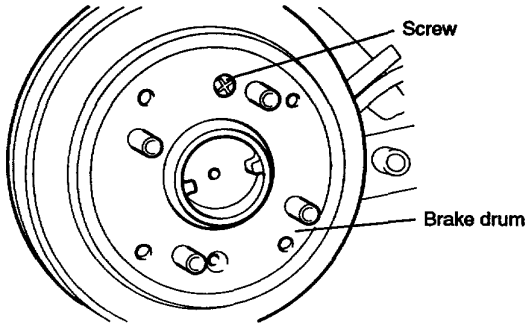
COMPONENTS EAAA4DBD



ELCDS35A

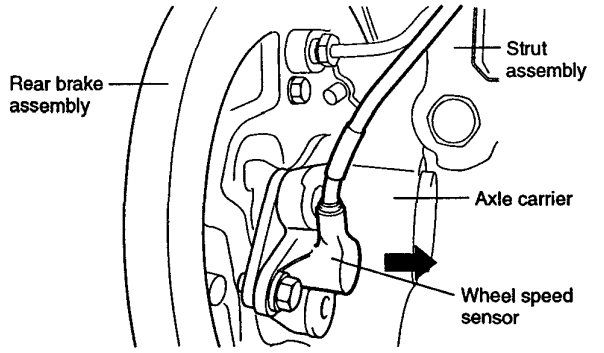
REMOVAL E6A81BB6

1. Remove the wheel hub grease cap with a (-) driver and a hammer.
2. Remove the wheel bearing nut and the tongued washer.
3. Remove the screw from the brake drum.



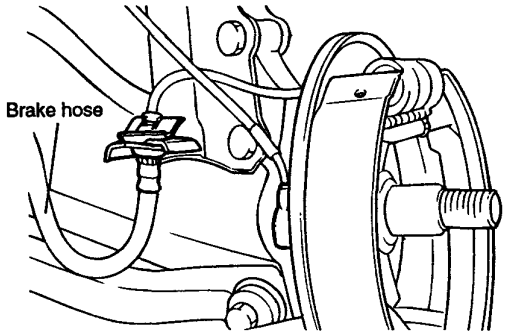
ETBDS14A

4. Remove the brake drum.
5. Remove the wheel speed sensor from the axle carrier.



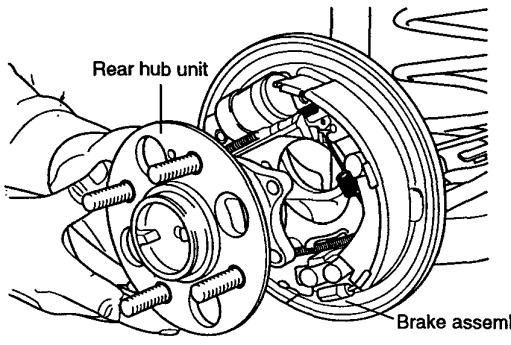
ELCDD37A

6. Remove the brake hose clip and detach the brake hose from the shock absorber.



EIDD801A

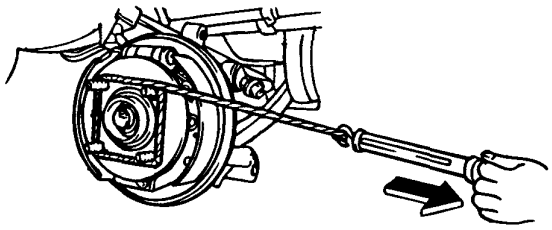
7. Remove the rear hub unit bearing from the brake assembly.



ETBDS25A

INSPECTION ED914699

1. Check the rear hub bearing for wear or damage.
2. Check the rear tone wheel for chipped teeth.
3. Check the rotating rear hub unit bearing for noise.
4. Check the hub inner surface for wear.
5. Check the carrier for cracks.
6. Check the rear hub unit bearing starting torque (it should be less than 1.8 Nm (18 kgf·cm, 1.33 lbf·ft)).



EIFA802A

INSTALLATION E773E3E2

Installation is the reverse of removal.

1. Install the rear hub unit bearing.
2. Assemble the tongued washer and the wheel bearing nut.

NOTE

- *Left and right bearing must be from one maker and press inner race further until inner race contacts end of splines.*
- *After tightening the wheel bearing nut, apply grease evenly to the clearance around the nut (India, Turkey only). (refer to 'LUBRICANTS', DS-p.3)*

3. Hammer the wheel bearing nut for the groove in the carrier.
4. Connect the rear speed sensor.
5. Fix up the brake drum to the rear hub assembly with the screw.
6. Install the wheel hub grease cab.

Emissions Control System

GENERAL
- SPECIFICATIONS ..... EC -2
- SERVICE STANDARD ..... EC -2
- TIGHTENING TORQUE ..... EC -2
- TOUBLESHOOTING ..... EC -2
- COMPONENTS ..... EC -3
- SCHEMATIC DRAWING ..... EC -5

CRANKCASE EMISSION CONTROL SYSTEM
- POSITIVE CRANKCASE VENTILATION VALVE
  - COMPONENTS ..... EC -8
  - REMOVAL ..... EC -9
  - INSPECTION ..... EC -9
  - INSTALLATION ..... EC -9

EVAPORATIVE EMISSION CONTROL SYSTEM
- PURGE CONTROL SOLENOID VALVE
  - COMPONENTS ..... EC -10
  - PURGE CONTROL SYSTEM ..... EC -11
  - INSPECTION ..... EC -12
- CANISTER
  - INSPECTION ..... EC -13
- FUEL FILLER CAP
  - OPERATION ..... EC -14

EXHAUST EMISSION CONTROL SYSTEM
- OPERATION ..... EC - 15

GENERAL

SPECIFICATIONS EC579C29

COMPONENTS	FUNCTION	REMARKS
Crankcase Emission System Positive Crankcase Ventilation (PCV)	HC reduction	Variable flow rate type
Evaporative Emission System Evaporative emission canister EVAP canister Purge Solenoid Valve	HC reduction	Duty control solenoid valve
Exhaust Emission System MFI system (Air-fuel mixtrue control device) Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

MFI : Multiport Fuel Injection
EVAP : Evaporative Emission

SERVICE STANDARD EFD74BBC

Evaporative emission canister purge solenoid valve Coil resistance	26 Ω [at 20°C (68 °F)]

TIGHTENING TORQUE EC5D19C4

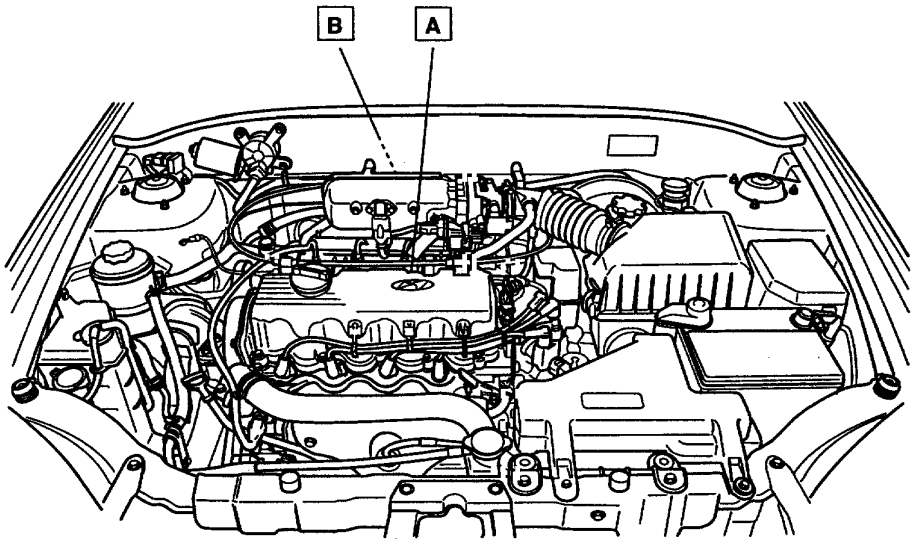
	Nm	kg·cm	lb·ft
Positive Crankcase Ventilation Valve	8 ~ 12	80 ~ 120	5.8 ~ 8.7

TROUBLESHOOTING E1C9A64A

Symptom	Probable cause	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged Malfunction of the EVAP Canister Purge Solenoid Valve	Repair or replace Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged Malfunction of the PCV vavle Malfunction of the evaporative emission canister purge system	Repair or replace Replace Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

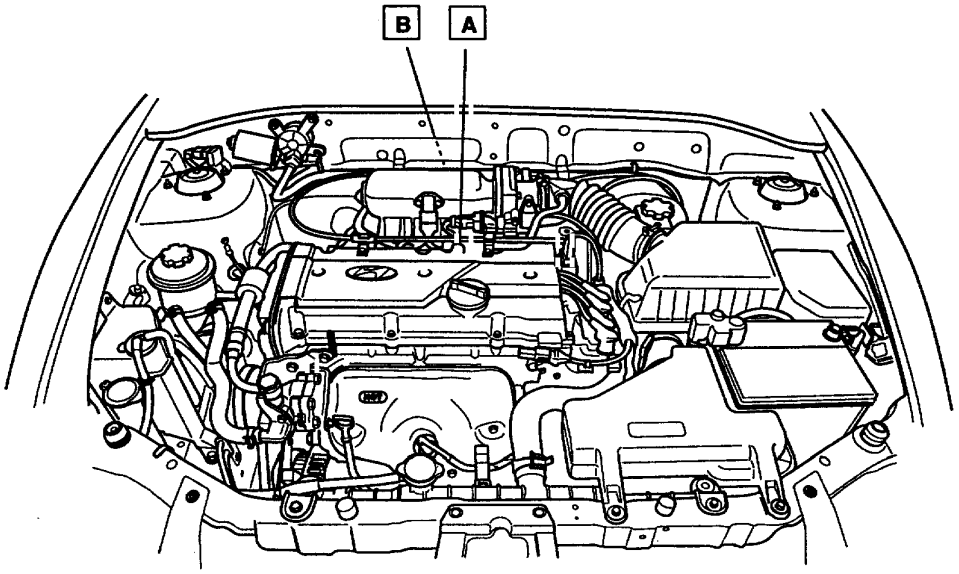
COMPONENTS E5D23C5F

[SOHC]



A Positive Crankcase Ventilation Valve (PCV valve)
B Purge Control Solenoid Valve (PCSV)

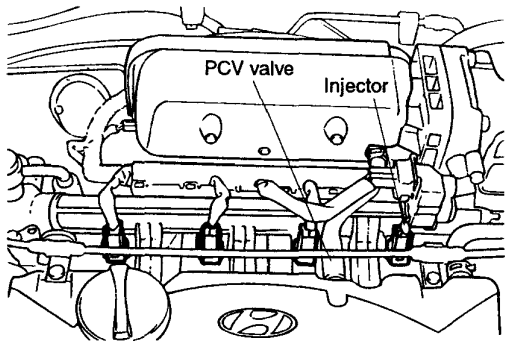
[DOHC]



A Positive Crankcase Ventilation Valve (PCV valve)
B Purge Control Solenoid Valve (PCSV)

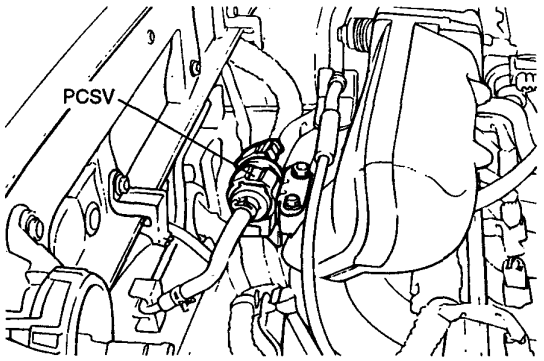
EFDD301C

A. PCV valve



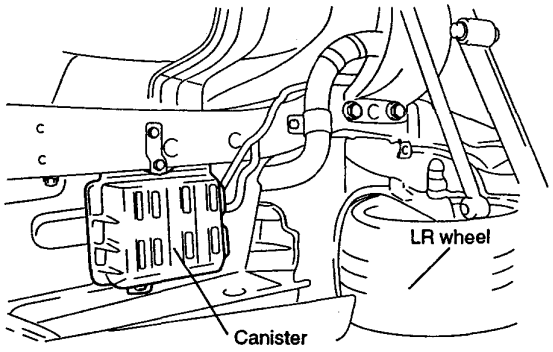
EEDA105B

B. PCSV



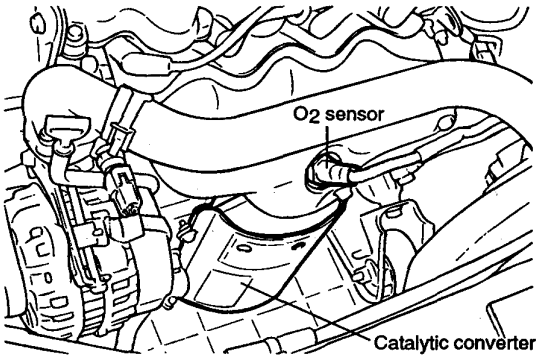
EEDA204A

C. Evaporative emission canister



EEDA005A

D. Three way catalytic converter



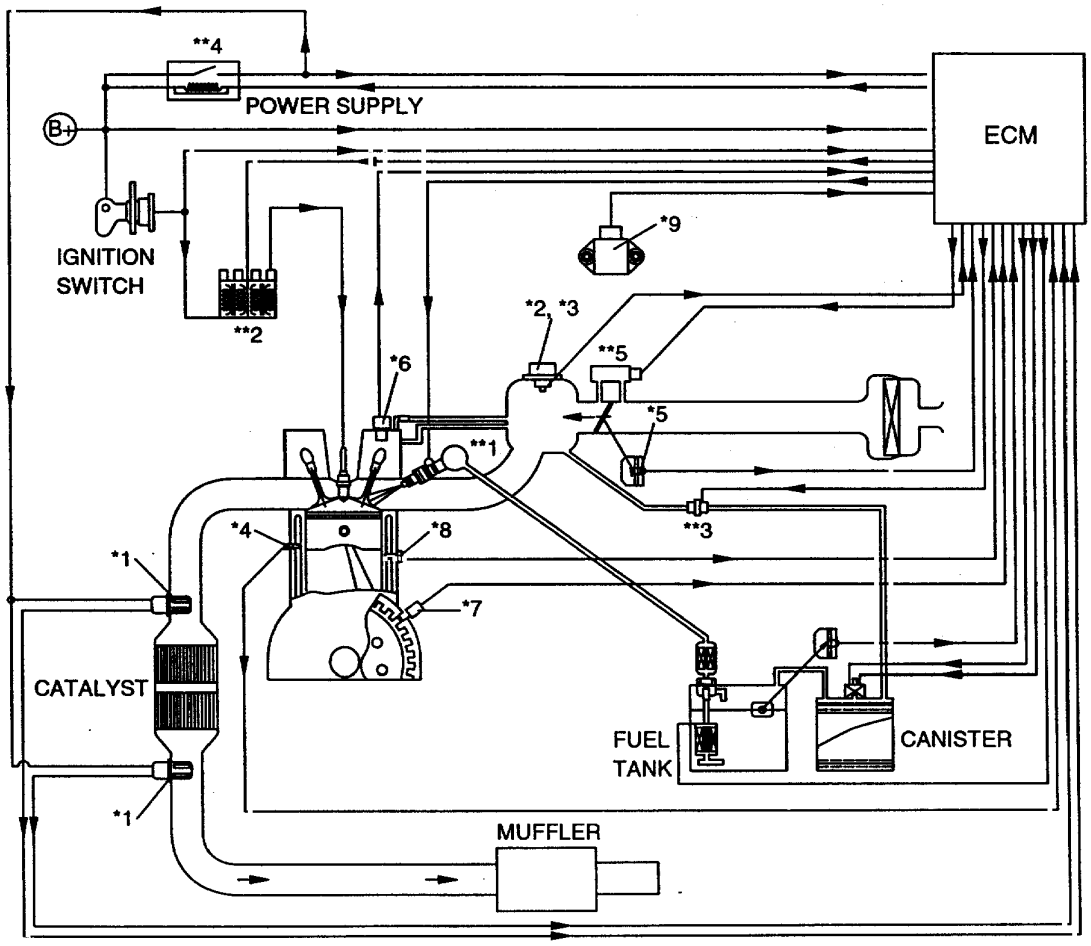
EFPD301K

SCHEMATIC DRAWING [WITH EOBD] E07381DC

*1. Heated Oxygen Sensor
*2. Manifold Absolute Pressure Sensor
*3. Intake Air Temperature Sensor
*4. Engine Coolant Temperature Sensor
*5. Throttle Position Sensor
*6. Camshaft Position Sensor
*7. Crankshaft Position Sensor
*8. Knock Sensor
*9. Acceleration Sensor

ECM

**1. Fuel Injector
**2. Ignition Coil
**3. Purge Control Solenoid Valve
**4. Main Relay
**5. Idle Speed Actuator



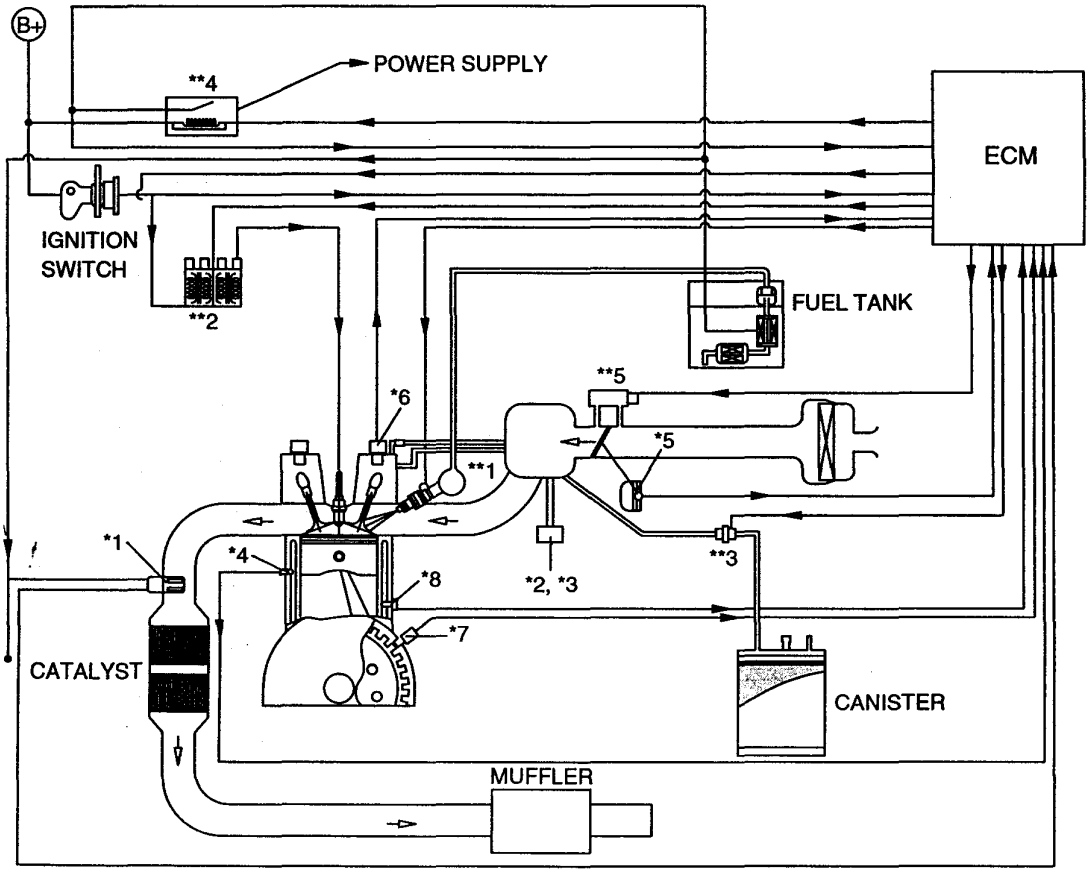
EFPD401A

SCHEMATIC DRAWING [WITHOUT EOBD]

*1. Heated Oxygen Sensor
*2. Manifold Absolute Pressure Sensor
*3. Intake Air Temperature Sensor
*4. Engine Coolant Temperature Sensor
*5. Throttle Position Sensor
*6. Camshaft Position Sensor
*7. Crankshaft Position Sensor
*8. Knock Sensor

ECM

**1. Fuel Injector
**2. Ignition Coil
**3. Purge Control Solenoid Valve
**4. Main Relay
**5. Idle Speed Actuator



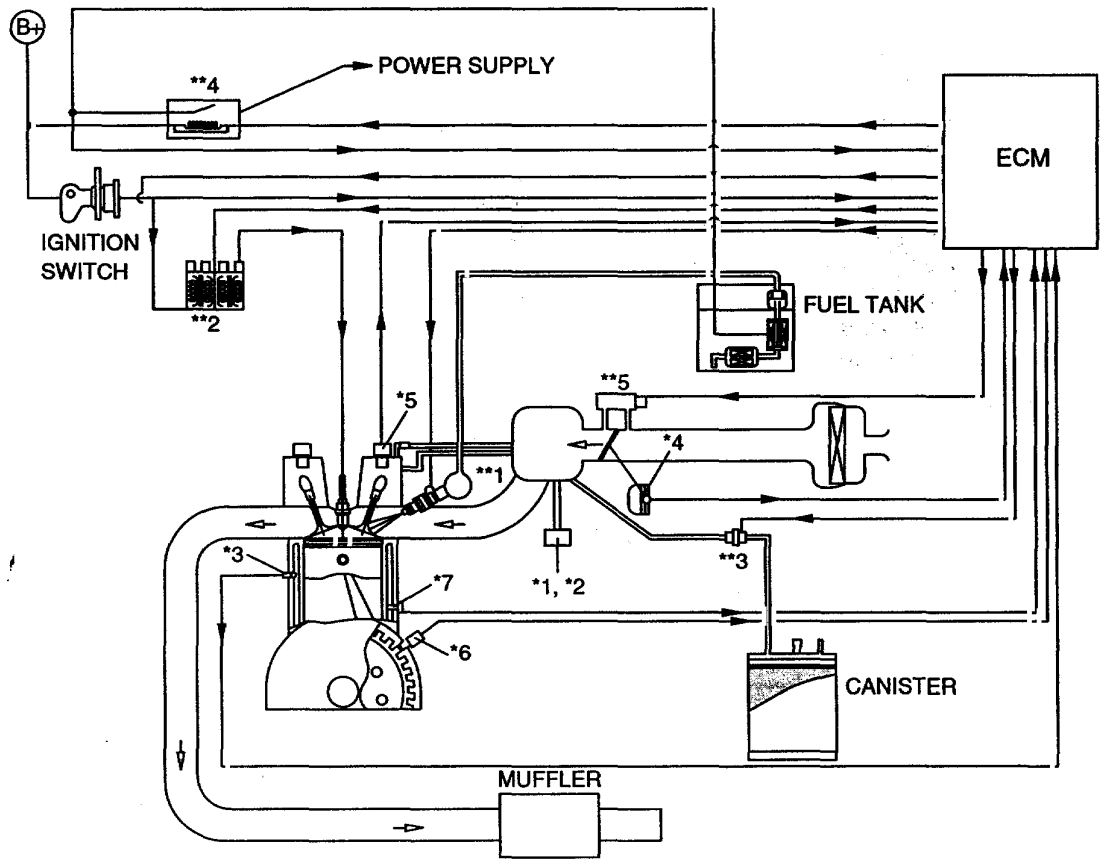
EFPD401B

SCHEMATIC DRAWING [WITH LEADED]

*1. Manifold Absolute Pressure Sensor
*2. Intake Air Temperature Sensor
*3. Engine Coolant Temperature Sensor
*4. Throttle Position Sensor
*5. Camshaft Position Sensor
*6. Crankshaft Position Sensor
*7. Knock Sensor

ECM

**1. Fuel Injector
**2. Ignition Coil
**3. Purge Control Solenoid Valve
**4. Main Relay
**5. Idle Speed Actuator

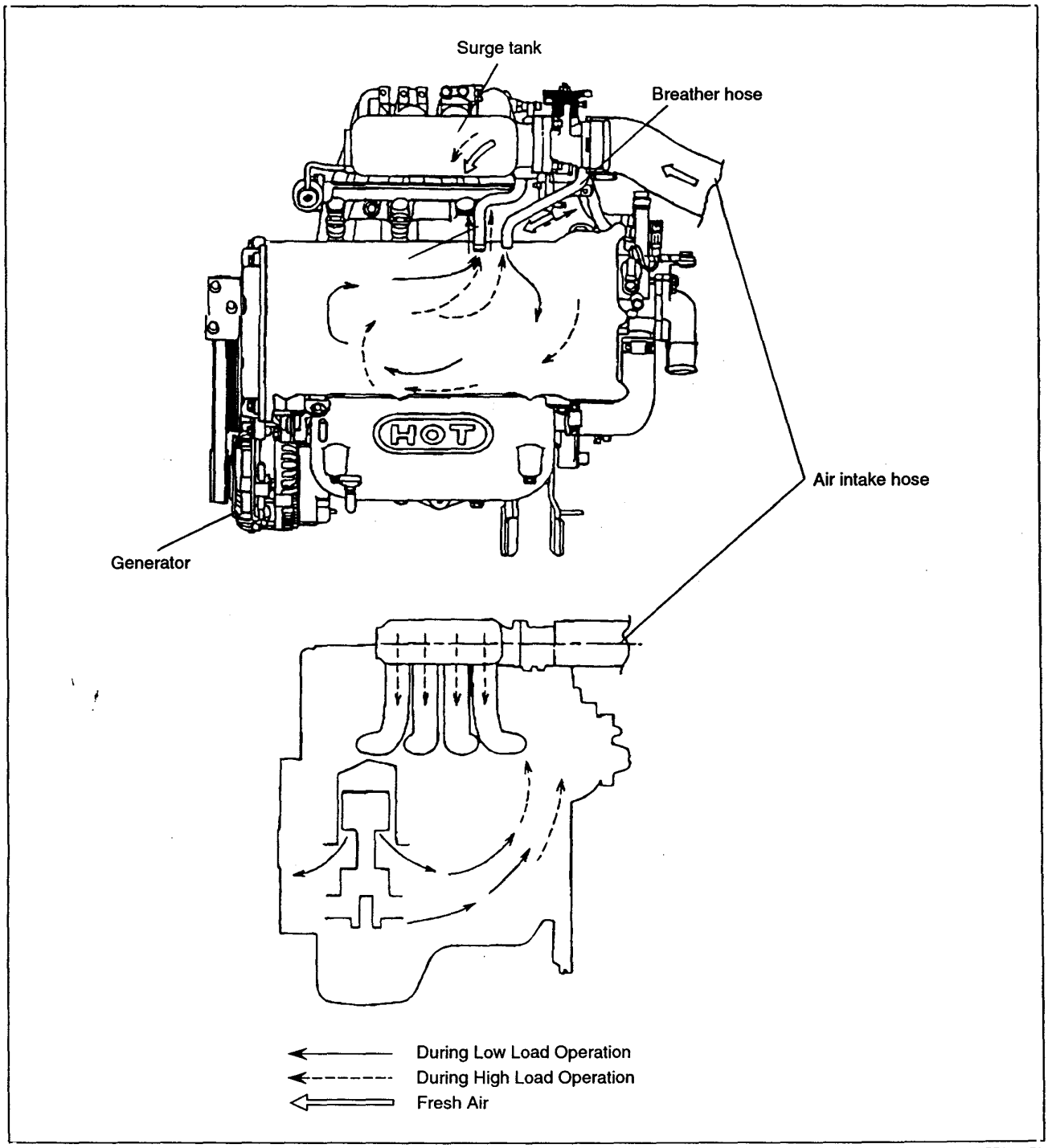


EFPD401C

CRANKCASE EMISSION CONTROL SYSTEM

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

COMPONENTS ECE0FFDA



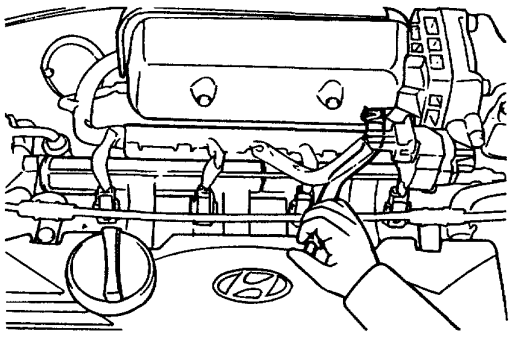
EEDA007A

REMOVAL EEEB9D34

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that the intake manifold vacuum can be felt.

   NOTE

   The plunger inside the PCV valve will move back and forth.

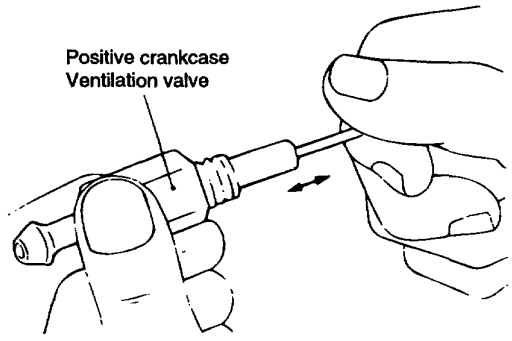


EEDA010A

3. If the vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent or replace if necessary.

INSPECTION E3CFD725

1. Remove the PCV valve.
2. Insert a thin stick into the PCV valve from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



EEDA010B

INSTALLATION EB8BC3C9

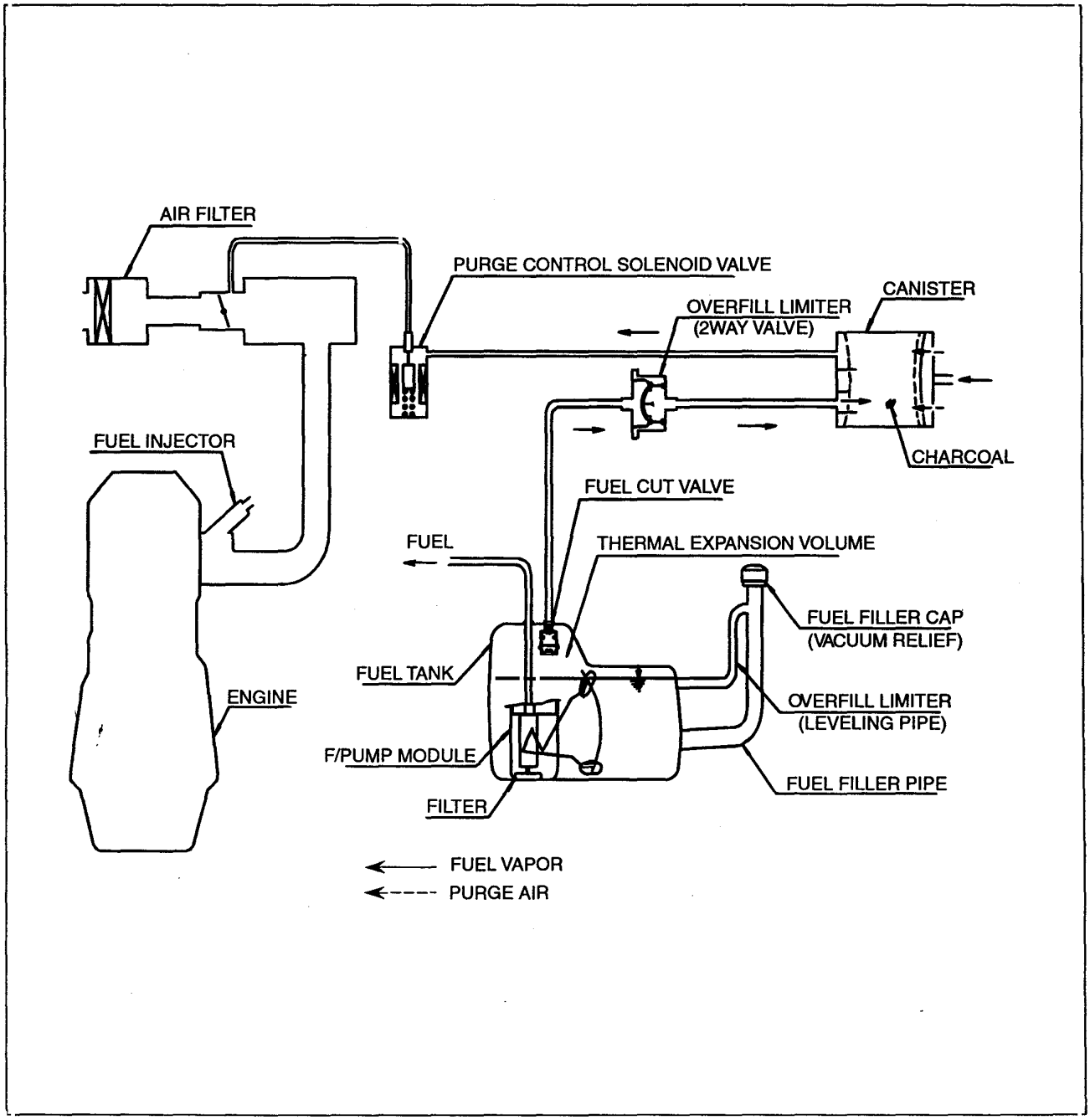
Install the PCV valve and tighten to specified torque.

PCV valve tightening torque :
8 ~ 12 Nm (80 ~ 120 kg·cm, 5.8 ~ 8.7 lb·ft)

EVAPORATIVE EMISSION CONTROL SYSTEM

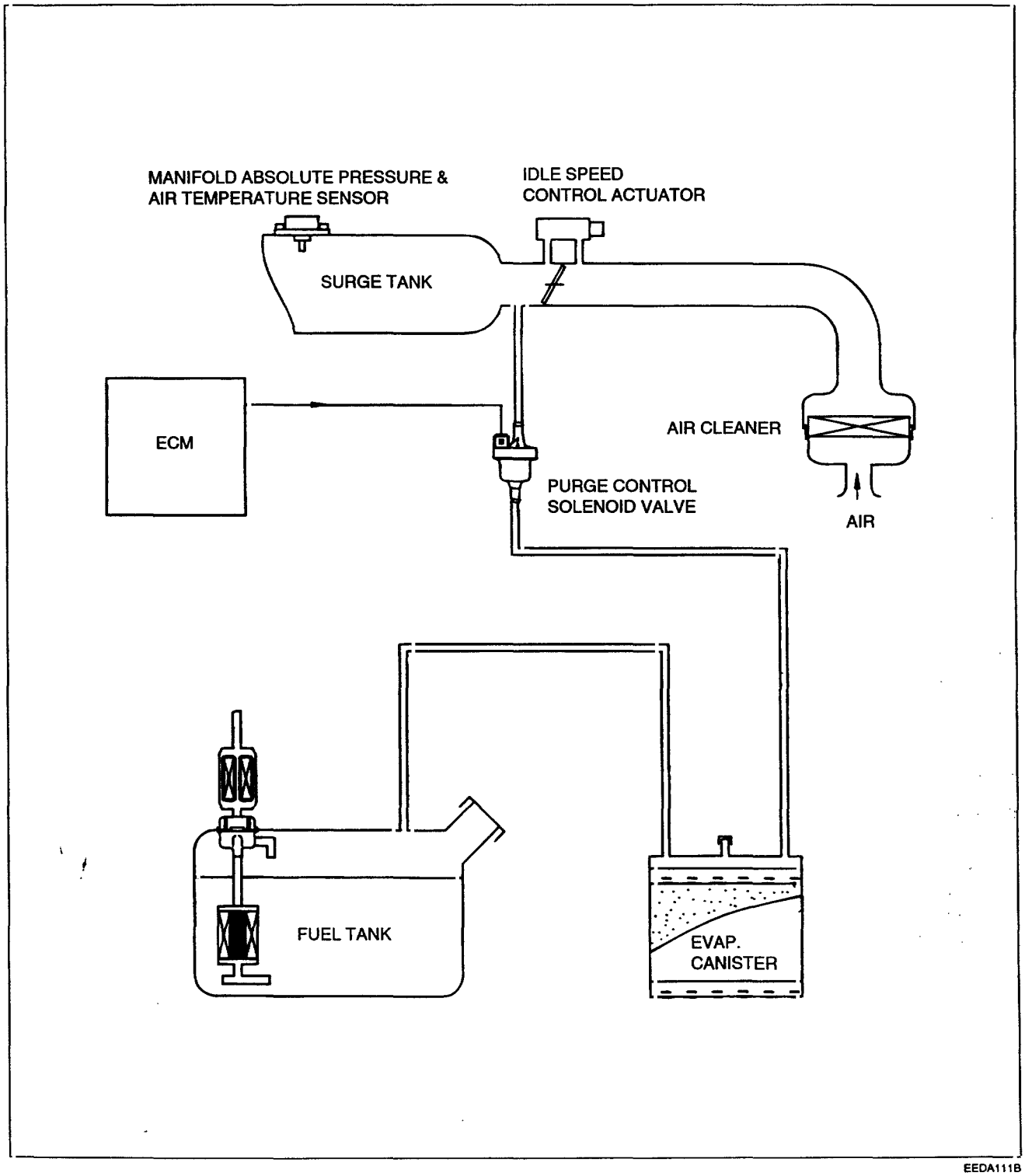
EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE

COMPONENTS E63C2D81



EEDA011B

PURGE CONTROL SYSTEM EC18ACFE



EEDA111B

INSPECTION EE4141AE

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operation condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

WHEN ENGINE IS WARM

Engine operation condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after enginestart at 3,000 rpm	Try to apply vacuum	Vacuum is held
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily. after which, it will be released.

PURGE CONTROL SOLENOID VALVE

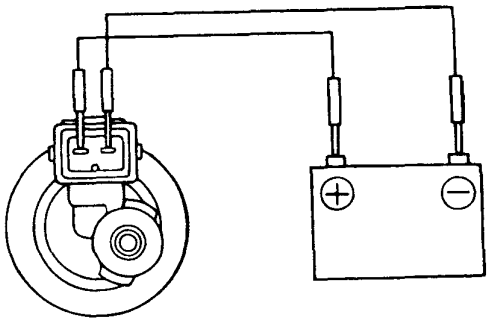
INSPECTION

NOTE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the evaporative emission canister purge solenoid valve and when the voltage is discontinued.

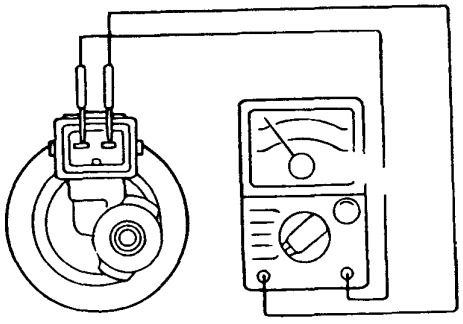
Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



EEDA013A

5. Measure the resistance between the terminals of the solenoid valve.

Evaporative emission canister purge solenoid valve
Coil resistance :
26Ω [at 20°C (68°F)]

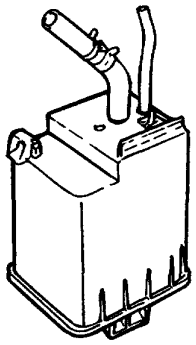


EEDA013B

EVAPORATIVE (EVAP) CANISTER

INSPECTION EBD2FF0B

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the EVAP canister, inspect for cracks or damage.

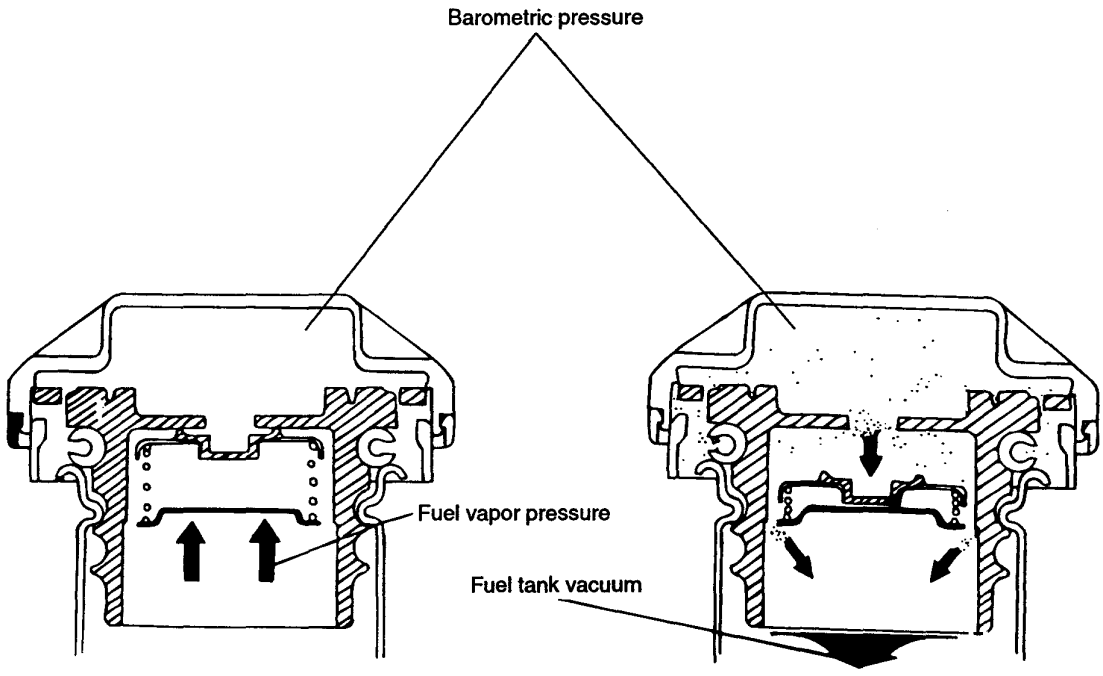


EEDA013C

FUEL FILLER CAP

OPERATION EFCFE6A2

The fuel filler cap is equipped with a vacuum relief valve to prevent the escape of fuel vapor into the atmosphere.



When fuel tank is under pressure. **When fuel tank is under vacuum.**

EEDA015A

EXHAUST EMISSION CONTROL SYSTEM

OPERATION E65D3F87

Exhaust emissions (CO,HC,NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.

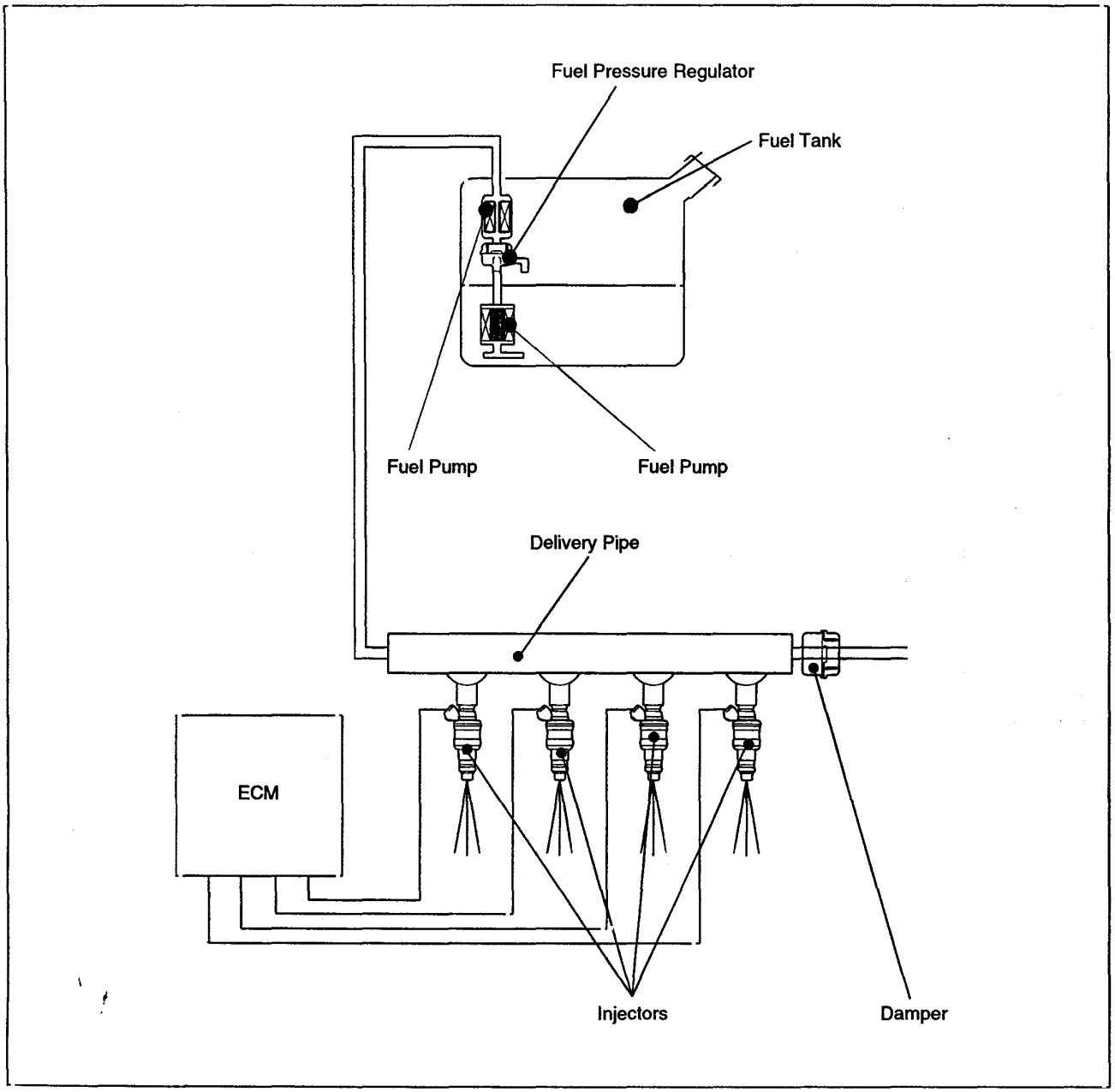
These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

The MFI system is a system which uses the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.


Fuel Pressure Regulator
Fuel Tank
Fuel Pump
Fuel Pump
Delivery Pipe
ECM
Injectors
Damper

EENB015A

Engine [DIESEL]

GENERAL
- WARNING ..... EMB -2
- SPECIFICATIONS ..... EMB -3
- SPECIAL TOOLS ..... EMB -15
- TROUBLESHOOTING ..... EMB -17
- ENGINE AND TRANSAXLE ASSEMBLY ..... EMB -19

TIMING SYSTEM
- TIMING BELT
  - COMPONENTS ..... EMB -24
  - REMOVAL ..... EMB -25
  - INSPECTION ..... EMB -26
  - INSTALLATION ..... EMB -29

CYLINDER HEAD ASSEMBLY
- CYLINDER HEAD
  - COMPONENTS ..... EMB -30
  - DISASSEMBLY ..... EMB -31
  - INSPECTION ..... EMB -32
  - REASSEMBLY ..... EMB -33
- CYLINDER HEAD COVER AND PLUG
  - COMPONENTS ..... EMB -35
  - REMOVAL ..... EMB -36
  - INSTALLATION ..... EMB -36

MAIN MOVING SYSTEM
- CAM SHAFT
  - COMPONENTS ..... EMB -37
  - DISASSEMBLY ..... EMB -38
  - INSPECTION ..... EMB -38
  - REASSEMBLY ..... EMB -39
- COUNTER BALANCE SHAFT
  - COMPONENTS ..... EMB -40
  - DISASSEMBLY ..... EMB -41
  - INSPECTION ..... EMB -41
  - REASSEMBLY ..... EMB -42
- CRANK SHAFT
  - COMPONENTS ..... EMB -44
  - DISASSEMBLY ..... EMB -44
  - INSPECTION ..... EMB -45
  - REASSEMBLY ..... EMB -46
- PISTON
  - COMPONENTS ..... EMB -48
  - INSPECTION ..... EMB -49
  - INSTALLATION ..... EMB -50

COOLING SYSTEM
- RADIATOR
  - REMOVAL ..... EMB -52
  - INSPECTION ..... EMB -52
  - INSTALLATION ..... EMB -52
- ENGINE COOLANT HOST/PIPES
  - COMPONENTS ..... EMB -53
  - INSPECTION ..... EMB -54
  - REASSEMBLY ..... EMB -54
  - REMOVAL ..... EMB -54
  - INSTALLATION ..... EMB -54
- ENGINE COOLANT PUMP
  - COMPONENTS ..... EMB -55
  - REMOVAL ..... EMB -56
  - INSPECTION ..... EMB -56
  - INSTALLATION ..... EMB -56
- RADIATOR CAP
  - COMPONENTS ..... EMB -57
  - INSPECTION ..... EMB -57
- THERMOSTAT
  - COMPONENTS ..... EMB -58
  - REMOVAL ..... EMB -58
  - INSPECTION ..... EMB -58
  - INSTALLATION ..... EMB -59

LUBRICATION SYSTEM
- OIL PUMP
  - COMPONENTS ..... EMB -60
  - DISASSEMBLY ..... EMB -61
  - INSPECTION ..... EMB -61
  - REASSEMBLY ..... EMB -62
  - REMOVAL ..... EMB -62
  - INSTALLATION ..... EMB -62
- OIL COOLER
  - COMPONENTS ..... EMB -63
  - REMOVAL ..... EMB -64
  - INSPECTION ..... EMB -64
  - INSTALLATION ..... EMB -64

ENGINE BLOCK
- ENGINE BLOCK
  - COMPONENTS ..... EMB -65
  - REMOVAL ..... EMB -66
  - INSPECTION ..... EMB -66
  - INSTALLATION ..... EMB -67
- ENGINE MOUNTS
  - COMPONENTS ..... EMB -68
  - REMOVAL ..... EMB -69

INTAKE AND EXHAUST SYSTEM
- TURBO CHARGER (TC)
  - COMPONENTS ..... EMB -71
  - INSPECTION ..... EMB -72
- EXHAUST MANIFOLD
  - COMPONENTS ..... EMB -73
- MUFFLER
  - REMOVAL ..... EMB -74
  - INSTALLATION ..... EMB -75
- INTERCOOLER
  - COMPONENTS ..... EMB -76
  - REMOVAL ..... EMB -76
- AIR CLEANER (ACL)
  - COMPONENTS ..... EMB -77
  - REMOVAL ..... EMB -78
  - INSPECTION ..... EMB -78
  - INSTALLATION ..... EMB -78

GENERAL

WARNING ED70B615

REMOVAL AND INSTALLATION OF INJECTOR AND HIGH PRESSURE PUMP.

1. Fuel system is subject to extremely high pressure (1350 bar).
2. Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
3. Always pay attention to safety precautions.
4. Ensure the absolute cleanliness.
5. Never remove the injectors.

SPECIFICATIONS(D3EA)

Description	Specification 1.5(D3EA)	Limit
General		
Type	In-line, Single Overhead Camshaft	
Number of cylinders	3	
Bore	83 mm (3.27 in.)	
Stroke	92 mm (3.62 in.)	
Total displacement	1493 cc (91.1 cu.in.)	
Compression ratio	17.7:1	
Firing order	1 - 3 - 2	
Valve timing		
Intake valve		
Opens (BTDC)	7°	
Closes (ABDC)	43°	
Exhaust valve		
Opens (BBDC)	52°	
Closes (ATDC)	6°	
Cylinder head		
Flatness of gasket surface	0.03 mm (0.0012 in.) for width 0.09 mm (0.0035 in.) for length 0.012 mm (0.00047 in.) / 51 x 51	
Camshaft		
Cam height		
Intake	34.697 mm (1.366 in.)	34.197 mm (1.346 in.)
Exhaust	34.570 mm (1.361 in.)	34.070 mm (1.341 in.)
Journal O.D.	28 mm (1.10 in.)	
Bearing oil clearance	0.040 ~ 0.074 mm (0.0020 ~ 0.0029 in.)	
End play	0.05 ~ 0.15 mm (0.002 ~ 0.006 in.)	
Valve		
Valve length		
Intake	95.7 mm (3.77 in.)	
Exhaust	95.4 mm (3.76 in.)	
Stem O.D.		
Intake	5.953 mm (0.234 in.)	
Exhaust	5.925 mm (0.233 in.)	
Face angle	44.5°	
Thickness of valve head (margin)		
Intake	1.6 mm (0.063 in.)	
Exhaust	1.3 mm(0.0512 in.)	
Valve stem to valve guide clearance		
Intake	0.022 ~ 0.049 mm (0.00086 ~ 0.00193 in.)	0.1 mm (0.0039 in.)
Exhaust	0.050 ~ 0.077 mm (0.0020 ~ 0.0030 in.)	0.15 mm (0.0059 in.)
Valve guide		
Length		
Intake	36.5 mm (1.437 in.)	
Exhaust	36.5 mm (1.437 in.)	
Valve seat		
Width of seat contact	1.21mm (0.0477 in.) / 1.61mm (0.0634 in.) (IN/EX)	
Seat angle	44° ~ 44.5°	

Description	Specification 1.5(D3EA)	Limit
Valve spring		
Free length	39.14 mm (1.541 in.)	38.14 mm (1.502 in.)
Load	21.4 kg / 32 mm (47.2 lb / 1.26 in.) at installed height	
Cylinder block		
Cylinder bore	83 + 0.03 mm (3.27 + 0.0012 in.)	
Flatness of gasket surface	0.042 mm (0.00165 in.) for width 0.096 mm (0.0038 in.) for length 0.012 mm (0.00047 in.) 50 x 50	0.1 mm (0.0039 in.)
Piston		
O.D.	82.919 ~ 82.951 mm (3.26 ~ 3.27 in.)	
Piston - to - cylinder clearance	0.069 ~ 0.091 mm (0.0027 ~ 0.0036 in.)	
Ring groove width		
No. 1	1.915 ~ 1.945 mm (0.075 ~ 0.076 in.)	
No. 2	2.06 ~ 2.08 mm (0.08 ~ 0.082 in.)	
Oil	3.02 ~ 3.04 mm (0.119 ~ 0.1196 in.)	
Service size	0.25 mm (0.010 in), 0.5 mm (0.020 in.) 0.75 mm (0.030 in.), 1.00 mm (0.039 in.) oversize	
Piston ring		
Side clearance		
No. 2	0.065 ~ 0.11 mm (0.00256 ~ 0.00433 in.)	
Oil ring	0.03 ~ 0.07 mm (0.00118 ~ 0.00275 in.)	
End gap		
No. 1	0.2 ~ 0.3 mm (0.0079 ~ 0.0118 in.)	
No. 2	0.3 ~ 0.45 mm (0.0118 ~ 0.0177 in.)	
Oil ring side rail	0.2 ~ 0.45 mm (0.0079 ~ 0.0177 in.)	
Connecting rod		
Connecting rod pin O.D	28.022 ~ 28.034 mm (1.103 ~ 1.104 in.)	0.1 mm (0.0039 in.)
Connecting rod bearing oil clearance	0.024 ~ 0.042 mm (0.0009 ~ 0.0016 in.)	0.1 mm (0.0039 in.)
Crankshaft main bearing oil clearance	0.024 ~ 0.042 mm (0.0009 ~ 0.0016 in.)	
Crankshaft		
Journal O.D.	60.002 ~ 60.020 mm (2.362 ~ 2.363 in.)	
Out-of-round of journal and pin	Less than 0.015 mm (0.0006 in.)	
Taper of journal and pin	Less than 0.005 mm (0.0002 in.)	
End play	0.09 ~ 0.32 mm (0.0035 ~ 0.0126 in.)	
Flywheel		
Runout		0.13 mm (0.0051in.)
Oil pressure (1500 rpm) [Oil temperature is 95 - 105°C (203 - 221°F)]	More than 250 kPa (36.26 psi)	
Oil pump		
Tip clearance	0.12 ~ 0.2 mm (0.00472 ~ 0.0078 in.)	
Radial clearance	0.13 ~ 0 .23 mm (0.0051 ~ 0.009 in.)	
Side clearance	0.02 ~ 0.07 mm (0.00078 ~ 0.0027 in.)	
Relief spring		
Free length	47.5 mm (1.835 in.)	
Opening pressure	570 ± 50 kPa (87.67 ± 7.25 psi)	

Description	Specification 1.5(D3EA)	Limit
Silent shaft		
Front journal diameter	70.01 ~ 70.03 mm (2.756 ~ 2.757 in.)	
Rear journal diameter	40.01 ~ 40.03 mm (1.575 ~ 1.576 in.)	
Oil clearance		
Front	0.050 ~ 0.09 mm (0.0020 ~ 0.0036 in.)	
Rear	0.050 ~ 0.091 mm (0.0020 ~ 0.0036 in.)	
Cooling method	Forced circulation with electric fan	
Cooling system quantity	5.3 lit (5.6 U.S.qts., 4.66 Imp.qts.)	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	85°C (185°F)	
Opening temperature range	83.5°C - 86.5°C (182°F - 188°F)	
Wide open temperature	100°C (212°F)	
Radiator cap		
Main valve opening pressure	107.9 ± 14.7 kPa (1.1 ± 0.15 kg/cm², 15.64 ± 2.13 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/ cm², 12.1 psi)	
Vacuum valve opening pressure	- 6.86 kPa (- 0.07 kg/ cm², - 1.00 psi)	
Air cleaner	Dry type	
Type	Unwoven cloth type	
Element		
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	
Coolant temperature sensor	Thermister type	
Type		
Resistance		
20°C (68°F)	2.45 ± 0.14 kΩ	
80°C (176°F)	0.3222 kΩ	

SERVICE STANDARDS

Standard value	
Coolant concentration	
Tropical area	40%
Other area	50%

LUBRICANT

Engine coolant	Ethylene glycol base for aluminum radiator

SEALANT

Engine coolant temperature sensor	LOCTITE 262, three bond No. 1324 or equivalent
Oil pressure switch	3M ATD No. 8660 or Three bond No. 1141E
Crankshaft bed plate	LOCTITE 5205

NOTE

O.D.= Outer Diameter

I.D.= Inner Diameter

O.S.= Oversize Diameter

U.S. = Undersize Diameter

TIGHTENING TORQUE

Item	Nm	kg·cm	lb·ft
Engine mount insulator bolt	90 ~ 110	900 ~ 1100	65 ~ 80
Engine mounting bracket nuts	60 ~ 80	600 ~ 800	43 ~ 58
Engine mounting bracket bolts	60 ~ 80	600 ~ 800	43 ~ 58
Engine Support bracket bolt and nut	43 ~ 55	430 ~ 550	32 ~ 40
Front roll stopper bracket to cross member bolts	40 ~ 55	400 ~ 550	29 ~ 40
Front roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper bracket to cross member bolts	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Transaxle mounting bracket bolts	60 ~ 80	600 ~ 800	43 ~ 58
Transaxle mounting insulator bolt	90 ~ 110	900 ~ 1100	65 ~ 80
Front exhaust pipe to exhaust manifold	30 ~ 40	300 ~ 400	22 ~ 29
Head cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft sprocket bolt	125 ~ 140	1250 ~ 1400	92 ~ 103
Camshaft bearing cap bolt	27 ~ 30	270 ~ 300	20 ~ 22
Crankshaft position sensor	7 ~ 11	70 ~ 110	5 ~ 8
Air cleaner body installation bolt	8 ~ 10	80 ~ 100	6 ~ 7
Crankshaft sprocket bolt	185 ~ 195	1850 ~ 1950	136 ~ 144
Damper pulley to crankshaft sprocket	30 ~ 34	300 ~ 340	22 ~ 25
Cylinder head bolt (cold engine)	50 + 120° + 90°	500 + 120° + 90°	36 + 120° + 90°
Timing belt auto tensioner bolt	50 ~ 55	500 ~ 550	36 ~ 40
Drive blet Auto tensioner bolt	26 ~ 31	260 ~ 310	19 ~ 23
Timing belt auto tensioner adjustable bolt	10 ~ 12	100 ~ 120	7 ~ 9
Drive belt idler bolt	46 ~ 51	460 ~ 510	34 ~ 38
Front exhaust pipe clamp bolt	20 ~ 30	200 ~ 300	14 ~ 22
Oil pan	10 ~ 12	100 ~ 120	7 ~ 9
Oil pan drain plug	35 ~ 45	350 ~ 450	25 ~ 33

Item	Nm	kg·cm	lb·ft
Oil screen	10 ~ 12	100 ~ 120	7 ~ 9
Oil pressure switch	15 ~ 22	150 ~ 220	11 ~ 16
Oil screen bracket bolt	34 ~ 38	340 ~ 380	25 ~ 28
Oil pump cover bolt	20 ~ 27	200 ~ 270	15 ~ 20
Oil seal case bolt	10 ~ 12	100 ~ 120	7 ~ 9
Plug cap	20 ~ 27	200 ~ 270	14 ~ 20
Oil jet bolt	9 ~ 13	90 ~ 130	7 ~ 10
Oil pump rotor bolt	8 ~ 10	80 ~ 100	6 ~ 97
Timing belt upper cover	8 ~ 12	80 ~ 120	6 ~ 9
Timing belt lower cover	8 ~ 12	80 ~ 120	6 ~ 9
Relief plug (oil pump relief valve cap)	42 ~ 52	420 ~ 520	31 ~ 38
Flywheel	70 ~ 80	700 ~ 800	52 ~ 59
Drive plate	70 ~ 80	700 ~ 800	52 ~ 59
Connecting rod cap bolt	25 + 90°	250 + 90°	18 + 90°
Engine coolant pump to cylinder block bolt			
14 mm	48 ~ 52	480 ~ 520	35 ~ 38
10 mm	10 ~ 12	100 ~ 120	7 ~ 9
Engine coolant temperature sensor	40 ~ 55	400 ~ 550	30 ~ 41
Engine coolant inlet fiting attaching bolt	20 ~ 25	200 ~ 250	15 ~ 18
Air cleaner mounting bolts	8 ~ 10	80 ~ 100	6 ~ 7
Resonator mounting bolt (Nut)	8 ~ 10	80 ~ 100	6 ~ 7
Intake manifold mounting bolt (M8)	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold nuts	25 ~ 38	250 ~ 380	18 ~ 28
Air cleaner bracket bolt	10 ~ 13	100 ~ 130	7 ~ 9
Oil level gauge	10 ~ 12	100 ~ 120	7 ~ 9
Balance shaft bolt	53 ~ 57	530 ~ 570	39 ~ 42
Starter bolt to cylinder block	48 ~ 52	480 ~ 520	35 ~ 38
Turbocharger support bolt	35 ~ 45	350 ~ 450	26 ~ 33
Crankshaft bedplate bolt			
15 mm	28 - 32 + 120°	280 - 320 + 120°	20.65 - 23.6 + 120°
12 mm	33.7 ~ 37.7	337 ~ 377	24.9 ~ 27.8

CHECKING ENGINE OIL

1. Position a vehicle on a level surface.
2. Turn off the engine.

   NOTE

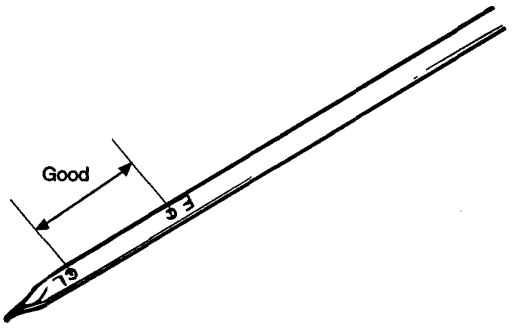
   If a vehicle that has not been used for a prolonged period, run the engine for several minutes.
   Turn off the engine and wait for 5 minutes at least, and then check the oil level.

3. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the "L" mark), refill to the "F" mark.

   NOTE

   When refilling, use the proper grade of engine oil.

4. Check that the oil is not dirty or mixed with coolant or gasoline and it has the proper viscosity.

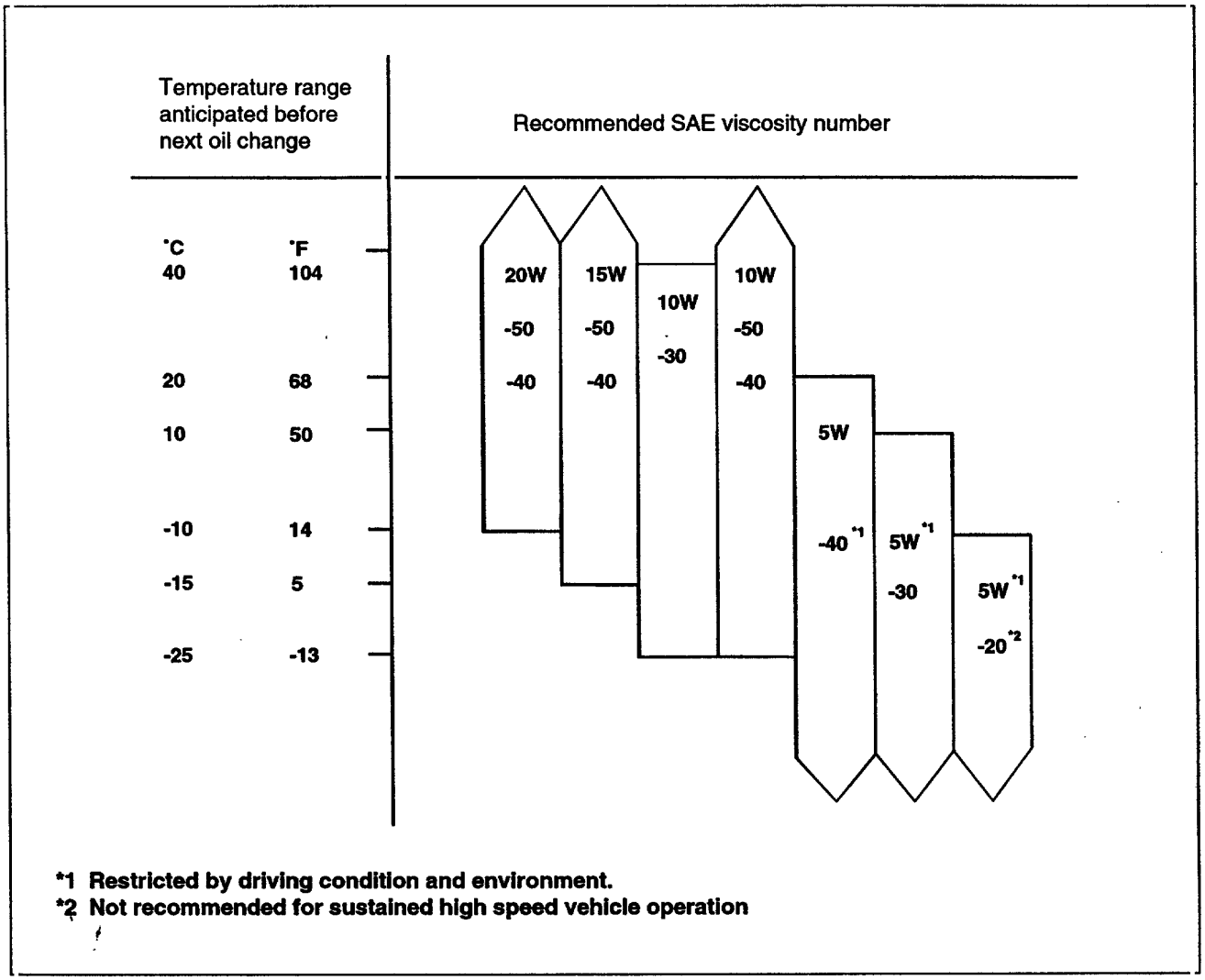


EDA9000A

SELECTION OF ENGINE OIL

Recommended API classification : CE OR ABOVE

Recommended SAE viscosity graded :



***1 Restricted by driving condition and environment.**
***2 Not recommended for sustained high speed vehicle operation**

EDA9990B

NOTE

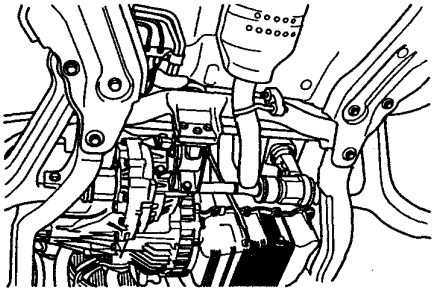
For best performance and maximum protection of all types of operation, select only those lubricants which:

1. *Satisfy the requirements of the API classification.*
2. *Have the proper SAE grade number for expected ambient temperature range.*

Lubricants which do not have both SAE grade number and an API service classification on the container should not be used.

CHANGING ENGINE OIL

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and the drain plug. Drain the engine oil.



ECDC880D

4. Tighten the drain plug to the specified torque.

Tightening torque
Oil pan drain plug :
35 ~ 45 Nm (350 ~ 450 kg.cm, 25 ~ 33 lb.ft)

NOTE

Whenever tightening the oil drain plug, use a new drain plug gasket.

5. Fill new engine oil through the oil filler cap opening.

Capacity
Drain and refill : 4.3 lit (4.88 U.S.qts., 4.07 Imp.qts.)
Oil filter : 0.5 lit (0.53 U.S.qts., 0.44 Imp.qus.)
Total : 4.8 lit (5.45 U.S.qts., 4.54 Imp.qts)

NOTE

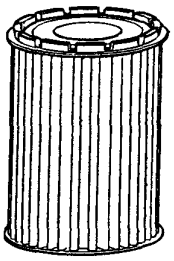
Do not overfill. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

REPLACING THE OIL FILTER

All Hyundai Motor Company engines are equipped with a high quality, disposable oil filter. The quality of aftermarket replacement filters is considerably diverse.

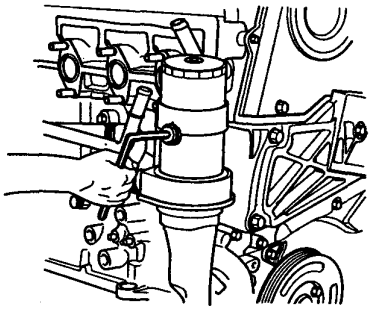
High quality replacement filters should be used to assure the most efficient service.



ECHB001A

PROCEDURE FOR REPLACING THE OIL FILTER

1. After loosening the drain plug and copper washer, drain a small quantity of oil from the filter.



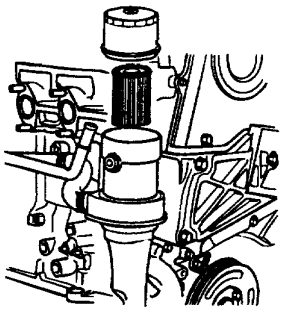
ECDC090B

2. After loosening the plastic upper cap until the O-ring in the lower case is visible, completely drain oil from the filter. (Use filter wrench. 09263-27100)
3. Remove the upper cap. Be sure that the oil filter element is removed with the plastic upper cap simultaneously.
4. Replace the oil filter element and O-ring with new ones.
5. Tighten the oil filter upper cap to the specified torque.

Oil filter : 23 ~ 25 Nm (230 ~ 250 kg.cm, 17 ~ 18 lb.ft)

6. After replacing the copper washer in drain plug with a new one, install to the alulminum lower case. (Specified torque : 8-10 Nm, 80-100 kg.cm, 5.9-7.4 lb.ft)

7. Start and run the engine and check for engine oil leak.
8. After turning off the engine, check the oil level and add oil as necessary.



ECHB001B

CHECKING COOLANT LEAK

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 150 KPa (21psi, 1.53 kg/cm²) pressure. Hold it for two minutes in that condition while checking for leakage from the radiator, hoses or connections.

NOTE

1. *Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.*
2. *When the tester is removed, be careful not to spill any coolant from it.*
3. *Be sure to clean away completely any from the area.*
4. *Be careful when installing and removing the tester and when testing, not to deform the filler neck of the radiator.*

4. If there is leakage, repair or replace with the appropriate part.

RADIATOR CAP PRESSURE TEST

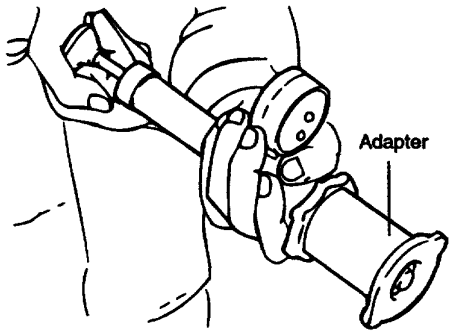
1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure : 107.9 kPa ± 14.7 kPa (1.1 ± 0.15 kg/cm², 15.64 ± 2.13) Main valve closing pressure : 83.4 kPa (0.85 kPa (0.85 kg/cm², 12.1 psi)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE

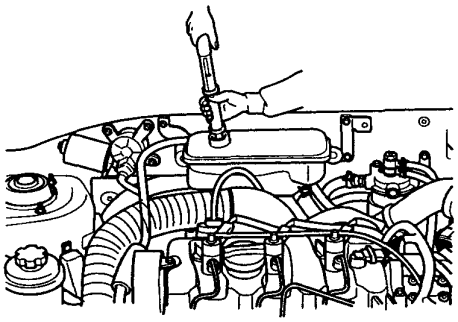
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.



ECA9090A

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature, using the following table for reference.



EDDD500C

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperature °C (°F) and specific gravity							
10 (20)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (-12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

Example

The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F)

⚠ ***CAUTION***

- ***If the concentration of the coolant is below 30%, its anti-corrosion properties will be adversely affected.***
- ***If the concentration is above 60%, both the anti-freeze and engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.***
- ***Do not mix types of anti-freeze.***

RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]

CHECKING COMPRESSION PRESSURE

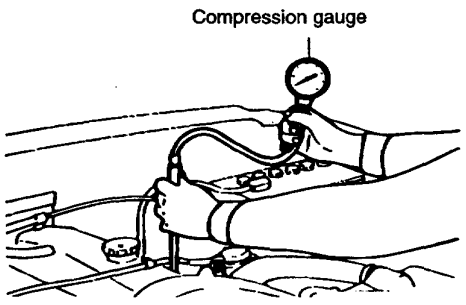
1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until the engine coolant temperature reaches 80 ~ 95 °C (176 ~ 205°F).
3. Turn off the engine and remove the aircleaner element.
4. Remove the injectors.
5. Crank the engine to remove any foreign material in the cylinders.
6. Insert the compression gauge (09351 - 27000) into the injector hole.
7. Check the engine and read the gauge.

Standard value : 2942 kPa (30 kg/cm², 426 psi)

8. Repeat steps 6 to 7 for all cylinders, ensuring that the pressure difference for each of the cylinders is within the specified limit.

Limit :
Max. 100 kPa (1.0 kg/cm², 14 psi) between cylinders

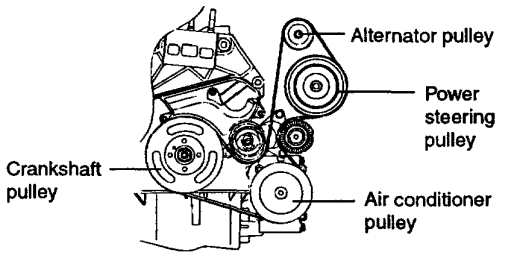
9. If a cylinder/s compression or pressure differential is outside the specification, add a small amount of oil through the injector hole, and repeat steps 6 to 8.
   1) If the addition of oil causes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
   2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.



ECLA005A

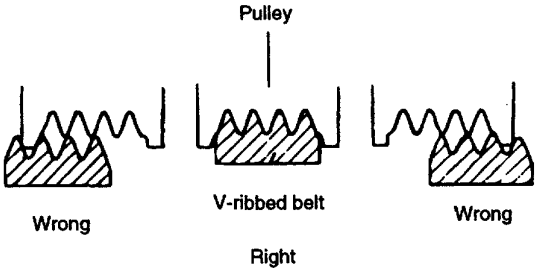
ADJUSTING DRIVE BELT AND TENSIONER

1. Check that the belts are not damaged and are properly placed for the pulley grooves.



ECHB002E

2. Install the belt in the following order.
   [Alternator → Power steering → Idler → Air conditioner pulley → Crankshaft pulley]
3. When installing the belt on the pulley, make sure it is centered on the pulley.

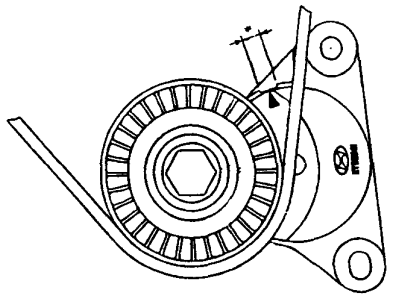


ECA9980A

⚠ ***CAUTION***

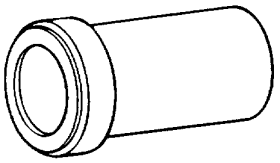
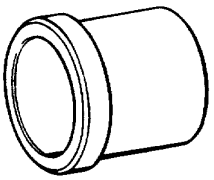
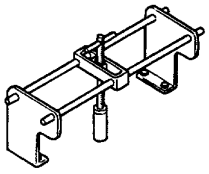
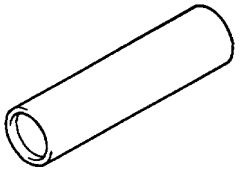
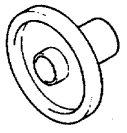
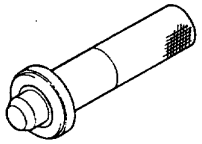
1. ***When installing the V - ribbed belt, check that the V - ribs are properly aligned.***
2. ***If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.***

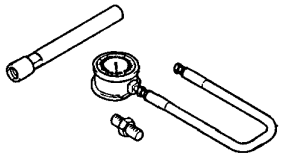
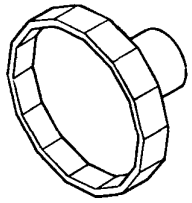
4. The tensioner mark should be between the "*" position.
   If not, replace the belt.



KCHB002F

SPECIAL TOOLS EDA4A1B8

Tool (Number and name)	Illustration	Use
Ballanceshaft drive gear and comshaft oil seal installer (09214-32000)	 ECA9930A	Installation of the ballance shaft drive gear on crankshaft and camshaft oil seal
Front case oil seal installer (09231-27100)	 ECA9930C	Installation of the front case oil seal
Valve spring compressor (09222-27300)	 KCHB600C	Removal and installation of inlet and exhaust valves
Valve stem oil seal installer (09222-27200)	 KCHB600E	Installation of valve stem oil seals
Crankshaft rear oil seal installer (09231-27000)	 KCHB600G	Installation of the crankshaft real oil seal
Injector oil seal installer (09351-27401)	 KCHB600A	Installation of the injector oil seal

Tool (Number and name)	Illustration	Use
Compression gauge&adapter (09351-27000) (09351-27100)	 KCHB600D	Checking engine compression pressure
Oil filter wrentch (09263-27100)	 KCHB600H	Removal and installation of oil filter

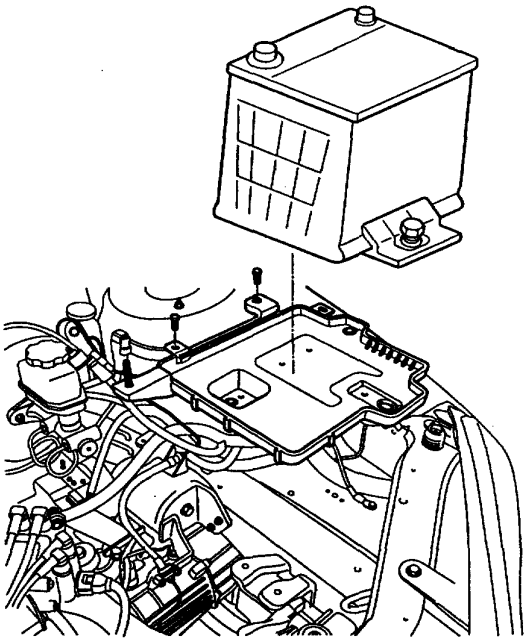
TROUBLESHOOTING E268FC2D

Stmptom	Probable cause	Remedy
Low compression	Damaged cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and / or cylinder block
	Worn or damaged vlave seat	Repair or replace valve and / or seat ring
Oil pressure drop	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Colgged oil filter	Replace
	Worn oil pump rotor or cover	Replace
	Thin or diluted engine oil	Change and find out cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine vibration	Loose engine roll stopper (front, rear)	Re - tighten
	Loose transaxle mount bracket	Re - tighten
	Loose engine mount bracket	Re - tighten
	Loose center member	Re - tighten
	Broken transaxle mount insulator	Replace
	Broken enhine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Connecting rod and / main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
Timing belt noise	Incorrect belt tension (Timing belt tensioner, timing belt)	Adjust belt tension
Low coolant level	Leakage of coolant	
	Damaged radiator core joint	Replace
	Corroded or cracked hoses (radiator hose, heater hose, etc.)	Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace
	Faulty engine coolant pump.	Replace
Clogged radiaotr	Foreign material in coolant	Replace

Stmptom	Probable cause	Remedy
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restricted of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature sensor wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo - sensor on radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	Replace
Inoperative electrical cooling fan	Damaged, fuse	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle pklate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

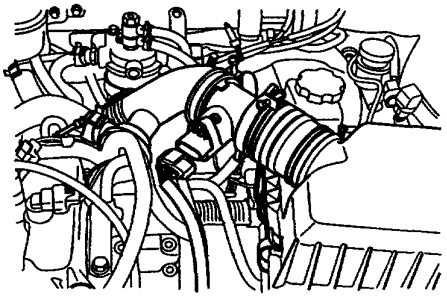
ENGINE AND TRANSAXLE ASSEMBLY EC0AFA44

1. Remove the battery.



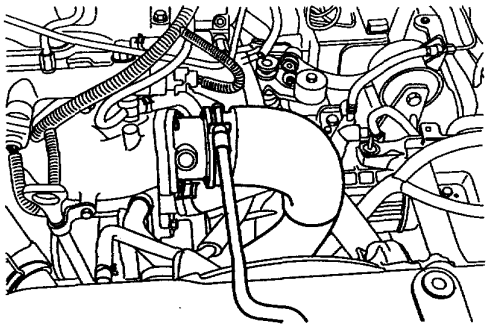
KDDC009B

2. Remove the engine cover.
3. Detach the air duct and the air cleaner.

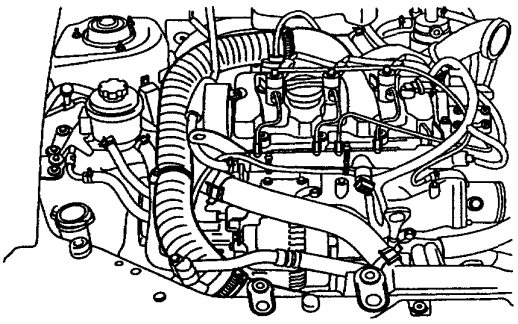


EDDD504D

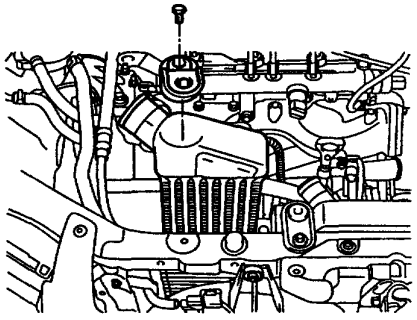
4. Disconnect the air hose and remove the intercooler.



EDDD505C

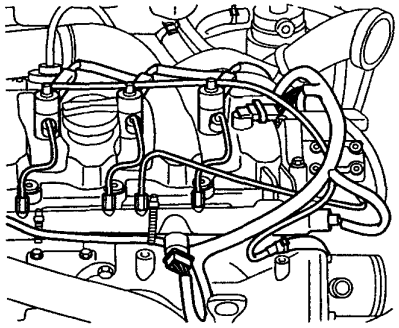


EDDD505D



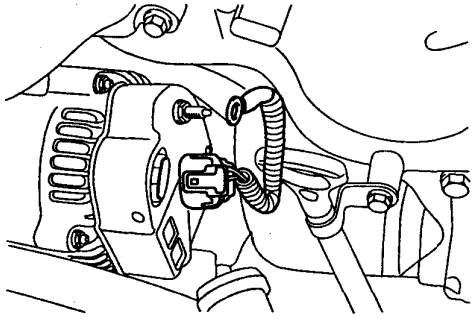
EDDD505E

5. Disconnect the engine harness connectors.
   1. Engine wiring connectors (injector, No 1 TDC sensor, etc.)



EDDD504C

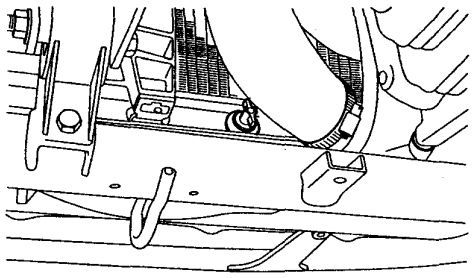
   2. Coolant temperature sensor.
   3. Alternator connector, oil pressure gauge connector.



EDDD504B

   4. Back up lamp switch connector.
   5. A/T solenoid, inhibitor switch connector.

6. Drain the engine coolant and remove the engine coolant reservoir tank.



EDDD505B

7. For a vehicle with automatic transaxles, disconnect the transaxle oil cooler hoses.

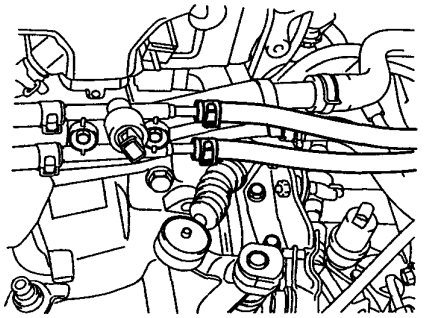
NOTE

When disconnecting hoses, make identification marks to avoid making any mistake when installing them again.

CAUTION

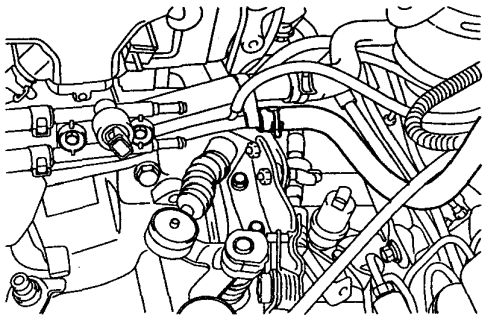
Be careful not to spill any of oil or fluid out of the hoses. Plug the openings to prevent the entry of foreign material.

8. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.
9. Disconnect the EGR vacuum hose.
10. Remove the main fuel line at the common rail (supply/return).



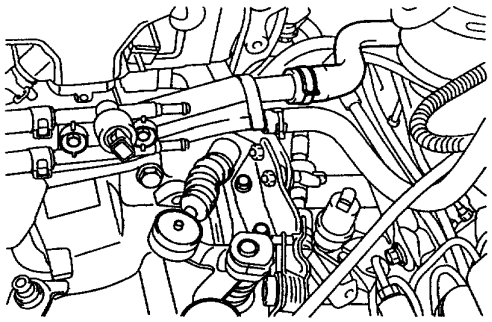
EDDD505F

11. Disconnect the brake booster vacuum hose.

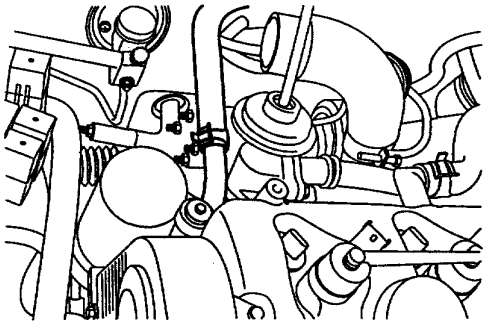


EDDD505G

12. Disconnect the heater hoses (inlet and outlet) on the engine side.



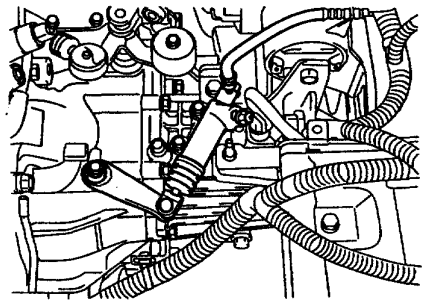
EDDD505H



EDDD505I

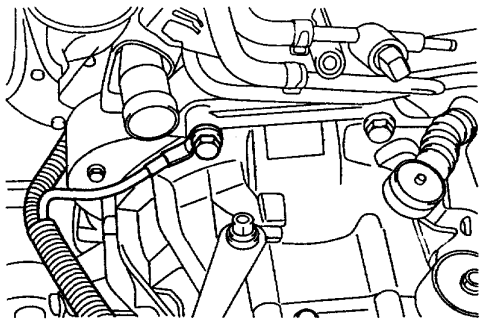
13. Disconnect the speedometer cable from the transaxle.

14. Disconnect the clutch cable or control cable from the transaxle.



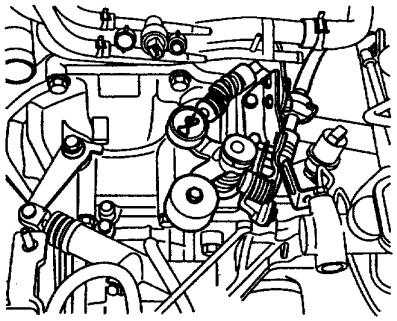
EDDD505J

15. Remove the transaxle ground.



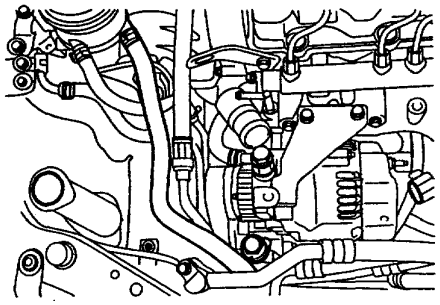
EDDD505K

16. Remove the transaxle control rod and extension rod (M/T only).



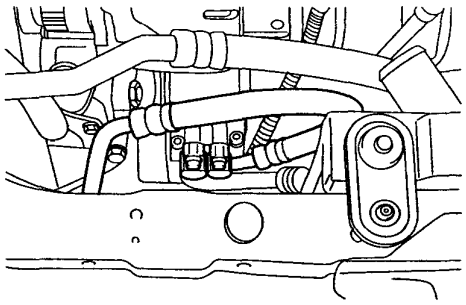
EDDD505L

17. Disconnect the power steering suction hose and return hose from the pump.



EDDD505M

18. Disconnect the air conditioner pipe.

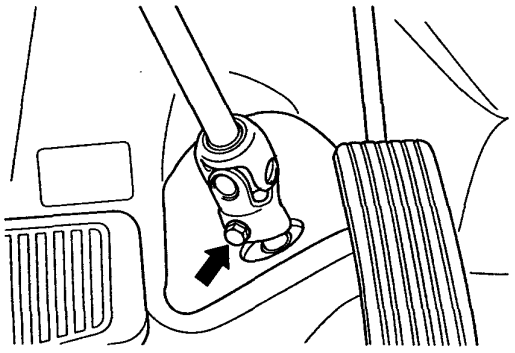


EDDD505N

19. Detach the steering dust cover in the engine compartment and then disconnect the gear box universal joint bolt.

NOTE

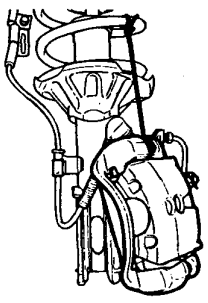
Make sure to make identification marks between the universal joint and the gear box for reassembly.



KPPD014A

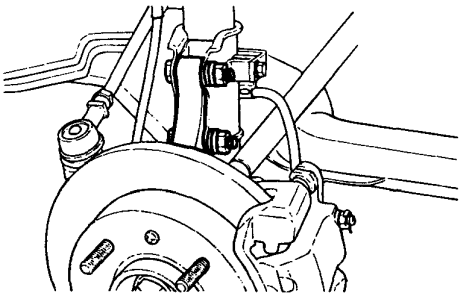
20. Raise the vehicle and then remove the front tire.

21. Remove the calliper assembly from the knuckle. Tie it using wire, hang it from the suspension.



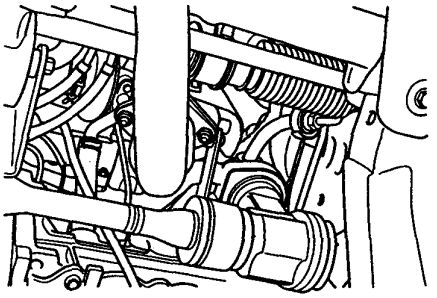
ECHA004J

22. Loosen the strut lower bolt and then remove it.



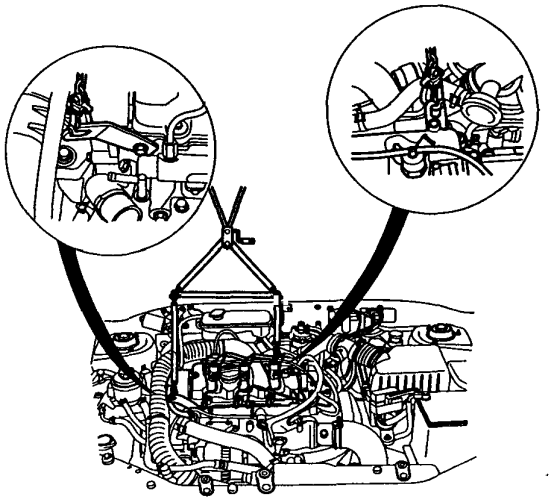
ECHA004K

23. Remove the front muffler bolts.



ECDC880C

24. Attach a chains or cables to the engine. Use an engine hoist or a chain hoist to slightly raise the engine.

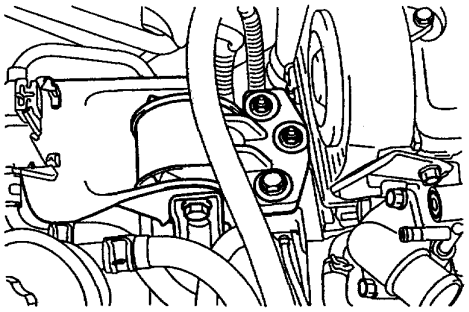


EDDD501B

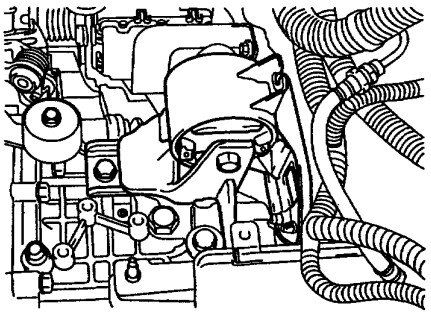
25. Put the special fixture on the T/M jack and then adjust it to the sub-frame.

> **NOTE**
>
> *Check that all the cables, harness connector and hose are disconnected from the engine and transaxle assembly.*

26. Remove the engine mounting bracket and the transaxle mounting bracket.

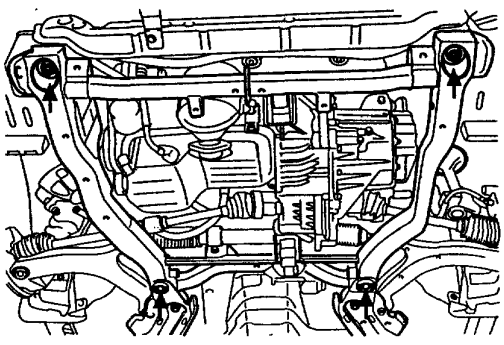


EDDD502B



EDDD502C

27. Remove the sub-frame installation bolts.



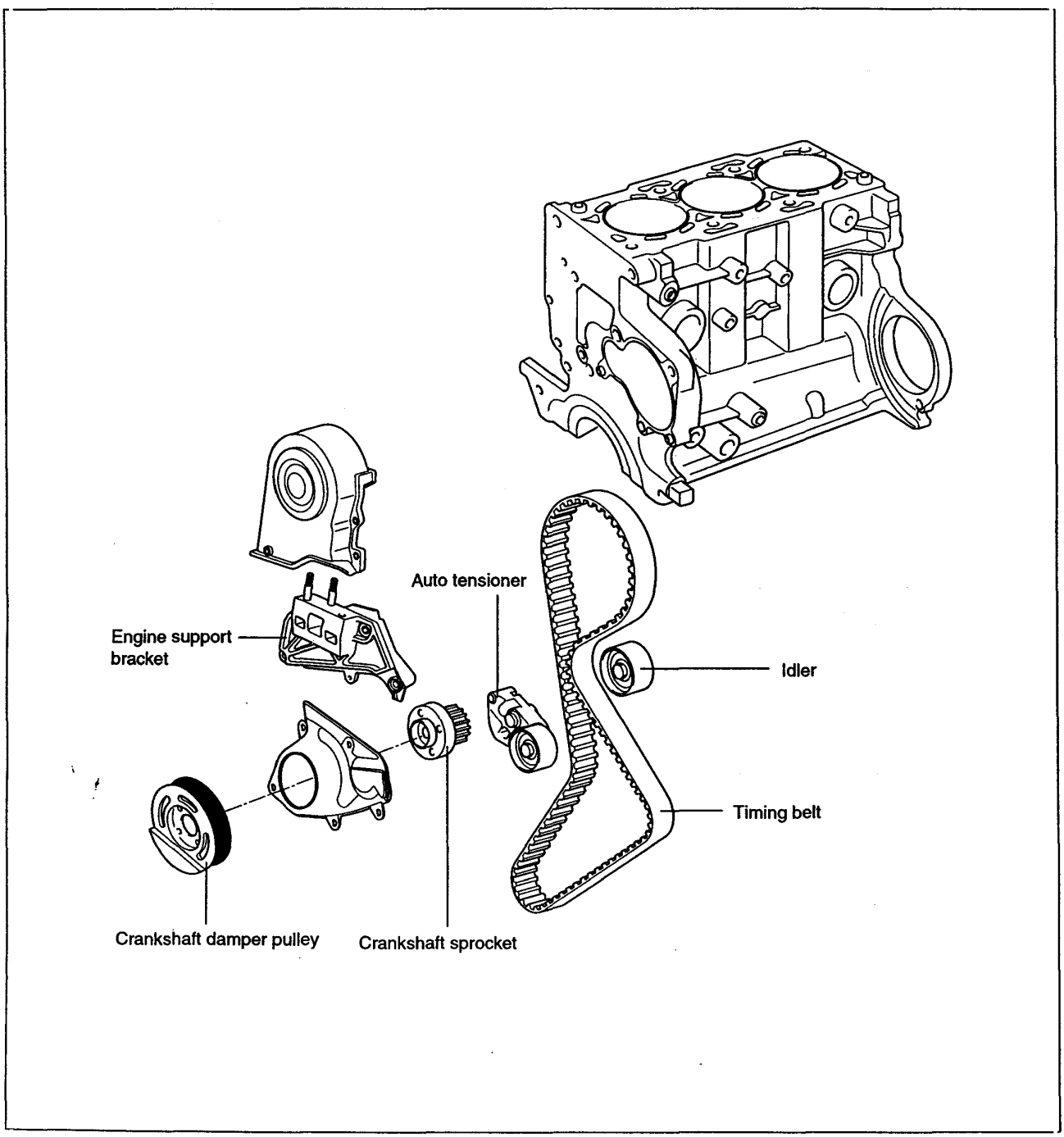
KDDC013B

28. Remove the engine and transaxle assembly as a unit.

TIMING SYSTEM

TIMING BELT

COMPONENTS E164DACD

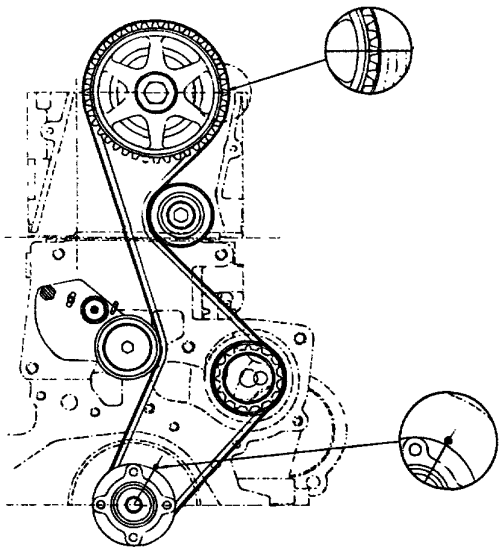


ECDC900A

REMOVAL E38B61B7

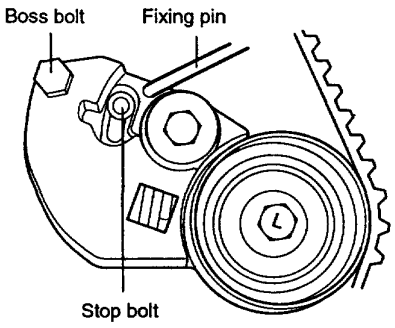
⚠ *CAUTION*

Rotate the crankshaft clockwise and align the timing marks to set the No. 1 cylinder's piston to TDC.
At this time, the timing marks of the camshaft sprocket and cylinder head should coincide with eachother and the dowel pin of the camshaft sprocket should be at the upper side.



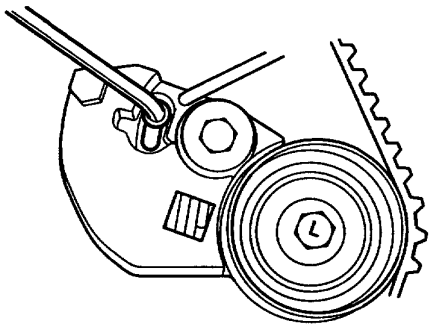
KCHB014B

1. Remove the crankshaft pulley and dirve belt.
2. Remove the timing belt cover.
3. Remove the engine support bracket.
4. Using the boss bolt, rotate the tensioner to align the stop plate with the housing hole, and then engage the fixing pin.



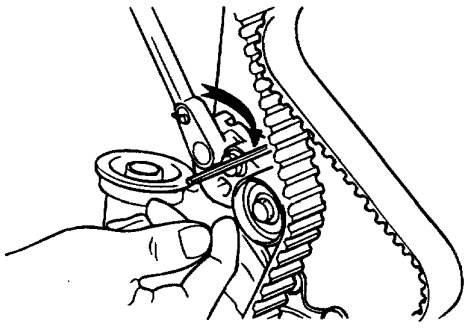
KCHB014F

5. Using a hexagonal wrench, loosen the stop bolt. (Do not remove it.)



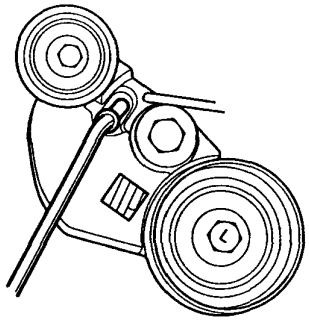
KCHB014G

6. Using the boss bolt, rotate the tensioner assembly to clockwise direction until not rotate.



KCHB014C

7. Tighten the stop bolt.



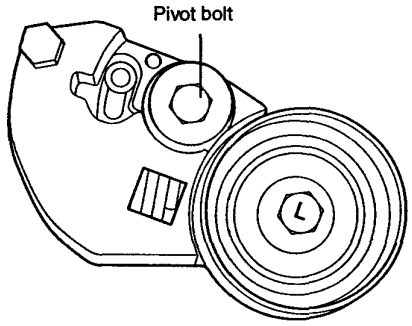
KCHB014H

8. Remove the timing belt.

NOTE

If the timing belt is reused, make an arrow mark indicating the turning direction (or the front of the engine) to make sure that the belt is reinstalled in the same direction as before.

9. Remove the pivot bolt and then remove the auto tensioner.

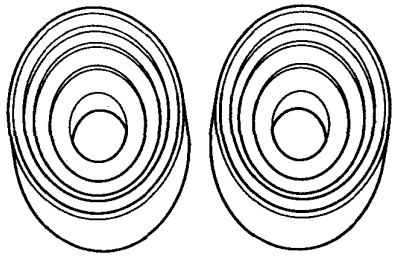


KCHB014L

INSPECTION EF2ABB3E

SPROCKETS, TENSIONER PULLEY AND IDLER PULLEY

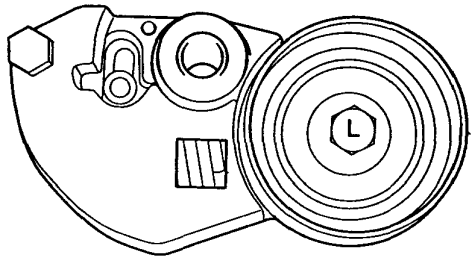
1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley and idler pulley for abnormal wear, cracks or damage. Replace if necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise. Replace if necessary.
3. Replace the pulley if there is a grease leak from it s bearing.



KCHB014J

AUTO TENSIONER

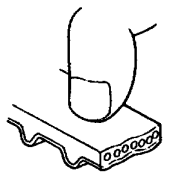
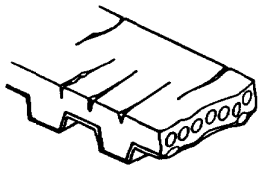
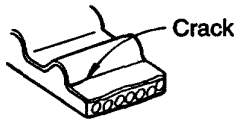
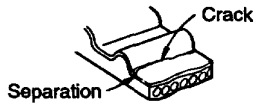
1. Check the auto tensioner for leaking and replace if necessary.
2. Check the rod end for wear or damage and replace if necessary.

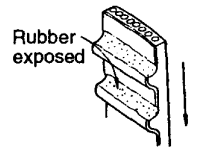
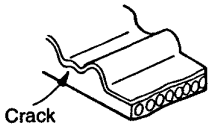
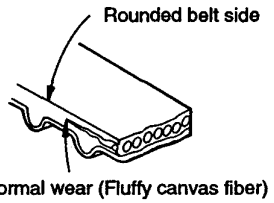
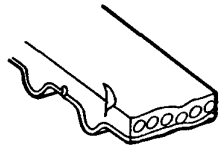


KCHB014K

TIMING BELT

1. Check the belt for oil or dust deposit. Replace if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension is adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt with a new one.

Description	Flaw conditions
1. Hardened back surface of rubber	Back susrface is glossy, Non - elastic and so hard that, when your fingernail is pressed into it, no mark is produced.
	 ECA9200B
2. Cracked back surface of rubber	 ECA9200Y
3. Cracked or separating canvas	 ECA9200I
	 ECA9200J
	 ECA9200K
4. Badly worn out teeth (initial stage)	Tooth flank shows canvas on the load side (Fluffy canvas fibers, rubber changed into white color and unclear canvas texture)
	 ECA9200C

Description	Flaw conditions
5. Badly worn out teeth (last stage)	Tooth flank worn and runner exposed on load side (tooth width reduced)
	 ECA9200D
6. Cracked tooth bottom	 ECA9200E
7. Missing tooth	 ECA9200F
8. Badly worn side of belt	 ECA9200G
9. Cracked side of belt	 ECA9200H

INSTALLATION E12AFDEF

1. Install the crankshaft sprocket onto the crankshaft.

> ⚠ ***CAUTION***
>
> ***Pay attention to the direction of the flange. If it is installed in the wrong direction, a broken belt could result.***

2. Install the special washer and sprocket bolt to the crankshaft and then tighten the sprocket bolt.

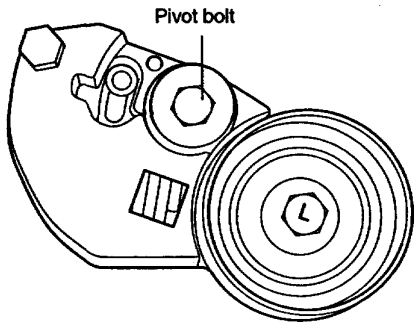
Tightening torque
Crankshaft sprocket bolt :
185 ~ 195 Nm (1850 ~ 1950 kg.cm, 136 ~ 144 lb.ft)

TIMING BELT

1. Check timing mark.
   - Crankshaft side : Timing mark at crankshaft sprocket and timing pin at oil pump housing.
   - Camshaft side : Timing mark at camshaft sprocket and head.

2. Install tensioner.

3. Install the auto tensioner.

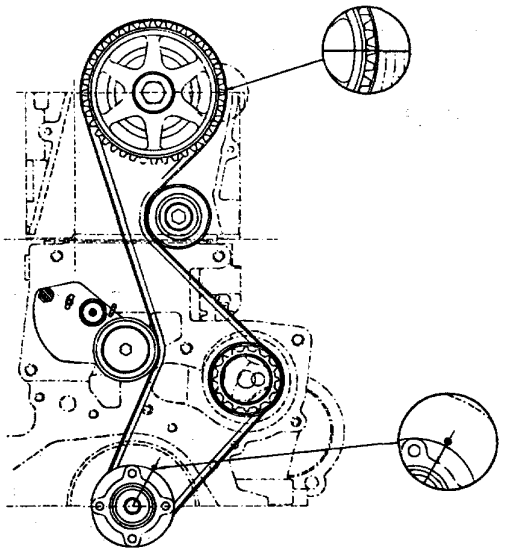


KCHB014L

4. Tighten the pivot bolt.

Tightening torque
50 ~ 55 Nm (500 ~ 550 kg.cm, 37 ~ 40.6 lb.ft)

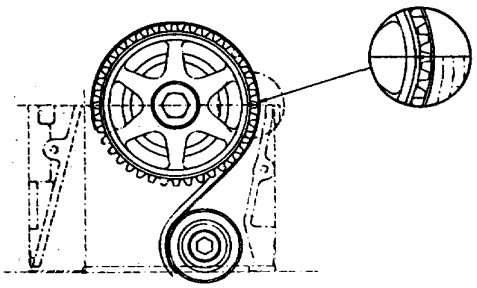
5. Install timing belt.



KCHB014B

6. Loosen the stop bolt. (Tensioner arm will move and tighten timing belt)

7. Rotate engine more than 2 revelutions (Check timing mark).



KCHB014E

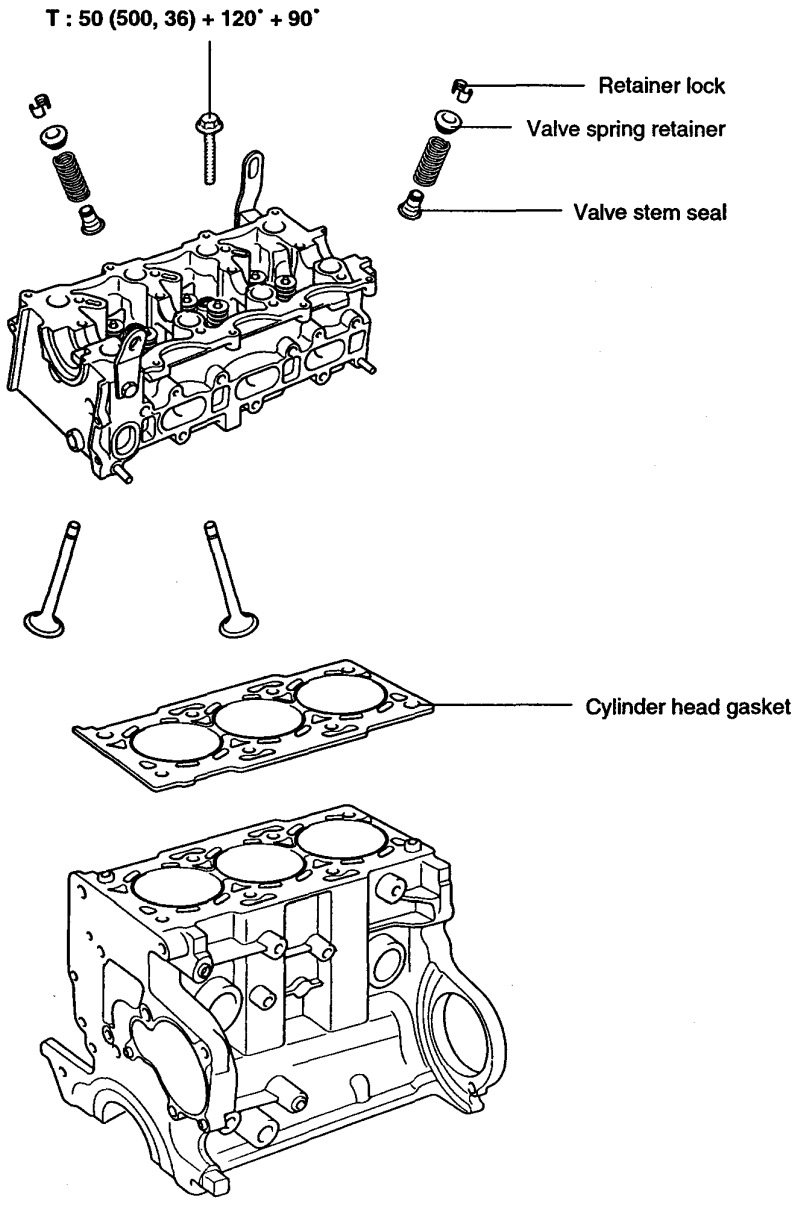
8. Tighten stop bolt.

9. Remove the pin.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS EDDCAFCE

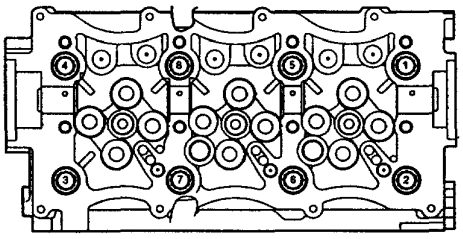


TORQUE : Nm (kg.cm, lb·ft)

ECDC895A

DISASSEMBLY EA6CDEC2

1. Rmove the cylinder head bolts in the order shown in the illustration.

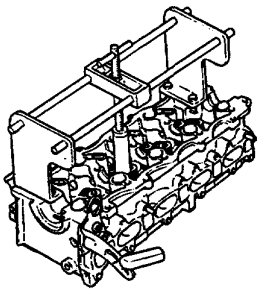


ECDC896B

2. Using the special tool (09222 - 27300) remove the valve spring retainer lock. Then remove the spring retainer, valve spring, spring seat and valve.

NOTE

Arrange these parts so that they can be reinstalled in their original positions.

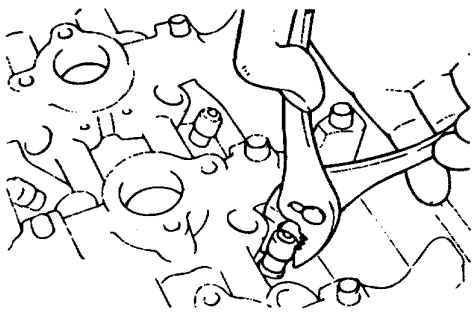


KCHB012F

3. Remove the valve stem seals with pliers.

NOTE

Do not reuse the valve stem seals.



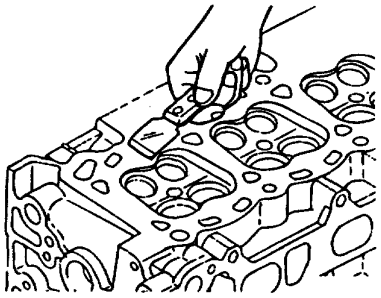
ECA9270C

INSPECTION EE61C4CC

CYLINDER HEAD

1. Check the cylinder head for cracks, damage and coolant leakage. If cracked, replace the cylinder head.

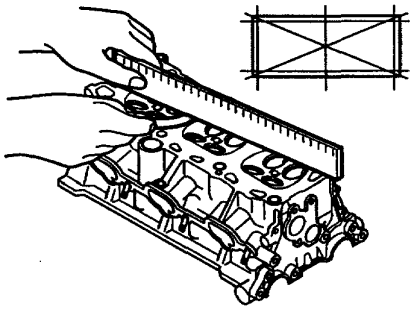
2. Remove scale, sealing compound and carbon deposits completely. After cleaning the oil passages, apply compressed air to verify that the passages are not clogged.



ECA9280A

3. Check the cylinder head surface for flatness in the direction as shown in the illustration. If flatness exceeds service limit in any direction, either replace the cylinder head or machine the cylinder head matching surface lightly.

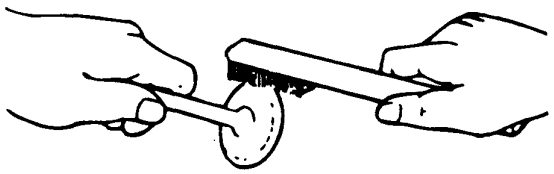
Flatness of cylinder head gasket surface
0.03 mm (0.0012 in.) for width
0.09 mm (0.0035 in.) for length
0.012 mm (0.00047 in.) 51 x 51



KFW3047A

VALVES

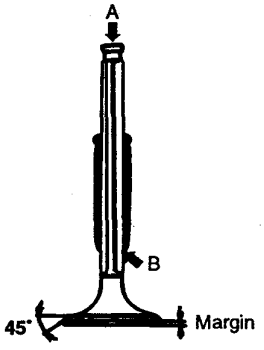
1. Using a wire brush, clean the valve thoroughly.



ECA9281A

2. Check each valve for wear, damage and distortion of the head and the stem at B Position. Replace, if necessary. If stem end, A, is hollowed out or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.
   Replace the valve if the margin has decreased to less than the service limit.

Margin [Standard] Intake : 1.6 mm (0.063 in.) Exhaust : 1.3 mm (0.0512 in.)

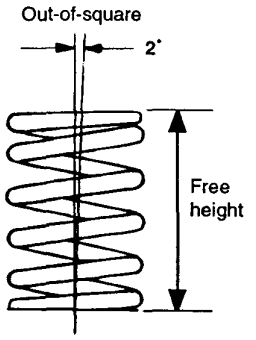


ECA9281B

VALVE SPRINGS

1. Check the free height of each valve spring. If they exceed the service limit, replace the springs.
2. Using a square, test the squareness of each spring. If a spring is excessively out- of-square, replace it.

Valve spring [Standard] Free height : 39.14 mm (1.54 in.) Load : 21.4 kg / 32 mm (47.2 lb / 1.26 in.) Out of square : 1.5° or less [Limit] Free height : 38.14 mm (1.50 in.) Out of square : 4°

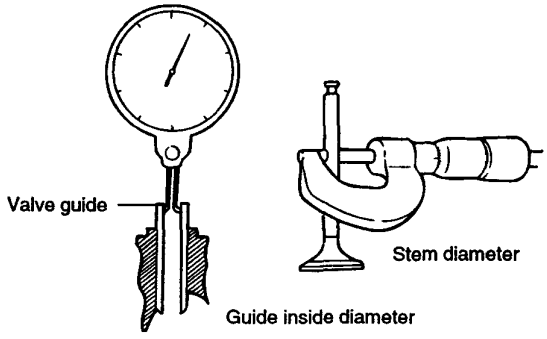


ECA9281C

VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with the next oversize part.

Valve stem - to - guide clearance [Standard] Intake : 0.022 ~ 0.067 mm (0.00087 ~ 0.0026 in.) Exhaust : 0.05 ~ 0.095 mm (0.0020 ~0.0037 in.) [Limit] Intake : 0.1 mm (0.0040 in.) Exhaust : 0.15 mm (0.0059 in.)



ECA9281D

RECONDITIONING VALVE SEAT

Check the valve seat for overheating and unequal contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it and then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specificatons and centered on the valve face. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.

REASSEMBLY E0A8CB56

NOTE

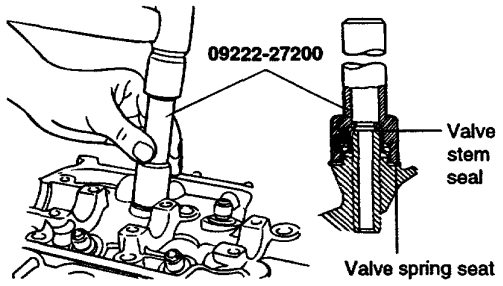
1. *Clean each part before assembly.*
2. *Apply engine oil to the sliding and rotating parts.*

1. Install the spring seats.
2. Using a special tool (09222 - 27200), tap the seal in position lightly.

NOTE

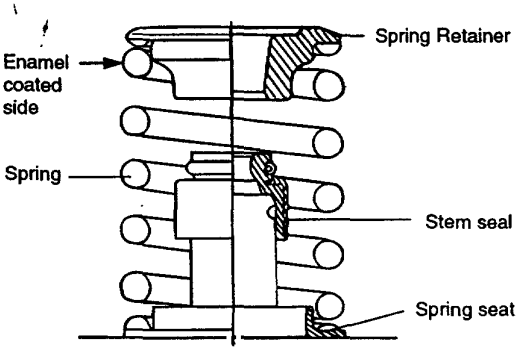
- *Do not reuse old valve stem seals.*
- *Incorrect installation of the seal could result in oil leakage past the valve guides.*

3. Apply engine oil to each valve. Insert the valve into the valve guide. Avoid pushing the valve into the seal by force. After inserting the valve, check that it moves smoothly.



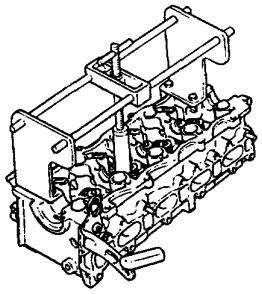
ECHB012Z

4. Place valve springs so that the side coated with enamel faces the valve spring retainer and then install the retainer.



ECA9290B

5. Using the special tool (09222 - 27300), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

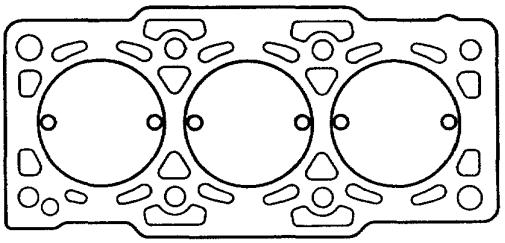


KCHB012F

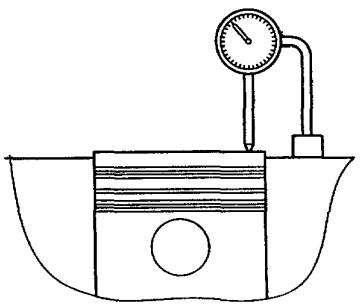
NOTE

When the spring is compressed, Check that the valve stem seal is not pressed against the bottom of the retainer.

6. Clean both gasket surfaces of the cylinder block and cylinder head.
7. Select the cylinder head gasket.
   1) Measure the piston protrusion from the upper cylinder block face on 6 places at T.D.C. Measure on the crankshaft center line considering the piston migration.



EDDD510B



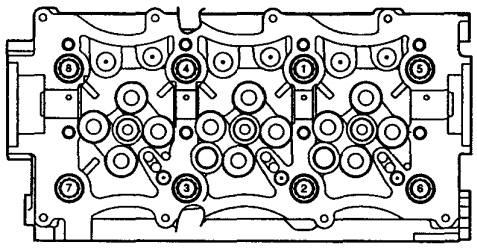
LCAC319B

2) Select the gasket in the table below using the average value of 6 piston protrusions.
Even if only 1 point is over than the limit of piston protrusion at each grade, 1 grade upper gasket than specified below.

Displacement	1.5 L		
Average of piston protrusion	0.194 ~ 0.337 mm (0.0076 ~ 0.013 in.)	0.337 ~ 0.440 mm (0.013 ~ 0.017 in.)	0.440 ~ 0.542 mm (0.017 ~ 0.021 in.)
Gasket thickness	1.13 ± 0.05 mm (0.0445 ± 0.0019 in.)	1.23 ± 0.05 mm (0.0484 ± 0.0019 in.)	1.33 ± 0.05 mm (0.0523 ± 0.0019 in.)
Limit of each rank extent	0.43 mm (0.0169 in.)	0.53 mm (0.0208 in.)	–
Identification cade	EDDD510C	 EDDD510D	 EDDD510E

8. Install the gasket so that the surface with the identification mark faces toward the cylinder head.

9. Tighten the bolts to the specified torque.

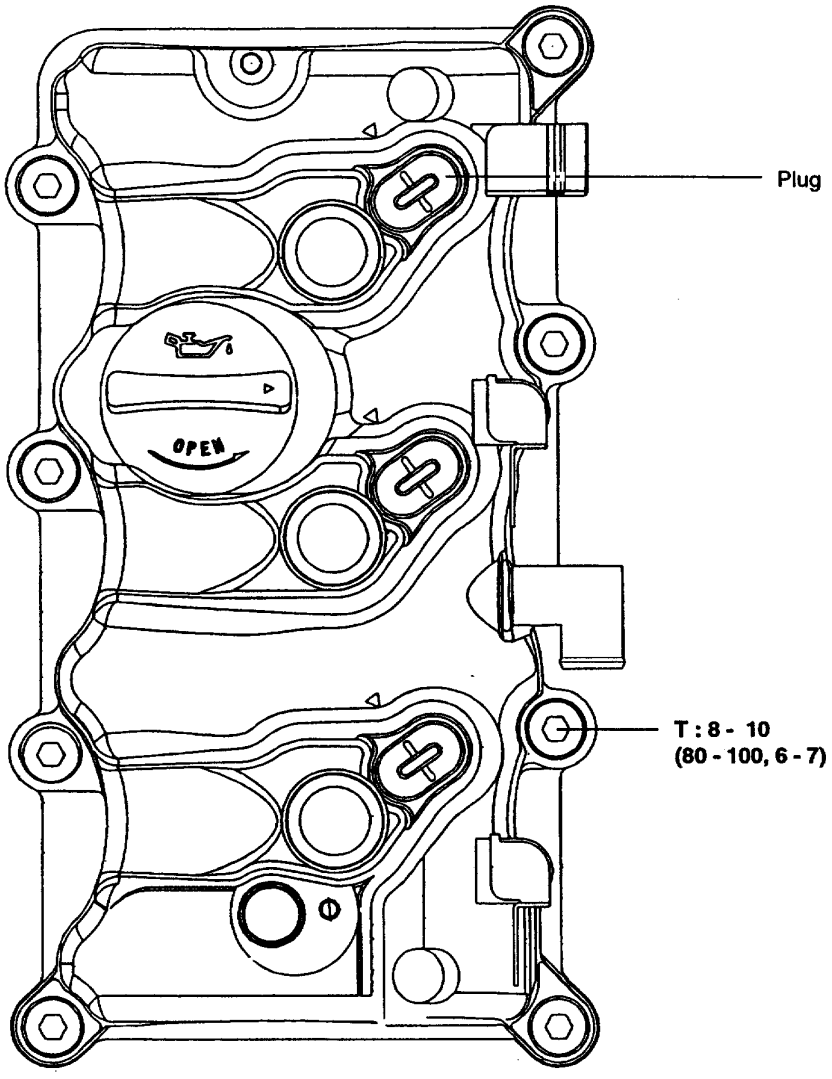


ECDC898B

Tightening torque :
50 Nm (500 kg.cm, 36.9 lb.ft) + 120° + 90°

CYLINDER HEAD COVER AND PLUG

COMPONENTS ECC18F55

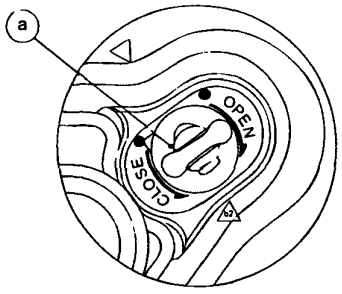


TORQUE : Nm (kg.cm, lb.ft)

ECDC950A

REMOVAL EFC23EDA

1. Smoothly pull and turn the handle to the right.

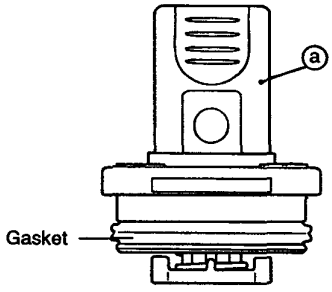


KCHB022B

2. Pull out the pulg assembly.
   After using (-) driver to increase the clearance between cylinder head cover and plug assembly.

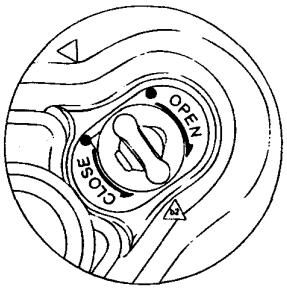
INSTALLATION E5CF047A

1. Apply oil to the gasket of the plug.



KCHB022C

2. Push the plug assembly into the hole and then turn the handle to the left.

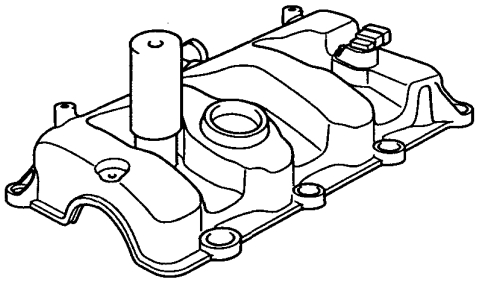


KCHB022D

NOTE

Whenever installing the plug, always replace a new one.

3. Using a special tool (09351 - 27401), install the injector oil seal.



ECDC970B

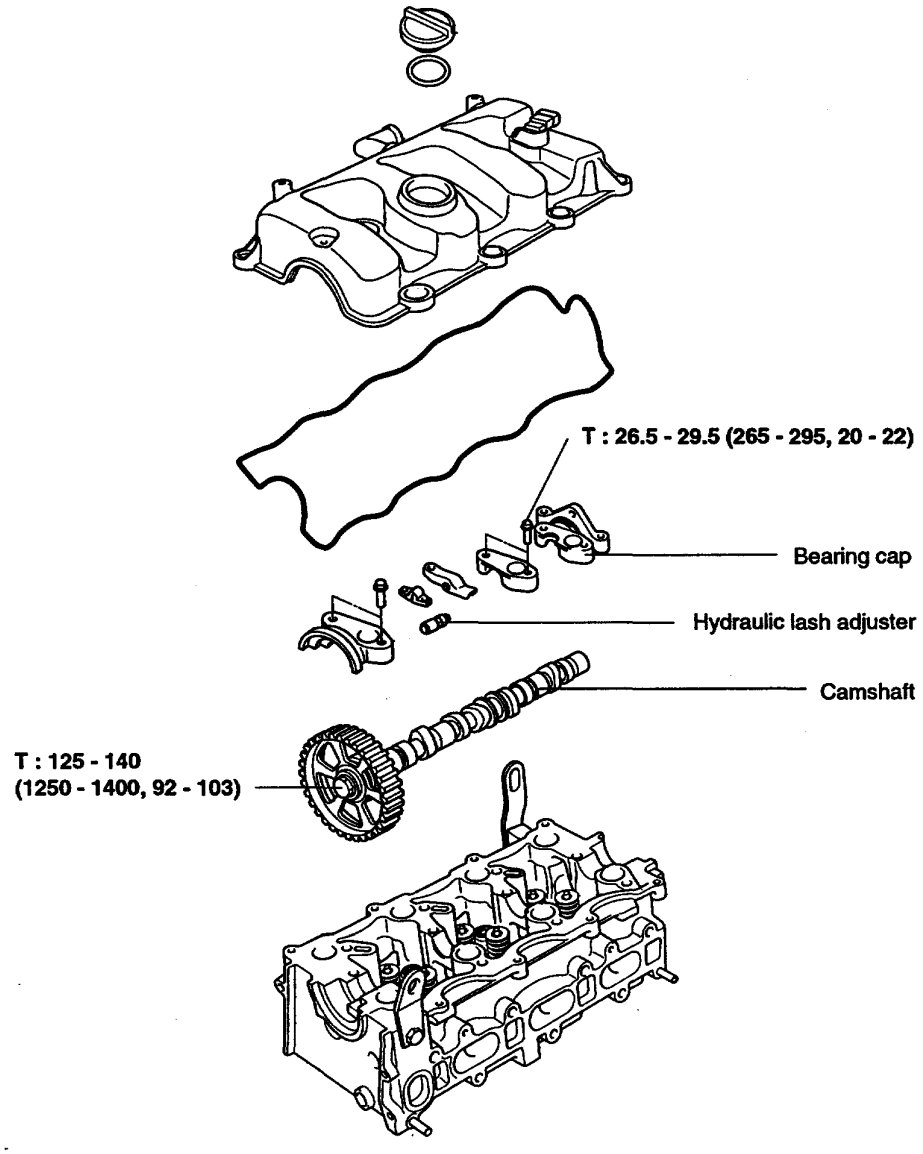
4. Tighten the head cover bolts to the specified torque.

Tightening toruqe : 8 ~ 10 Nm (80 ~ 100 Nm, 6 ~ 7 lb.ft)

MAIN MOVING SYSTEM

CAM SHAFT

COMPONENTS E60FB1ED



TORQUE : Nm (kg.cm, lb.ft)

ECDC300A

DISASSEMBLY EABB58ED

1. Disconnect the negative terminal from the battery.
2. Drain the engine coolant.
3. Remove the breather hose between the air intake hose and the head cover.
4. Remove the air cleaner.
5. Remove the timing belt cover.
6. Remove the head cover and disconnect camshaft position sensor.
7. Loosen the camshaft sprocket bolts then remove the camshaft sprockets.
8. Loosen the camshaft bearing cap bolts and remove the bearing caps, camshafts, rocker arms and lash adjusters.

WARNING

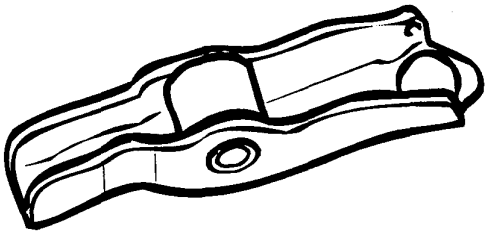
REMOVAL AND INSTALLATION OF INJECTOR AND HIGH PRESSURE PUMP.

1. Fuel system is subject to extremely high pressure (1350 bar).
2. Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
3. Always pay attention to safety precautions.
4. Ensure the absolute cleanliness.
5. Never remove the injectors.

INSPECTION ED420680

ROCKER ARMS

1. Check rotation of the roller. If they do not rotate smoothly or are loose, replace them.
2. Check the roller surface. Replace if there is any dent, damage or evidence of seizure.
3. Check the valve contact surface for possible damage or evidence of seizure. Replace if necessary.

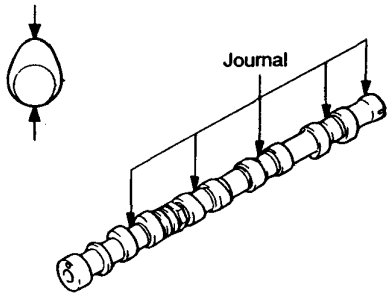


KCHB013B

CAMSHAFTS

1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height
[Standard]
Intake : 34.697 mm (1.366 in.)
Exhaust : 34.570 mm (1.361 in.)
[Limit]
Intake : 34.197 mm (1.346 in.)
Exhaust : 34.070 mm (1.341 in.)



ECA9240B

REASSEMBLY E1397C9A

1. Install the camshafts on the cylinder head.

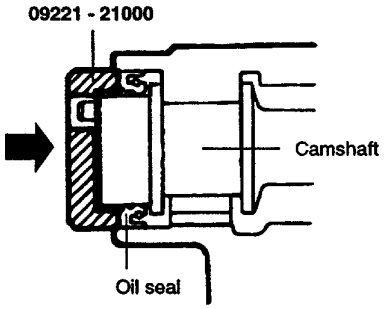
   NOTE

   Apply engine oil to journals and cams of the camshafts.

2. Install the bearing caps.

3. Check that the camshaft can be easily turned by hand. After checking, remove the bearing caps and the camshafts, and then install the rocker arms.

4. Make sure that the dowel pins on the camshaft sprocket ends are located on the top.



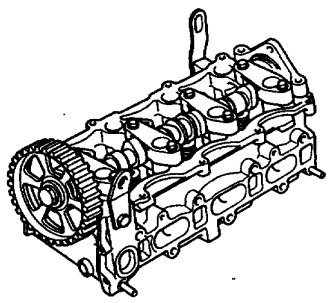
ECLA019E

5. Tighten the bearing caps to the specified torque in two or three increments as shown.

   NOTE

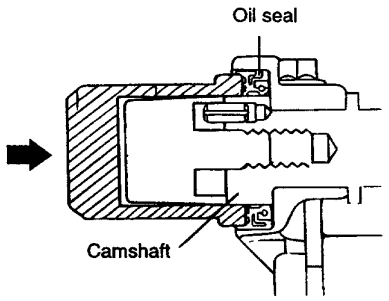
   Tighten the rocker arms uniformly.

Tightening torque
Bearing cap bolts :
26.5 ~ 29.5 Nm (265 ~ 295 kg.cm, 20 ~ 22 lb.ft)



ECDC330B

6. Using the special tools, camshaft oil seal Installer. Be sure to apply engine oil to the external surface of the oil seal.
   Insert the oil seal along the camshaft front end and install it by driving the installer with a hammer until the oil seal is fully seated.



KCHA330C

7. Install the camshaft sprocket bolts to the specified torque.

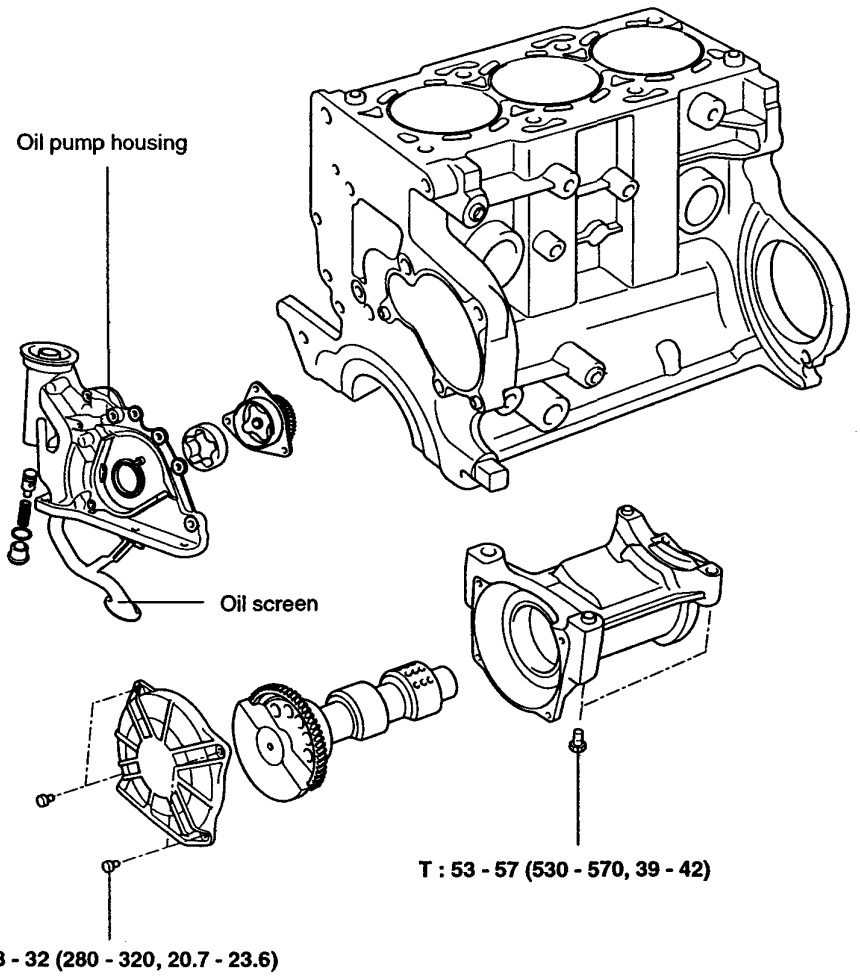
Tightening torque
Camshaft sprocket bolts :
125 ~ 140 Nm (1250 ~ 1400 kg.cm, 92 ~ 103 lb.ft)

8. Install the rocker cover.

Tightening torque
Rocket cover bolts :
8 ~ 10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

COUNTER BALANCE SHAFT

COMPONENTS E4E74F30

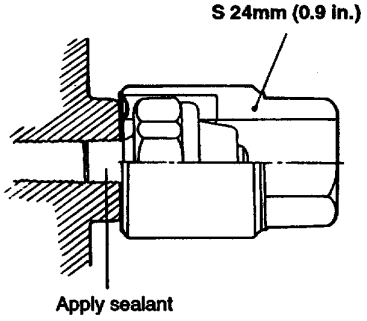


TORQUE : Nm (kg·cm, lb·ft)

ECDC250A

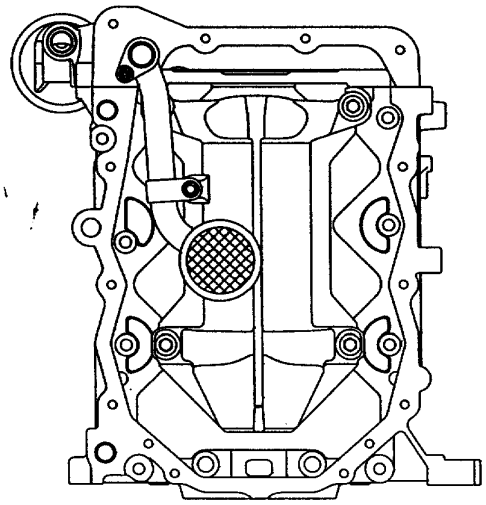
DISASSEMBLY EE1457CC

1. Remove the timing belt. Refer to "Timing Belt."
2. Remove all the oil pan bolts.
3. Tap the oil pan with a rubber hammer and remove the pan.
4. Remove the oil screen and O-ring.
5. Remove the oil pump housing.
6. Remove the oil pressure switch.



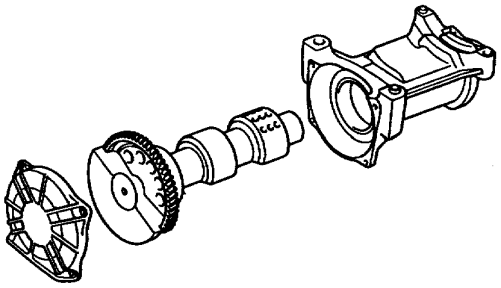
ECHA260A

7. Remove all the balance shaft bolt.



ECDC260B

8. Disassembly the balance shaft assembly.



ECDC260C

9. Remove the oil pump housing mounting bolts and remove the oil pump housing assembly and O-ring from the cylinder block.
10. Remove the oil pump rotor from the oil pump housing.

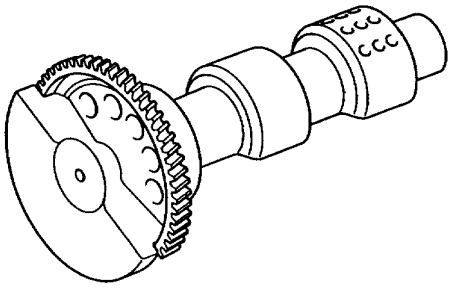
INSPECTION EDED6CCD

OIL PUMP HOUSING

1. Check all oil holes for clogging. Clean the holes if necessary.
2. Check the balance shaft bearing for wear, damage and seizure. If there is anything wrong with the bearing, replace the balance shaft case.
3. Check the front case for cracks and other damage.
4. Replace a cracked or damaged front case.

BALANCE SHAFT

1. Check the journals for wear or seizure.
2. If excessive wear or seizure is evident, check the bearing carefully.
3. If necessary, replace the balance shaft.



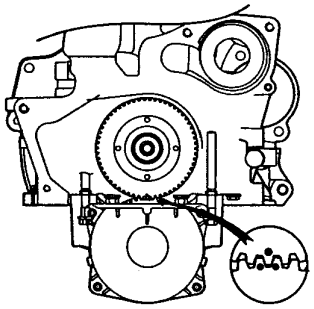
ECDC270B

OIL SEAL

1. Check the oil seal lip for wear and damage. Replace the oil seal if necessary.
2. Check the oil seal lip for deterioration. Replace the oil seal if necessary.

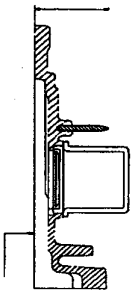
REASSEMBLY EA9DABDA

1. Install a balance shaft assembly to the cylinder block.



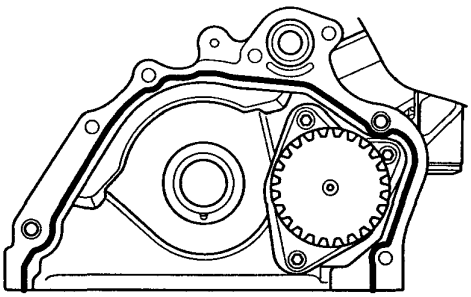
ECDC280B

2. Using the special tool, the crankshaft front oil seal installer (09231-27100), install the crankshaft front oil seal into the oil pump housing.



KCHB004I

3. Apply sealant to the groove of the oil pump housing as shown.



EDDD503B

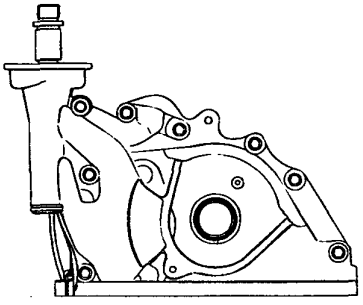
Sealant : Loctite 5900 or gquivalant

NOTE

1. *Apply sealant approximately 2.5 ± 0.5 mm (0.098 ± 0.019 in.) in thickness.*
2. *After the application of the sealant, install the oil pump housing within 5 minutes.*

4. Install a new O - ring to the oil pump housing and tighten the flange bolts temporarily.
5. Install the oil pump housing with a new O - ring. Tighten bolts to the specified torque.

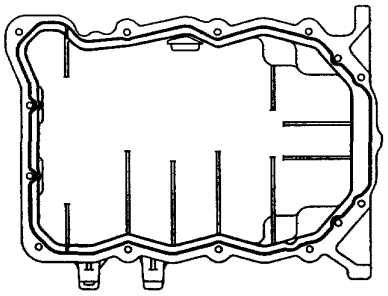
Tightening torque
Oil pump housing :
20 ~ 27 Nm (200 ~ 270 kg.cm, 14 ~ 20 lb.ft)



KCHB004H

6. Apply sealant to the groove of the pan flange as shown.

Sealane : Loctite 5900 or equivalent



ECDC280C

NOTE

1. *Apply sealant approximately 3 ± 0.5 mm (0.12 ± 0.019 in.) in thickness.*
2. *After the application of the sealant, install the oil pan within 5 minutes.*

7. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque Oil pan bolt : 10 ~ 12 Nm (100 ~ 120 kg.cm, 7 ~ 9 lb.ft)

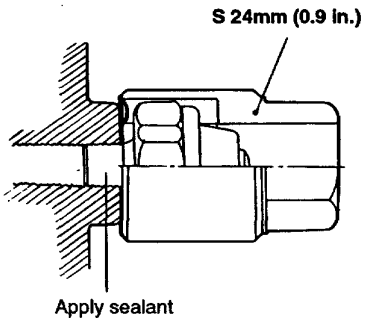
8. Using a 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch excessively.

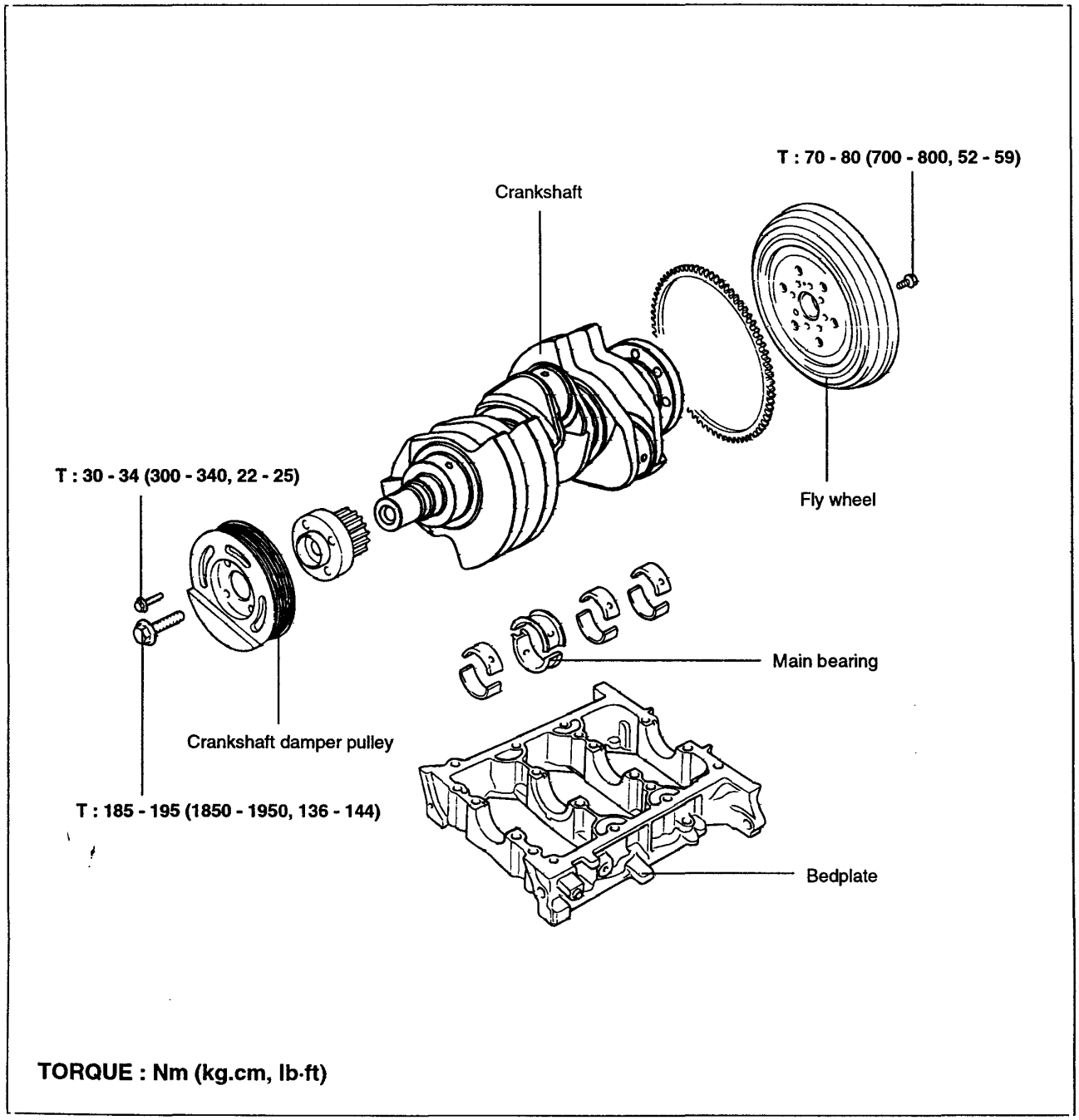
Tightening torque Oil pressure switch : 15 ~ 22 Nm (150 ~ 220 kg.cm, 11 ~ 16 lb.ft)



ECHA260A

CRANK SHAFT

COMPONENTS E0D8BE98



ECDC400A

DISASSEMBLY ECF2D497

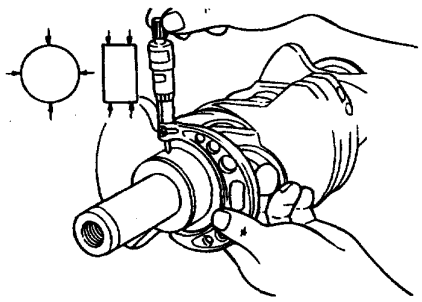
1. Remove the timing belt, front case, flywheel, cylinder head assembly and oil pan. For details, refer to the respective chapters.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.
4. Remove the bedplate and the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION EA92ABA2

CRANKSHAFT

1. Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check the oil holes for restrictions. Repair or replace any defective part.
2. Inspect the crankshaft journal for taper and out-of-round.

Standard value
Crankshaft journal O.D. :
60.002 ~ 60.020 mm (2.362 ~ 2.363 in.)
Crankshaft pin O.D. :
50.008 ~ 50.026 mm (1.969 ~ 1.9695 in.)



ECA9410A

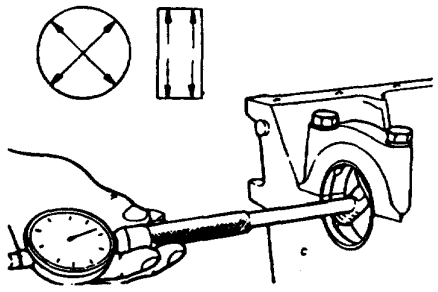
MAIN BEARINGS AND CONNECTING ROD BEARINGS

Visually inspect each bearing for peeling, melting, seizure and improper contact. Replace any defective bearings.

MEASURING OIL CLEARANCE

Check the oil clearance by measuring the outside diameter of the crankshaft journal as well as the the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured diameters.

Standard value
Oil clearance
Crankshaft main bearing :
0.024 ~ 0.042 mm (0.0009 ~ 0.0017 in.)
Connecting rod bearing :
0.024 ~ 0.042 mm (0.0009 ~ 0.0017 in.)
Limit : 0.1 mm (0.0039 in.)



ECA9410B

HOW TO USE PLASTIGAUGE

Plastigauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plasticgauge to the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plasticgauge at the widest part by using the scale printed on the gauge package. If the clearance exceeds the service limit, the bearing should be replaced or an undersize bearing should be used. When installing a new crankshaft, be sure to use standard size bearings. If the standard clearance can not be obtained even after replacing the bearing, the journal and pin should be ground to the undersize and a bearing of the corresponding size should be installed.

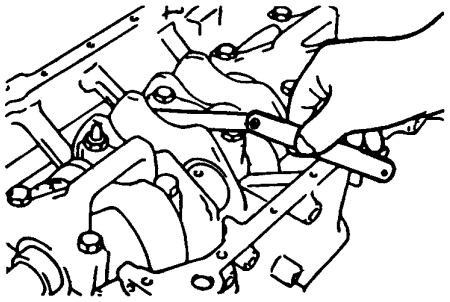
OIL SEAL

Check the front and rear oil seals for damage or worn surfaces. Replace any seat that is defective.

BEDPLATE

After installing the bedplate, make sure the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace the crankshaft bearings.

Standard value : 0.09 ~ 0.32 mm (0.0035 ~ 0.026 in.)



ECA9410D

DRIVE PLATE (A/T)

Replace distorted, damaged, or cracked drive plates.

FLYWHEEL (M/T)

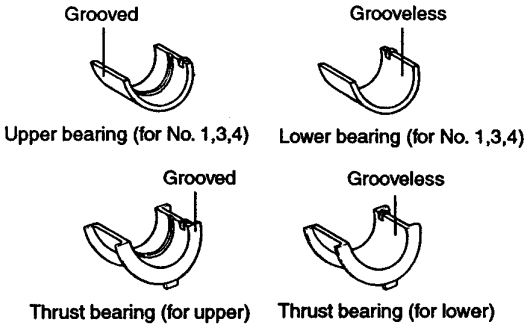
1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for run - out.

Limit
Flywheel run - out : 0.13 mm (0.0051 in.)

3. Check the ring gear for damage, cracks and wear. Replace if necessary.

REASSEMBLY EB6290AF

1. Install a grooved main bearing (upper bearing) on the cylinder block side.
2. Install a grooveless main bearing (lower bearing) on the main bearing cap side.
3. Lower center thrust bearing is grooveless. Upper center thrust bearing is grooveed.



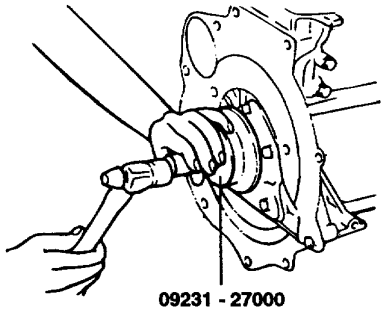
ECDC430B

4. Apply engine oil to journals and pins. Install the crankshaft.
5. Install the bedplate. (Apply Loctite 5205)
6. Tighten the bedplate bolts to the specified torque.

Tightening torque
Bedplate bolts :
15 mm : 28 ~ 32 Nm (280 ~ 320 kg.cm,
20.7 ~ 23.6) + 120°
12 mm : 33.7 ~ 37.7 Nm (337 ~ 377 kg.cm,
24.9 ~ 27.8 lb.ft)

7. Bedplate bolts should be tightened nly in 4 to 5 increments before they are tightened to the specified torque.
8. Make sure that the crankshaft turns freely and check the end play of the crankshaft.

9. Using a special tool (09231 - 27000). Install the oil seal in the oil seal case. A new oil seal should be used.



ECHB014Z

〈For M/T〉

10. Install the flywheel housing to the cylinder block.

11. Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque
Flywheel bolt :
70 ~ 80 Nm (700 ~ 800 kg.cm, 52 ~ 59 lb.ft)

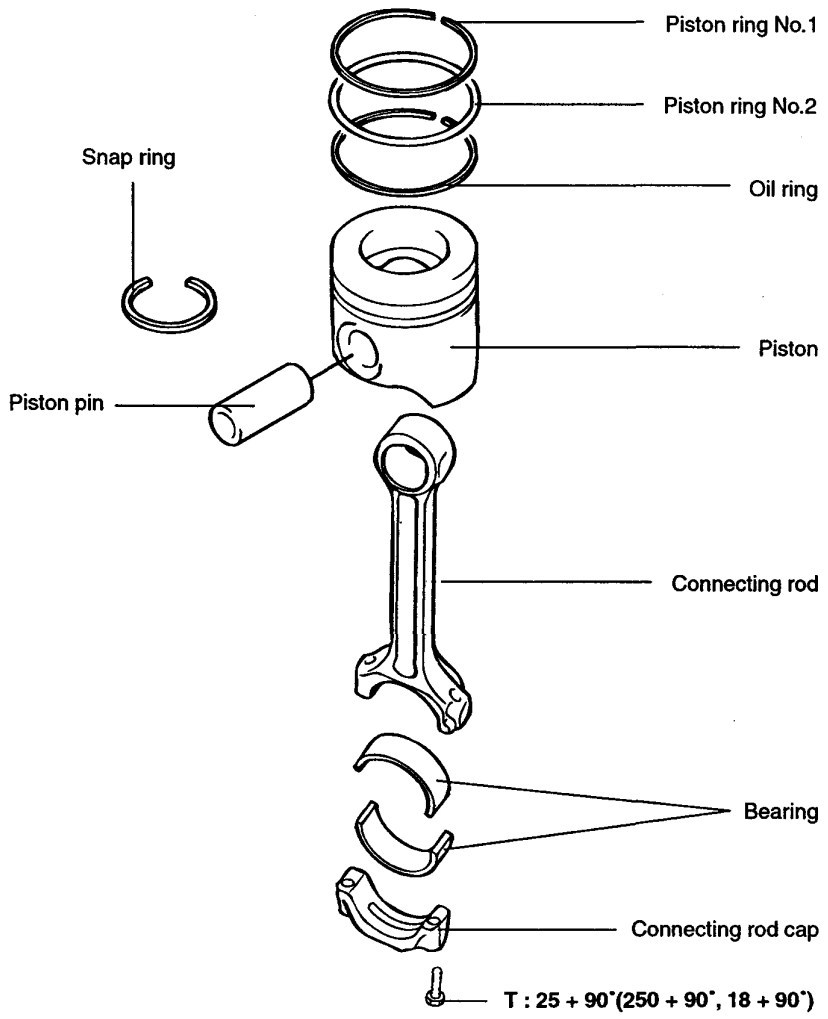
〈For A/T〉

12. Install the drive plate and tighten the bolts to the specified torque.

Tightening torque
Drive plate : 70 ~ 80 Nm (700 ~ 800 kg.cm, 52 ~ 59 lb.ft)

PISTON

COMPONENTS E93DF7AD



TORQUE : Nm (kg.cm, lb-ft)

KCHB006A

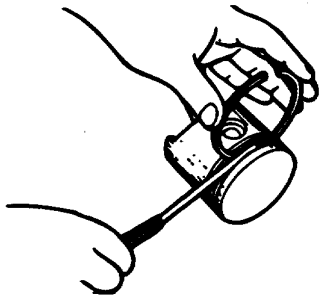
INSPECTION E8EA722F

PISTON

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature)

PISTON RING

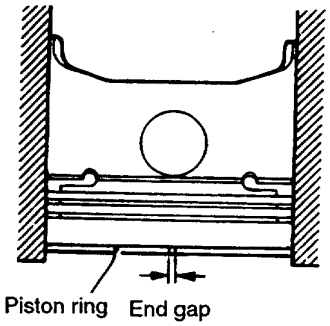
1. Check each piston ring for breakage, damage and abnormal wear.
   Replace the defective rings.
2. When the piston requires replacement, its ring should also be replaced.
3. Measure the clearance between piston ring and ring groove.



ECLA010B

Standard Value : Ring - to - ring groove clearance
No. 2 : 0.065 ~ 0.11 mm (0.00256 ~ 0.00433 in.)
Oil ring : 0.03 ~ 0.07 mm (0.00118 ~ 0.00275 in.)

4. Place a piston ring in the cylinder bore and set it square by pushing it down with piston.
5. Measure the end clearance using a thickness gauge.

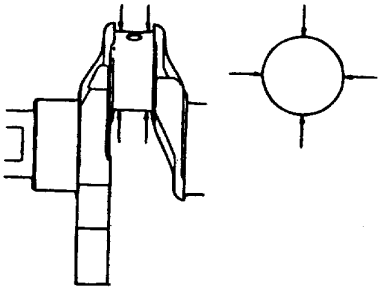


ECLA010D

Standard Value : End gap
No. 1 : 0.2 ~ 0.3 mm (0.0079 ~ 0.0118 in.)
No. 2 : 0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)
Oil ring : 0.2 ~ 0.45 mm (0.0079 ~ 0.0177 in.)
Limit : 0.8 mm (0.0315 in.)

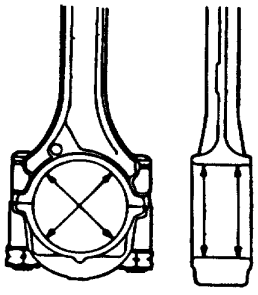
CONNECTING ROD BEARING

1. Check the bearing surfaces for uneven contact pattern, streaks, scratches, and seizure. If defects are evident, replace. If the surfaces are seriously nicked and seized, check also the crankshaft. If the crankshaft is also damaged, replace the crankshaft or grind to undersize for reuse.



ECLA010E

2. Measure the connecting rod bearing I.D. and crankshaft pin O.D. If the clearance (oil clearance) exceeds the limit, replace the bearing and, if necessary, the crankshaft. Or, grind the crankshaft to an undersize and, at the same time, replace the bearing with an undersize.
   Check the bearing surfaces for uneven contact pattern, streaks, scratches, and seizure. If defects are evident, replace. If the surfaces are seriously nicked and seized, check also the crankshaft. If the crankshaft is also damaged, replace the crankshaft or grind to undersize for reuse.



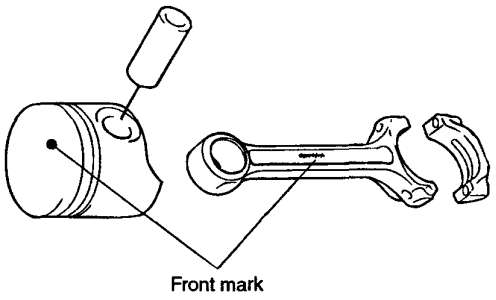
ECLA010F

Standard value :
0.024 ~ 0.042 mm (0.0009 ~ 0.0016 in.)
Limit : 0.10 mm (0.0039 in.)

INSTALLATION E36A15BD

CONNECTING ROD, PISTION PIN AND PISTON

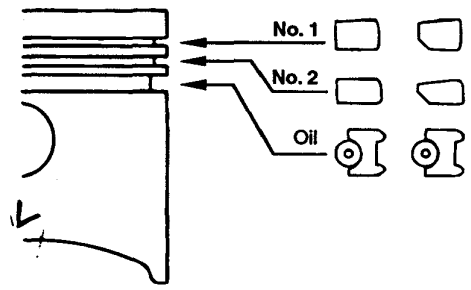
1. Match the piston with the connecting rod.
2. Line up the front marks and insert the piston pin. The piston pin must be smoothly pressed by hand into position. Replace the piston pin if there is excessive play.



KCHB006B

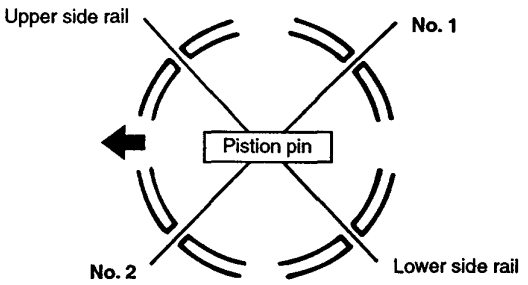
PISTON RING

1. Install the oil ring expander and oil ring to the piston. Then, install No.2 piston ring and No.1 piston ring, in that order. Make sure that the ring side, on which manufacturer and size marks are stamped, faces to the piston crown.



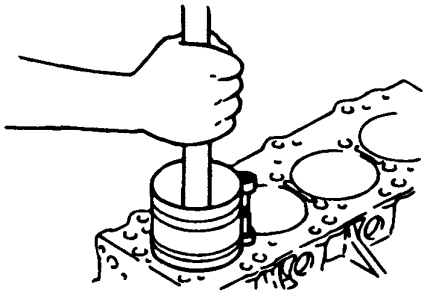
ECLA010L

2. Position ends of piston and oil (side rail, spacer) rings as illustrated.



ECLA010M

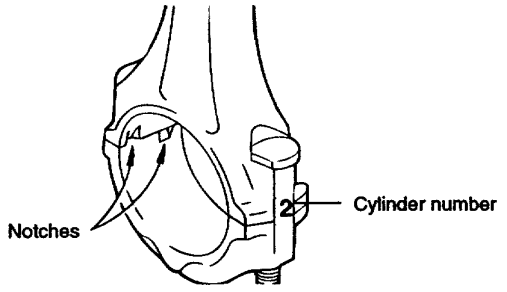
3. Insert the piston and connecting rod assembly from above the top of cylinder. Ensure that the front mark on piston crown and that (ID mark) on the connecting rod face toward the front of engine (to the crank pulley side).
4. Clamp firm the piston rings with the ring band and install the piston assembly into cylinder. Do not strike it hard into the piston, as broken piston ring or damaged crank pin could result.



ECLA010N

5. Tighten the connecting rod cap bolts.

Tightening torque
Connecting rod cap bolts :
25 Nm (250 kg.cm, 18.4 lb.ft) + 90°



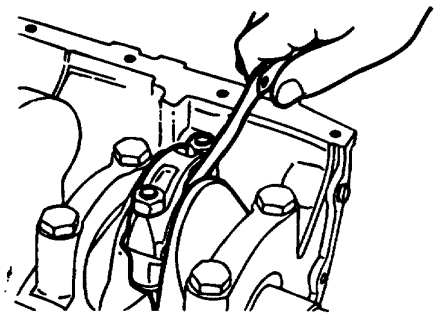
ECA9360A

NOTE

Re-use of the bolt must be limited to 3 times.

6. Make sure the clearance of connecting rod big end side.

Standard Value : 0.10 ~ 0.35 mm (0.0039 ~ 0.0138 in.)
Limit : 0.4 mm (0.0157 in.)



ECLA010O

COOLING SYSTEM

RADIATOR

REMOVAL EABC0EBB

1. Disconnect the ground cable from the battery terminal.
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp.
5. For vehicles with automatic transaxles, disconnect the oil cooler hoses from the automatic transaxle.

   ⚠ ***CAUTION***

   Cover or plug the hose and inlets of the radiator so that dust and other foreign materials can not enter after the hose is disconnected from the radiator.

6. Remove the radiator upper mounting bolt.
7. Remove the radiator together with the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION E9678BBD

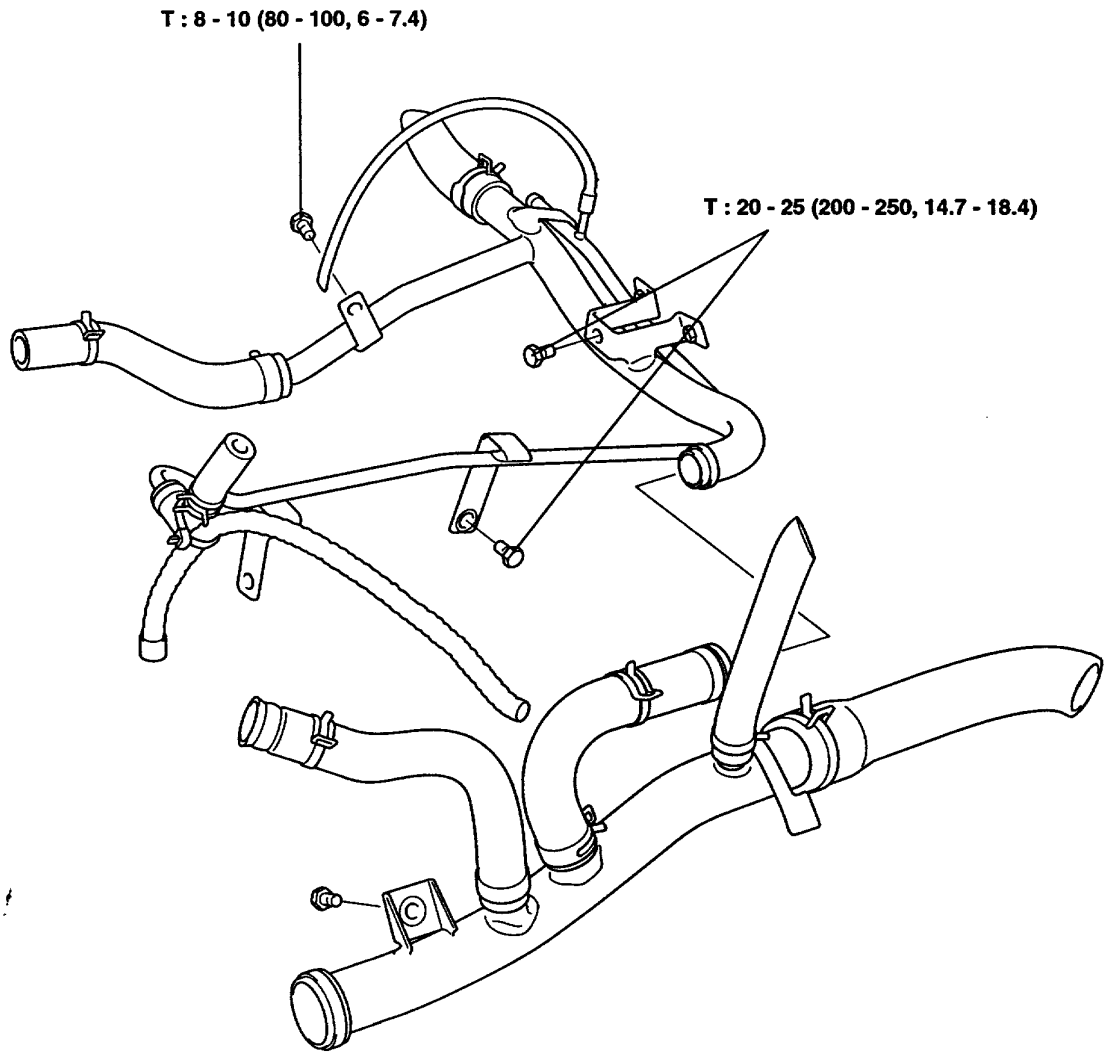
1. Check for foreign material between the radiator fins.
2. Check the radiator fins for damage and straighten if necessary.
3. Check the radiator for corrosion, damage, rust or scale.
4. Check the radiator hoses for cracks, damage or deterioration.
5. Check the reservoir tank for damage.
6. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration (only A/T).

INSTALLATION E4DECC2A

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the coolant has warmed up enough so that the thermostat valve is open. Then, stop the engine.
3. Remove the radiator cap and pour the coolant into the filler neck of the radiator. Fill the reservoir tank with the coolant to the upper level. Replace the radiator cap.
4. Check that there are no leaks from the radiator, hoses or connections.

ENGINE COOLANT HOSE / PIPES

COMPONENTS EB5DAADE



TORQUE : Nm (kg.cm, lb·ft)

ECDC450A

INSPECTION EFE48BE7

Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

REASSEMBLY E4DA498F

Fit an O-ring in the groove provided at the engine coolant inlet pipe end. Wet the periphery of the O-ring with water and insert the engine coolant inlet pipe.

NOTE

1. *Do not apply oil or grease to engine coolant pipe O-ring.*
2. *Keep the engine coolant pipe connections free of sand, dust, etc.*
3. *Insert the engine coolant pipe into the end of the engine coolant pump inlet.*
4. *Whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.*

COOLANT TEMPERATURE SENSOR E9B09E64

REMOVAL

1. Drain the coolant to a level below the bottom of the sensor.
2. Disconnect the ground cable from the battery and then remove the sensor connector.
3. Remove the coolant sensor.

INSTALLATION ECD32473

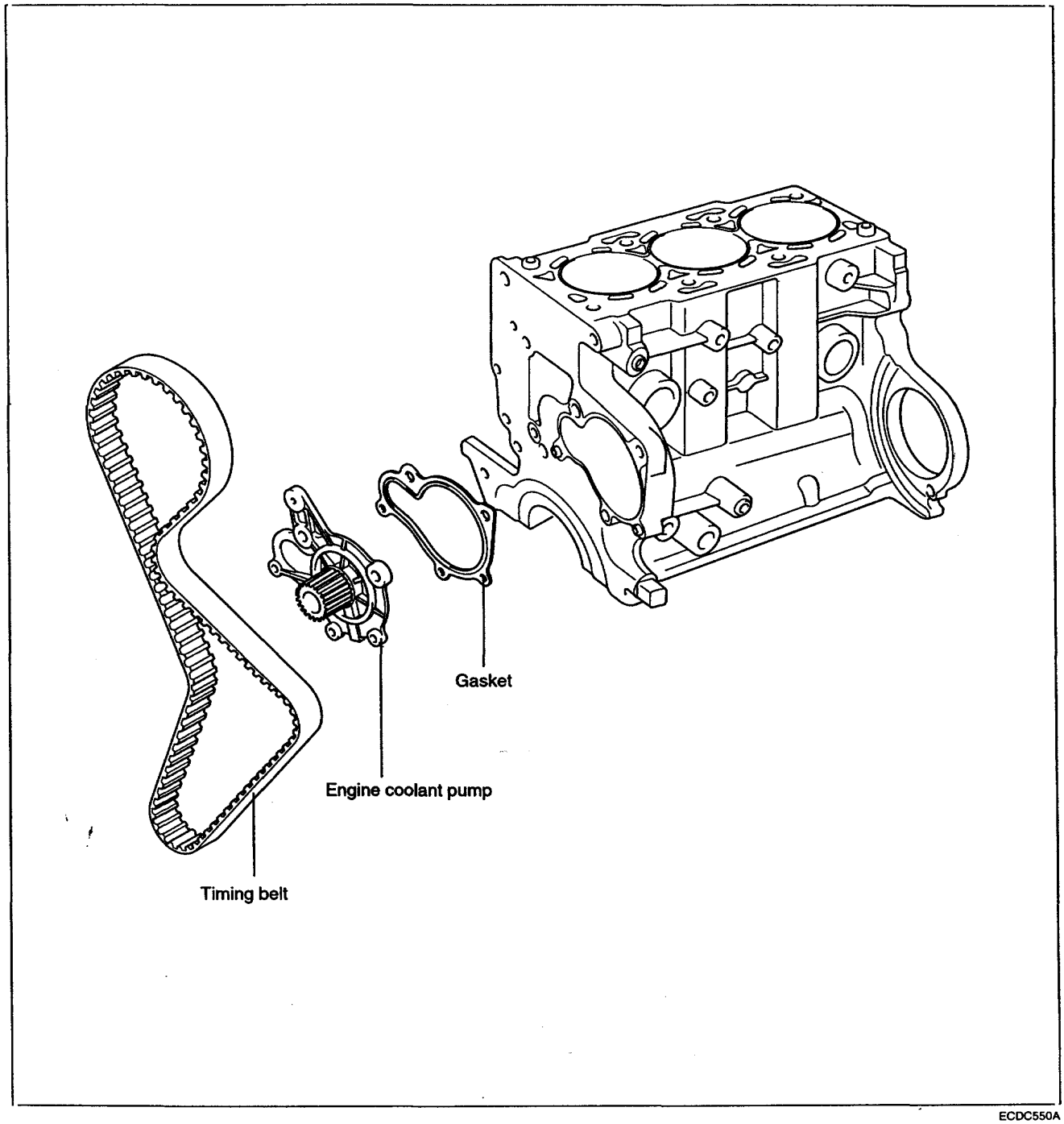
1. Tighten the coolant temperature sensor to the specified torque after applying the sealant to the screw area.

Recommened sealant :
Threebond No. 1324 N or LOCTITE 262
Tightening torque
The coolant temperature sensor :
20 ~ 40 Nm (200 ~ 400 kg.cm, 14 ~ 29 lb.ft)

2. Connect the sensor to the harness.
3. Connect the ground cable to the battery.
4. Refill the engine coolant.

ENGINE COOLANT PUMP

COMPONENTS E71E67FA



ECDC550A

REMOVAL EB3BF5FA

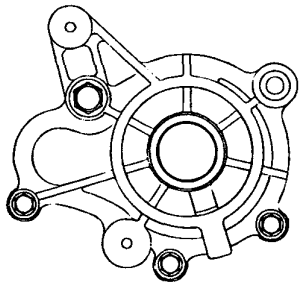
1. Drain the coolant and disconnect the coolant pump inlet pipe.
2. Remove the drive belt and engine support bracket.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION E3C9BA05

1. Check the pump for cracks, damage or wear. Replace the pump assembly if necessary.
2. Check the bearing for damage, abnormal noise, and sluggish rotation. Replace the pump assembly if necessary.
3. Check the seal for leaks. Replace the pump assembly if necessary.
4. Check for engine coolant leakage. If the engine coolant leaks, the seal is defective. Replace the engine coolant pump assembly.

INSTALLATION EEDBC20D

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.
2. Install the new O-ring onto the groove on the front end of the engine coolant pipe, then wet the O-ring with water. Do not apply oil or grease.
3. Install a new engine coolant pump gasket and engine coolant pump assembly. Tighten the bolts to the specified torque.



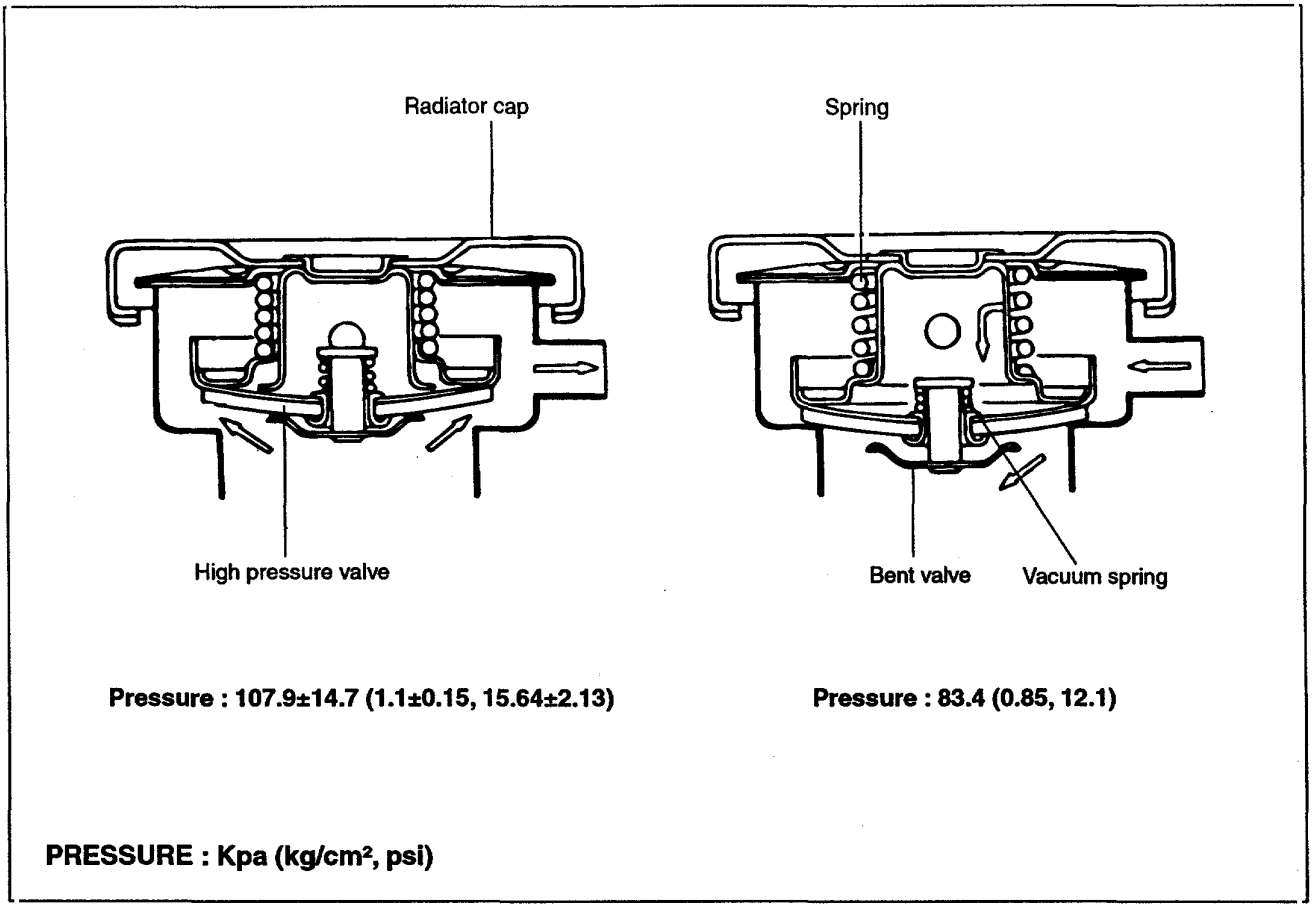
KCHB007B

Tightening torque
Engine coolant pump bolt
10 mm : 10 ~ 12 Nm (100 ~ 120 kg.cm, 7 ~ 9 lb.ft)
14 mm : 48 ~ 52 Nm (480 ~ 520 kg.cm, 35 ~ 38 lb.ft)

4. Install the timing belt tensioner and timing belt. Adjust the timing belt tension, then install the timing belt covers.
5. Refill the coolant.
6. Run the engine and check for leaks.

RADIATOR CAP

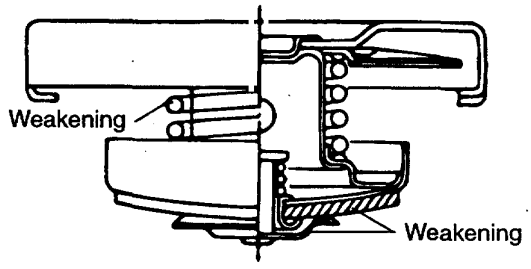
COMPONENTS ED54D9C6



ECHA014A

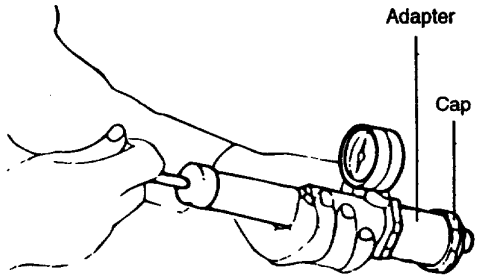
INSPECTION EFA1EE49

1. Check the radiator cap for damage, cracks or weakening.



ECHA014B

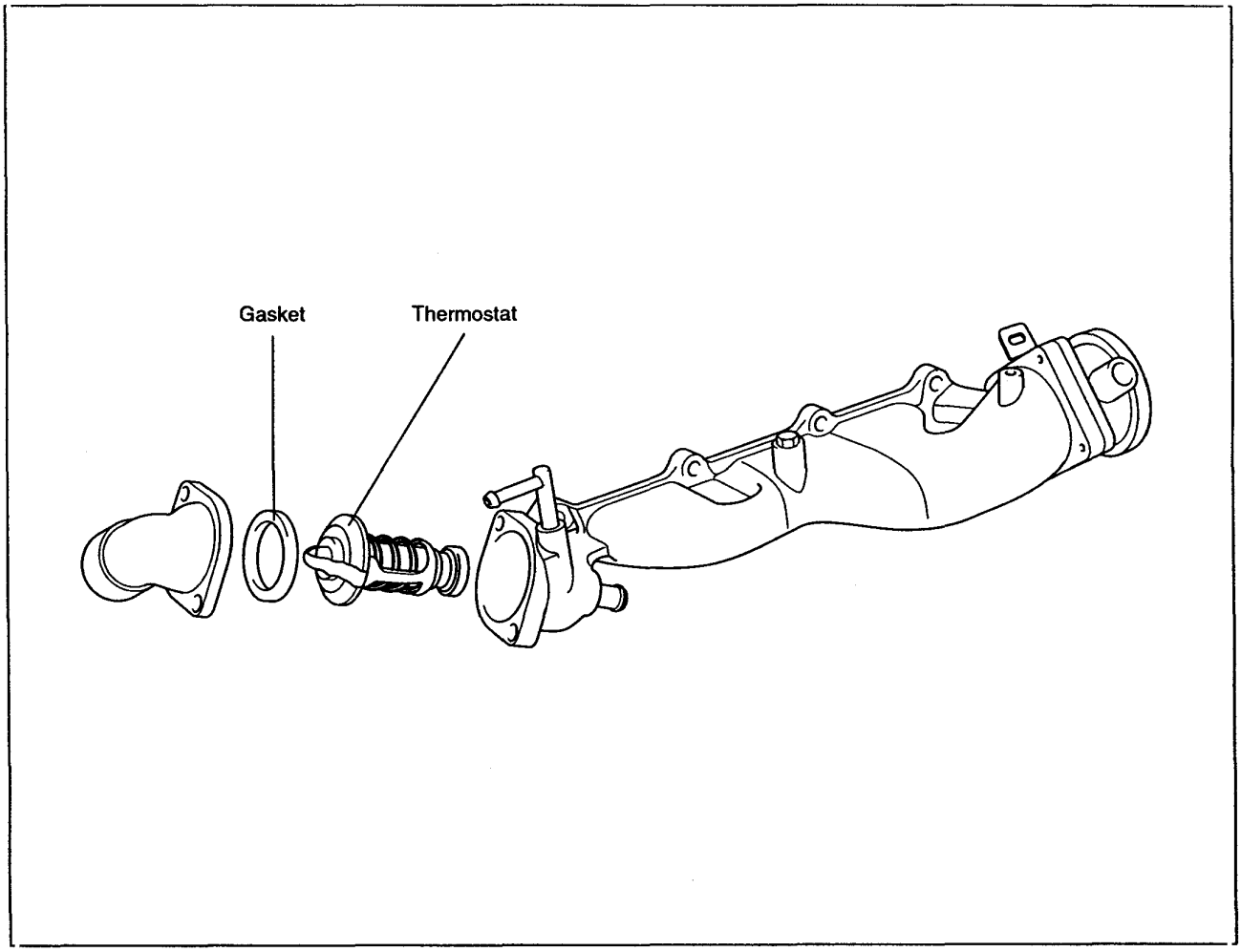
2. Connect the tester to the radiator cap.
3. Increase the pressure until the indicator stops moving.
4. Replace the radiator cap if the reading does not hold steady for about 10 seconds.



ECHA014C

THERMOSTAT

COMPONENTS EB35A5C8



ECDC720A

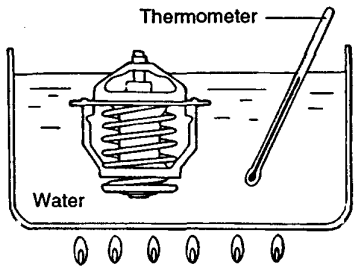
REMOVAL EECDDB53

1. Drain the coolant so its level is below the thermostat.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.

INSPECTION E7B3CEFD

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Verify the temperature at which the valve begins to open.

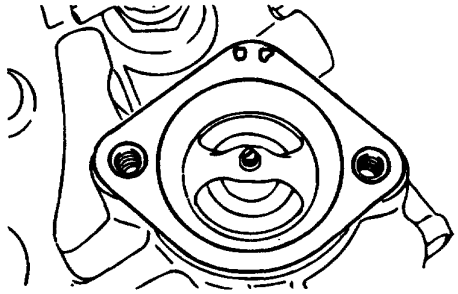
Valve opening temperature : 83.5 ~ 86.5°C (182 ~ 188°F)
Full opening temperature : 100°C (212°F)



ECA9600A

INSTALLATION ECCBB05C

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install the inlet fitting.



ECHA013B

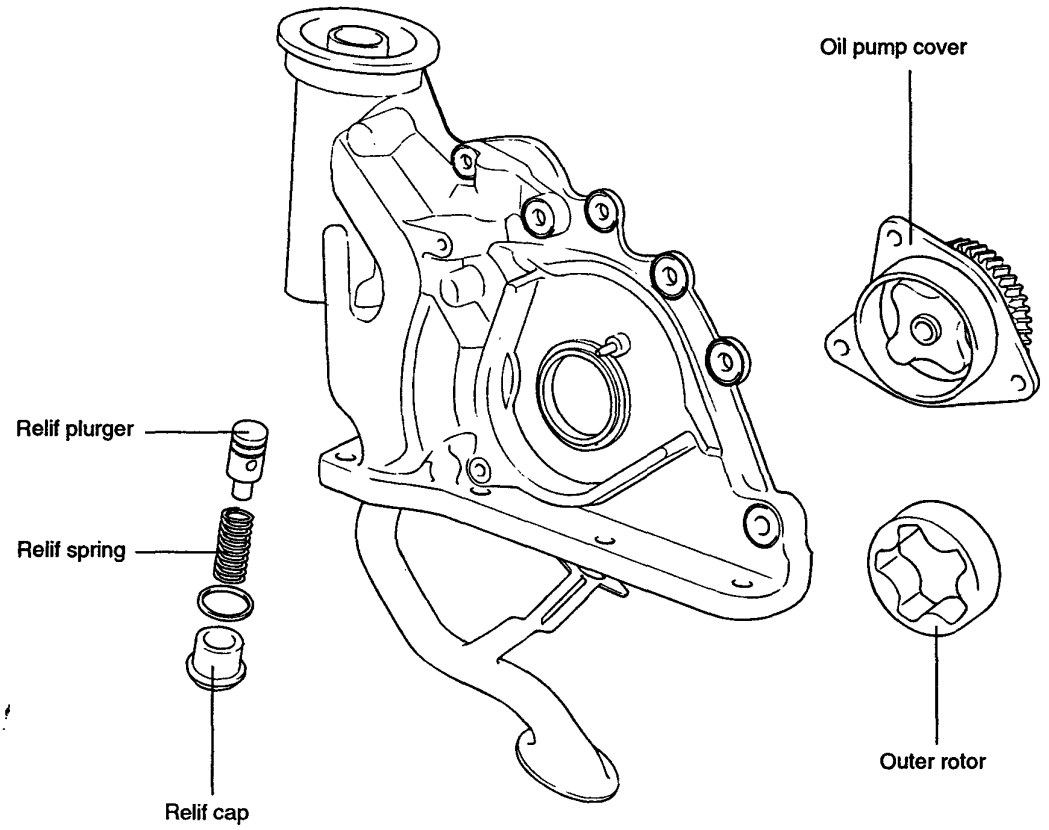
Tightening torque
Engine coolant inlet fitting bolt :
20 ~ 25 Nm (200 ~ 250 kg.cm, 14.7 ~ 18.4 lb.ft)

3. Refill the coolant.

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS E440CCE8



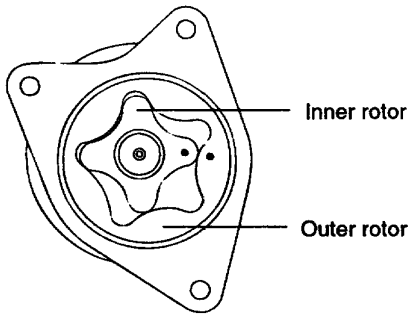
TORQUE : Nm (kg.cm, lb·ft)

KCHB009A

DISASSEMBLY EFFCEE9E

OIL PUMP

Before removing the oil pump outer and inner gears, mark the outer gear to make sure that it goes back to the position with correct direction.



ECHB009B

INSPECTION E2BF1D9D

OIL PUMP

1. Install the outer and inner gear into the oil pump housing and make sure that they turn smoothly with no excessive play between them.
2. Check the side clearance (drive gear and drivengear))

Standard : 0.02 ~ 0.07 mm (0.00078 ~ 0.0027 in.)

3. Check the tip clearance.

Standard : 0.12 ~ 0.2 mm (0.00472 ~ 0.0078 in.)

4. Check the radial clearance.

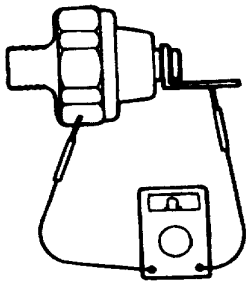
Standard : 0.13 ~ 0.23 mm (0.0051 ~ 0.009 in.)

OIL FILTER BRACKET

1. The oil filter mounting surface must be free from damage.
2. Check for cracks and oil leaks.
3. Make sure that the relief plunger slides smoothly and the relief spring is not damaged.

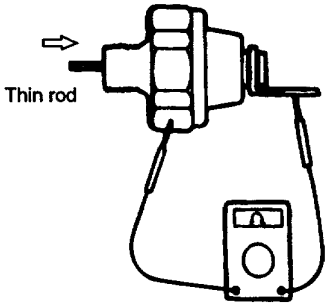
OIL PRESSURE SWITCH

1. Connect a tester (ohm range) between the terminal and the body of the switch to check for continuity. The switch is normal if there is continuity. If there is no continuity, replace the switch.



ECLA013C

2. Insert a thin rod in the oil hole of the switch and push it in lightly. The switch is normal if no continuity is detected (infinite resistance on the tester). If there is continuity, replace the switch.

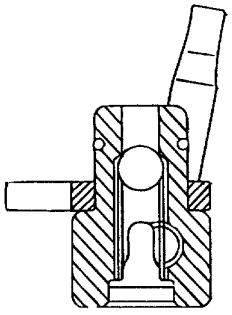


ECLA013D

3. Apply a 0.5 kg/cm² pressure to the oil hole.
The switch is normal if there is no continuity.
Also check for air leaks. If any air leaks are detected, the cause may be a broken diaphragm. Replace the switch if it leaks.

OIL JET, CHECK VALVE

1. Check the oil jet and check valve for clogging.
2. Check the oil jet for damage and deformation.



KCHB008D

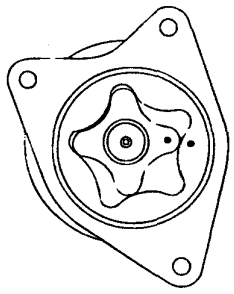
REASSEMBLY E9E5CFFC

OIL PUMP

Install the outer rotor, ensuring it is in position with correct direction according to the alignment mark made during disassembly.

NOTE

When installing the rotor, be sure to apply engine oil to the entire surfaces of the rotor.



KCHB009B

REMOVAL E95AFB7C

OIL PRESSURE SWITCH

To remove the oil pressure switch, use Oil Pressure Switch Wrench.

INSTALLATION E54EE98C

OIL PRESSURE SWITCH

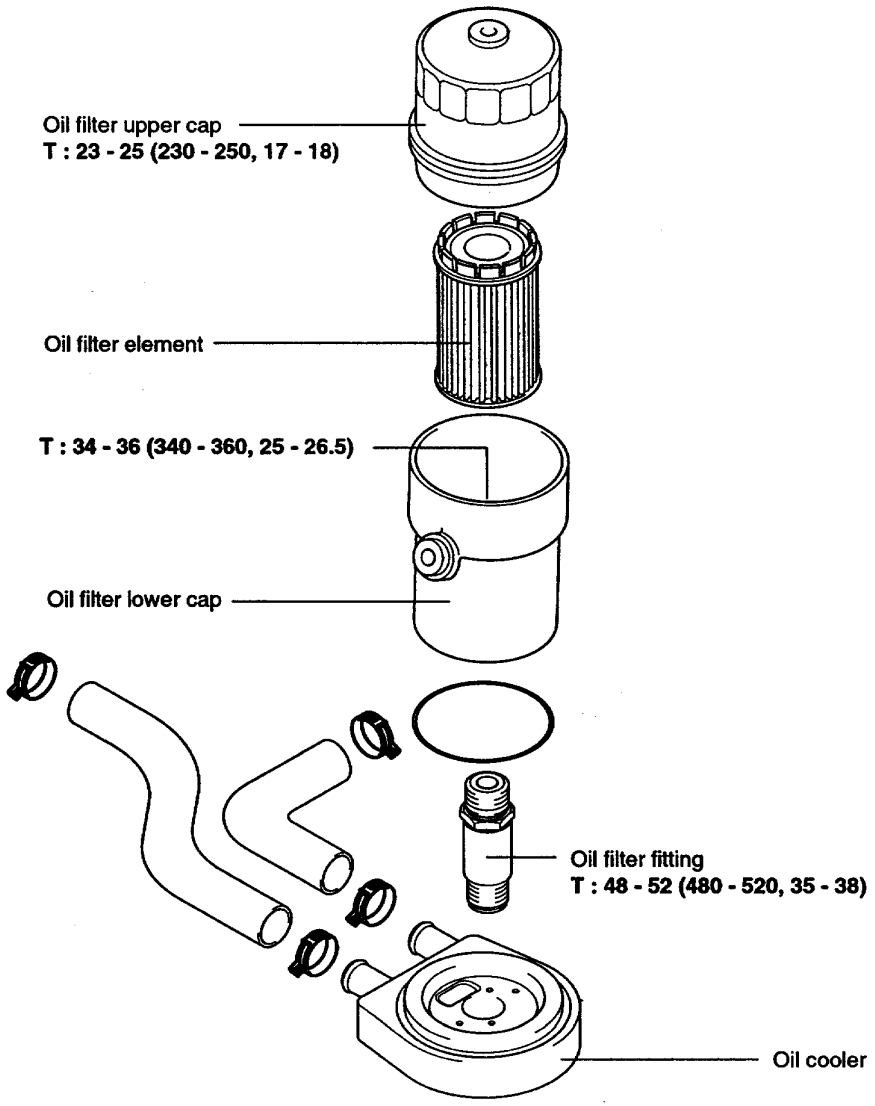
Before installation, apply sealant to the switch threads.

NOTE

The sealant must not get into the thread top surface. Use care not to torque excessively.

OIL COOLER

COMPONENTS E838DBAA



ECDC850A

REMOVAL ECB639A1

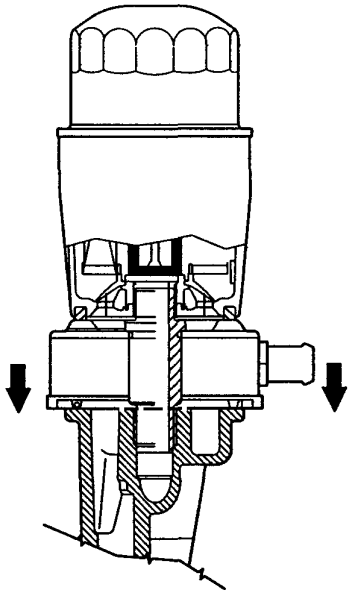
1. Remove the oil filter upper cap.
2. Remove the oil filter element.
3. Loosen the non return valve assembly of the oil filter lower case.
4. Remove the coolant hose from the oil cooler.
5. Remove the oil cooler from the oil pump.

INSPECTION ED3C5CBE

1. Check for oil leaks.
2. Check the oil cooler for damage.

INSTALLATION EE725EA4

1. Install the oil cooler to the oil pump housing.
2. Install the oil filter lower case.
3. Tighten the non return valve assembly with oil filter lower case and oil cooler.



ECDC853B

Tightening Torque
Non return valve :
48 ~ 50 Nm (480 ~ 500 kg.cm, 35 ~ 37 lb.ft)

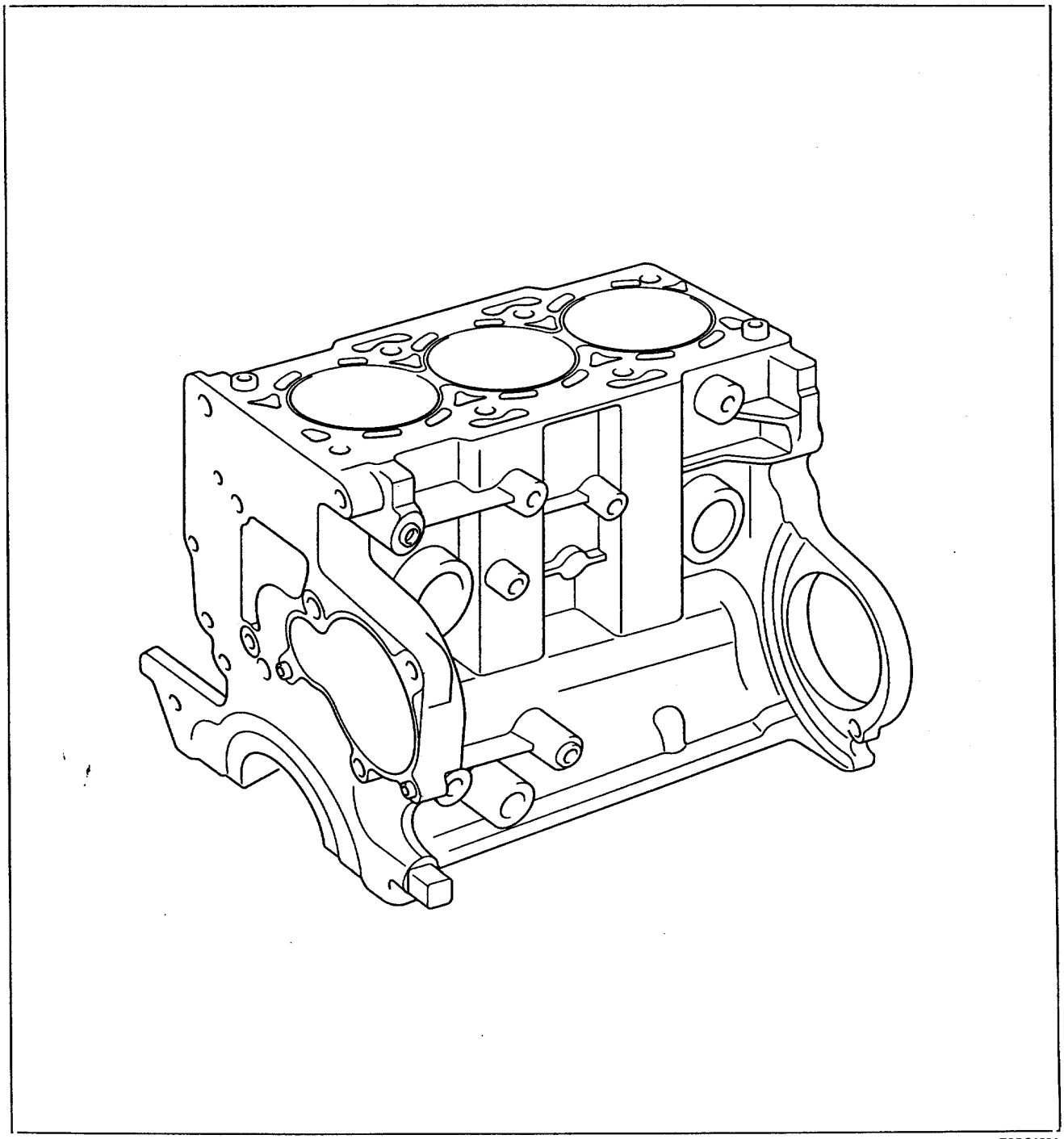
4. Install the oil filter element.
5. Install the oil filter upper cap.

Tightening Torque
Oil filter upper cap :
23 ~ 25 Nm (230 ~250 kg.cm, 17 ~ 18 lb.ft)

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS E9C84FB7



ECDC150A

REMOVAL E04DDCCB

Remove the cylinder head, timing belt, front case flywheel, pistons and crankshaft.

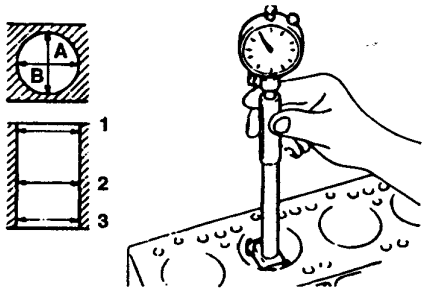
For further details, refer to the appropriate section.

INSPECTION E45FF63B

CYLINDER BLOCK

1. Check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Replace the block if defective.

2. Measure the cylinder bore with a cylinder gauge at the three levels indicated and in the directions of A and B.
   Level 1 : No. 1 piston ring position at TDC
   Level 2 : Center of cylinder
   Level 3 : Bottom of cylinder



ECA9450A

3. If the cylinder bores show more than specified out - of - round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed. New oversize piston and rings should be installed.

Standard value
Cylinder bore : 83 + 0.03 mm (3.27 + 0.0012 in.)

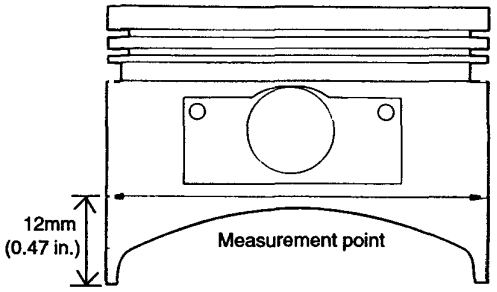
4. If a ridge exists at the top of the cylinder, cut it away with a ridge reamer.

PISTON SERVICE SIZE AND MARK MM (IN.)

Identification Mark	Size
0.25	0.25 (0.010) O.S.
0.50	0.50 (0.020) O.S.
0.75	0.75 (0.030) O.S.
1.00	1.00 (0.039) O.S.

5. To rebore the cylinder bore to oversize, maintain the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize. The standard measurement of the poston outside diameter is taken at a level 12 mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston - to - cylinder clearance : 0.069 ~ 0.091 mm



ECA9451A

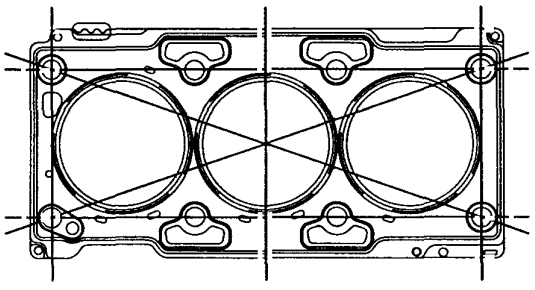
6. Check for damage and cracks.

7. Check the top surface of the cylinder block for flatness. If the top surface exceeds limits, surface to minimum limit or replace.

Standard value
Flatness of cylinder block
0.042 mm (0.00165 in.) for width
0.096 mm (0.00378 in.) for length
0.012 mm (0.00047 in.) 50 x 50
Service limit
Flatness of cylinder block : 0.1 mm (0.0039 in.)

NOTE

When the cylinder head is assembled, grinding less than 0.2 mm (0.008 in.) is permissible.



ECDC170B

BORING CYLINDER

1. Oversize pistons should be selected on the basis of the largest cylinder bore.

Identification Mark	Size
0.25	0.25 mm (0.010 in.) O.S.
0.50	0.50 mm (0.020 in.) O.S.
0.75	0.75 mm (0.030 in.) O.S.
1.00	1.00 mm (0.039 in.) O.S.

NOTE

The size of a piston is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.
3. On the basis of the measured O.D., calculate the new bore size.
   New bore size = Piston O.D + clearance between piston and cylinder - 0.02 mm (0.0008 in.) (honing margin.)
4. Bore each of cylinders to the calculated size.

NOTE

To prevent distortion that may result from temperature rise during honing, bore the cylinders, holes in the firing order sequence.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Verify the clearance between the piston and cylinder.

NOTE

When boring cylinders, finish all four cylinders to the same oversize. Do not bore only one cylinder to the oversize.

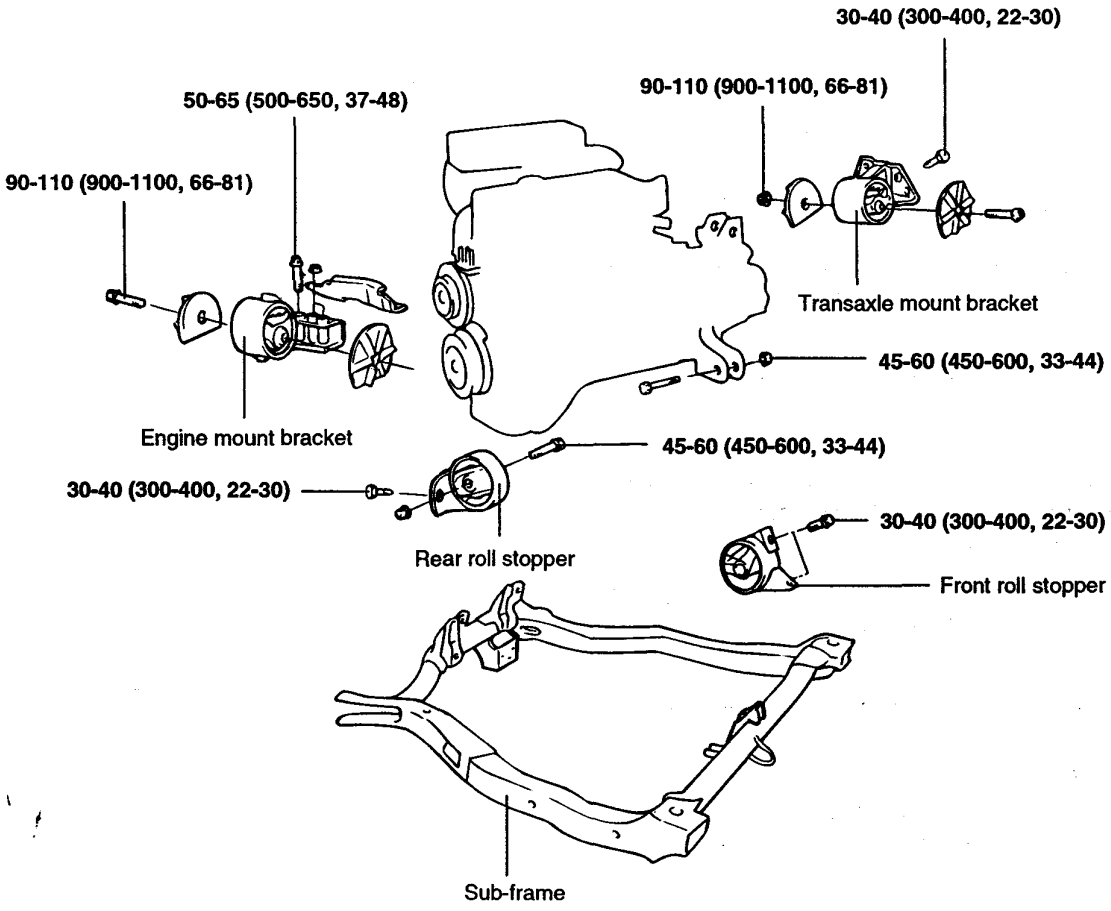
INSTALLATION EE20CA5F

Install the following parts by referring to their respective paragraphs.

1. Crankshaft
2. Flywheel
3. Piston
4. Cylinder head
5. Timing belt train
6. Front case

ENGINE MOUNTS

COMPONENTS EB53E86E

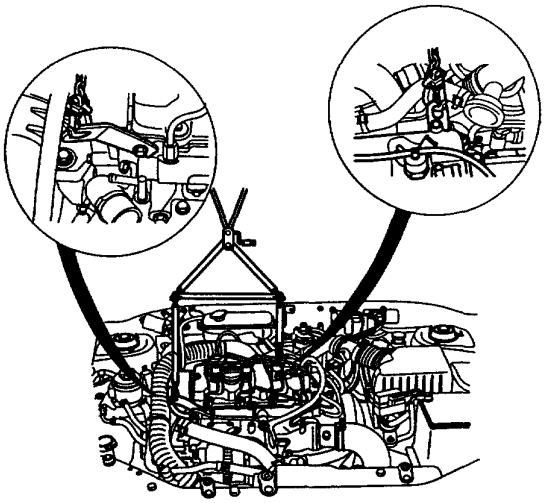


TORQUE : Nm (kg·cm, lb·ft)

ECDC210A

REMOVAL EEDCCDDB

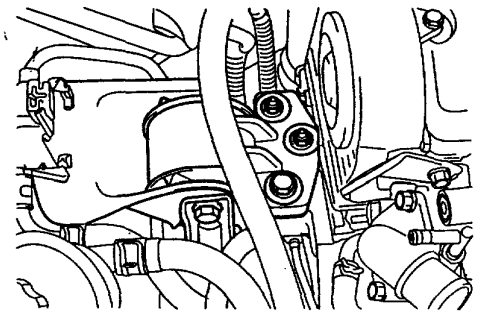
1. Attach an engine hoist to the engine hooks, and raise the engine just enough so that there is no pressure on the insulators.



EDDD501B

ENGINE MOUNTING

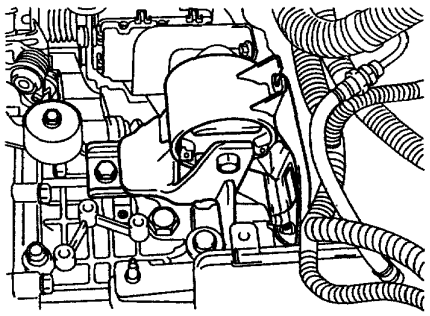
1. Remove the engine mounting insulator bolts.
2. Remove the engine mounting bracket from the engine.



EDDD502B

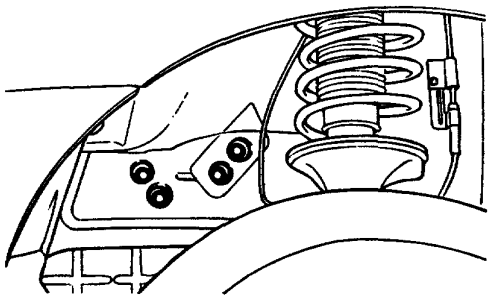
TRANSMISSION MOUNTING

1. For vehicles with a 5-speed manual transmission, remove the select control valve.
2. Remove the transmission mounting bolt.



EDDD502C

3. Detach the cap from inside the right fender shield. Remove the transmission mounting bolts.

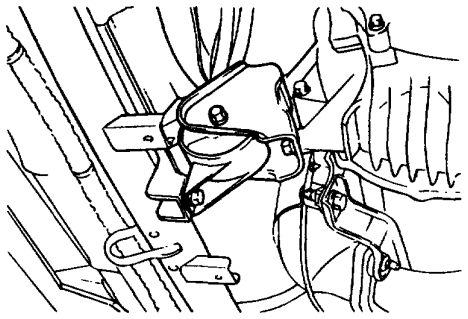


ECDA012D

4. Remove the transmission bracket.

FRONT ROLL STOPPER

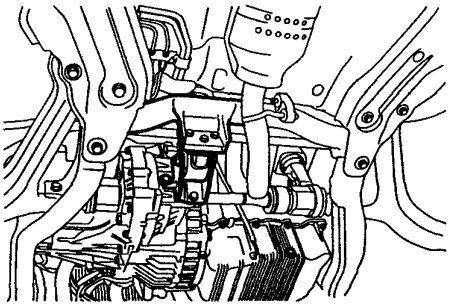
1. Remove the front roll stopper bracket from the center member.



ECDA012E

REAR ROLL STOPPER

1. Remove the rear roll stopper from the center member.

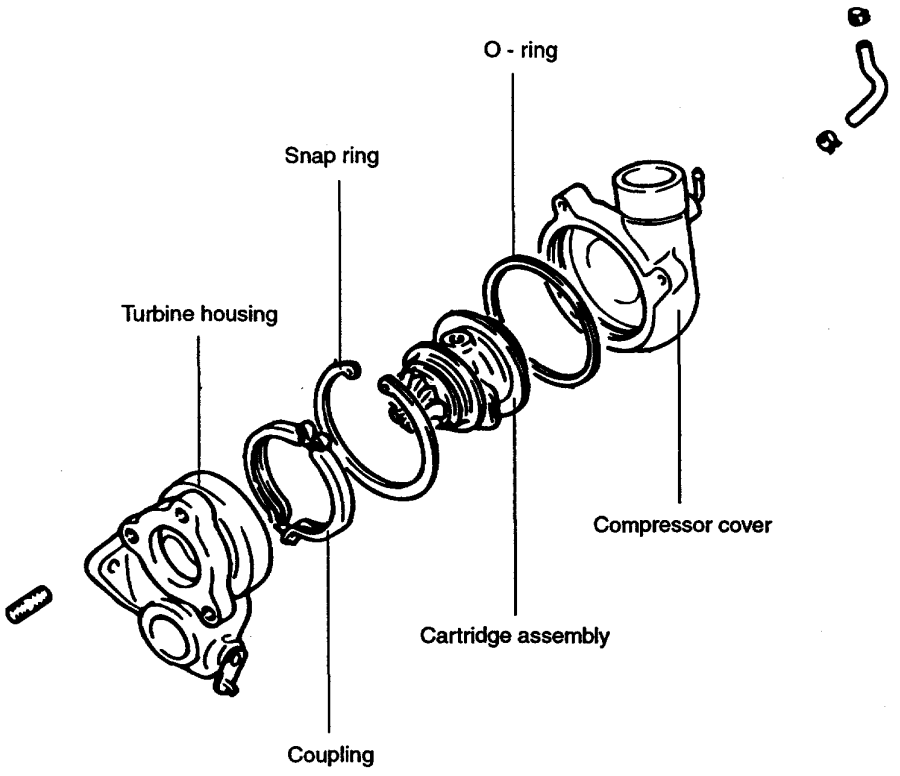


ECDC220B

INTAKE AND EXHAUST SYSTEM

TURBO CHARGER (TC)

COMPONENTS E988F7C5



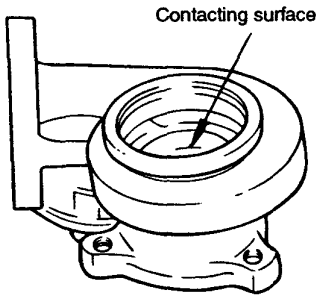
*** Replace the gasket with new ones after removal.**

TORQUE : Nm (kg.cm,lb.ft)

ECLA016A

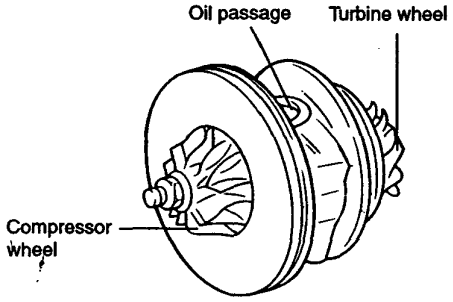
INSPECTION ECA12DC4

1. Check the inner housing contacting turbine wheel for crack, pitching and other damages caused by overheat.
2. Make sure that the waste gate valve lever operates freely by hands.
3. Make sure there are no damages on the inner housing surface contacting compressor wheel.



ECLA016E

4. Turbine wheel and shaft assemblies with cracks in the blades or broken blades can not be used again. If the blades are slightly bent, it can be used again but severely bent blades can not be reused.



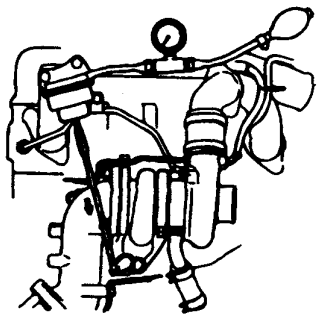
ECLA016F

5. Check if there are foreign materials disturbing the oil flow in the oil passage of cartridge assembly.

WASTE GATE INSPECTION

1. Check the waste gate rod operation under the pressure below.

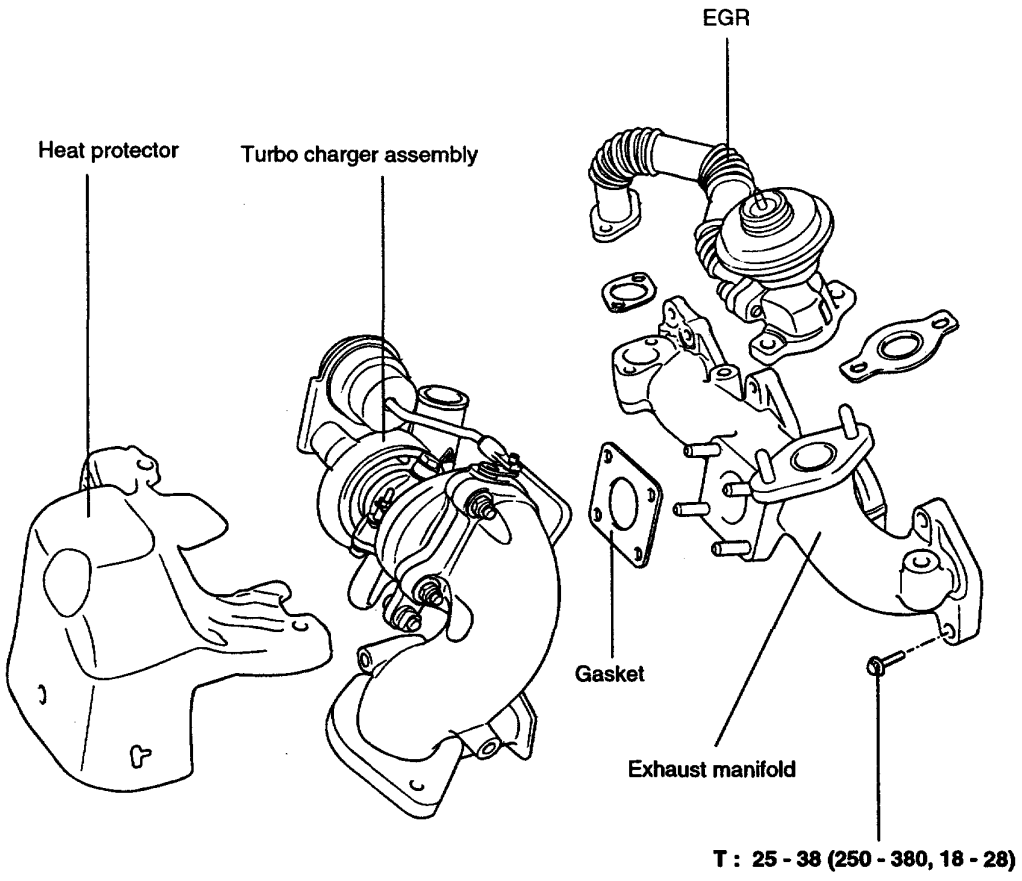
Nominal Value : 142 kPa (1.45 kgf / cm²)



ECLA016J

EXHAUST MANIFOLD

COMPONENTS E2BAEBBF



TORQUE : Nm (kg.cm, lb·ft)

KCHB010A

MUFFLER

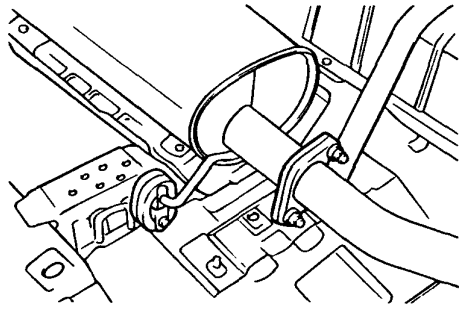
REMOVAL EAC4A231

MAIN MUFFLER

⚠ ***CAUTION***

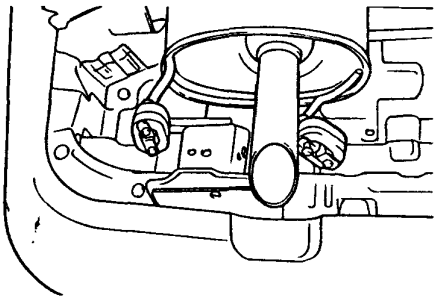
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool enough.

1. Disconnect the main muffler from the center exhaust pipe.



ECHA019E

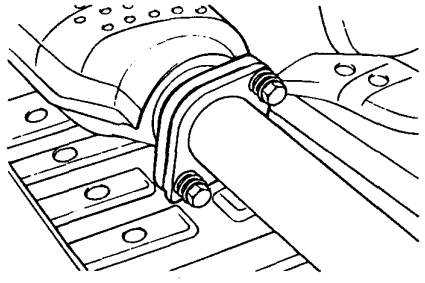
2. Remove the rubber hangers and take out the main muffler.



ECHA019B

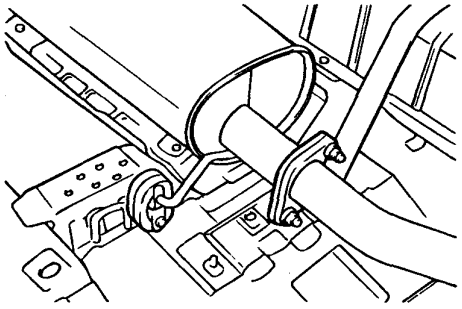
CENTER EXHAUST PIPE

1. Disconnect the center exhaust pipe from the main muffler.
2. Remove the center exhaust pipe from the front exhaust pipe.



KCHB500C

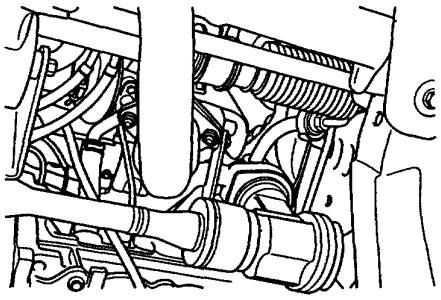
3. Remove the rubber hangers and take out the center exhaust pipe.



ECHA019E

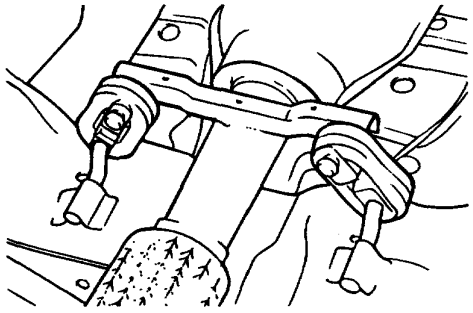
FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe bolts and exhaust manifold pipe mounting nuts.



ECDC880C

3. Remove the front exhaust pipe from the rubber hanger.



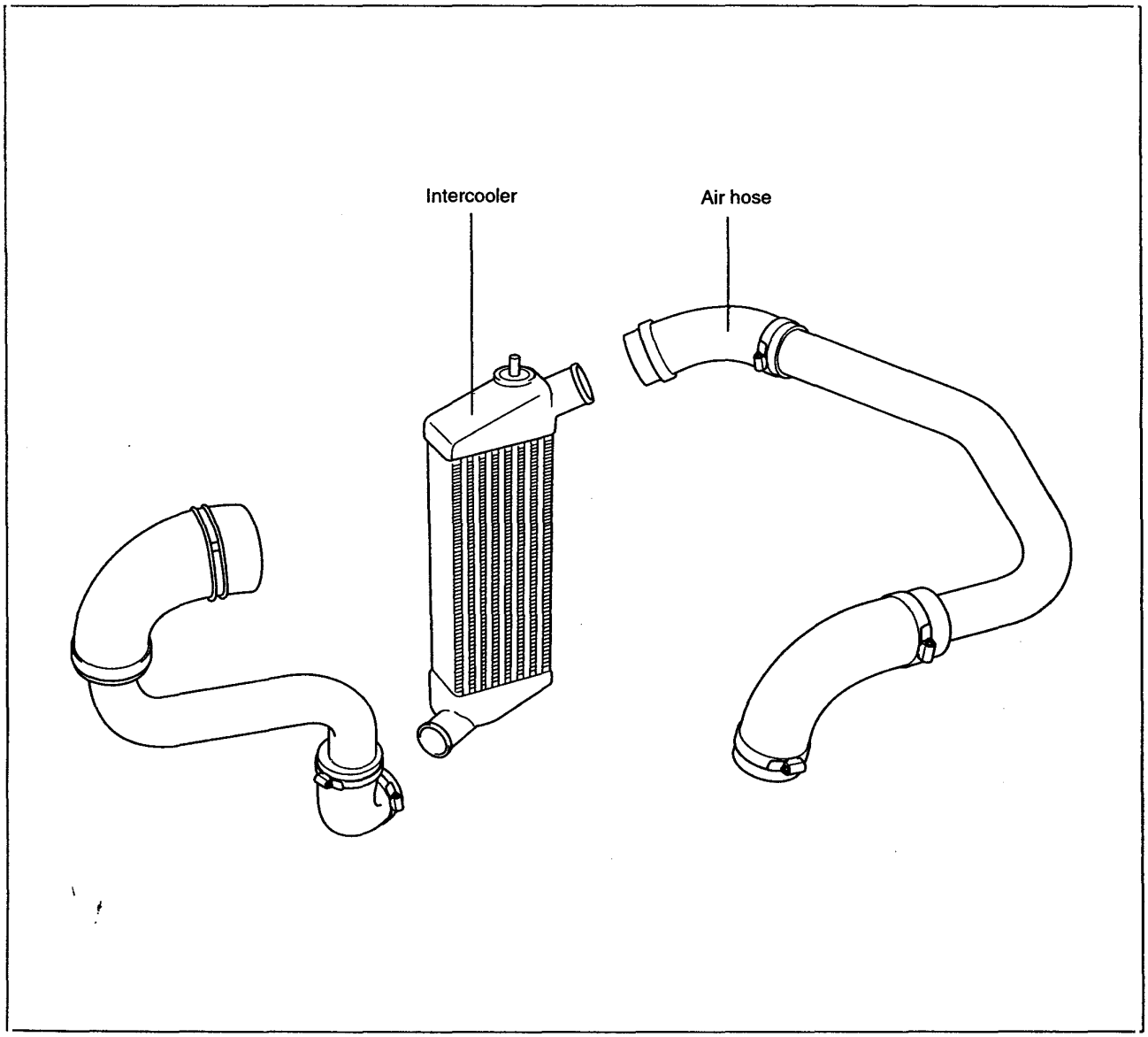
ECHA019H

INSTALLATION EBAC003F

1. Temporarily, install the front exhaust pipe (catalytic converter assembly), the center exhaust pipe and the main muffler in this order.
2. Install the rubber hangers so that they cam be identical (left and right) in length.
3. Tighten the parts securely and then confirm that there is no interference with any of components.

INTERCOOLER

COMPONENTS EF2B7BDF



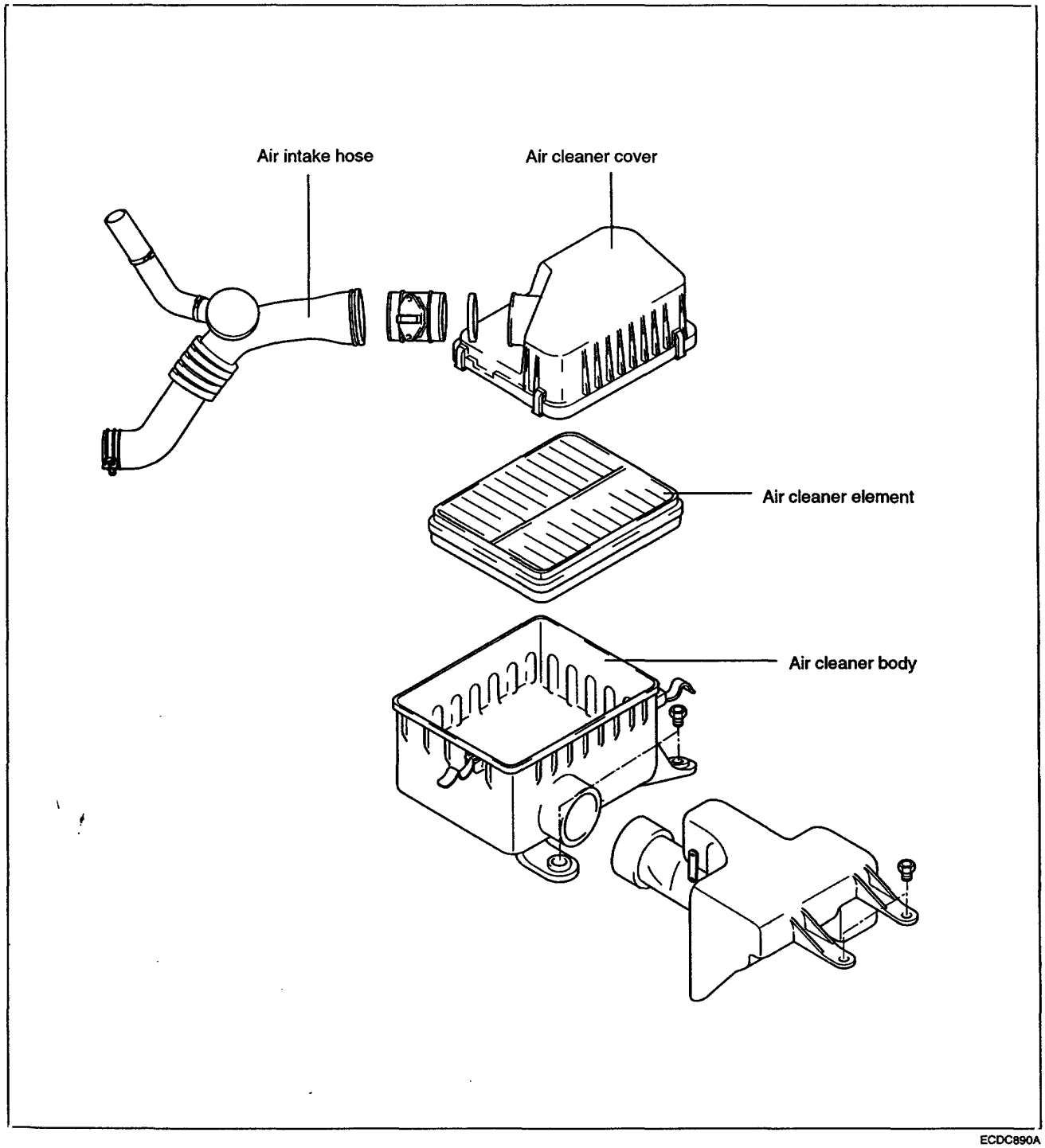
ECDC886A

REMOVLE E41F49DF

1. Remove the air hoses.
2. Remove the radiator bracket.
3. Remove the intercooler assembly.

AIR CLEANER (ACL)

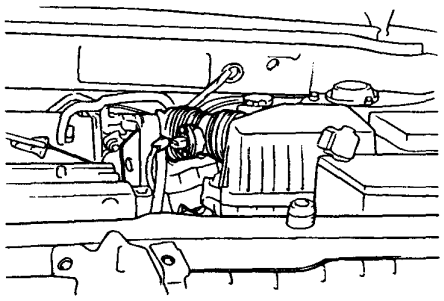
COMPONENTS E7DD5E6B



ECDC890A

REMOVAL EE75CFAA

1. Disconnect the air flow sensor connector.
2. Remove the air intake hose at the air cleaner.
3. Remove the three bolts attaching the air cleaner mounting brackets.
4. Detach the air cleaner.



ECJA870B

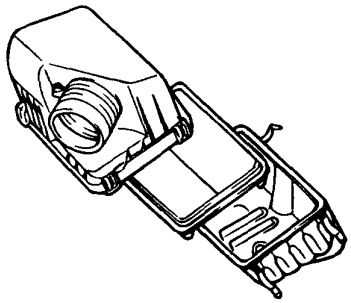
5. Remove the air flow sensor from the air intake hose.

⚠ ***CAUTION***

Do not pull on the air flow sensor wires.

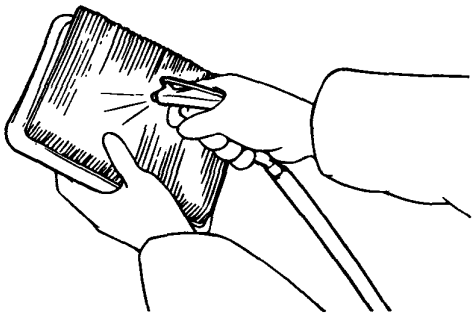
INSPECTION E5D69422

1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.
2. Check the air duct for damage.



ECJA870A

3. Check the air cleaner element for restriction, contamination or damage. If the element is slightly restricted, remove the dust and debris by blowing compressed air from the inside of the element.



ECA9066A

INSTALLATION E3F6961D

Install the air cleaner assembly following the reverse order of removal.

Engine DOHC

GENERAL
- SPECIFICATION ..... EM -2
- SPECIAL TOOLS ..... EM -18
- TROUBLE SHOOTING ..... EM -20
- ENGINE AND TRANSAXLE ASSEMBLY .. EM -22

TIMING SYSTEM
- TIMING BELT
  - COMPONENTS ..... EM -28
  - DISASSEMBLY ..... EM -29
  - INSPECTION ..... EM -31
  - REASSEMBLY ..... EM -34

CYLINDER HEAD ASSEMBLY
- CYLINDER HEAD
  - COMPONENTS ..... EM -36
  - DISASSEMBLY ..... EM -38
  - INSPECTION ..... EM -38
  - REASSEMBLY ..... EM -42

MAIN MOVING SYSTEM
- CAM SHAFT
  - COMPONENTS ..... EM -44
  - DISASSEMBLY ..... EM -45
  - INSPECTION ..... EM -45
  - REASSEMBLY ..... EM -47
- CRANK SHAFT
  - COMPONENTS ..... EM -49
  - DISASSEMBLY ..... EM -50
  - INSPECTION ..... EM -50
  - REPLACEMENT ..... EM -51
  - REASSEMBLY ..... EM -52
- FLY WHEEL
  - COMPONENTS ..... EM -53
  - DISASSEMBLY ..... EM -53
  - INSPECTION ..... EM -53
  - REASSEMBLY ..... EM -53
- PISTON
  - COMPONENTS ..... EM -54
  - DISASSEMBLY ..... EM -54
  - INSPECTION ..... EM -56
  - REPLACEMENT ..... EM -57
  - REASSEMBLY ..... EM -57

COOLING SYSTEM
- ENGINE COOLANT HOST/PIPES
  - COOLING SYSTEM ..... EM -60
  - COMPONENTS ..... EM -61
  - INSPECTION ..... EM -61
  - REASSEMBLY ..... EM -61
- ENGINE COOLANT PUMP
  - COMPONENTS ..... EM -62
  - DISASSEMBLY ..... EM -62
  - INSPECTION ..... EM -63
  - REASSEMBLY ..... EM -63
- RADIATOR
  - DISASSEMBLY ..... EM -64
  - INSPECTION ..... EM -64
  - REASSEMBLY ..... EM -65
- RADIATOR CAP
  - COMPONENTS ..... EM -66
  - INSPECTION ..... EM -67
- THERMOSTAT
  - COMPONENTS ..... EM -68
  - INSPECTION ..... EM -68
  - REASSEMBLY ..... EM -69

LUBRICATION SYSTEM
- OIL PUMP
  - COMPONENTS ..... EM -70
  - DISASSEMBLY ..... EM -71
  - INSPECTION ..... EM -71
  - REASSEMBLY ..... EM -72

ENGINE BLOCK
- ENGINE BLOCK
  - COMPONENTS ..... EM -74
  - DISASSEMBLY ..... EM -74
  - INSPECTION ..... EM -75
- ENGINE MOUNTS
  - COMPONENTS ..... EM -76
  - REMOVAL ..... EM -77

INTAKE AND EXHAUST SYSTEM
- EXHAUST MANIFOLD
  - COMPONENTS ..... EM -79
  - DISASSEMBLY ..... EM -80
  - INSPECTION ..... EM -80
  - REASSEMBLY ..... EM -80
- INTAKE MANIFOLD
  - COMPONENTS ..... EM -81
  - REMOVAL ..... EM -82
  - INSPECTION ..... EM -83
  - INSTALLATION ..... EM -83
- MUFFLER
  - COMPONENTS ..... EM -84
  - REMOVAL ..... EM -85
  - INSTALLATION ..... EM -85
- AIR CLEANER (ACL)
  - COMPONENTS ..... EM -86
  - REMOVAL ..... EM -87
  - INSPECTION ..... EM -87
  - INSTALLATION ..... EM -87

GENERAL

SPECIFICATION E5EC07D6

Description	Specification	Limit
General		
Type	In-line, Double Over Head Camshaft	
Number of cylinders	4	
Bore	76.5mm (3.0118 in)	
Stroke	87mm (3.4252 in)	
Total displacement	1599 cc (97.54 cu.in)	
Compression ratio	10	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (BTDC)	5°	
Closes (ABDC)	35°	
Exhaust valve		
Opens (BBDC)	43°	
Closes (ATDC)	5°	
Valve overlap	10°	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03mm (0.0012 in.)	0.1 mm (0.0039in.)
Flatness of mainfold mounting surface	0.15mm (0.0059 in.)	0.2mm (0.008in.)
Oversize rework dimension of valve seat hole		
Intake		
0.3mm (0.012 in.) O.S.	30.7 ~ 30.721 mm (1.2087 ~ 1.2095 in.)	
0.6mm (0.024 in.) O.S.	31.0 ~ 31.021 mm (1.2205 ~ 1.2213 in.)	
Exhaust		
0.3mm (0.012 in.) O.S.	27.3 ~ 27.321mm (1.0748 ~ 1.0756 in.)	
0.6mm (0.024 in.) O.S	27.6 ~ 27.621mm (1.0866 ~ 1.0874 in.)	
Oversize rework dimensions of valve		
Guide hole		
0.05mm (0.002 in.) O.S.	11.05 ~ 11.068mm (0.435 ~ 0.4357 in.)	
0.25mm (0.010 in.) O.S.	11.25 ~ 11.268mm (0.443 ~ 0.4436 in.)	
0.50mm (0.020 in.) O.S.	11.50 ~ 11.518mm (0.453 ~ 0.4535 in.)	
Camshaft		
Cam lobe height		
Intake	43.4484mm (1.7106 in.)	42.9484mm (1.6909in.)
Exhaust	43.8489mm (1.7263 in.)	43.3489mm (1.7.66in.)
Joumal O.D	ø27mm (1.0630 in.)	
Bearing oil clearance	0.035 ~ 0.072mm (0.0014 ~ 0.0028 in.)	
End play	0.1 ~ 0.2mm (0.004 ~ 0.008 in.)	

Description	Specification	Limit
Valve		
Valve length		
Intake	91.7mm (3.6102 in.)	
Exhaust	92.3mm (3.6339 in.)	
Stem O.D.		
Intake	5.955 ~ 5.97mm (0.2344 ~ 0.2350 in.)	
Exhaust	5.935 ~ 5.95mm (0.2337 ~ 0.2343 in.)	
Face angle thickness of valve head (Margin)		
Intake	1.1mm (0.0433 in.)	0.8mm (0.031in.)
Exhaust	1.3mm (0.0512 in.)	1.0mm (0.039in.)
Valve stem to valve guide clearance		
Intake	0.03 ~ 0.06mm (0.0012 ~ 0.0024 in.)	0.10mm (0.0039in.)
Exhaust	0.05 ~ 0.08mm (0.0020 ~ 0.0031 in.)	0.15mm (0.0059in.)
Valve guide		
Installed dimension O.D.		
Intake	12.8mm (0.504 in.)	
Exhaust	12.8mm (0.504 in.)	
Service size	0.05, 0.25, 0.50mm (0.002, 0.010, 0.020 in.) oversize	
Valve seat		
Width of seat contact		
Intake	0.8 ~ 1.2mm (0.031 ~ 0.047 in.)	
Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066 in.)	
Seat angle	45°	
Oversize	0.3, 0.6mm (0.012, 0.024 in.) oversize	
Valve spring		
Free length	44.00mm (1.7323 in.)	
Load	21.6kg/ 35mm (47.6lb/1.3780 in.) 45.1kg/ 27.2mm (99.4lb/1.071 in.)	
Squareness	1.5° or less	
Cylinder block		
Cylinder bore	76.50 ~ 76.53mm (3.0118 ~ 3.0130 in.)	
Out- of- round and taper of cylinder bore	Less than 0.01mm (0.0004 in.)	
Clearance with piston	0.025 ~ 0.045mm (0.0009 ~ 0.0017 in.)	
Piston		
O.D.	76.465 ~ 76.495mm (3.0104 ~ 3.0116 in.)	
Service size	0.25 mm (0.010 in.) oversize	
Piston ring		
Side clearance		
No. 1	0.04 ~ 0.085 mm (0.0015 ~ 0.0033 in.)	0.1 mm (0.004 in.)
No. 2	0.04 ~ 0.085 mm (0.0015 ~ 0.0033 in.)	0.1 mm (0.004 in.)
Endgap		
No. 1	0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.)	1.0 mm (0.039 in.)
No. 2	0.30 ~ 0.45 mm (0.012 ~ 0.0177 in.)	1.0 mm (0.039 in.)
Oil ring side rail	0.2 ~ 0.7 mm (0.0078 ~ 0.0275 in.)	1.0 mm (0.039 in.)
Service size	0.25 mm (0.010 in.) oversize	

Description	Specification	Limit
Connecting rod		
Bend	0.05mm (0.0020 in.) or less	
Twist	0.1mm (0.0039 in.) or less	
Connecting rod big end to crankshaft side clearance	0.100-0.250mm (0.0039-0.0098 in.)	0.4mm (0.0157in.)
Connecting rod bearing oil clearance	0.018-0.036mm (0.0007-0.0014 in.)	
Undersize	0.25, 0.50, 0.75mm (0.010, 0.020, 0.030 in.)	
Crankshaft		
Pin O.D.	45 mm (1.77 in.)	
Journal O.D.	50 mm (1.97 in.)	
Bend	0.03 mm (0.0012 in.) or less	
Out- of- round, taper of journal and pin	0.005 mm (0.0002 in.) or less	
End play	0.05- 0.175 mm (0.0019- 0.0068 in.)	
Undersize rework dimension of pin		
0.25mm (0.010 in.)	44.725 ~ 44.74mm (1.7608 ~ 1.7614 in.)	
0.50mm (0.020 in.)	44.475 ~ 44.49mm (1.7509 ~ 1.7516 in.)	
0.75mm (0.030 in.)	44.225 ~ 44.24mm (1.7411 ~ 1.7417 in.)	
Undersize rework dimension of journal		
0.25mm (0.010 in.)	49.727 ~ 49.742mm (1.9577 ~ 1.9583 in.)	
0.50mm (0.020 in.)	49.477 ~ 49.492mm (1.9479 ~ 1.9485 in.)	
0.75mm (0.030 in.)	49.227 ~ 49.242mm (1.9380 ~ 1.9386 in.)	
Flywheel		
Runout	0.1mm (0.0039 in.)	0.13mm (0.0051in.)
Oil pump		
Clearance between outer circumference and front case (body clearance)	0.12 ~ 0.18mm (0.0047 ~ 0.0070 in.)	
Front case tip clearance	0.025 ~ 0.069mm (0.001 ~ 0.0027 in.)	
Side clearance		
Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033 in.)	
Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035 in.)	
Engine oil pressure		
Engine at idle [Oil temperature is 90 to 100°C (194 to 215°F)]	147KPa (1.5 kg/ cm², 21.33psi)	
Relief spring		
Free height	46.6mm (1.8346 in.)	
Load	6.1kg at 40.1mm (13.42lb/ 1.578 in.)	
Cooling method	Water-cooled, pressurized, forced circulation with electrical fan	
Coolant		
Quantity	6.5 liter	
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	81.4 ~ 108 kpa (11.8 ~ 15.6 psi.,0.83 ~ 1.1kg/cm²)	
Vacuum valve opening pressure	-6.86 kpa (-1.00 psi, -0.07 kg/cm² or less	
Coolant pump	Centrifugal type impeller	

Description	Specification	Limit
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (180°F)	
Full-opening temperature	95°C (203°F)	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59k Ω at 20°C(68°F) 146.9 ~ 147.3 Ω at 110°C(230°F)	
Air cleaner		
Type	Dry type	
Element	Un woven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

NOTE

O.D. = Outer Diameter
I.D. = Inner Diameter
O.S. = Oversize Diameter
U.S. = Undersize Diameter

TIGHTENING TORQUE

Item	Nm	Kg.cm	lb.ft
Cylinder Block			
Front engine support bracket bolt and nut	45 ~ 55	450 ~ 550	33 ~ 41
Engine suppot bracket stay bolt	45 ~ 55	450 ~ 550	33 ~ 41
Oil pressure switch	13 ~ 15	130 ~ 150	10 ~ 11
Cylinder head			
Cylinder head bolt	30+(90°)+Release all bolts+30+(90°)	300+(90°)+Release all bolts+300+(90°)	22+(90°)+Release all bolts+22+(90°)
Intake manifold bolts or nuts	15 ~ 20	150 ~ 200	11 ~ 15
Exhaust manifold nut	25 ~ 30	250 ~ 300	18 ~ 22
Cylinder head cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft bearing cap bolt	12 ~ 14	120 ~ 140	9 ~ 10
Rear plate bolt	32 ~ 35	320 ~ 350	24 ~ 26
Main Moving system			
Connecting rod cap nut	32 ~ 35	320 ~ 350	24 ~ 26
Crankshaft bearing cap bolt	55 ~ 60	550 ~ 600	41 ~ 44
Fly wheel M/T bolt	120 ~ 130	1200 ~ 1300	89 ~ 96
Drive plate A/T bolt	120 ~ 130	1200 ~ 1300	89 ~ 96
Timing system			
Crankshaft pulley bolt	140 ~ 150	1400 ~ 1500	103 ~ 111
Camshaft sprocket bolt	80 ~ 100	800 ~ 1000	59 ~ 74
Timing belt tensioner bolt	20 ~ 27	200 ~ 270	15 ~ 20
Timing belt idle bolt	43 ~ 55	430 ~ 550	32 ~ 41
Timing belt cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Front case bolt	20 ~ 27	200 ~ 270	15 ~ 20
Engine Mounting			
Right mounting insulator (large) bolt	90 ~ 110	900 ~ 1100	66 ~ 81
Right mounting insulator (small) nut	50 ~ 65	500 ~ 650	37 ~ 48
Transmission mount insulator bolt	90 ~ 110	900 ~ 1100	66 ~ 81
Transmission insulator bracket to side member bolts	30 ~ 40	300 ~ 400	22 ~ 30
Front roll stopper insulator bolt	45 ~ 60	450 ~ 600	33 ~ 44
Front roll stopper bracket to sub frame bolt	30 ~ 40	300 ~ 400	22 ~ 30
Rear roll stopper insulator bolt	45 ~ 60	450 ~ 600	33 ~ 44
Rear roll stopper bracket to sub frame bolt	30 ~ 40	300 ~ 400	22 ~ 30
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Oil pan bolts	10 ~ 12	100 ~ 120	7 ~ 9
Oil pan drain plug	35 ~ 45	350 ~ 450	25 ~ 33
Oil screen bolts	15 ~ 22	150 ~ 220	11 ~ 16

Item	Nm	Kg.cm	lb.ft
Alternator support bolt and nut	20 ~ 25	200 ~ 250	15 ~ 18
Alternator lock bolt	12 ~ 15	120 ~ 150	9 ~ 11
Alternator brace mounting bolt	20 ~ 27	200 ~ 270	15 ~ 20
Coolant pump pulley	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolt	12 ~ 15	120 ~ 150	9 ~ 11
Coolant temperature sensor	25 ~ 30	250 ~ 300	18 ~ 22
Coolant inlet fitting bolt	17 ~ 20	170 ~ 200	13 ~ 14
Thermostat housing bolt	15 ~ 20	150 ~ 200	11 ~ 14
Air cleaner body mounting bolts	8 ~ 10	[80 ~ 100	6 ~ 7
Resonator mounting bolts	4 ~ 6	40 ~ 60	3 ~ 4
Intake manifold to cylinder head nuts and bolts	15 ~ 20	150 ~ 200	11 ~ 14
Surge tank stay to cylinder block bolts	18 ~ 25	180 ~ 250	13 ~ 18
Throttle body to surge tank bolts	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold to cylinder head nuts	25 ~ 30	250 ~ 300	18 ~ 22
Exhaust manifold cover to exhaust manifold bolts	15 ~ 20	150 ~ 200	11 ~ 14
Oxygen sensor to exhaust manifold	50 ~ 60	500 ~ 600	37 ~ 44
Front exhaust pipe to exhaust manifold nuts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe bracket bolts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe to catalytic converter bolts	40 ~ 60	400 ~ 600	30 ~ 44

SERVICE STANDARD

Standard value	
Antifreeze	Mixture ratio of anti-freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

MAINTENANCE

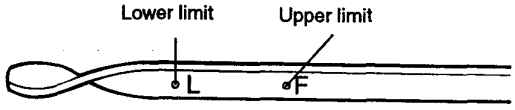
CHECKING ENGINE OIL

1. Position the vehicle on a level surface.
2. Warm up the engine.

NOTE

If a vehicle has been out of service for a prolonged period of time, warm up the engine for approximately 20 minutes.

3. Turn off the engine, and wait 2 or 3 minutes, then check the oil level.
4. Check that the engine oil level is within the level range indicated on the oil dipstick If the oil level is found to have fallen to the lower limit (the L mark), refill to the "F" mark.



ECDA001A

NOTE

When refilling, use the same type of engine oil.

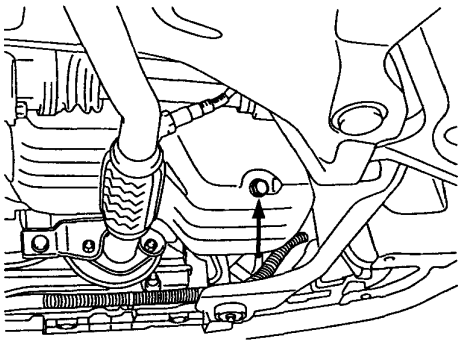
5. Check that the oil is not dirty or contaminated with coolant or gasoline, and that it has the proper viscosity.

CHANGING ENGINE OIL

CAUTION

Be careful not to burn yourself, as the engine oil is hot.

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine
3. Remove the oil filler cap and the drain plug (on the oil pan). Drain the engine oil.



KCPC001B

4. Install and tighten the drain plug to the specified torque.

Tightening torque
Drain plug : 35 ~ 45 Nm (350 ~ 450 kg.cm, 24 ~ 33 lb.ft)

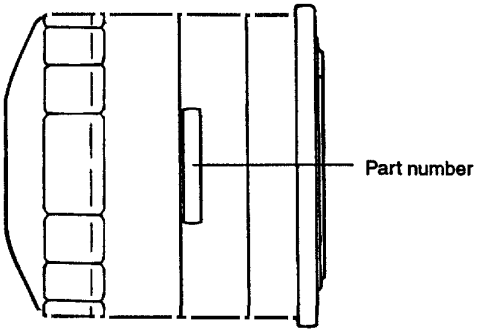
5. Fill the crankcase with fresh engine oil through the oil filler cap opening.

Drain and Refill Without oil filter : 3.0 liter (3.17 U.S.qts, 2.64 Imp.quts) Draing and Refill With oil filter : 3.3 liter (3.48 U.S.qts, 2.64 Imp.quts)

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

FILTER SELECTION

All Hyundai engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing the new filter.



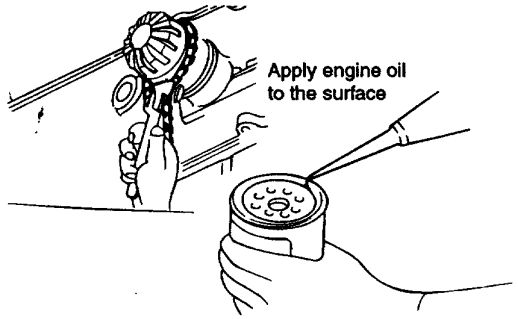
EDDA063A

PROCEDURE FOR REPLACING THE OIL FILTER

⚠ ***CAUTION***

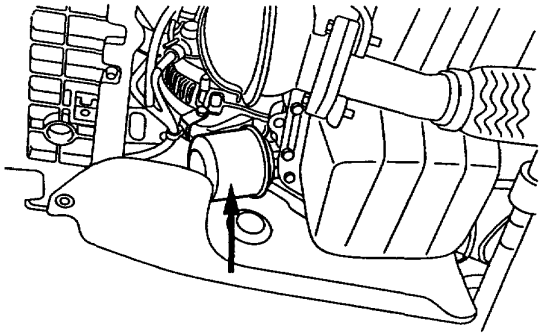
Be careful not to burn yourself, as the engine and engine oil are hot.

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.



EDDA063B

3. Tighten the oil filter to the specified torque.



KCPC001C

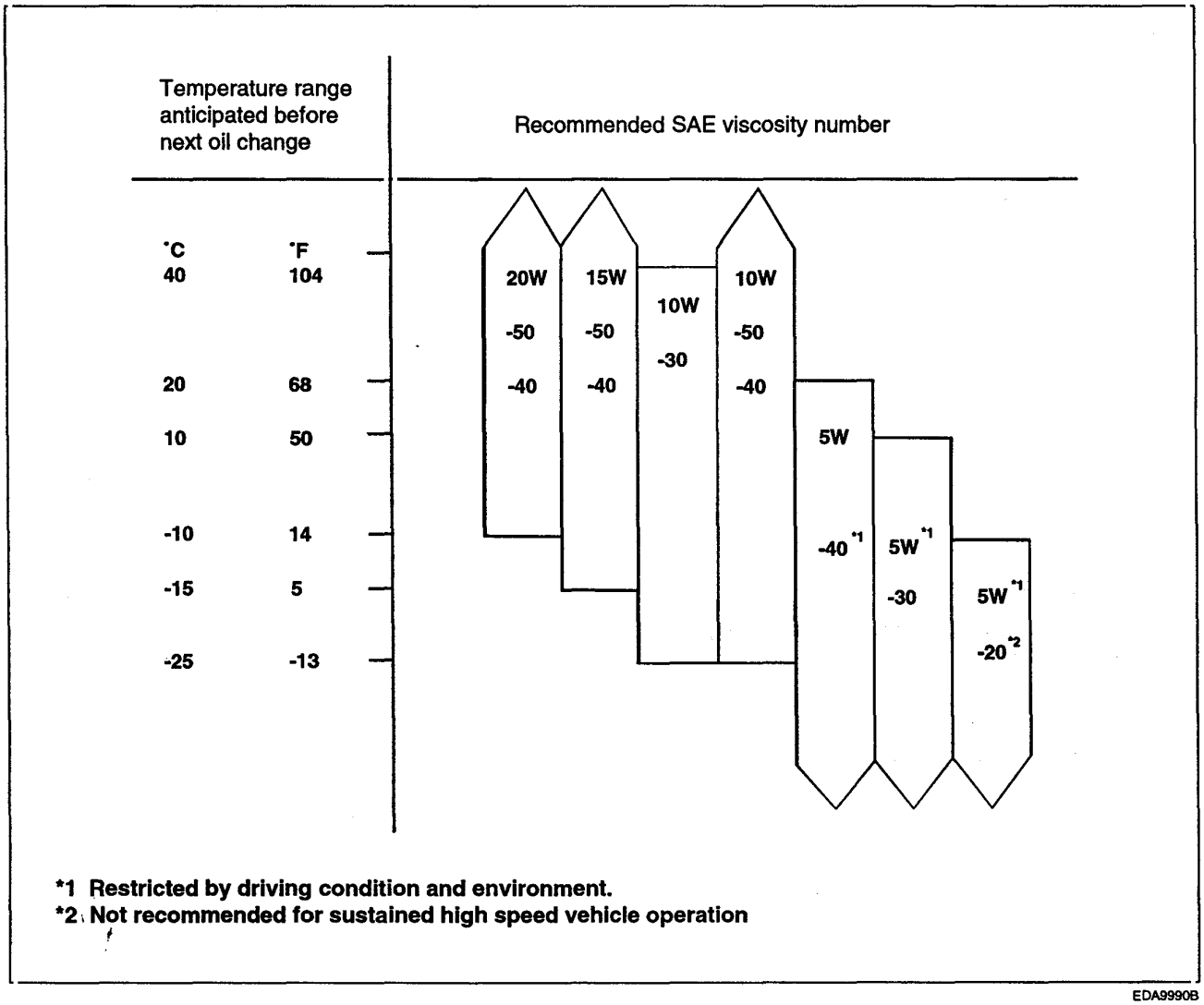
Tightening torque
Oil filter : 12 ~ 16 Nm (120 ~ 160 kg.cm, 9 ~ 12 lb.ft)

4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

SELECTION OF ENGINE OIL

Recommended API classification : SH OR ABOVE SG

Recommended SAE viscosity grades :



***1 Restricted by driving condition and environment.**
***2 Not recommended for sustained high speed vehicle operation**

EDA9990B

NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which:

1. *Satisfy the requirements of the API classification.*
2. *Have proper SAE grade number for expected ambient temperature range.*

Lubricant that does not have both an SAE grade number and an API service classification on the container should not be used.

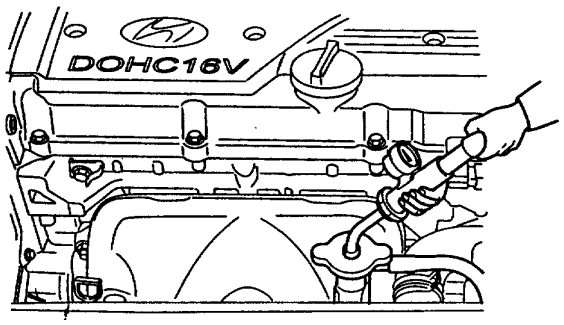
CHECKING COOLANT LEAK

1. Wait until the engine is cool, then carefully remove the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 KPa (1.4 kg/cm², 20psi) pressure. Hold it for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.

NOTE

1. *Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.*
2. *Be sure to clean away any moisture from the places checked completely.*
3. *When the tester is removed, be careful not to spill any coolant from it.*
4. *Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.*

4. If there is leakage, repair or replace with the apropriate part.



KDPC001F

RADIATOR CAP PRESSURE TEST

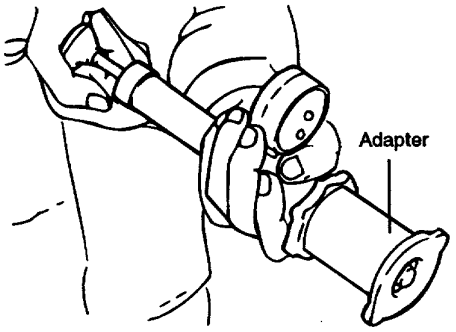
1. Remove the radiator cap, wet its seal with engine coolant, then install it on the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure :
83 ~ 110 kPa (0.83 ~ 1.1 kg/cm², 12 ~ 16 psi)
Vacuum valve opening pressure :
-7 kPa (-0.07 kg/cm², -1.0 psi)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE

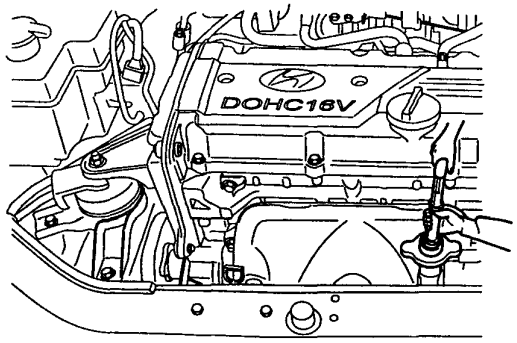
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.



ECA9090A

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature, using the following table for reference.



KDPC001E

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperatur °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25(-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

Example

The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F)

⚠ ***CAUTION***

- ***If the concentration of the coolant is below 30%, its anti-corrosion properties will be adversely affected.***
- ***If the concentration is above 60%, both the anti-freeze and engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified ragne.***
- ***Do not use together with another brank's product.***

RECOMMENDED COOLANT

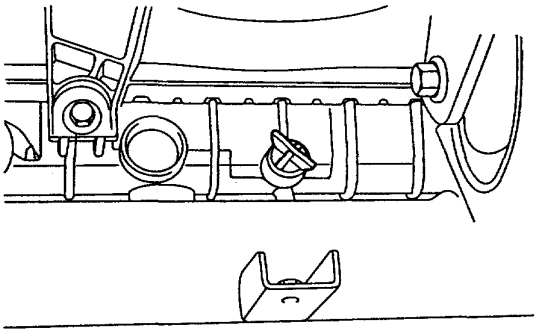
Antifreeze	Mixture ratio of anti freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]

CHANGING ENGINE COOLANT

⚠ *CAUTION*

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap.
3. Loosen the drain plug, and drain the coolant.

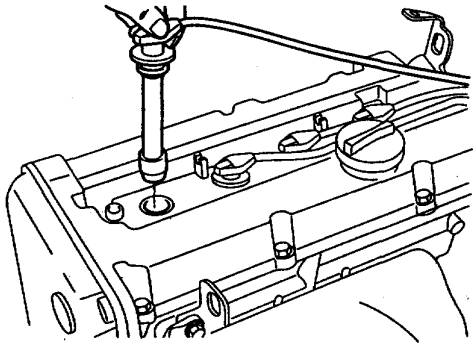


KDDC008B

4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservior.
   Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Pour coolant into the radiator up to the base of the filler neck, and install the radiator cap loosely.
7. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).
8. Turn off the engine.
   Check the level in the radiator, add coolant if needed.
9. Put the radiator cap on tightly, then run the engine again and check for leaks.

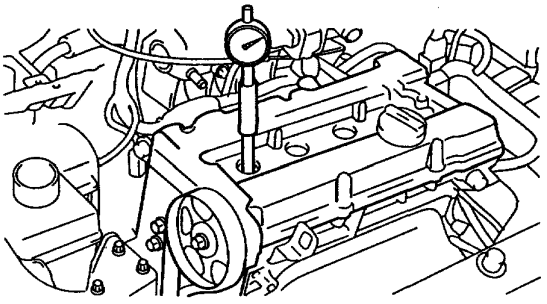
CHECKING COMPRESSION PRESSURE

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Check the DTC and note it. Use the scan tool to clear the ECM'S memory.
3. Start the engine and wait until engine coolant temperature reaches 80 ~ 95°C (176 ~ 205°F).
4. Disconnect the fule pump connector.
5. Turn off engine and disconnect the spark plug cables.



KCDC002B

6. Remove the spark plugs.
7. Disonnect the I.G. connector.
8. Crank the engine to remove any foreign material in the cylinders.
9. Insert the compression gauge into the spark plug hole.



KDPC001B

10. Depress the accelerator pedal to open the throttle fully.

11. Crank the engine and read the gauge.

Standard value : 1500kpa (15Kg/cm², 218 psi)
Limit : 1400kpa (14Kg/cm², 203 psi)

12. Repeat steps 9 to 11 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

Limit :
Max 100 kpa (1.0 kg/cm², 14 psi) between cylinders

13. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 9 to 12.
    1) If the addition of oil makes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
    2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

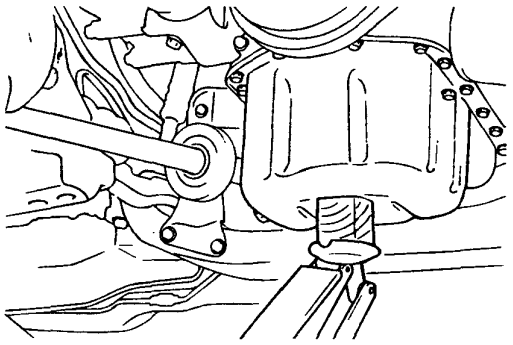
Tightening torque
Spark plug : 20 ~ 30 Nm (200 ~ 300 kg.cm, 14 ~ 22 lb.ft)

ADJUSTING TIMING BELT TENSION

1. Rotate the steering wheel counter-clockwise throughly.

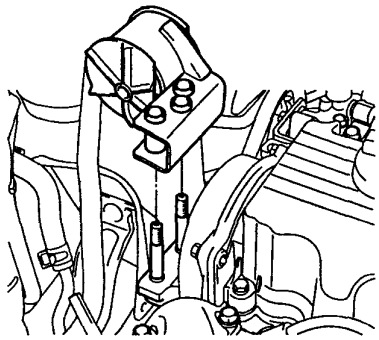
   NOTE
   Do watch not to over load.

2. Lift the vehicle by using of jack.



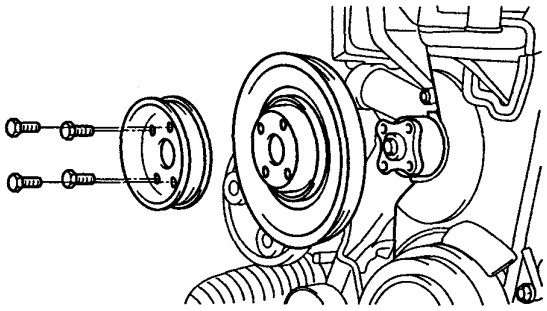
KCDA125K

3. Remove the engine support bracket. (14mm bolt and 2nuts, 17mm bolt)



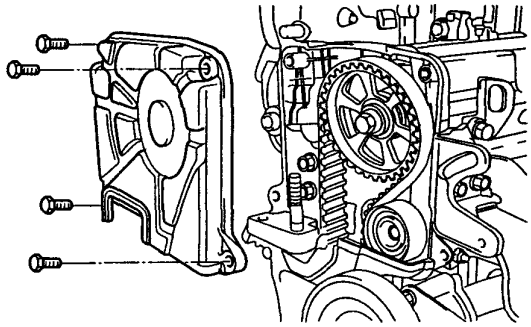
KDDC003B

4. Remove the drive belts and the water pump pulley. (10 mm 4 bolts)



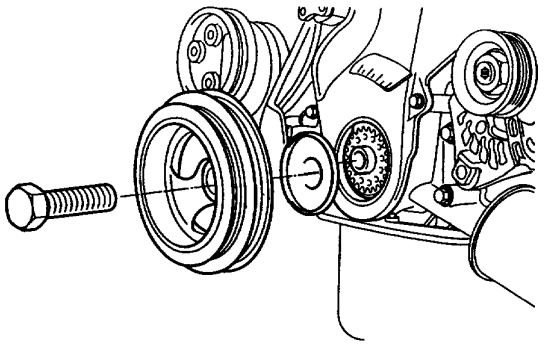
KDDC004B

5. Remove the timing belt upper cover. (10 mm 4 bolts)



KCDC002C

6. Remove the crankshaft pulley.



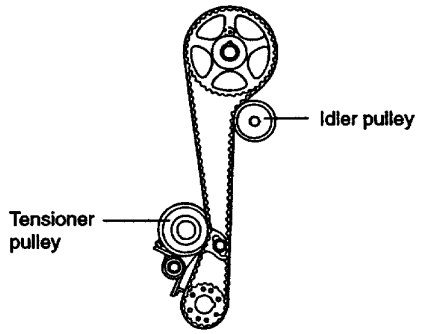
KDDC007B

7. Remove the timing belt lower cover.

8. Place the pistion of No. 1 cylinder to TDC of the compression stroke by rotating the crankshaft clockwise.

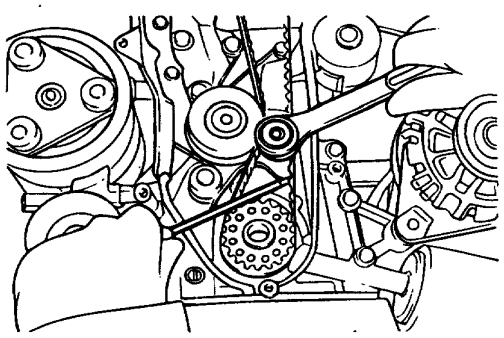
NOTE

Crankshaft is to be rotated clockwise otherwise, the tension is inadequately adjusted.



EDDB091A

9. Loosen the tensioner bolt of pivot side and slotside.



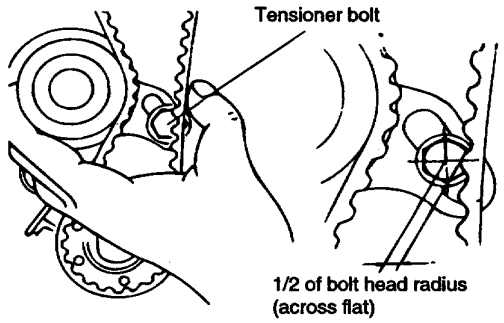
EDDA092A

10. Rotate the crankshaft clockwise as many as 2 teeth of camshaft sprocket.

11. Check that the teeth of sprocket and belt coincide with each other.

12. Tighten the bolt of slot side of first and then tighten the bolt of pivot side.

13. Check the tension of timing belt.
When the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11 lb)], the the timing belt log end is approx. half of the tensioner mounting bolt head radius (cross flats) away from the bolt head center.



ECDA125S

14. Rotate the crankshaft pulley two turns clockwise so that the timing belt positions on the pulleys.

15. Install the timing belt lower cover.

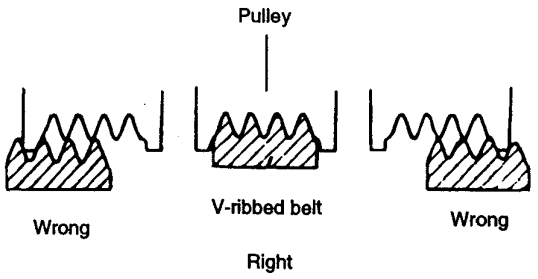
16. Install the crankshaft pulley.

17. Install the timing belt upper cover.

18. Install the water pump pulley and engine support bracket.

ADJUSTING DRIVE BELT TENSION

1. Check that the belts are not damaged and are properly fit for the pulley grooves.
2. Apply 100 N (22 lbs.) force to the back and midway portion of the belt between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge.



ECA9980A

⚠ ***CAUTION***

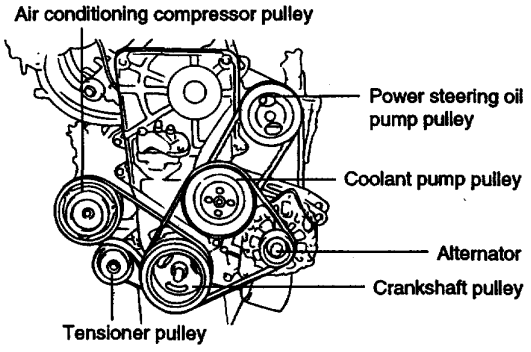
1. ***When installing the V-ribbed belt, check that the V-ribs are properly aligned.***
2. ***If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.***

STANDARD VALUE:

Itmes		Inspection	Adjustment	
			New	Used
For alternator	Deflection mm (in.)	5.1~6.0(0.200~0.236)	4.0~4.4(0.157~0.173)	5.0~5.7(0.200~0.224)
	Tension N (lb)	350~500(79~112	650~750(143~165)	400~500(88~110)
For air conditioner	Deflection mm (in.)	8(0.31)	5.0~5.5(0.20~0.22)	6.0~7.0(0.24~0.28)
	Tension N (lb)	250~500(56~112)	470~570(106~128)	320~400(72~90)
For power steering	Deflection mm (in.)	6.0~9.0(0.24~0.35)	-	-

NOTE

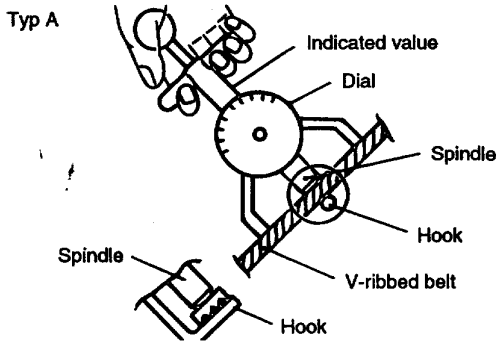
1. *The belt tension must be measured half - way between the specified pulleys.*
2. *When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in the above table. Let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection."*
3. *When adjusting a belt which has been used,or newly installed, after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table.*
4. *Refer to the standard value indicated under "Inspection" for periodic inspections.*



ECPD001B

TYPE A TENSION GAUGE

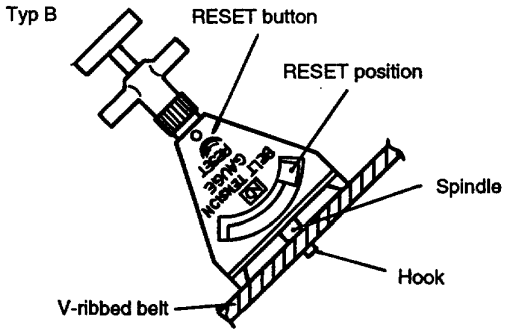
Do not let the dial section of the tension gauge contact other objects during measurement.



ECA9980C

TYPE B TENSION GAUGE

1. When measuring, turn the reset button in the direction of the arrow and set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.



ECA9980D

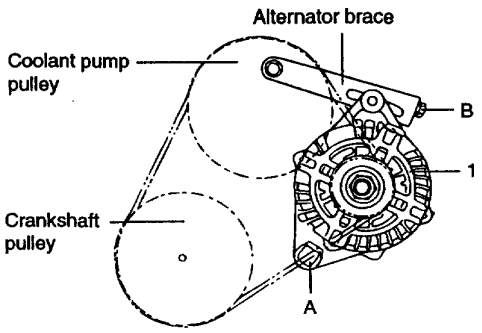
ADJUSTING THE ALTERNATOR BELT

CAUTION

If the belt is too loose, it will cause noise or sudden wear.
If the belt is too tight, the engine coolant pump bearing or the alternator can get damaged.

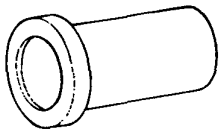
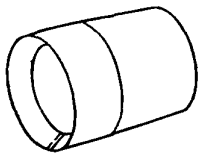
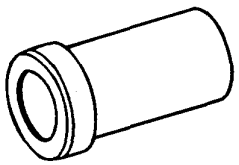
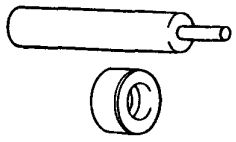
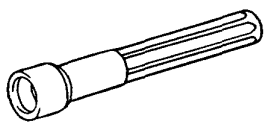
1. Loosen the alternator nut "A" and the tension adjuster lock bolt "B".
2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the alternator nut "A".
5. Check the tension or the deflection of belt, readjust if necessary.

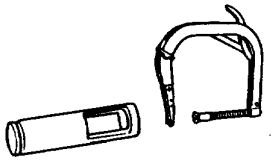
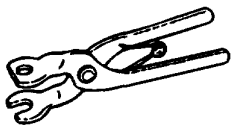
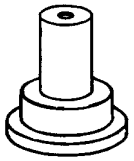
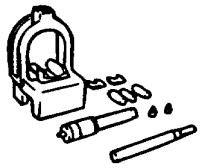
Tightening torque
Alternator support bolt and nut :
20 ~ 25 Nm (200 ~ 250 kg.cm, 14 ~ 18 lb.ft)
Alternator lock bolt B :
12 ~ 15 Nm (120 ~ 150 kg.cm, 9 ~ 11 lb.ft)
Alternator brace mounting bolt :
20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)



ECKA010H

SPECIAL TOOLS E0845550

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214 - 21000)	 ECKA010C	Installation of the front oil seal
Crankshaft front oil seal guide (09214 - 21100)	 ECKA010D	Guide of oil seal
Camshaft oil seal installer (09221 - 21000)	 EDDA005B	Installation of the camshaft oil seal
Valve guide installer (09221 - 22000)	 ECKA010B	Removal and installation of valve guides
Valve stem oil seal installer (09222 - 22001)	 ECKA010A	Installation of valve stem oil seals

Tool (Number and name)	Illustration	Use
Valve spring compressor (09222 - 28000) Valve spring compressor holder (09222 - 28000)	 J20008F	Removal and installation of intake and exhaust valves
Valve stem seal remover 09222 - 29000)	 EDDA005J	Removal of valve stem seal
Crankshaft rear oil seal installer (09231 - 21000)	 EDDA005F	Installation of engine real oil seal and crankshaft rear oil seal
Piston pin remover and installer kit (09234 - 33001)	 EDDA005G	Removal and installation of piston pin (Use with 09234 - 33003)
Piston pin setting tool insert (09234 - 33002)	 EDDA005H	Removal and installation of piston pin (Use with 09234 - 33001)

TROUBLESHOOTING E6712BDA

Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Low oil pressure	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and determine cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve sutck (closed)	Repair
Excessive engine vibration	Loose engien roll stopper (front, rear)	Re-tighten
	Loose transaxle mount bracket	Re-tighten
	Loose engine mount bracket	Re-tighten
	Loose center member	Re-tighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
	HLA abnormal operation	Speed the engine up (for venting) or Replace the HLA
Connecting rod and/or main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and determine cause
	Excessive bearing clearance	Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low coolant level	Leakage of coolant	
	1. Heater or radiator hose	Repair or replace parts
	2. Faulty radiator cap	Tighten or replace clamps
	3. Thermostat housing	Replace gasket or housing
	4. Radiator	Repair or replace
	5. Engine coolant pump	Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant

Symptom	Probable cause	Remedy
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	Replace parts
	Restricted flow in cooling system	Clear restriction or replace parts
	Loose or missing drive belt	Adjust or replace
	Faulty water pump	Replace
	Faulty electric fan	Repair or replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor wiring	Repair or replace
Inoperative electrical cooling fan	Damaged thermo sensor, electrical motor, radiator fan relay and wiring, fuse	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehuicle body	Correct
	Broken pipe or muffler	Repair or replace

ENGINE AND TRANSAXLE ASSEMBLY EFB83064

REMOVAL

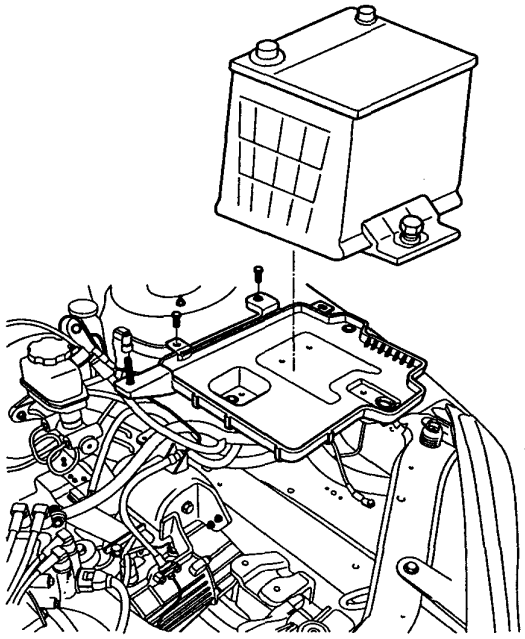
WARNING

- **Make sure jacks and safety stands are placed properly and hoist brackets are atteched to the correct position on the engine.**
- **Make sure the vehicle will not roll off stands and fall while you are working under it.**

CAUTION

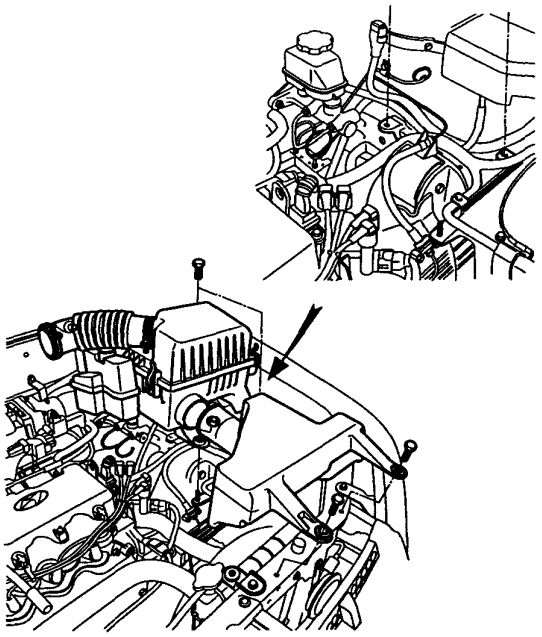
Use fender covers to avoid damaging painted surface.

1. Remove the battery.



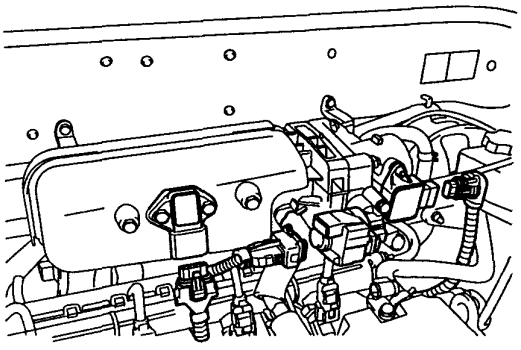
KDDC009B

2. Detach the air cleaner.

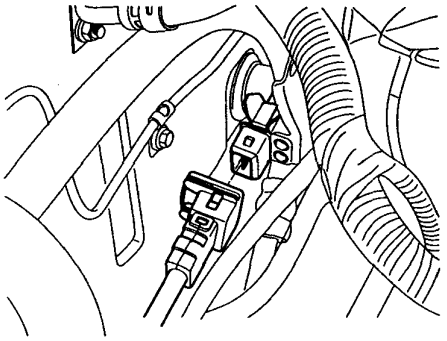


KDDC010B

3. Disconnect the connectors for engine harness.



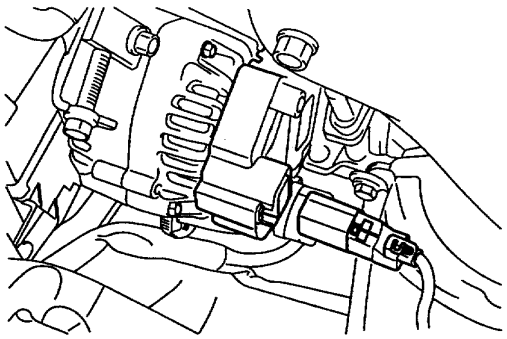
KDDC010C



KDDC010D

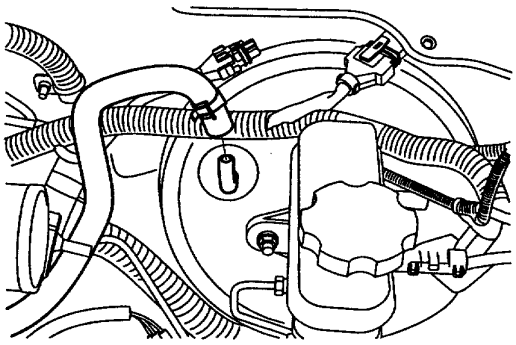
4. Disconnect the engine ground.

5. Disconnect the connectors for the alternator harness and the oil pressure gauge wiring.



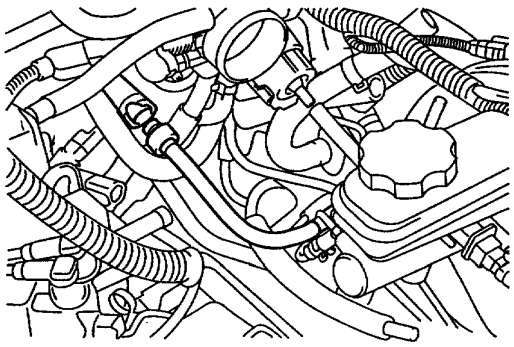
KDDC010E

6. Disconnect the brake booster vacum hose.

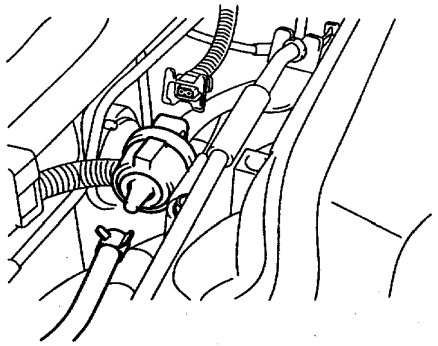


KCPC003B

7. Remove the main fuel line, the return and vapor hoses from the engine side.

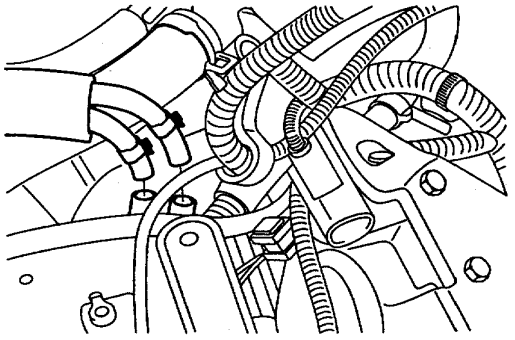


KCPC003C



KDDC010I

8. Disconnect the transaxle oil cooler hoses. (A/T)



KCPC003E

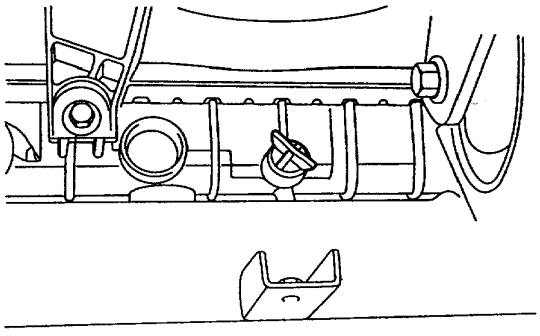
NOTE

When disconnecting hoses, make identification marks to ensule they are reconnected correctly.

CAUTION

Be careful not to spill oil or fluid from hoses. Plug the openings to prevent foreign material from entering.

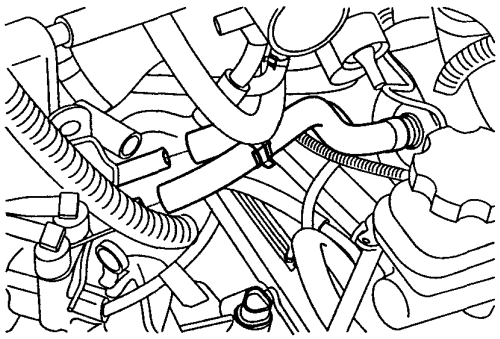
9. Drain the engine coolant.



KDDC008B

10. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.

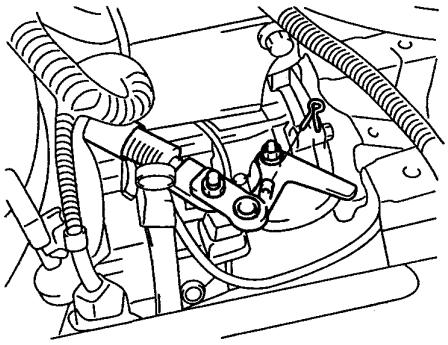
11. Disconnect the heater hoses (inlet and outlet) on the engine side.



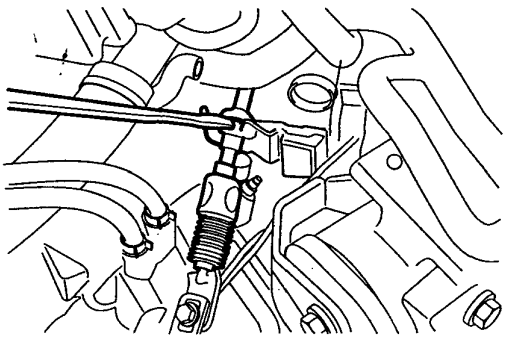
KCPC003F

12. Disconnect the accelerator cable at the engine side.

13. For vehicles with automatic transmission, remove the control cable from the transmission.

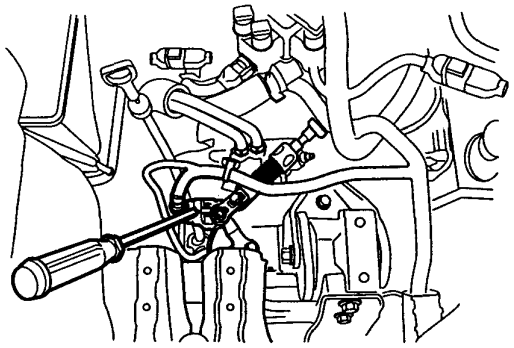


KCPC003H

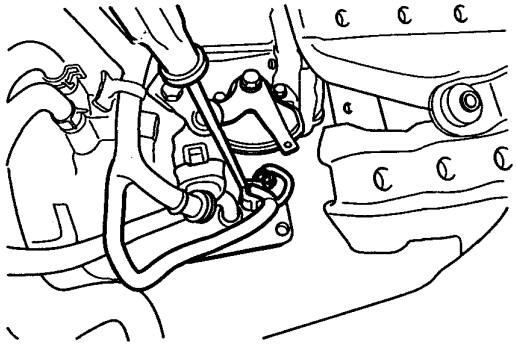


KKPC022K

14. Disconnect the inhibitor switch and solenoid valve connector.

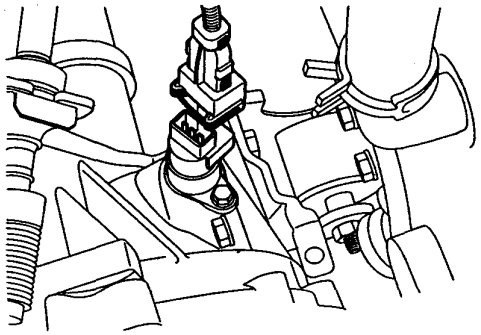


KKPC022G



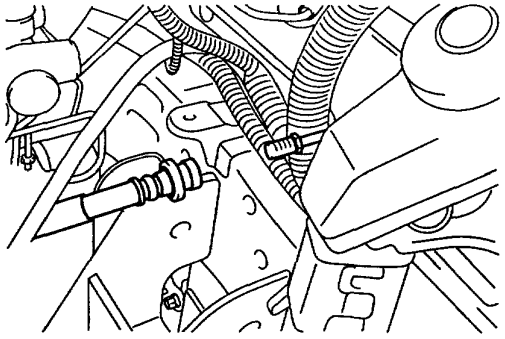
KKPC022H

15. Disconnect the vehicle speed sensor connector.



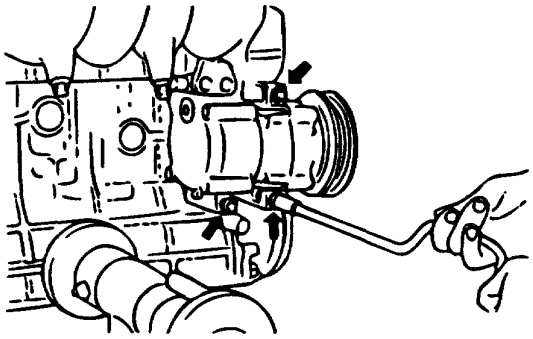
KDDC010F

16. Disconnect the clutch tube.



KDDC010G

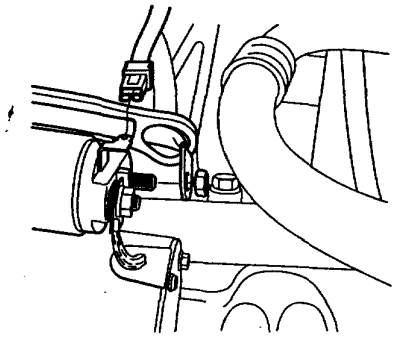
17. Disconncet the air conditioner compressor from the mounting bracket.



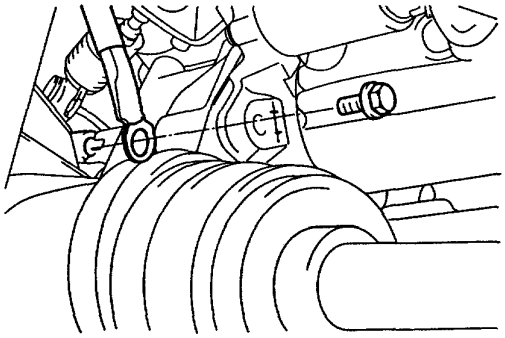
EDDA016C

18. Jack up the vehicle.

19. Disconnect the start motor connector and ground.

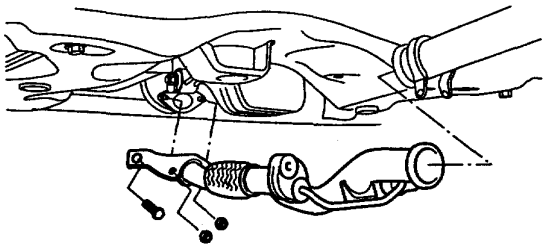


KDDC010J



KDDC010K

20. Disconnect the front exhaust pipe from the manifold.

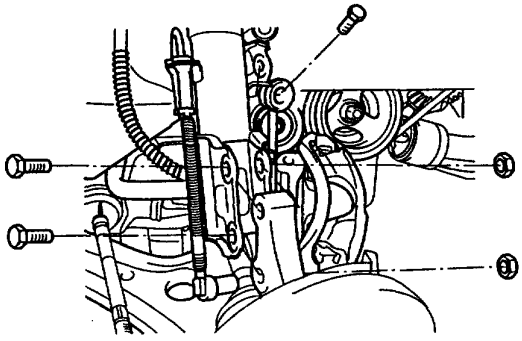


KCPC003G

NOTE

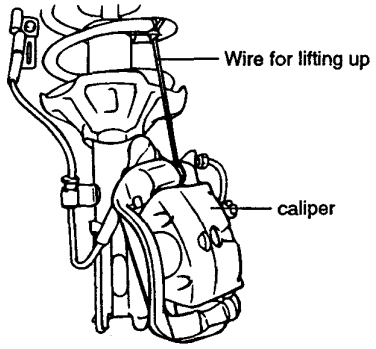
Use wire to suspend the exhaust pipe from the bottom of the vehicle.

21. Remove the knuckle form the front damper.



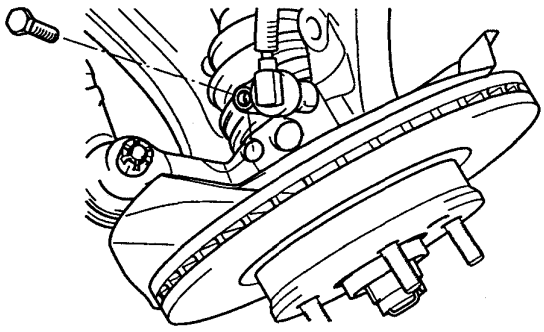
KCPC003I

22. Remove the caliper from the knuckle and hang the caliper from the front damper with wine.



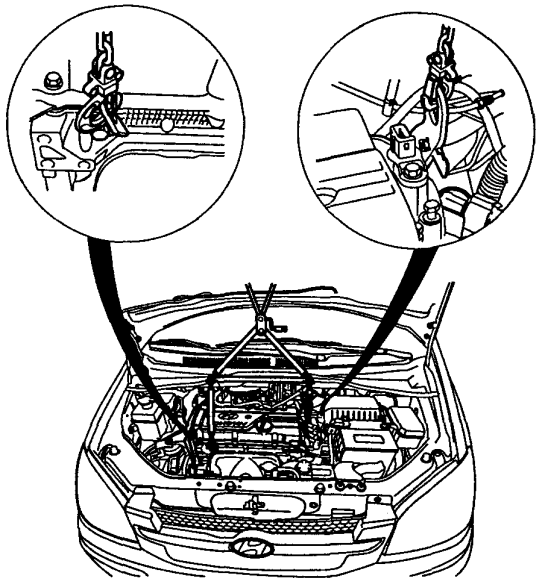
ECTC040F

23. Remove the wheel speed sensor form the knuckle. (with ABS)



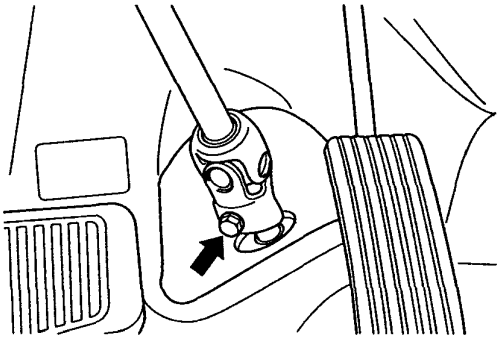
KCPC003J

24. Attach a chains or cables to the engine. Use an engine hoist or a chain hoist to slightly raise the engine (enough to support the engine's weight while processing with the following steps).



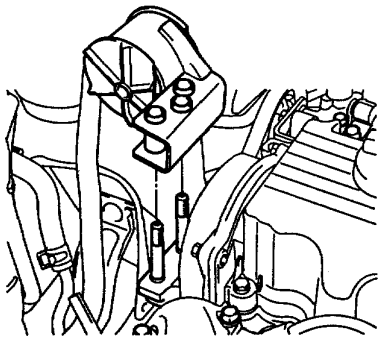
KDPC002B

25. Remove the steering joint bolt.



KPPD014A

26. Remove the engine mounting bracket from the engine.



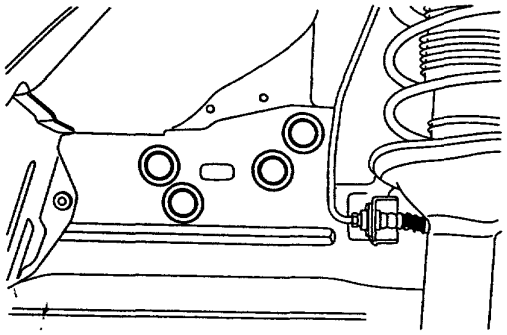
KDDC003B

27. Slowly raise the engine (to the extent that the weight of the engine and transmission assembly is not applied to the mounting portions) and temporarily hold it in the raised position.

⚠ ***CAUTION***

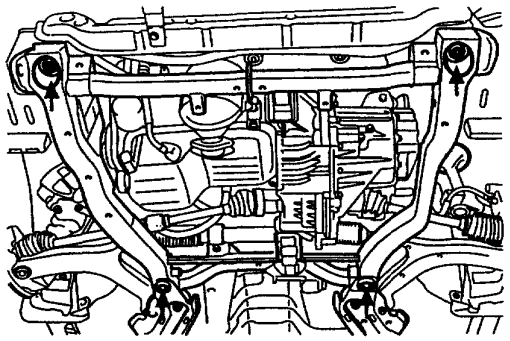
Check that all cables, hoses, harnesses, connectors etc. are disconnected from the engine.

28. Remove the caps from the inside of the right fender shield and remove the transaxle mount bracket bolts.



KDDC012B

29. Remove the cross member fixing bolts and nuts.



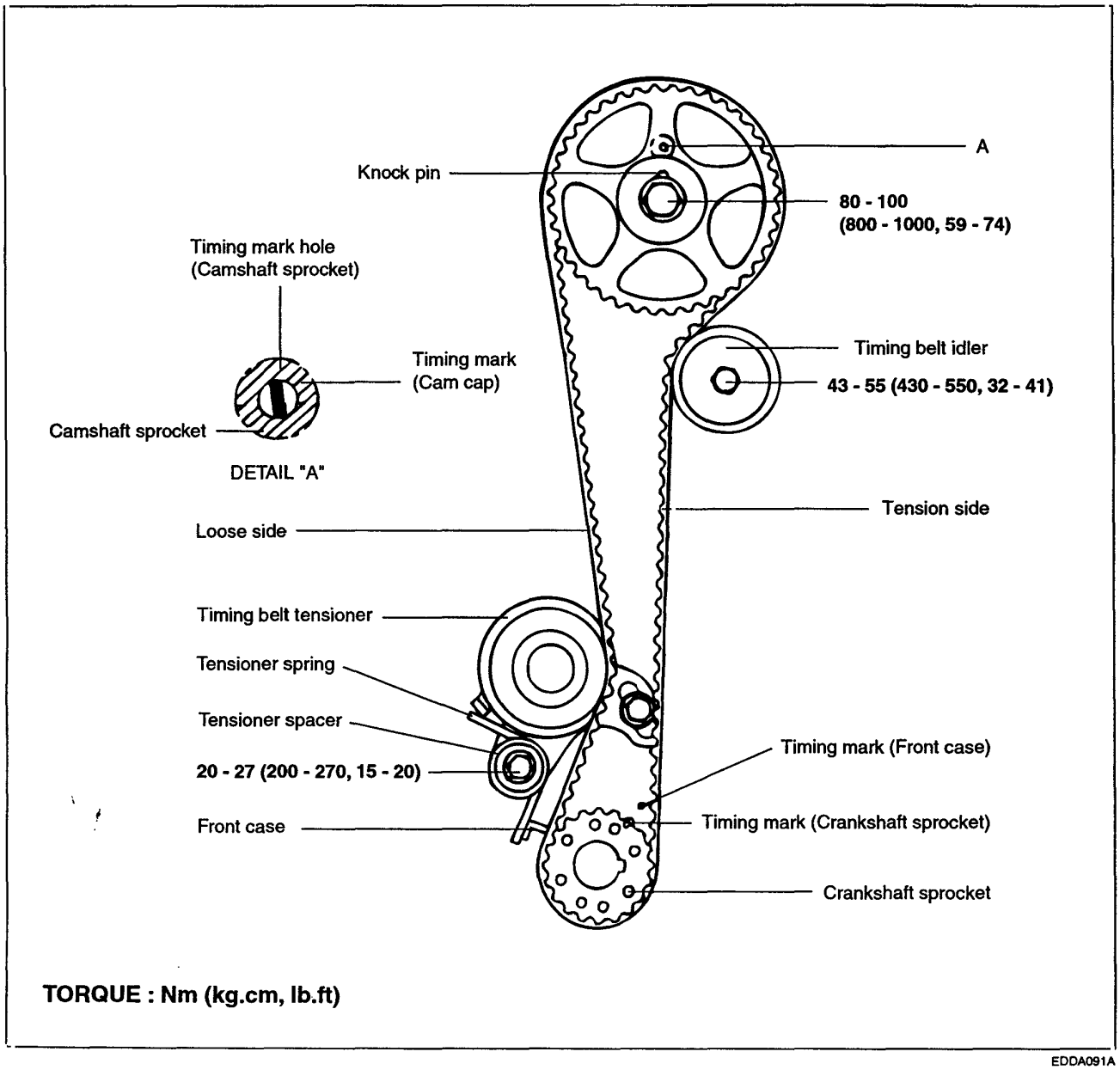
KDDC013B

30. While directing the transmission side downward, lift the engine and transmission assembly up and out of the vehicles.

TIMING SYSTEM

TIMING BELT

COMPONENTS E4B24FDE

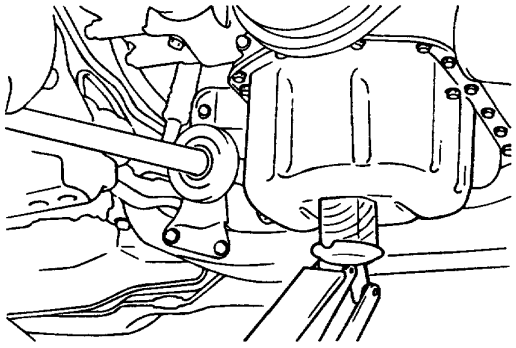


TORQUE : Nm (kg.cm, lb.ft)

EDDA091A

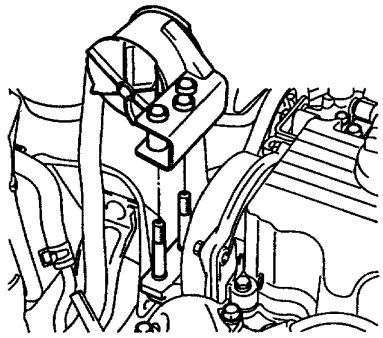
DISASSEMBLY EE695E6A

1. Lift the vehicle by using of jack.



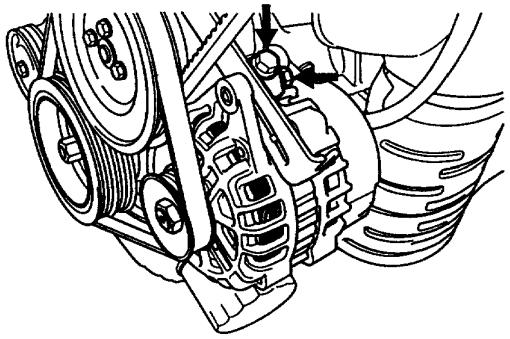
KCDA125K

2. Remove the engine support bracket. (14 mm bolt and 2 nuts, 17 mm bolt)

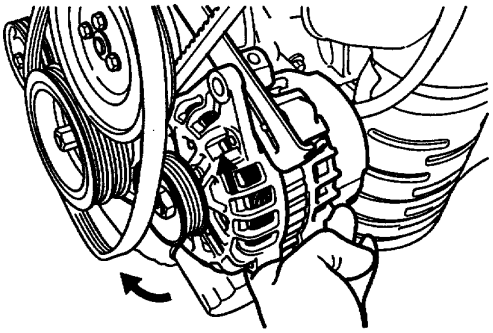


KDDC003B

3. Remove the power steering belt.
4. Remove the air conditioning compressor belt.
5. Remove the alternator belt.

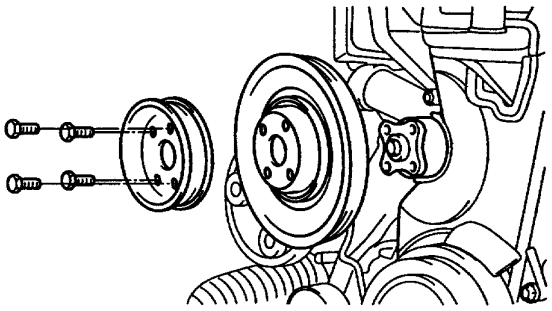


KBPD160A



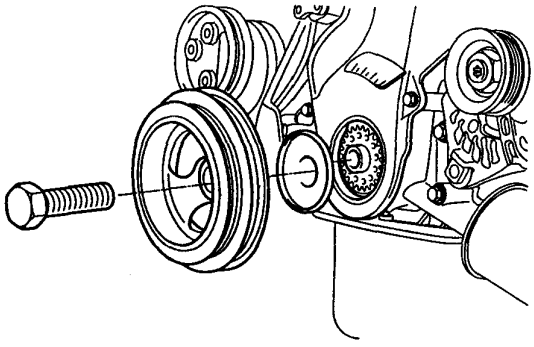
KBPD160B

6. Remove the coolant pump pulley.



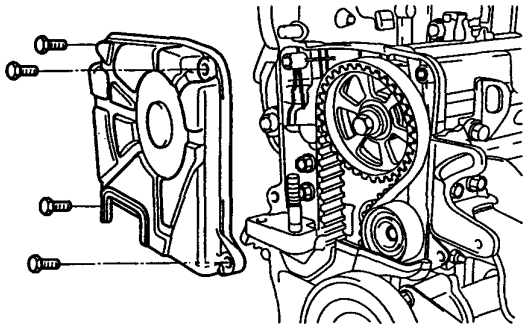
KDDC004B

7. Remove the crankshaft pulley.



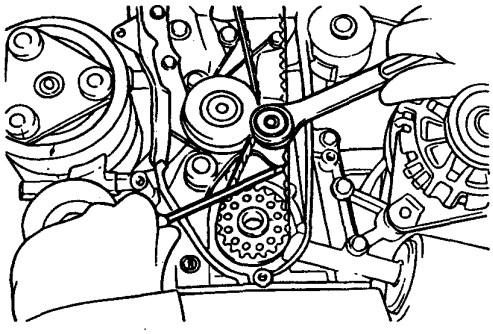
KDDC007B

8. Remove the timing belt cover.



KCDC002C

9. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.

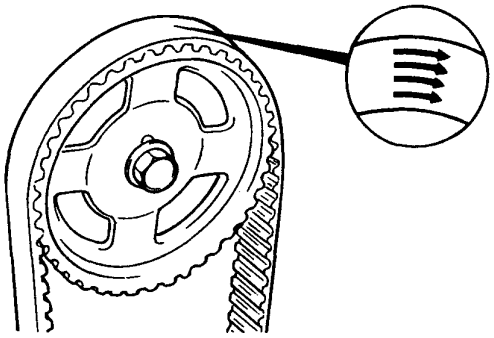


EDDA092A

10. Remove the timing belt.

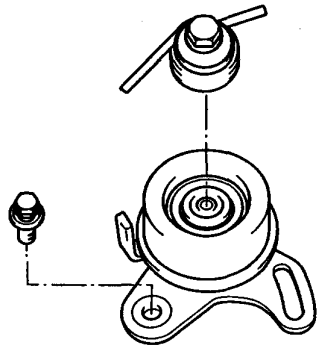
NOTE

If the timing belt is reused, mark with an arrow to indicate direction of rotation (on the front of the engine) to make sure that the belt is reinstalled in the same direction as before.



ECDA121B

11. Remove the camshaft from the camshaft sprocket.
12. Remove the crankshaft sprocket and flange.
13. Remove the timing belt idler.
14. Remove the timing belt tensioner.

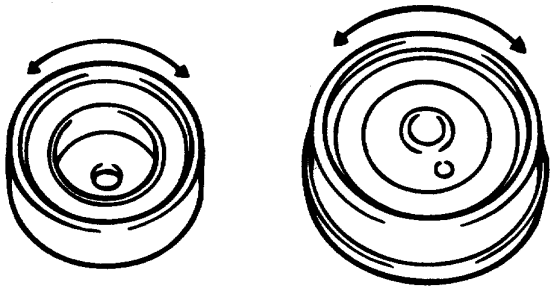


KDPC008C

INSPECTION E193FC6F

SPROCKETS TENSIONER PULLEY, AND IDLER PULLEY

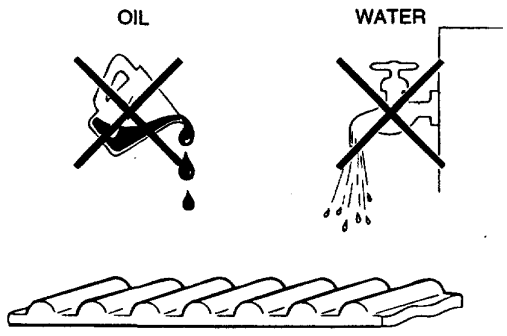
1. Check the camshaft sporcket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage.
   Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise.
   Replace as necessary.
3. Replace the pulley if there is a grease leak from its bearing.



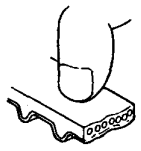
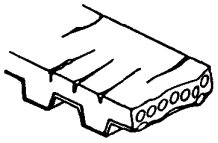
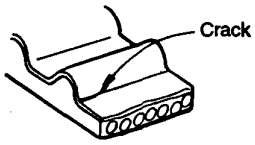
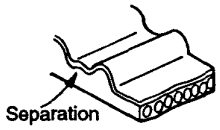
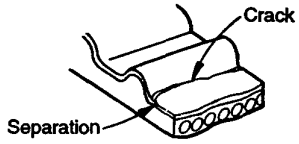
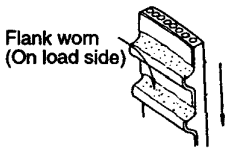
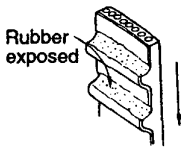
ECKA070A

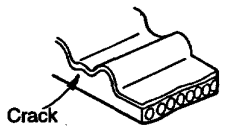
TIMING BELT

1. Check the belt for oil or dust deposits. Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt with a new one.



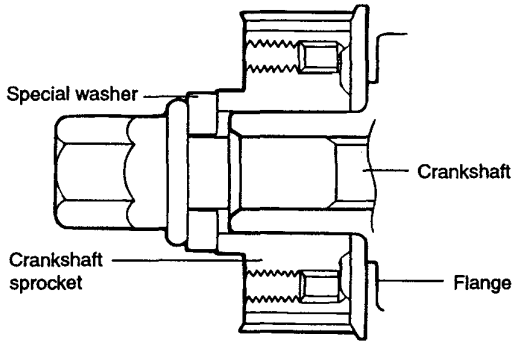
EDDA093B

Description	Flaw conditions
1. Hardened back surface • Back surface is glossy, non-elastic and so hard that when your fingernail is pressed into it. no mark is produced.	 EDDA093C
2. Cracked back surface rubber	 EDDA093D
3. Cracked or separating canvas	 EDDA093E
	 EDDA093F
	 EDDA093G
4. Badly worn teeth (initial stages) • Canvas on load side of tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)	 EDDA093H
5. Badly worn teeth (last stage) • Canvas on load side of tooth flank worn down and rubber exposed (tooth width reduced)	 EDDA093I

Description	Flaw conditions
6. Cracked tooth bottom	 EDDA093J
7. Missing tooth	 EDDA093K
8. Side of belt badly worn **NOTE** *Normal belt shluld have precisely cut sides as if cut by a sharp knife.*	
9. Side of belt cracked	

REASSEMBLY E6A34B7C

1. Install the flange and crankshaft sprocket as shown. Pay close attention to their mounting directions.



ECNC094B

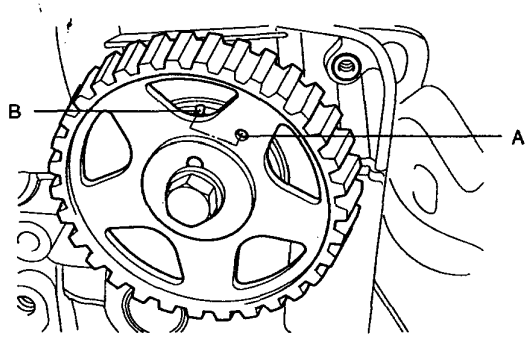
2. Install the camshaft sprocket and tighten the bolt to the specified torque.

Tightening torque
Camshaft sprocket bolt :
80 ~ 100 Nm (800 ~ 1000 kg.cm, 59 ~74 lb.ft)

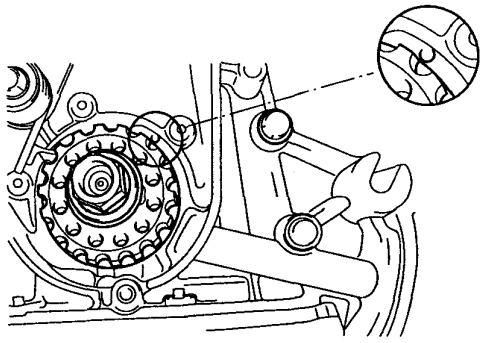
3. Install the idler and tighten the idler bolt to the specified torque.

Tightening torque
Idler bolt : 43 ~ 55 Nm (430 ~ 550 kg.cm, 32 ~ 41 lb.ft)

4. Align the timing marks of the camshaft sprocket (A) and camshaft bearing cap (B).
Then align the timing marks of crankshaft sprocket and front case with the No.1 piston placed at top dead center on its compression stroke as shown in the illustration.

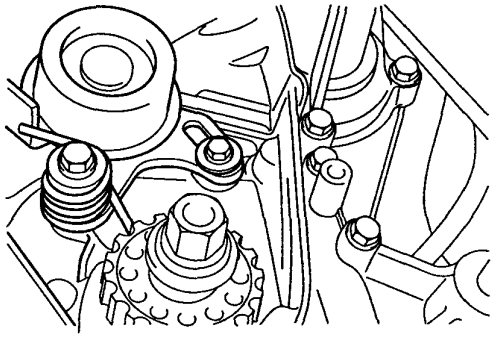


ECDD008F



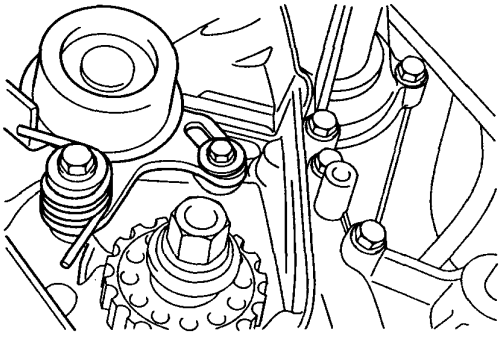
KDPC008H

5. To install the timing belt tensioner, first mount the tensioner, spring, and spacer. Temporarily tighten the bolts. Next, temporarily tighten the tensioner long hole side washer and bolts. Install the bottom end of the spring against the front case as shown in the illustration.



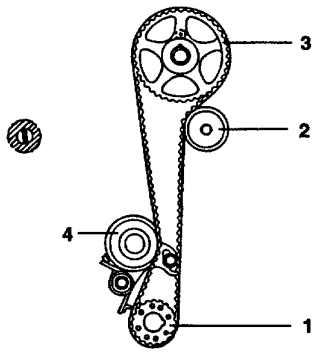
KDPC008D

6. Secure the tensioner, positioned towards the water pump.



KDPC008E

7. Install the timing belt on the crankshaft sprocket.
(1) Crankshaft sprocket → (2) Timing belt idler → (3) Camshaft sprocket → (4) Timing belt



KDDA991A

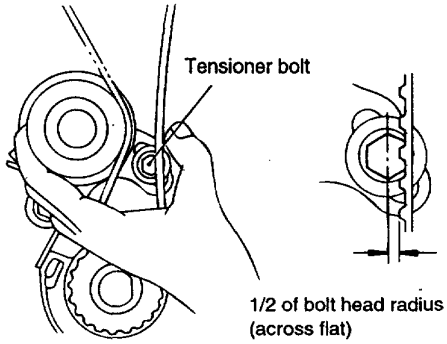
8. Install the timing belt on the camshaft sprocket. When the timing belt is installed on the camshaft sprocket, make sure that the tension side is tight. Then, check to ensure that when the tension side is tightened by turning the camshaft sprocket in a reverse direction and all timing marks are in line.

9. Tighten the tensioner bolts.

Tightening torque
Tensioner attaching bolt :
20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)

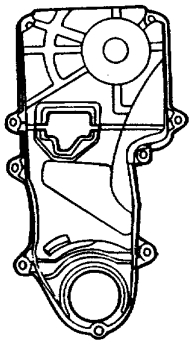
10. Turn the crankshaft two turns in its operating direction (clock-wise) and realign the camshaft sprocket timing mark with the top dead center position.

11. Then recheck the belt tension Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is aprox. 1/2 of the tensioner monting bolt head radius (across flats) away from the bolt head center.



EDDA094E

12. Install the timing belt cover.



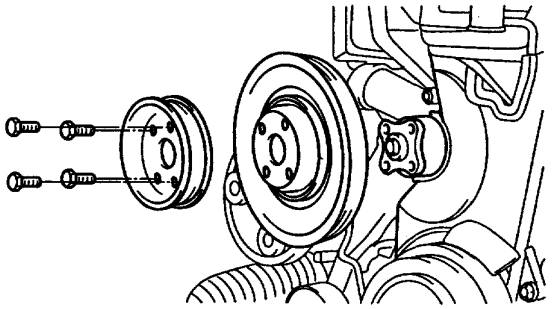
EDDA094F

Tightening torque
Timing belt cover bolt :
8 ~10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

13. Install the crankshaft pulley. Make sure that the crankshaft sprocket pin fits the small hole in the pulley.

Tightening torque
Crankshaft pulley bolt :
140 ~ 150 Nm (1400 ~ 1500 kg.cm, 103 ~ 111 lb.ft)

14. Install the water pump pulley.



KDDC004B

15. Install the alternator belt and adjust the belt tension.

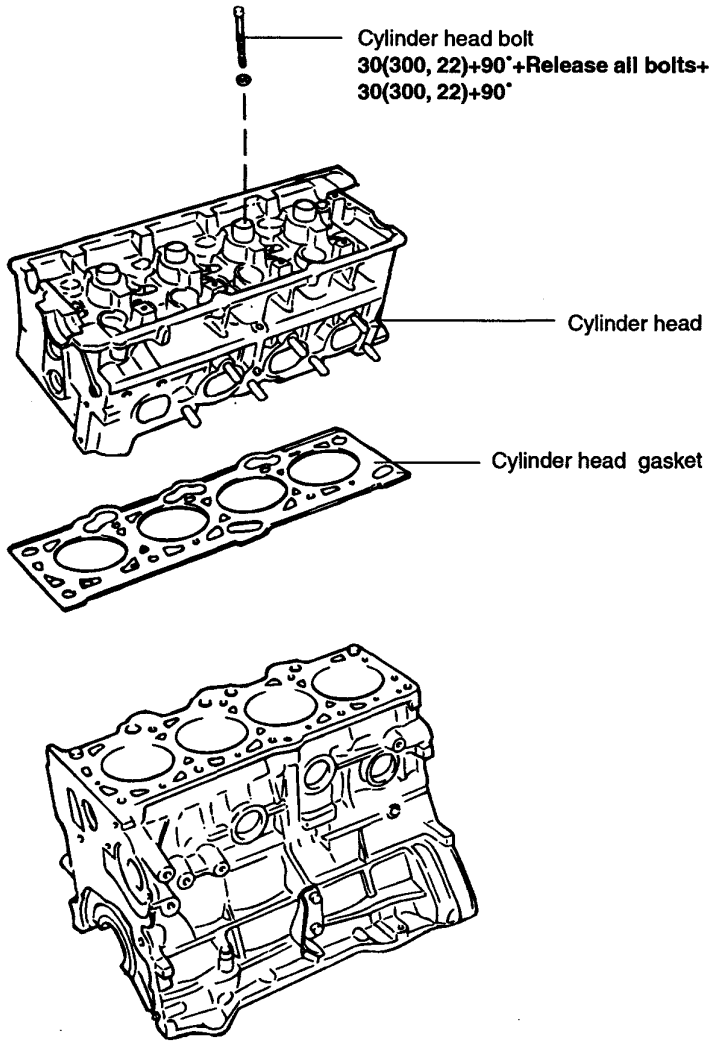
16. Install the air conditioning compressor belt and adjust the belt tension.

17. Install the power steering belt and adjust the belt tension.

CYLINDER HEAD ASSEMBLY

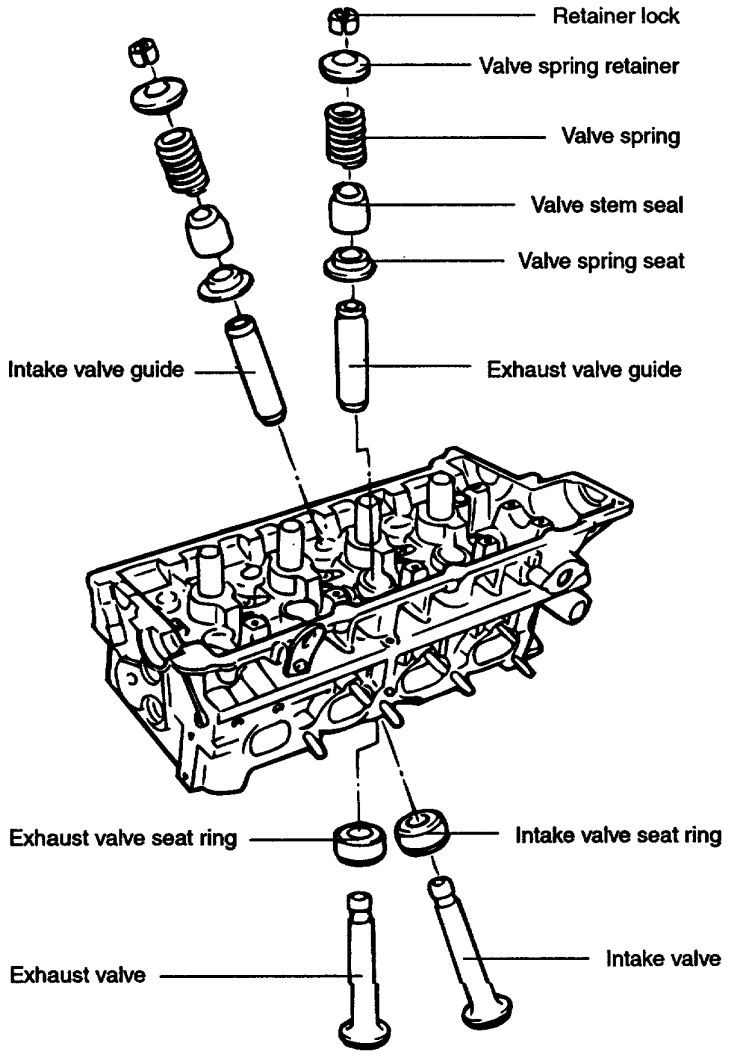
CYLINDER HEAD

COMPONENTS E804EE47



TORQUE : Nm (kg.cm, lb.ft)

ECDC777A



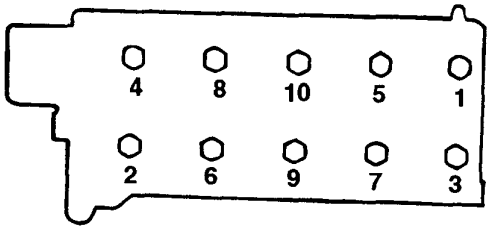
TORQUE : Nm (kg.cm, lb.ft)

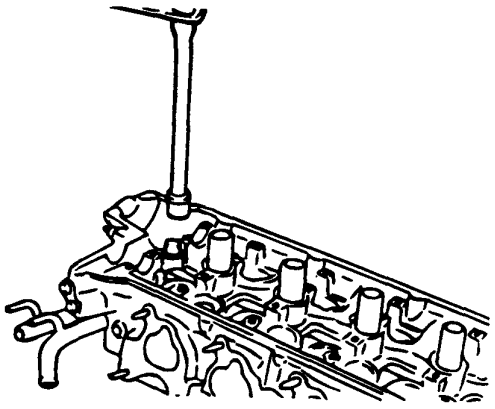
***Replace the seal with new one after removal**

EDKB050D

DISASSEMBLY EBCFA4C6

1. Using a tool remove the cylinder head bolts in the order shown in the illustration.



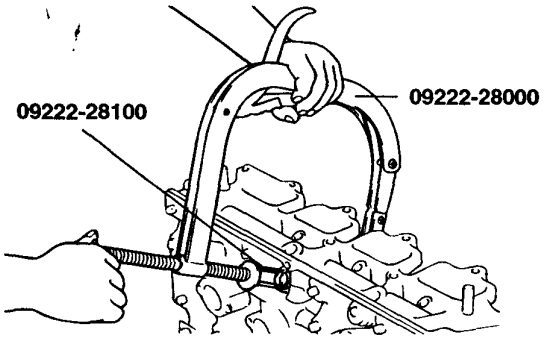


KDDB001L

2. Using the special tool (09222-28000, 09222-28100), remove the valve retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

NOTE

Arrange these parts so that they can be reinstalled in their original positions.

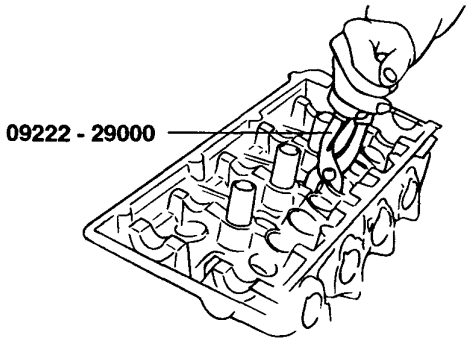


ECHA910B

3. Remove the valve stem seals with pliers.

NOTE

Do not reuse the valve stem seals.



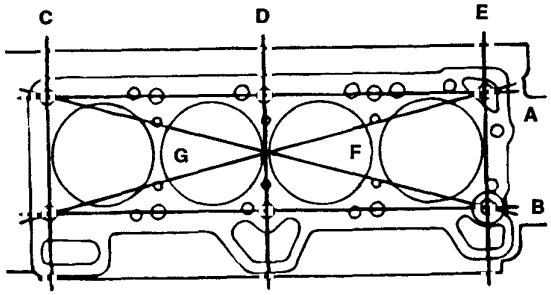
EDDA088B

INSPECTION EE4FDB50

CYLINDER HEAD

1. Check the cylinder head for cracks, damage and coolant leakage. If cracked, replace the cylinder head.

2. Remove scale, sealing compound and carbon deopsits completely. After cleaning the oil passages, apply compressed air to verify that the passages are not clogged.



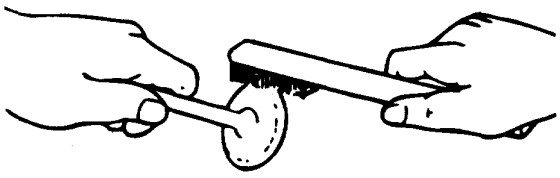
EDDA084A

3. Check the cylinder head surface for flatness in the direction as shown in the illustration. If flatness exceeds the service limit in any direcftion, either replace the cylinder head or machine the cylinder head matching surface lightly.

Flatness of cylinder head gasket surface Standard : Less than 0.03 mm (0.0012 in.) Limit : 0.05 mm (0.002 in.)

VALVES

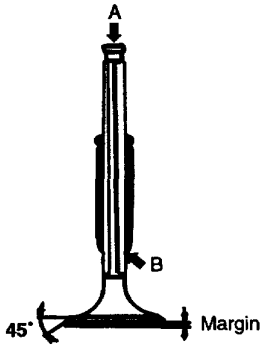
1. Using a wire brush, clean the valve thoroughly.



ECA9281A

2. Check each valve for wear, damage and distortion of the head and the stem at B position. Replace, if necessary. If stem end, A, is hollowed out or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.
   Replace the valve if the margin has decreased to less than the service limit.

Margin
[Standard]
Intake : 1.1 mm (0.043 in.)
Exhaust : 1.3 mm (0.051 in.)
[Limit]
Intake : 0.8 mm (0.028 in.)
Exhaust : 1.0 mm (0.040 in.)



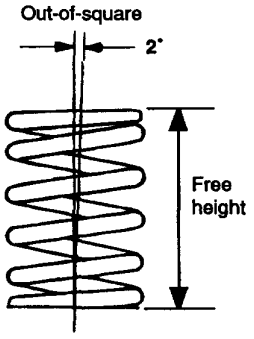
ECA9281B

VALVE SPRINGS

1. Check the free height of each valve spring. If they exceed the servicd limit, replace the springs.

2. Using a square, test the squareness of each spring. If a spring is excessively out - of - square, replace it.

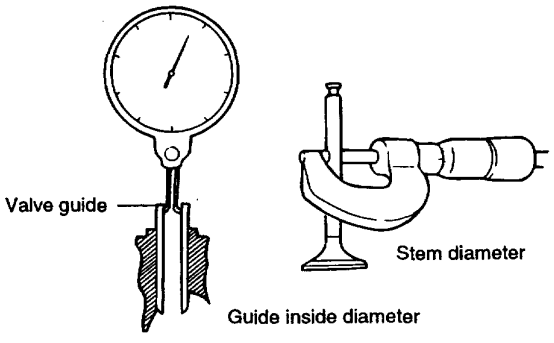
Valve spring
[Standard]
Free height : 44 mm (1.7323 in.)
Load :
21.6 kg/35 mm (47.6 lb/1.3780 in.)
45.1 kg/27.2 mm (99.4 lb/1.0709 in.)
Out of square : 1.5° or less 100
[Limit]
Free height : - 1.0 mm (- 0.039 in.)
Out of square : 4°



ECA9281C

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with the next oversize part.

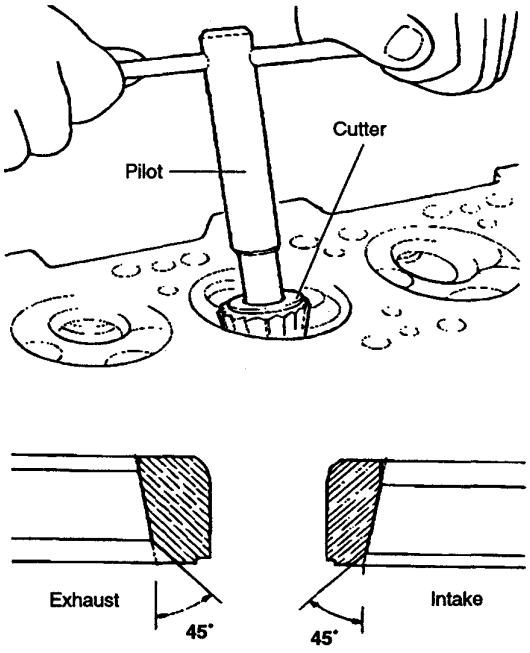
Valve stem-to-clearance
[Standard]
Intake : 0.03 ~ 0.06 mm (0.0012 ~ 0.0024 in.)
Exhaust : 0.05 ~ 0.08 mm (0.0020 ~ 0.0031 in.)
[Limit]
Intake : 0.1 mm (0.0040 in.)
Exhaust : 0.15 mm (0.0059 in.)



ECA9281D

RECONDITIONING VALVE SEAT

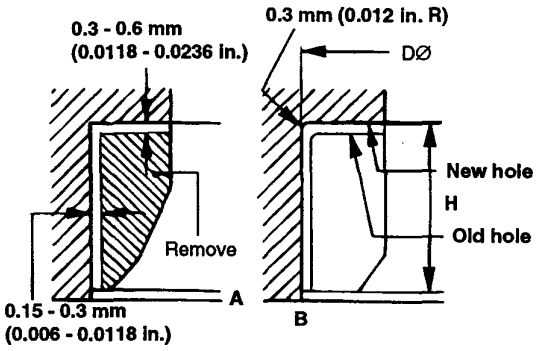
Check the valve seat for overheating and unequal contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it and then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.



ECHA920B

REPLACING THE VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



ECA9281F

2. Enlarge the diameter of the valve seat so that it matches the specified oversize hole diameter of the new valve seat ring.
3. Heat the cylinder head to about 250°C (480°F) and press - fit an oversize seat ring for the bore in the cylinder head.
4. Using lapping compound, lap the valve to the new seat.

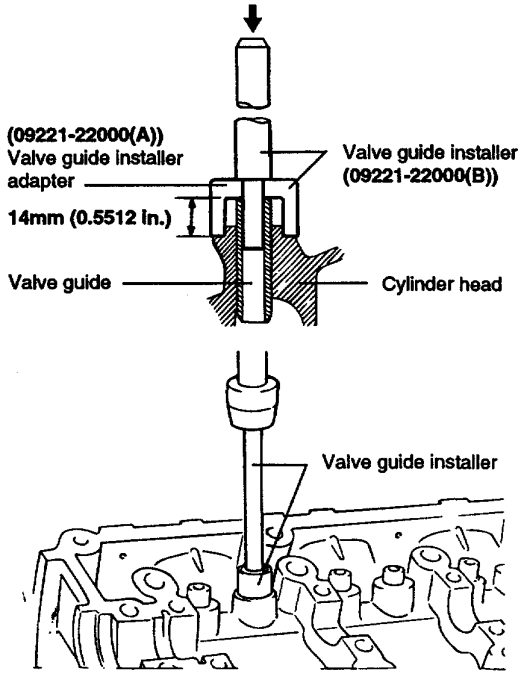
Valve seat contact width Intake : 0.8 ~ 1.2 mm (0.0315 ~ 0.0472 in.) Exhaust : 1.3 ~ 1.7 mm (0.0512 ~ 0.0670 in.)

VALVE SEAT INSERT OVERSIZES

Description	Size mm (in.)	Size mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)
Intake valve Seat ring	0.3 (0.012) O.S.	30	5.1~5.3(0.2008~0.2087)	30.7~30.721 (1.2087~1.2095
	0.6 (0.024) O.S.	60	5.4~5.6(0.2126~0.2205)	31.0~31.021(1.2205~1.2213)
Exhaust valve Seat ring	0.3 (0.012) O.S.	30	6.2~6.4(0.2441~0.2520)	27.3~27.321(1.0748~1.0756)
	0.6 (0.024) O.S.	60	6.5~6.7(0.2560~0.2638)	27.6~27.621(1.0866~1.0874)

REPLACING VALVE GUIDE

1. Using the special tool (09221~22000 A/B), withdraw the old valve guide toward the bottom of cylinder head.
2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.



ECDA109C

3. Using the special tool (09221 ~ 22000 A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head.
4. After the valve guide is press-fitted, insert a new valve and check for proper the clearance
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

VALVE GUIDE OVERSIZES

Over size mm (in.)	Size mark	Oversize valve guide hole size mm (in.)
0.05 (0.002)	5	11.05~11.068 (0.4350~0.4357)
0.25 (0.010)	25	11.25~11.268 (0.4429~0.4436)
0.50 (0.020)	50	11.50~11.518 (0.4528~0.4535)

REASSEMBLY EC46B95A

NOTE

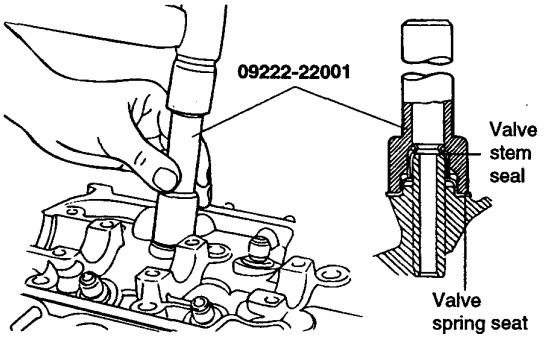
1. *Clean each part before assembly.*
2. *Apply engine oil to the sliding and rotating parts.*

1. Install the spring seats.
   Using a special tool (09222-22001), tap the seal in position lightly.

NOTE

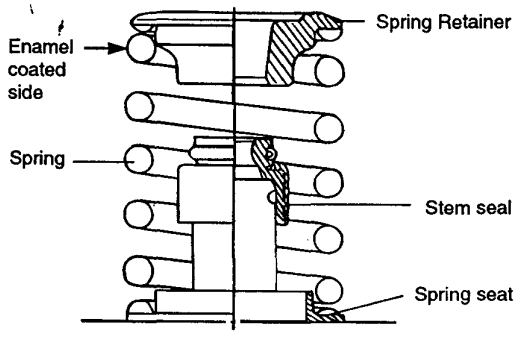
- *Do not reuse old valve stem seals.*
- *Incorrect installation of the seal could result in oil leakage past the valve guides.*

2. Apply engine oil to each valve. Insert the valve into the valve guide.
   Avoid pushing the valve into the seat by force. After inserting the valve, check that it moves smoothly.



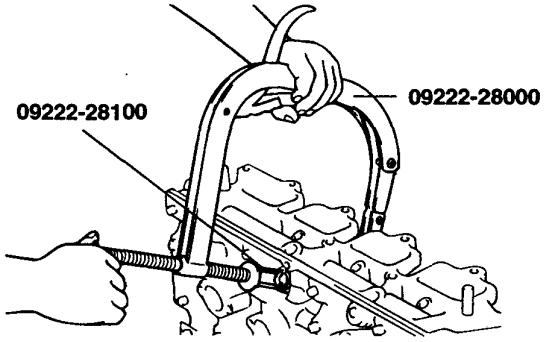
ECHB930A

3. Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then install the retainer.



ECA9290B

4. Using the special tool (09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



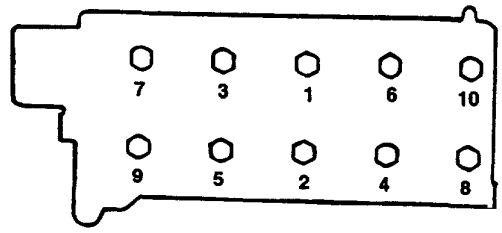
ECHA910B

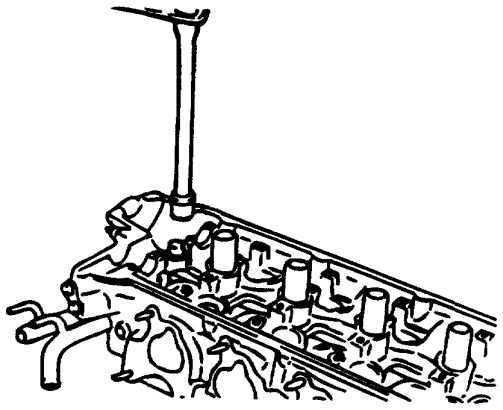
NOTE

When the spring is compressed, Check that the valve stem seal is not pressed against the bottom of the retainer.

5. Clean both gasket surfaces of the cylinder block and cylinder head.
6. Verify the identification marks on the cylinder head gasket.
7. Install the gasket so that the surface with the identification mark faces toward the cylinder head.

8. Tighten the bolts to the specified torque in the sequence shown.





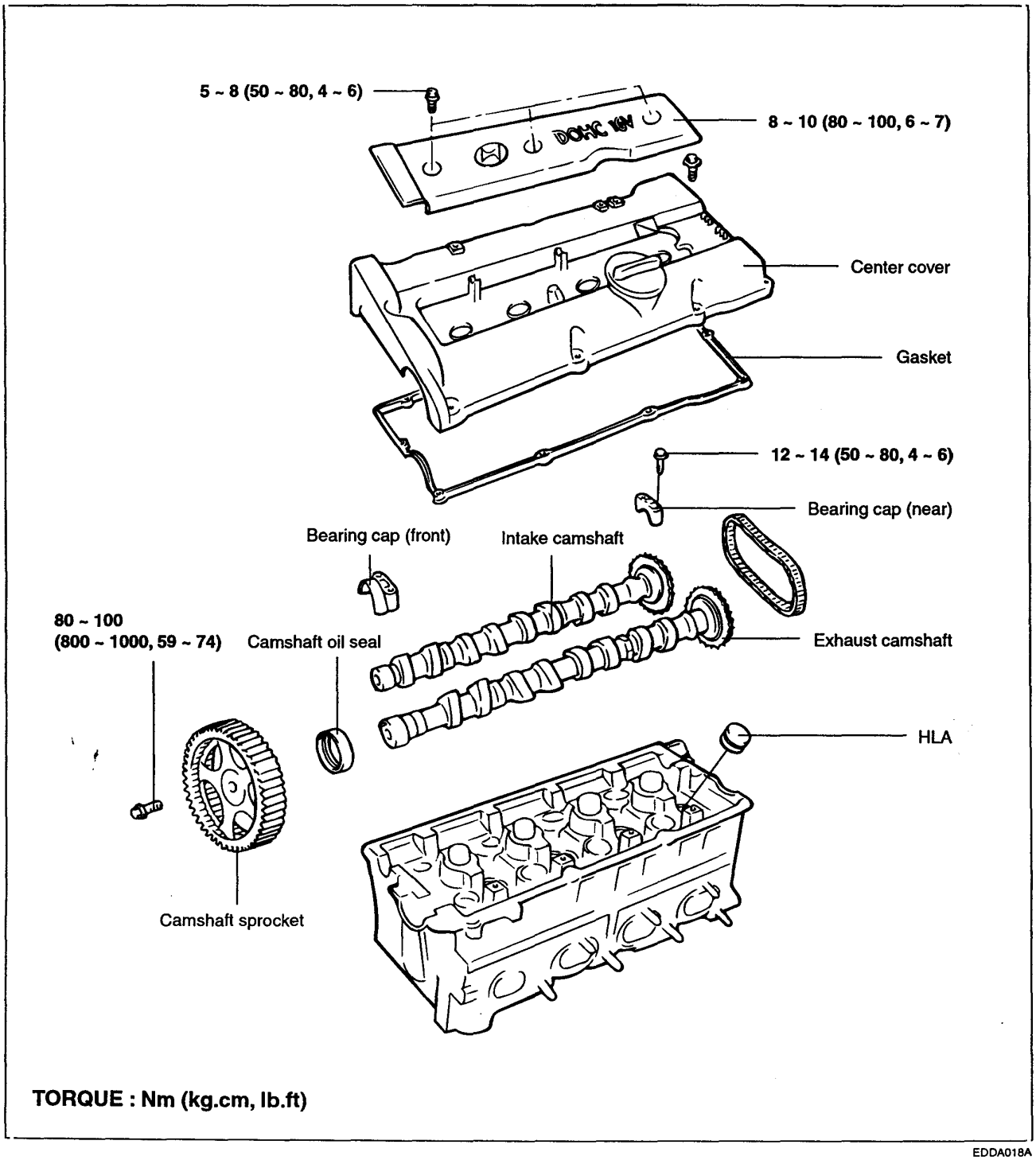
KDDA001L

Cylinder head bolt : 30 Nm (300 kg.cm, 22 lb.ft)+90°+Release all bolts + 30 Nm(300kg.cm, 22 lb.ft)+90°

MAIN MOVING SYSTEM

CAM SHAFT

COMPONENTS EE8F4E76

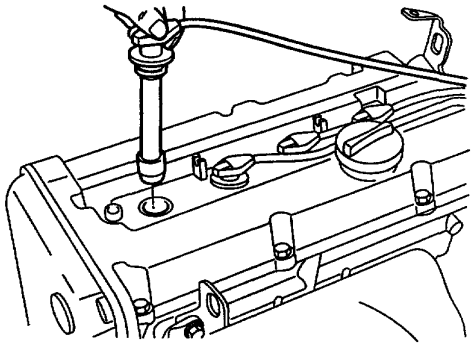


TORQUE : Nm (kg.cm, lb.ft)

EDDA018A

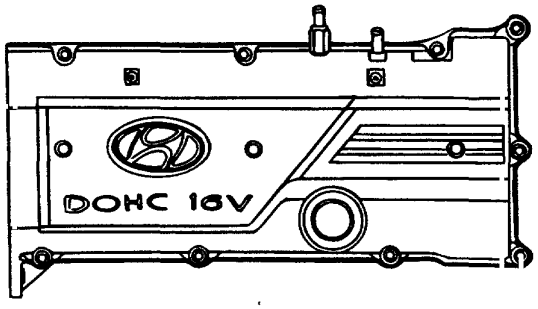
DISASSEMBLY EBF99CFA

1. Disconnect the breather hose and the P.C.V. hose.
2. Loosen the center cover bolts and then remove the center cover.
3. Remove the ignition coil assembly and the spark plug cables.



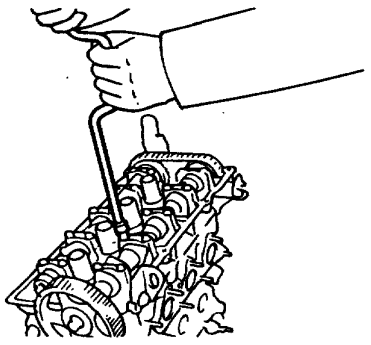
KCDC002B

4. Loosen the cylinder head cover bolts and then remove the cylinder head cover.



ECKA030A

5. Remove the camshaft sprocket.
6. Remove the camshaft bearing caps and timing chain.



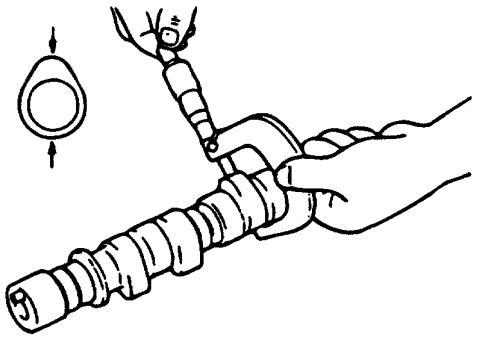
EDDA019C

7. Remove the camshaft.
8. Remove the HLA.

INSPECTION ECDFFBF8

1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Standard value Intake : 43.4484 mm (1.7106 in.) Exhaust : 43.8489 mm (1.7263 in.) Limit Intake : 42.9484 mm (1.6909 in.) Exhaust : 43.3489 mm (1.7066 in.)



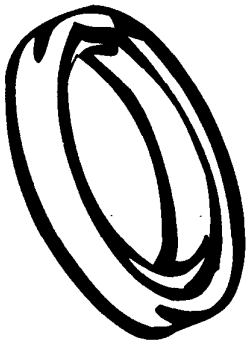
KDDA001D

3. Check the cam surface for abnormal wear or damage, and replace if necessary.
4. Check each bearing for damage. If the bearing surface is excessively damaged, replace the cylinder head assembly or camshaft bearing cap, as necessary.

Camshaft end play : 0.1 - 0.2 mm (0.0039 - 0.0079 in.)

OIL SEAL

1. Check the lips for wear. If the lip threads are worn, replace.
2. Check the oil seal lip contacting surface of the camshaft. If it is worn, replace the camshaft.

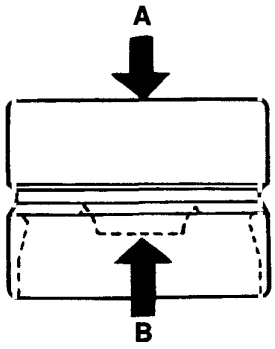


V5EM202A

HLA (HYDRAULIC LASH ADJUSTER)

With the HLA filled with engine oil, hold A and press B by hand. If B moves, replace the HLA.

For other specific troubleshooting regarding HLA, refer to the table below.

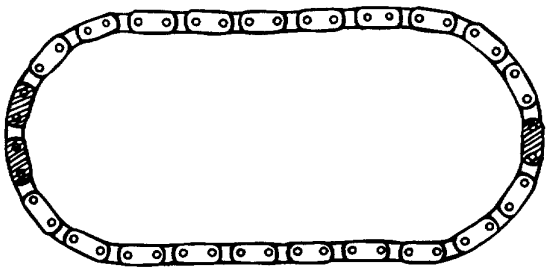


EDDA020B

Problem	Possible cause	Action
Temporary noise on starting a cold engine.	Normal	This noise will disappear after the oil in the engine has reached normal pressure.
Continuous noise when engine is running after sitting more than 48 hours.	Oil leakage of the high pressure chamber on HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2000~3000 rpm If it doesn't disappear, refer to item 7 below
Continuous noise when engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
Continuous noise when engine is running after excessive cranking.	Oil drain out of the high-pressure chamber in HLA, allowing air to get in.	
Continuous noise when engine is running after changing HLA.	Insufficient oil in HLA.	⚠ ***CAUTION*** ***Do not run engine at a speed higher than 3000 rpm as this may damage HLA.***
Continuous noise during idle after high speed running.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system
	Deteriorated oil	Check oil quality.
Noise continuous for more than 15 minutes.	Low oil pressure	Check oil pressure and oil supply system of each part of engine
	Faulty HLA.	Remove the cylinder head cover and press down on the HLA by hand. If it move, replace HLA. ⚠ ***CAUTION*** ***Be careful of hot HLA.***

TIMING CHAIN

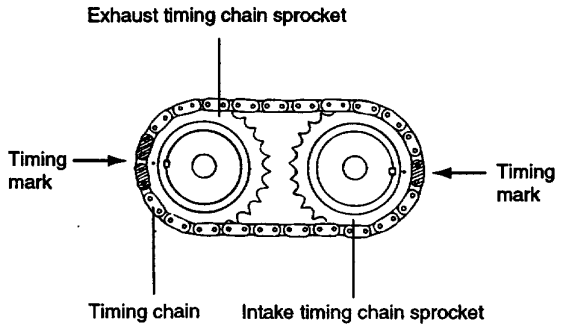
Check the bushing and plate of timing chain for wear. Replace if wear is severe.



EDDA020C

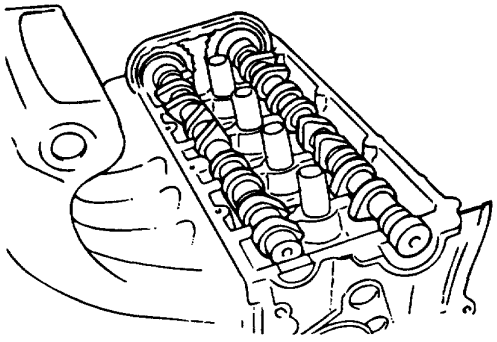
REASSEMBLY E1337F9D

1. Install the HLA.
2. Align the camshaft timing chain with intake timing chain sprocket and exhaust timing chain sprocket as shown.



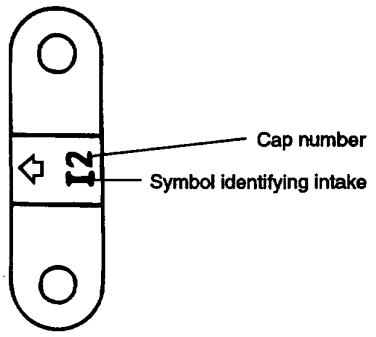
EDDA021A

3. Install the camshaft after lubricating the camshaft journals with engine oil.



EDDA021B

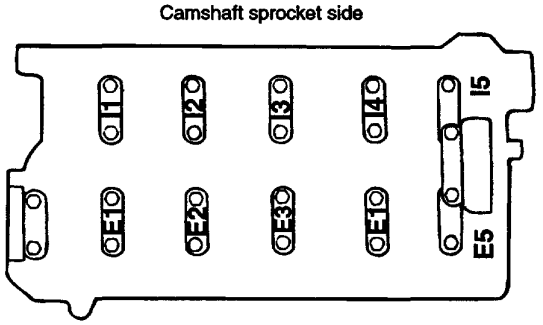
4. Install the bearing caps. The markings on the caps are for intake/exhaust identification.
   I: Intake camshaft
   E: Exhaust camshaft



EDDA021C

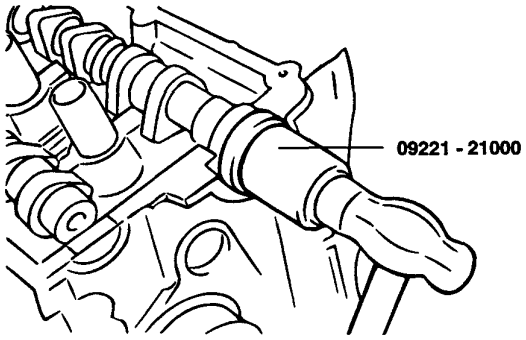
5. Tighten the bearing caps to the specified torque in two or three steps as shown.

Tightening torque
Bearing cap bolt :
12 ~ 14 Nm (120 ~ 140 kg.cm, 9 ~ 10 lb.ft)



EDDA021D

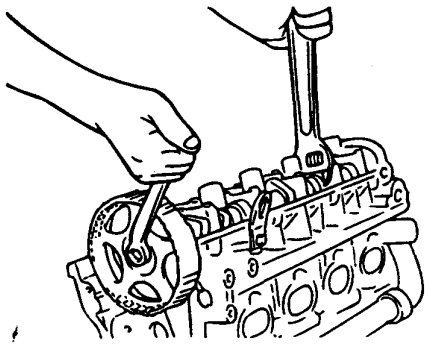
6. Using the special tool, camshaft oil seal installer (09221 - 21000), press fit the camshaft oil seal. Be susre to apply engine oil to the oil seal lip. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.



EDDA021E

7. Install the camshaft sprocket bolts to the specified torque.

Tightening torque
Camshaft sprocket bolt :
80 ~ 100Nm (800 ~ 1000 kg.cm, 59 ~ 74 lb.ft)

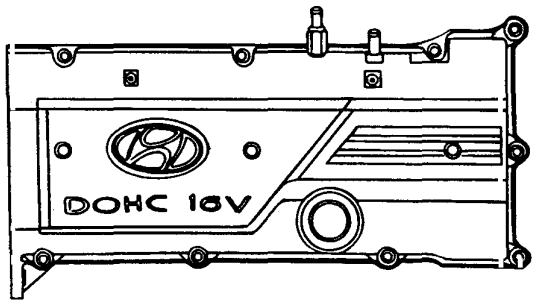


EDDA021F

8. Align the camshaft sprocket and crankshaft sprocket timing marks. Place the poston in the No.1 cylinder to top dead center on the compression strokie. (Refer to the timing belt)

9. Install the cylinder head cover.

Tightening torque
Cylinder head cover bolts :
8 ~ 10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)



ECKA030A

10. Install the spark plug cables, ignition coil assembly and cylinder head center cover.

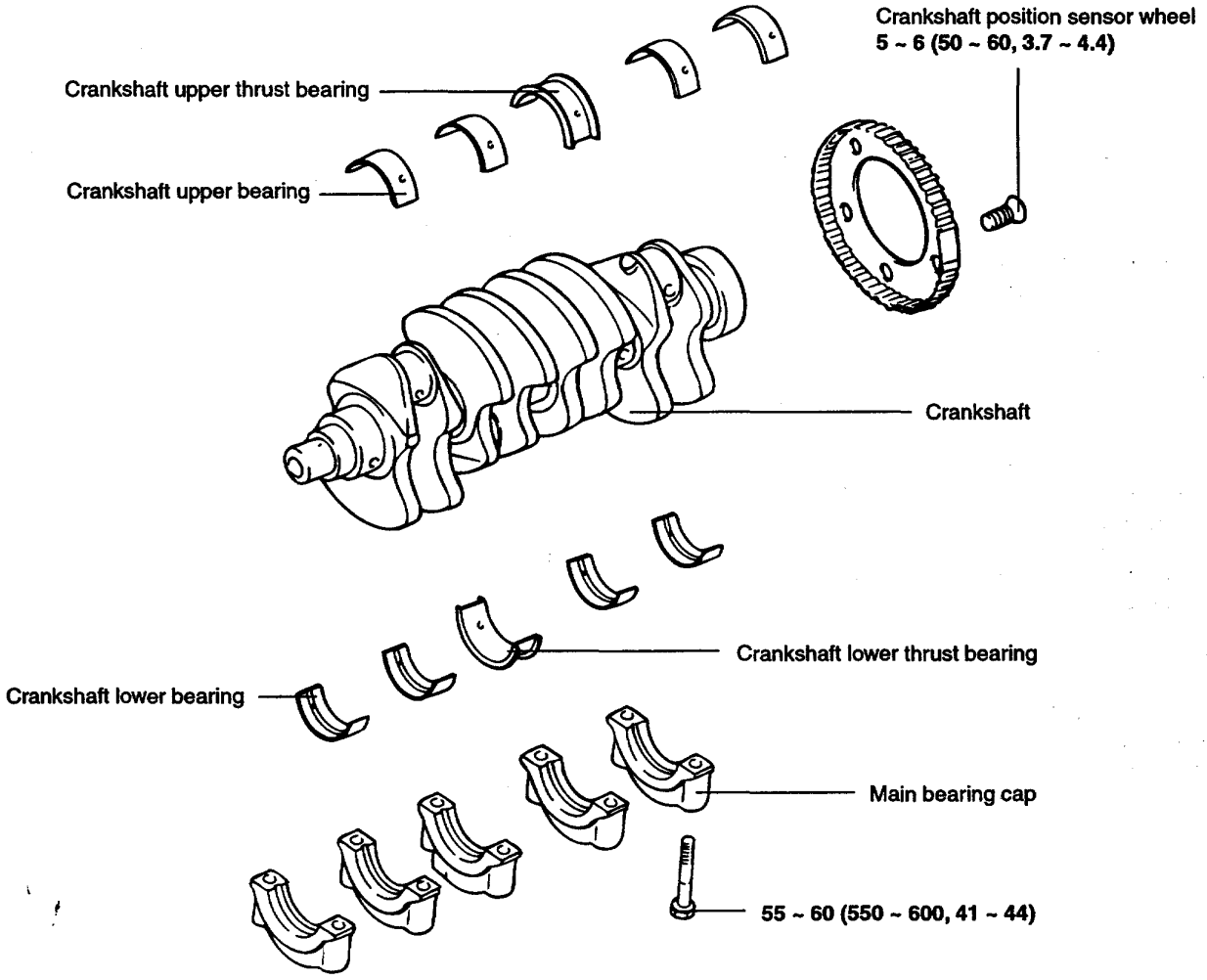
11. Install the timing belt and then tighten the timing belt tensioner pulley.

12. Install the timing belt cover.

Tightening torque
Timing belt cover : 8 ~ 10Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

CRANK SHAFT

COMPONENTS ED67A7AC



TORQUE : Nm (kg.cm, lb.ft)

ECDA031A

DISASSEMBLY EA7E6C0F

1. Remove the timing belt, front case, flywheel, cylinder head assembly and oil pan. For details, refer to the respective chapters.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.
4. Remove the main bearing caps and remove the crankshaft.
5. Remove the crankshaft position sensor wheel.

⚠ ***CAUTION***

Mark the main bearing caps to permit reassembly in the original position and direction.

INSPECTION E76DB219

CRANKSHAFT

1. Check the crankshaft journals and pins for damage, uneven wear, and cracks. Also check oil holes for clogging. Correct or replace any defective part.
2. Inspect the crankshaft journal for taper and out - of - round.

Standard value
Crankshaft journal O.D : 50 mm (1.9685 in.)
Crankshaft pin O.D : 45 mm (1.7717 in.)
Crankshaft journal, pin out-of-roundness and taper : 0.005 mm (0.0002 in.) or less

MAIN BEARINGS AND CONNECTING ROD BEARINGS

Visually inspect each bearing for peeling, melting, seizure, and improper contact. Replace the defective bearings.

OIL CLEARANCE MEASUREMENT

1. Measure the diameter of the crankshaft journal and pin.
2. Measure the diameter of the crankshaft bore and connecting rod bore.
3. Measure the thickness of the crankshaft bearing and connecting rod bearing.
4. Measure the clearance by the value that subtract the diameter of journal and pin and the thickness of bearing from the diameter of bore.

Connecting rod bearing oil clearance :
0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)
Crankshaft main bearing oil clearance
NO. 1,2,4,5 : 0.022 ~ 0.040 mm (0.0009 ~ 0.0018 in.)
NO.3 : 0.028 ~ 0.046 mm (0.0011 ~ 0.0018 in.)

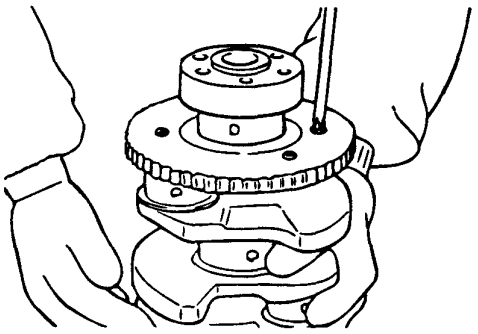
OIL SEAL

Check front and rear oil seals for damage or wear. Replace any seal that is defective.

CRANKSHAFT SENSOR WHEEL

1. Remove the sensor wheel.
2. Check the sensor wheel for damage, cracks and wear, and replace if necessary.
3. Check the clearance between the sensor wheel and the crank position sensor with a depth gage.

Standard value
Clearance between sensor wheel and crank position sensor : 0.5 ~ 1.1 mm (0.020 ~ 0.043 in.)



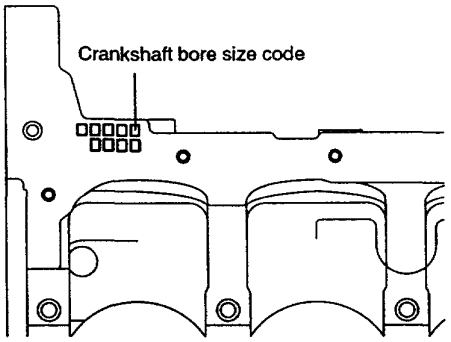
EDDA028C

📖 ***NOTE***

1. *Measure the depth of the top of sensor wheel tooth and the cylinder block mounting block.*
2. *Measure the difference between sensor length and depth.*
3. *Sensor length is the distance between the end of the sensor and the inner point of the contacting face.*

REPLACEMENT E8EBDEBC

1. Check the cylinder block crankshaft bore size code.



EDPC004C

NOTE

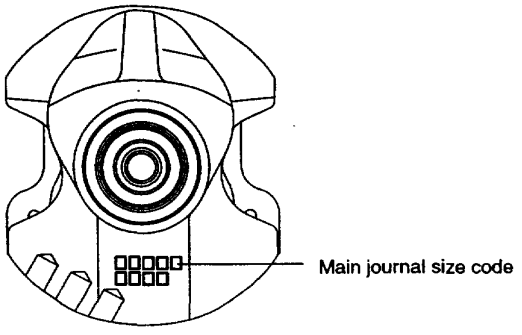
Record the cylinder block crankshaft bore size code letters on cylinder block as shown.
Reading order is from left to right with front crankshaft bore size code shown first.

Class	Crankshaft bore diameter	Size code
a	54~54.006mm (2.1259~2.1262in.)	A
b	54.006~54.012mm (2.1262~2.1264in.)	B
c	54.012~54.016mm (2.1264~2.1266in.)	C

2. Check the crankshaft main journal size code.

NOTE

Record the main journal size code letters on the crankshaft balance weight.
Reading order is from left to right as shown, with No.1 main journal size code shown first.



ECPC004B

CRANKSHAFT MAIN JOURNAL DIAMETER

Class	Main journal diameter	Size code
I	49.968 ~ 49.962 mm (1.9672 ~ 1.9670 in.)	A
II	49.962 ~ 49.956 mm (1.9670 ~ 1.9667 in.)	b
III	49.956 ~ 49.950 mm (1.9667 ~ 1.9665 in.)	c

MAIN JOURNAL BEARING THICKNESS

No. 1, 2, 4, 5 (MAIN BEARING)

Color	Main journal bearing thinckness
Yellow	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in.)
Green	2.005 ~ 2.008 mm (0.0789 ~ 0.0790 in.)
No color	2.008 ~ 2.011 mm (0.0790 ~ 0.0791 in.)
Black	2.011 ~ 2.014 mm (0.0791 ~ 0.0793 in.)
Blue	2.014 ~ 2.017 mm (0.0793 ~ 0.0794 in.)

NO.3 (CENTER BEARING)

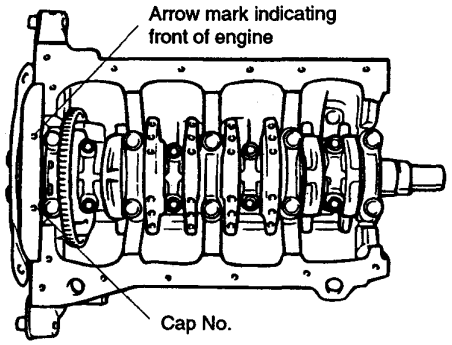
Color	Main journal bearing thickness
Yellow	1.999 ~ 2.002 mm (0.0787 ~ 0.0788 in.)
Green	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in.)
No color	2.005 ~ 2.008 mm (0.0788 ~ 0.0790 in.)
Black	2.008 ~ 2.011 mm (0.0790 ~ 0.0791 in.)
Blue	2.011 ~ 2.014 mm (0.0791 ~ 0.0793 in.)

3. Choose proper main journal bearing in table.

REASSEMBLY E0ABCAB2

1. Install the upper main bearing inserts in the cylinder block.
   When reusing the main bearings, remember to install them by referring to the location marks made at the time of disassembly.
2. Install the crankshaft. Apply engine oil to the journals.
3. Install bearing caps and tighten cap bolts to the specified torque in the following sequence; center, No.2, No.4, front, and rear caps.
   Cap bolts should be tightened evenly in 2 to 3 stages before they are tightened to the specified torque.
   The caps should be installed with the arrow mark directed toward the crank pulley side of engine. Cap numbers must be correct.

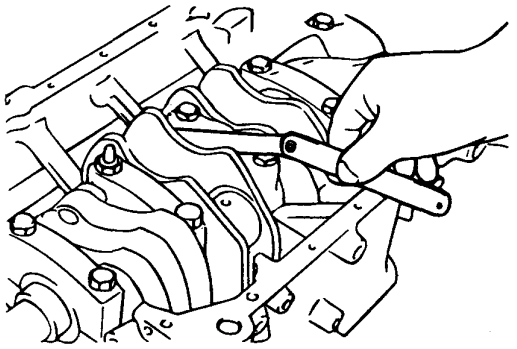
Tightening torque
Main bearing cap bolt :
55 ~ 60 Nm (550 ~ 600 kg.cm, 41 ~ 44 lb.ft)
Connecting rod cap bolt :
32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)



ECDA034A

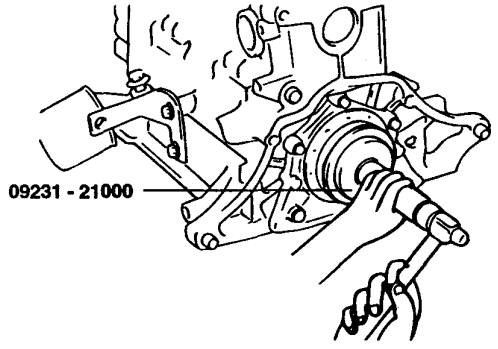
4. Make certain that the crankshaft turns freely and has the proper clearance between the center main bearing thrust flange and the connecting rod big end bearing.

Standard value
Crankshaft end play :
0.05 ~ 0.175 mm (0.0019 ~ 0.0068 in.)



KCPC050B

5. Install the oil seal in the crankshaft rear oil seal case. Use the Special Tool, Crankshaft Rear Oil Seal Installer (09231 - 21000) as shown. Press fit the oil seal all the way in, being careful not to misalign it.

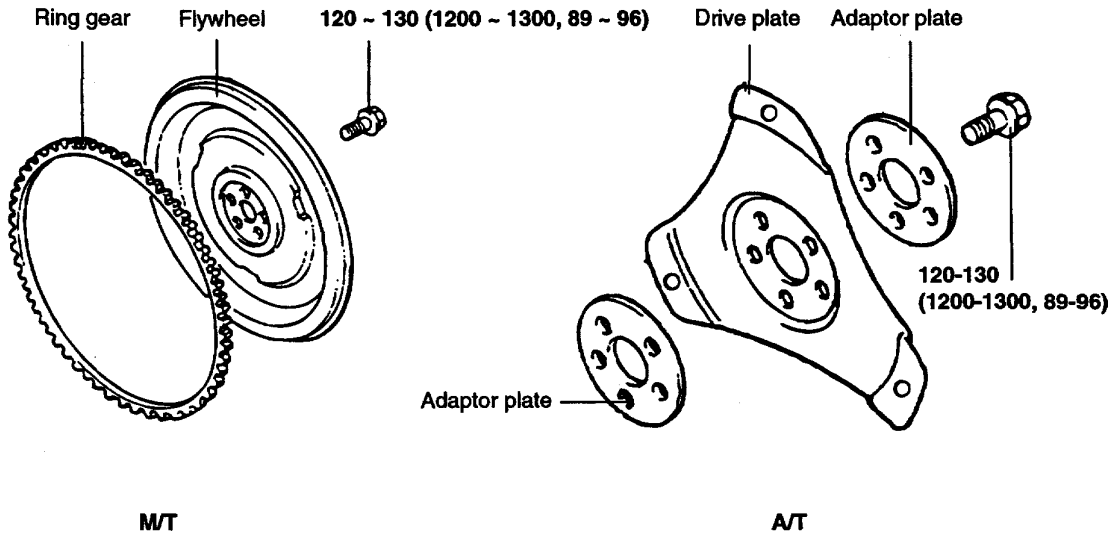


EDDA029B

6. Install the rear plate and tighten the bolts.
7. Install the connecting rod caps.
8. Install the flywheel, front case, oil pan and timing belt. For further details, refer to the respective chapters.

FLY WHEEL

COMPONENTS E3FB04C9



TORQUE : Nm (kg.cm, lb.ft)

EDDA030A

M/T : Manual Transmission Vehicles
A/T : Automatic Transmission Vehicles

DISASSEMBLY E543FBCD

1. Remove the Transmission and clutch.
2. Remove the flywheel.

INSPECTION EB2E8F43

1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for runout.

Standard value
Flywheel run - out : 0.1 mm (0.0039 in.)

3. Check the ring gear for damage, cracks, and wear, and replace if necessary.

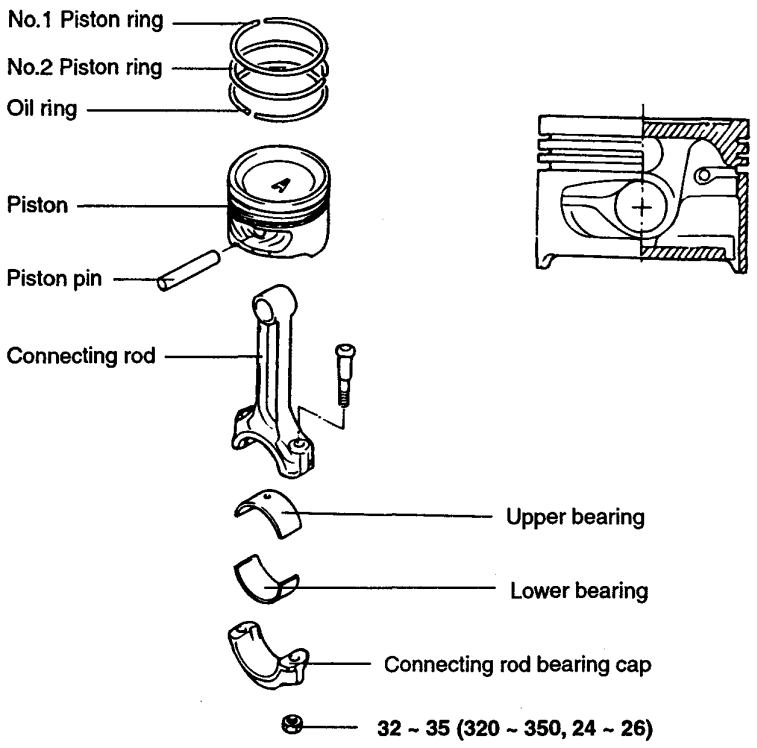
REASSEMBLY E650BE51

Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque
Flywheel bolt :
120 ~ 130 Nm (1200 ~ 1300 kg.cm, 89 ~ 96 lb.ft)

PISTON

COMPONENTS E1D1ECDE



TORQUE : Nm (kg.cm, lb.ft)

EDDA034A

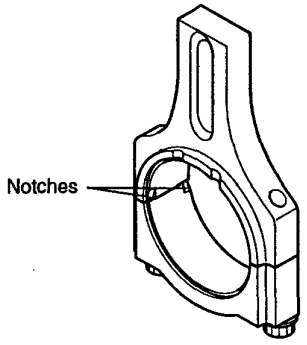
DISASSEMBLY EEDFC26E

CONNECTING ROD CAP

⚠ ***CAUTION***

Keep the bearings in order with their corresponding connecting rods (according to cylinder numbers) for proper reassembly.

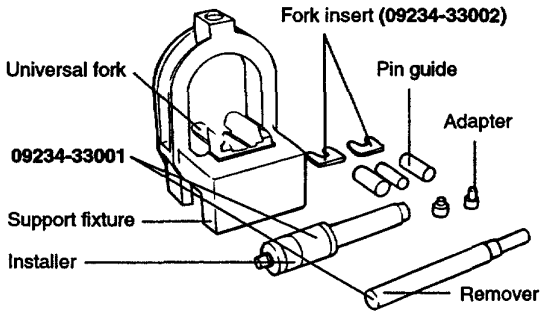
1. Remove the connecting rod cap bolts, then remove the caps and the big end lower bearing.
2. Push each piston connecting rod assembly toward the top of the cylinder.



KFW3049A

DISASSEMBLY AND REASSEMBLY OF THE PISTON PIN

1. Using the special tools (09234-33001) and (09234-33002), disassemble and reassemble the piston and connecting rod.

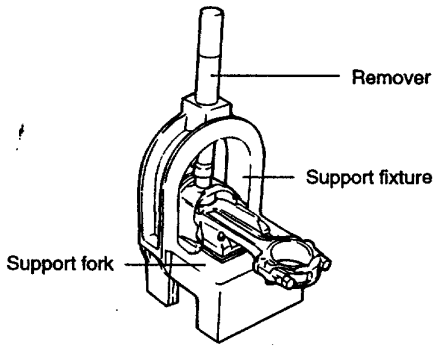


ECA9361A

2. The piston pin is press fit into the rod little end, and the piston floats on the pin.

3. The tool consists of a support fixture with fork inserts, guides, adapters, an installer and a remover. The piston is supported in the support fixture while the pin is being installed or removed. Guides help position the pin as it is installed or removed, while the rod is supported by fork inserts.

4. To remove the pin from the piston, place the piston in the support fixture with the rod resting on the fork inserts. Pass the remove tool through the top of the support fixture and use it to press out the pin.



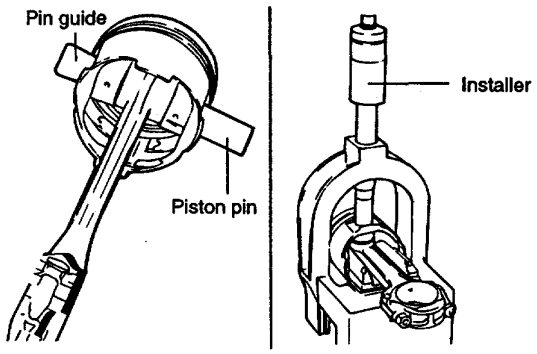
EDA9048A

5. To install a new pin, the proper fork inserts must be in place to support the rod.

6. Position the rod inside the piston. Insert the proper pin guide through one side of the piston and through the rod.
   Hand tap the pin guide so it is held by the piston. Insert the new pin into the piston from the other side and set the assembly into the support fixture with the pin guide facing down.

NOTE

The pin guide should be centered on the connecting rod through the piston. If assembled correctly, the pin guide will sit exactly under the center of the hole in the tool's arch, and rest evenly on the fork inserts. If the wrong size pin guide is used, the piston and pin will not line up with the support fixture.

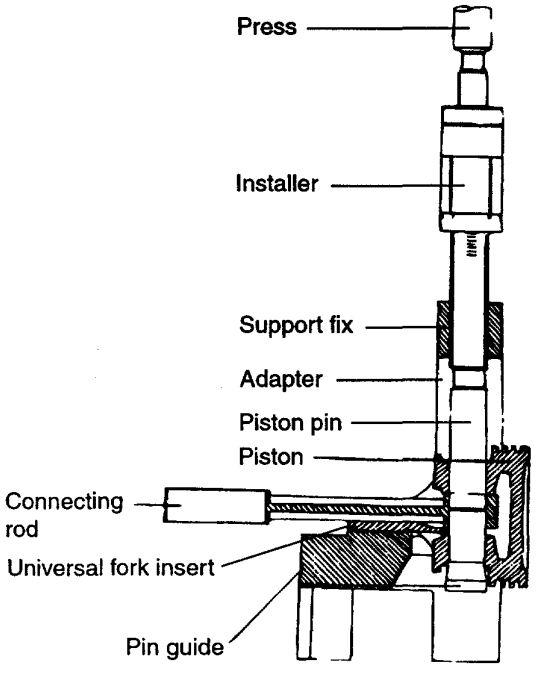


ECA9361C

7. Insert the installer tool through the hole in the arch of the support fixture and use an hydraulic press to force the piston pin through the rod little end. Continue pressing until the pin guide falls free and the installer tool seats against the top of the arch.

CAUTION

Do not exceed 1250 ± 500 kg (2765 ± 1102 lb) of force when the installing tool seats against the top of the arch.



HEW20A55

INSPECTION E005DAEA

PISTONS AND PISTON PINS

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature).

PISTON RINGS

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in the ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace the piston rings only.

Piston ring side clearance
No.1 : 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)
No. 2 : 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)
Limit
No. 1 : 0.1 mm (0.004 in.)
No. 2 : 0.1 mm (0.004 in.)

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles in the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring.

Piston ring end gap
[Standard dimensions]
No. 1 : 0.20 ~ 0.35 mm (0.0079 ~ 0.0138 in.)
No. 2 : 0.37 ~ 0.52 mm (0.0146 ~ 0.020 in.)
Oil ring side rail : 0.2 ~ 0.7 mm (0.0079 ~ 0.0276)
[Limit]
No. 1, No. 2 : 1.0 mm (0.039 in.)
Oil ring side rail : 1.0 mm (0.0.39 in.)

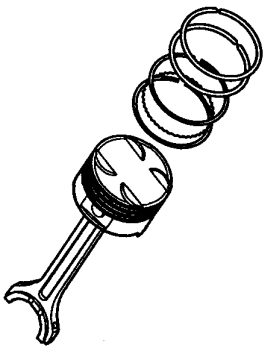
When replacing the ring without correcting the cylinder bore, check the gap with the ring situated at the low part of cylinder that is less worn out.

PISTON RING SERVICE SIZE AND MARK

Standard	None
0.25 mm (0.010 in.) O.S	25
0.50 mm (0.020 in.) O.S	50
0.75 mm (0.030 in.) O.S	75
1.00 mm (0.039 in.) O.S	100

NOTE

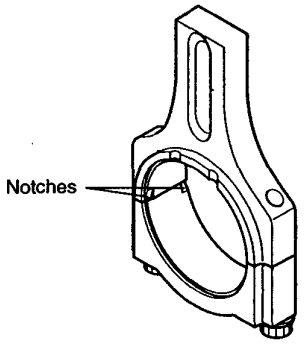
The mark can be found on the upper side of the ring next to the end.



KFW3037C

CONNECTING RODS

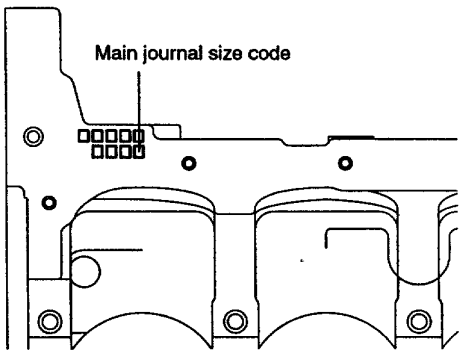
1. When the connecting rod cap is installed, make sure that the cylinder numbers, marked on rod end cap at disassembly, match. When a new connecting rod is installed, make sure that the notches holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either end of the thrust faces. If it has a stratified wear in, or if the surface of the inside diameter of the small end is severely rough, replace the rod.



KFW3049A

REPLACEMENT EF4FCD8C

1. Check the cylinder bore size code on the cylinder block bottom face.

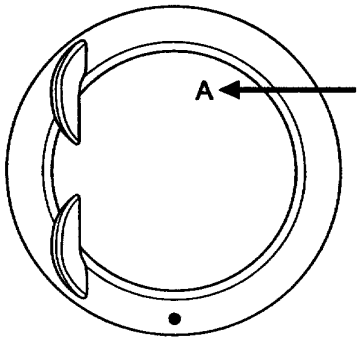


EDPC004B

1.6 L

Class	Cylinder bore inner diameter	Size code
A	76.5~76.51mm (3.0118~3.0121in.)	A
B	76.51~76.52mm (3.0121~3.0126in.)	B
C	76.52~76.53mm (3.0126~3.0129in.)	C

2. Check the piston size code on the piston top face.



KDPC005Z

NOTE

Stamp the grade mark of basic diameter with rubber stamp.

1.6 L

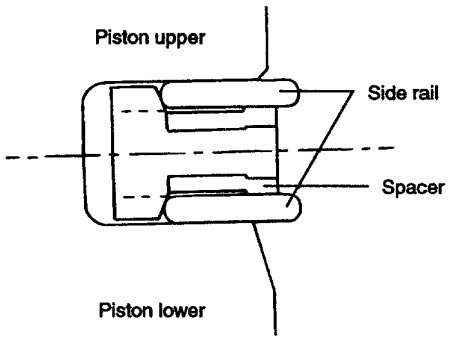
Class	Piston outer diameter	Size code
A	76.465~76.475mm (3.0104~3.0108in.)	A
B	76.475~76.485mm (3.0108~3.0112in.)	B
C	76.485~76.495mm (3.0112~3.0116in.)	C

3. Select the piston related to cylinder bore class.

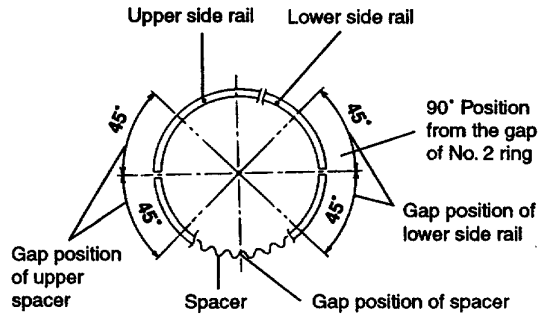
Oil clearance :
0.025 ~ 0.045mm (0.00098 ~ 0.00177in.)

REASSEMBLY ECCF87EF

1. Install the spacer.



ECA9082A



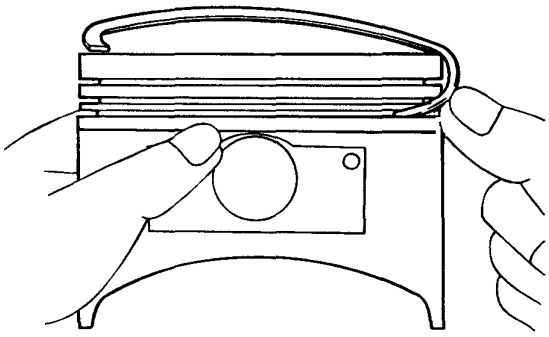
EDJA490A

2. Install the upper side rail. To install the side rail, first put one end of the side rail between the piston ring groove and spacer, hold it firmly, and press down with a finger on the portion to be inserted into the groove (as illustrated).

⚠ ***CAUTION***

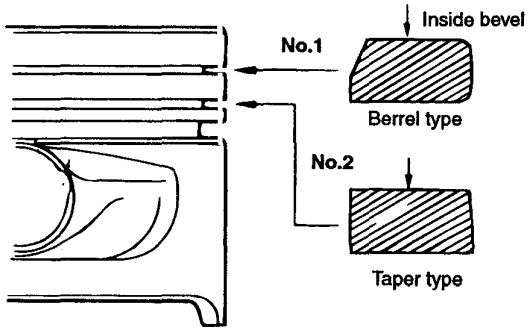
Do not use a piston ring expander when installing side rail.

3. Install the lower side rail by the same procedure described in Step 2.



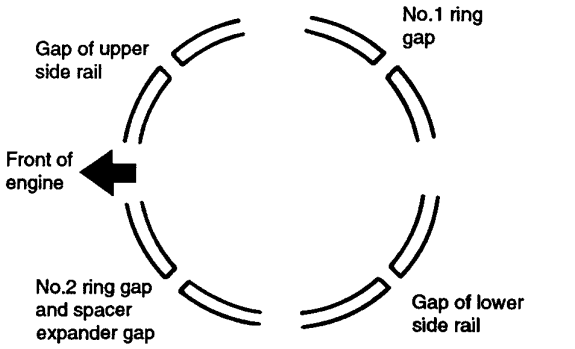
ECA9380B

4. Apply engine oil around the piston and piston grooves.
5. Using a piston ring expander, install the No.2 piston ring.
6. Install the No. 1 piston ring.



EDDA037B

7. Position each piston ring end gap as far away from its neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.
8. Hold the piston rings firmly with a piston ring compressor as they are inserted into cylinder.



ECA9380D

9. Install the upper main bearings in the cylinder block.
10. Install the lower main bearings in the main bearing caps.
11. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
12. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
13. When assembling, bolts should be fastened by the angle - torque controlled method as the following.
    1) Apply oil to the thread of nuts and spot areas.
    2) Tighten the connecting rod bolt.

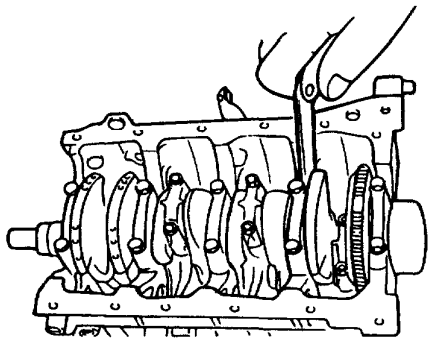
Tightening torque
Connecting rod cap nut :
32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)

⚠ ***CAUTION***

After removing the connecting rod bolt, do not use if again.
When using a new bolt, do not tighten the bolt more than 3 times.

14. Check the connecting rod side clearance.

Connecting rod side clearance
Standard : 0.10 ~ 0.25 mm (0.0039 ~ 0.0098 in.)
Limit : 0.4 mm (0.0157 in.)



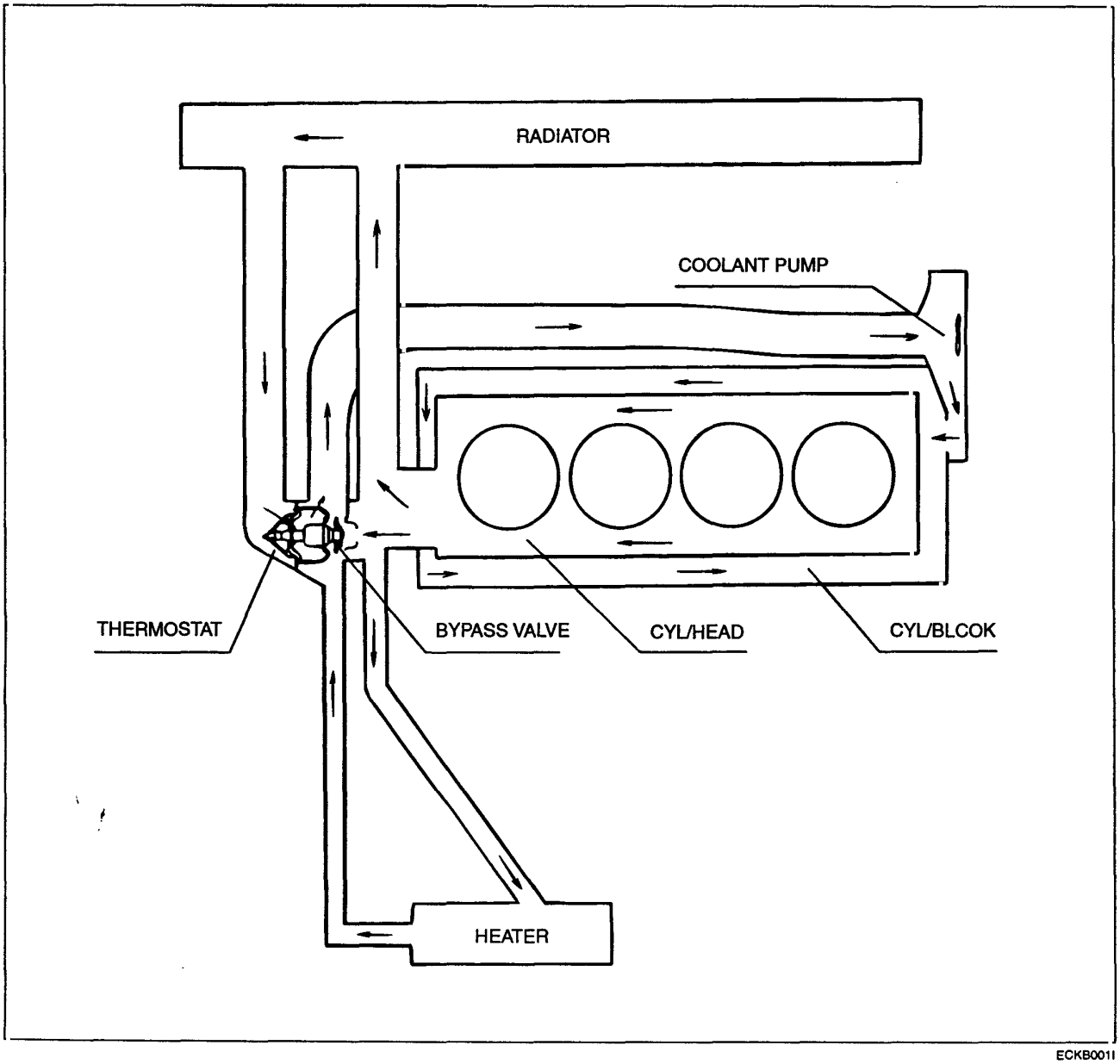
ECDA043F

15. Install the oil screen.
16. Install the oil pan.
17. Install the cylinder head.

COOLING SYSTEM

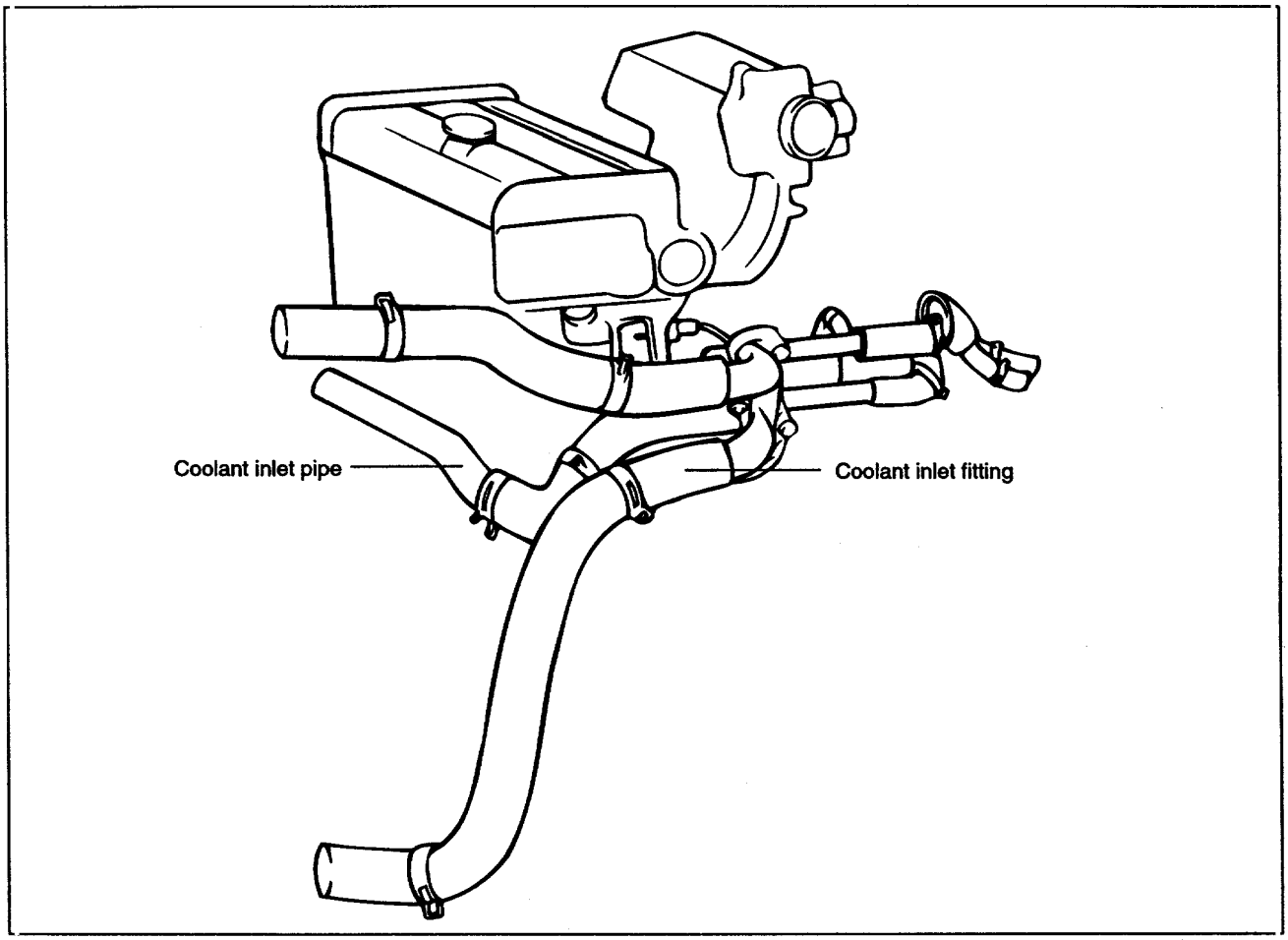
ENGINE COOLANT HOSE / PIPES

COOLING SYSTEM ED460284



ECKB0011

COMPONENTS E2BAF9FA



EDDA043A

INSPECTION E6CC2E0F

Check the coolant pipe and hoses for cracks, damage, or restrictions.

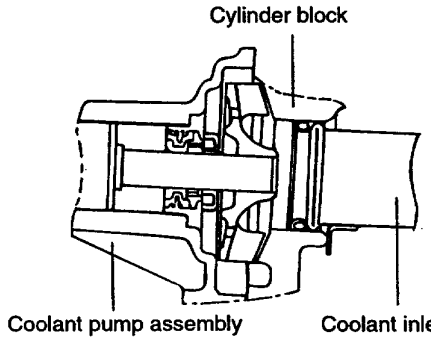
Replace if necessary.

REASSEMBLY E1DCE4A4

Fit on O-Ring in the groove provided at the coolant inlet pipe end, wet the O-ring with coolant and insert the coolant inlet pipe.

NOTE

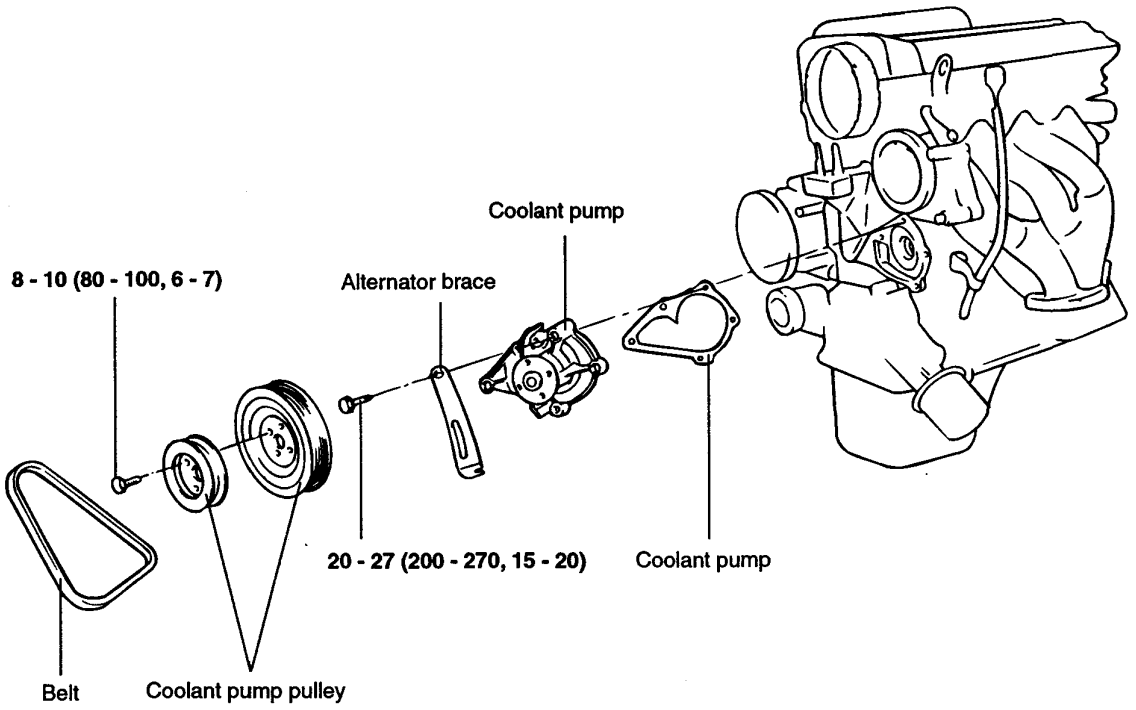
1. *Do not apply oil or grease to the coolant pipe O-ring.*
2. *Keep the coolant pipe connections free of sand, dust, etc.*
3. *Insert the coolant pipe fully into the cylinder block.*
4. *Do not reuse the O-ring. Replace it with a new part.*



ECKA040A

ENGINE COOLANT PUMP

COMPONENTS E8D2CBAD



TORQUE : Nm (kg.cm, lb.ft)

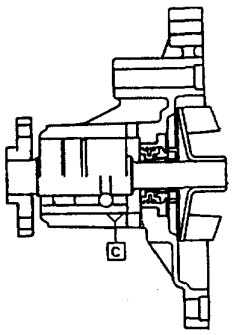
EDDA046A

DISASSEMBLY EA98DF28

1. Drain the coolant and disconnect the coolant inlet pipe connection hose from the coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt idler.
4. Remove the coolant pump mounting bolts, then remove the alternator brace.
5. Remove the coolant pump assembly from the cylinder block.

INSPECTION E5229EB7

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks then the seal is defective. Replace the coolant pump assembly.

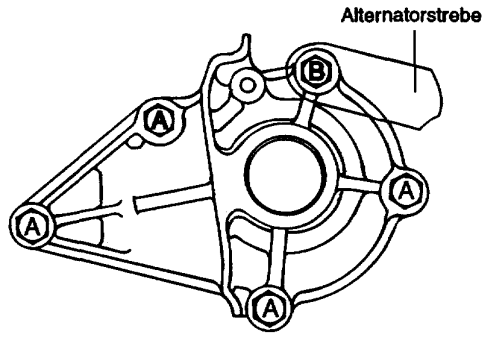


EDKB051A

REASSEMBLY E0C24D31

1. Clean the gasket surfaces of the coolant pump body and the cylinder block.
2. Install a new coolant pump gasket to the coolant pump and tighten the bolts to the specified torque.

Tightening torque
Coolant pump to cylinder block :
A : 12 ~ 15 Nm (120 ~ 150 kg.cm, 9 ~ 11 lb.ft)
B : 20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)



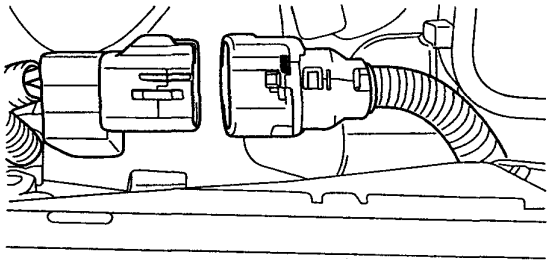
ECKA040B

3. Install the timing tensioner and timing belt. Adjust the timing belt tension.
4. Install the timing belt covers.
5. Install the coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the system with clean coolant.
7. Run the engine and check for leaks.

RADIATOR

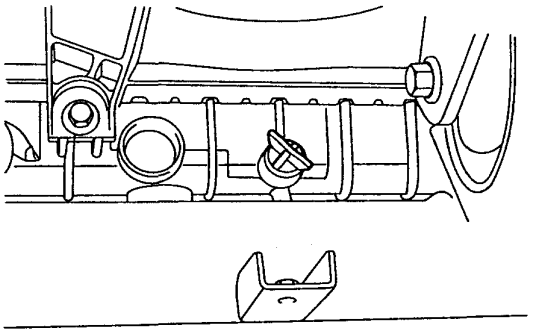
DISASSEMBLY E3A4A9CF

1. Disconnect the radiator fan motor connector.



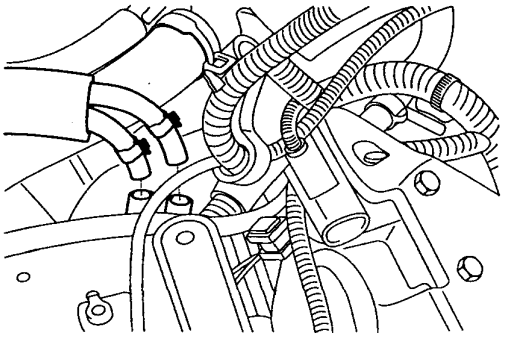
KCPC006B

2. Set the temperature of the heater control to the hot position.
3. Loosen the radiator drain plug to drain coolant.



KDDC008B

4. Disconnect the upper and lower hose and overflow tube.
5. For vehicles with automatic transmission, disconnect the oil cooler hoses from the automatic transmission.

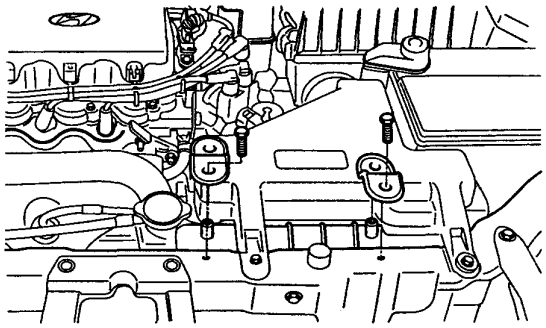


KCPC003E

⚠ ***CAUTION***

Plug the ends of the oil cooler hoses and the automatic transmission fittings to prevent transmission fluid from spilling out and foreign material from entering.

6. Remove the radiator mounting bolts.



KDDC014B

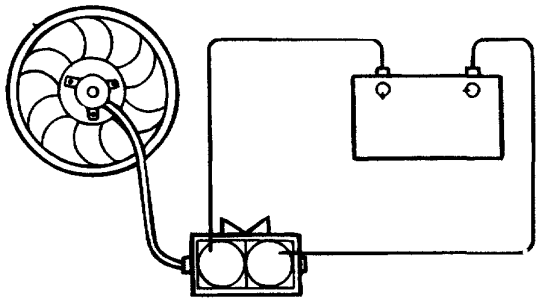
7. Remove the radiator together with the fan motor.
8. Remove the fan motor from the radiator.

INSPECTION EC662470

1. Check the radiator for bent, broken or plugged fins.
2. Check the radiator for corrosion, damage, rust or scale.
3. Check the radiator hoses for cracks, damage or deterioration.
4. Check the reservoir tank for damage.
5. Check the radiator cap spring for damage.
6. Test the pressure of the cap using a cooling system checker.
7. Check the radiator cap seal for cracks or damage.

RADIATOR FAN MOTOR

1. Check that the radiator fan rotates when the battery voltage is applied to the terminals.



ECDA064A

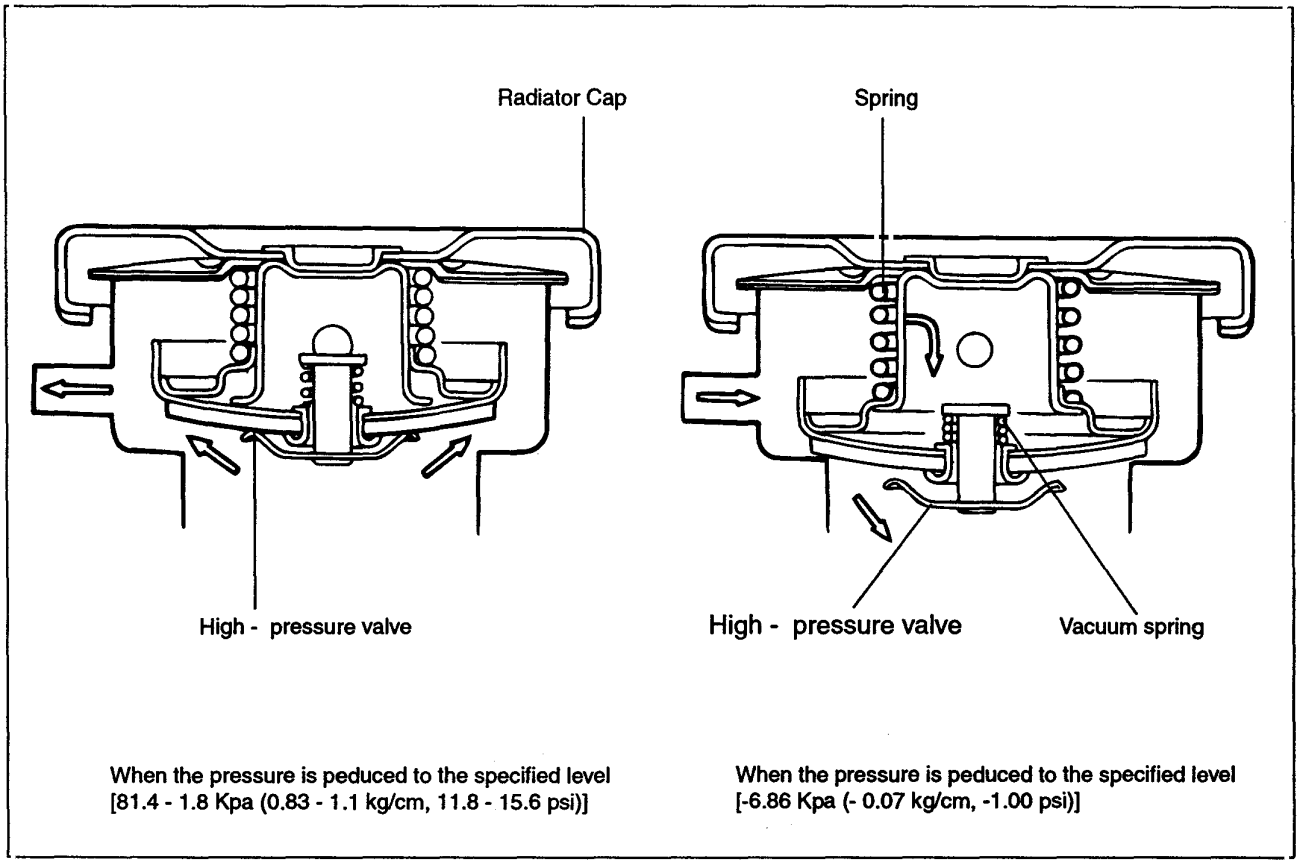
2. Check that abnormal noises are not produced while the motor is turning.

REASSEMBLY EF7E7B75

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the thermostat opens, and then stop the engine.
3. Remove the radiator cap, and add coolant up to the filler neck of the radiator, and then fill the reservoir tank to the upper level. Replace the radiator cap.
4. Check that there are no leaks from the radiator, hoses or connections.

RADIATOR CAP

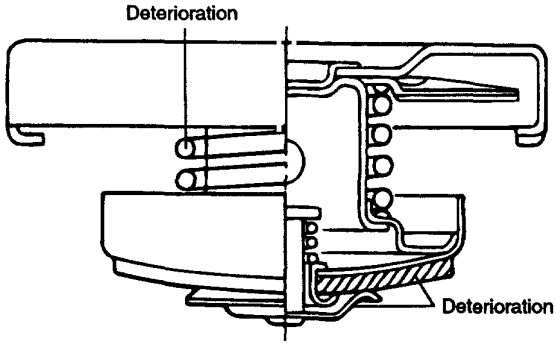
COMPONENTS EA37EA8B



ECDA066A

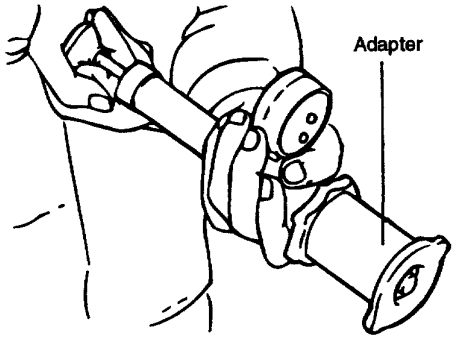
INSPECTION E7AA67F9

1. Check the radiator cap for damage, cracks and deterioration.



ECDA068A

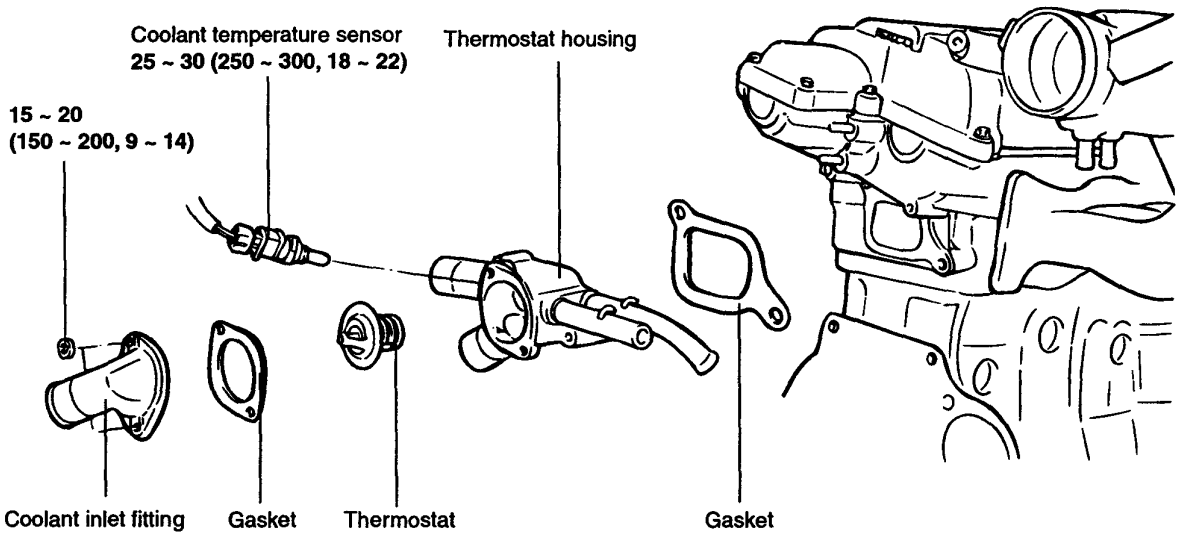
2. Attach a radiator cap tester to the radiator
3. Pump the tester until the pointer stabilizes.
4. If the pointer stays constant for 10 sec. at a point exceeding the service limit, the radiator cap is good.



ECDA068B

THERMOSTAT

COMPONENTS E1CCF4F8



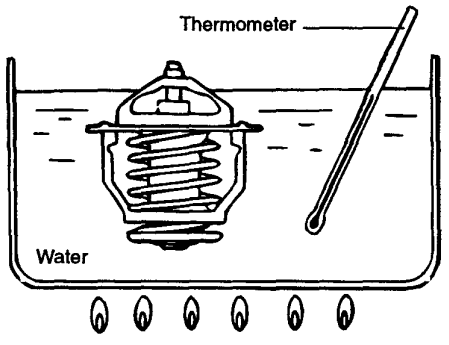
TORQUE : Nm (kg.cm, lb.ft)

ECKB040D

INSPECTION EE55C20B

1. Drain the coolant so its level is below thermostat.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.
4. Immerse thermostat in hot coolant to check proper valve opening temperature. Replace if necessary.

Valve opening temperature : 82°C (177°C)
Full opening temperature : 95°C (205 °F)



ECDA070A

COOLANT TEMPERATURE SENSOR

1. Heat the sensor by submerging it in hot engine coolant.
2. Check that the resistance is within the specified range.

Resistance
At : 20°C (68°F) : 2.31 ~ 2.59 kΩ

REASSEMBLY E342AFA3

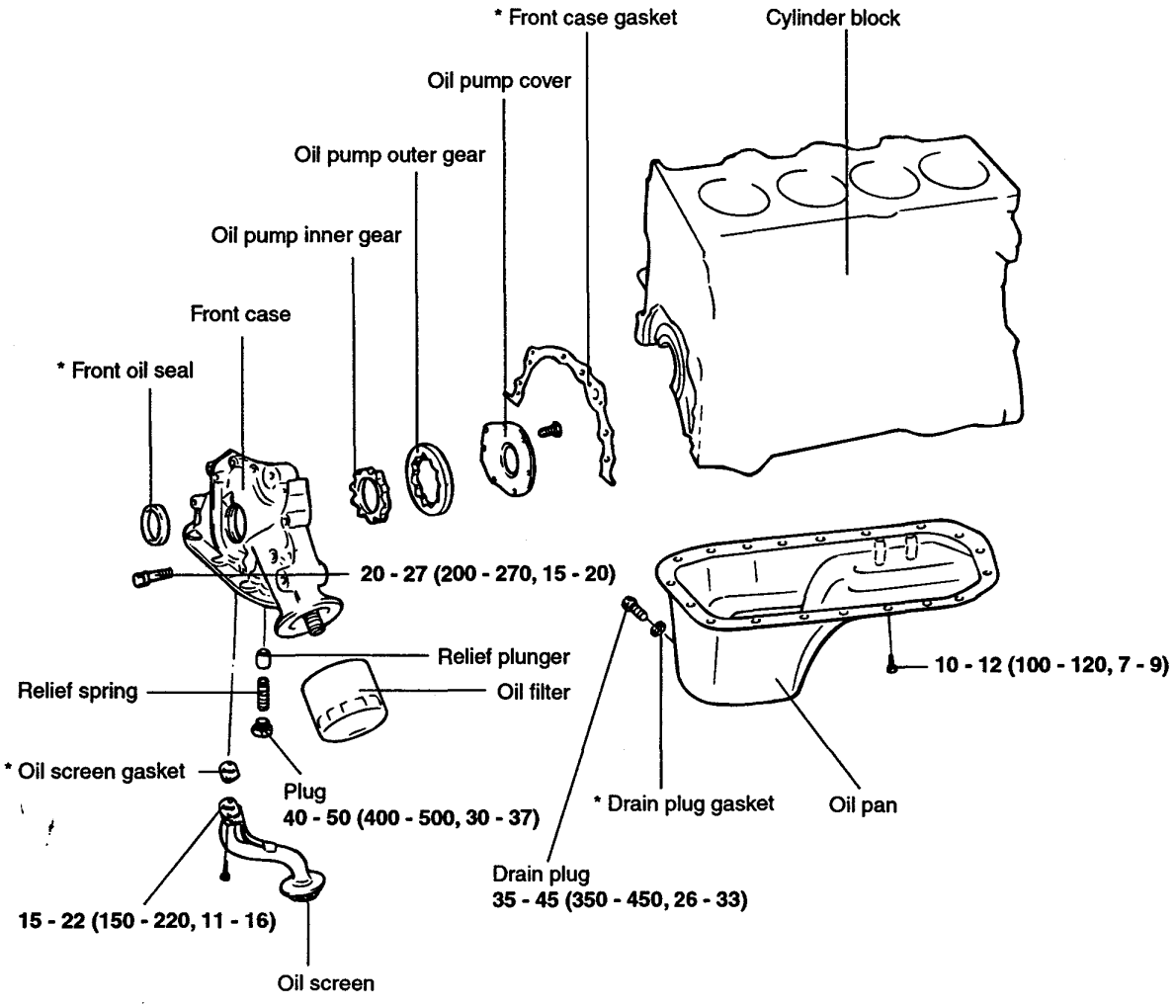
1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install a new gasket and the coolant inlet fitting.
3. Refill the system with clean coolant.

Tightening torque
Coolant temperature sensor :
25 ~ 30 Nm (250 ~ 300 kg.cm, 18 ~ 22 lb.ft)

LUBRICATION SYSTEM

OIL PUMP

COMPONENTS EDF9B71D



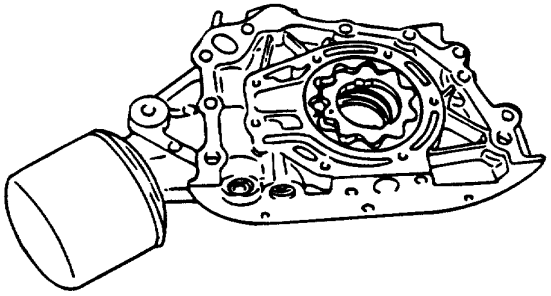
*** Replace the gasket and seal with new ones after removal.**

TORQUE : Nm (kg.cm, lb.ft)

EDDA012A

DISASSEMBLY E450CC2F

1. Remove the timing belt.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen.
5. Remove the front case assembly.



ECDA020A

6. Remove the oil pump cover.
7. Remove the inner and outer gears from the front case. The matching marks on the inner and outer gears indicate the direction of installation.
8. Remove all the oil pan bolts.

INSPECTION E9D08BBC

FRONT CASE

1. Check the front case for cracks or damage. Replace as necessary.
2. Check the front oil seal for worn or damaged lips. Replace if defective.

OIL PAN AND OIL SCREEN

1. Check the oil pan for failure, damage or cracks. Replace if defective.
2. Check the oil screen for failure, damage and cracks and replace if defective.

FRONT CASE AND OIL PUMP COVER

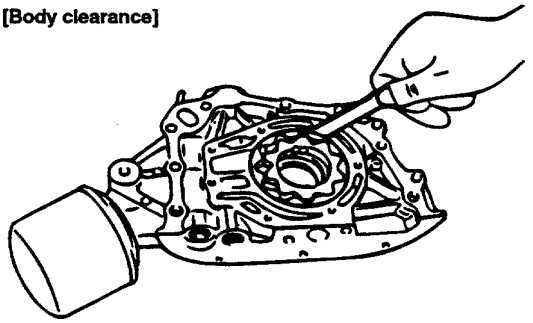
Check the surfaces contacting the gears for damage or wear.

OIL PUMP GEARS

1. Check the gear tooth surfaces for wear or damage.
2. Measure the clearance between outer gear and front case.

Body clearance : 0.12 ~ 0.185 mm (0.0047 ~ 0.0073 in.)
Tip clearance : 0.025 ~ 0.069 mm (0.0010 ~ 0.0027 in.)
Side clearance
Outer gear : 0.06 ~ 0.11 mm (0.0023 ~ 0.0043 in.)
Inner gear : 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

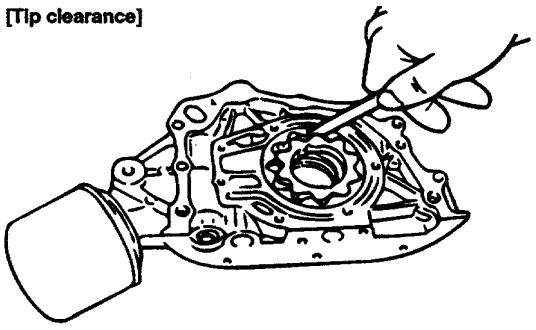
[Body clearance]



EDDA066A

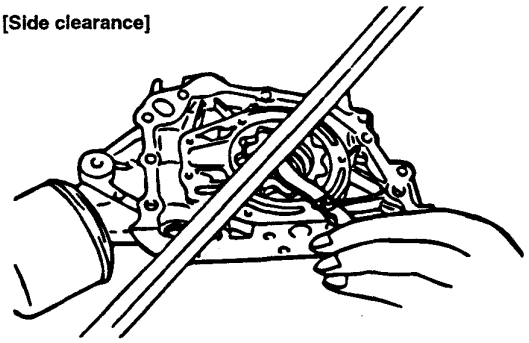
3. Check the tip clearance on the pump roter.

[Tip clearance]

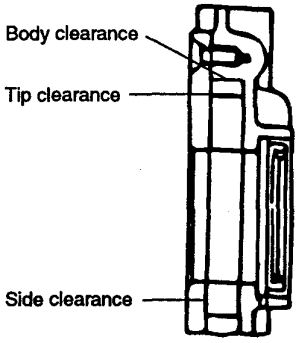


EDDA066B

[Side clearance]



A5EM048C



EDDA066D

RELIEF VALVE AND SPRING

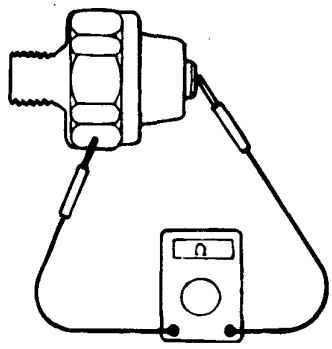
1. Check sliding condition of the relief valve inserted in the front case.

2. Inspect for distorted or broken relief valve spring.

Standard value
Free height : 46.6 mm (1.8346 in.)
Load : 6.1 kg/40.1 mm (13.42 lb/1.578 in.)

OIL PRESSURE SWITCH

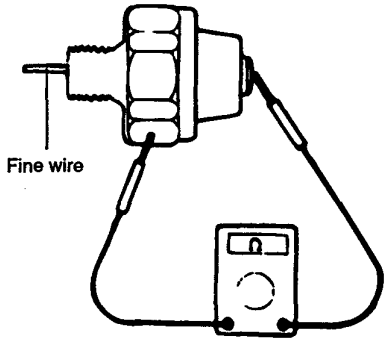
1. Use an ohmmeter to check the continuity between the terminal and the body. If there is no continuity, replace the oil pressure switch.



EDDA061A

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.

3. If there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.
   Check for air leaks. If air does leak, the diaphragm is broken. Replace the switch.



EDDA061B

REASSEMBLY E1BA8FB0

OIL PUMP

1. Install the outer and inner gears into the front case.Make sure that the inner and outer gears are installed in the same direction as shown.

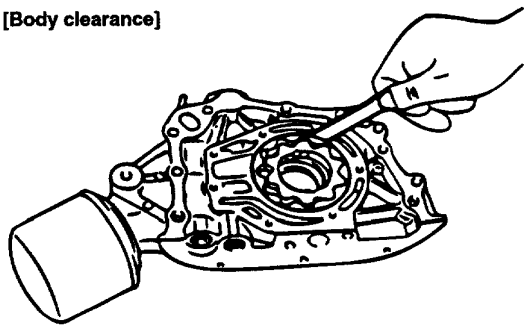
2. Install the oil pump cover and tighten the bolts to the specified torque. After the bolts have been tightened, check to ensure that the gear turns smoothly.

Tightening torque
Oil pump cover bolt :
8~ 12 Nm (80 ~ 120 kg.cm, 6 ~ 9 lb.ft)

3. Install the relief valve and spring. Tighten the plug to the specified torque. Apply engine oil to the relief valve.

Relief valve plug :
40 ~ 50 Nm (400 ~ 500 kg.cm, 30 ~ 37 lb.ft)

[Body clearance]

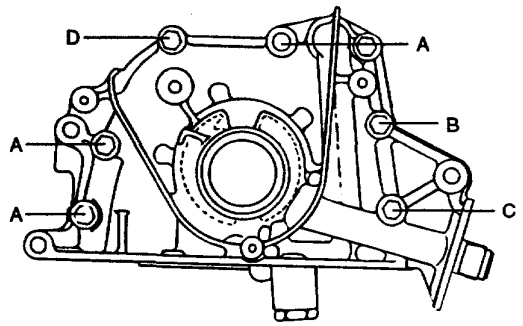


EDDA066A

FRONT CASE

1. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

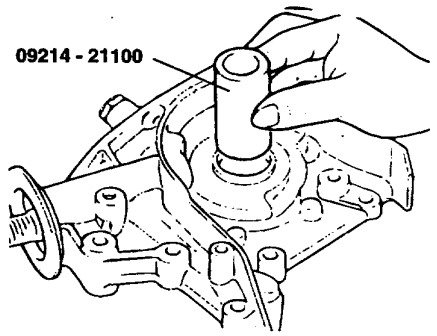
Tightening torque :
20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)
Length
A : 30 mm (1.18 in.)
B : 45 mm (1.77 in.)
C : 60 mm (2.36 in.)
D : 22 mm (0.89 in.)



ECKA020E

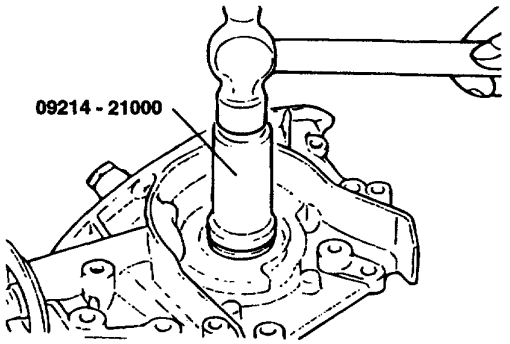
OIL SEAL

1. Using the special tool, Crankshaft oil seal guide(09214 - 21100), install the oil seal.



EDDA018B

2. Using the special tool, Crankshaft front oil seal installer (09214-21000), install the oil seal.

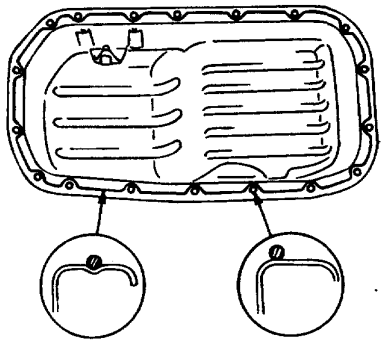


EDDA018C

3. Install the oil screen.
4. Clean both gasket surfaces of the oil pan and the cylinder block.
5. Apply sealant into the groove of the oil pan flange as shown.

⚠ ***CAUTION***

- ***Apply sealant approx. 4mm (0.16 in.) in thickness.***
- ***After application of sealant, do not exceed 15 minutes before installing the oil pan.***



ECDA018D

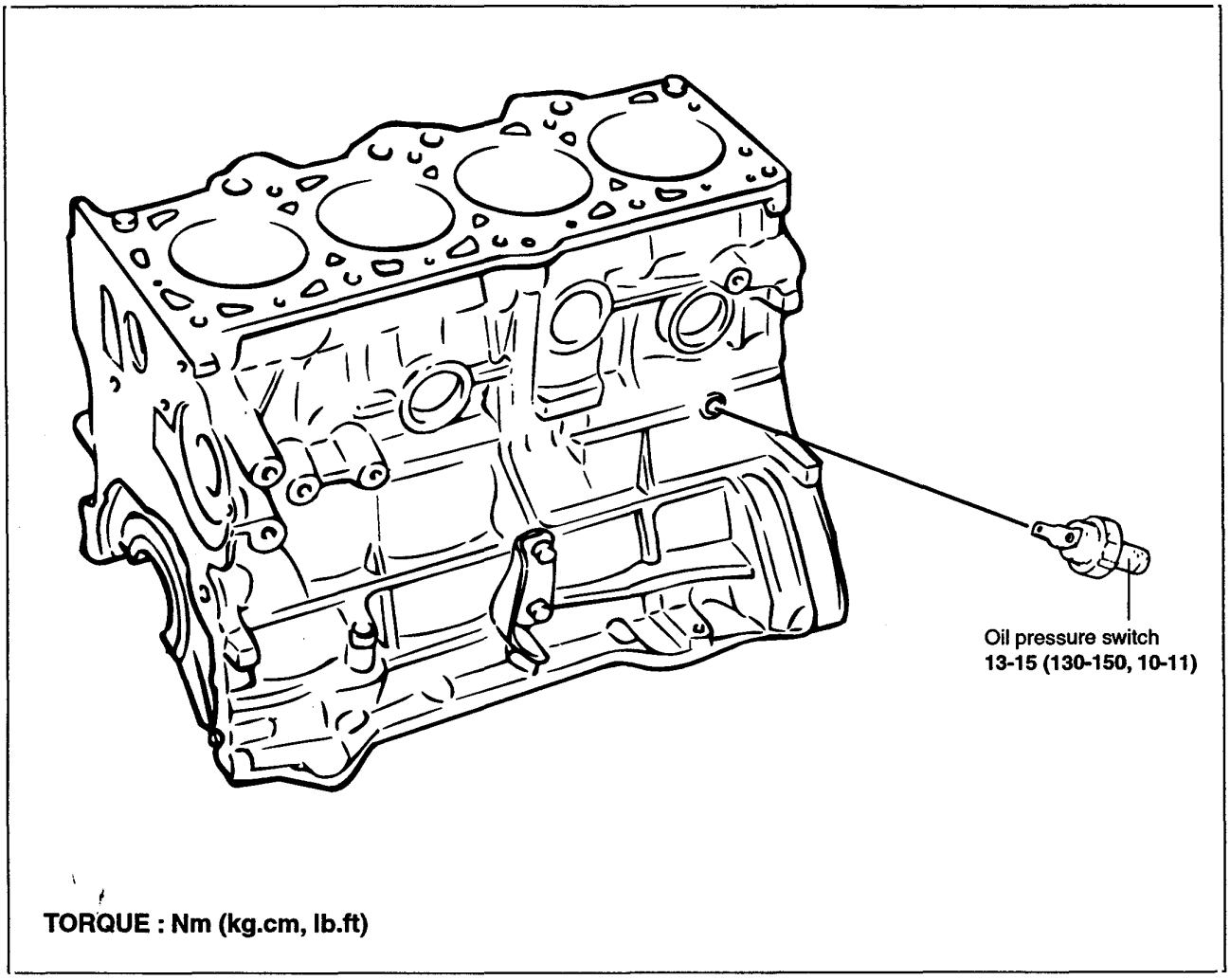
6. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque
Oil pan bolt : 10 ~ 12 Nm (100 ~ 120 kg.cm, 7 ~ 9 lb.ft)

ENGINE BLOCK

ENGINE BLOCK

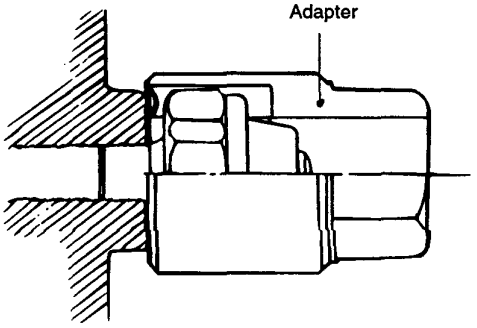
COMPONENTS E362FF2F



V5EM104B

DISASSEMBLY EE96372F

1. Remove the timing belt, cylinder head, front case, flywheel, pistons and crankshaft.
2. Remove the oil pressure switch.



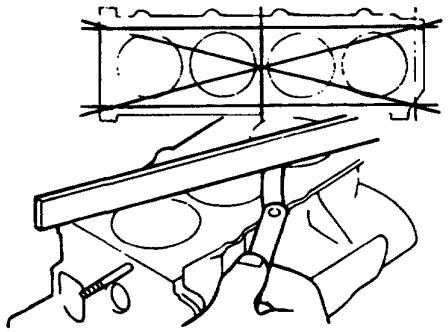
EDDA008A

INSPECTION EBADEC3C

1. Check the engine block for scores, rust and corrosion. Also check for cracks or any other defects. Replace the block if defective.

2. Using a straight edge and feeler gauge, check the top surface of the block for warpage. Make sure that the surface is free from gasket chips or other foreign material.

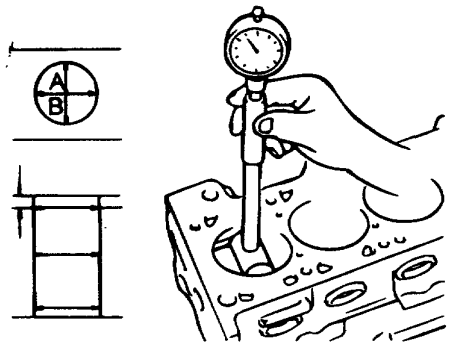
Standard : 0.03 mm (0.0012 in.) or less
Limit : 0.15 mm (0.0059 in.) or less



ECA9450B

3. Measure the cylinder bore with a cylinder gauge at three levels in the direction of A and B. If the cylinder bores show more than the specified out-of-round or taper or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed. Oversize pistons and rings must be fitted.

Cylinder I.D : 76.5 ~ 76.53 mm (3.0118 ~ 3.0130 in.)
Cylinder I.D taper : 0.01 mm (0.0004 in.) or less



EDDA085B

4. If a cylinder ridge exists, cut away with a ridge reamer.

5. Oversize pistons are available in four sizes.

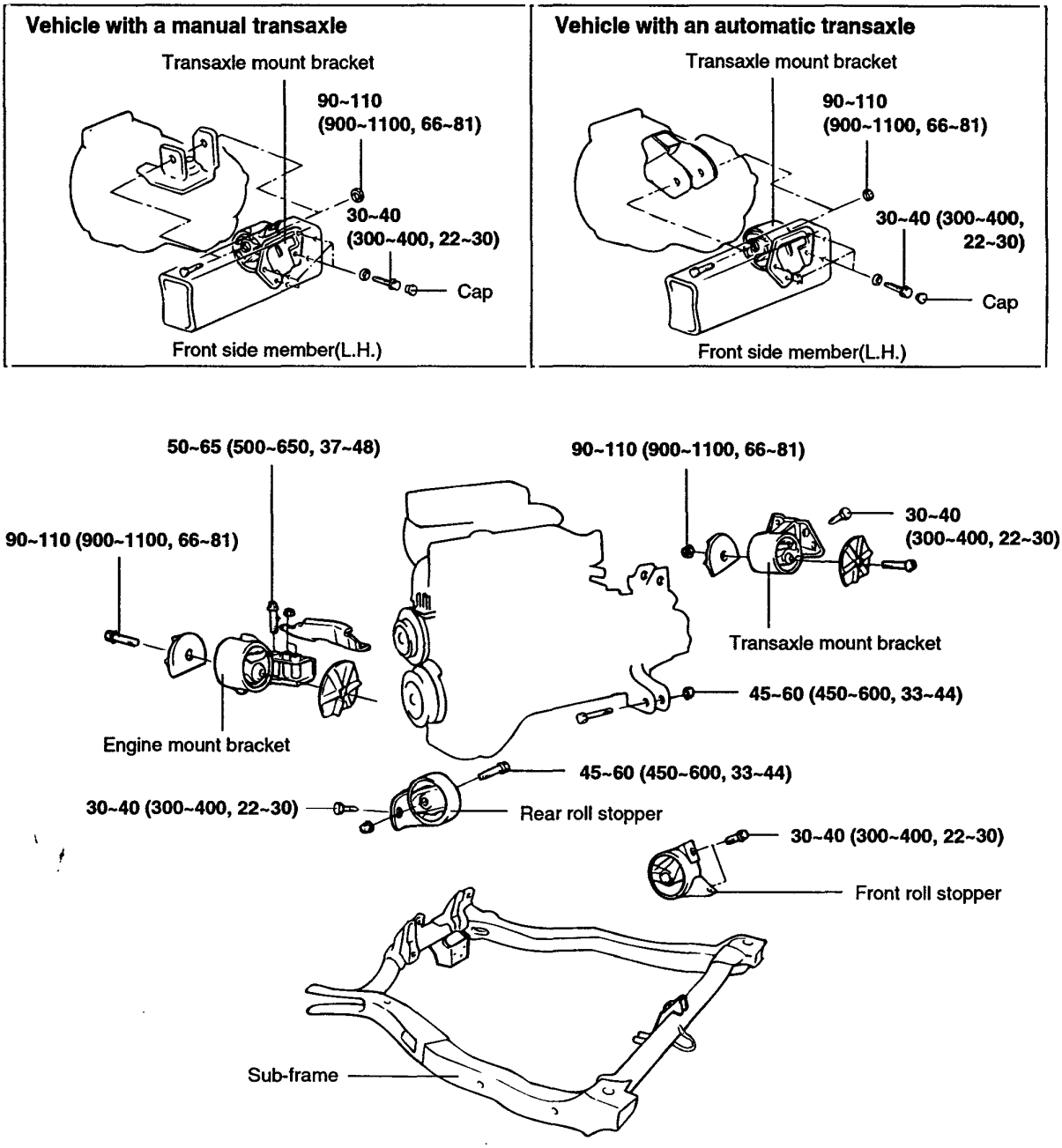
Pistom service size and mark mm (in.)
0.25 (0.010) O.S. : 0.25
0.50 (0.020) O.S. : 0.50
0.75 (0.030) O.S. : 0.75
1.00 (0.039) O.S. : 1.00

6. When boring the cylinder to the oversize, maintain the specified clearance between the oversize piston and the bore, and make sure that all pistons used are the same oversize.
The standard measurment of the piston's outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Piston - to - cylinder clearance :
0.025 ~ 0.045 mm (0.0010 ~ 0.0018 in.)

ENGINE MOUNTS

COMPONENTS E89C5244

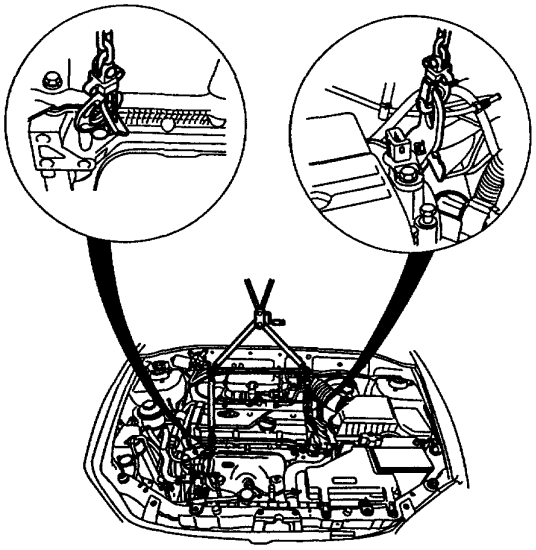


TORQUE : Nm (kg·cm, lb·ft)

ECDA011D

REMOVAL E1CA6FC7

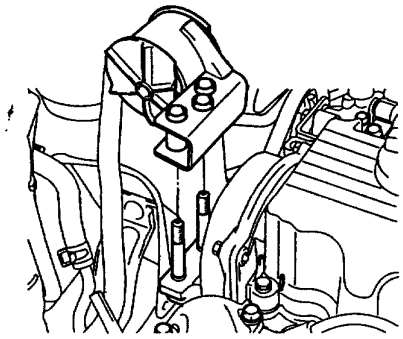
Attach an engine hoist to the engine hooks, and raise the engine just enough so that there is no pressure on the insulators.



KCDC020B

ENGINE MOUNTING

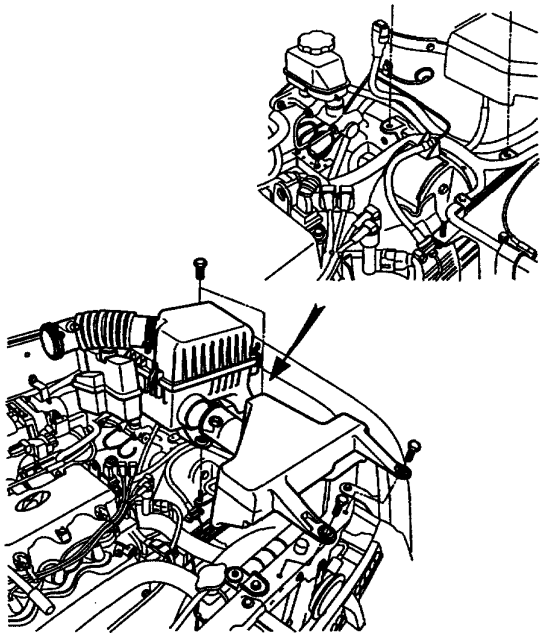
Remove the engine mounting support bracket from the engine.



KDDC003B

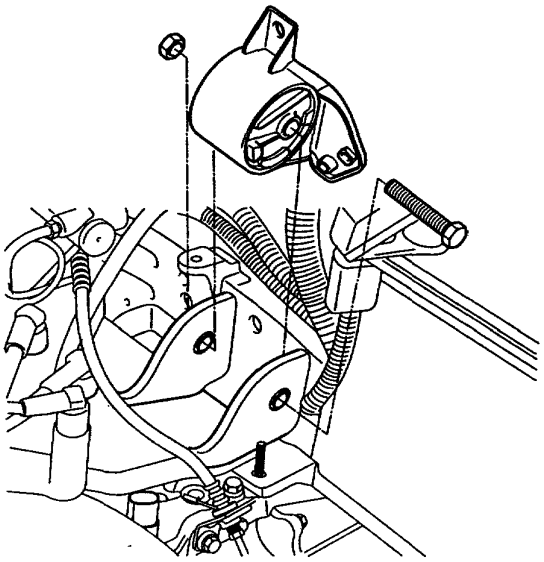
TRANSMISSION MOUNTING

1. Remove the air cleaner.



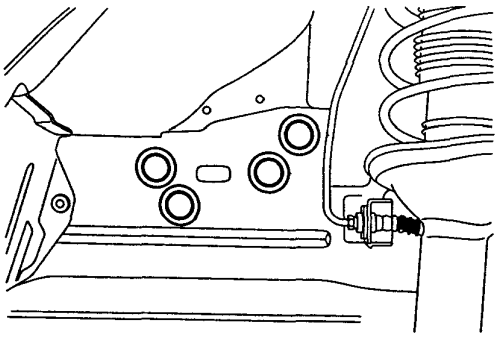
KDDC010B

2. Remove the transmission mounting bolt. (17 mm)



KDDC015D

3. Detach the cap from inside the right fender shield. Remove the transmission mounting bolts. (14 mm)

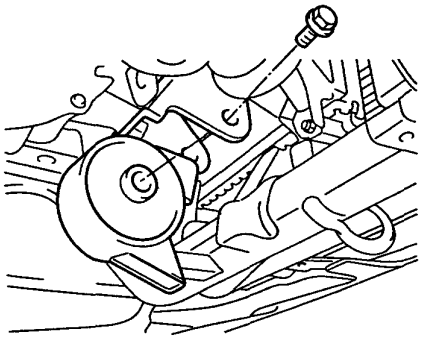


KDDC012B

4. Remove the transmission bracket.

FRONT ROLL STOPPER BRACKET

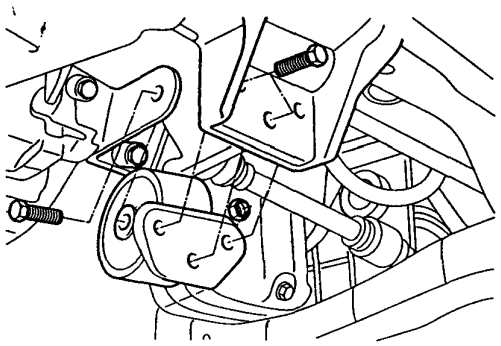
Remove the roll rod bracket from the cross member.



KDDC015B

REAR ROLL STOPPER BRACKET

Remove the rear roll stopper bracket from the sub frame.

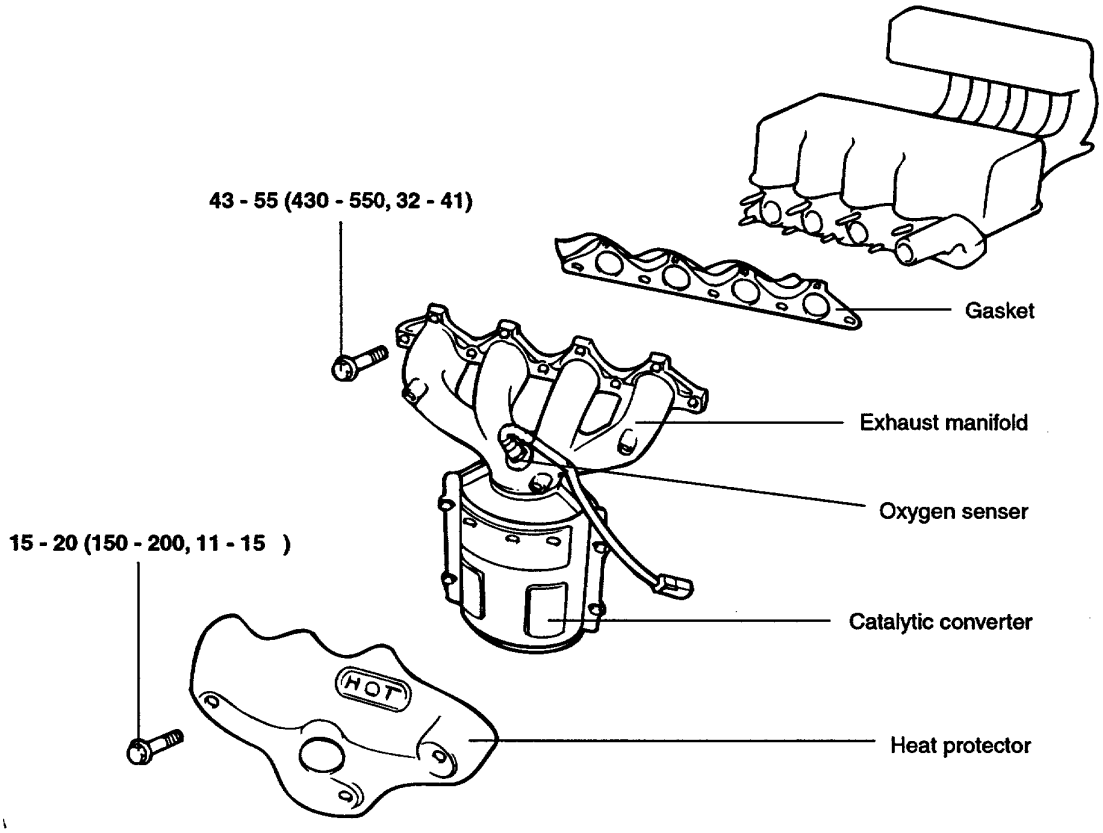


KDDC015C

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS E6FBC7D4

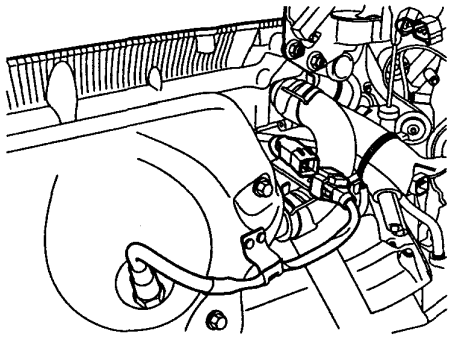


TORQUE : Nm (kg.cm, lb.ft)

ECKA050A

DISASSEMBLY EAA67563

1. Disconnect the oxygen sensor connect.



KDPC007D

2. Remove the exhaust manifold heat protector.
3. Remove the exhaust manifold assembly from the cylinder head.
4. Remove the exhaust manifold gasket.

INSPECTION ED2622EE

EXHAUST MANIFOLD

1. Check for damage or cracking.
2. Check for damage or cracking of welding between exhaust manifold and converter.

REASSEMBLY E1BC9FEF

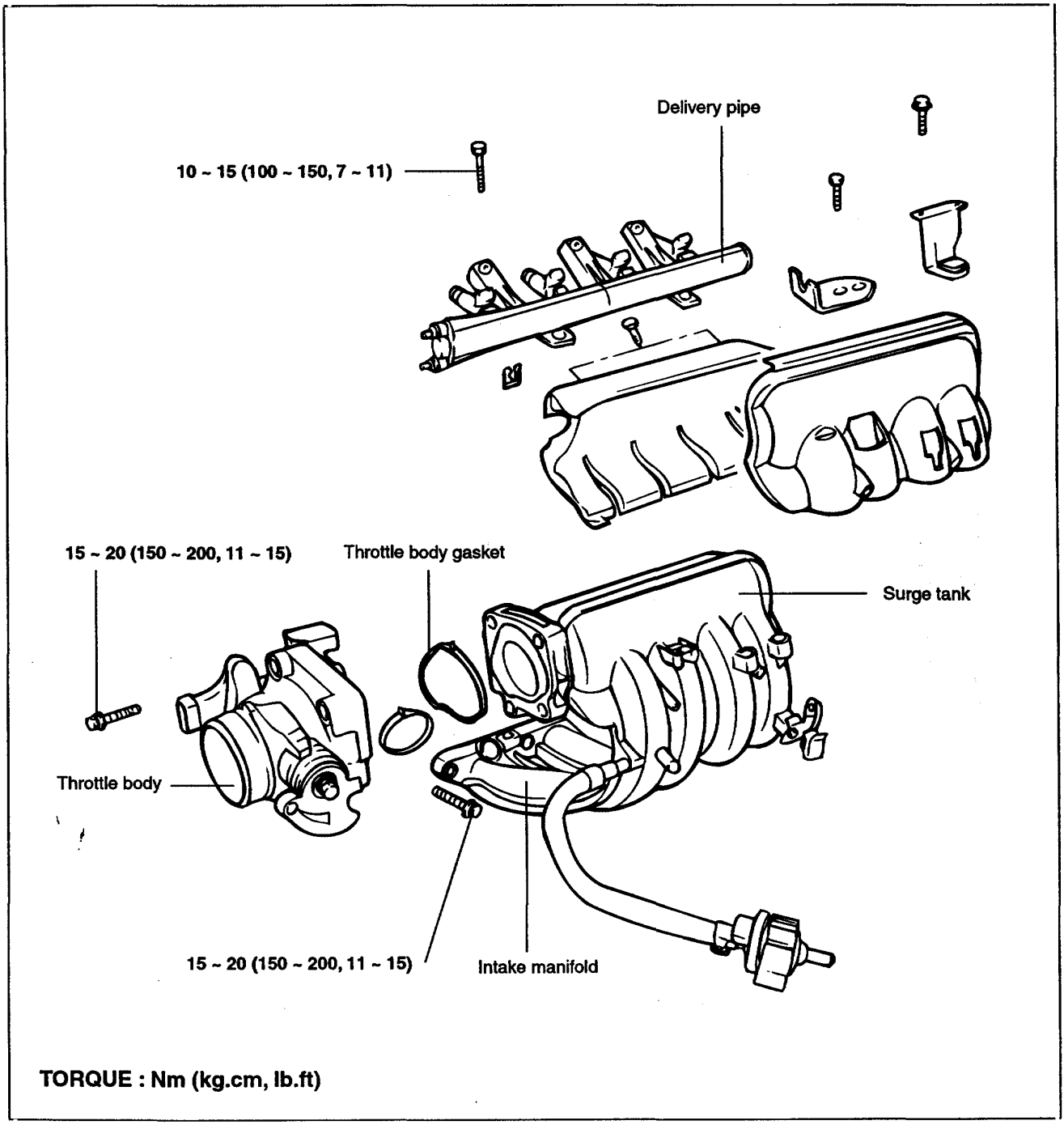
Install the exhaust manifold in the reverse order of removal.

⚠ ***CAUTION***

Replace the exhaust manifold gasket and lock nut when reassembling.

INTAKE MANIFOLD

COMPONENTS EF98EE9D

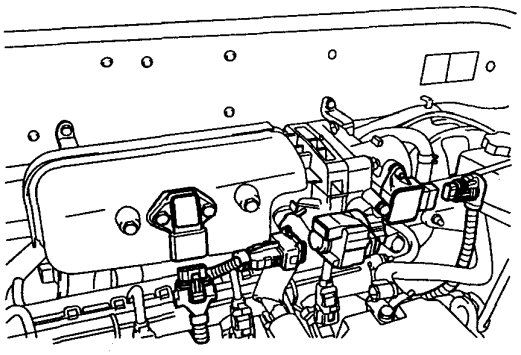


TORQUE : Nm (kg.cm, lb.ft)

ECDA087A

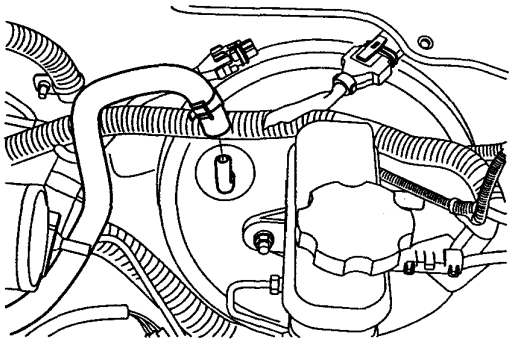
REMOVAL E2211C9C

1. Disconnect the MAP, ISA and TPS connect.



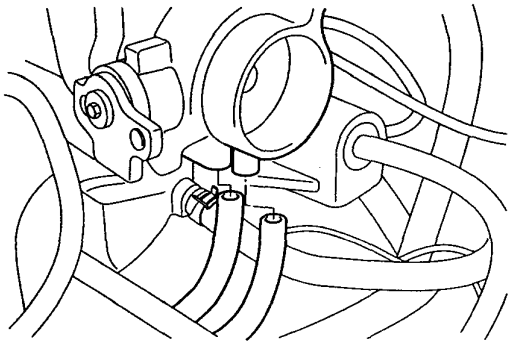
KDDC010C

2. Remove the intake air hose connected to the throttle body.
3. Remove the accelerator cable.
4. Remove the P.C.V. hose and brake booster vacuum hoses.



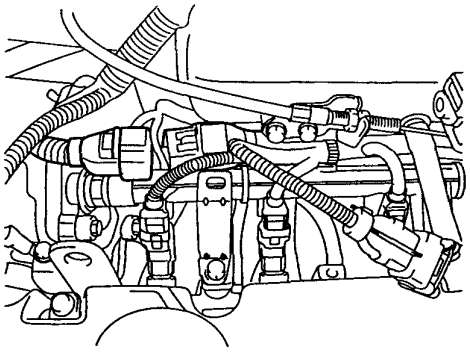
KCPC003B

5. Disconnect the coolant hose connections front the throttle body.



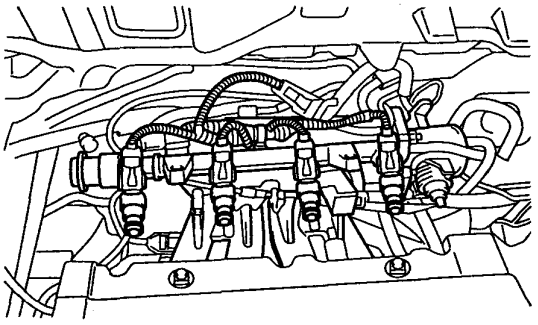
KDPC005D

6. Disconnect the fuel injector harness connector.



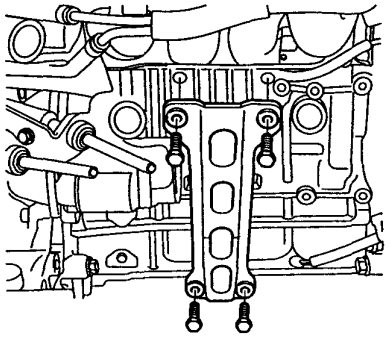
KDPC006E

7. Remove the dilivery pipe with the fuel injectors.



KDPC005C

8. Remove the intake manifold stay.



KDPC005B

9. Remove the intake manifold.
10. Remove the intake monifold assembly and gasket.

INSPECTION EC3F3909

INTAKE MANIFOLD

Check the parts for damage or cracking.

AIR HOSE

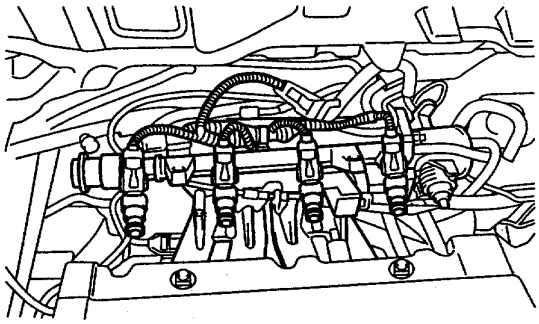
Check for damage or cracking of any part.

INSTALLATION E7C2DBAF

1. Replace the intake manifold gasket and install the intake manifold.
2. Install the intake manifold stay.
3. Install the delivery pipe with the fuel injectors.

⚠ ***CAUTION***

Be careful not to drop the injectors when removing the delivery pipe.

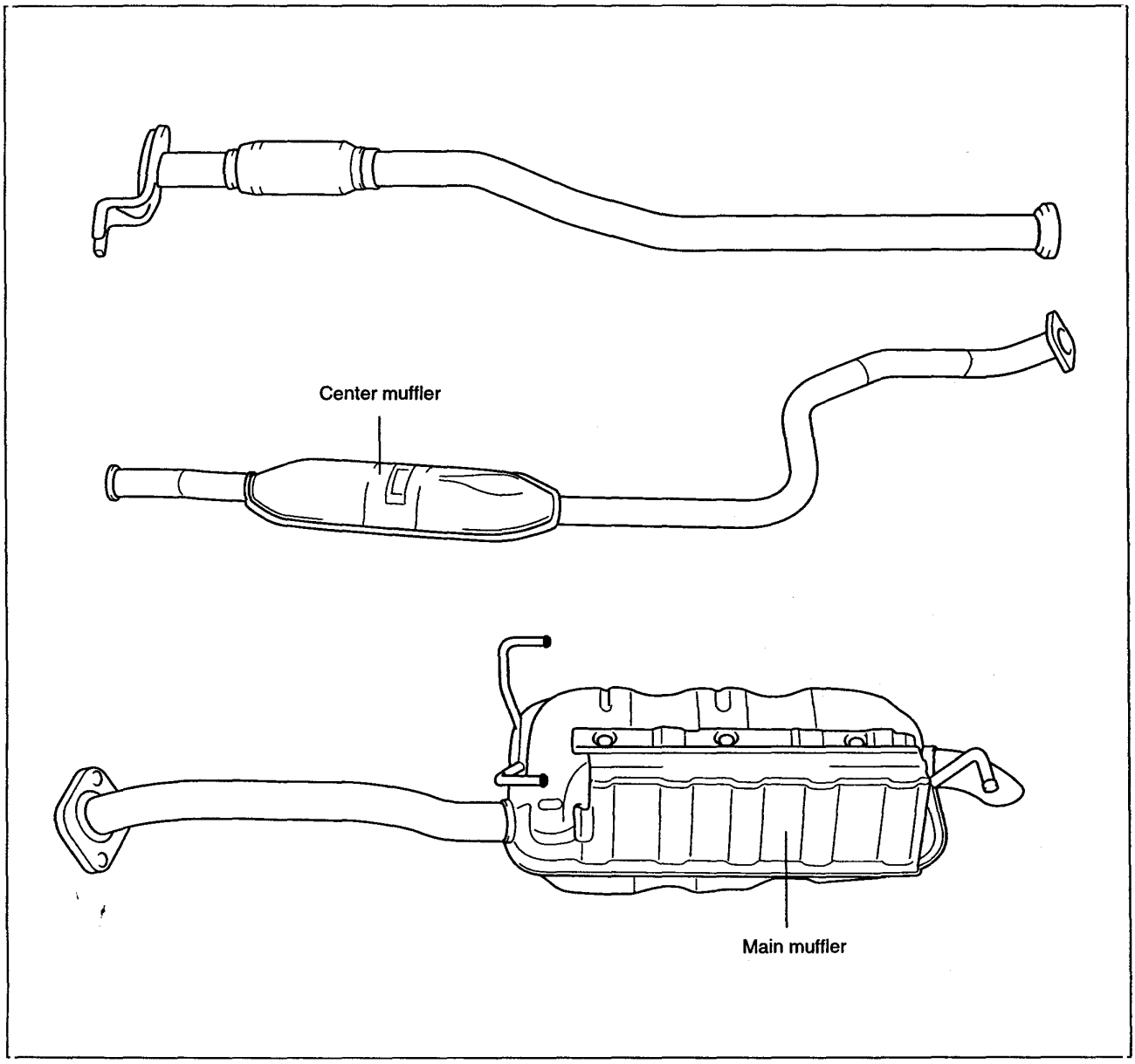


KDPC005C

4. Connect the fuel injector harmess connector.
5. Install the P.C.V hose and brake booster vacuum hose.
6. Install the intake air hose to the throttle body.
7. Install the accelorator cable.
8. Connect the ISA and TPS wire harness connector.

MUFFLER

COMPONENTS EEED4EAB



ECDD017A

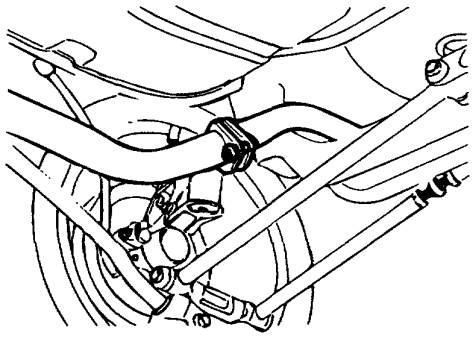
REMOVAL EAAF84BA

REAR MUFFLER

⚠ ***CAUTION***

Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

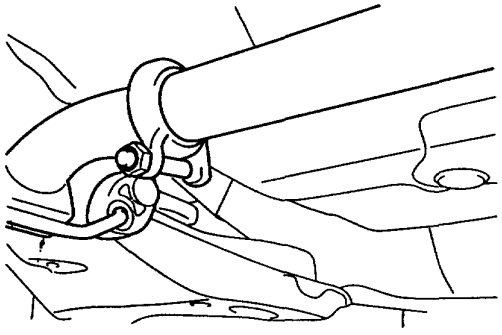
1. Disconnect the rear muffler from the center muffler.
2. Remove the rubber hangers and remove the rear muffler.



KDNB007C

CENTER MUFFLER

1. Remove the center muffler assembly from the rear muffler and front exhaust pipe.

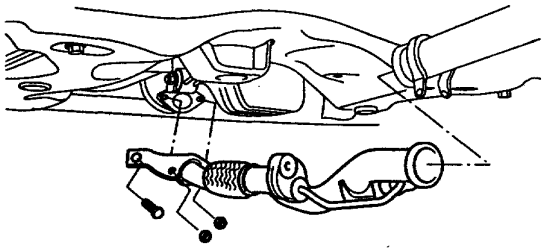


KDPC007C

2. Remove the rubber hanger, then remove the center muffler.

FRONT EXHAUST PIPE

1. Remove the front exhaust pipe clamp bolts. and remove the front exhaust pipe nuts from the catalytic converter.
2. Remove the front exhaust pipe and center muffler bolt.



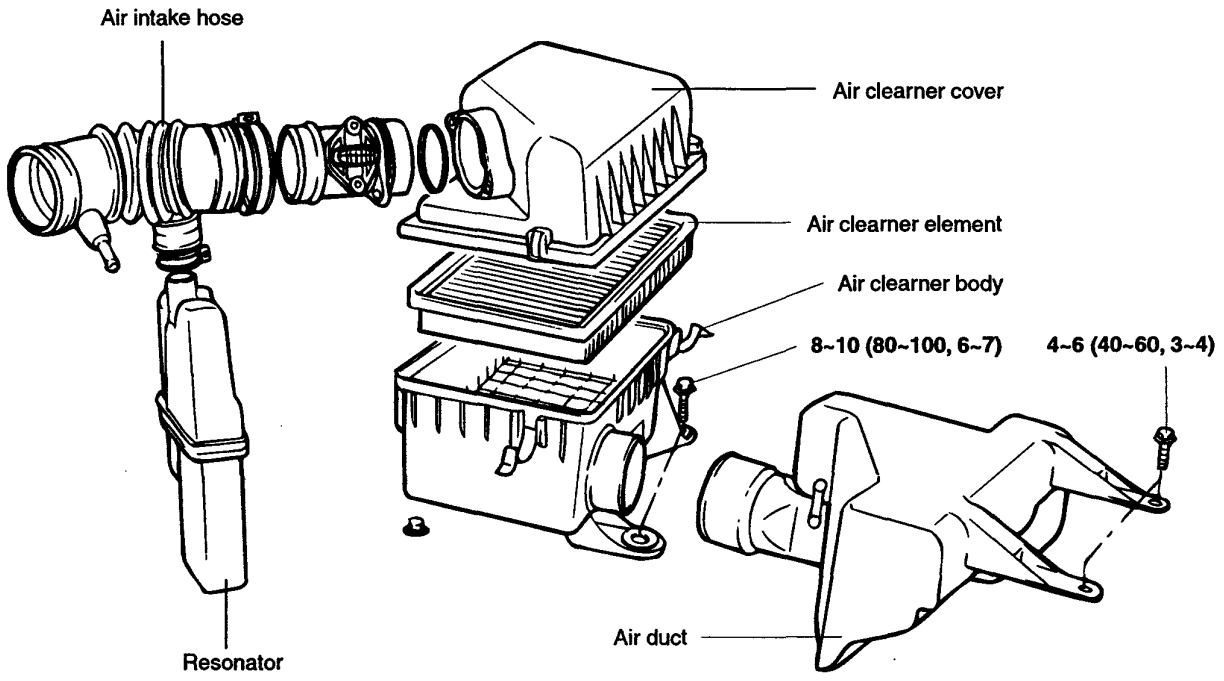
KCPC003G

INSTALLATION E61A3B25

1. Temporarily install the front exhaust pipe, the center exhaust pipe, and the rear muffler, in that order.
2. Tighten the parts securely. Make sure there is no interference with any body components.

AIR CLEANER (ACL)

COMPONENTS EB17093D

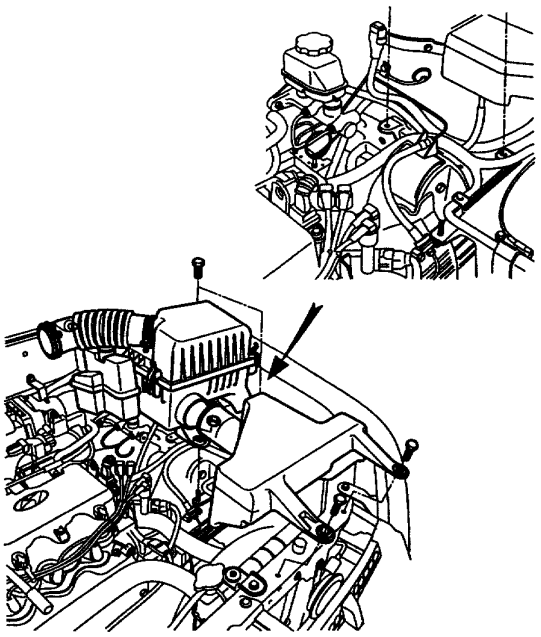


TORQUE : Nm (kg.cm, lb.ft)

ECDA095A

REMOVAL E98AF6C2

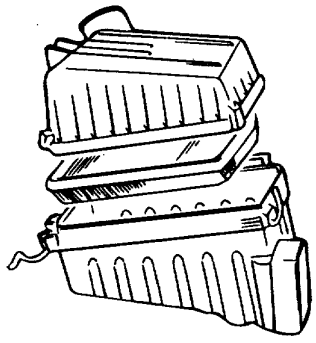
1. Remove the air duct connected to the air cleaner.
2. Remove the air intake hose at the air cleaner side.
3. Remove the air cleaner cover and filter.
4. Remove the air cleaner mounting bolts and remove the air cleaner.



KDDC010B

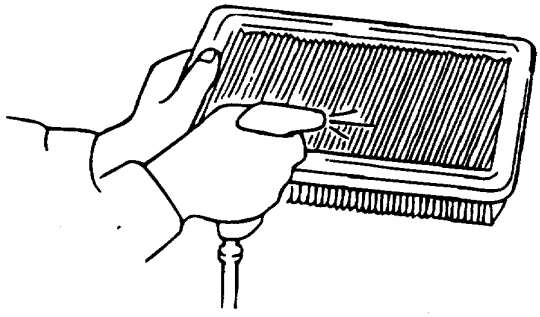
INSPECTION EFBD7BD6

1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.
2. Check the air duct for damage.
3. Check the resonator for distortion or damage.



ECKA060B

4. Check the air cleaner filter for restriction, contamination or damage. If the filter is slightly restricted, remove the dust and other contamingnts by blowing compressed air from the upper side through the filter.



EDDA080B

5. Check the air cleaner housing for restrictions, contamination or damage.

INSTALLATION E31D2C41

Install the air cleaner assembly following the reverse order of removal.

Engine SOHC

GENERAL
- SPECIFICATION ..... EMA -2
- SPECIAL TOOLS ..... EMA -17
- TROUBLE SHOOTING ..... EMA -19
- ENGINE AND TRANSAXLE ASSEMBLY ..... EMA -21

TIMING SYSTEM
- TIMING BELT
  - COMPONENTS ..... EMA -28
  - DISASSEMBLY ..... EMA -29
  - INSPECTION ..... EMA -30
  - REASSEMBLY ..... EMA -32

CYLINDER HEAD ASSEMBLY
- CYLINDER HEAD
  - COMPONENTS ..... EMA -34
  - DISASSEMBLY ..... EMA -35
  - INSPECTION ..... EMA -36
  - REASSEMBLY ..... EMA -37
- ROCKER ARM
  - COMPONENTS ..... EMA -38
  - DISASSEMBLY ..... EMA -38
  - INSPECTION ..... EMA -39
  - REASSEMBLY ..... EMA -41
- VALVES
  - COMPONENTS ..... EMA -42
  - DISASSEMBLY ..... EMA -43
  - INSPECTION ..... EMA -43
  - REASSEMBLY ..... EMA -46

MAIN MOVING SYSTEM
- CAM SHAFT
  - COMPONENTS ..... EMA -48
  - DISASSEMBLY ..... EMA -49
  - INSPECTION ..... EMA -50
  - REASSEMBLY ..... EMA -50
- CRANK SHAFT
  - COMPONENTS ..... EMA -52
  - DISASSEMBLY ..... EMA -53
  - INSPECTION ..... EMA -53
  - REPLACEMENT ..... EMA -54
  - REASSEMBLY ..... EMA -55
- FLY WHEEL
  - COMPONENTS ..... EMA -57
  - DISASSEMBLY ..... EMA -57
  - INSPECTION ..... EMA -57
  - REASSEMBLY ..... EMA -57
- PISTON
  - COMPONENTS ..... EMA -58
  - DISASSEMBLY ..... EMA -59
  - INSTALLATION ..... EMA -59
  - INSPECTION ..... EMA -60
  - REPLACEMENT ..... EMA -61
  - REASSEMBLY ..... EMA -62

COOLING SYSTEM
- ENGINE COOLANT HOST/PIPES
  - COMPONENTS ..... EMA -64
  - INSPECTION ..... EMA -64
  - REASSEMBLY ..... EMA -65
- ENGINE COOLANT PUMP
  - COMPONENTS ..... EMA -66
  - DISASSEMBLY ..... EMA -66
  - INSPECTION ..... EMA -67
  - REASSEMBLY ..... EMA -67
- RADIATOR
  - DISASSEMBLY ..... EMA -68
  - INSPECTION ..... EMA -69
  - REASSEMBLY ..... EMA -69
- RADIATOR CAP
  - COMPONENTS ..... EMA -70
  - INSPECTION ..... EMA -71
- THERMOSTAT
  - COMPONENTS ..... EMA -72
  - INSPECTION ..... EMA -72
  - REASSEMBLY ..... EMA -73

LUBRICATION SYSTEM
- OIL PUMP
  - COMPONENTS ..... EMA -74
  - DISASSEMBLY ..... EMA -75
  - INSPECTION ..... EMA -75
  - REASSEMBLY ..... EMA -76
  - OIL PRESSURE SWITCH ..... EMA -77

ENGINE BLOCK
- ENGINE BLOCK
  - COMPONENTS ..... EMA -78
  - INSPECTION ..... EMA -79
- ENGINE MOUNTS
  - COMPONENTS ..... EMA -80
  - REMOVAL ..... EMA -81

INTAKE AND EXHAUST SYSTEM
- EXHAUST MANIFOLD
  - COMPONENTS ..... EMA -83
  - INSPECTION ..... EMA -84
- INTAKE MANIFOLD
  - COMPONENTS ..... EMA -85
  - REMOVAL ..... EMA -86
  - INSPECTION ..... EMA -87
  - INSTALLATION ..... EMA -87
- MUFFLER
  - COMPONENTS ..... EMA -88
  - REMOVAL ..... EMA -89
  - INSPECTION ..... EMA -89
  - INSTALLATION ..... EMA -89
- AIR CLEANER (ACL)
  - COMPONENTS ..... EMA -90
  - REMOVAL ..... EMA -91
  - INSPECTION ..... EMA -91
  - INSTALLATION ..... EMA -91

GENERAL

SPECIFICATIONS EF5CBAD1

	SPEC	LIMIT
General		
Type	In-line, SOHC	
No. of cylinder	4	
Bore		
1.3 L	71.5 mm (2.81 in.)	
1.5 L	75.5 mm (2.97 in.)	
Stroke	83.5 mm (3.29 in.)	
Total displacement		
1.3 L	1341 cc	
1.5 L	1495 cc	
Compression ratio		
1.3 L	9.5	
1.5 L	10.0	
Firing order	1 - 3 - 4 - 2	
Valve timing		
Intake valve opens (BTDC)	12°	
Intake valve closes (ABDC)	52°	
Exhaust valve opens (BBDC)	52°	
Exhaust valve closes (ATDC)	12°	
Valve overlap	24°	
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.08 mm (0.00315 in.)
Flatness of manifold mount'g surface	Max. 0.15 mm (0.0059 in.)	0.3 mm (0.0118 in.)
Dimension for reworking oversize valve seat hole		
Intake		
0.03 O.S.	28.8 ~ 28.821 mm (1.134 ~ 1.135 in.)	
0.06 O.S.	29.1 ~ 29.121 mm (1.146 ~ 1.1467 in.)	
Exhaust		
0.03 O.S.	34.3 ~ 34.325 mm (1.350 ~ 1.351 in.)	
0.06 O.S.	34.6 ~ 34.625 mm (1.362 ~ 1.363 in.)	
Valve guide hole diameter (intake/exhaust)		
0.05 O.S.	11.05 ~ 11.068 mm (0.435 ~ 0.436 in.)	
0.25 O.S.	11.25 ~ 11.268 mm (0.443 ~ 0.4436in.)	
0.50 O.S.	11.50 ~ 11.518 mm (0.453 ~ 0.4535in.)	
Camshaft		
Cam height intake	42.8575 mm (1.687 in.)	42.3575 mm (1.667 in.)
Cam height exhaust	42.7354 mm (1.682 in.)	42.2624 mm (1.664 in.)
Journal diameter	30 mm (1.181 in.)	
Bearing oil clearance	0.045 ~ 0.085 mm (0.0018 ~ 0.0033 in.)	
End play	0.07 ~ 0.28 mm (0.0027 ~ 0.011 in.)	

	SPEC	LIMIT
Crankshaft		
Journal diameter	50 mm (1.97 in.)	
Pin diameter	45 mm (1.77 in.)	
Bend	0.03 mm (0.0018 in.)	
Out of roundness of journal and pin	Max. 0.005	
Taper of journal and pin	Max. 0.005	
End play	0.05 ~ 0.175 mm (0.002 ~ 0.007 in.)	0.25 mm (0.0098 in.)
Undersize of Pin		
0.25	44.725 ~ 44.740 mm (1.76 ~ 1.761 in.)	
0.50	44.475 ~ 44.490 mm (1.75 ~ 1.751 in.)	
0.75	44.225 ~ 44.240 mm (1.74 ~ 1.741 in.)	
Undersize of Journal		
0.25	49.727 ~ 49.742 mm (1.957 ~ 1.958in.)	
0.50	49.477 ~ 49.492 mm (1.948 ~ 1.9485in.)	
0.75	49.227 ~ 49.242 mm (1.938 ~ 1.9386in.)	
Main bearing oil clearance		
No. 1,2,4,5	0.022 ~ 0.040 mm (0.0086 ~ 0.0016 in.)	0.1 mm (0.00394 in.)
No. 3.	0.028 ~ 0.046 mm (0.0011 ~ 0.0018 in.)	
Valve		
Stem diameter		
Intake	5.955 ~ 5.97 mm (0.234 ~ 0.235 in.)	
Exhaust	5.935 ~ 5.95 mm (0.2336 ~ 0.234 in.)	
Face angle	45° ~ 45.5°	
Thickness of valve head (margin)		
Intake	1.1 mm (0.043 in.)	0.8mm (0.031in.)
Exhaust	1.3 mm (0.051 in.)	1 (0.039 in.)
Valve stem to valve guide clearance		
Intake	0.03 ~ 0.06 mm (0.0012 ~ 0.0024 in.)	0.1 mm (0.0039 in.)
Exhaust	0.05 ~ 0.08 mm (0.0020 ~ 0.0031 in.)	0.15 mm (0.006 in.)
Valve guide		
Length		
Intake	12.8 mm (0.504 in.)	
Exhaust	12.8 mm (0.504 in.)	
Service oversize	0.05, 0.25, 0.50	
Valve seat		
Width of seat contact		
Intake	0.8 ~ 1.2 mm (0.031 ~ 0.047 in.)	
Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.067 in.)	
Seat angle	45°	
Service oversize	0.3, 0.6	
Valve spring		
Free length (Installed height)	44 mm (1.732 in.)	
Load	21.6kg/35mm, 45.1kg/27.2mm	
Out of squareness	Max 1.5	
Cylinder block		
Cylinder bore		
1.3 L	71.5 ~ 71.53 mm (2.815 ~ 2.816 in.)	
1.5 L	75.5 ~ 75.53 mm (2.9724 ~ 2.9736 in.)	
Out of roundness of cylinder bore	Max. 0.01	
Taper of cylinder bore	-	
Flatness of gasket surface	Max. 0.05	0.1 mm (0.0039 in.)

	SPEC	LIMIT
Piston		
Dameter		
1.3 L	71.47 ~ 71.50 mm (2.814 ~ 2.815 in.)	
1.5 L	75.47 ~ 75.50 mm (2.9713 ~ 2.9724 in)	
Piston to cylinder clearance	0.02 ~ 0.04 mm (0.0078 ~ 0.00157 in.)	
Piston ring		
No. of rings per piston	3	
Compression ring	2	
Oil ring	1	
Compression ring type		
No. 1	Inside bevel type, steel	
No. 2	Taper type	
Oil ring type	3-piece type	
Side clearance		
No. 1	0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	0.1 mm (0.00394 in.)
No. 2	0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	0.1 mm (0.00394 in.)
Oil ring	0.06 ~ 0.15 mm (0.0023 ~ 0.006 in.)	
End gap		
No. 1	0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.)	1 mm (0.0394 in.)
No. 2	0.30 ~ 0.45 mm (0.012 ~ 0.0177 in.)	1 mm (0.0394 in.)
Oil ring side rail	0.2 ~ 0.7 mm (0.008 ~ 0.028 in.)	1 mm (0.0394 in.)
Sevice oversize	0.25, 0.50, 0.75, 1.0	
Connecting rod		
Bend	Max. 0.05 per 100 mm	
Twist	Max. 0.1 per 100mm	
Connecting rod big end to crankshaft side clearance	0.10 ~ 0.25 mm (0.004 ~ 0.01 in.)	0.4mm(0.016in.)
Piston pin press in load	1250 ± 500 kg	
Bearing oil clearance	0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)	0.1mm(0.0039in.)
Flywheel		
Runout	0.1mm (0.0014 in.)	0.13mm (0.005in.)
Oil pressure at curb idle speed (oil temp. 90~110°C)	1.5kg/cm²	
Oil pump		
Clearance between outer circum-ference and front	0.12 ~ 0.18 mm (0.0047 ~ 0.0071 in.)	
Clearance between rotor axial side and front case	0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	
Tip clearance between outer and inner rotor	0.025 ~ 0.069 mm (0.0010 ~ 0.0027 in.)	
Relief spring		
Free length	46.6 mm (1.8346 in.)	
Load	6.1kg at 40.1 mm (13.4216 at 1.578 in.)	
Cooling method	Water-cooled, Pressurized, Forced circulation with electrical fan	
Cooling sys. Quantity		
1.3 L	6.2 lit (6.55 U.S qts 5.46 Imp qts)	
1.5 L	6.5 lit (6.87 U.S. qut, 5.72 Imp qts)	

	SPEC	LIMIT
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temp.	82°C	
Opening temp. range	80.5 ~ 83.5°C	
Wide opening temp.	95°C	
Radiator cap		
Main valve opening pressure	86.1 ~ 124.5 kpa	
Main valve colseing pressure	83.4 kpa	
Vacuum valve opening preesur	-86.6 kpa	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension sys.	Rubber hanger type	

TIGHTENING TORQUE (1.3 /1.5 L)

Item	Nm	kg.cm	lb.ft
Cylinder Block			
Left engine support bracket bolt	30 ~ 42	300 ~ 420	22 ~ 31
Oil pressure switch	13 ~ 15	130 ~ 150	9.6 ~ 11
Cylinder head			
Cylinder head bolt	(23 ~ 27) + (60° ~ 62°) + (60° ~ 62°)	(230 ~ 270) + (60° ~ 62°) + (60° ~ 62°)	(17 ~ 20) + (60° ~ 62°) + (60° ~ 62°)
Intake/manifold bolts or nuts	15 ~ 20	150 ~ 200	11 ~ 15
Exhaust manifold nut	15 ~ 20	150 ~ 200	11 ~ 15
Recker cover bolt	8 ~ 10	80 ~ 100	6 ~ 7
Recker arm shaft bolt	20 ~ 24	20 ~ 240	15 ~ 18
Camshaft bolt	20 ~ 27	200 ~ 270	15 ~ 20
Rear plate bolt	8 ~ 10	80 ~ 100	6 ~ 7
Main Moving parts			
Connecting rod cap nut	32 ~ 35	320 ~ 350	24 ~ 26
Crankshaft bearing cap bolt	55 ~ 60	550 ~ 600	41 ~ 44
Flywheel M/T bolt	130 ~ 140	1300 ~ 1400	96 ~ 103
Drive plate A/T bolt	130 ~ 140	1300 ~ 1400	96 ~ 103
Timing Belt			
Crankshaft sprocket bolt	140 ~ 150	1400 ~ 1500	103 ~ 111
Camshaft sprocket bolt	80 ~ 100	800 ~ 1000	59 ~ 74
Timing belt tensioner bolt	20 ~ 27	200 ~ 270	15 ~ 20
Timing belt cover bolt	10 ~ 12	100 ~ 120	7 ~ 9
Front case bolt	12 ~ 15	120 ~ 150	9 ~ 11
Engine Mounting			
Engine mounting insulator bolt	90 ~ 110	900 ~ 1100	66.4 ~ 81.1
Engine mounting bracket to engine nuts and bolts	50 ~ 65	500 ~ 650	36.9 ~ 48.0
Transaxle mount insulator bolt	90 ~ 110	900 ~ 1100	66.4 ~ 81.1
Transaxle insulator bracket to side member bolts	30 ~ 40	300 ~ 400	22.1 ~ 29.5
Front roll stoper insulator bolt	45 ~ 60	450 ~ 600	33.2 ~ 44.3
Front roll stoper bracket to sub-frame bolt	30 ~ 40	300 ~ 400	22.1 ~ 29.5
Rear roll stoper insulator bolt	45 ~ 60	4520 ~ 600	33.2 ~ 44.3
Rear roll stoper bracket to sub-frame bolt	30 ~ 40	300 ~ 400	22.1 ~ 29.5
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Oil pan bolts	6 ~ 8	60 ~ 80	4 ~ 6
Oil pan drain plug	35 ~ 45	350 ~ 450	26 ~ 33
Oil screen bolts	15 ~ 22	150 ~ 220	11 ~ 16
Timing belt upper cover bolts	10 ~ 12	100 ~ 120	7 ~ 9
Timing belt lower cover bolts	10 ~ 12	100 ~ 120	7 ~ 9
Surge tank to inlet manifold nuts and bolts	15 ~ 20	150 ~ 200	11 ~ 15
Alternator support and nut	20 ~ 25	200 ~ 250	15 ~ 18
Alternator lock bolt	15 ~ 22	150 ~ 220	11 ~ 16
Alternator brace mounting bolt	20 ~ 28	200 ~ 280	15 ~ 21

Item	Nm	kg.cm	lb.ft
Cooling system			
Coolant pump pulley	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolt	12 ~ 15	120 ~ 150	9 ~ 11
Coolant temperature gauge unit	10 ~ 12	100 ~ 120	7 ~ 9
Coolant temperature sensor	15 ~ 20	150 ~ 200	11 ~ 15
Coolant outlet fitting bolt	17 ~ 20	170 ~ 200	13 ~ 15
Thermostat housing bolt	15 ~ 20	150 ~ 200	11 ~ 15
Intake and Exhaust system			
Air cleaner body mounting bolts	8 ~ 10	80 ~ 100	6 ~ 7
Resonator mounting bolts	4 ~ 6	40 ~ 60	2.9 ~ 4.3
Throttle body to surge tank bolts	15 ~ 20	150 ~ 200	11 ~ 15
Oxygen sensor to exhaust manifold	50 ~ 60	500 ~ 600	37 ~ 44
Front exhaust pipe to exhaust manifold nuts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe bracket bolts	30 ~ 40	300 ~ 400	22 ~ 30
Front exhaust pipe to cataiytic converter bolts	40 ~ 60	400 ~ 600	30 ~ 44

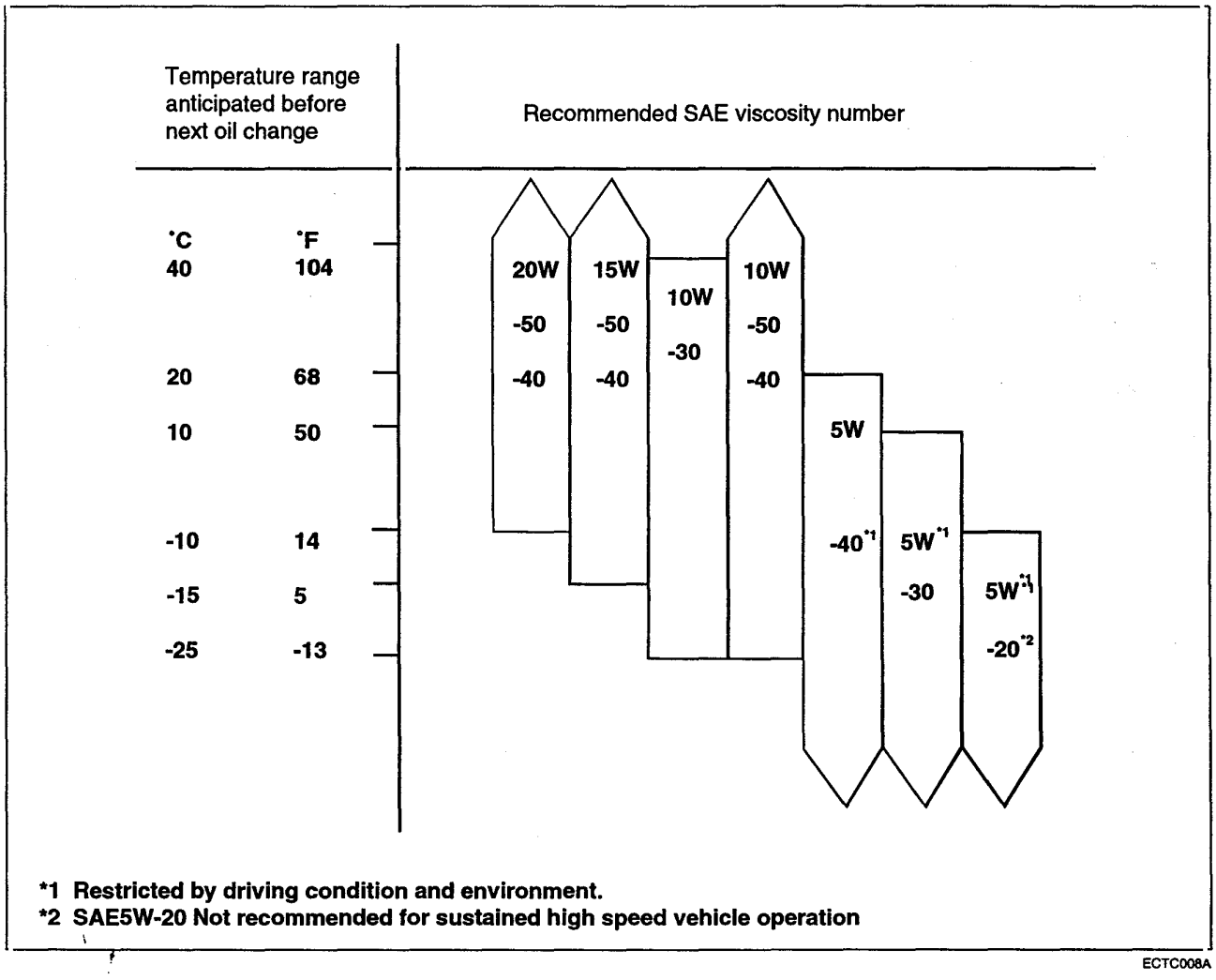
M/T : Manual Transaxle

A/T : Automatic Transaxle

SELECTION OF ENGINE OIL

Recommended API classification : SH OR ABOVE SG

Recommended SAE viscosity grades :



***1 Restricted by driving condition and environment.**
***2 SAE5W-20 Not recommended for sustained high speed vehicle operation**

ECTC008A

NOTE

For best performance and maximum protection of all types of operation, select only those lubricants below :

1. *Satisfy the requirements of the API classification.*
2. *Have proper SAE grade number for expected ambient temperature range.*

Lubricant that does not have both an SAE grade number and an API service classification on the container should not be used.

MAINTENANCE

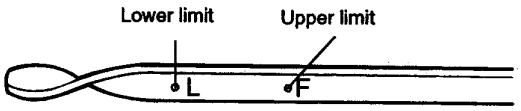
CHECKING ENGINE OIL

1. Position the vehicle on a level surface.
2. Warm up the engine.

   NOTE

   If a vehicle has been out of service for a prolonged period of time, warm up the engine for approximately 20 minutes.

3. Turn off the engine, and wait 2 or 3 minutes, then check the oil level.
4. Check that the engine oil level is within the level ragne indicated on the oil dipstick if the oil level is found to have fallen to the lower limit (the "L" mark), refill to the "F" mark.



ECDA001A

   NOTE

   When refilling, use the same type of engine oil.

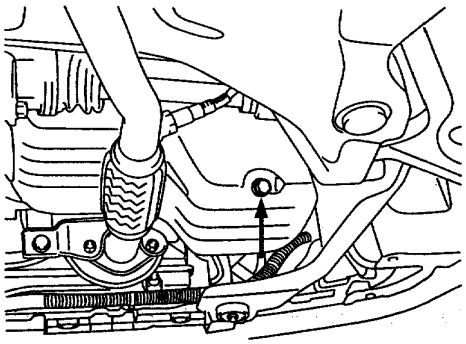
5. Check that the oil is not dirty or contaminated with coolant or gasoline and that it has proper viscosity.

CHANGING ENGINE OIL

WARNING

Be careful not to brun yourself, as the engine oil is hot.

1. Run the enigne until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and the drain plug (on the oil pan). Drain the engine oil.



KCPC001B

4. Install and tighten the drain plug to the specified torque.

Tightening torque
Drain plug : 35 ~ 45 Nm (350 ~ 450 kg.cm, 24 ~ 33 lb.ft)

   NOTE

   Whenever tightening the oil drain plug, use a new drain plug gasket.

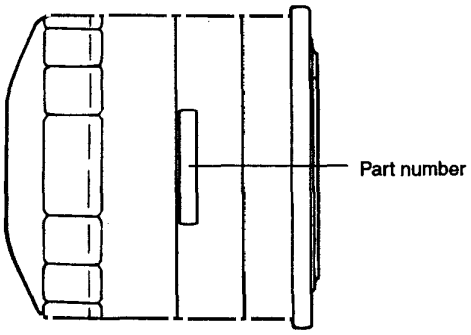
5. Fill the crankcase with fresh engine oil through the oil filler cap opening.

Drain and Refill Without oil filter
3.0 liter (3.17 U.S. qts., 2.64 Imp. qts.)
Drain and Refill With oil filter
3.3 liter (3.48 U.S. qts., 2.90 Imp. qts.)

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

FILTER SELECTION

All Hyundai engines are dquipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block be fore installing the new filter.



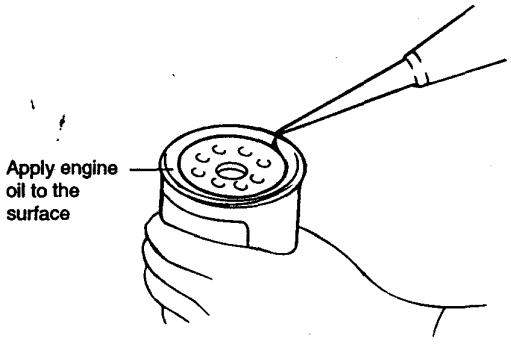
EDDA063A

PROCEDURE FOR REPLACING THE OIL FILTER

⚠ ***CAUTION***

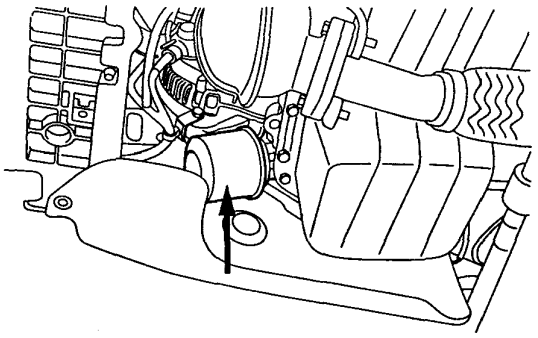
Be careful not to burn ylurself, as the engine and engine oil are not.

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.



ECTC007A

3. Tighten the oil filter to the specified torque.



KCPC001C

Tightening torque
Oil filter : 12 ~ 16 Nm (120 ~ 160 kg.cm, 9 ~ 12 lb.ft)

4. Run the engine to check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

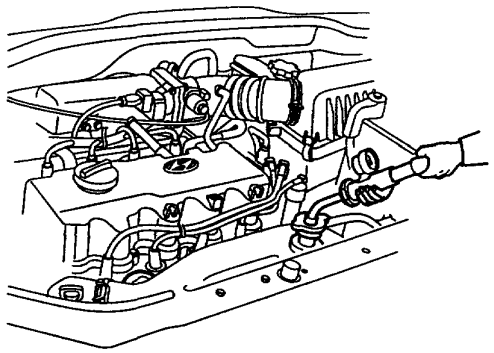
CHECKING COOLANT LEAK

1. Wait until the engine is cool, then carefully remove the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 140 KPa (1.4 kg/cm², 20 psi) pressure. Hold it for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.

📖 ***NOTE***

1. *Radiator coolant may be extremely hot. Do not open the system because hot, or scalding water could gush out causing personal injury. Allow the vehicle to cool before servicing this system.*
2. *Be sure to clean away any moisture from the places checked completely.*
3. *When the tester is removed, be careful not to spill any coolant from it.*
4. *Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.*

4. If there is leakage, repair or replace with the apropriate part.



KCPC001E

RADIATOR CAP PRESSURE TEST

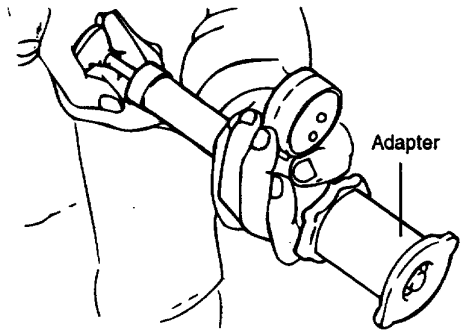
1. Remove the radiator cap. Wet its seal with engine coolant, then install it on the tester.
2. Increase the pressure until the gauge stops moving.

Main valve opening pressure :
78 ~ 108 kPa (0.8 ~ 1.1 kg/cm², 11.3 ~ 15.6 psi)
Limit : 65 kPa (0.66 kg/cm², 9.2 psi)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE

Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.



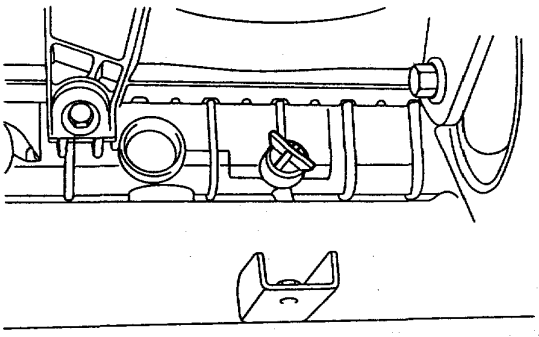
ECA9090A

CHANGING ENGINE COOLANT

CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap.
3. Loosen the drain plug and drain the coolant.

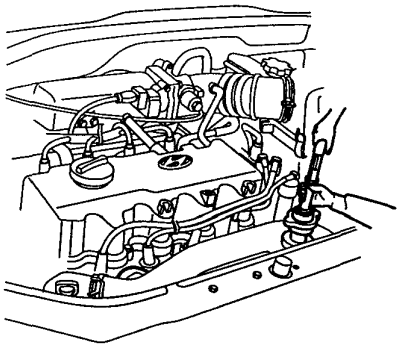


KDDC008B

4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservior.
   Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Pour coolant into the radiator up to the base of the filler neck, and install the radiator cap loosely.
7. Start the engine and let it run until it warms up (the radiator fan comes on at least twice)
8. Turn off the engine. Check the level in the radiator, add coolant if needed.
9. Put the radiator cap on tightly, then run the engine again and check for leaks.

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Mesure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature, using the following table for reference.



KCPC001F

RELATION BERWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperature °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
10 (50)	**20 (68)**	**30 (86)**	**40 (104)**	**50 (122)**			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

Example

The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F)

⚠ ***CAUTION***

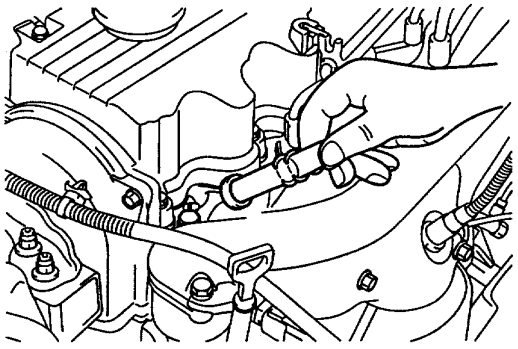
- ***If the concentration of the coolant is below 30%, its anti-corrosion properties will be adversely affected.***
- ***If the concentration is above 60%, both the antifreeze and engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.***
- ***Do not use together with another brand's product.***

RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]

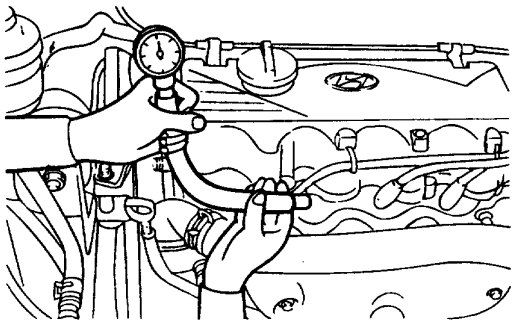
CHECKING COMPRESSION PRESSURE

1. Befor checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Check the DTC and resetting the ECM will erase any stored DTCs.
3. Stsrt the engine and wait until engine coolant temperature reaches 80~95°C (176~205°F).
4. Disconnect the fuel pump connector.
5. Turn off engine and disconnect the spark plug cables.



KDDC002B

6. Remove the spark plug.
7. Disconnect the I.G. connector.
8. Crank the engine to remove any foreign material in the cylinders.
9. Insert the compression gauge into the spark plug hole.



ECDA102C

10. Depress the accelerator pedal to open the throttle fully.
11. Crank the engine and read the gauge.

Standard value : 1500 kpa (15.5 kg/cm², 220 psi)
Limit : 1200 kpa (12.5 kg/cm², 178 psi)

12. Repeat steps 9 to 11 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

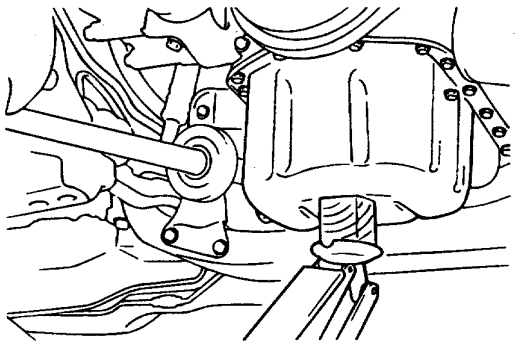
Limit : Max. 150 kpa (1.5 kg/cm², 21 psi)
between cylinders

13. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 9 to 12.
    1. If the addition of oil makes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
    2. If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

Tightening torque
Spark plug : 20~30 Nm (200~300 kg.cm, 14~22 lb.ft)

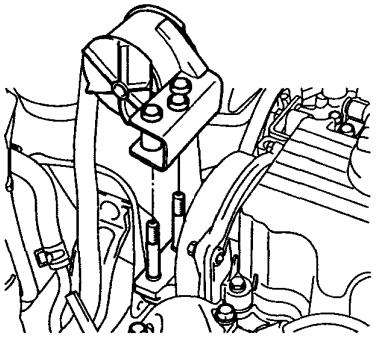
ADJUSTING TIMING BELT TENSION

1. Turn the steering wheel fully counter clock wise.
2. Lift the vehicle by using of jack.



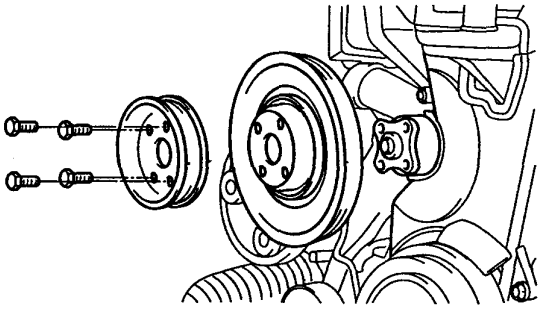
KCDA125K

3. Remove the engine support bracket.



KDDC003B

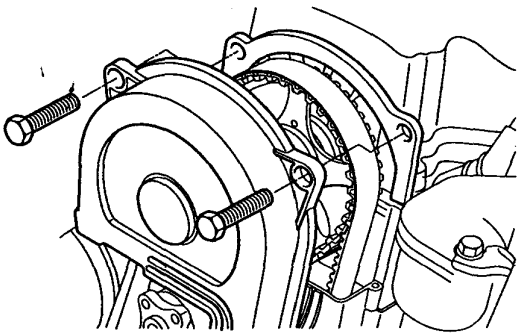
4. Loosen the coolant pump pulley mounting bolt and loosen the generator belt tension adjustment bolt.



KDDC004B

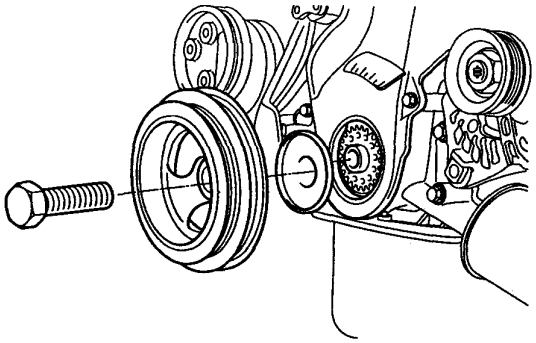
5. Remove the coolant pump pulley, generator belt, power steering pulley and power steering belt.

6. Remove the timing cover upper side mounting bolt.



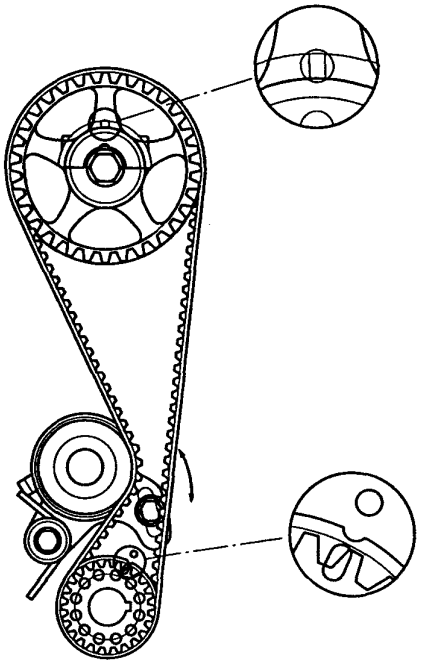
KDDC005B

7. Remove the crankshaft pulley.



KDDC007B

8. Turn crankshaft to place clockwise in No.1 cylinder at top head center on compression stroke.

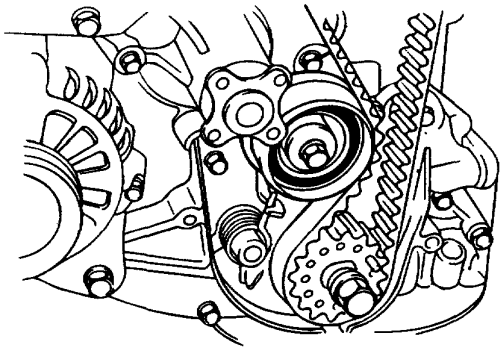


KCPC010B

NOTE

Turn the crankshaft clock wise. If counter clock wise, tension is not available.

9. Loosen the tensioner bolt 1 ~ 2 turn and tension the belt by tensioner spring.



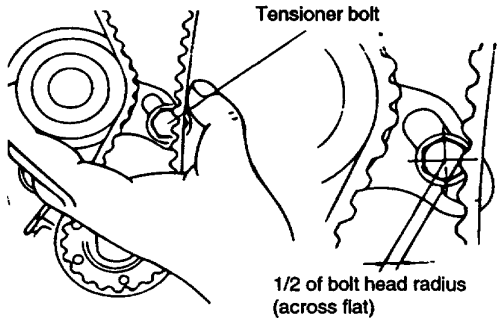
ECTC012F

10. Turn crankshaft clockwise as much as two camshaft sprocket teeth.

11. Tighten the tensioner bolt of slot side of first and then tighten the bolt of pivot side.

12. Rotate the crankshaft pulley two turns clockwise so that the timing belt positions on the pulleys.

13. Check the tension of timing belt.
When the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11 lb)], the timing belt log end is approx. half of the tensioner mounting bolt head radius (cross flats) away from the bolt head center.



ECDA125S

14. Install the timing belt cover.

STANDARD VALUE :

Items		Adjustment	
		New	Used
For alternator	Deflection mm (in.)	7.5 ~ 9.0 (0.29 ~ 0.35)	10 (0.39)

Tightening torque :
10 ~ 12 Nm (100 ~ 120 kg.cm, 7.2 ~ 8.7 lb.ft)

15. Install the crankshaft pulley.

16. Install the coolant pump pulley.

17. Install V-belt and adjust the belt tension.

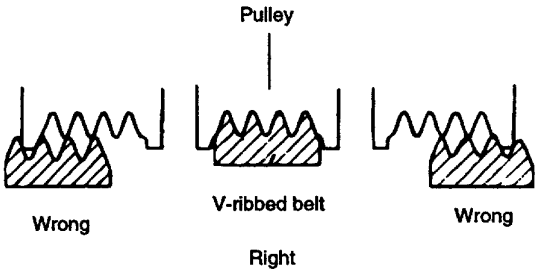
ADJUSTING DRIVE BELT TENSION

1. Check that the belts are not damaged and are properly fit for the pulley grooves.

2. Apply 100 N (22 lbs.) force to the back and midway portion of the belt between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge.

⚠ ***CAUTION***

1. ***When installing the V-ribbed belt, check that the V-ribs are properly aligned.***
2. ***If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.***



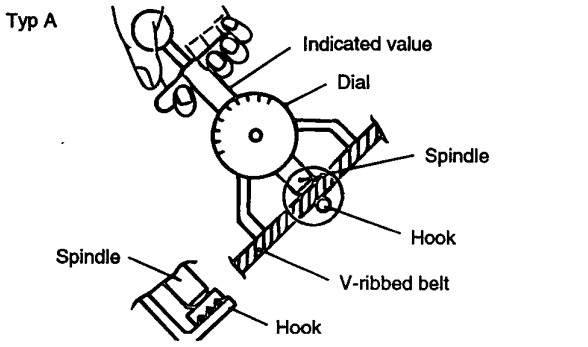
ECA9980A

NOTE

1. *The belt tension must be measured half - way between the specified pulleys.*
2. *When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in the above table. Let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection".*
3. *When adjusting a belt which has been used, or newly installed, after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table.*
4. *Refer to the standard value indicated under "Inspection" for periodic inspections.*

TYPE A TENSION GAUGE

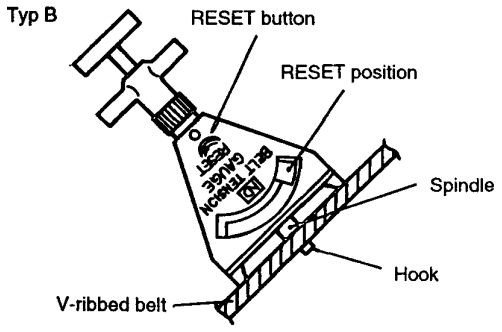
Do not let the dial section of the tension gauge contact other objicts during measurement.



ECA9980C

TYPE B TENSION GAUGE

1. When measuring, turn the reset button in the direction of the arrow and set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.



ECA9980D

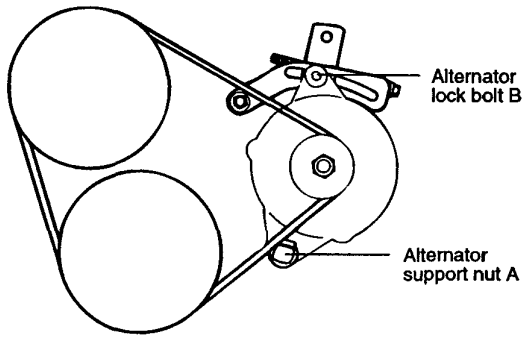
ADJUSTING THE ALTERNATOR BELT

CAUTION

If the belt is too loose, it will cause noise or sudden wear.
If the belt is too tight, the engine coolant pump bearing or the alternator can get damaged.

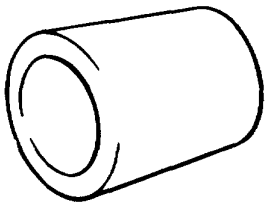
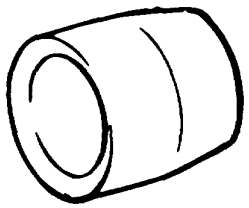
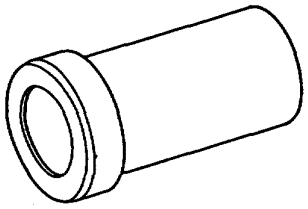
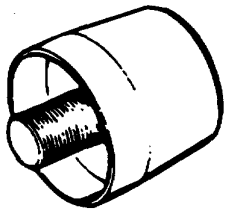
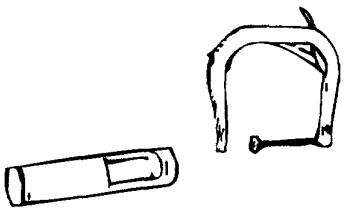
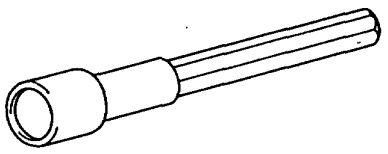
1. Loosen the alternator nut "A" and the tension adjuster lock the bolt "B"
2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the alternator nut "A".
5. Check the tension or the deflection of belt, readjust if necessary.

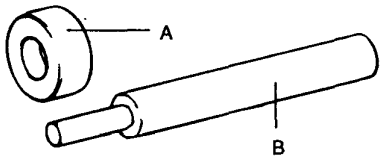
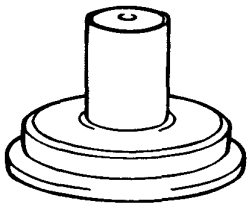
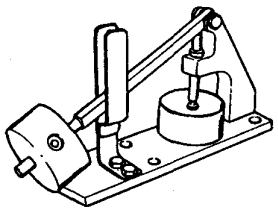
Tightening torque
Alternator support nut A :
20 ~ 25 Nm (200 ~ 250 kg.cm, 15 ~ 18 lb.ft)
Alternator lock bolt B :
15 ~ 22 Nm (150 ~ 220 kg.cm, 11 ~ 16 lb.ft)
Alternator brace mounting bolt :
20 ~ 28 Nm (200 ~ 280 kg.cm, 15 ~ 21 lb.ft)



ECDA051A

SPECIAL TOOLS EED6A55D

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer 09231 - 22000	 ECDA005A	Installation of the crankshaft front oil seal (use with 09231 - 22100)
Crankshaft front oil seal guide 09231 - 22100	 ECDA005B	Installation of the crankshaft front oil seal (use with 09214 - 22000)
Camshaft oil seal installer 09221 - 21000	 ECDA005D	Installation of the camshaft oil seal (use with 09221 - 21100)
Camshaft oil seal guide 09221 - 21100	 ECDA005E	Used as a guide when pressing in the camshaft oil seal (use with 09221 - 21000)
Valve spring remover and installer 09222 - 22100	 ECDA005F	Removal and installation of the inlet or exhaust valve
Valve stem oil seal installer 09222 - 22001	 ECDA005G	Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Valve guide installer 09221 - 21200 A/B	 ECDA005H	Removal and installation fo the valve guide
Crankshaft rear oil seal installer 09231 - 21000	 ECDA005I	1) Installation of the engine rear oil seal 2) Installation of the crankshaft rear oil seal
Leak down tester 09246 - 32000	 ECDA005M	Leak down test of auto lash adjuster

TROUBLESHOOTING E52AF2D2

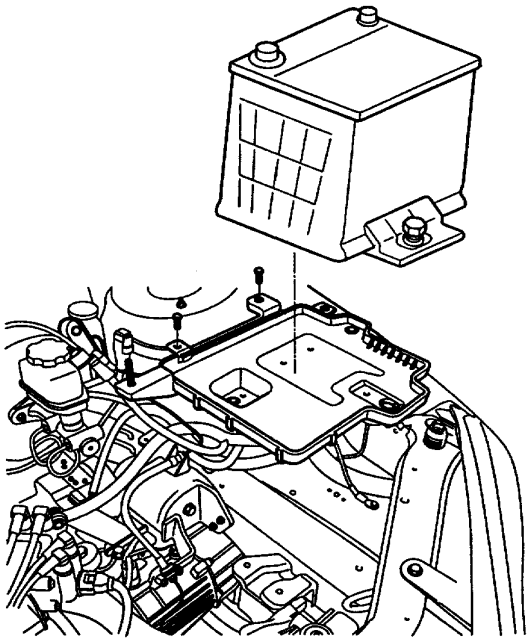
Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace the piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace the valve and/or seat ring
Low oil pressure	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and find out cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine vibration	Loose engine roll stopper (front, rear)	Retighten
	Loose transaxle mount bracket	Retighten
	Loose engine mount bracket	Retighten
	Loose center member	Retighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Noisy valves	Thin or diluted engine oil (Low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Connecting rod and main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension
Low coolant level	Leakage of coolant	
	1. Heater or radiator hose	Repair or replace parts
	2. Faulty radiator cap	Tighten or replace clamps
	3. Thermostat housing	Replace the gasket or housing
	4. Radiator	Repair or replace
	5. Engine coolant pump	Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant

Symptom	Probable cause	Remedy
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	Replace parts
	Restricted flow in cooling system	Clear restriction or replace parts
	Loose or missing drive belt	Adjust or replace
	Faulty water pump	Replace
	Faulty temperature sensor or wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor or wiring	Replace or repair
Leakage from oil cooling system	Loose connections	Replace
	Cracked or damaged ; hoses, pipes or oil cooler	Replace or repair
Inoperative electrical cooling fan	Damaged : Thermo sensor, Electrical motor, Radiator fan relay, Wiring	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

ENGINE AND TRANSAXLE ASSEMBLY EC6CE7E6

REMOVAL

1. Remove the battery.



KDDC009B

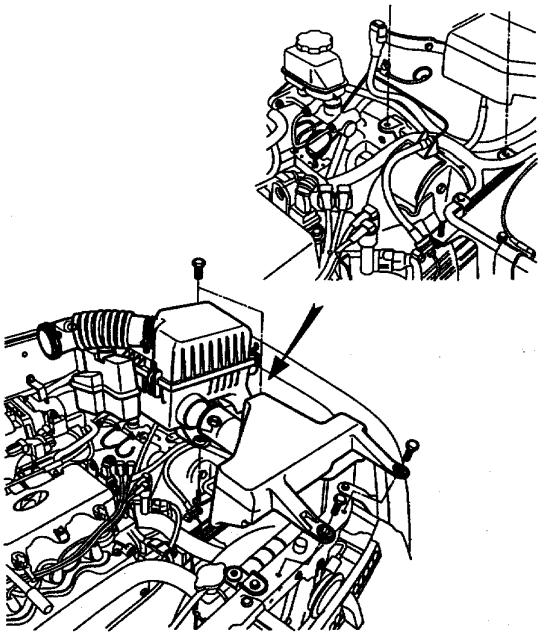
WARNING

Make sure jacks and safety stands are placed properly and hoist brackets are attached to the correct position on the engine.

CAUTION

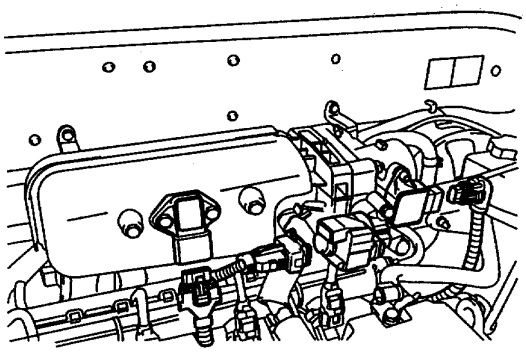
Use fender covers to avoid damaging painted surface.

2. Detach the air cleaner.

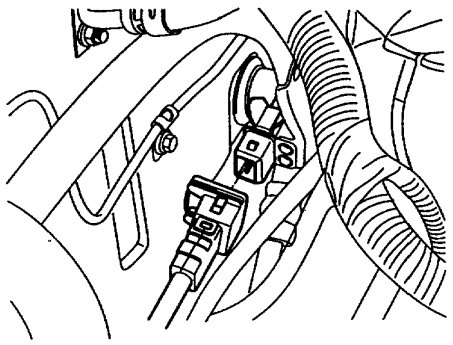


KDDC010B

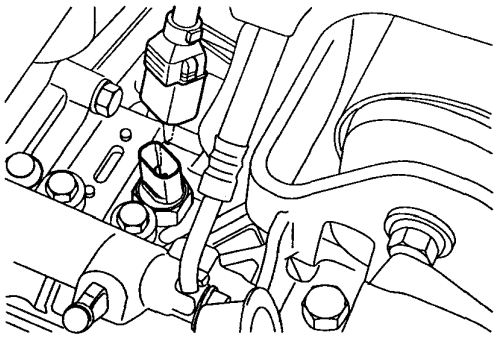
3. Disconnect the backup lamp and engine harness connectors.



KDDC010C

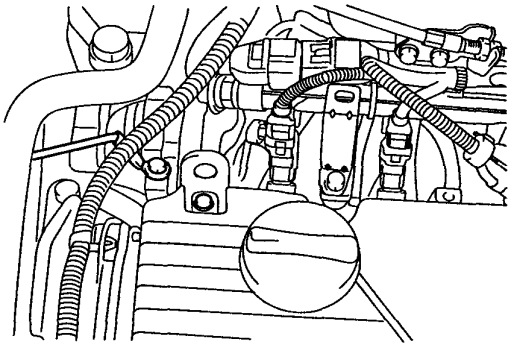


KDDC010D



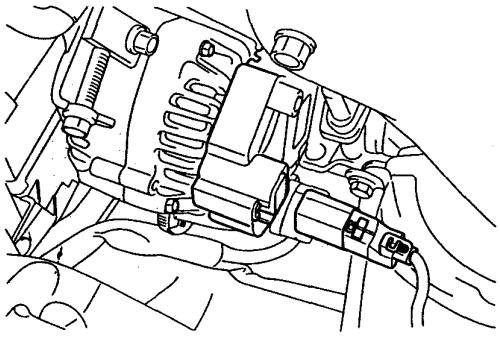
ECPD003M

4. Disconnect the engine ground.

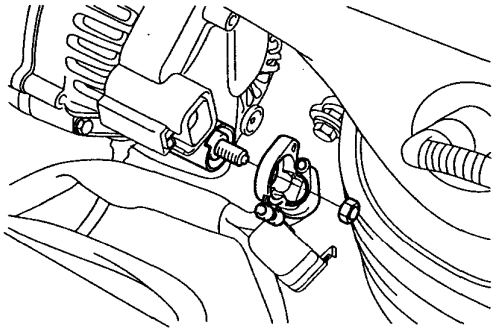


ECDD008C

5. Disconnect the alternator connector.

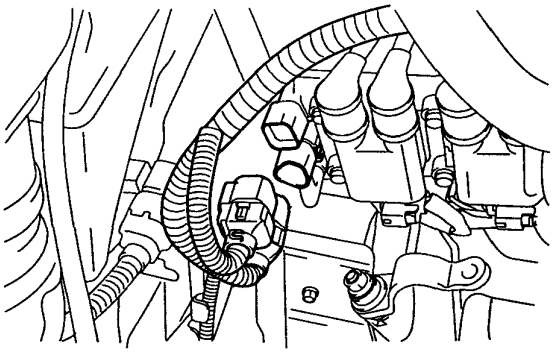


KDDC010E



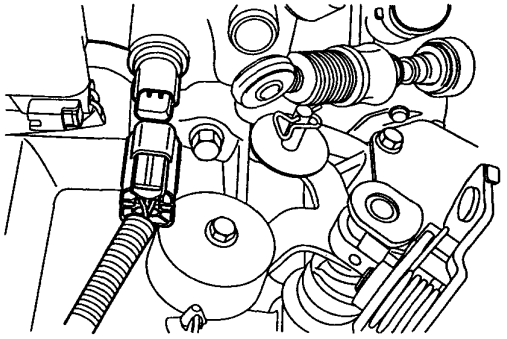
KDDC011E

6. Disconnect the connectors for the rear Oxygen sensor harness and the ignition coil harness.

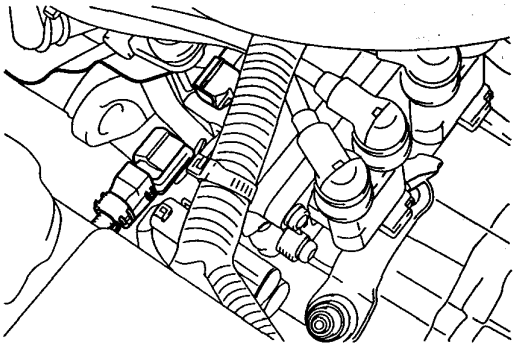


ECPD003F

7. Disconnect the coolant temperature sensor and No.1 TDC sensor connector.

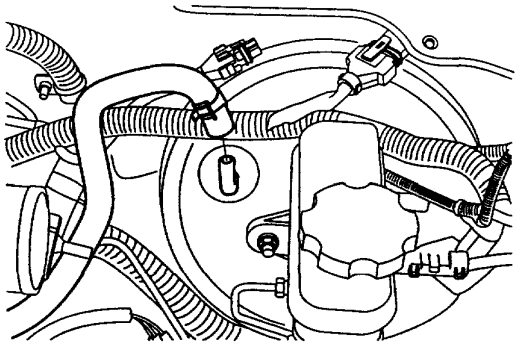


ECPD003A



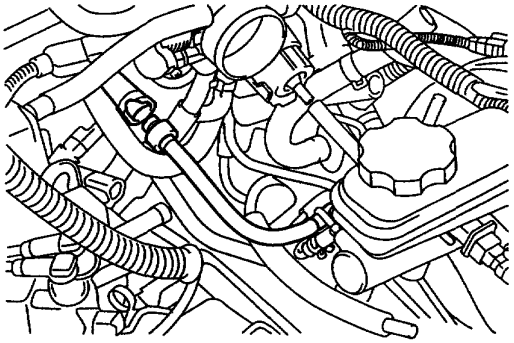
ECPD003K

8. Disconnect the brake booster vacuum hose.

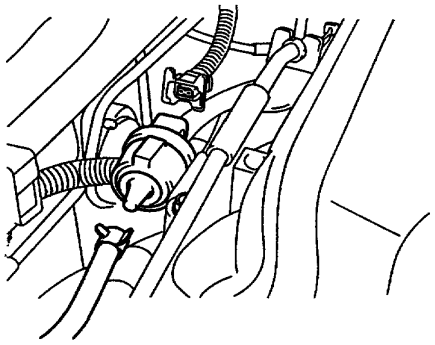


KCPC003B

9. Remove the main fuel line and the return and vapor hoses form the engine side.



KCPC003C

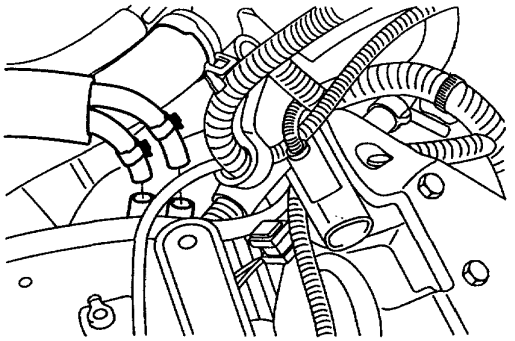


KDDC010I

⚠ CAUTION

To reduce the residual pressure in the hoses, refer to Group Fuel System "Fuel filter replacement."

10. For vehicles with automatic transaxles, disconnect transaxle oil cooler hoses.



KCPC003E

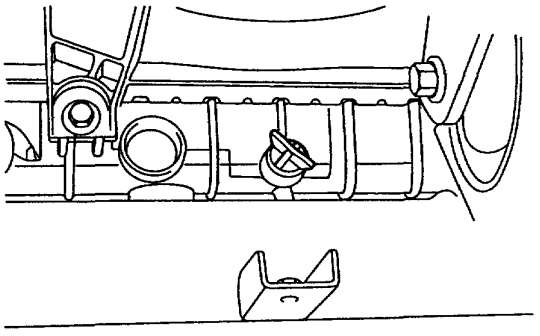
NOTE

When disconnecting the hoses, make identification marks to avoid making mistakes when reconnecting them.

⚠ CAUTION

Be caurful not to spill oil or fluid from hoses, Plug the openings to prevent foreign material from entering.

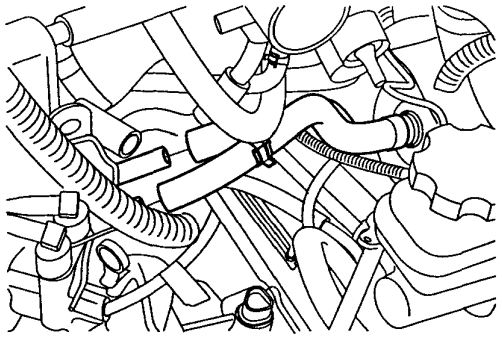
11. Drain the engine coolant from the radiator.



KDDC008B

12. Disconnect the radiator upper and lower hoses on the engine side, then remove the radiator assembly.

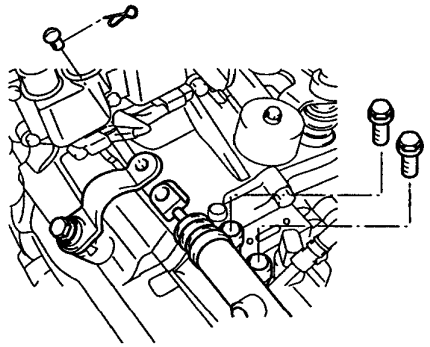
13. Disconnect the heater hoses (inlet and outlet) on the engine side.



KCPC003F

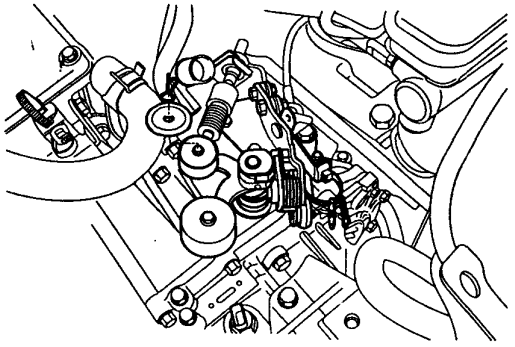
14. Disconnect the accelerator cable at the engine side.

15. For vehicles with 5-speed manual transaxles, remove the clutch release cylinder.



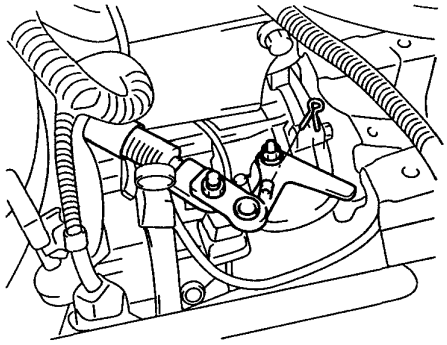
ECPD003B

16. For vehicles with manual transaxles, remove the shift control cable from the transaxle.

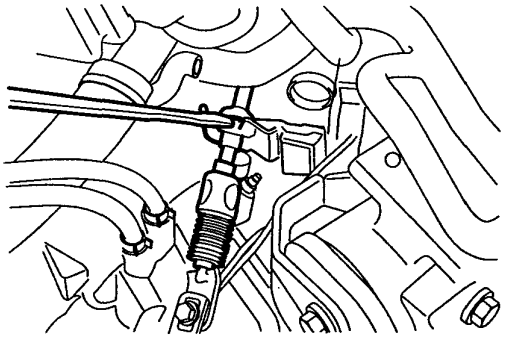


ECPD003I

17. For vehicles with automatic transaxles, remove the control cable from the transaxle.

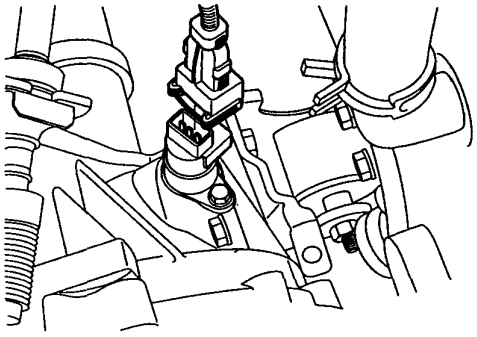


KCPC003H



KKPC022K

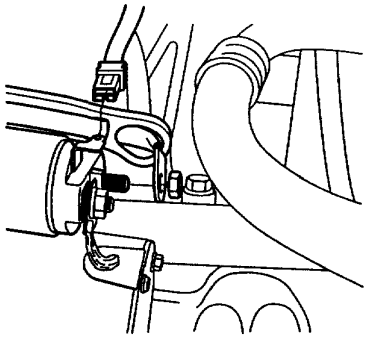
18. Disconnect the speedometer cable from the transaxle.



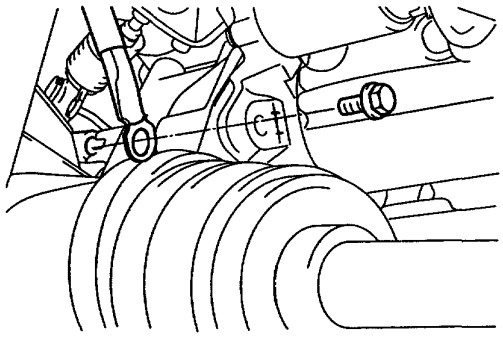
KDDC010F

19. Disconnect the air conditioning compressor from the mounting bracket.

20. Disconnect the starter motor connector and ground.



KDDC010J

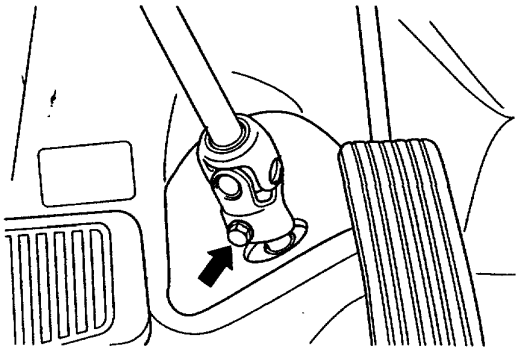


KDDC010K

21. Remove the steering dust cover, the U-joint bolt and the gear box assembly.

NOTE

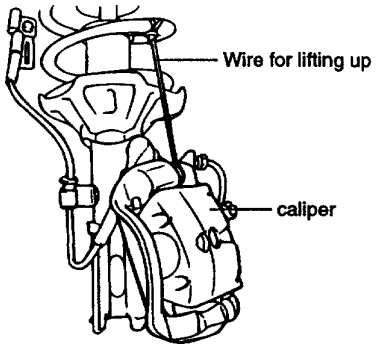
Mark between U-joint and gear box before disassembling.



KPPD014A

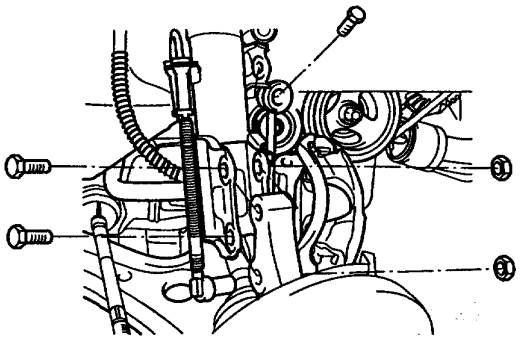
22. Jack up the vehicle and remove the front tire.

23. Remove the caliper assembly from knuckle and hold the upper side.



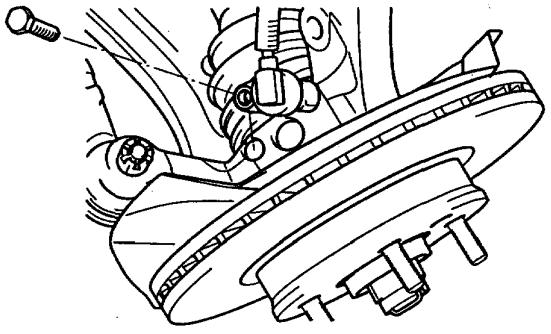
ECTC040F

24. Loosen the strut lower bolt and separate from the knuckle.



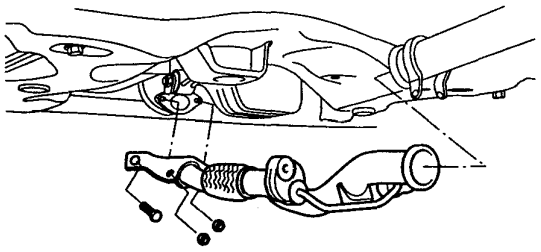
KCPC003I

25. Remove the wheel speed sensor from the knuckle. (with ABS)



KCPC003J

26. Disconnect the front exhaust pipe from the manifold.

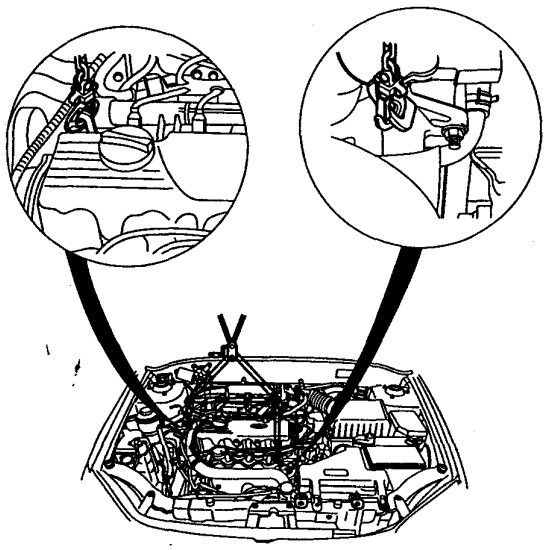


KCPC003G

NOTE

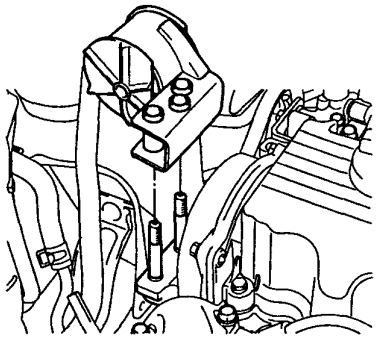
Use wire to suspend the exhaust pipe from the bottem of the vehicle.

27. Attach a chains or cables to the engine.
Use an engine hoist or a chain hoist to slightly raise the engine (enough to support the engine's weifht while processing with the following steps.)



KDDC011B

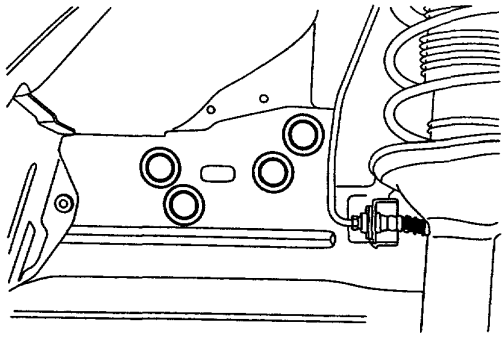
28. Remove the engine mounting bracket from the engine.



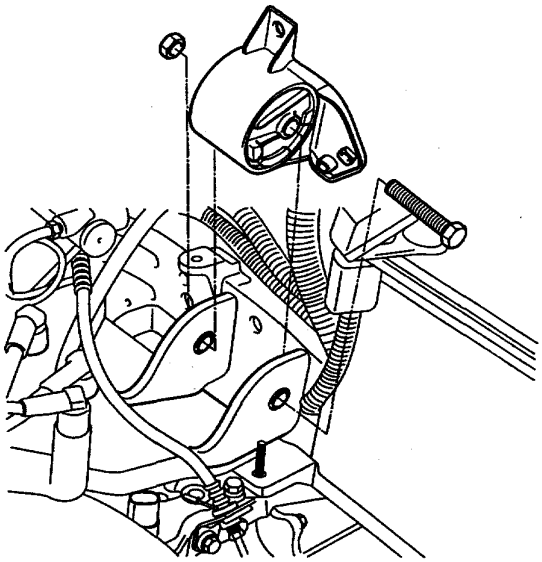
KDDC003B

29. Slowly raise the engine (to the extent that the weight of the engien and transmission assembly is not applied to the mounting portions) and temporarily hold it in the raised position.

30. Remove the caps from the inside of the right fender shield and remove the transaxle mount bracket bolts.

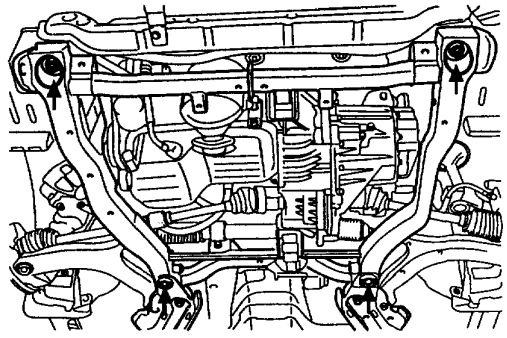


KDDC012B



KDDC015D

31. Remove the cross member fixing bolts and nuts.



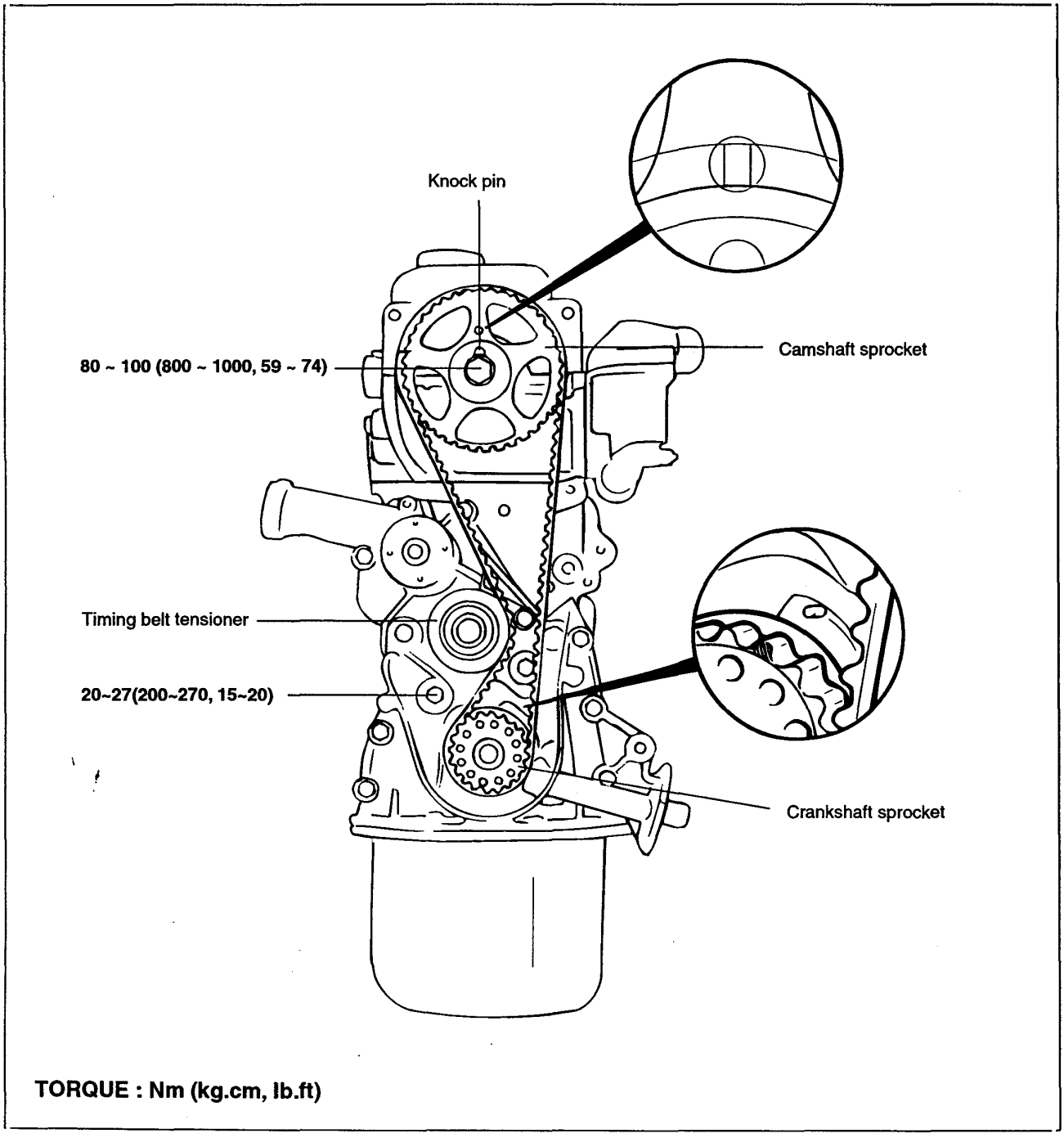
KDDC013B

32. While directing the transmission side downward, lift the engine and transmission assembly up and out of the vehicles.

TIMING SYSTEM

TIMING BELT

COMPONENTS E0FA5331

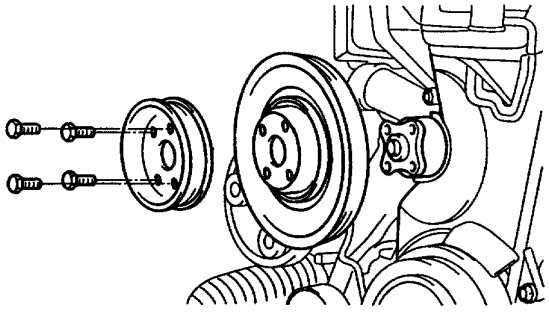


TORQUE : Nm (kg.cm, lb.ft)

ECDD010A

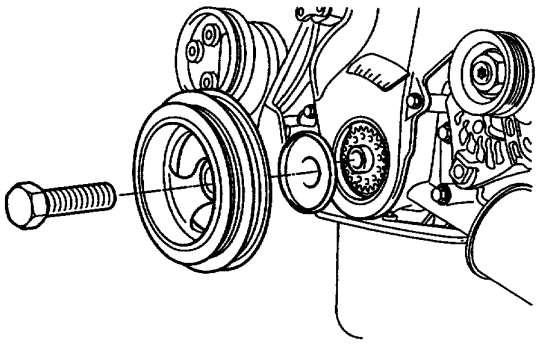
DISAESSEMBLY E8D5C0CE

1. Loosen the coolant pump pulley bolt.



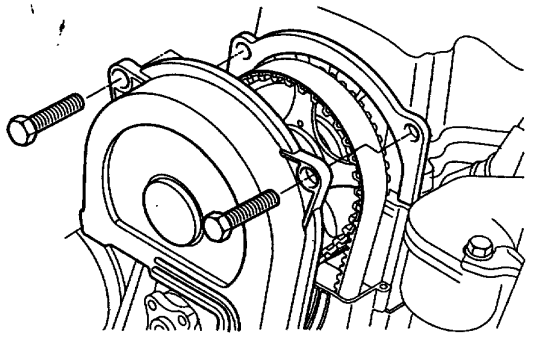
KDDC004B

2. Loosen the alternator bolt.
3. Remove the coolant pump pulley and belt.
4. Remove the crankshaft pulley.



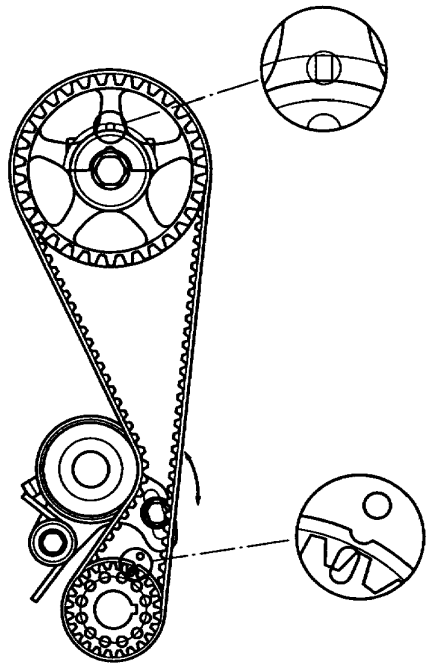
KDDC007B

5. Remove the timing belt cover.



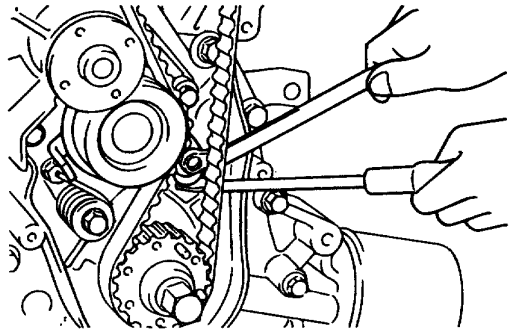
KDDC005B

6. Align the timing marks of the camshaft sprocket and crankshaft sprocket, with the No.1 piston placed at top dead center on its compression stroke.



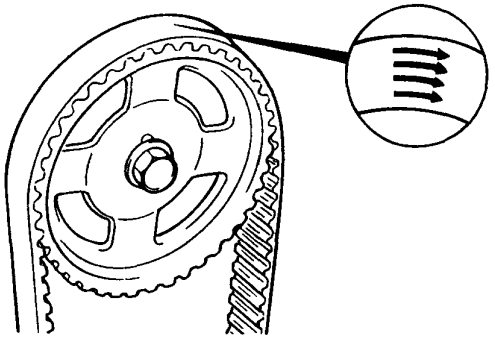
KCPC010B

7. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.



ECDA121A

8. Remove the timing belt.



ECDA121B

9. Remove the camshaft sprocket.

10. Remove the crankshaft sprocket bolts. Remove the crankshaft sprocket and flange.

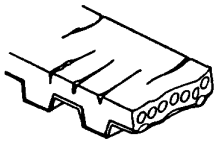
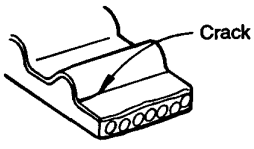
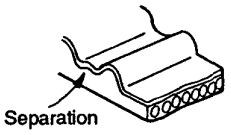
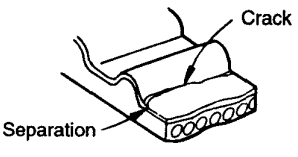
11. Remove the timing belt tensioner.

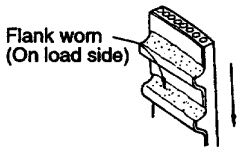
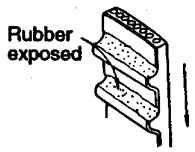
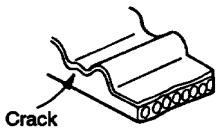
INSPECTION EBF978DD

TIMING BELT

1. Check the belt for oil or dust deposits. Replace, if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.

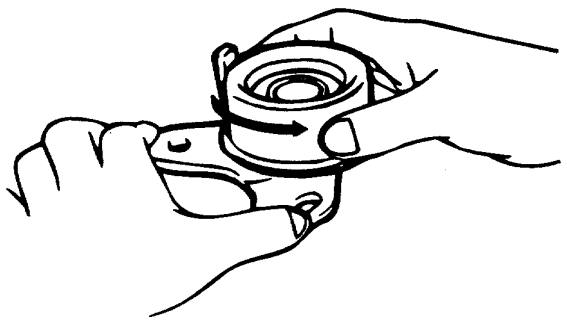
2. When the engine is overhauled or belt tension adjusted, carefully check the belt. If any of the following flaws are evident, replace the belt.

Description	Flaw conditions
1. Hardened back suface Back suface glossy. Non-elastic and so hard that when your fingernail is pressed into it, no mark is produced.	 ECDA122A
2. Cracked back surface rubber	 ECDA122B
3. Cracked or separating canvas	 ECDA122C
	 ECDA122D
	 ECDA122E

Description	Flaw conditions
4. Badly worn teeth (initial stage) Canvas on load side tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)	 ECDA122F
5. Badly worn teeth (last stage) Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced)	 ECDA122G
6. Cracked tooth bottom	 ECDA122H
7. Missing tooth	 ECDA122I
8. Side of belt badly worn **NOTE** *A normal belt should have precisely cut sides as if cut by a sharp knife.*	
9. Side of belt cracked	

SPROCKETS AND TENSIONER

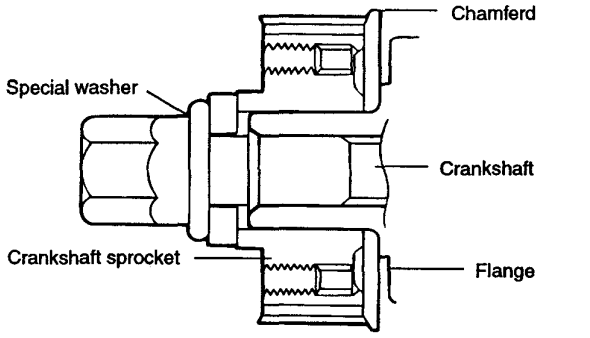
1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth pulley rotation and check for play or noise. Replace as necessary.



ECDA122J

REASSEMBLY EE0925DA

1. Install the flange and crankshaft sprocket as shown. Pay close attention to their mounting directions.



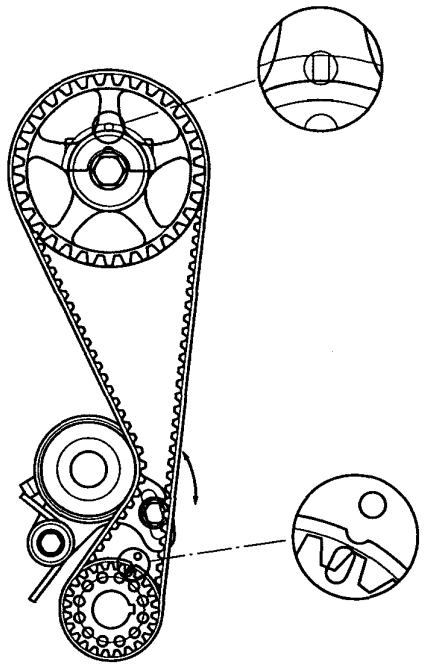
ECDD125A

Tightening torque
Crankshaft sprocket bolt :
140 ~150Nm (1400 ~ 1500kg.cm, 103 ~ 111lb.ft)

2. Install the camshaft sprocket and tighten the bolt to the specified torque.

Tightening torque
Camshaft sprocket bolt :
80 ~ 100 Nm (800 ~ 1000 kg.cm, 59 ~ 74 lb.ft)

3. Align the timing marks of the camshaft sprocket and crank shaft sprocket, with the No.1 piston placed at top dead center on its compression stroke.

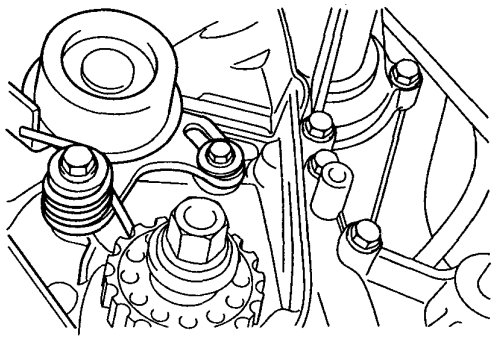


KCPC010B

NOTE

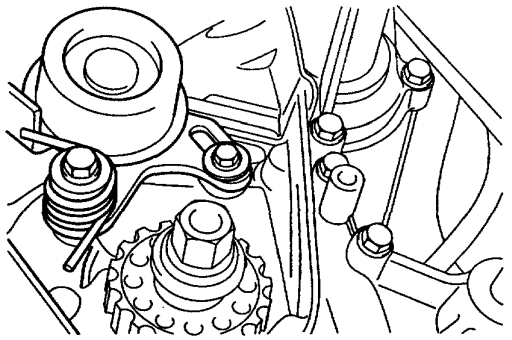
When installing camshaft sprocket.
Make sure that cmashaft sprocket knock pin fits small hole in pulley as shown.

4. Tentatively fasten timing belt tensioner as such position as to place its pulley nearest to water pump body.



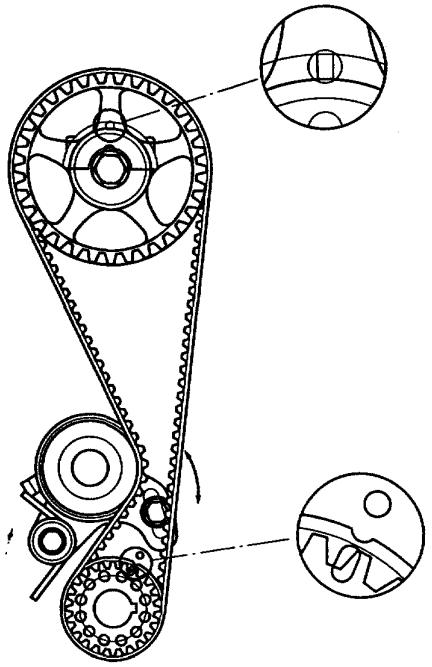
KDPC008D

5. Hang the tensioner spring on the tensioner bracket and insert the other spring side in the front case using the screw driver.



KDPC008E

6. Install the timing belt tightly in the sequence shown.
①Crankshaft sprocket → ②Camshaft sprocket → ③Timing belt tensioner.



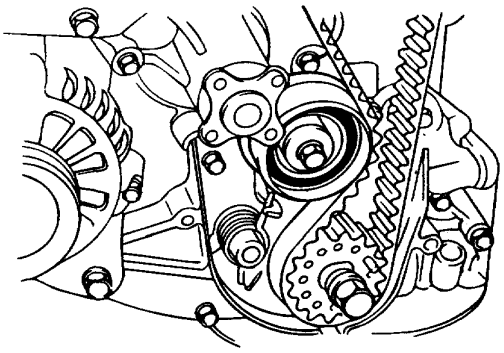
KCPC010B

7. Install timing belt so as not to give salck to tension side.

NOTE

Then make sure that timing marks are at correct position respectively with tension side in strained state by applying force to camshaft sprocket in reversing direction.

8. Loosen the tensioner mounting bolt in the order as shown tio give the timing belt spring tension.



ECTC012F

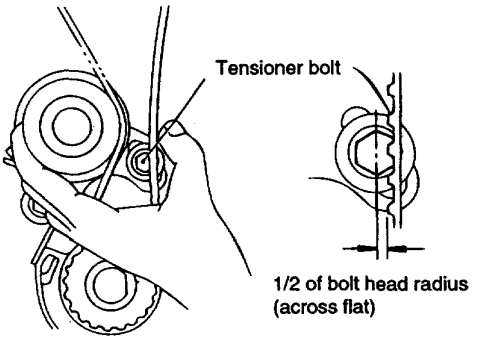
9. Rotate crankshaft in regular direction (clock wise view from 8 front) through angle dquivalent to two teeth (15°) of camshaft sprocket.

10. Add force to tensioner in direction of regular rotation (→ direction) so as to bring belt teeth in perfect contact with sprocket teeth without gap.

11. After marking sure of this state.
Fix tensioner in state that only tensioner spring is movable.

12. Rotate the crankshaft pulley two or four turns conter clockwise so that the timing belt positions on the pulleys.

13. Then recheck the belt tension. Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11 lb)], the timing belt is offest from bolt head center by approxmately bolt of the tensioner adjusting bolt head radius.



ECDA125G

14. Install the timing belt cover.

15. Install the crankshaft pulley.

16. Install the air condition belt and adjust belt tension.

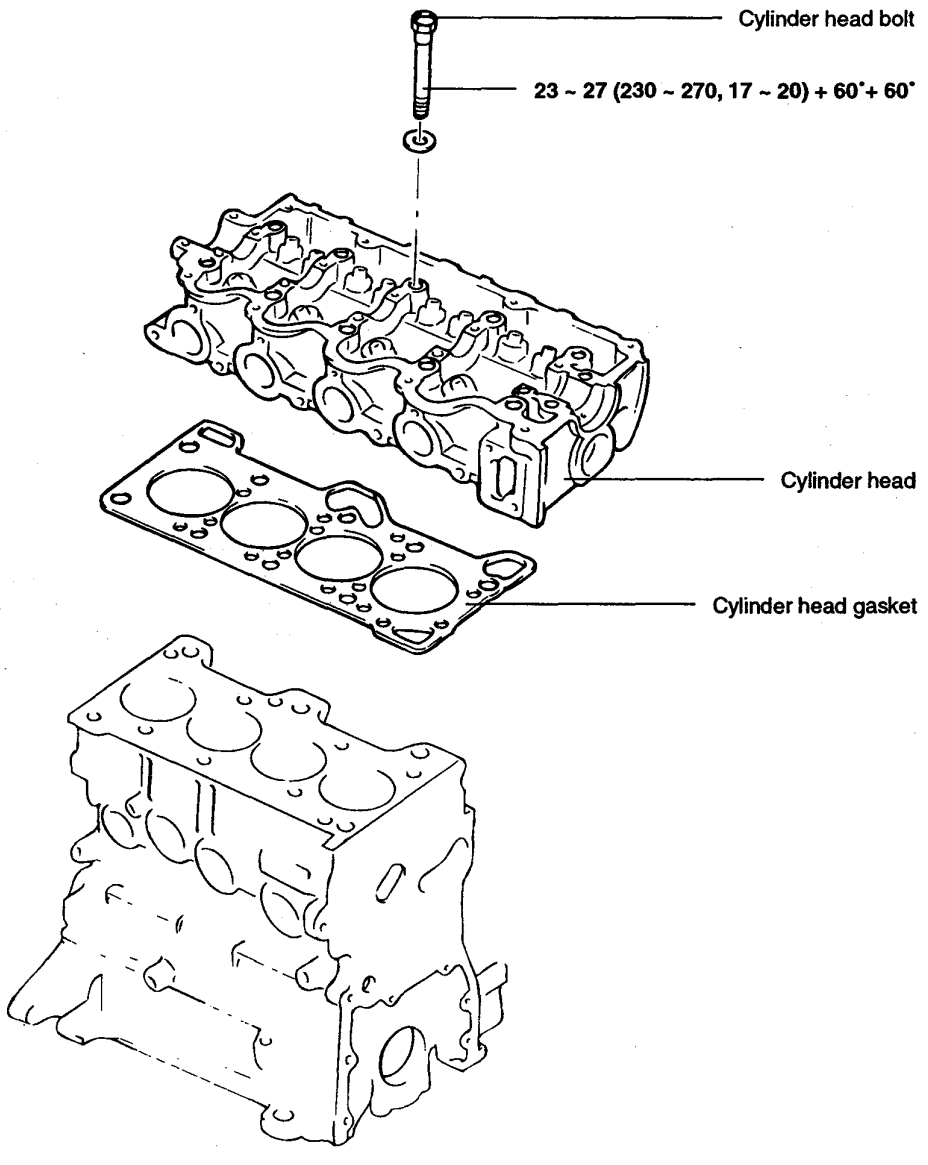
17. Install the coolant pump pulley.

18. Install V-belt and adjust the belt tension.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS ECFA7D82

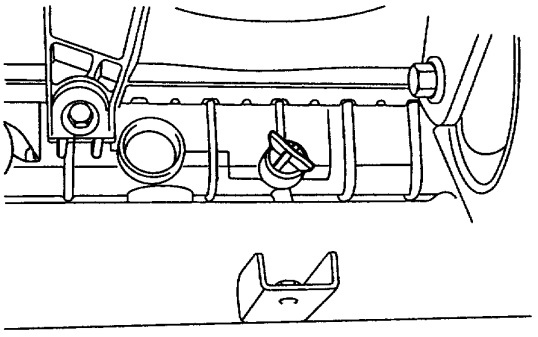


TORQUE : Nm (kg.cm, lb.ft)

ECDD099A

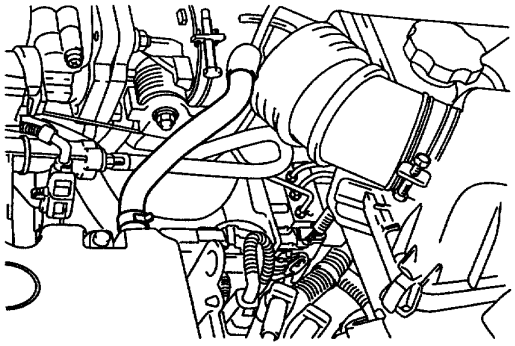
DISASSEMBLY ED98BBCB

1. Drain the coolant and disconnect the upper radiator hose.



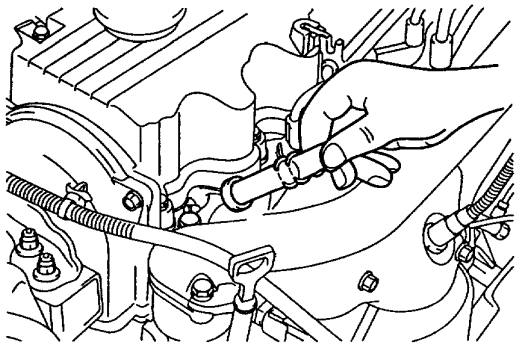
KDDC008B

2. Remove the breather hose. (between the air cleaner and the rocker cover)



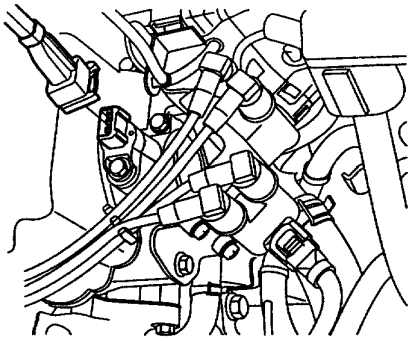
ECDD007C

3. Remove the air-intake hose.
4. Remove the vacuum hose, fuel hose and coolant hose.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.



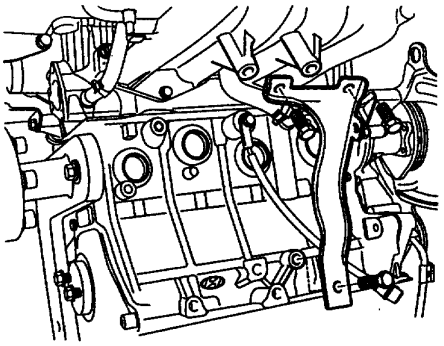
KDDC002B

6. Remove the ignition coil.



KCPC008D

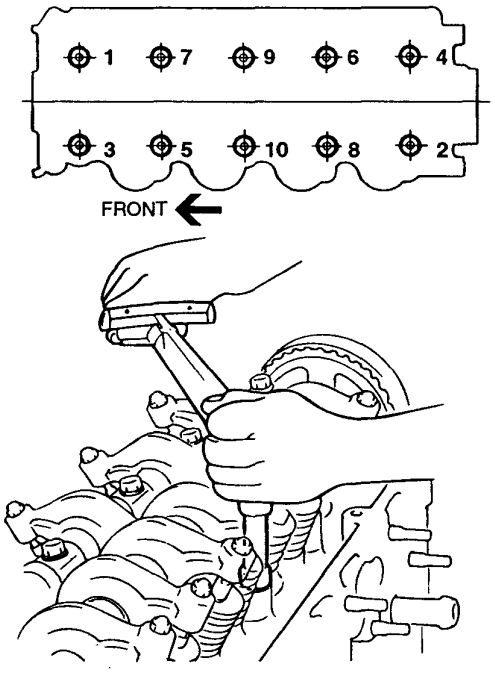
7. Remove the surge tank stay.



ECPD007B

8. Remove the intake manifold.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and the crankshaft pulley.
11. Remove the timing belt cover.
12. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
13. Remove the timing belt.
14. Remove the rocker cover.

15. Remove the cylinder head assembly. The cylinder head bolts should be removed using Cylinder Head Bolt Wrench, in the sequence as shown in the illustration.



ECDA100B

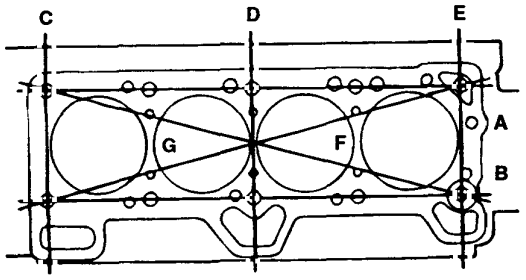
16. Remove the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE

Make sure that the gasket pieces do not fall in to the engine.

INSPECTION ED691D53

1. Check the cylinder head for cracks, damage and coolant leakage.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed aor to make certain that the passages are not clogged.
3. Check the cylinder head surface for flatness using a straight edge in the direction of A, B, ...as shown.



ECDA101A

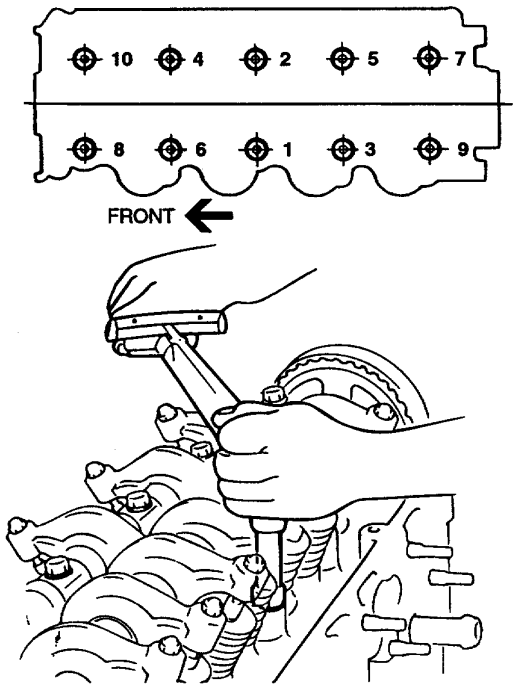
If flatness exceeds service limit in any direction, replace the cylinder head, or lightly machine the cylinder head surface.

Cylinder head flatness Standard value : Less than 0.03 mm (0.012 in.) Limit : 0.06 mm (0.0024 in.)

REASSEMBLY EBE87E53

1. Clean all gasket surfaces of the cylinder block and the cylinder head.
2. Install a new cylinder head gasket into the cylinder head assembly. Do not apply sealant to the gasket and do not reuse the old cylinder head gasket.
3. Install the cylinder head bolts. Starting from the top center, tighten all cylinder head bolts in sequence as shown in illustration, using the Cylinder Head Bolt Wrench. Repeat the procedure, retightening all cylinder head bolt to the specified torque.

Tightening torque
23~27NM (230~270kg.cm, 17~20lb.ft)+60°+60°



ECDA102A

4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Install the timing belt on the camshaft sprocket, making sure that the tension side is tightened by turning the camshaft sprocket in reverse. Make sure all timing marks are in alignment.
6. Adjust the timing according to the "Timing Belt" section.
7. Install the rocker cover and tighten the bolts to the specified torque.

Tightening torque
Rocker cover bolt :
8 ~ 10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

8. Install the timing belt cover.
9. Install the new intake manifold gasket and the intake manifold. Tighten the nuts and bolts to the specified torque.

Tightening torque
Manifold nuts and bolts (both intake and exhaust) :
15 ~ 20 Nm (150 ~ 200 kg.cm, 11 ~ 15 lb.ft)

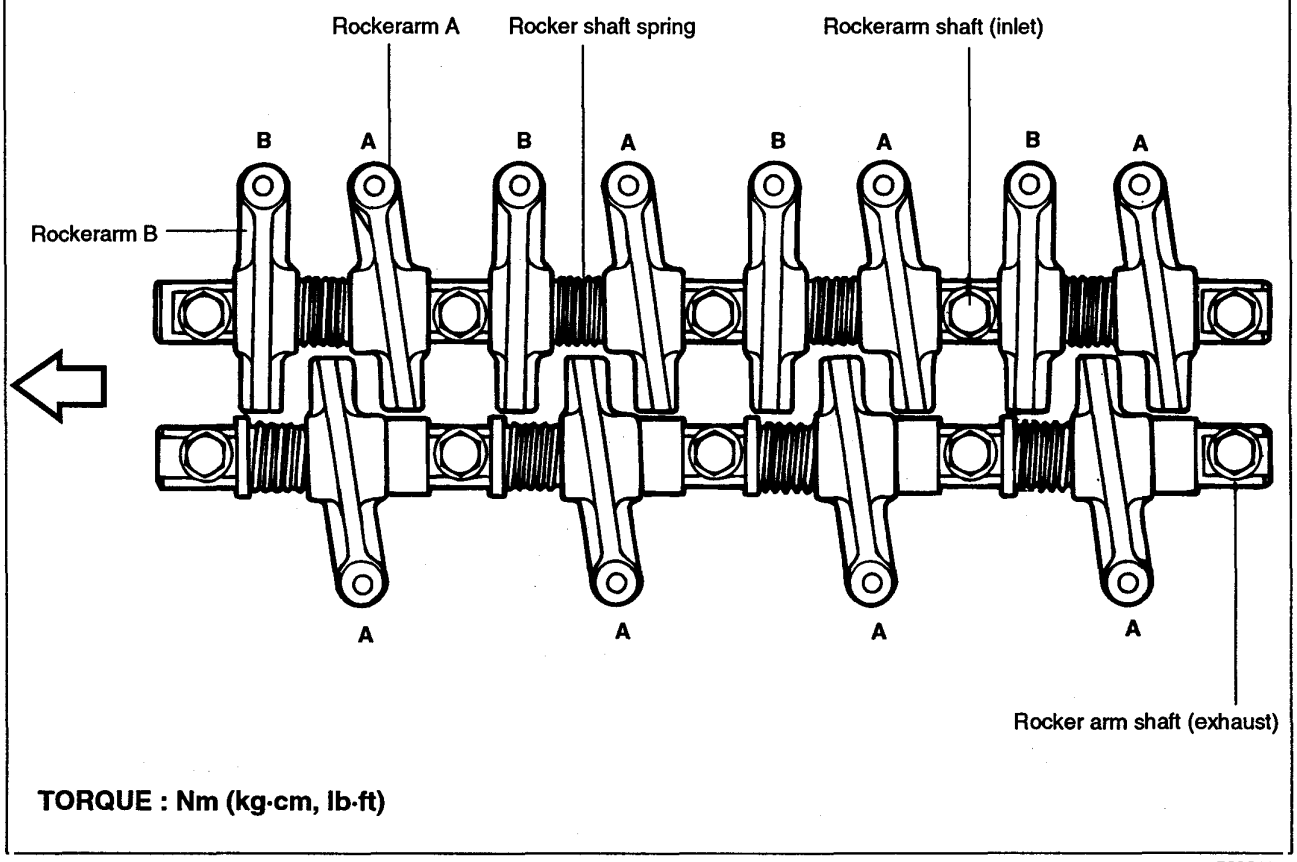
10. Install the new exhaust manifild gasket and the exhaust manifold. Tighten the exhaust manifold attaching nuts to the specified torque.
11. Install the surge tank and tighten the nuts and bolts to the specified torque.

Tightening torque
Surge tank to inlet manifold nuts and bolts :
15 ~ 20 Nm (250 ~ 200 kg.cm, 11 ~ 15 lb.ft)

12. Install the ignition coil.
13. Install the air intake hose.
14. Connect the vacuum hose, fuel hose and coolant hose.
15. Install breather hose.

ROCKER ARM

COMPONENTS EE1DADA3

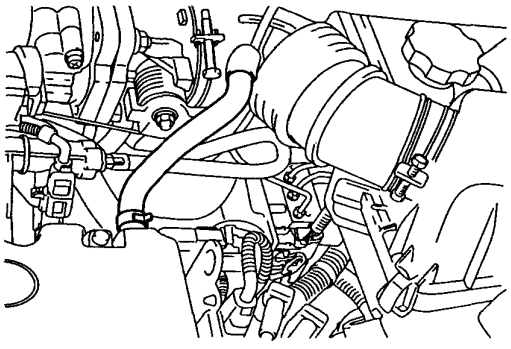


TORQUE : Nm (kg·cm, lb·ft)

ECDD104A

DISASSEMBLY EA9843F3

1. Remove the breather hose and PCV valve.



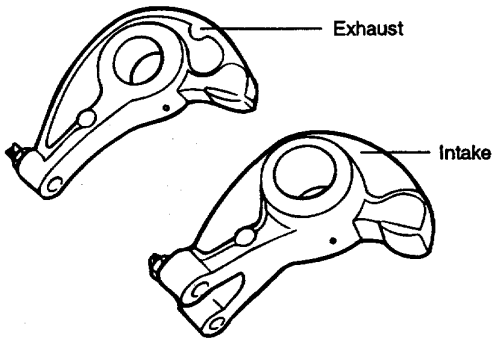
ECDD007C

2. Remove the timing belt cover.
3. Remove the rocker cover.
4. Loosen the flange bolts and remove the rocker arm shaft, rocker arms and rocker arm shaft springs as an assembly.
5. Remove the bolts, the rocker arms and arm shaft springs from the rocker arm shaft.

INSPECTION E7EBB099

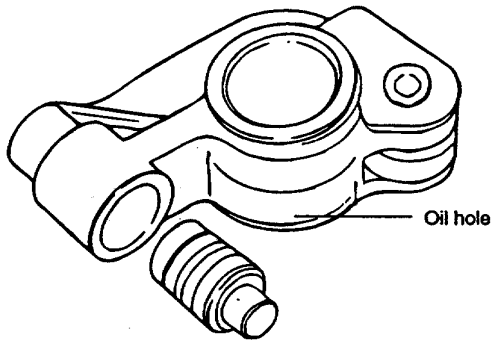
ROCKER ARM

1. Check the rocker face.
   Replace it if damaged or pressed.
2. Check the contact surface on the cam and vlave stem.
   If badly worn or damaged, replace it.



ECTC265A

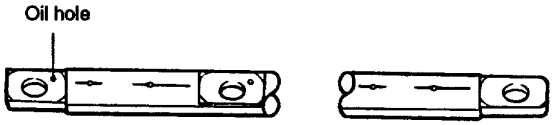
3. Check hydraulic lash adjust (HLA) face that contact the valve stem if badly worn or damaged, replace the HLA.



ECDA106A

ROCKER ARM SHAFT

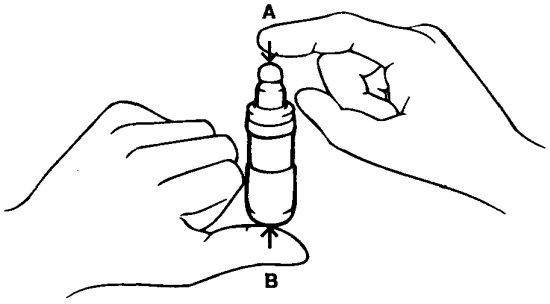
1. Check the rocker arm shafts for damage. Replace as necessary.
2. Check the oil hole whether clogged or not.



ECTC265B

HLA

With the HLA filled with engine oil, hold A and press B by hand. If B moves, Replace the HLA. For other specific troubleshooting regarding HLA, refer to the table below.



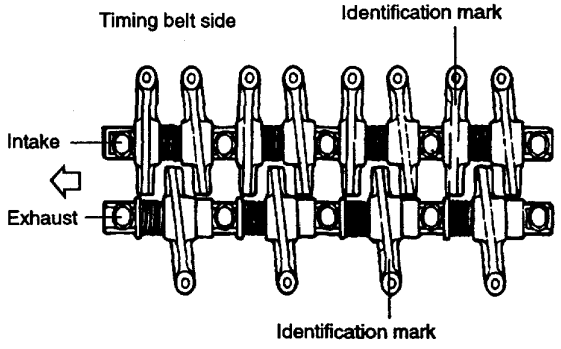
EDB9030D

Problem	Possible cause	Action
• Temporary noise on starting a cold engine	Normal	This noise will disappear after the oil in the engine has reached normal pressure.
• Continuous noise when engine is started after longer than 48 hours parking.	Oil drain out of the high pressure chamber on HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine run at 2000~3000 rpm If not disappear, refer to item 7 below
• Continuous noise when engine is first started after rebuilding cylinder head.	Insuffecient oil in cylinder head oil gallery.	
• Continuous noise when engine is after excessive craking the engine by starter motor or band.	Oil drain out of the high-pressure chamber in HLA, allowing air to get in.	
• Continuous noise when engine is after changing HLA.		⚠ ***CAUTION*** ***Do not run engine all a speed higher than 3000 rpm as this may damage HLA.***
• Continuous noise during idle after high speed running.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Execssive amount of air in the oil at high engine speed.	Check oil supply system
	Deteriorated oil	Check oil quality. If deteriorated, replace with specified type and amount of oil.
• Noise cotinues more than 15 minutes.	Low oil pressure	Check oil pressure and oil supply system of each part of engine.
	Faulty HLA.	Remove the cylinder head over and press down HLA by band. If it moves, replace HLA. ⚠ ***CAUTION*** ***Be careful of hot HLA.***

REASSEMBLY E1FD6E08

1. Install the rocker arms and rocker arm shaft springs to the rocker arm shafts, install the rocker arm shaft to the cylinder head.
   Tighten the rocker arm shaft mounting bolts to the specified torque.

Tightening torque
Rocker arm shaft mounting bolt :
20 ~ 27 Nm (200 ~ 270 kg.cm, 15 ~ 20 lb.ft)



ECDD107A

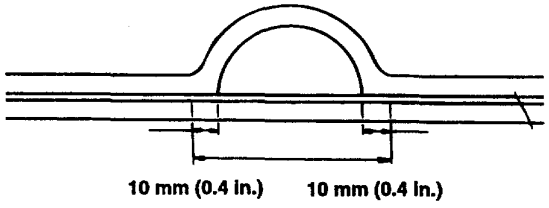
2. When installing the rocker arm, shaft and spring, mark the difference of left and right part.
   Use the spring without distinction of intake and exhaust valve.
   Must set the part that is small chamfer side between tow parts of rocker arm shaft to the timing belt.

3. Install the air rocker cover and tighten the bolts to the specified torque.

Tightening torque
Rockr cover bolt :
8 ~ 10 Nm (80 ~ 100 kg.cm, 6 ~ 7 lb.ft)

⚠ ***CAUTION***

1. ***Sealant must be applied to top surface of cylinder head and cam cap and area of application is shown in figure.***
2. ***The proper amount of sealant must be used to prevent the sealant from pushing excessive amounts.***
3. ***Use sealant of specified brands or equivalant.***
4. ***Sealant (Three bond No. 1212D aluminum color or equivalent) application place (4 place).***



ECDA107C

4. Install the timing belt cover.

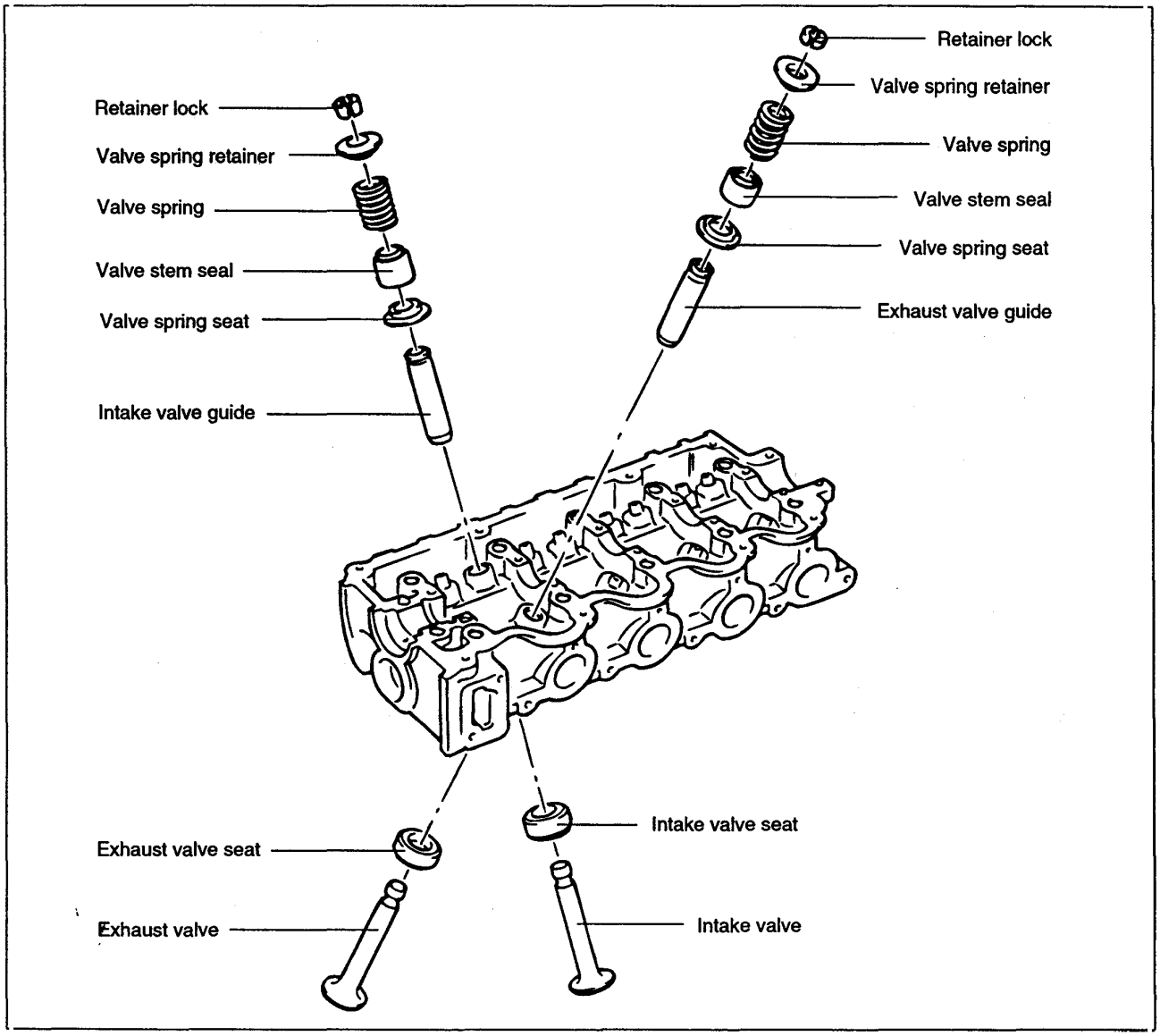
Tightening torque
Timing belt cover bolt :
10 ~ 12 Nm (100 ~ 120 kg.cm, 7 ~ 9 lb.ft)

5. Install the breather hose, PCV hose, blow by hose and spark plug cable.

6. Install the air intake hose and aor duct.

VALVES

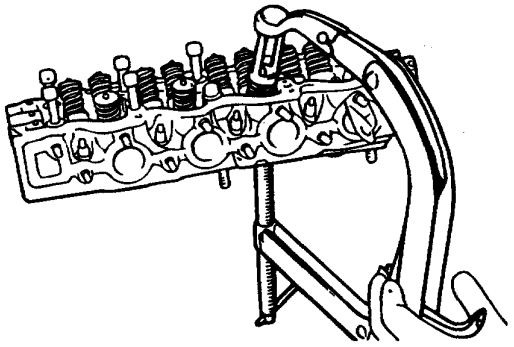
COMPONENTS E4F48D3A



ECDD108A

DISASSEMBLY E2A38BAC

1. Using the special tool, Valve Spring Remover and Installer, remove the retainer lock. Next, remove the spring retainer, vlave spring, spring seat and valve.



ECDA113A

NOTE

Keep these parts in order so that they can be reinstalled in their original positions.

2. Remove the valve stem seals with pliers, and discard them.

NOTE

Do not reuse the valve stem seals.

INSPECTION ED509AB7

VALVE SPRING

1. Check the valve spring free length and tension. If they exceed the service limit, replace the spring.
2. Using a square, test the squareness of each spring. If a spring is excessively out of square, replace it.

VALVE SPRING

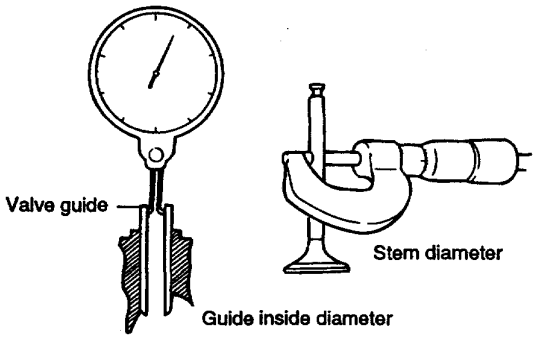
Standard vlaue
Free height : 42.03 mm (1.655 in.)
Load : 24.7 kg at 34.5 mm
Out of square : 1.5° or less

VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the vlave guide with the next oversize part.

VALVE STEM-TO-GUIDE CLEARANCE

Standard vlaue
Intake : 0.030 ~ 0.060 mm (0.0012 ~ 0.0024 in.)
Exhaust : 0.035 ~ 0.065 mm (0.0014 ~ 0.0026 in.)



ECDA113B

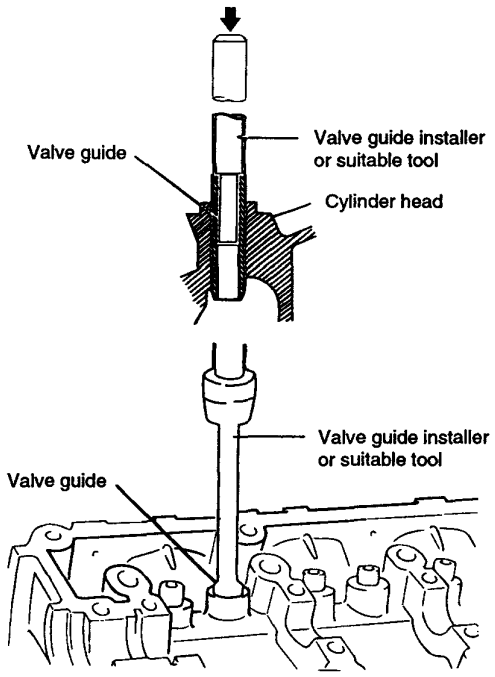
VALVE GUIDE OVERSIZES

Size mm (in.)	Size mark	Cylinder head hole size [mm (in.)]
0.05 (0.002) O.S.	5	11.05 ~ 11.058 (0.435 ~ 0.4354)
0.25 (0.010) O.S.	25	11.25 ~ 11.258 (0.429 ~ 0.4432)
0.50 (0.020) O.S.	50	11.50 ~ 11.508 (0.4528 ~ 0.4531)

VALVE GUIDE REPLACEMENT PROCEDURES

The valve guide is installed using a press fit. Using Value Guide installer (09221- 21200 A/B or suitable tool, replace the valve guide described in the following procedure.

1. Using the Valve Guide installer push rod, push the valve guide out toward the cylinder block with a press.

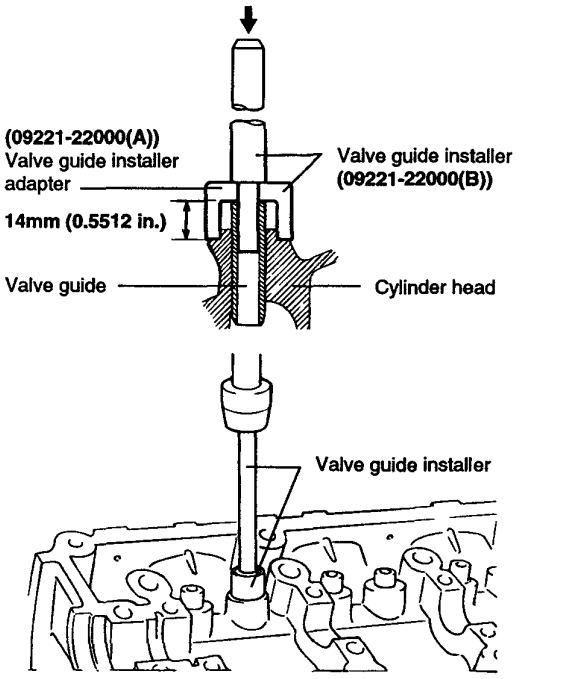


ECDA109B

2. Machine the valve guide insert hole in the cylinder head to the specified oversize of the new valve guide.

3. Using the Valve Guide installer or suitable tool, press fit the valve guide. Using the vlalve guide installer makes it possinle to press fit the valve guide to a pre-determined height. Install the vlave guide from the top of the cylinder head. Note that intake and exhaust valve guides differ in length.

4. After installing the valve guides, insert new valves and check the clearance.



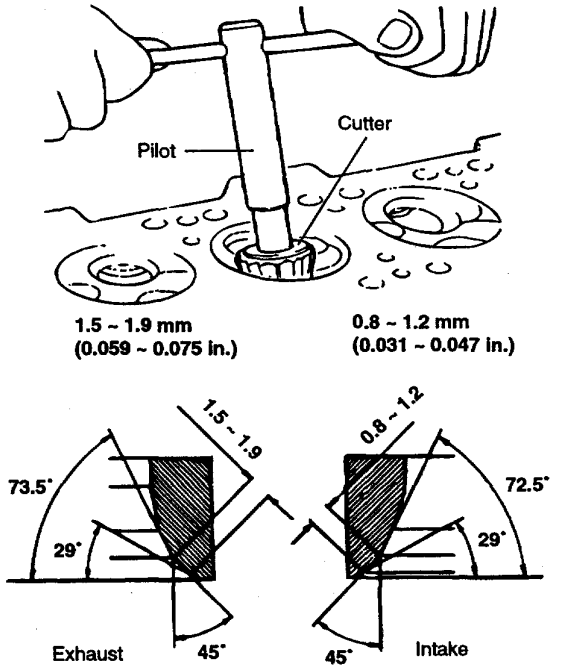
ECDA109C

5. Whenever valve guides are replaced, check for valve-to-seat contact, and recondition the valve seats as necessary.

VALVE SEAT INSERT

Check the valve seat for evidence of overheating and improper contact with the valve face. Recondition or replace the seat, if necessary.

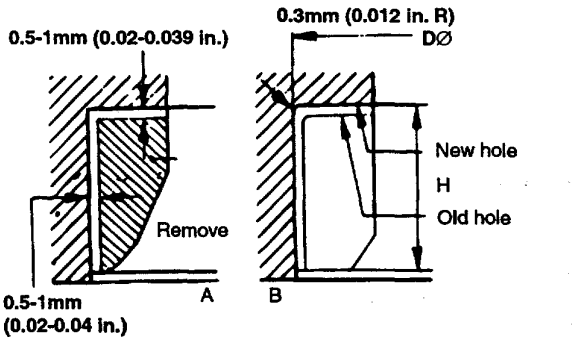
Before reconditioning the seat, check the valve guide for wear. If the vlave guide is worn, replace it, then recondition the seat. Recondition the vlave seat with a valve seat grinder or cutter. The valve seat contact width should be with within specifications and centered on the valve face.



ECTC285A

VALVE SEAT INSERT REPLACEMENT PROCEDURE

1. Any valve seat insert that has been worn over the service limit should be removed at normal temperature after cutting away most of the insert wall, using valve seat cutters, as shown in Fig A.
2. After removing the seat insert, machine the seat insert bore using a reamer or a cutter. Cut to the size shown in the table.
3. Heat the cylinder head to about 250°C (480°F) and press in the oversize seat insert. The oversize seat insert should be at normal room temperature for installation. After installing a new valve seat insert, resurface the valve seat using the same procedure described in the first paragraph of "Valve Seat Insert" (above).



ECDA109A

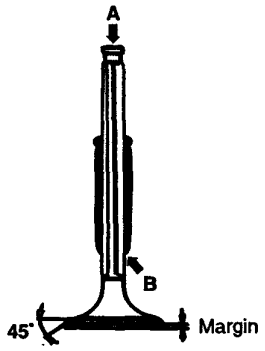
VALVE SEAT INSERT OVERSIZES

Description	Size mm (in.)	Size mark	Seat insett height H mm (in.)	Cylinder head I.D. mm (in.)
Intake valve seat insert	0.3 (0.012) O.S.	30	5.1~5.3 (0.201~0.2069)	28.80~28.821(1.134~1.135)
	0.6(0.024) O.S.	60	5.4~5.6 (0.213~0.220)	29.10~29.121(1.146~1.147)
Exhaust valve seat	0.3 (0.012) O.S.	30	5.9~6.1 (0.232~0.240)	34.30~34.325(1.350~1.351)
	0.6 (0.024) O.S.	60	6.2~6.4(0.244~0.252)	34.60~34.625(1.362~1.363)

VALVES

Check each valve for wear, damage and distortion of head and stem at B. Repair or correct, if necessary. If stem end A is pitted or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face.

Replace the valve if the margin has decreased to less than the service limit.



ECDA113D

MARGIN

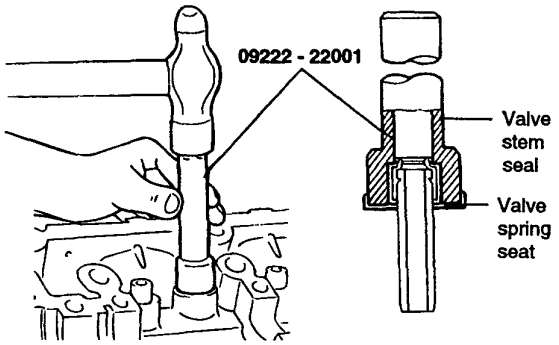
Standard value
Intake : 1.1 mm (0.043 in.)
Exhaust : 1.4 mm (0.055 in.)
Limit
Intake : 0.8 mm (0.031 in.)
Exhaust : 1.1 mm (0.043 in.)

REASSEMBLY E9733FB6

NOTE

1. *Thoughly clean each part before assembly.*
2. *Apply engine oil to sliding and rotating parts.*

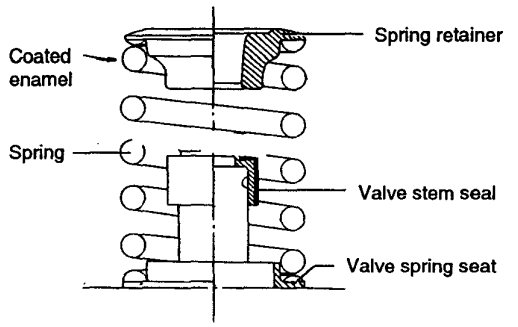
1. After installing the spring seat, fit the stem seal into the valve guide.
   To install, fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal Installer.
   The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leaking down the valve guides. Therefore, when installing, be careful not to twist the seal. Do not reuse old stem seals.



ECDD113E

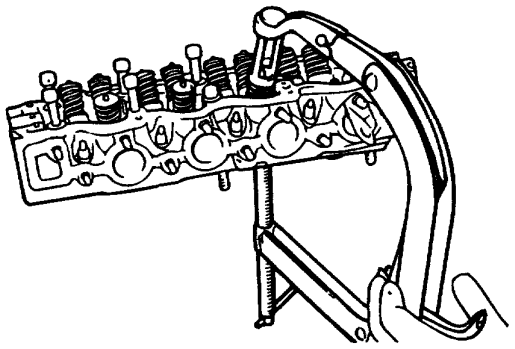
2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid using force when inserting the valve into the seal. After insertion, check to see if the valve moves smoothly.

3. Install springs and spring retainers. Valve springs should be installed with the enamel coated side toward the valve spring retainer.
   Valve springs should be installed with the enamel coated side toward the valve spring retainer.



ECDA113F

4. Using special tool, Valve Spring Remover and Installer, compress the spring. Be careful that the valve stem seal is not distorted by the bottom of the retainer. Then install the retainer locks. After installation of the valves, make certain that the retainer locks are properly installed.



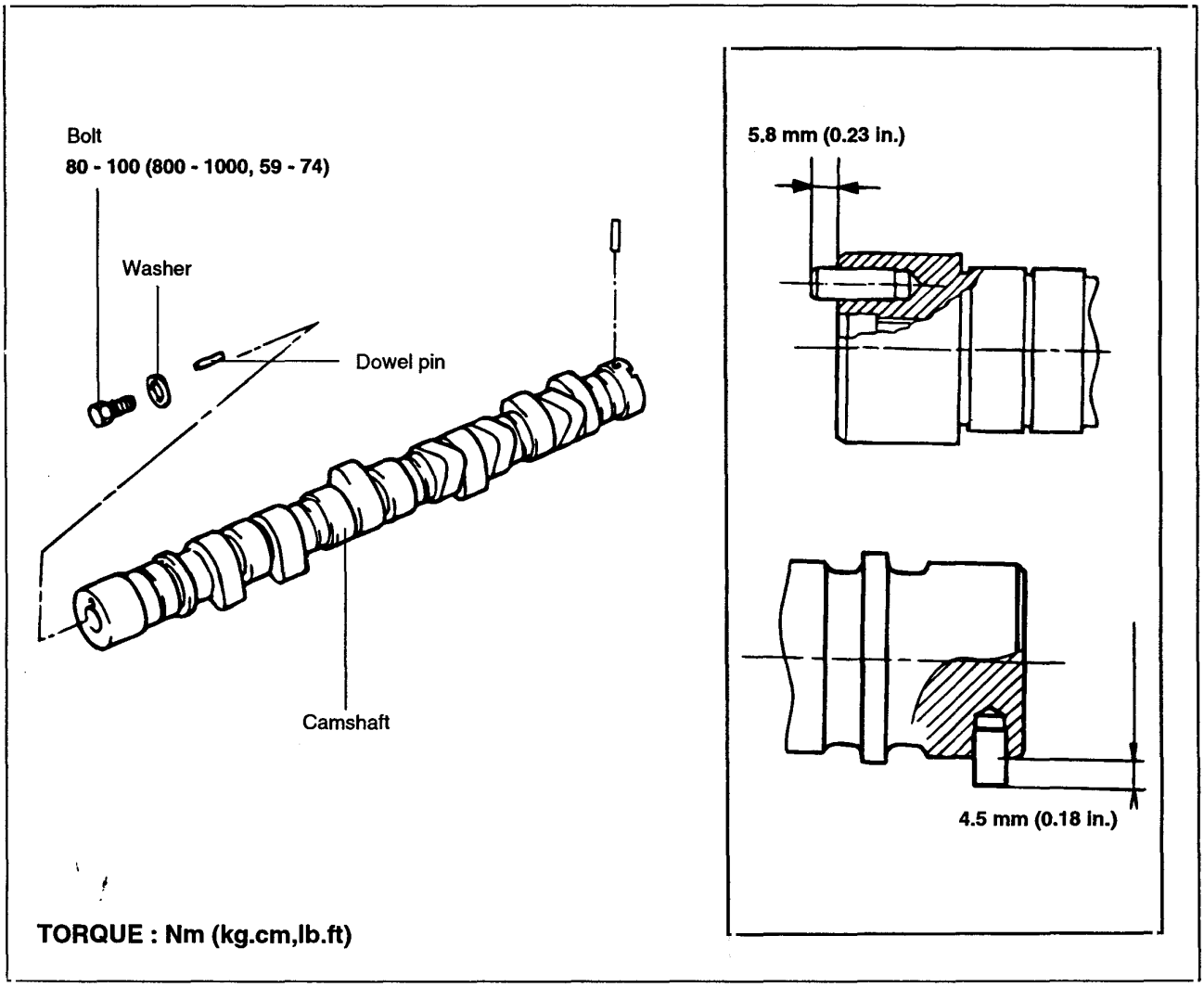
ECDA113A

5. Install the cylinder head. Refer to "Cylinder Head"

MAIN MOVING SYSTEM

CAM SHAFT

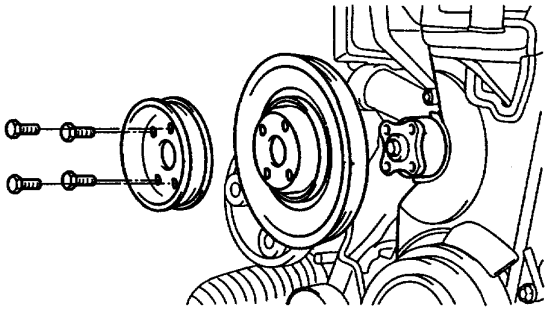
COMPONENTS ECDFF72C



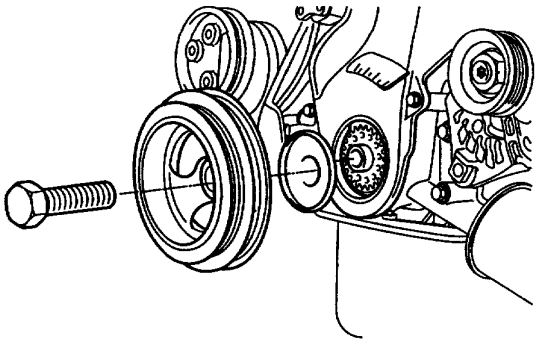
ECDD023A

DISASSEMBLY E84A1503

1. Disconnect the breather hose and the PCV hose.
2. Remove the coolant pump pulley and crankshaft pulley.

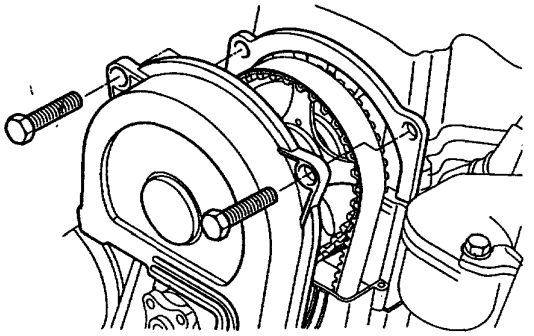


KDDC004B



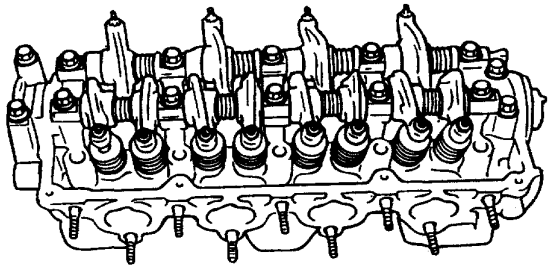
KDDC007B

3. Remove the timing belt cover.



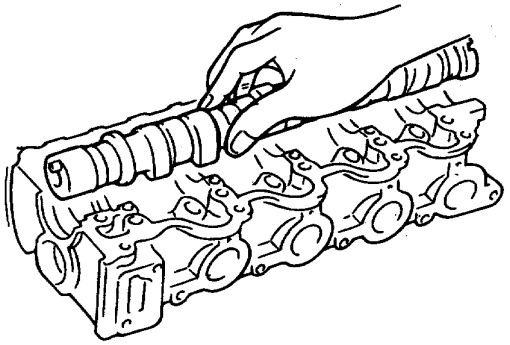
KDDC005B

4. Move the timing belt tensioner pulley toward the coolant pump and temporarily secure it.
5. Remove the timing belt from the camshaft sprocket.
6. Remove the camshaft sprocket.
7. Remove the rocker cover.
8. Remove the rocker arm shaft assembly, Refer to "Rocker Arms and Rocker Arm Shafts" section.



ECDD105A

9. Remove the camshaft bearing caps.
10. Remove the camshaft.



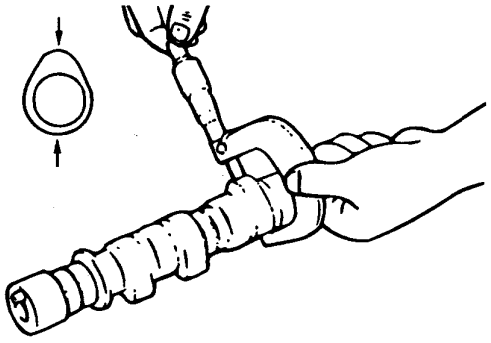
ECDD026A

INSPECTION ED14F2AA

CAMSHAFT

1. Check the caqmshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam olbes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height Standard value Intake : 42.8575 mm (1.6873 in.) Exhaust : 42.7354 mm (1.6825 in.) Limit Intake : 42.3575 mm (1.6676 in.) Exhaust : 42.2353 mm (1.6628 in.)



ECDA025A

3. Check the cam surface for dbnormal wear or damage, and replace if necessary.
4. Check each bearing for damage. If the bearing surface is excessively damaged, Replace the cylinder head assembly or camshaft bearing cap, as necessary.

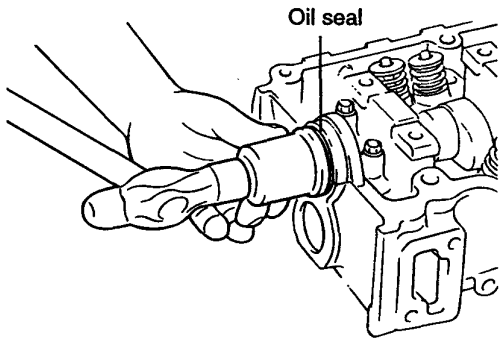
OIL SEAL (CAMSHAFT FRONT)

1. Check the lips for wear. If lip threads are worn, replace.
2. Check the oil seal lip contacting surface of the camshaft. If it is worn in stages, replace the camshaft.

Camshaft end play : 0.07 ~ 0.28 mm (0.0003 ~ 0.0011 in.)

REASSEMBLY EF4730AF

1. Install the camshaft after lubricating the journal of the camshaft with engine oil.
2. Install the camshaft bearing caps.
3. Install the rocker arm and rocker arm shaft.
   Refer to the "Rocker Arms and Rocker Arm Shafts" section.
4. Using the Special Tools, Camshaft Oil Seal Installer (09221-21000), press and fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the ouil seal.
   Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.

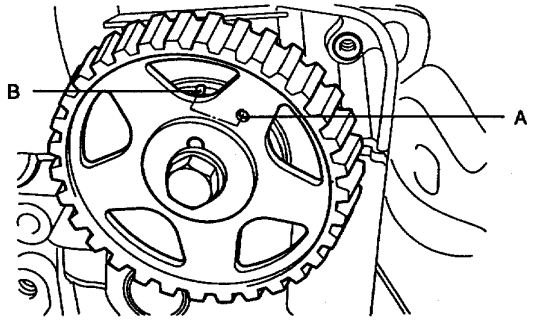


ECTC065A

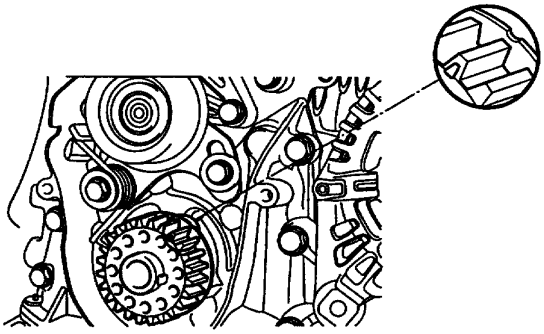
5. Install the camshaft sprocket and tighten the bolts to the specified torque.

Tightening torque Camshaft sprocket bolt : 80 ~ 100 Nm (800 ~ 1000 kg.cm, 59 ~ 74 lb.ft)

6. Align the camshaft sprocket and crankshaft sprocket timing marks. The piston in the No. 1 cylinder will then be at top dead center on the compression stroke.



ECDD008F



KDDC001B

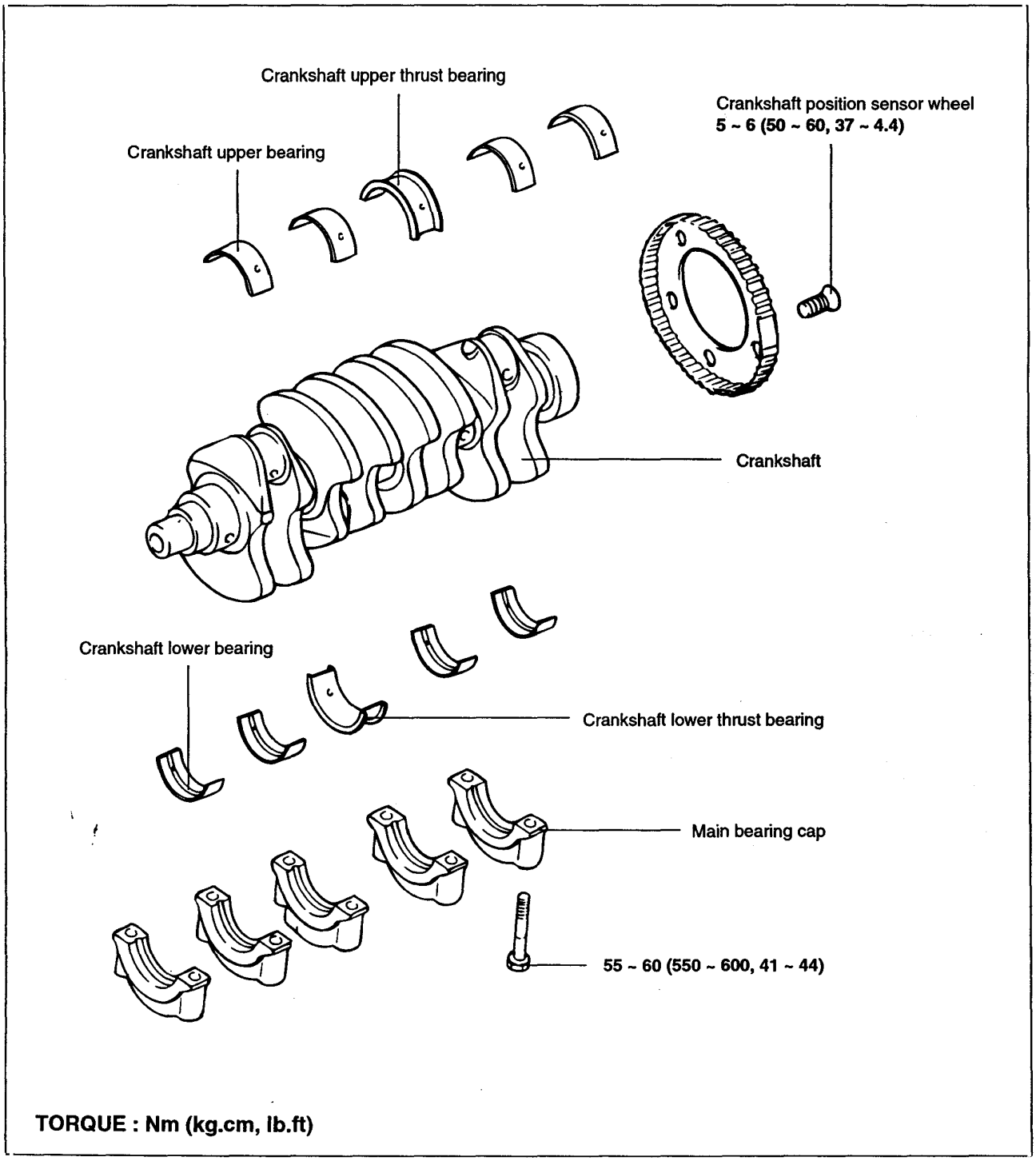
7. Intall a gasket in the rocker cover groove.
8. Temporarily install the rocker cover.
9. Start the engine and run at idle.
10. Install the rocker cover and tighten the bolts to the specified torque.

Tightening torque
Rocker cover bolt : 8~10Nm (80~100 kg.cm, 6~7 lb.ft)

11. Install the timing belt cover.
12. Install the coolant pump pulley and crankshaft pulley.

CRANK SHAFT

COMPONENTS E5DBAB64



TORQUE : Nm (kg.cm, lb.ft)

ECDD031A

DISASSEMBLY E80FB07E

1. Remove the timing belt train, front case, flywheel cylinder head assembly and oil pan. For details, refer to related chapters.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.
4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.
5. Remove the crankshaft position sensor wheel.

⚠ ***CAUTION***

Mark the main bearing caps topermit reassembly in the original position and direction.

INSPECTION E6D0BE8A

CRANKSHAFT

1. Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check oil holes for clogging. Correct or replace any defective part.
2. Inspect out-of-roundness and taper of crankshaft journal and pin.

Standard value
Crankshaft journal O.D. : 50 mm (1.9685 in.)
Crankshaft pin O.D. : 45 mm (1.7717 in.)
Crankshaft journal, pin out-of-roundness and taper :
0.01 mm (0.0004 in.) or less

MAIN BEARINGS AND CONNECTING ROD BEARINGS

Visually inspect each bearing for peeling, melting, seizure and improper contact. Replace the defective bearings.

OIL CLEARANCE MEASUREMENT

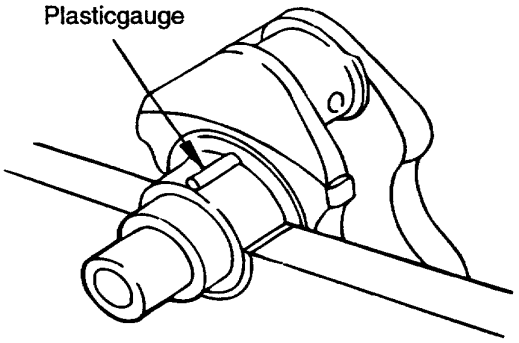
To check the oil clearance, measure outside diameter of the crankshaft journal and the crank pin and inside diameter of the bearing. The clearance measurement is the difference between the measured outside and inside diameters.

Standard value
Journal oil clearance No. 1, 2, 4, 5 :
0.028 ~ 0.046 mm (0.0011 ~ 0.0018 in.)
Journal oil clearance No. 3 (center) :
0.034 ~ 0.52 mm (0.0013 ~ 0.002 in.)
Pin oil clearance :
0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)

PLASTIC GAUGE METHOD

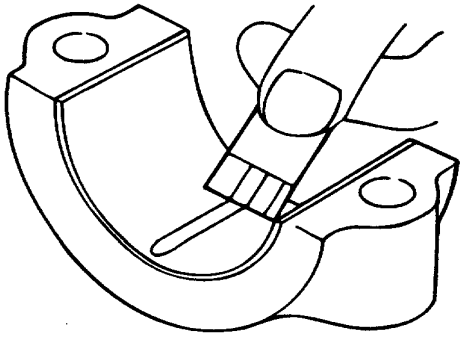
A plastic gauge may be used to measure the clearance.

1. Remove oil, greass and any other dirt from bearings and journals.
2. Cut plastic gauge to the same length as the width of the bearing and place ot parallel with the journal, off from the oil holes.



ECDA033A

3. Install the crankshaft , bearings, and caps. Tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps.
   Measure the width of the plastic gauge at the widest point using the scale printed on the gauge package.
   If the clearance exceeds the repair limit, replace the bearing.
   Should the standard clearance not be obtained even after bearing replacement, the journal should be fround to a recommended undersize, and a bearing of the same size should be installed.



ECDA033B

OIL SEAL

Check front and rear oil seals for damage or worn lips. Replace any seat that is defective.

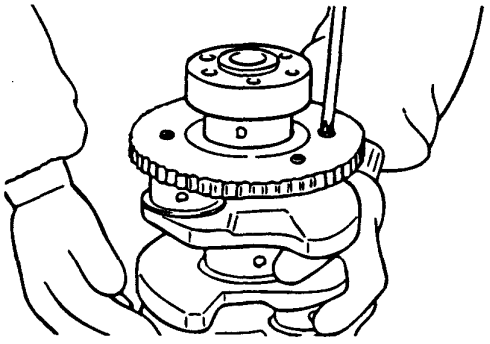
CRANKSHAFT POSITION SENSOR WHEEL

1. Remove the crankshaft position sensor wheel.
2. Check the crankshaft position sensor wheel for damage, cracks and wear, and replace if necessary.
3. Check the clearance between the crankshaft position sensor wheel and the crankshaft position sensor with a depth gage.

Standard value
Clearance between the crankshaft position sensor wheel and crankshaft position sensor :
0.5 ~ 1.5 mm (0.0020 ~ 0.059 in.)

NOTE

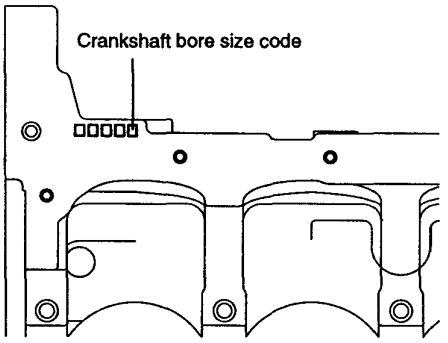
1. *Measure the depth of the top of the crankshaft position sensor wheel teeth and the outside of transaxle housing.*
2. *Measure the difference between the crankshaft position sensor length and depth.*
3. *The crankshaft position sensor length is the distance between the end of crankshaft position sensor and inner point of contacting face.*



ECDA033C

REPLACEMENT E330EBFB

1. Check the cylinder block stamping crankshaft bore size code.



ECDD004C

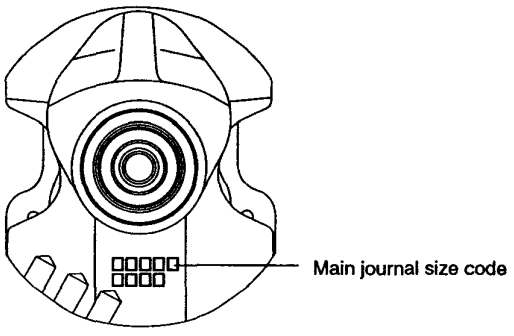
NOTE

Record the cylinder block crankshaft bore size code letters on cylinder block as shown.
Reading order is from left to right with front crankshaft bore size code shown first.

Cylinder block crankshaft bore diameter

Class	Cylinder block crankshaft bore diameter	Size code.
a	54 ~ 54.006 mm (2.1259 ~ 2.1262 in.)	Λ
b	54.006 ~ 54.012 mm (2.1262 ~ 2.1264 in.)	b
c	54.012 ~ 54.016 mm (2.1264 ~ 2.1266 in.)	c

2. Check the crankshaft main journal



ECPC004B

NOTE

Record the main journal size code letters on the crankshaft blance weight.
Reading order is from left to right as shown, with no.1 main journal size code shown first.

CRANKSHAFT MAIN JOURNAL DIAMETER

Class	Main journal diameter	Size code.
I	49.968 ~ 49.962 mm (1.9672 ~ 1.9670 in.)	Λ
II	49.962 ~ 49.956 mm (1.9670 ~ 1.9667 in.)	b
III	49.956 ~ 49.950 mm (1.9667 ~ 1.9665 in.)	c

MAIN JOURNAL BEARING THICKNESS

NO. 1, 2, 4, 5

Color	Main journal bearing thickness
Yellow	2.002~2.005mm (0.0788~0.0789in.)
Green	2.005~2.008mm (0.0789~0.0790in.)
No color	2.008~2.011mm (0.0790~0.0791in.)
Black	2.011~2.014mm (0.0791~0.0793in.)
Blue	2.014~2.017mm (0.0793~0.0794in.)

NO.3 (CENTER BEARING)

Color	Main journal bearing thickness
Yellow	1.999~2.002mm (0.0787~0.0788in.)
Green	2.002~2.005mm (0.0788~0.0789in.)
No color	2.005~2.008mm (0.0789~0.0790in.)
Black	2.008~2.011mm (0.0790~0.0791in.)
Blue	2.011~2.014mm (0.0791~0.0793in.)

3. Choose proper main journal bearing in table.

REASSEMBLY E1718CF4

1. Install the upper main bearing inserts in the cylinder block.

   When reusing the main bearings, remember to install them by referring to the location marks made at the time of disassembly.

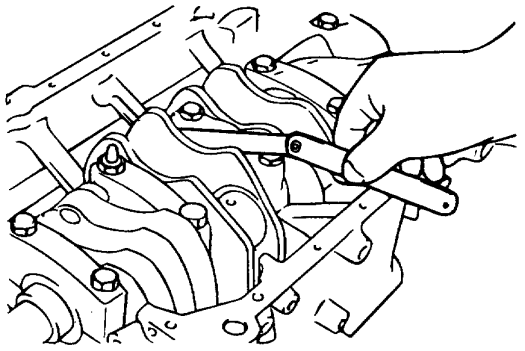
2. Install the crankshaft. Apply engine oil to the journals.

3. Install bearing caps and tighten cap bolts to the specified torque in the sequence of the center, No.2, 4, front and rear caps.
   Cap bolts should should be tightened evenly in 2 to 3 stages before they are tightened to the specified torque.
   The caps should be installed with the arrow mark directed toward the crank pulley side of engine. Cap numbers must be correct.

Tightening torque
Main bearing cap bolt :
55 ~ 60 Nm (550 ~ 600 kg.cm, 41 ~ 44 lb.ft)
Connecting rod cap bolt :
32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)

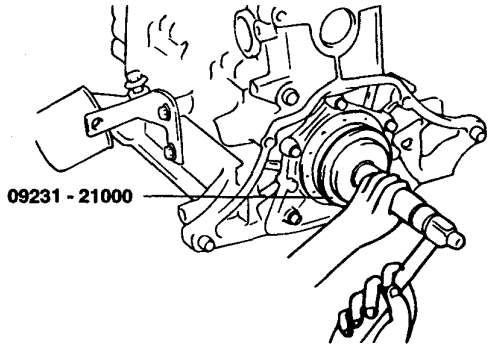
4. Make certain that the crankshaft turns freely and has the proper clearance between the center main bearing thrust flange and the connecting rod big end bearing.

Standard value
Crankshaft end play :
0.05 ~ 0.175 mm (0.002 ~ 0.005 in.)



KCPC050B

5. Install the oil seal in the crankshaft rear oil seal case. Use the Special Tool, Crankshaft Rear Oil Seal installer (09231 - 21000) as shown. Press and fit the oil seal in all the way, being careful not to misalign it.



ECDA034B

6. Install the rear oil seal case and gasket. Tighten the five bolts.
   Apply engine oil to the oil seal lips and crankshaft of the time of installation.

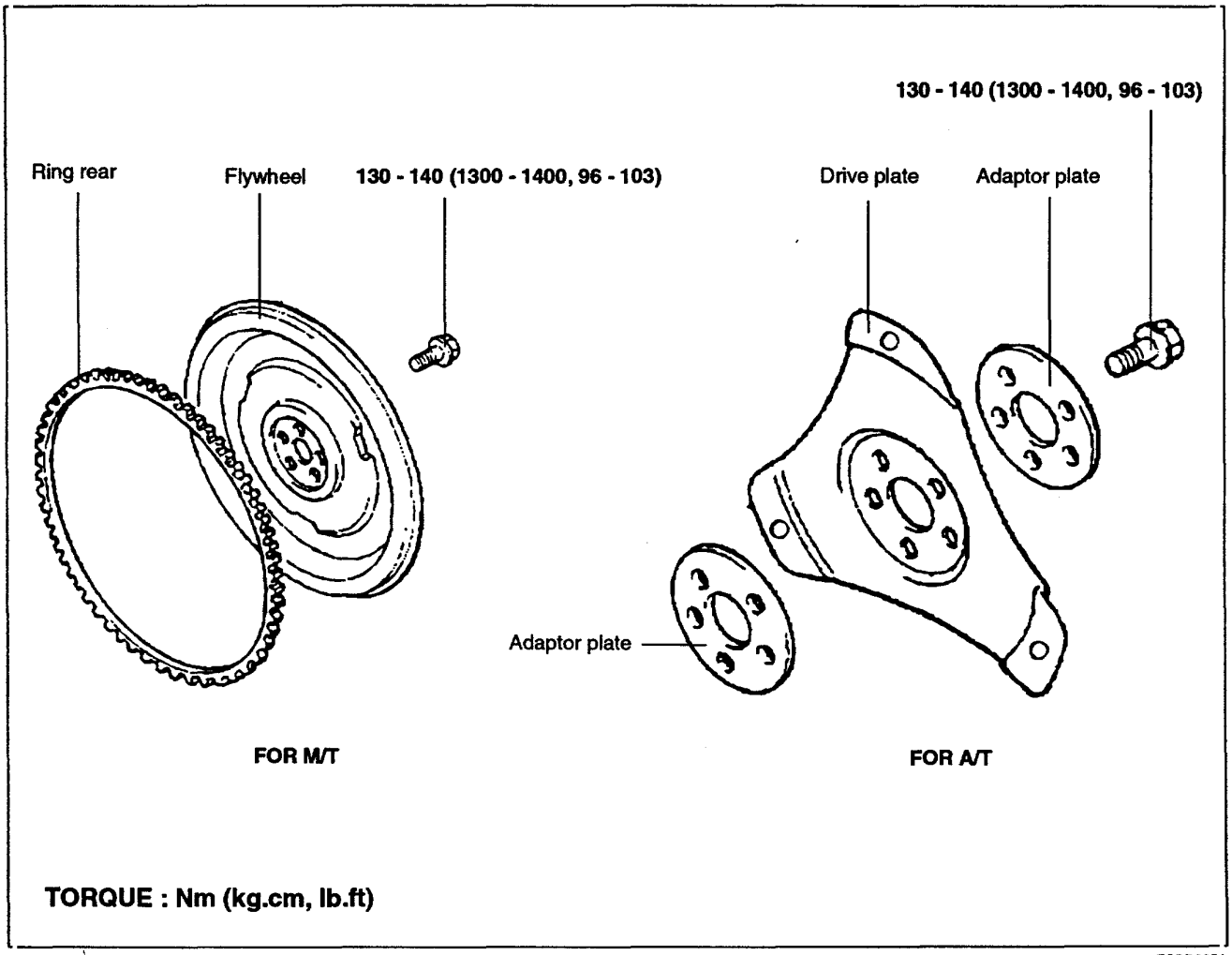
7. Install the rear plate and tighten the bolts.

8. Install the connecting rod caps. Refer to the "Piston and Connecting Rods" section.

9. Install the flywheel, front case, oil pan and timing belt. For further details, refer to the respective chapters.

FLY WHEEL

COMPONENTS EEE442CE



ECDD035A

DISASSEMBLY E02150DA

1. Remove the transaxle and clutch.
2. Remove the flywheel.

INSPECTION EC55F7DF

1. Check the clutch disc contacting surface of the fly wheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the fly wheel for runout.

Standard value
Flywheel run-out : 0.1 mm (0.004 in.)

3. Check the ring gear for damage, crack and wear, and replace if necessary.

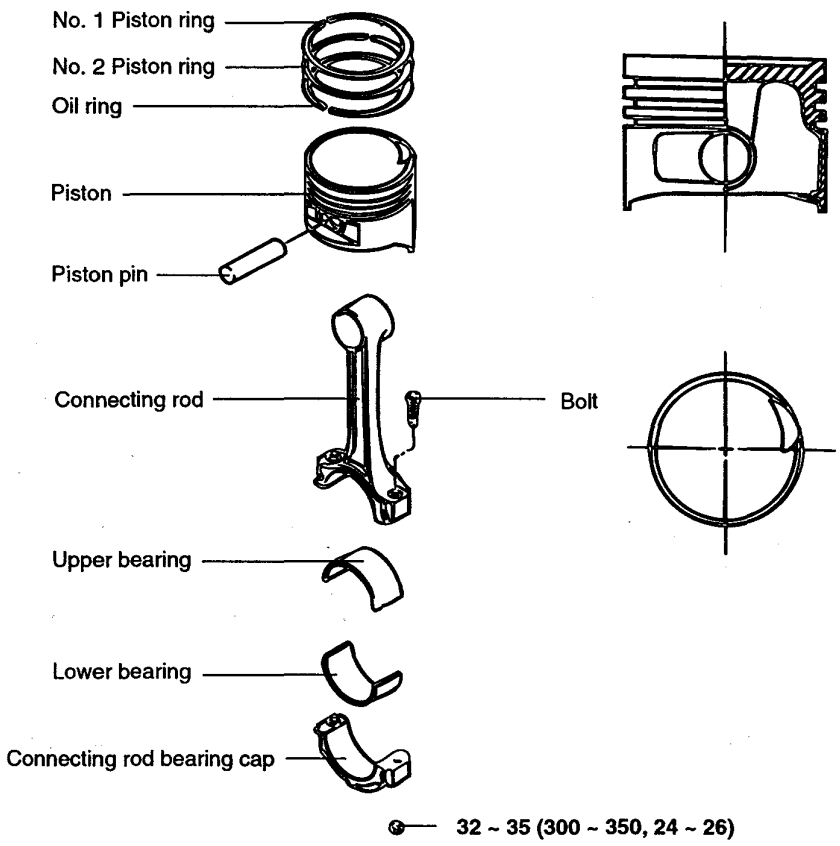
REASSEMBLY EFD5456C

Install the flywheel assembly and tighten the bolts to the specified forque.

Tightening torque
Flywheel bolt :
130 ~ 140 Nm (1300 ~ 1400 kg.cm, 96 ~ 103 lb.ft)

PISTON

COMPONENTS EAAD6A08

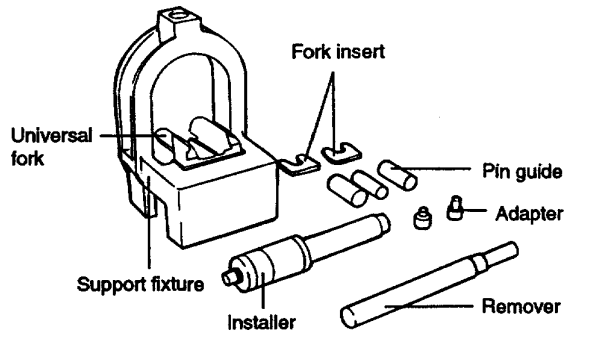


TORQUE : Nm (kg.cm, lb.ft)

ECDD095A

DISASSEMBLY E4CFA707

1. Use the Special Tools (09234-33001) to disassemble and reassemble the piston and connecting rod.



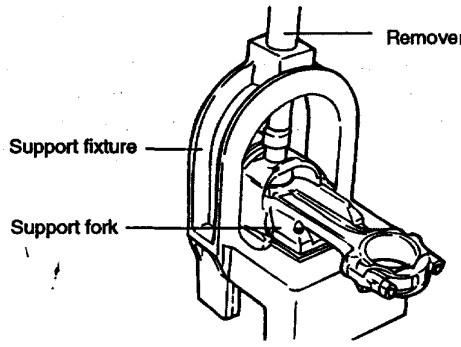
ECDA040A

2. Place the proper fork inserts in the fork of the tool. Between the connecting rod and the piston.
3. Insert the proper removal tool through the hole in the arch of the tool.

NOTE

Center the piston, rod and pin assembly with the removal arbor.

4. Press the piston pin out of the connecting rod.



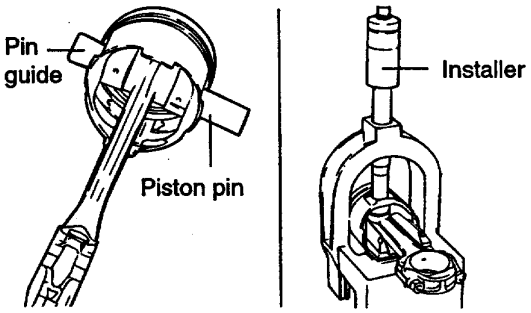
ECDA040B

INSTALLATION EE5CCEC8

1. Install proper pin guide through piston and into connecting rod. Hand tap pin guide into piston for proper retention. Drop piston pin into the other side of the piston.

NOTE

The pin guide centers the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool.If too small a pin guide is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or insert of the tool.



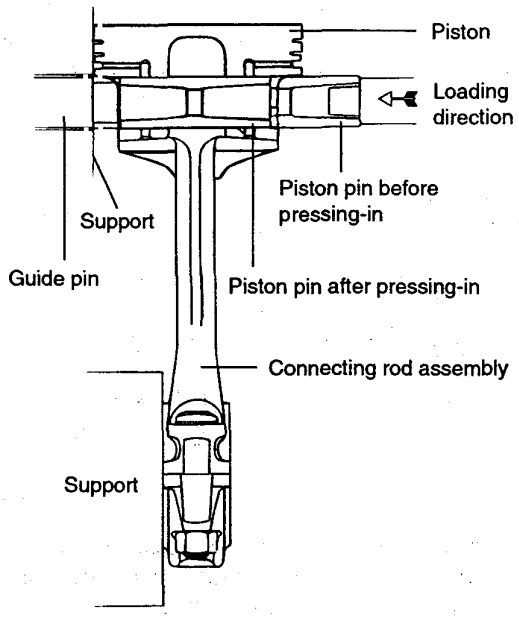
ECDA041A

2. Install piston assembly onto fork assembly of tool. Tool will supprot connecting rod at the piston pin. Be sure to slide the piston assembly into the fork until the pin guide contacts the fork insert.
3. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alpha-numeric setting from the application chart is obtained. Turn knurled nut to lock numbered sleeve on shaft.

4. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

⚠ ***CAUTION***

Do not exceed 5000 pounds of force when stopping the installing arbor sleeve against the arch.



ECDA041B

INSPECTION E9DFDD12

PISTON AND PISTON PINS

1. Check each piston for scuffing, scoring wear, and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, also replace the rings.
3. Check the piston pin fit in the piston pin hole. Replace any defective piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature).

PISTON RINGS

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in a ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace only the piston rings.

Piston ring side clearance
Standard value
No. 1 : 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)
No.2 : 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)
Limit
No. 1 : 0.1 mm (0.004 in.)
No. 2 : 0.1 mm (0.004 in.)

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring.

Item	Standard - mm (in.)	Limit - mm (in.)
Piston ring end gap No.1	0.15 ~ 0.30 (0.0059 ~ 0.012)	1 (0.039)
Piston ring end gap No.2	0.30 ~ 0.45 (0.012 ~ 0.0177)	1 (0.039)
Oil ring side rail end gap	0.20 ~ 0.70 (0.078 ~ 0.0275)	1 (0.039)

When replacing the ring without correcting the cylinder bore, check the gap with the ring positioned at the bottom of the ring travel.
When replacing a ring, use a ring of the same size.

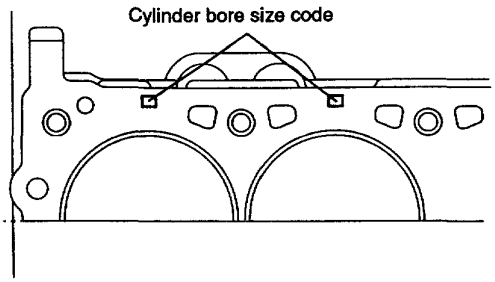
Piston ring service size and mark
STD : None
0.25 mm (0.010 in.) O.S. : 25
0.50 mm (0.020 in.) O.S. : 50
0.75 mm (0.030 in.) O.S. : 75
1.00 mm (0.039 in.) O.S. : 100

📖 ***NOTE***

The mark can be found on the upper side of the ring.

REPLACEMENT E893C0BD

1. Check the cylinder bore size code on the cylinder block top face.



ECPC005B

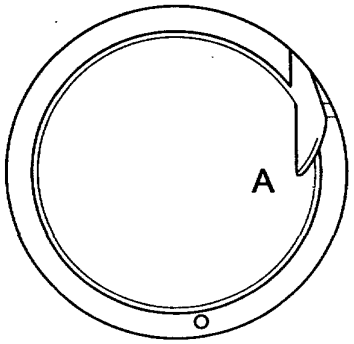
1.3 L

Class	Cylinder bore inner diameter	Size code
A	71.5 ~ 71.51 mm (2.815 ~ 2.8153 in.)	A
B	71.51 ~ 71.52 mm (7.8153 ~ 2.8157 in.)	None
C	71.52 ~ 71.53 mm (2.8157 ~ 2.8161 in.)	C

1.5 L

Class	Cylinder bore inner diameter	Size code
A	75.5 ~ 75.51 mm (2.9724 ~ 2.9728 in.)	A
B	75.51 ~ 75.52 mm (2.9728 ~ 2.9732 in.)	None
C	75.52 ~ 75.53 mm (2.9732 ~ 2.9736 in.)	C

2. Check the piston size code on the piston top face.



ECDD005C

1.3 L

Class	Piston outer diameter	Size code
A	71.47 ~ 71.48 mm (2.8138 ~ 2.814 in.)	A
B	71.48 ~ 71.49 mm (2.8141 ~ 2.8145 in.)	None
C	71.49 ~ 71.50 mm (2.8145 ~ 2.8149 in.)	C

1.5 L

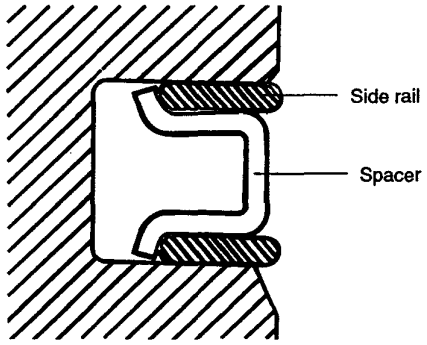
Class	Piston outer diameter	Size code
A	75.47 ~ 75.48 mm (2.9712 ~ 2.9716 in.)	A
B	75.48 ~ 75.49 mm (2.9716 ~ 2.9720 in.)	None
C	75.49 ~ 75.50 mm (2.9720 ~ 2.9724 in.)	C

3. Selce the piston related to cylinder bore class.

Oil clearance : 0.02 ~ 0.04 mm (0.00078 ~ 0.00157 in.)

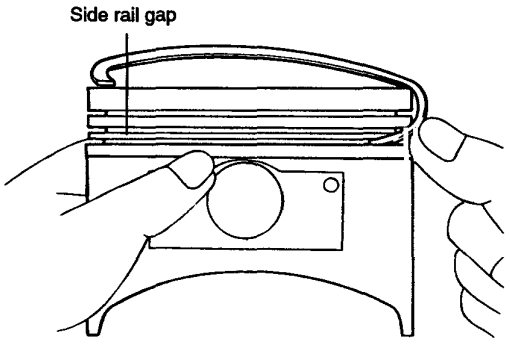
REASSEMBLY EDC6B22B

1. Install the spacer.



ECDA043A

2. Install upper side rail. To install side rail, first put one end of side rail between piston ring groove and spacer, hold it down firmly, then press down the portion to be inserted with your finger into groove as illustrated.



ECDA043B

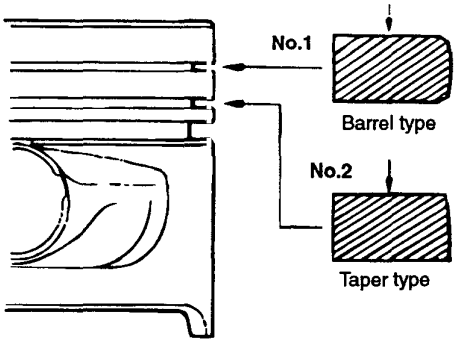
NOTE

Do not use piston ring expander when installing side rail.

3. Install lower side rail using same procedure as Step 2.

4. Using piston ring expander, install No. 2 piston ring.

5. Install No. 1 piston ring.

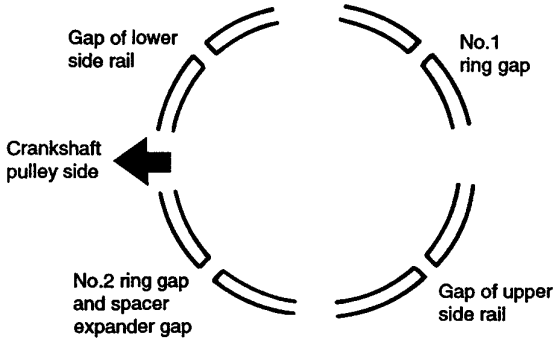


ECTC110A

6. Apply engine oil around piston and piston rings.

7. Position each piston ring end gap as far apart from neighboring gaps as possible. Make sure that gaps are not positioned in side rail thrust and pin directions.

8. Hold piston rings firmly in a piston ring compressor as you insert them into cylinder.



ECDA043D

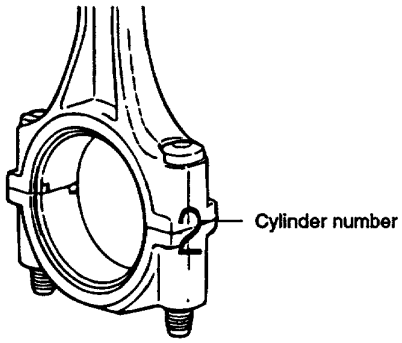
9. Make sure that the front mark of piston and the front mark (identification mark) of connecting rod are directed toward frront of engine.

10. When connecting rod cap is installed, make sure that cylinder numbers put on rod and cap at disassembly match each other.

11. When new connecting rod is installed, make sure that notches for holding bearing in place are on same side.

12. Tighten the connecting rod cap nuts.

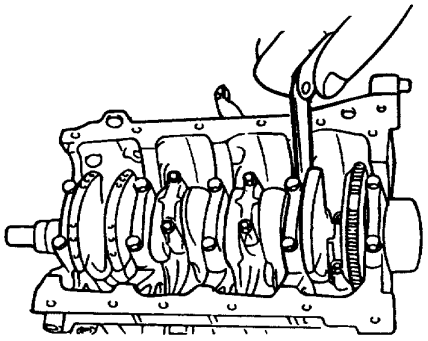
Tightening torque
Connecting rod cap nuts
32 ~ 35 Nm (320 ~ 350 kg.cm, 24 ~ 26 lb.ft)



ECDA043E

13. Check connecting rod side clearance.

Connecting rod side clearance
Standard value : 0.10 ~ 0.25 mm (0.004 ~ 0.0098 in.)
Limit : 0.4 mm (0.0157 in.)

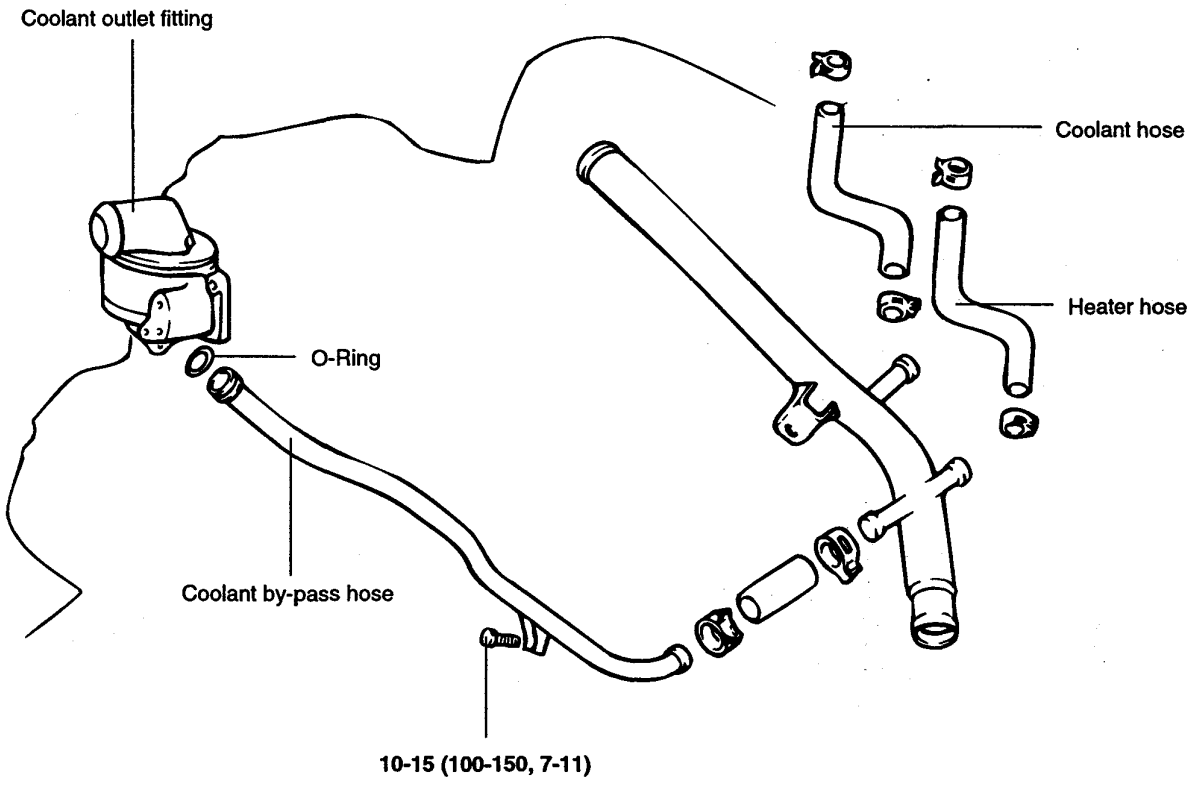


ECDA043F

COOLING SYSTEM

ENGINE COOLANT HOSE / PIPES

COMPONENTS E1A8EF5D



TORQUE : Nm (kg.cm, lb.ft)

ECDD055A

INSPECTION EB6C9C4B

1. Check the coolant puipes and hoses for cracks, damage, or restrictions.
2. Replace if necessary.

REASSEMBLY EC2C8BC0

1. Fit the O - ring in the groove provided at the coolant inlet pipe ends, wet the O-ring with coolant and insert into the coolant inlet pipe.

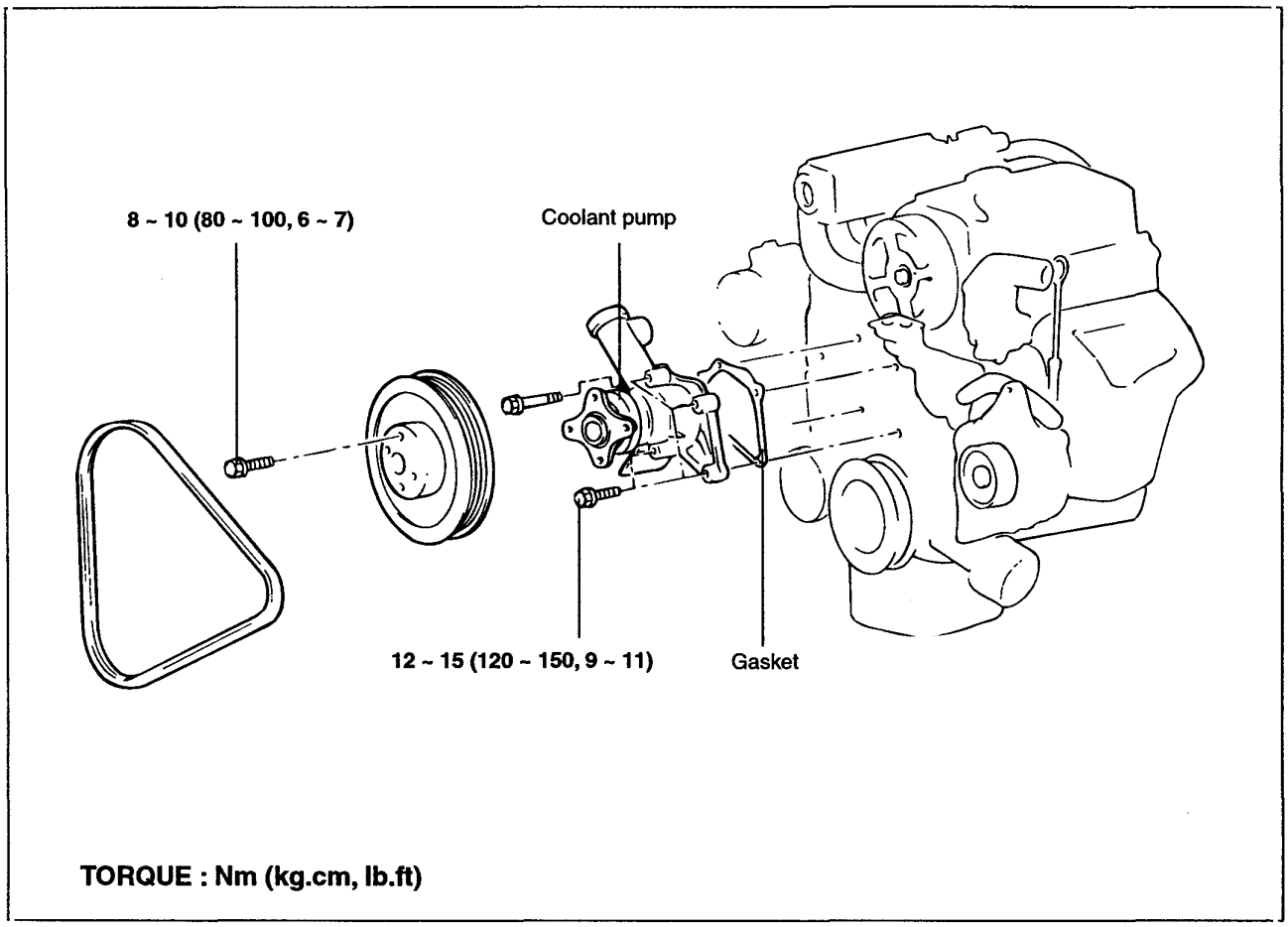
2. Make sure that there is a yellow mark on the inlet coolant hose and while keeping the yellow mark toward of the coolant inlet pipe, fit the hose to the pipe to the end of the yellow mark.

NOTE

1. *Do not apply oil or grease to the coolant pipe O-ring*
2. *Keep the coolant pipe connections free of sand, dust, etc.*
3. *Insert the coolant pipe fully into the coolant pump.*
4. *Do not reuse the O-ring but replace it with a new one.*

ENGINE COOLANT PUMP

COMPONENTS E072F0E6



TORQUE : Nm (kg.cm, lb.ft)

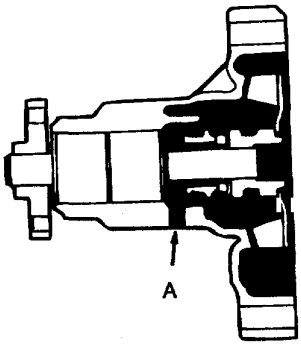
ECDD058A

DISASSEMBLY E5C20E5D

1. Drain the coolant and disconnect the coolant outlet pipe connection hose form the coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt idler.
4. Remove the coolant pump mounting bolts, then remove the generator brace.
5. Remove the coolant pump assembly from the cylinder block.

INSPECTION E042DDD0

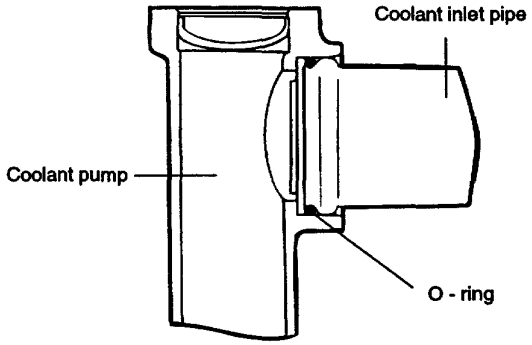
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks form hole "A", the seal is defective. Replace the coolant pump assembly.



ECDA060A

REASSDEMBLY E64FB2E0

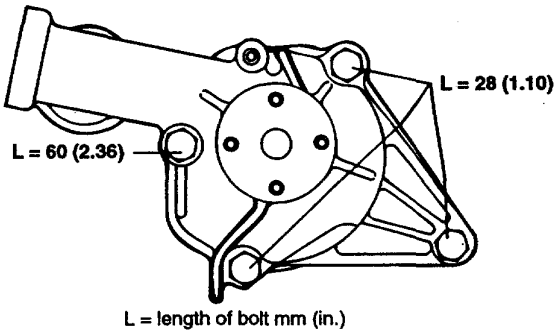
1. Clean the gasket surfaces of the coolant pump body and the cylinder block.



ECDA061A

2. Install a new coolant pump gasket to the coolant pump and tighten the bolts to the specified torque.

Tightening torque
Coolant pump bolt to cylinder block :
12 ~ 15 Nm (120 ~ 150 kg.cm, 9 ~ 11 lb.ft)



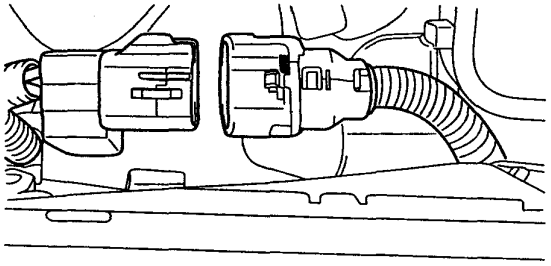
ECDD061B

3. Install the timing belt idler and timing belt. Adjust the timing belt tension. Refer to the "Timing System" section.
4. Install the timing belt covers.
5. Install the coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the system with clean coolant.
7. Run the engine and check for leaks.

RADIATOR

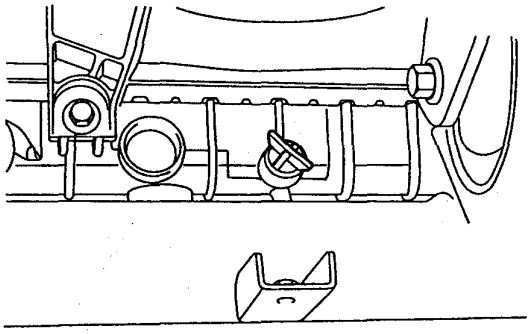
DISASSEMBLY EDBD1EA3

1. Disconnect the radiator fan motor connector.



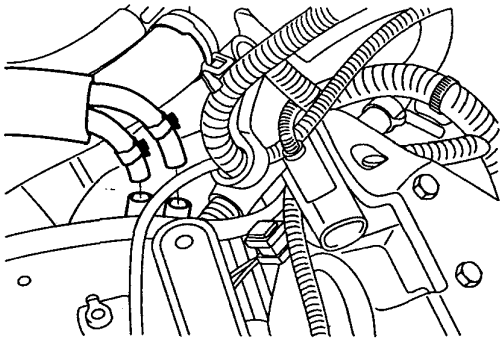
KCPC006B

2. Set the temperature of the heater control to the hot position.
3. Loosen the radiator drain plug to drain coolant.



KDDC008B

4. Disconnect the upper and lower hose and overflow tube.
5. For vehicles with automatic transaxles, disconnect the oil cooler hoses from the automatic transaxle.

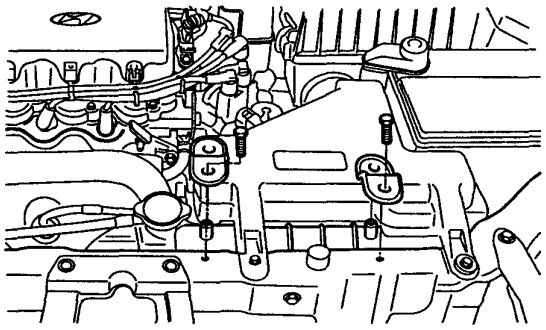


KCPC003E

⚠ ***CAUTION***

Plug the ends of the oil cooler hoses and the automatic transaxle fittings to prevent transaxle fluid form spilling out and foreign material from entering.

6. Remove the radiator mounting bolts.



KDDC014B

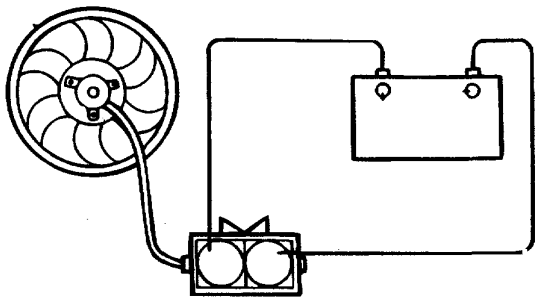
7. Remove the radiator together with the fan motor.
8. Remove the fan motor from the radiator.

INSPECTION EA35EDAE

1. Check the radiator for bent, broken or plugged fins.
2. Check the radiator for corrosion, damage, rust or scale.
3. Check the radiator hoses for cracks, damage or deterioration.
4. Check the reservoir tank for damage.
5. Check the radiator cap spring for damage.
6. Test the pressure of the cap using a cooling system checker
7. Check the radiator cap seal for cracks or damage.

RADIATOR FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied to the terminals (as shown in figure).



ECDA064A

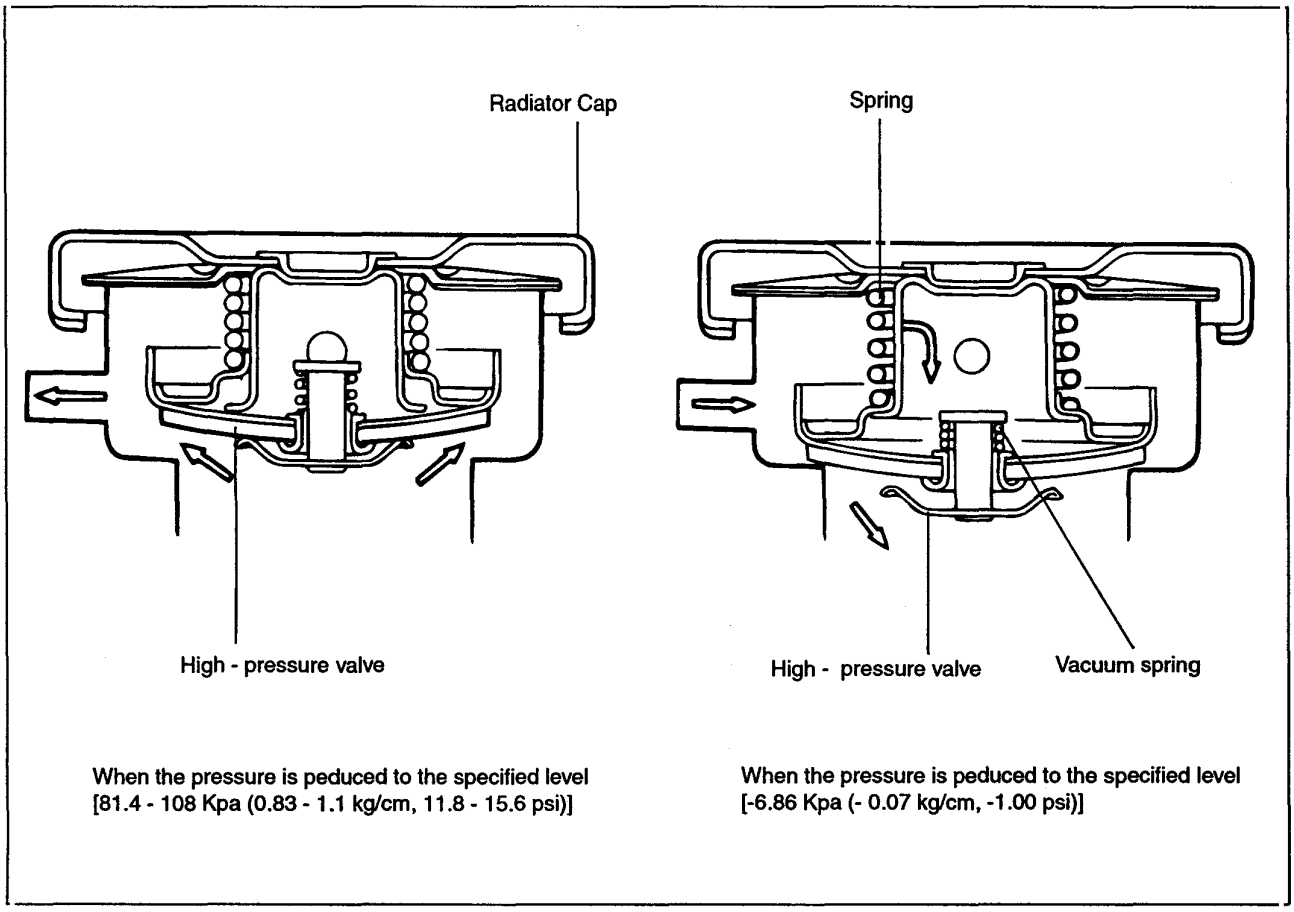
2. Check that abnormal noises are not produced while the motor is turning.

REASSEMBLY E6333BB8

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the thermostat opens, and then stop the engine.
3. Remove the radiator cap, and add coolant up to the filler neck of the radiator, and then fill the reservoir tank to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR CAP

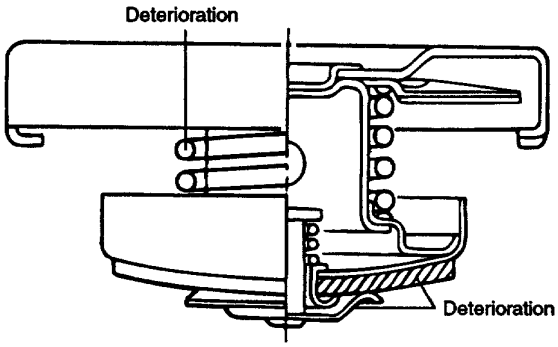
COMPONENTS EF8DCAE3



ECTC145A

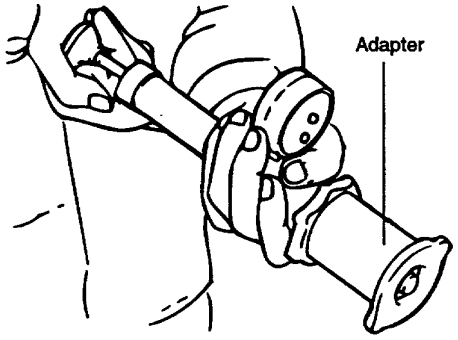
INSPECTION E31A77E2

1. Check the radiator cap for damage, cracks and deterioration.



ECDA068A

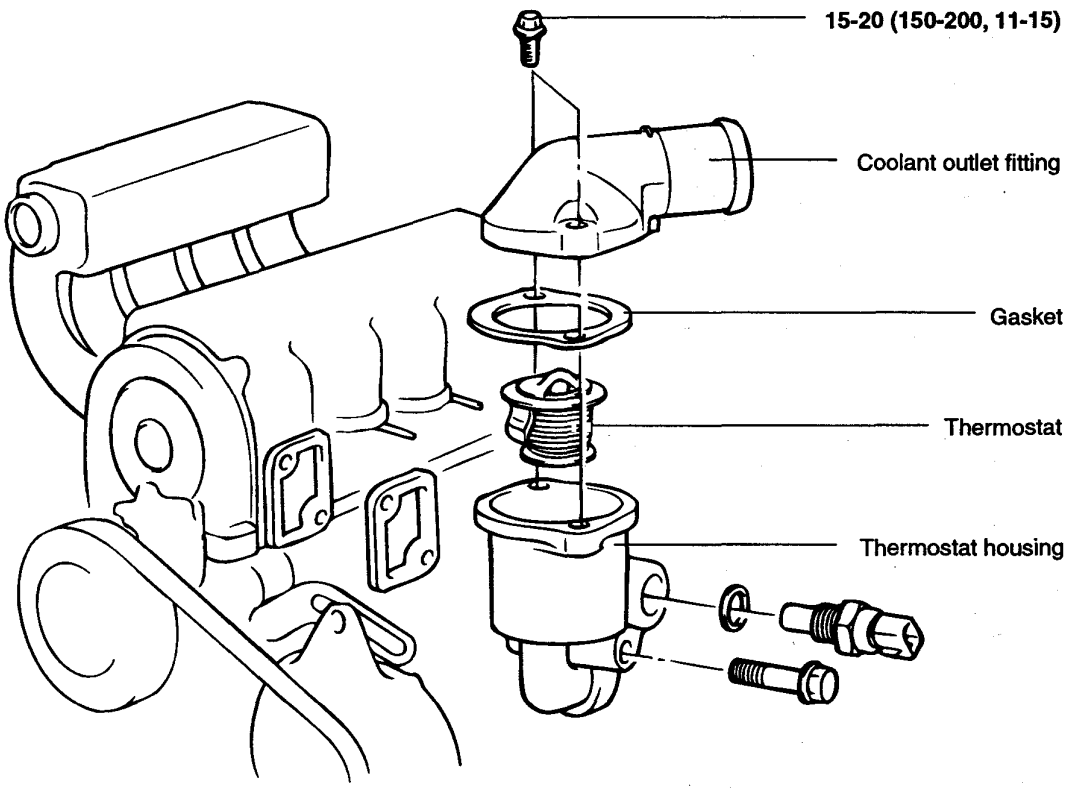
2. Attach a radiator cap tester to the radiator.
3. Pump the tester until the pointer stabilizes.
4. If the pointer stays constant for 10 sec. at a pioint exceeding the service limit, the radiator cap is good.



ECDA068B

THERMOSTAT

COMPONENTS E0EB6B0C



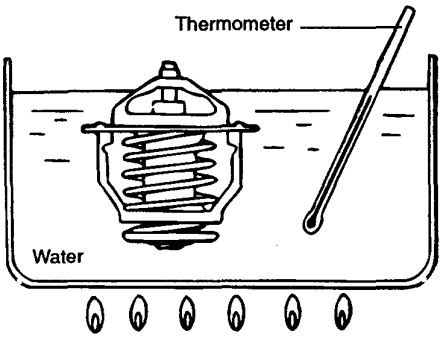
TORQUE : Nm (kg.cm, lb.ft)

ECDD069A

INSPECTION ECB7929E

1. Drain the coolant down to thermostat level or below.
2. Remove the coolant outlet fitting and gasket.
3. Remove the thrmostat.
4. Immerse the thermostat in hot coolant to check proper valve opening temperature. Replace if necessary.

Valve opening temperature : 82° C (177° F)
Full opening temperature : 95° C (205 °F)
Valve lift (at full open) : 8.5 mm (0.33 in.) or more

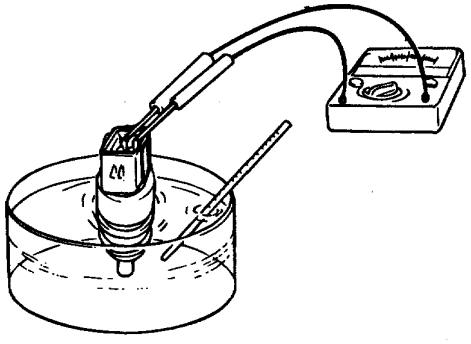


ECDA070A

COOLANT TEMPERATURE SENDER

1. Heat the engine coolant temperature sender by submerging it in hot water.
2. Check that the resistance is within the specified range.

Resistance : 123.8 ~ 172.8 Ω at 60°C (140°F) 23.5 ~ 29.5 Ω at 115°C (239°F)



ECTC155A

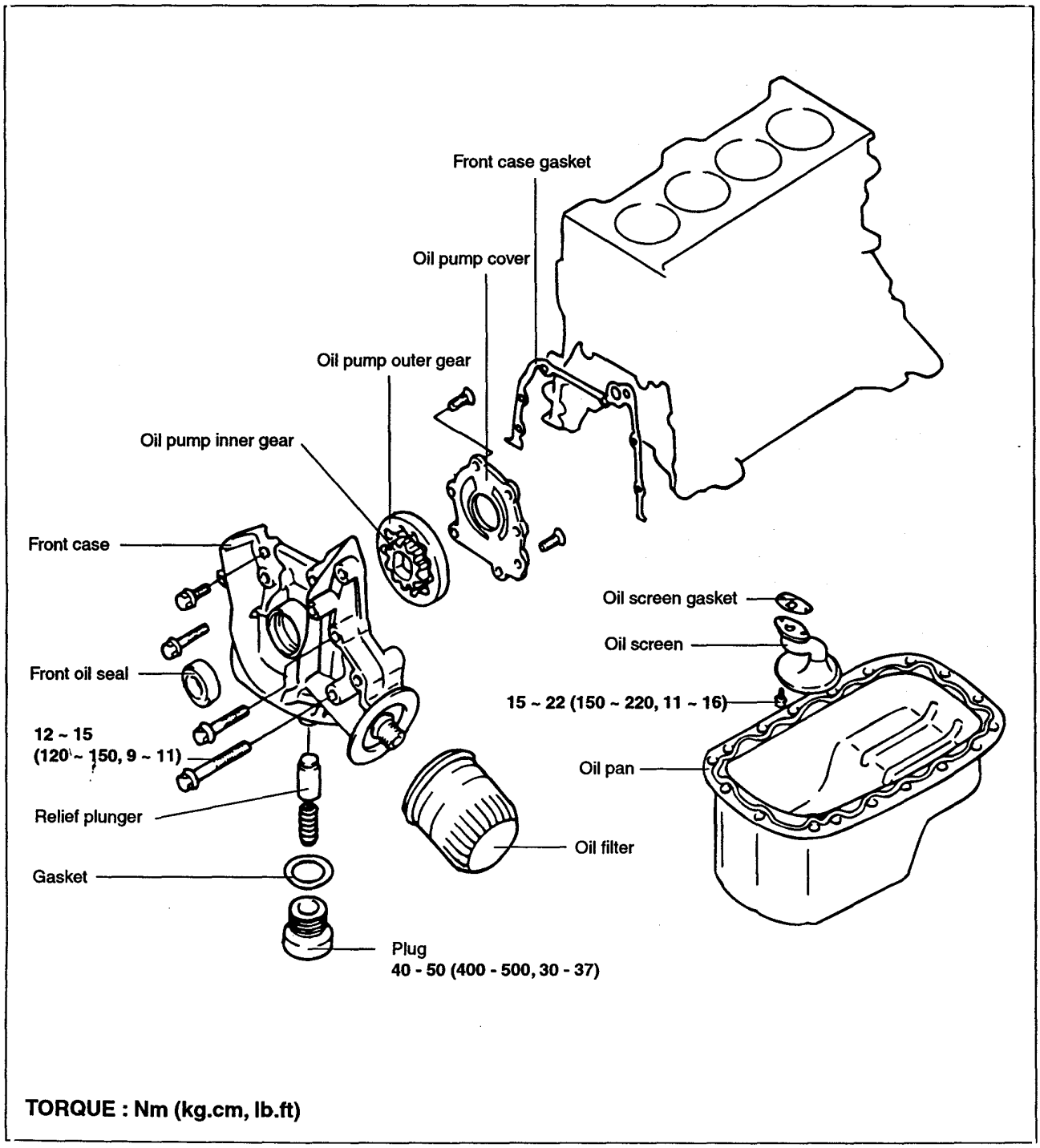
REASSEMBLY E19BF9A4

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will thuch the rib inside the intake manifold, making it impossible for the thermostat to operate properly.
2. Install a new gasket and the coolant outlet fitting.
3. Refill the system with clean coolant.

LUBRICATION SYSTEM

OIL PUMP

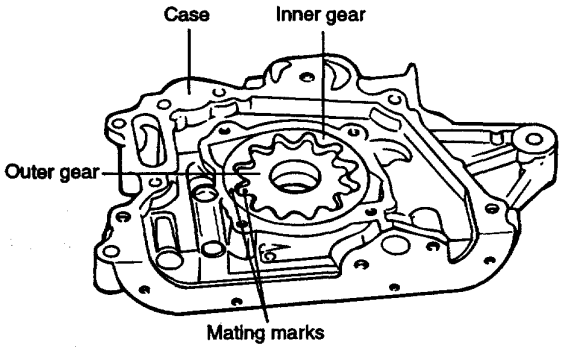
COMPONENTS E4410F51



ECDD078A

DISASSEMBLY ECA3FE3A

1. Remove the timing belt. Refer to the "Timing Belt" section.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen.
5. Remove the front case assembly.
6. Remove the oil pump cover.
7. Remove the inner and outer gears from the front case. The mating marks on the inner and outer gears indicate the direction of installation. Make sure that the inner and outer gears are installed as shown.



ECTC165A

8. Remove the plug and remove the relief spring and relief plunger.

INSPECTION EF1C3DC5

OIL PAN AND OIL SCREEN

1. Check the oil pan for failure, damage or cracks. Replace of defective.
2. Check the oil screen for failure, damage and cracks and replace of defective.

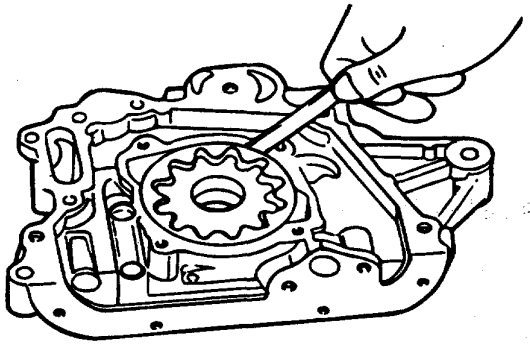
FRONT CASE AND OIL PUMP COVER

Check for worn (especially stepped) or damaged surfaces contacting gears.

OIL PUMP GEARS

1. Check for worn or damaged gear teeth surfaces.
2. Check for clearance between outer gear and front case.

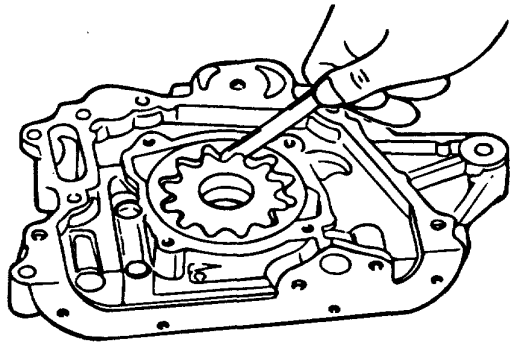
Outer gear Clearance between outer circumference and front case : 0.12 ~ 0.18 mm (0.005 ~ 0.007 in.)



ECTC170A

3. Check the tip clearance on the pump rotor.

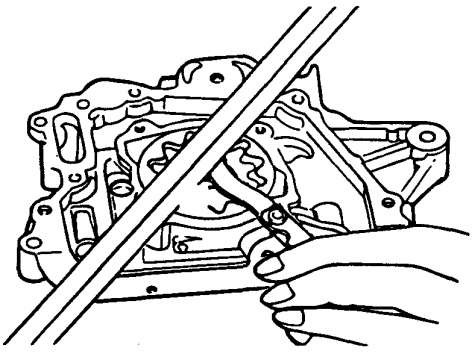
Standard value : 0.025 ~ 0.069 mm (0.001 ~ 0.003 in.)



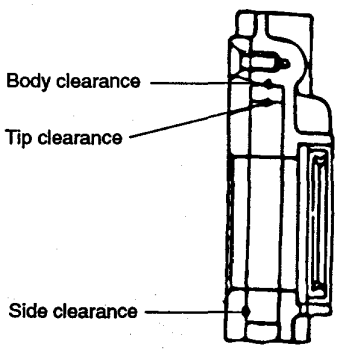
ECTC170B

4. Check the axial clearance on the outer pump roter.

Standard value :
0.04 ~ 0.087 mm (0.0016 ~ 0.0034 in.)



ECTC170C

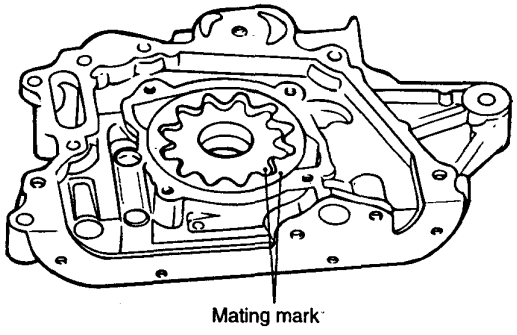


ECDA080D

REASSEMBLY E5AA0245

OIL PUMP

1. Install the outer and inner gears into the front case. Make sure that the inner and outer gears are installed in the same direction as shown.



ECTC175A

2. Install the oil pump cover and tighten the bolts to the specified torque. Atfer the bolts have been tithtened, check to ensure that the gear turns smoothly.

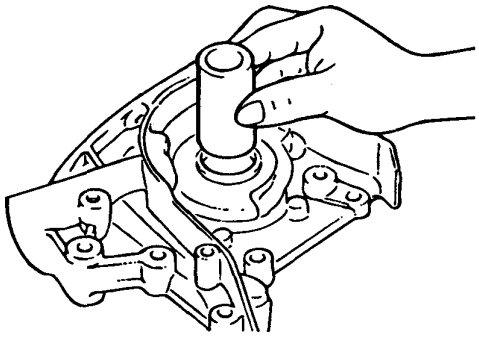
Tightening torque
Oil pump cover bolt :
8 ~ 12 Nm (80 ~ 120 kg.cm, 6 ~ 8.8 lb.ft)

3. Install the relief valve and spring. Tighten the plug to the specified torque. Apply engine oil to the relief valve.

Tightening torque
Relief valve plug :
40 ~ 50 Nm (400 ~ 500 kg.cm, 30 ~ 37 lb.ft)

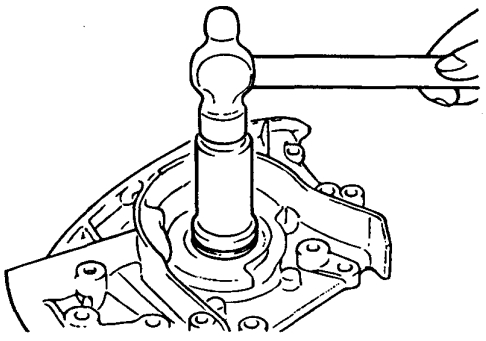
OIL SEAL

1. Inspect for worn, distorted or damaged lips.
2. Check for elongated spring ring.
3. Install the Special Tool, Crankshaft Front Oil Seal Guide (09231 - 22100), to the front end of the crankshaft. Apply engine oil to the outer surface of the oil seal guide, and install the new oil seal along the guide by hand, until it touches front case. Always use a new oil seal when reassembling.



ECTC175B

4. Use the Special Tool, Crankshaft Front Oil Seal Installer 909231 - 22000), to install the oil seal.



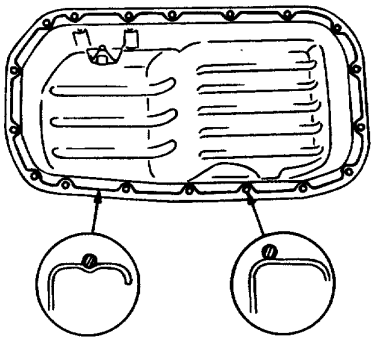
ECTC175C

5. Install the crankshaft sprocket, timing belt and crankshaft pulley. Refer to the "Timing Belt" section.
6. Install the oil screen.
7. Clean both gasket surfaces of the oil pan and the cylinder bolck.
8. Apply sealant into the groove of the oil pan glange as shown.

   ⚠ ***CAUTION***
   1. ***Apply sealant approx. 4 mm (0.16 in.) in thickness.***
   2. ***After application of sealant, do not exceed 15 minutes before installing the oil pan.***

9. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque
Oil pan bolt : 6 ~ 8 Nm (60 ~80 kg.cm, 4 ~ 6 lb.ft)

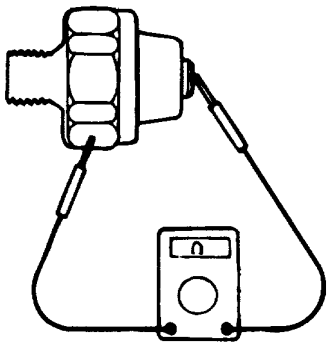


ECDA083D

OIL PRESSURE SWITCH EB8599D2

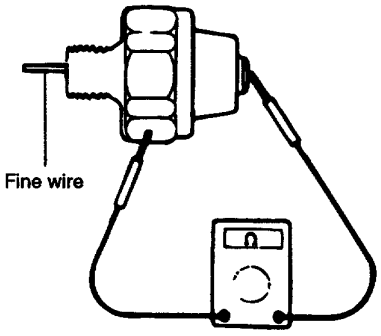
1. Check the continuity between the terminal and the body with an ohmmeter.

   If there is noncontinuity, replace the oil pressure switch.



ECDA073A

2. Check the continuity between the terminal and the body when the fine wedge is pushed. If there is continuity enve when the fine wedgew is pushed, replace it.
3. However, if there is non continuity when a 50 Kpa (70 psi) vacuum is applied through the oil hole, the switch is operating properly. Check to see that air doesn't leak. If air leaks, the diaphragm is broken. Replace the switch.

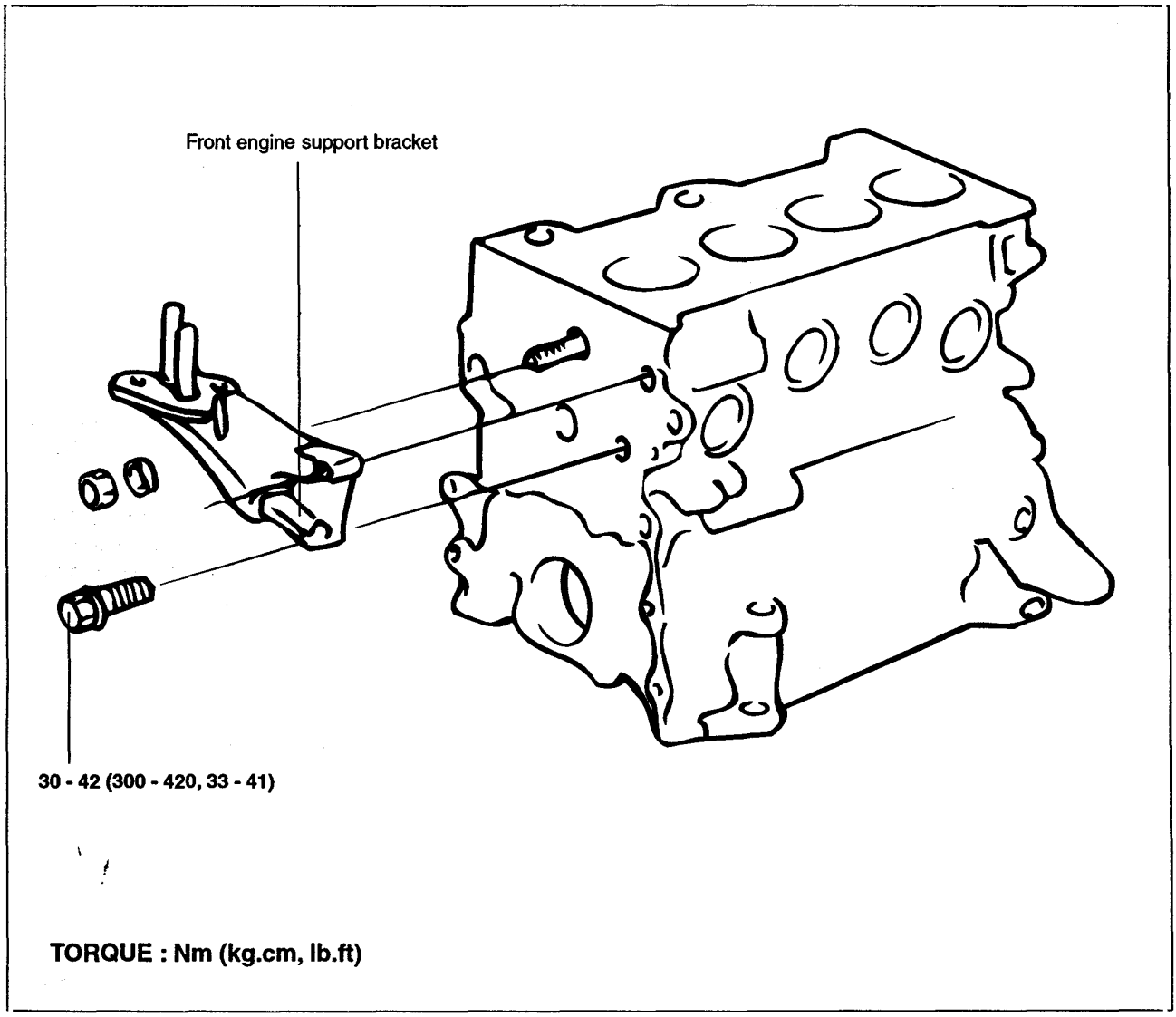


ECDA073B

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS E6BF432E



TORQUE : Nm (kg.cm, lb.ft)

ECDD008A

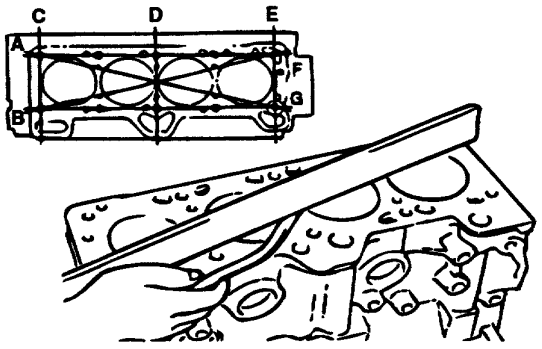
INSPECTION E3544F7F

CYLINDER BLOCK

1. Visually check the engine block for scores, rust and corrosion. Also check for cracks or any other defects. Repair or replace the block if defective.

2. Using a straight edge and feeler gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

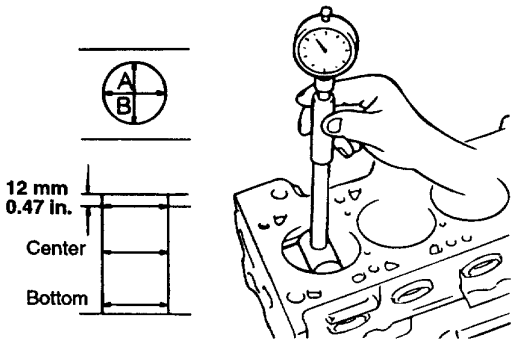
Standard : 0.05 mm (0.0020 in.) or less
Limit : 0.1 mm (0.0039 in.)



ECDA010A

3. Measure the cylinder bore with a cylinder gauge at three levels in the directionjs A and B. If the cylinder bores show more than the specified out-of-roundness or taper or if the cylinder walls are badly sucffed or scored, the cylinder block should be rebored and honed. New oversize pistons and rings must be fitted. Measuring points are as shown.

Cylinder I.D.
1.3 L : 71.5 mm (2.815 in.)
1.5 L : 75.5 mm (2.9724 in.)
Cylinder I.D. taper
1.3 / 1.5 L : 0.02 mm (0.0008 in,.) or less



ECDA010B

4. If a cylinder ridge exists, cut away with a ridge reamer.

5. Oversize postons are available in four sizes

Piston service size and mark mm (in.)
0.25 (0.010) O.S. : 25
0.50 (0.020) O.S. : 50
0.75 (0.030) O.S. : 75
1.00 (0.039) O.S. : 100

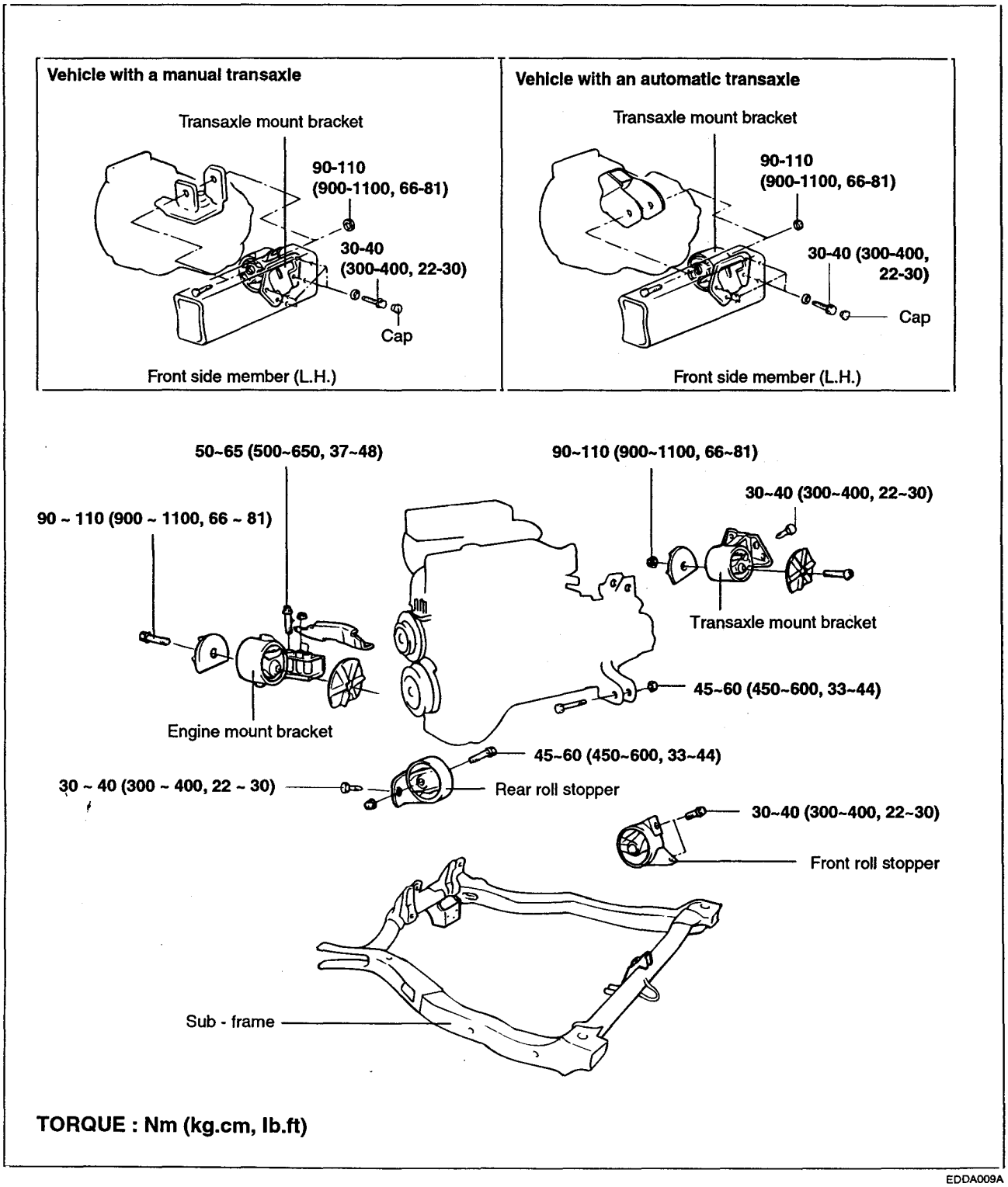
6. When boring the cylinder bore to oversize, keep the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize.

   The standard measurement of the piston outside diameter is taken at a level 12 mm (0.47 in.) above the bottom of the poston skirt and across the thrust faces.

Piston-to-cylinder wall clearance :
1.3 L / 1.5 L : 0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

ENGINE MOUNTS

COMPONENTS E7C29A8F

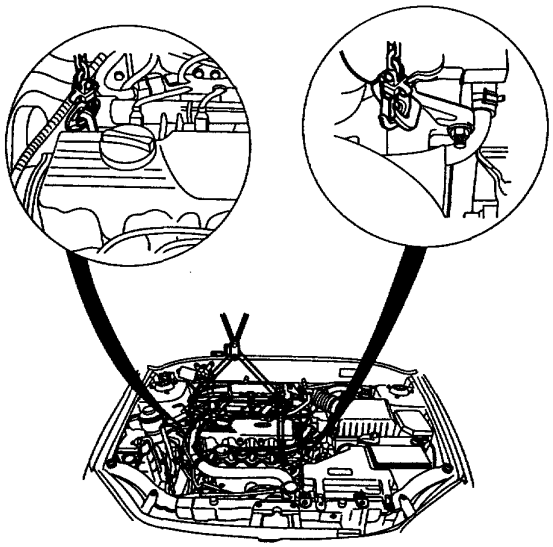


TORQUE : Nm (kg.cm, lb.ft)

EDDA009A

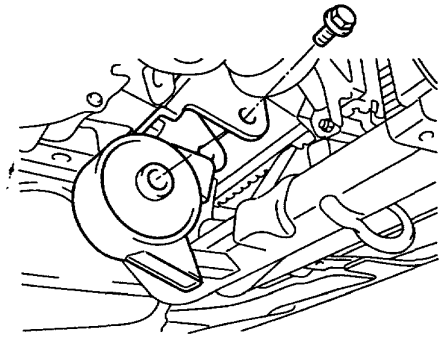
REMOVAL E2434EFC

Attach an engine hoist to the engine hooks, and raise the engine just enlugh so that there is no pressure on the insulators.



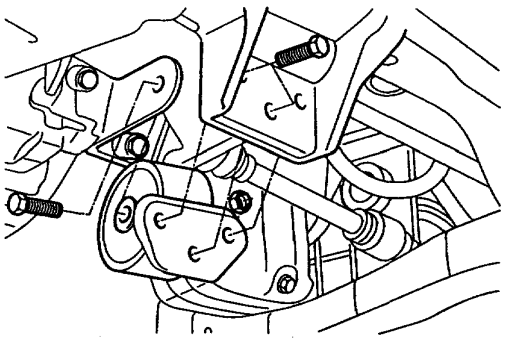
KDDC011B

1. Remove the front roll stoper bracket form the subframe. (14 mm bolt and nut, 17 mm bolt.)



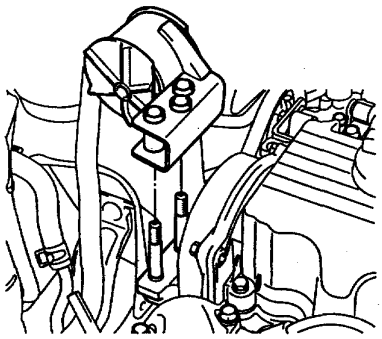
KDDC015B

2. Remove the rear roll stoper bracket from the subframe.



KDDC015C

3. Engine
   1) Remove the engine mount bracket form the engine. (14 mm, 17 mm)
   2) Remove the engine mount insulator.

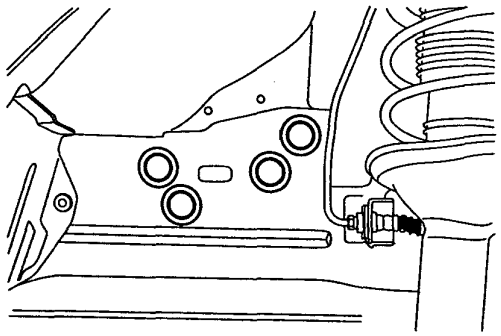


KDDC003B

4. Transaxle

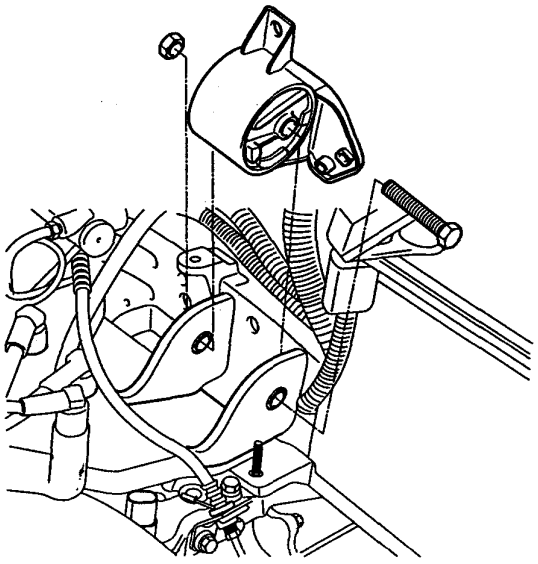
   1) Remove the transaxle mount bolt. (17 mm)

   2) Detach the cap from inside the right fender shield. Remove the transaxle mount bolts.



KDDC012B

   3) Remove the transaxle mount bracket.

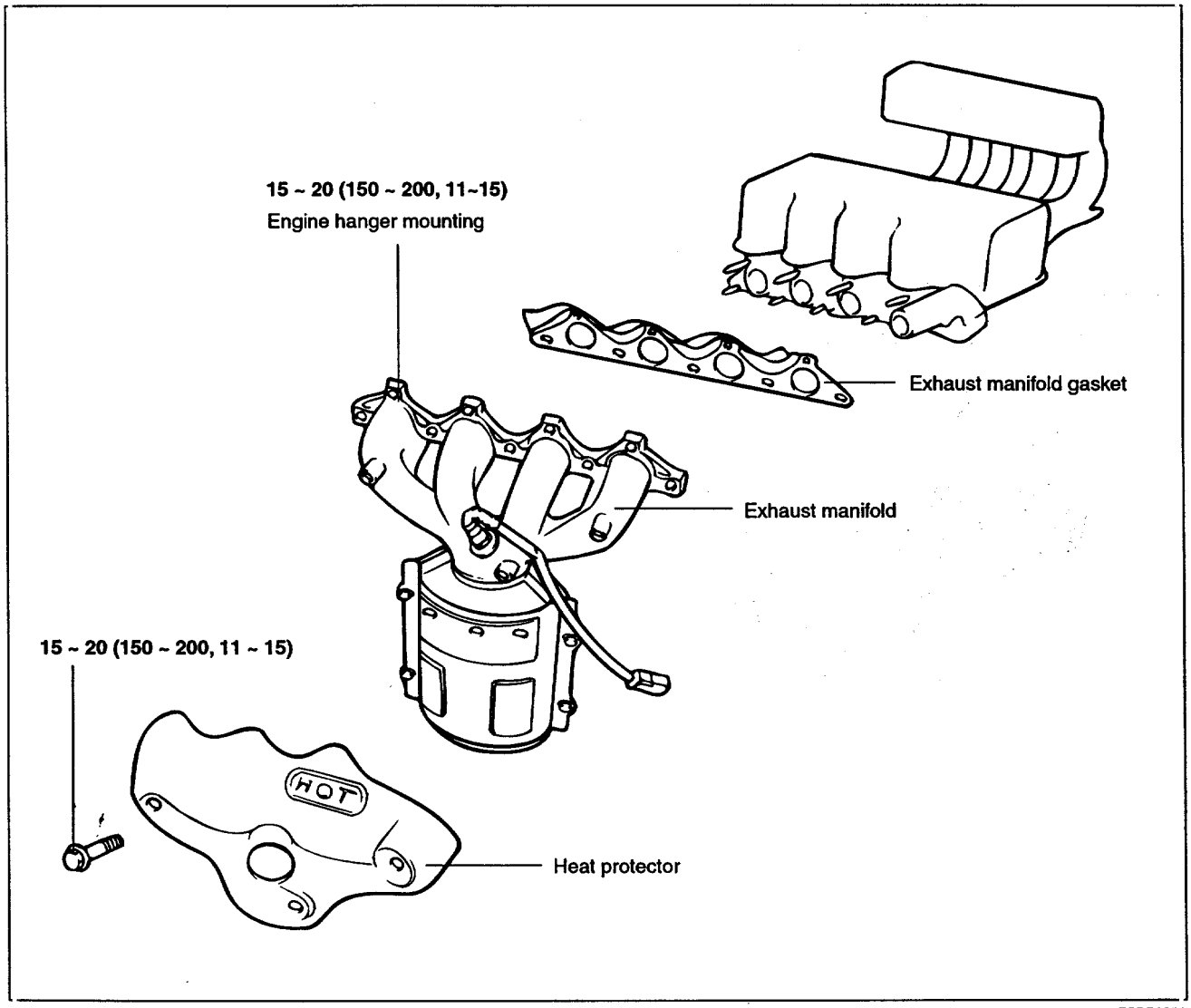


KDDC015D

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS E6DDDED4

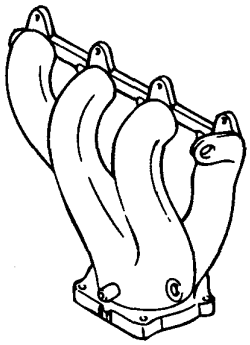


ECDD085A

INSPECTION E1BF7465

EXHAUST MANIFOLD

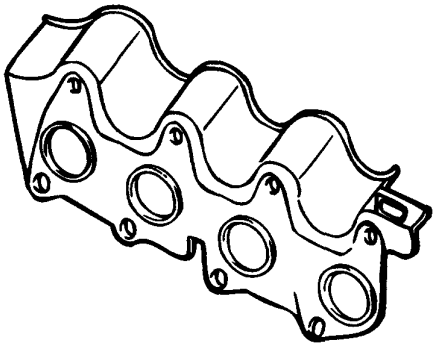
Check for damage or cracking.



ECTC185A

EXHAUST MANIFOLD GASKET

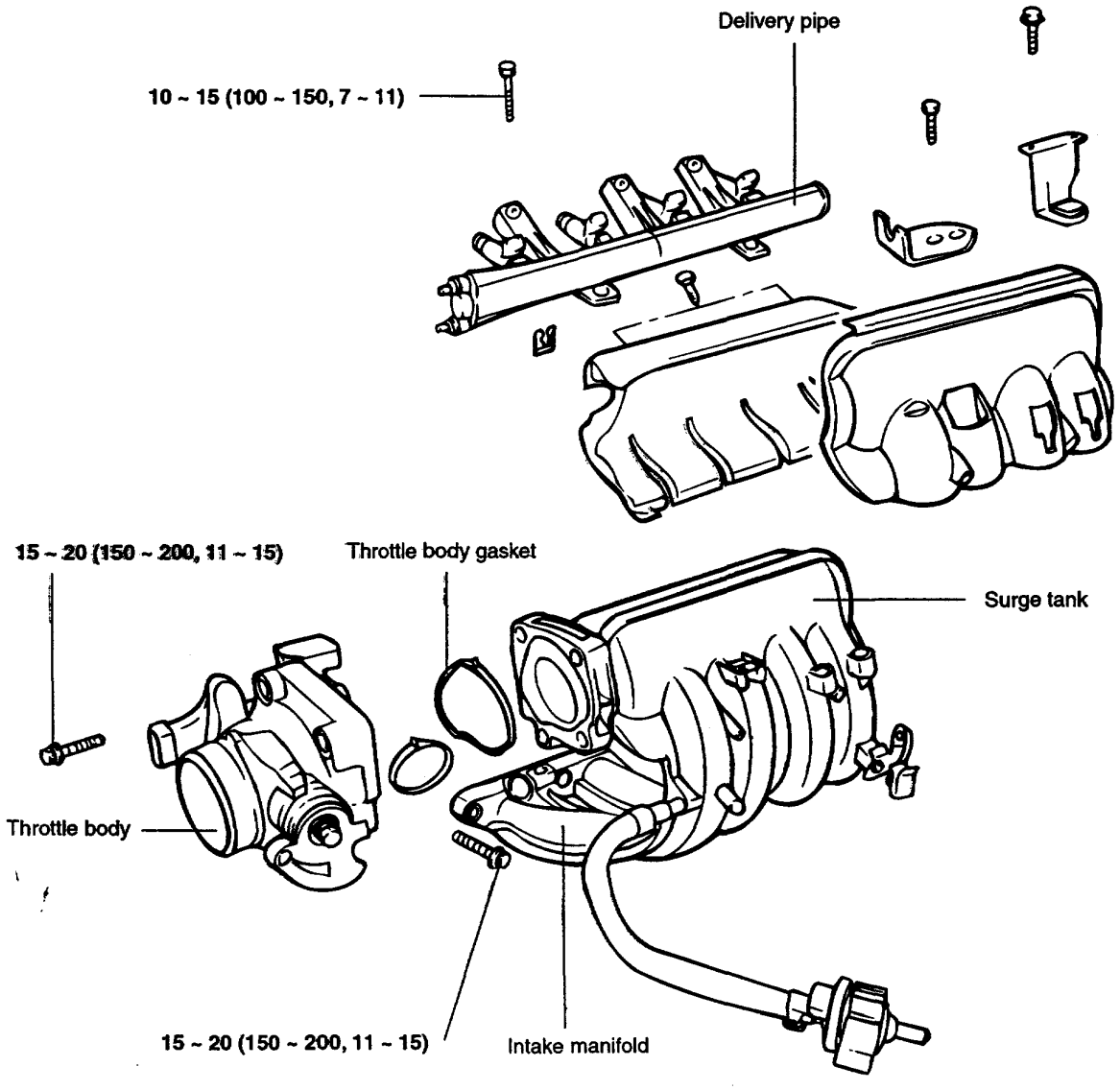
Check for flaking or damage of the gasket.



ECTC185B

INTAKE MANIFOLD

COMPONENTS E9AAD531

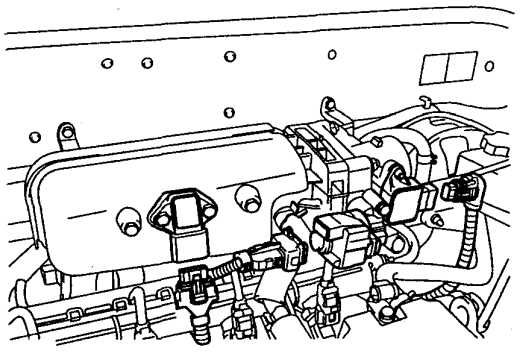


TORQUE : Nm (kg.cm, lb.ft)

ECDA087A

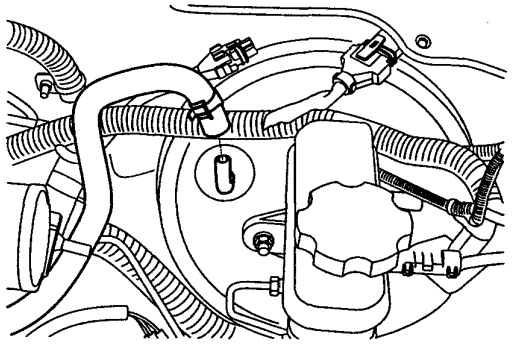
REMOVAL E3FBF211

1. Disconnect the ISA, TPS and MAP sensor.



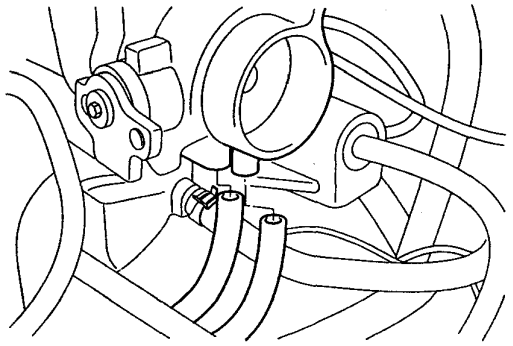
KDDC010C

2. Remove the intake air hose connected to the throttle body.
3. Remove the accelerator cable.
4. Remove the P.C.V. hose and brake booster vacuum hoses.



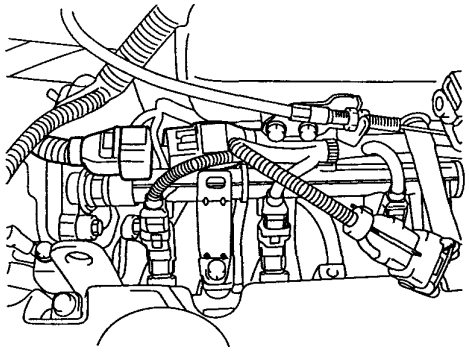
KCPC003B

5. Remove the coolant hose connections from the throttle body.



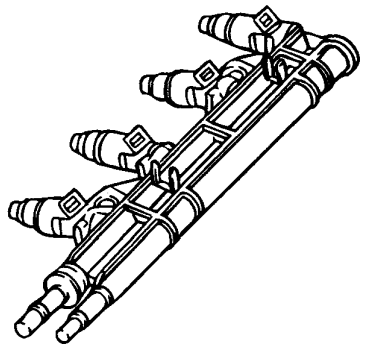
KDPC005D

6. Disconnect the fuel injector harness connector.



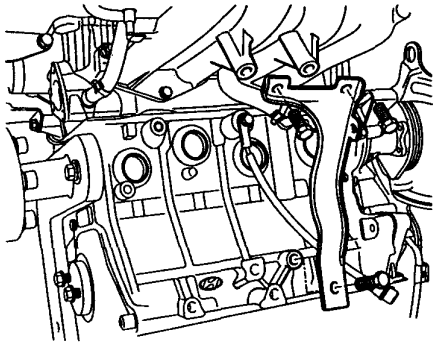
KDPC006E

7. Remove the delivery pipe and fuel injectors from the intake manifold.



ECTC195E

8. Remove the surge tank stay.



ECPD007B

9. Remove the intake manifold.

INSPECTION E48AA7B6

SURGE TANK

Check the surge tank for defects or cracks.
Replace if necessary.

INTAKE MANIFOLD

Check for damage or cracking of any part.

AIR HOSE

Check for damage or cracking of any part.

INSTALLATION EA66E9B7

1. Install the delivery pipe with the fuel injectors attached.

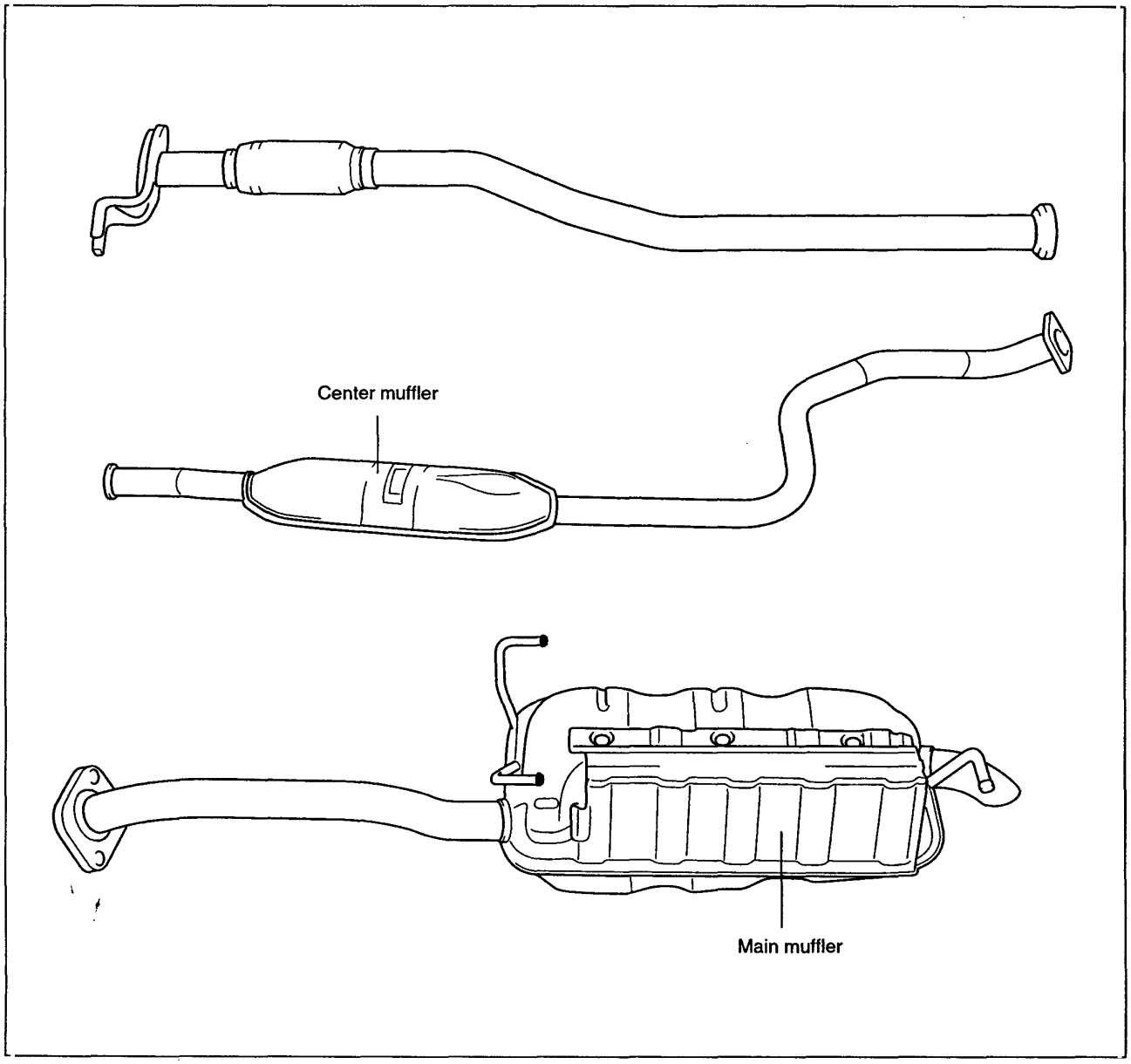
   ⚠ ***CAUTION***

   Be careful not to drop the injectors when removing the delivery pipe.

2. Ensure that insulators are correctly inserted into the delivery pipe hole.

MUFFLER

COMPONENTS E3F9E26B



ECDD017A

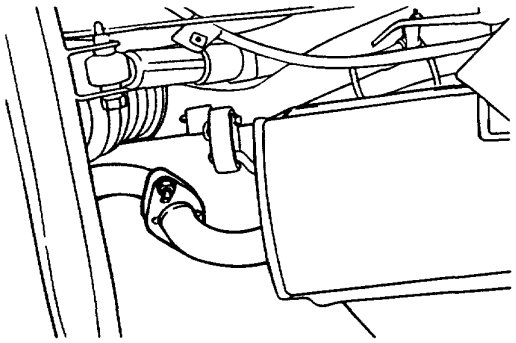
REMOVE E0EC6079

TAIL PIPE

⚠ *CAUTION*

Before removing or inspecting the exhaust system, ensure that it has cooled sufficiently.

1. Disconnect the tail pipe muffler from the center muffler.

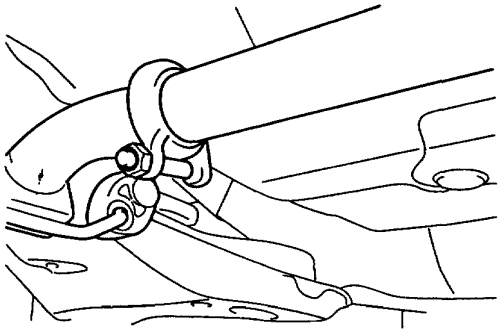


ECTC210A

2. Remove the rubber hangers and take out the tail pipe.

CENTER PIPE

1. Remove the center muffler assembly from the tail pipe.
2. Remove the rubber hanger, then remove the center muffler.



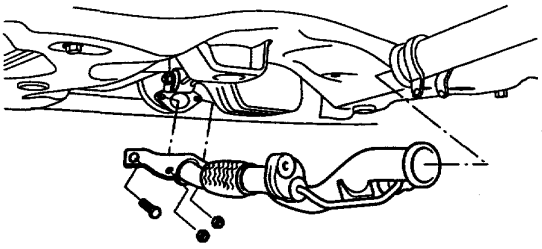
KDPC007C

CATALYTIC CONVERTER

Remove the catalytic converter from the front exhaust.

FRONT EXHAUST PIPE

1. Remove the front exhaust pipe from the catalytic converter (unleaded vehicle) or exhaust manifold (leaded vehicle).



KCPC003G

2. Remove the front exhaust pipe clamp bolt and remove the center muffler mounting nut.

INSPECTION EF07CDFB

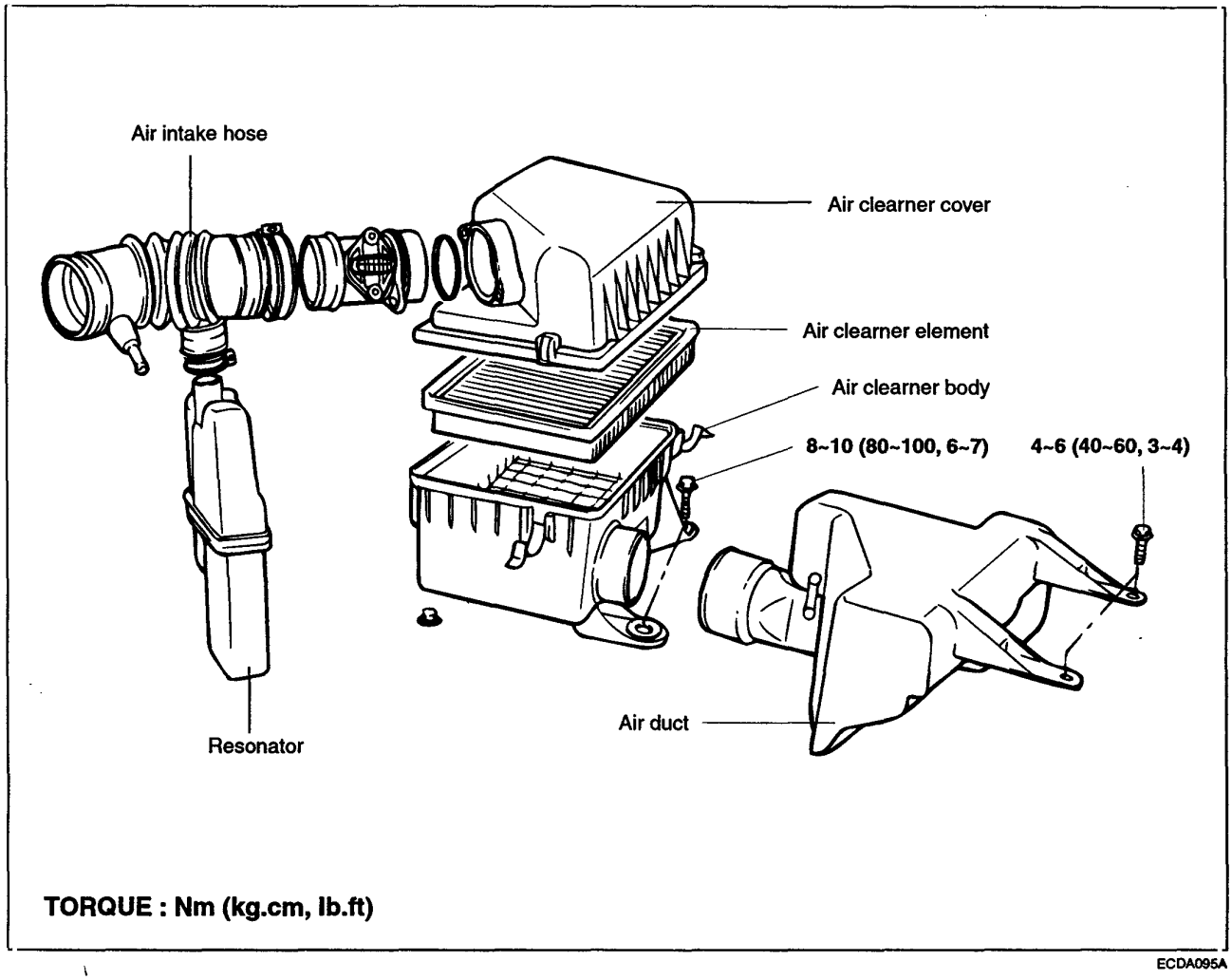
1. Check the mufflers and pipes for corrosion and damage.
2. Check the rubber hanger and bands for deterioration and cracks.

INSTALLATION ECFEFE88

1. Temporarily install the catalytic converter assembly the front exhaust pipe, the center exhaust pipe, and the tail pipe, in that orde.
2. Tighten the parts securely. Make sure there si no interference with any body components.

AIR CLEANER (ACL)

COMPONENTS ED04ABF3

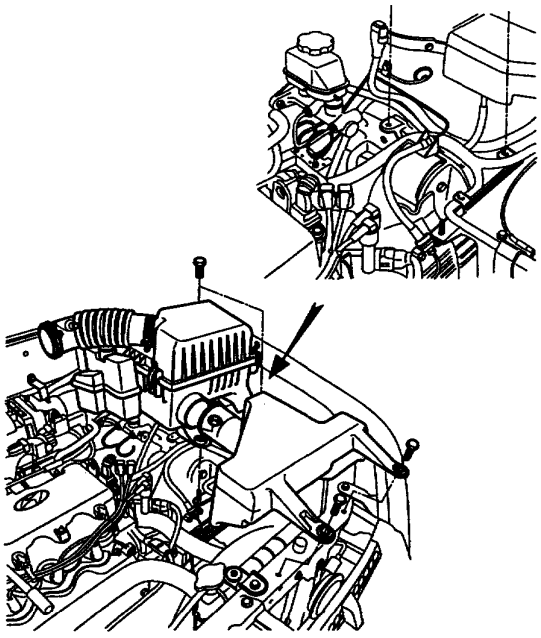


TORQUE : Nm (kg.cm, lb.ft)

ECDA095A

REMOVAL E8C1BA9E

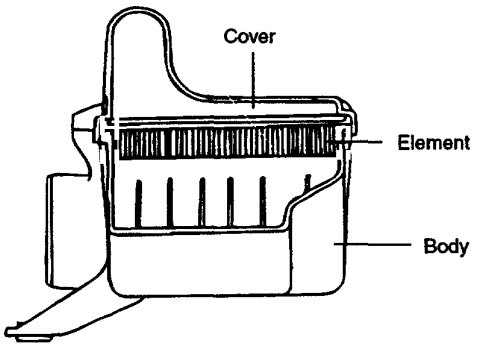
1. Remove the air duct connected to the air cleaner.
2. Remove the air intake hose from the air cleaner side.
3. Remove the air cleaner cover and filter.
4. Remove the air cleaner mounting bolts and remove the air cleaner.



KDDC010B

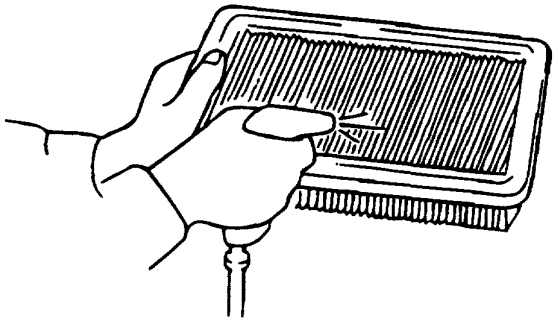
INSPECTION E1B2841C

1. Check the air cleaner body, cover, or filter for distortion, corrosion or damage.



ECDA097A

2. Check the air duct for damage.
3. Check the resonator for distortion or damage.
4. Check the air cleaner filter for restrictions, contamination or damage.
   If the filter is slightly restricted, remove dust and other contaminants by blowing air from the upper side through the filter.
5. Check the air cleaner housing for restrictions, contamination or damage.



ECDA097B

INSTALLATION E602C70F

Installation is the reverse order of removal.

Engine Electrical System

GENERAL
- SPECIFICATIONS ..... EE -2
- SPECIAL TOOLS ..... EE -3
- TOUBLESHOOTING ..... EE -4

IGNITION SYSTEM
- COMPONENT LOCATION ..... EE -6
- IGNITION COIL
  - REMOVAL AND INSTALLATION ..... EE -8
  - INSPECTION ..... EE -9
- IGNITION SWITCH
  - REMOVAL AND INSTALLATION ..... EE -11
  - INSPECTION ..... EE -12
- SPARK PLUG
  - INSPECTION ..... EE -14
- SPARK PLUG CABLE
  - COMPONENT LOCATION ..... EE -16
  - INSPECTION ..... EE -17

CHARGING SYSTEM
- GENERAL INFORMATION ..... EE -18
- INSPECTION ..... EE -19
- GENERATOR
  - INSTALLATION ..... EE -22
  - CIRCUIT DIAGRAM ..... EE -23
  - REMOVAL AND INSTALLATION ..... EE -25
  - COMPONENTS ..... EE -26
  - DISASSEMBLY ..... EE -28
  - INSPECTION ..... EE -31
  - REPLACEMENT ..... EE -32
- BATTERY
  - GENERAL INFORMATION ..... EE -33
  - INSPECTION ..... EE -34

STARTING SYSTEM
- GENERAL INFORMATION ..... EE -37
- INSPECTION ..... EE -38
- STARTER
  - REMOVAL AND INSTALLATION ..... EE -40
  - COMPONENTS ..... EE -41
  - INSPECTION ..... EE -42
  - REASSEMBLY ..... EE -43
  - CLEANING ..... EE -43
  - REPLACEMENT ..... EE -43

PREHEATING SYSTEM
- SPECIFICATIONS ..... EE -44
- INSPECTION ..... EE -44

GENERAL

SPECIFICATIONS EDF6FCFA

IGNITION COIL

	Gasoline
Type	Mold dual coil
Primary coil resistance	0.87Ω ± 10%
Secondary coil resistance	13.0kΩ ± 15%

SPARK PLUG

	Gasoline		
Type	Leaded	NGK	BKR5ES
		Champion	RC10TC
	Unleaded	NGK	BKR5ES-II
		Champion	RC10TC4
Plug gap mm(in)	Leaded	0.7 ~ 0.8 (0.028 ~ 0.032)	
	Unleaded	1.0 ~ 1.1 (0.039 ~ 0.043)	

STARTER

	Gasoline	Diesel
Type	Direct drive type	Direct drive type
Rated output	12V 0.9kW	12V 1.7kW
Rated time	30 sec.	30 sec.
No-load characteristics		
Terminal voltage	11.5V	11V
Amperage	60A	90A
Maximum speed	5,500 rpm	2,600 rpm
No. of pinion teeth	8	9
Pinion gap mm(in)	0.5 ~ 2 (0.0197 ~ 0.079)	0.5 ~ 2 (0.0197 ~ 0.079)

GENERATOR

	Gasoline	Diesel
Type	Battery voltage sensing	Battery voltage sensing
Rated output	13.5V, 90A	12V, 90A
Voltage regulator	Electronic built-in type	Electronic built-in type
Regulator setting voltage	14.55 ± 0.2V	14.5 ± 0.3V
Temperature compensation	-10 ± 3mV/°C	-10 ± 3mV/°C

BATTERY

Type	MF45AH	MF55AH	MF60AH
Ampere hours (5HR)	36A	44A	48AH
Cold cranking [at -17.8°C (0°F)]	410A	500A	550A
Reserve capacity	80 min.	85 min.	92A
Specific gravity [at 25°C (77°F)]	1,280 ± 0.01	1,280 ± 0.01	1,280 ± 0.01

NOTE

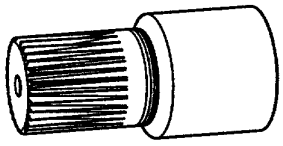
COLD CRANKING AMPERAGE is the amperage that the battery can delivery for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at a specified temperature.

RESERVE CAPACITY RATING is the amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5 volts at 26.7°C (80°F).

TIGHTENING TORQUE

Items	Nm	kg·cm	lb·ft
Generator terminal (B+)	5 ~ 7	50 ~ 70	3.6 ~ 5.1
Starter motor terminal (B+)	10 ~ 12	100 ~ 120	7.3 ~ 8.8
Battery terminal	4 ~ 6	40 ~ 60	2.9 ~ 4.3
Spark plug	20 ~ 30	200 ~ 300	15 ~ 22

SPECIAL TOOL EC2A7FAC

TOOL(Number and name)	Illustration	Use
09373-27000 Alternator pulley remover and installer	 EBDD700A	Removal and installation of the alternator pulley

TROUBLESHOOTING E1FC520A

IGNITION SYSTEM

Trouble symptom	Probable cause	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch faulty Ignition coil faulty Power transistor faulty Spark plugs faulty Ignition wiring disconnected or broken Spark plugs faulty	Replace ignition lock switch Inspect ignition coil Inspect power transistor Replace plugs Inspect wiring Replace plugs
Rough idle or stalls	Ignition wiring faulty Ignition coil faulty Spark plug cable faulty	Inspect wiring Replace ignition coil Replace spark plug cable
Engine hesitates/poor acceleration	Spark plugs faulty Ignition wiring faulty	Replace plugs Inspect ignition coil and wires
Poor mileage	Spark plugs faulty	Replace plugs

CHARGING SYSTEM

Trouble symptom	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator faulty	Check fuses Replace light Tighten loose connections Replace voltage regulator
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown Electronic voltage regulator or generator faulty Wiring faulty	Adjust tension or replace drive belt Repair or replace cables Check fuses Replace fusible link Test generator Repair wiring
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn Wiring connection loose or open circuit Fusible link blown Poor grounding Electronic voltage regulator or generator faulty Faulty battery Electronic voltage regulator faulty Voltage sensing wire faulty	Adjust tension or replace drive belt Tighten loose connection or repair wiring Replace fusible link Repair Test generator, if faulty, repair or replace Replace battery Replace voltage regulator Repair wire

STARTING SYSTEM

Trouble symptom	Probable cause	Remedy
Engine will not crank	Battery discharged	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
	Ignition lock switch faulty	Replace ignition lock switch
Engine cranks slowly	Battery discharged	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

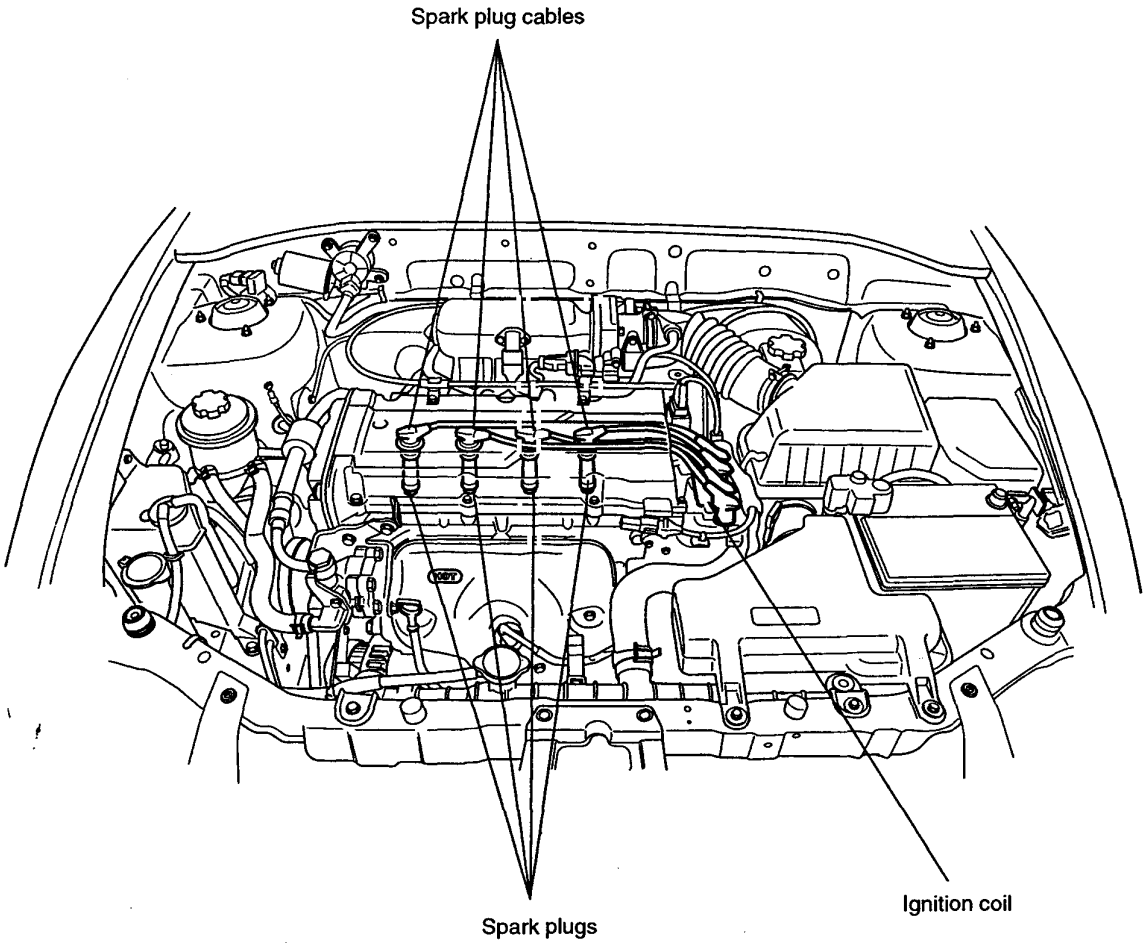
GLOW CONTROL SYSTEM (DIESEL)

Trouble symptom	Brobable cause	Remedy
Engine will not start below 50°C	Wiring connection loose or bad wiring	Repair or replace wiring
	ECT sensor malfunction	Replace ECT sensor
	Glow plug malfunction	Repair or replace glow plug
	Glow plug control unit failed	Replace glow control unit
After first combustion, engine stall or rough idle below 50°C	Wiring connection loose or bad wiring	Repair or replace wiring
	Glow plug malfunction	Check the resistance of glow plug and replace, of necessary
	Glow plug relay malfunction	Check the relay and replace, if necessary
	Glow plug control unit failed	Check the control unit and replace, if necessary
Yellow glow lamp will not turn-ON	Open lamp	Replce lamp
	Wiring connection loose or bad wiring	Repair or replace wiring
	Shorted wiring	Repair or replace wiring
	Glow plug control unit failed	Replace control unit, necessary

IGNITION SYSTEM

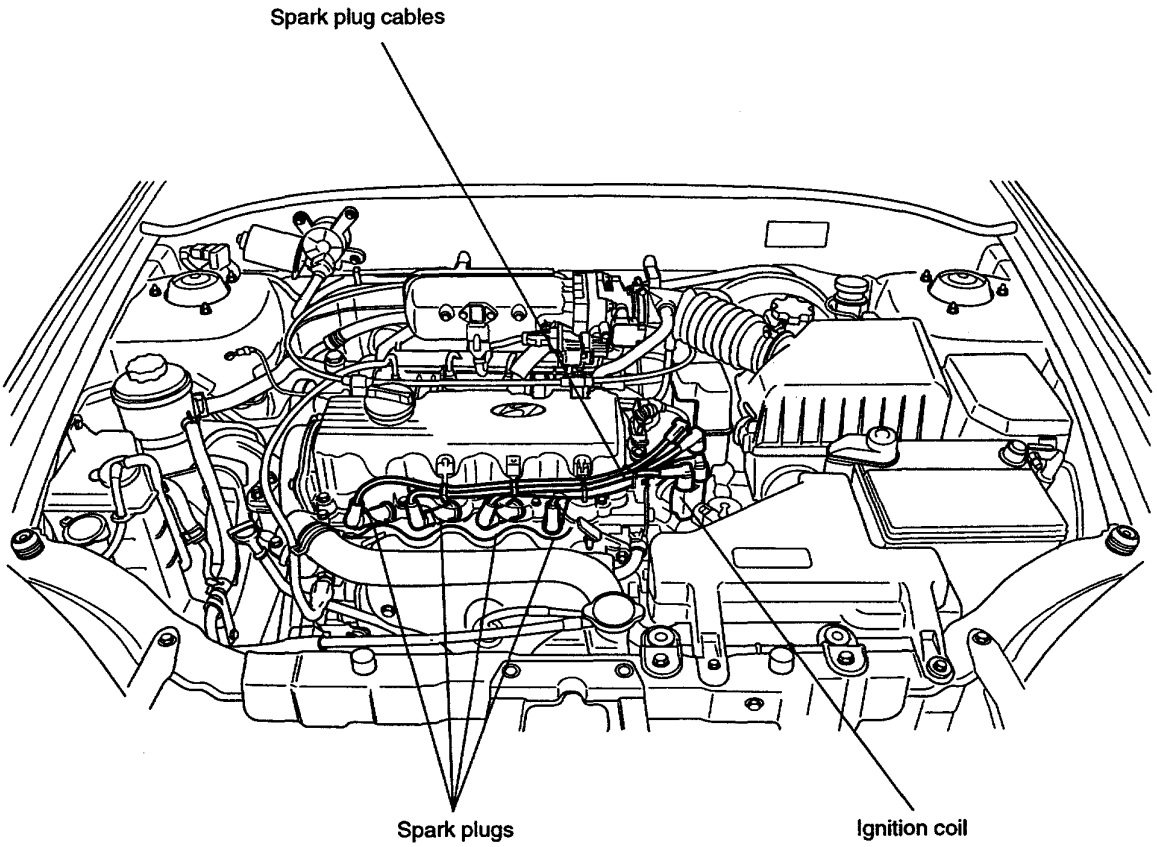
COMPONENT LOCATION E163DEFA

[DOHC]



EBDD001A

[SOHC]

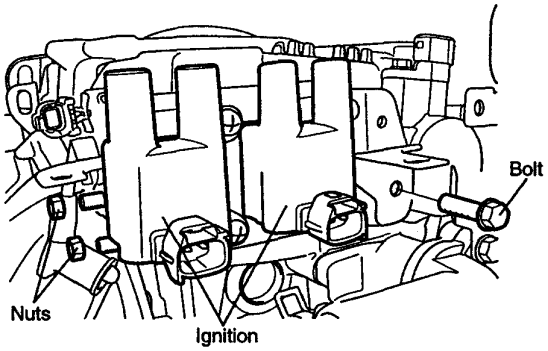


EBDD001B

IGNITION COIL

REMOVAL AND INSTALLATION E67C049D

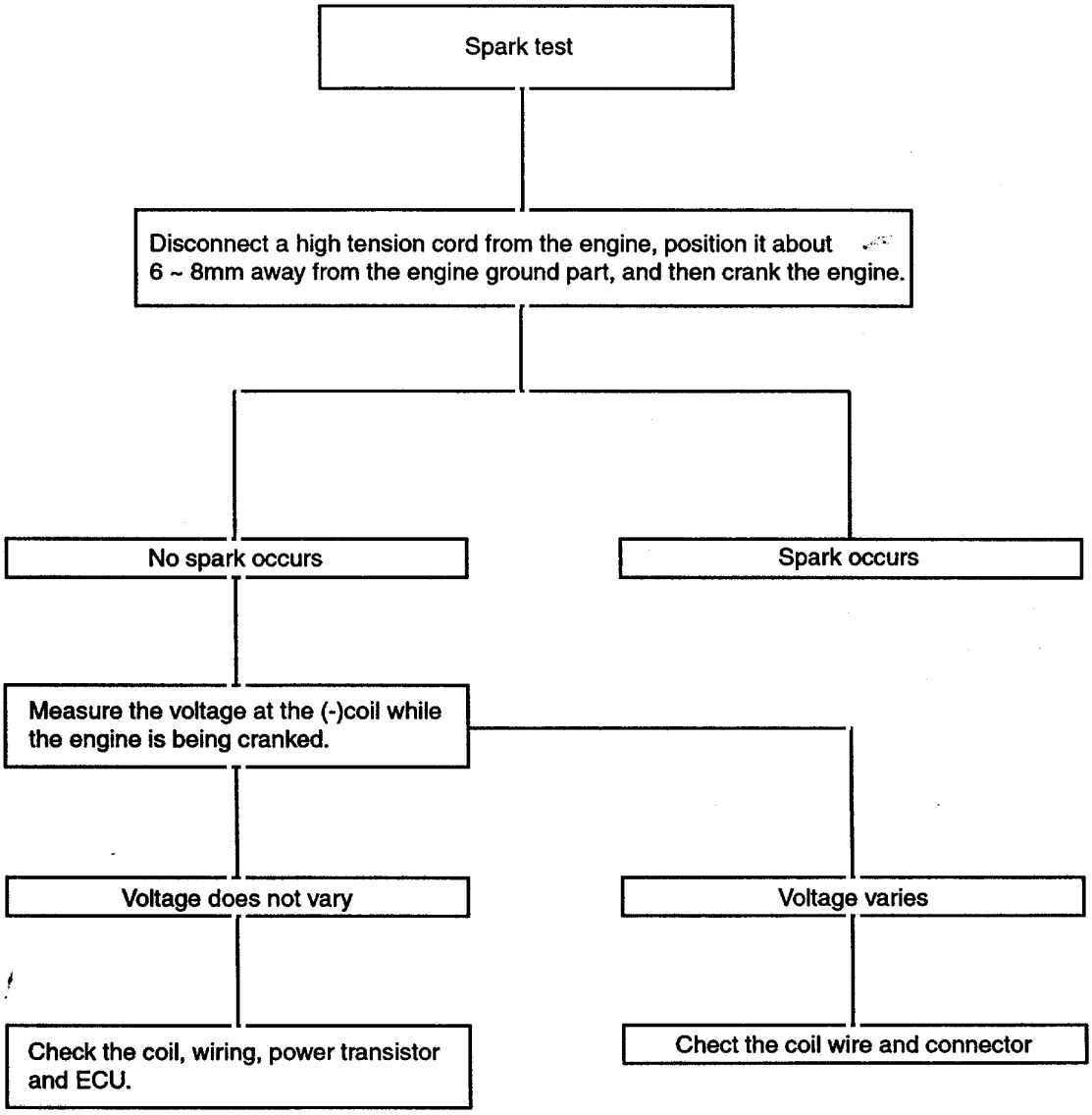
1. Remove the ignition fuse (Fusible link-F).
2. Disconnect the lead wire.
3. Remove the ignition coil mounting bolt and remove the ignition coil assembly.
4. Installation is the reverse order of removal.



EBDD004A

INSPECTION EB6AEBA6

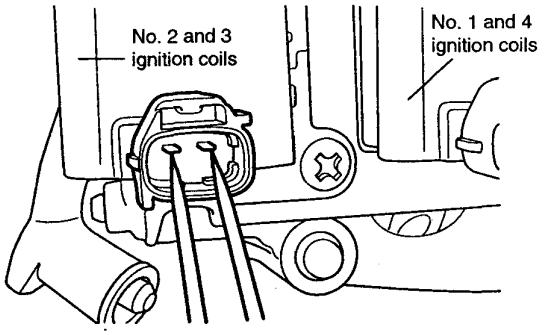
SPARK TEST



EBMB017A

CHECKING IGNITION COILS

1. Measure the primary coil resistance between terminals 1 and 2.



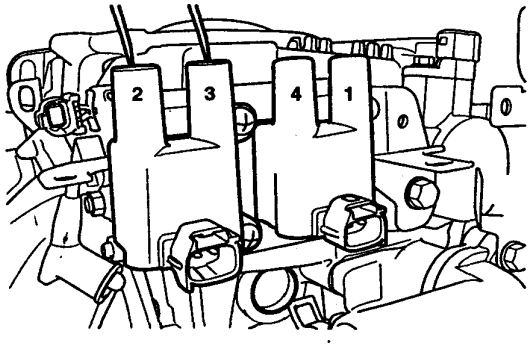
EBPD040B

2. Measure the secondary coil resistance between the high-voltage terminal for the No.1 and No.4 cylinders, and between the high-voltage terminals for the No.2 and No.3 cylinders.

Standard value: 13.0Ω ± 15%

⚠ ***CAUTION***

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.

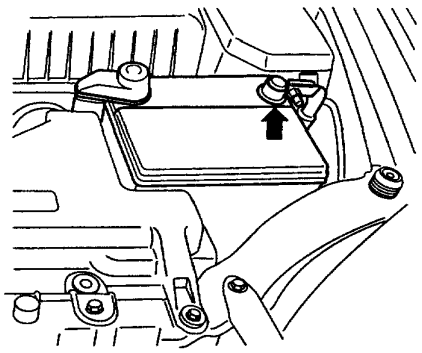


EBPD040A

IGNITION SWITCH

REMOVAL AND INSTALLATION EDAEF91F

1. Disconnect the negative(-) battery terminal.

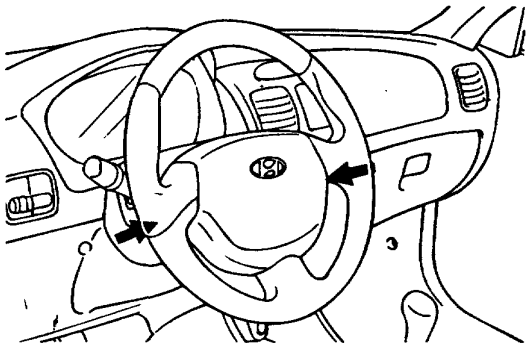


KPDD013A

2. Remove the 2 bolts and disconnect the airbag connector and the horn connector, then remove the airbag module.

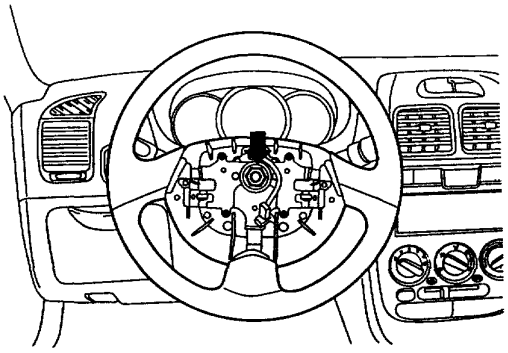
⚠ ***CAUTION***

Remove the horn pad only for vehicle without airbag.



ETDA035D

3. Remove the steering wheel lock nut.

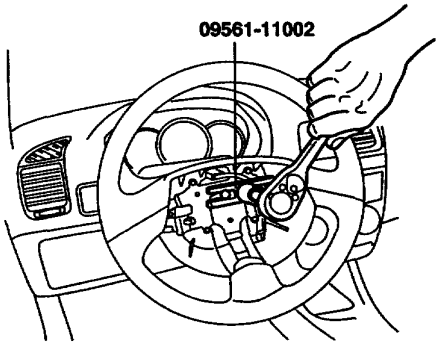


KPDD002A

4. Remove the steering wheel with special tool (09561-11002)

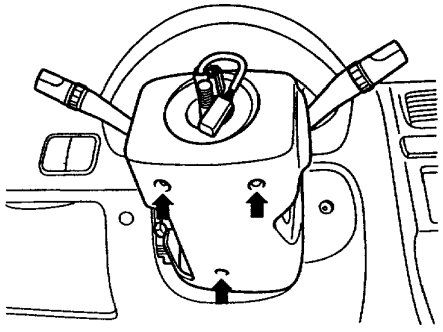
⚠ ***CAUTION***

Do not hammer on the steering wheel to remove it.
Doing so may damage the collapsible mechanism.



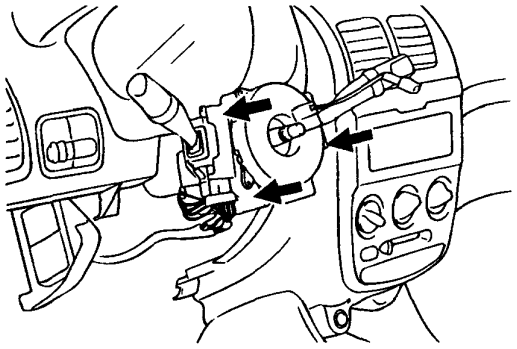
KPDD006A

5. Remove the steering column shroud after removing 3 screws.



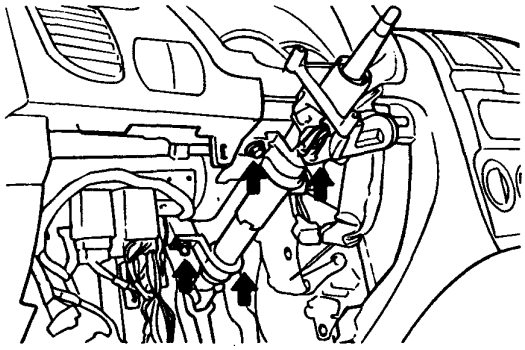
KPDD014A

6. Remove the screws holding the multi-function switch, then disconnect the wire connector.
   Remove the multi-function switch assembly.



ETDA035H

7. Remove the steering column mounting bolts.

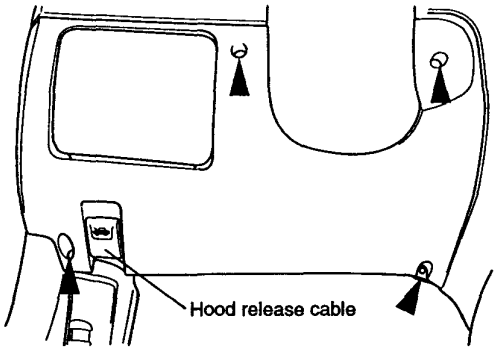


EPDA015G

8. Remove the key lock assembly from the steering column shaft. (Refer to ST group)
9. Installation is the reverse of removal.

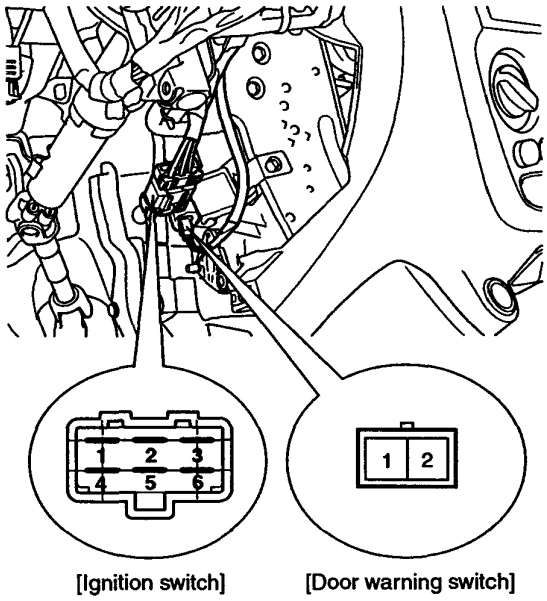
INSPECTION EFCABE1F

1. Remove the driver's side crash pad lower panel.



ESDC113S

2. Disconnect the ignition switch connector and the door warning switch connector under the steering column.



[Ignition switch] [Door warning switch]

ETDD605C

3. Check for continuity between the terminals.

4. If continuity is not as specified, replace the switch.

TERMINAL / POSITION	KEY	IGNITION SWITCH 6	3	2	4	1	5	STEERING LOCK TRAVEL	TRAVEL	DOOR WARNING SWITCH 1	2
LOCK	REMOVAL							LOCK			
	INSERT							LOCK	UNLOCK	○	○
ACC		○	○					UNLOCK			
ON		○	○	○	○						
START		○			○	○	○				

ETDD605A

SPARK PLUG

INSPECTION E451ECB3

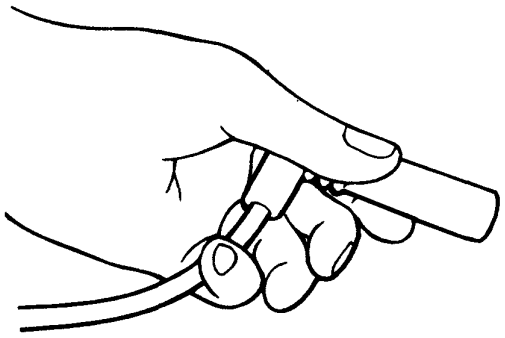
CHECKING SPARK PLUGS

1. Disconnect the spark plug cable from the spark plug.

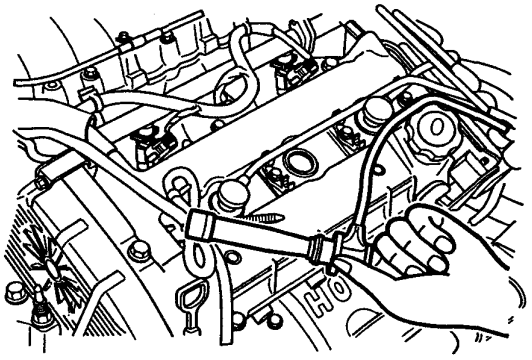
   NOTE

   Pull on the spark plug cable boot when removing the spark plug cable, not the cable, as it may be damaged.

[SOHC]



[DOHC]



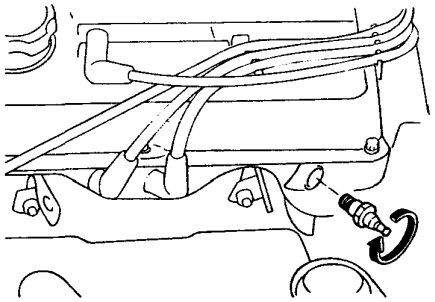
EBPD001K

2. Using a spark plug socket, remove all spark plugs from the cylinder head.

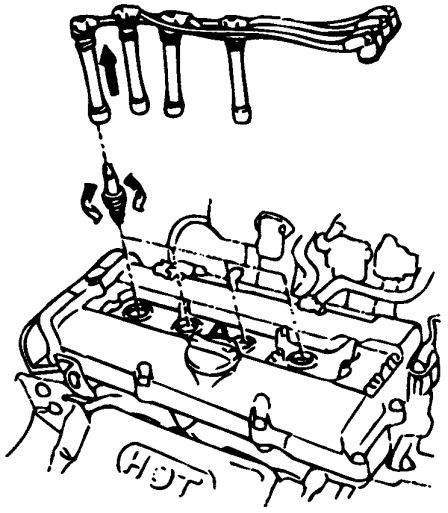
   CAUTION

   Take care not to allow contaminants to enter through the spark plug holes.

[SOHC]



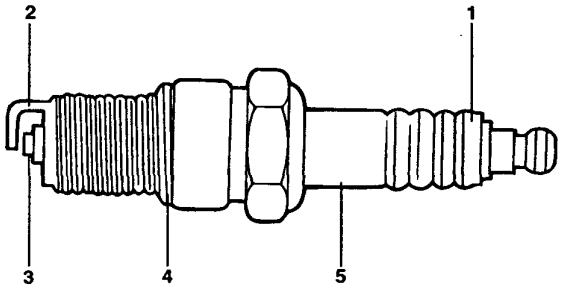
[DOHC]



EBPD001S

3. Check the spark plugs for the following :

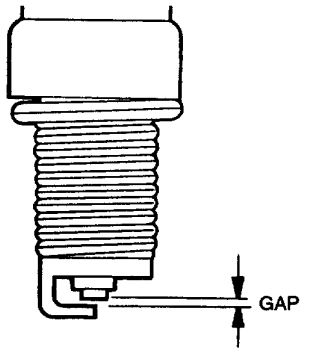
   1) Broken insulator
   2) Worn electrode
   3) Carbon deposits
   4) Damaged broken gasket
   5) Condition of the porcelain insulator at the tip of the spark plug



EBDA009B

4. Check the spark plug gap using a wire gap gauge, and adjust if necessary.

Standard value :
Unleaded : 1.0 ~ 1.1mm (0.039 ~ 0.043 in.)



EBDA009C

5. Re-insert the spark plug and tighten to the specified torque.
   If it is over torqued, damage to the thread portion of cylinder head might result.

Tightening torque :
20 ~ 30 Nm (200 ~ 300 kg·cm, 15 ~ 21 lb·ft)

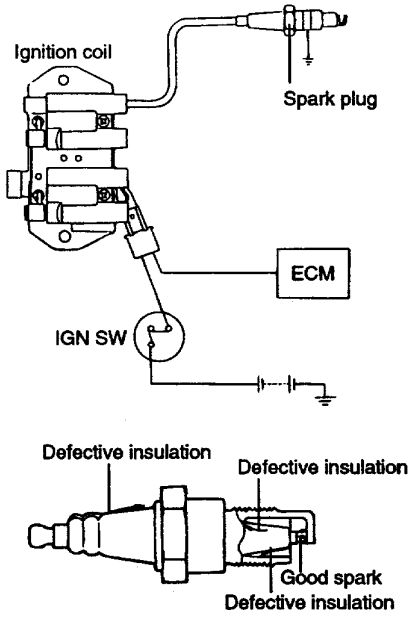
ANALYZING SPARK PLUGS

Engine conditions can be analyzed by examining the tip deposits near electrode.

Condition	Dark deposits	White deposits
Description	• Too rich a fuel minture • Low air intake	• Too lean a fuel mixture • Advanced ignition timing • Insufficient plug tightening

SPARK PLUG TEST (WHEN ENGINE CAN BE CRANKED)

Connect the spark plug cable. Ground the outer electrode (main body), and crank the engine. In the atmosphere, only short sparks are produced because of the small discharge gap. If the spark plug is good, however, sparks will occur in the discharge gap (between the electrodes). In a defective spark plug, no sparks will occur because of a leak through the insulation.



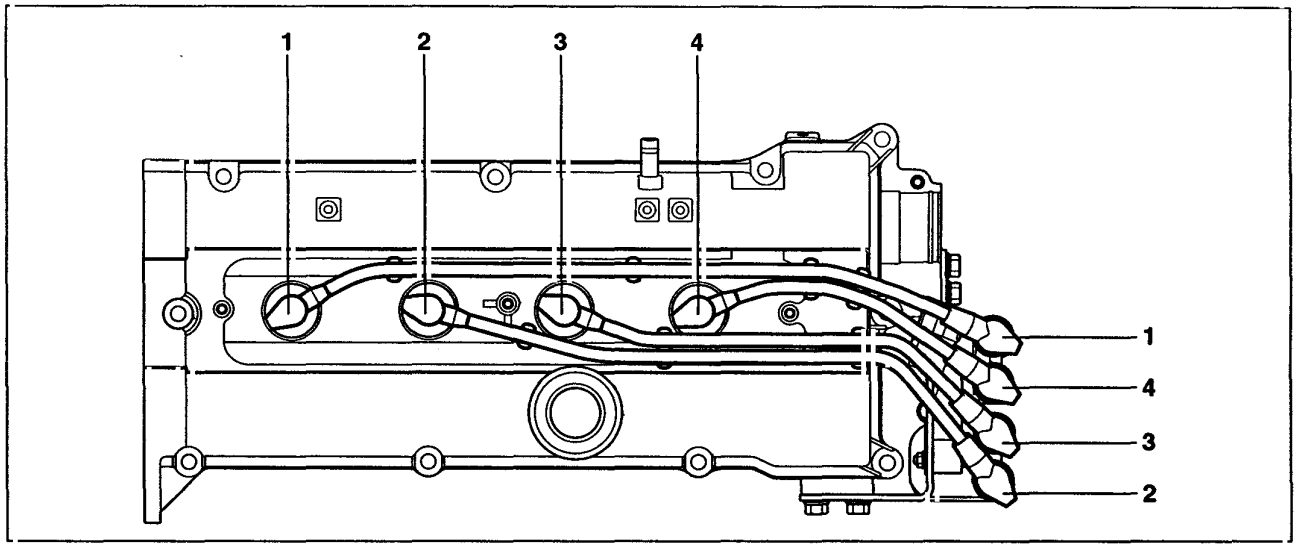
EBDA009E

SPARK PLUG CABLE

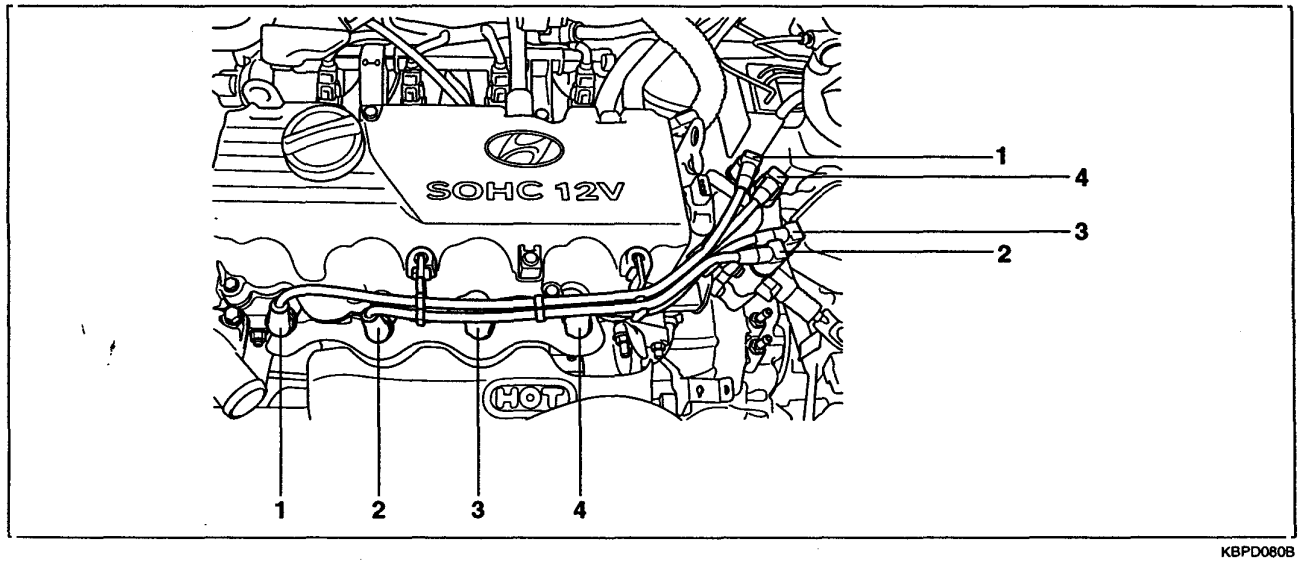
COMPONENT LOCATION EAC8C2BC

Improper arrangement of spark plug cables will induce flash over between the cables, causing misfiring and surging at acceleration in high-speed operations.

Therefore be careful to arrange the spark plug cables properly as shown in the illustration.



KBPD080A



KBPD080B

INSPECTION E72B3930

CHECKING SPARK PLUG CABLES

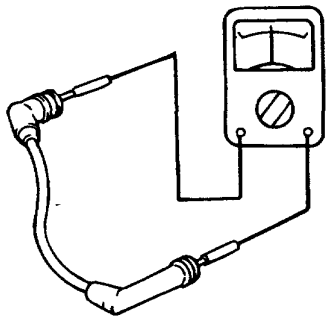
1. Check the cap and outer shell for cracks.
2. Measure the resistance.

Spark plug cable				
CYLINDER	No.1	No.2	No.3	No.4
LENGTH	560	440	360	310
RESISTANCE (BOUGI) Ω	2.51 ~ 3.76	1.97 ~ 2.96	1.61 ~ 2.42	1.39 ~ 2.08
RESISTANCE (R16AIPS) Ω	5.60 ~ 11.76	4.40 ~ 9.24	3.60 ~ 7.56	3.10 ~ 6.51

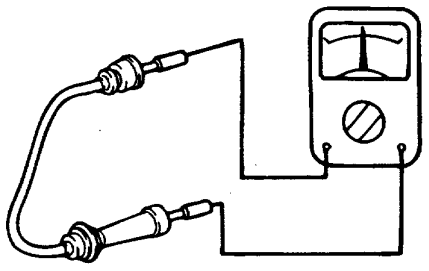
NOTE

Resistance should not be higher than 10,000 Ω per foot of cable. If resistance is higher, replace the cable.

[SOHC]



[DOHC]



EBPD006A

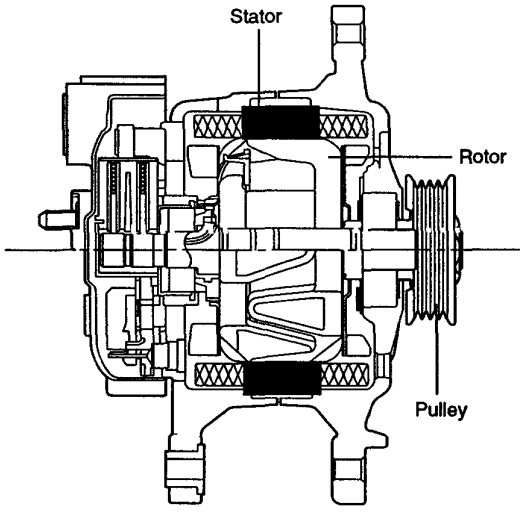
CHARGING SYSTEM

GENERAL INFORMATION E2817EBD

GASOLINE

The charging system includes a battery, a generator with a built-in regulator, and the charging indicator light and wire. The generator has six built-in diodes (three positive and three negative), each rectifying an AC current to DC current. Therefore, the DC current appears at generator "B" terminal.

In addition, the charging voltage of the generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and drive belt pulley. The brush holder contains a built-in electronic voltage regulator.



EBPD100A

INSPECTION E9D12228

VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE

This test determines if the wiring between the generator "B" terminal and the battery (+) terminal is good by the voltage drop method.

PREPARATION

1. Turn the ignition switch to "OFF".

   NOTE

   To identify connection problems, be sure not to disturb either of the two terminals or their connections during this test.

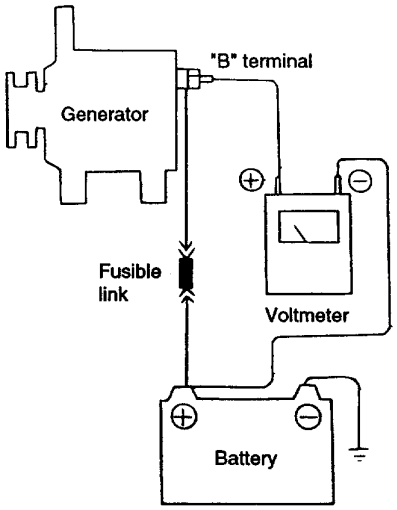
2. Connect a digital voltmeter between the generator "B" terminal and battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.

CONDITIONS FOR TESTING

With the engine running and headlamps, blower motor etc. ON, check the reading on the voltmeter.

RESULT

1. The voltmeter should read a standard 0.3V.
2. If the reading is above 0.3V, poor wiring should be suspected.
   Check wiring from generator 'B' terminal through the fusible link to the battery (+) terminal.
   Check for loose wiring or color change from an overheated harness. Correct and check again.
3. On completion of the test, set the engine at idle. Then turn off the headlamps, blower motor etc., and ignition.



EBDA029A

OUTPUT CURRENT TEST

This test determines if the generator gives an output current that is equivalent to the nominal output.

PREPARATION

1. Prior to the test, check the following items and correct as necessary.
   a. Check if that the battery installed in the vehicle is in good condition. For details, see "BATTERY".

      NOTE

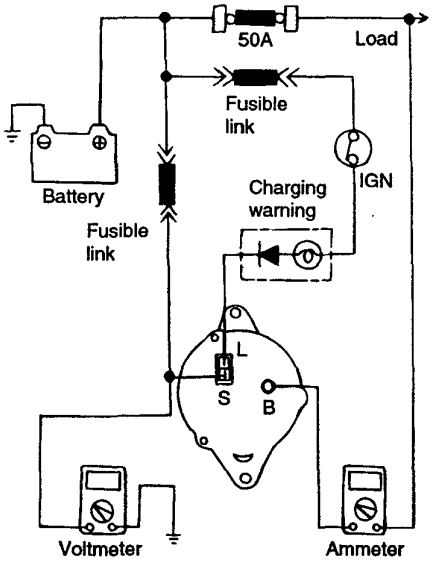
      The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.

   b. Check the tension of the generator drive belt. See "COOLING".
2. Turn the ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Disconnect the generator output wire from the generator "B" terminal.
5. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

   NOTE

   Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the generator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



EBDA033A

TEST

1. Check to see that the voltmeter reads the same value as the battery voltage. If the voltmeter reads 0V, an open circuit in the wire between the generator "B" terminal and battery (-) terminal, a blown fusible link or poor ground is suspected.
2. Start the engine and turn the headlights on.
3. Set the headlights to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

NOTE

After the engine starts, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the generator output wire is in good condition, remove the generator from the vehicle and test it.

Limit value
63A min : 90A generator

NOTE

1. *The nominal output current value is shown on the nameplate affixed to the generator body.*
2. *The output current value changes with the electrical load and the temperature of the generator itself.*
   Therefore, the nominal output current may not be obtained. In such case, keep the headlights on to discharge the battery, or use the lights of another vehicle to increase the electrical load.

2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the generator output wire to the generator "B" terminal.
6. Connect the battery ground cable.

REGULATED VOLTAGE TEST

The purpose of this test is to check that the electronic voltage regulator controls the voltage correctly.

PREPARATION

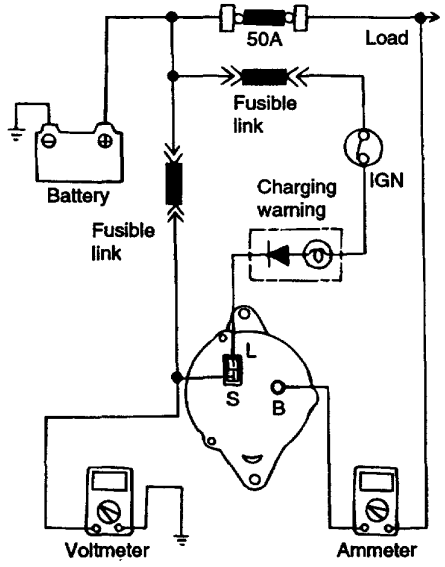
1. Prior to the test, check the following items and correct if necessary.
   a. Check that the battery installed in the vehicle is fully charged. For battery checking method, see the "BATTERY" section.
   b. Check the generator drive belt tension. For belt tension check, see section, "COOLING".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.

4. Connect a digital voltmeter between the "S(L)" terminal of the generator and ground.
   Connect the (+) lead of the voltmeter to the "S(L)" terminal of the generator. Connect the (-) lead to a good ground or the battery (-)terminal.

5. Disconnect the generator output wire from the generator "B" terminal.

6. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.

7. Attach the engine tachometer and connect the battery ground cable.



EBDA033A

TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.
   Voltage : Battery voltage
   If it reads 0V, there is an open circuit in the wire between the generator "S(L)" terminal and the battery and the battery (+), or the fusible link is blown.

2. Start the engine. Keep all lights and accessories off.

3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the generator output current drops to 10A or less.

RESULT

1. If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly.
   If the reading is other than the standard value, the voltage regulator or the generator is faulty.

REGULATING VOLTAGE TABLE

	Regulating voltage V
	90A generator
-20 (-4)	14.3 ~ 15.2
20 (68)	14.1 ~ 14.7
60 (140)	13.5 ~ 14.4
80 (176)	13.3 ~ 14.3

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.

3. Disconnect the battery ground cable.

4. Remove the voltmeter, ammeter, and the engine tachometer.

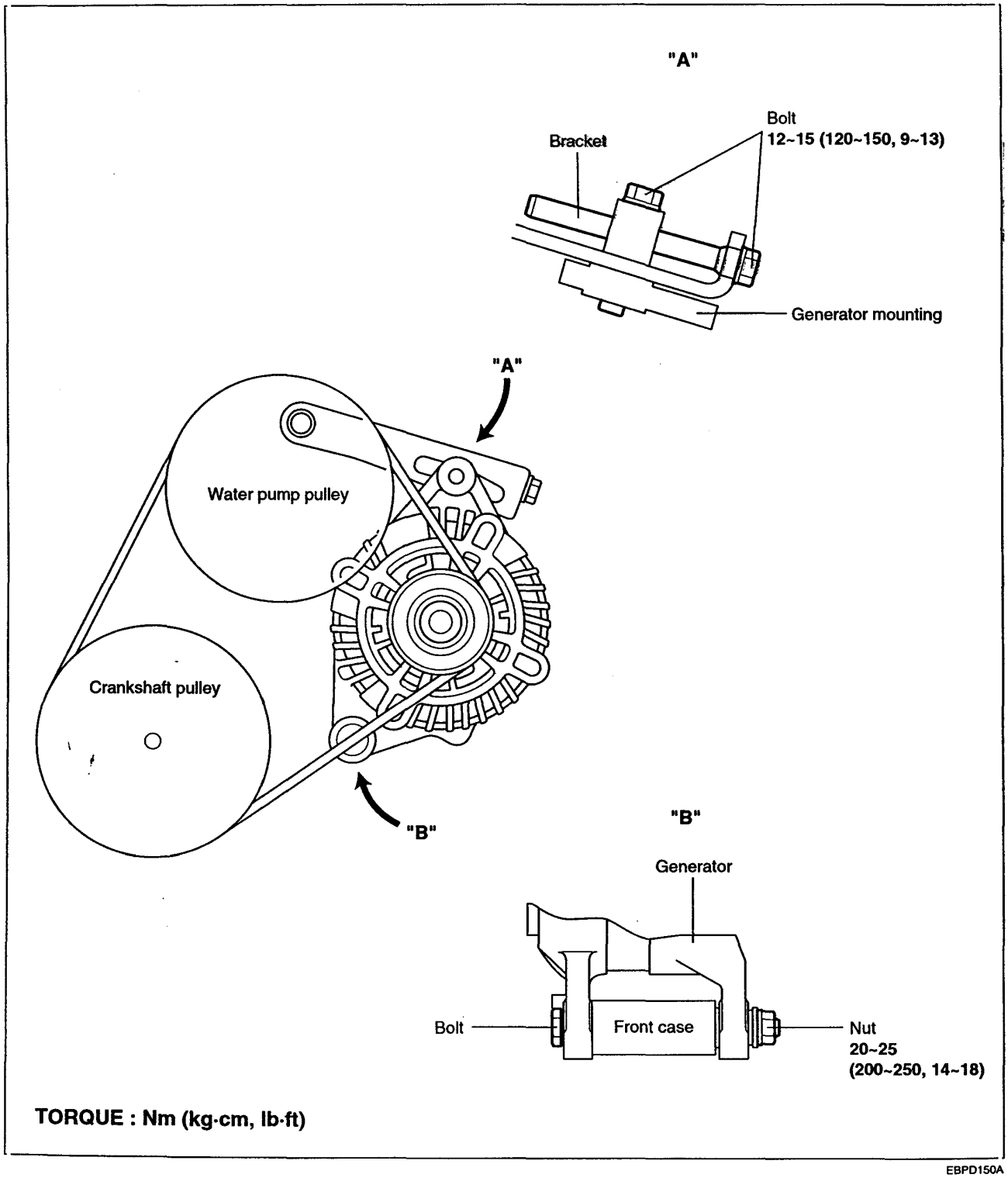
5. Connect the generator output wire to the generator "B" terminal.

6. Connect the battery ground cable.

GENERATOR

INSTALLATION E6CD193C

GASOLINE

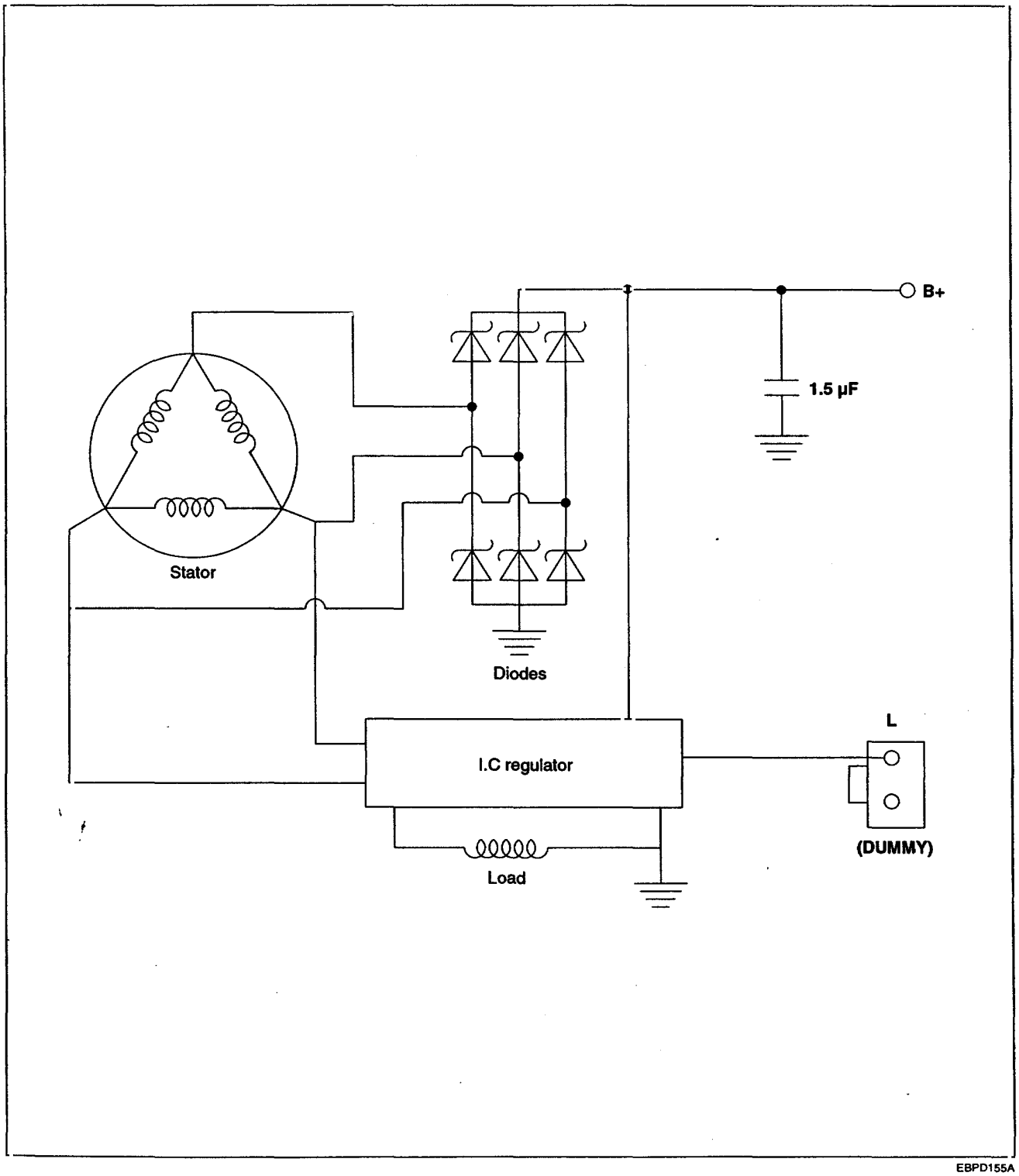


TORQUE : Nm (kg·cm, lb·ft)

EBPD150A

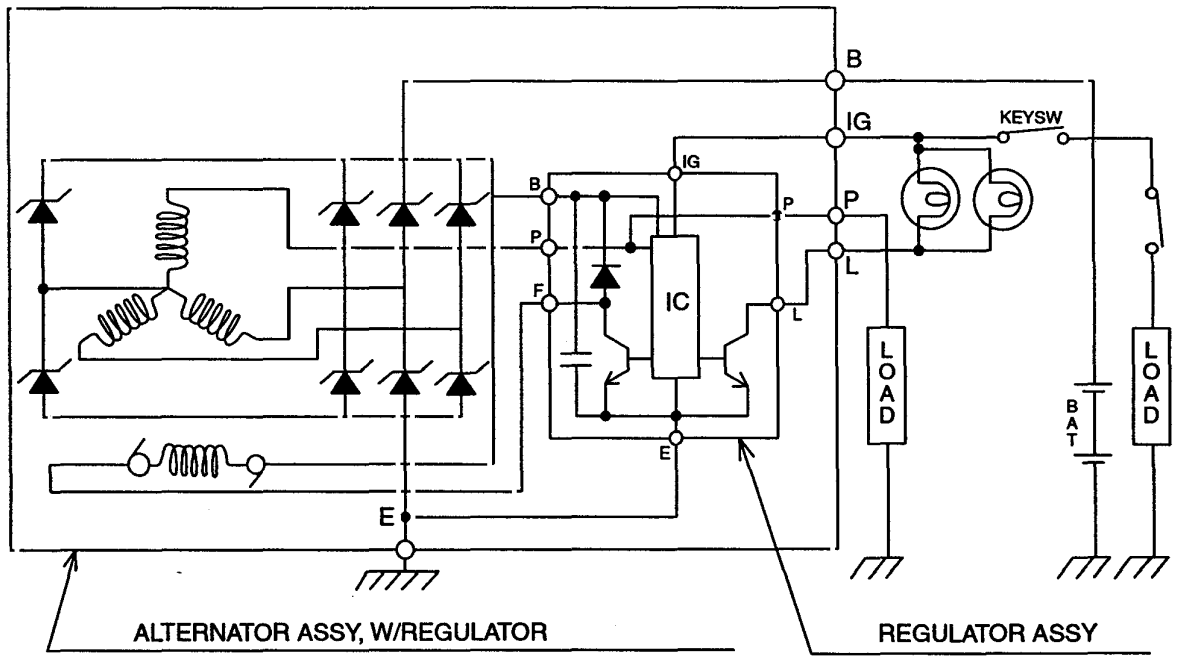
CIRCUIT DIAGRAM ED809CC8

GASOLINE



EBPD155A

DIESEL

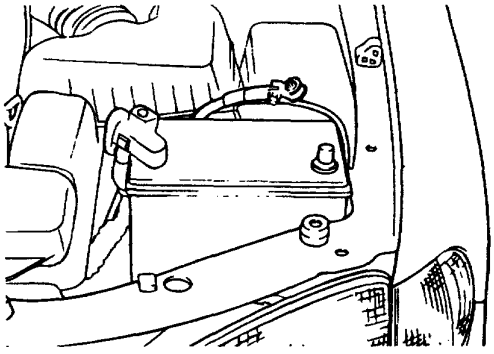


EBDD700B

REMOVAL AND INSTALLATION EB7761DF

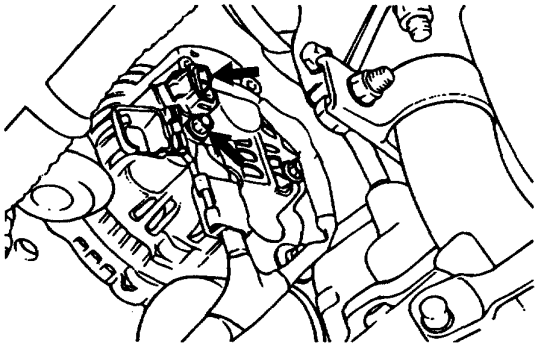
GASOLINE

1. Disconnect the negative (-) terminal.



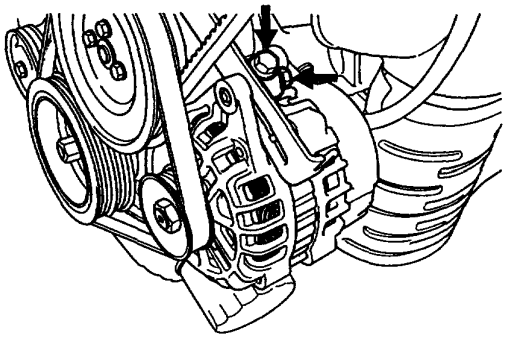
EBDA035B

2. Disconnect the generator connector and remove the "B+" terminal cable.



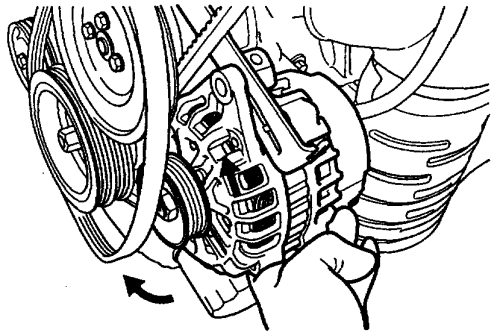
EBDA035E

3. Loosen the belt tension adjusting bolt and remove the mounting bolt.



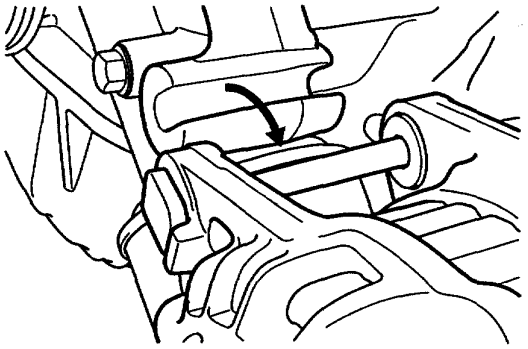
KBPD160A

4. Remove the belt by pushing the generator inward.



KBPD160B

5. Remove the generator assembly.

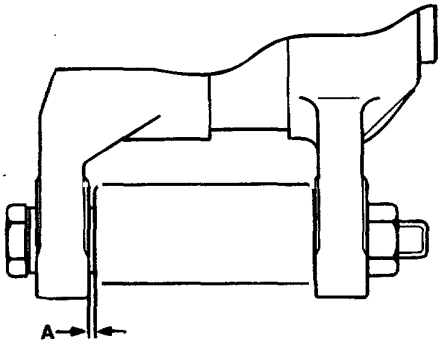


KBPD160C

6. Installation is the reverse of removal.

NOTE

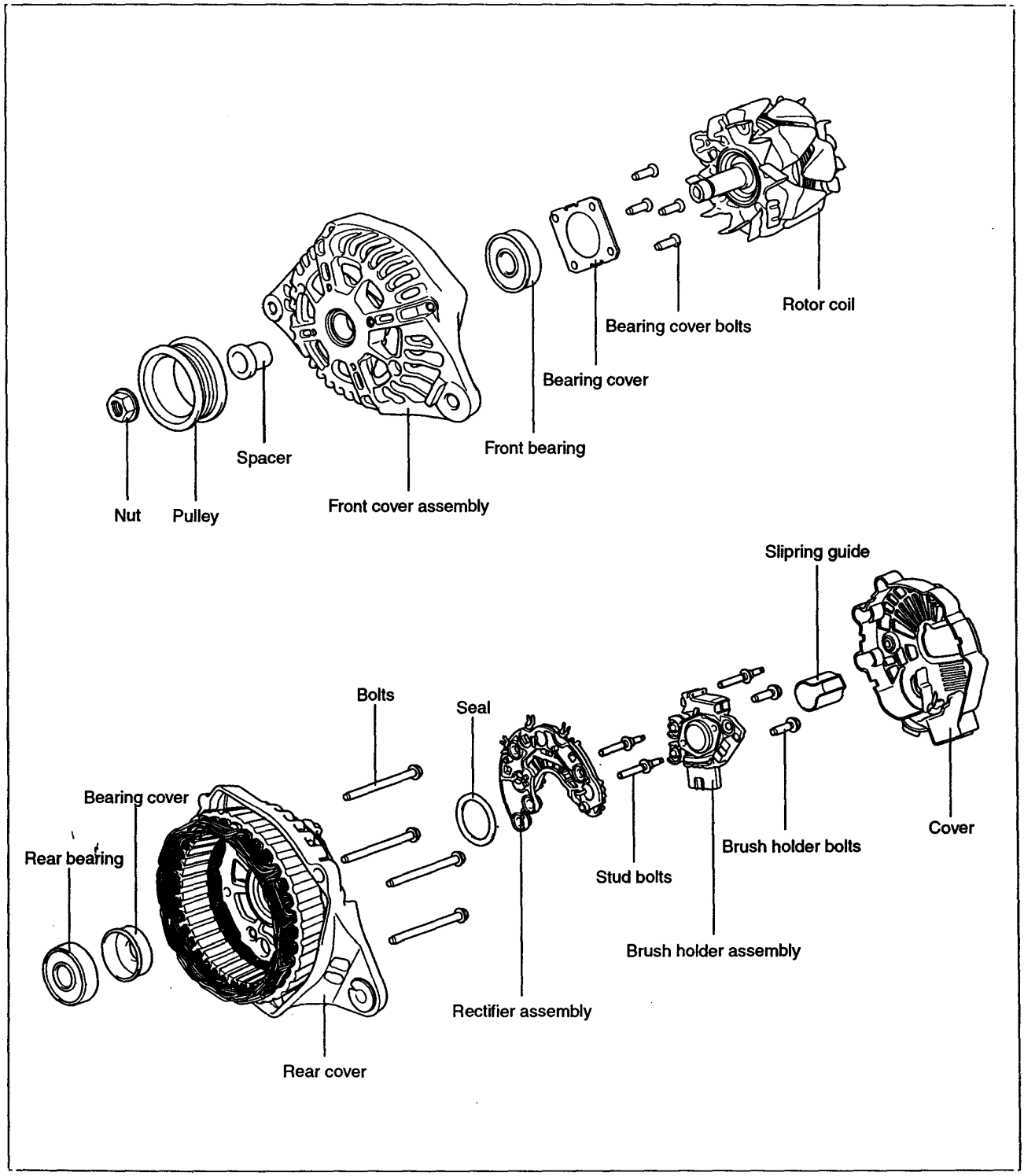
1. *Position the generator and insert the support bolt. (Do not attach the nut)*
2. *Push the generator forward and determine how many spacers (thickness : 0.198 mm) should be inserted between the front leg of the generator and the front case. (space "A" in the illustration) (There should be enough spacers so that they do not fall out when you let go of them.)*
3. *Insert the spacers (space "A" in the illustration), attach the nut, and complete the installation.*



KFW2009A

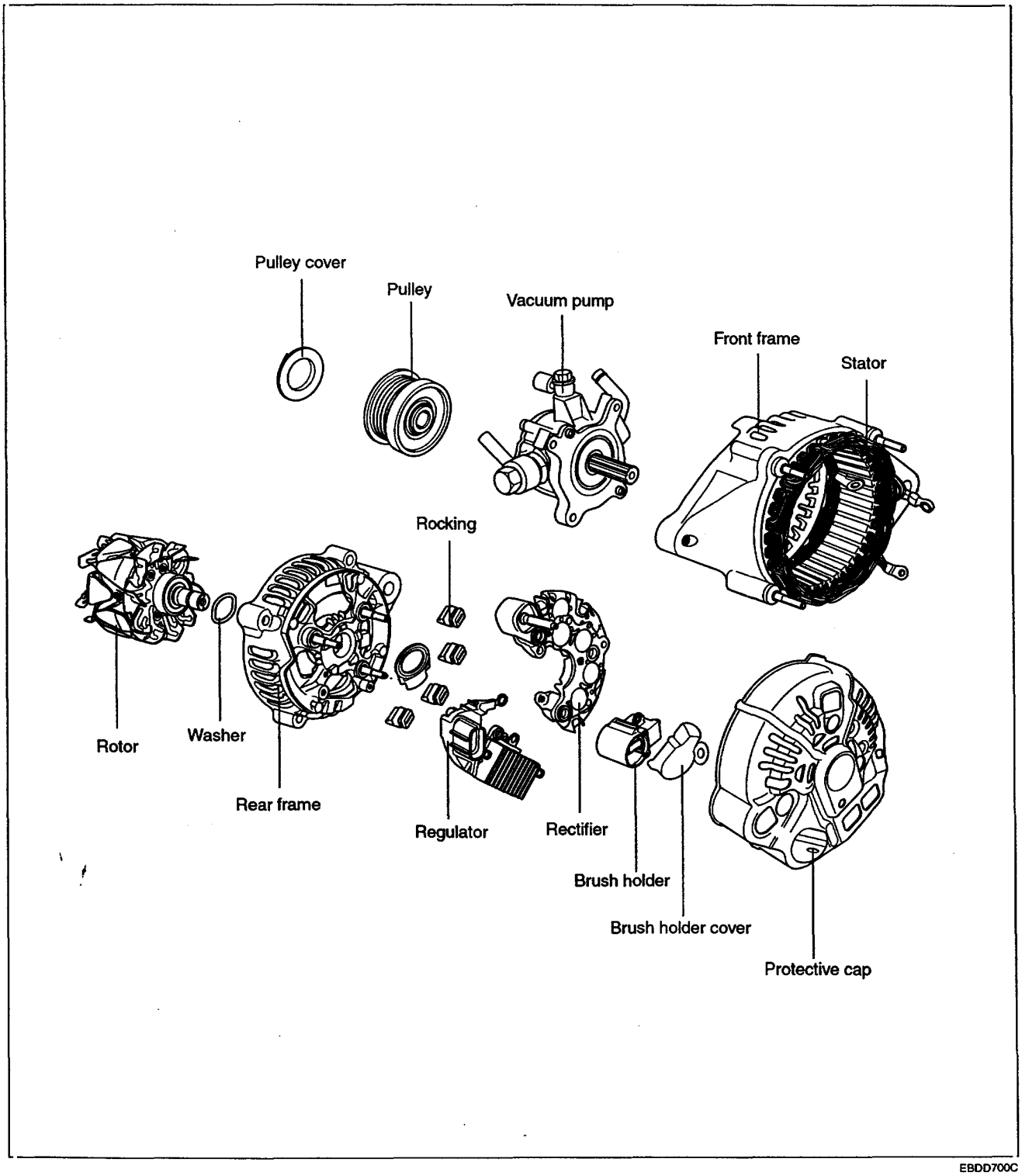
COMPONENTS EAEF4E4C

COMPONENTS



EBPD170A

DIESEL

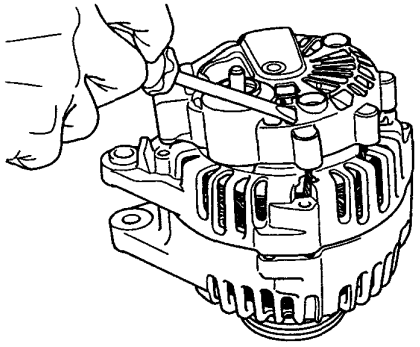


EBDD700C

DISASSEMBLY EFC7AED0

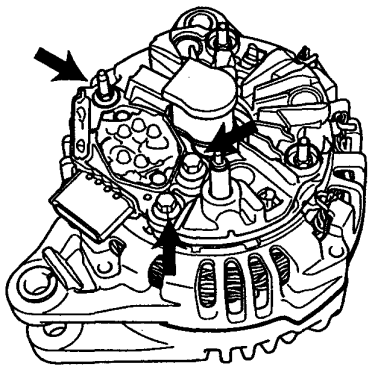
GASOLINE

1. Remove the generator cover using a screw driver.



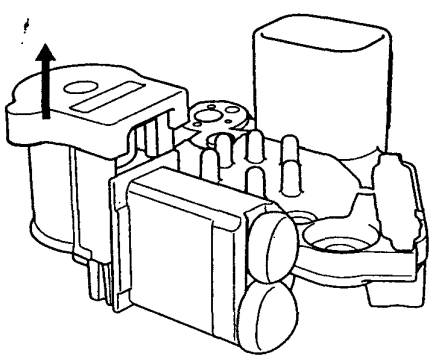
KBBC250A

2. Loosen the mounting bolts and disconnect the brush holder assembly.



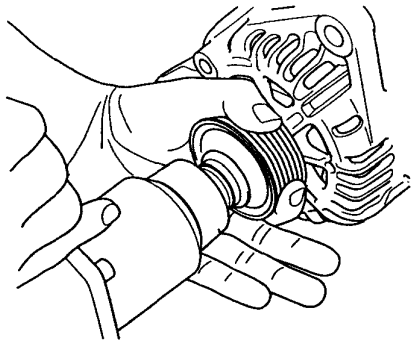
KBBC250B

3. Remove the slip ring guide.



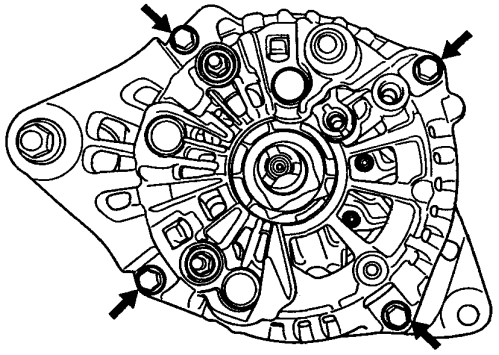
KBPD180A

4. Remove the nut, pully and spacer.



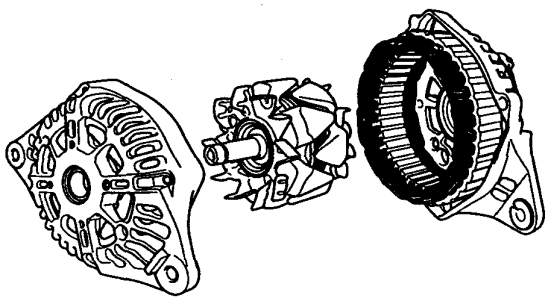
KBBC250C

5. Loosen the 4 through bolts.



KBPD180B

6. Disconnect the rotor and cover.



KBPD180C

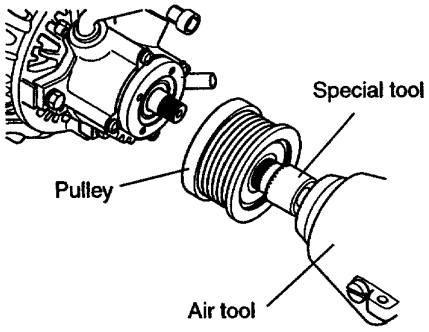
7. Reassembly is the reverse of disassembly.

DIESEL

1. Remove the pulley cover.
2. Remove the pulley using the special tool.

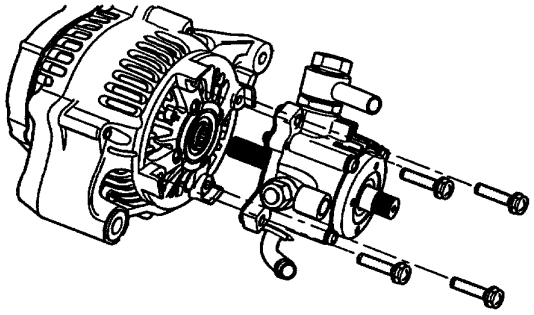
   NOTE

   Use an air tool



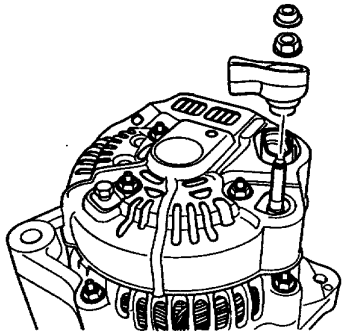
EBDD701A

3. After loosening the four vacuum pump mounting bolts, Remove the vacuum pump.



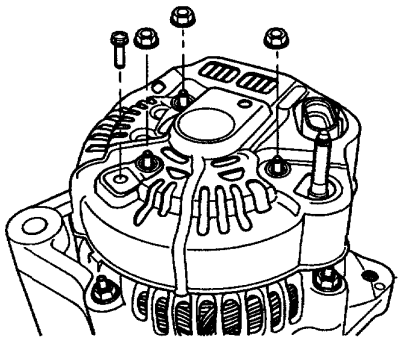
EBDD701B

4. Remove the B terminal insulator.



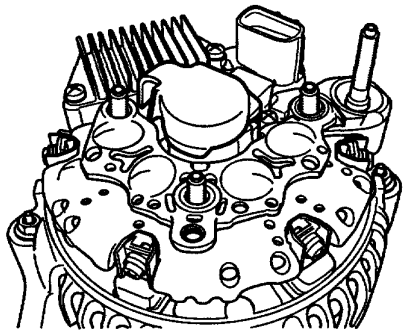
EBDD701C

5. After loosening the three rear cover mounting nuts and one bolt, remove the rear cover.

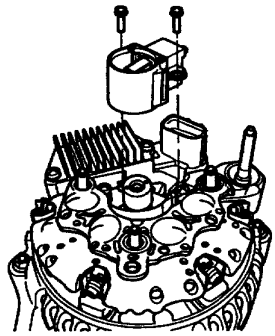


EBDD701D

6. Remove the two screws, then remove the brush holder cover and brush holder.

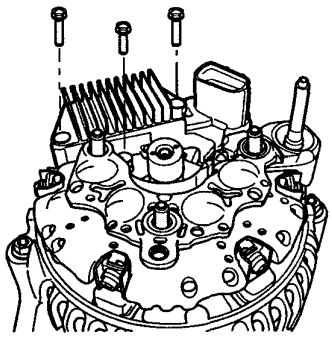


EBDD701I



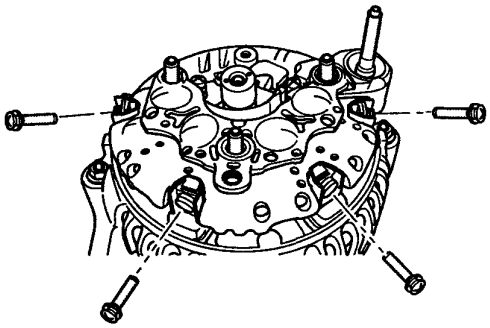
EBDD701J

7. Remove the three screws, then remove the regulator.



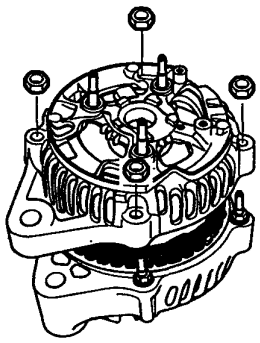
EBDD701E

8. After loosening the four screws, remove the retifier.



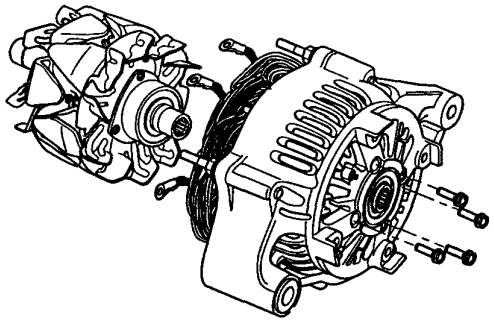
EBDD701F

9. After loosening the four nuts, remove the rear frame.



EBDD701G

10. After loosening the four screws, separate the motor from the stator assembly.



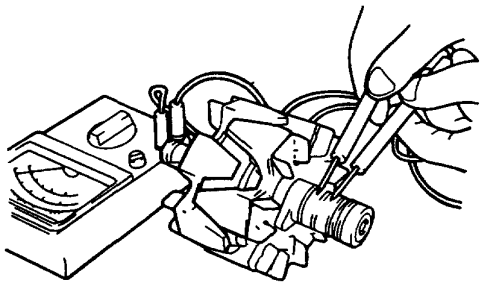
EBDD701H

INSPECTION ECDE6C75

ROTOR

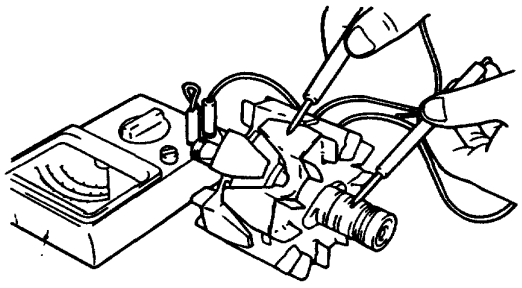
1. Check the rotor coil for continuity. Check to make sure that there is continuity between the slip rings. If resistance is extremely low, it means that there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.

Resistance value : Approx. 3.1Ω



EBDA039A

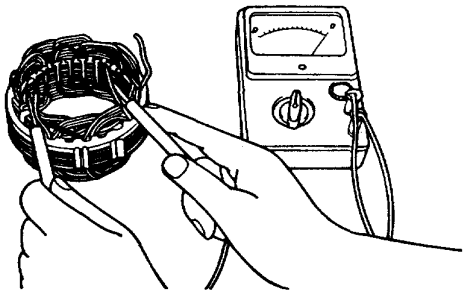
2. Check the rotor coil for ground. Check to make sure that there is no continuity between the slip ring and the core.
   If there is continuity, replace the rotor assembly.



EBDA039B

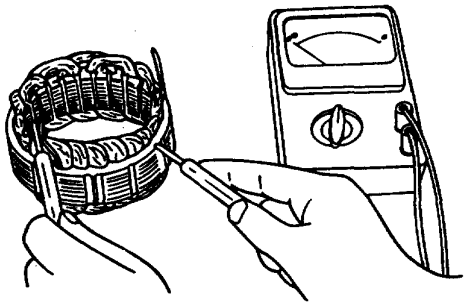
STATOR

1. Make a continuity check on the stator coil. Check to make sure that there is continuity between the coil leads.
   If there is no continuity, replace the stator assembly.



EBDA039C

2. Check the coil for grounding. Check to make sure that there is no continuity between the coil and the core.
   If there is continuity, replace the stator assembly.

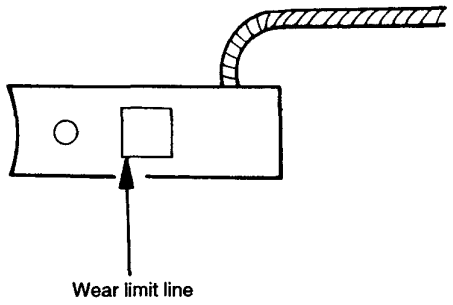


EBDA039D

REPLACEMENT E4B48F61

BRUSH

Replace the brushes if they are worn to the limit line.



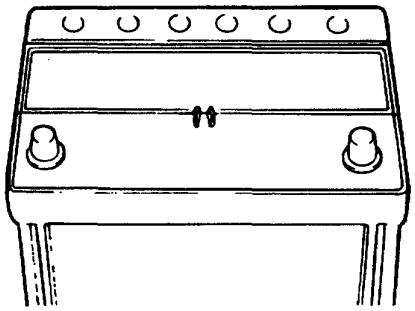
EBDA039H

1. Unsolder the pigtail and remove the old brush and spring.
2. Install the brush spring and a new brush in the brush holder.
3. Insert the brush so that there is a space of 2 to 3 mm (0.079 to 0.118 in.) between the limit line and the end of the brush holder.
4. Solder the pigtail to the brush holder.

BATTERY

GENERAL INFORMATION E0DDC27D

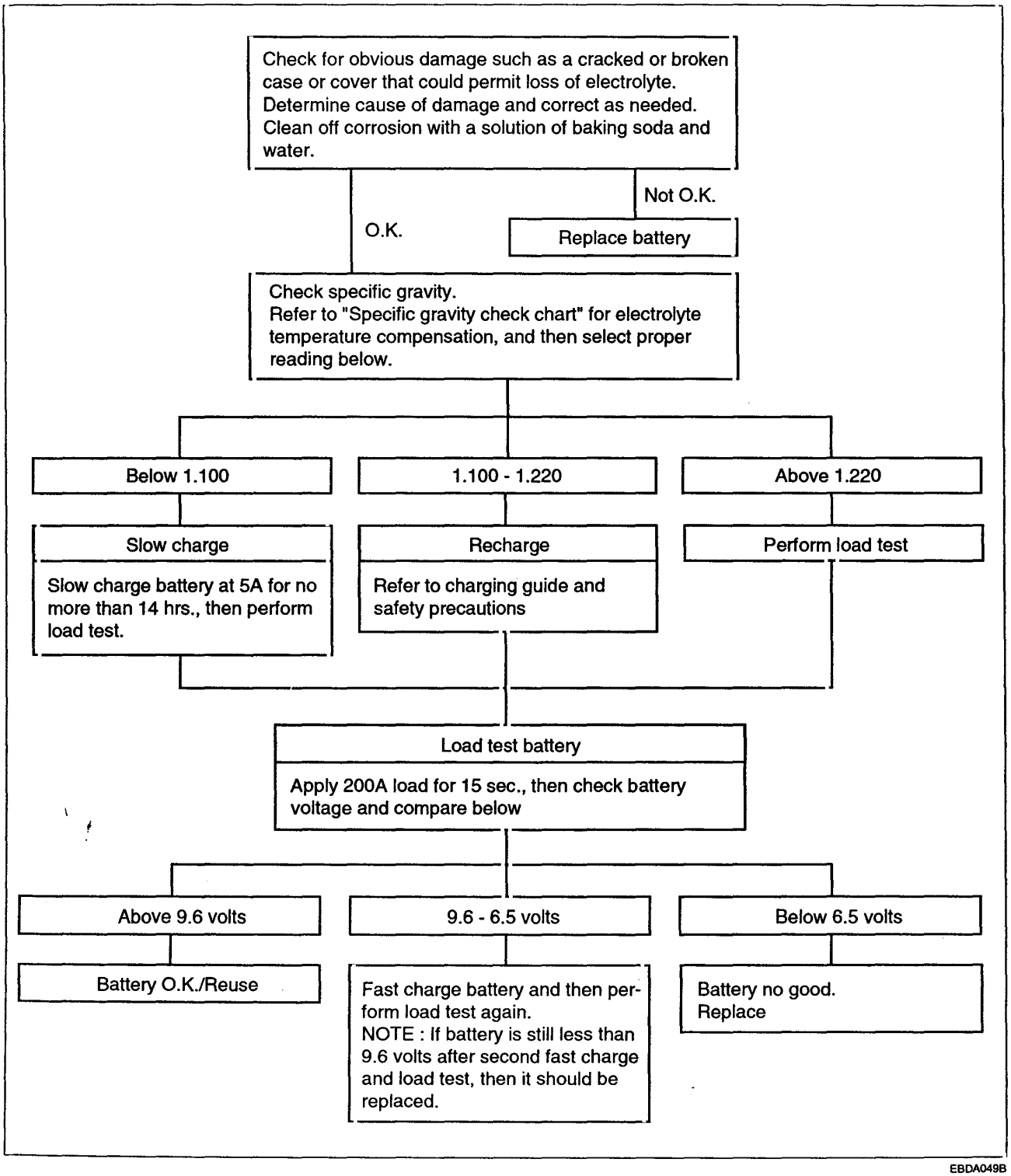
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



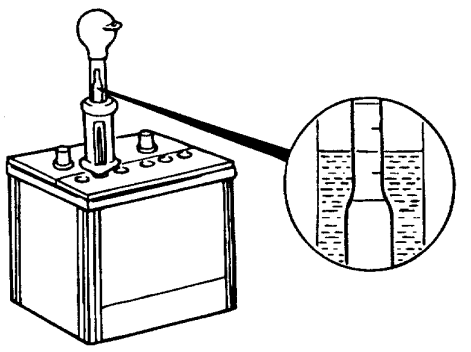
EBDA049A

INSPECTION EE3929FB

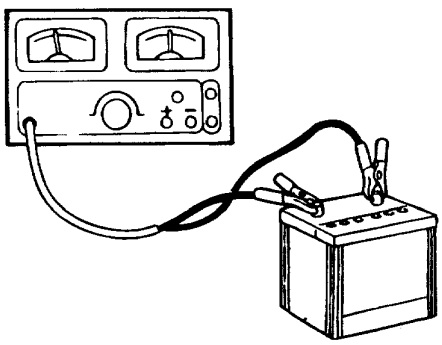
BATTERY VISUAL INSPECTION (1)



EBDA049B



EBDA049D



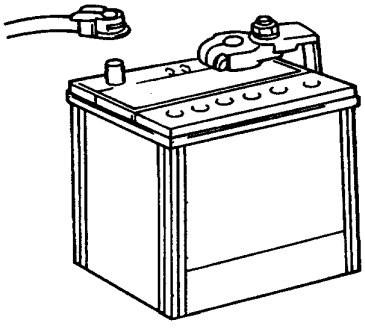
EBDA049E

BATTERY VISUAL INSPECTION (2)

1. Make sure ignition switch is in the Off position and all accessories are Off.
2. Disconnect the battery cables. (negative first)
3. Remove the battery from the vehicle.

⚠ ***CAUTION***

Care should be taken in the event that the battery case is cracked or leaking, to protect your skin from the electrolyte. A suitable pair of rubber gloves (not household type) should be worn when removing the battery.

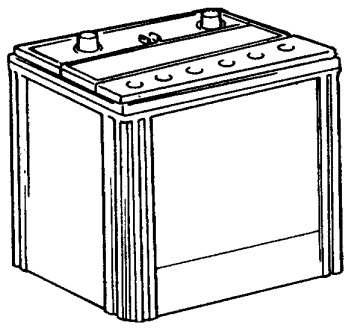


EBDA055A

4. Inspect the battery carrier for damage caused by the loss of acid from the battery. If acid damage is present, it will be necessary to clean the area with a solution of clean, warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described in step 4.
6. Inspect the battery case, and cover, for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post cleaner.
8. Clean the inside surface of the terminal clamps with a suitable battery terminal cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure the top of the terminals are flush with the top of the post.
11. Tighten the terminal nut securely.
12. Coat all connections with light mineral grease after tightening.

⚠ ***CAUTION***

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of the batteries being charged. A spark will occur where the circuit is broken. Keep all flames away from an open battery.



EBDA055B

SPECIFIC GRAVITY CHECK CHART

The specific gravity of battery electrolyte changes with temperature. Heat thins the solution and lowers the specific gravity. Cold thickens the solution and raises the specific gravity.

A fully charged battery should have a specific gravity between 1.260 and 1.280, with the electrolyte temperature at 26.7°C. The specific gravity reading must be corrected by adding 4 points (.004) for each 5.56°C above 26.7°C or subtracting 4 points for every 5.56°C below 26.7°C.

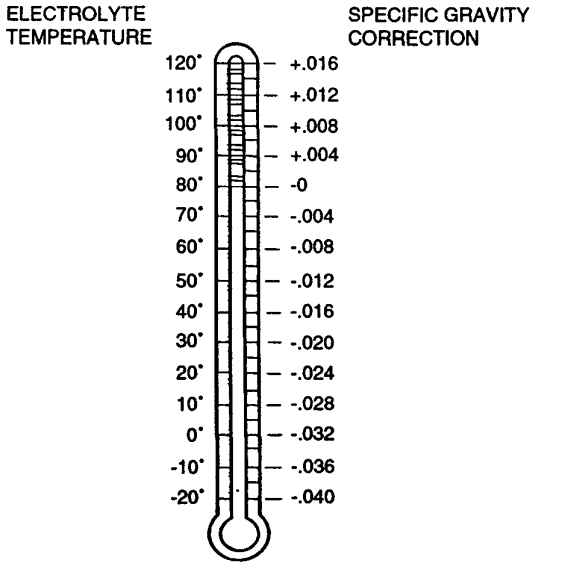
For example : The hydrometer reading is 1.280, and the electrolyte temperature reading is 5.56°C. According to the chart below, the specific gravity must be lowered by 0.028 points. The true corrected reading is 1.252.

1.280 - 0.028 = 1.252

You should never take a hydrometer reading immediately after water has been added. The water and electrolyte must be mixed by either charging for a few minutes at a low rate or by allowing the battery to sit for an hour.

⚠ *CAUTION*

A difference of 50 points (0.050) or more between one or more cells indicates a defective battery. It should be replaced.



EBDA051A

BATTERY CHARGE RATE

Specific gravity	Charge method	
	Slow charge (5A)	Fast charge (20A)
Below 1.100	14 hours	4 hours
100 ~ 1.130	12 hours	3 hours
130 ~ 1.160	10 hours	2.5 hours
160 ~ 1.190	8 hours	2.0 hours
190 ~ 1.220	6 hours	1.5 hours
Above 1.220	4 hours	1.0 hours

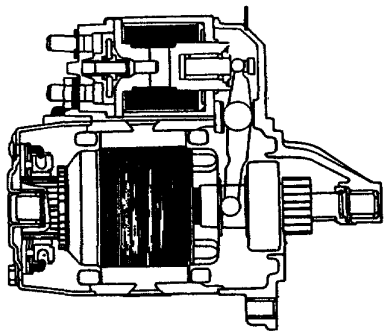
STARTING SYSTEM

GENERAL INFORMATION E98B27CE

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch (A/T only), connection wires and the battery cables.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear. The contacts close and the starter motor cranks.

In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



EBDA057A

INSPECTION EAF0C253

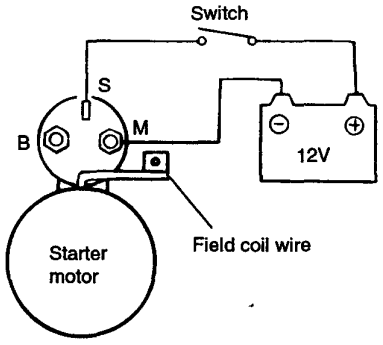
CHECKING FOR OPERATION

SERVICE ADJUSTMENT PROCEDURES FOR PINION GAP ADJUSTMENT

1. Disconnect the field coil wire from the M-terminal of the solenoid.
2. Connect a 12V battery the S-terminal and the M-terminal.
3. The pinion will move out.

⚠ ***CAUTION***

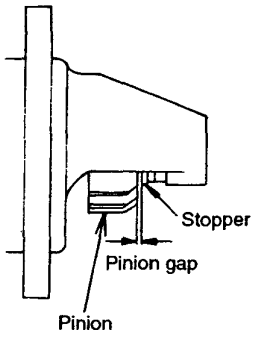
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



EBA9023A

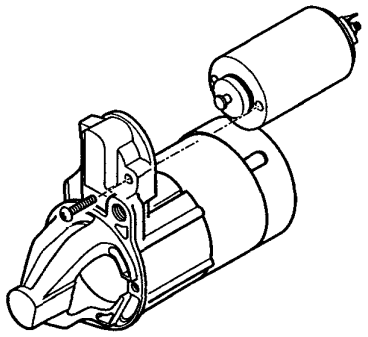
4. Check the pinion for stopper clearance (pinion gap) with a feeler gauge.

Pinion gap: 0.5 ~ 2.0 mm (0.02 ~ 0.079 in.)



EBA9023B

5. If the pinion gap is out of specification, adjust by adding or removing gaskets between the solenoid and the front bracket.



EBHA306D

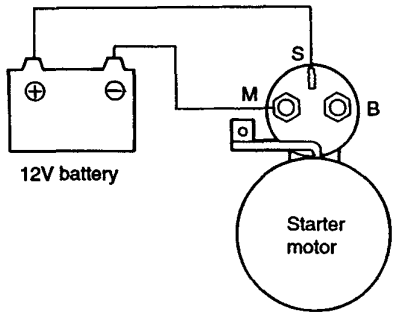
MAGNETIC SWITCH PULL-IN TEST

1. Disconnect the field coil wire from the M-terminal of the magnetic switch.
2. Connect a 12V battery between the S-terminal and the M- terminal.

⚠ ***CAUTION***

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

3. If the pinion moves out, then the pull-in coil is good. If it doesn't move out, replace the magnetic switch.



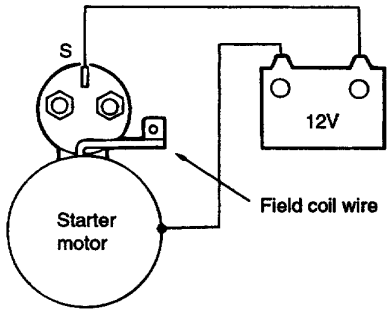
EBA9023D

MAGNETIC SWITCH HOLD-IN TEST

1. Disconnect the field coil wire from the M-terminal of the magnetic switch.
2. Connect a 12V battery between the S-terminal and the body.

> ⚠ ***CAUTION***
>
> ***This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.***

3. If the pinion moves out, everything is in order. If the pinion moves back and forth repeatedly, the hold-in circuit is open. Then replace the magnetic switch.

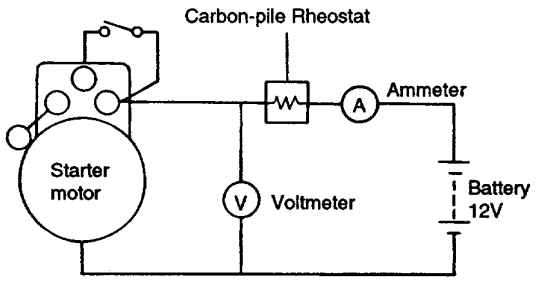


EBA9023E

FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostat as shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications and that thestarter motor turns smoothly and freely:

Current :	Max. 90 Amps
Speed :	Min. 2,800 Amps



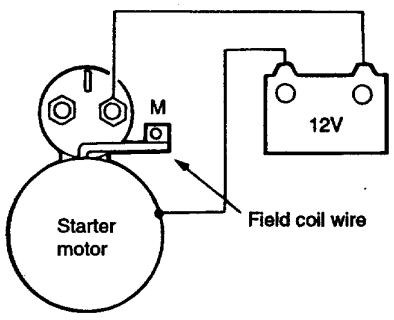
EBAC9023F

MAGNETIC SWITCH RETURN TEST

1. Disconnect field coil wire from the M-terminal of the magnetic switch.
2. Connect a 12V battery between M-terminal and the body.

> 📖 ***NOTE***
>
> *This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.*

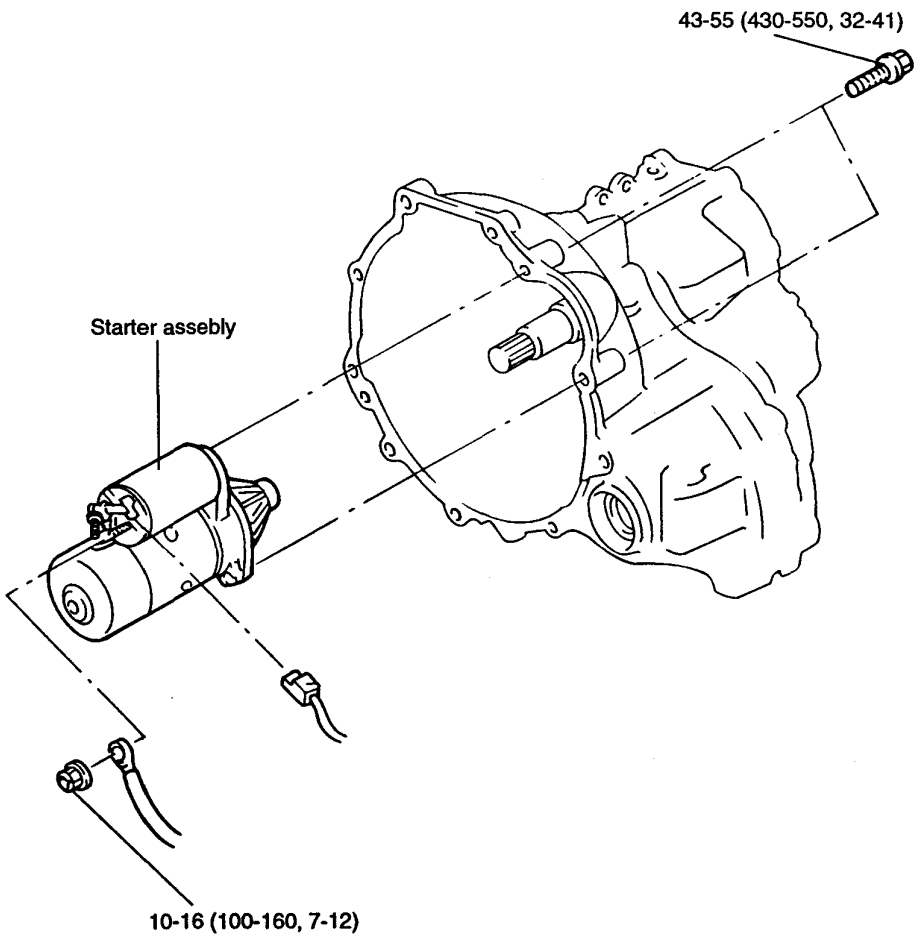
3. Pull pinion out and release. If pinion returns quickly to its original position, everything is in order. If it doesn't, replace the magnetic switch.



EBA9023G

STARTER

REMOVAL AND INSTALLATION E7EC39DF

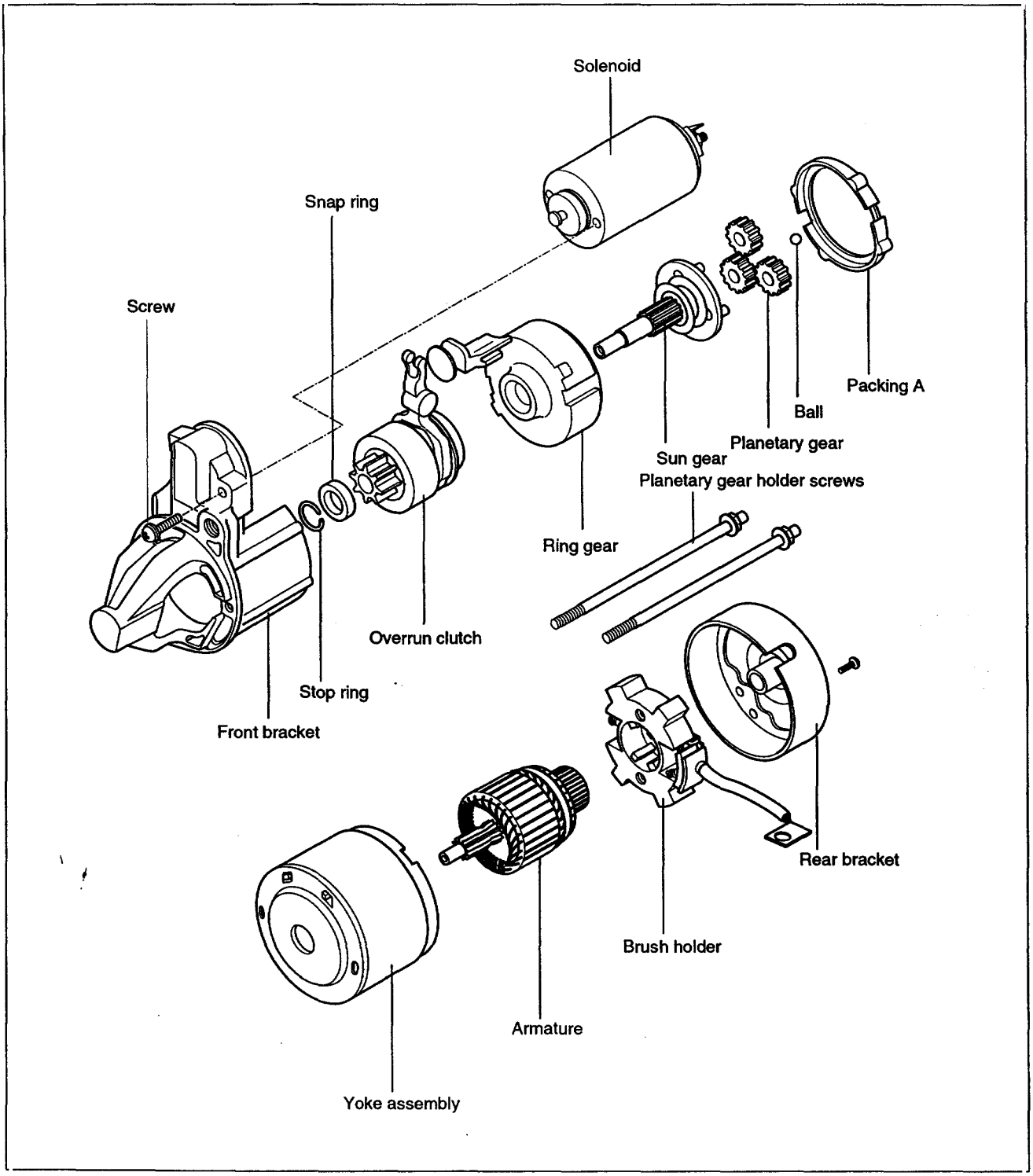


TORQUE : Nm (kg·cm, lb·ft)

EBDD059A

1. Disconnect the battery ground cable.
2. Remove the speedometer cable and the shift cable.
3. Disconnect the starter motor connector and terminal.
4. Remove the starter motor assembly.
5. Installation is the reverse order of removal.

COMPONENTS EE0FBCE3



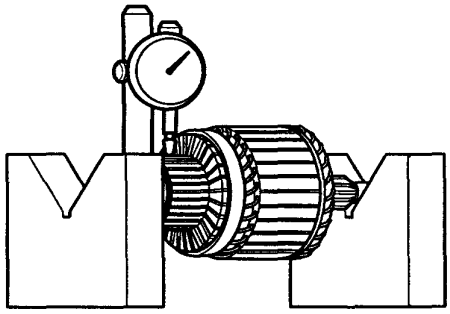
EBHA306A

INSPECTION E0E63E95

CHECKING THE COMMUTATOR

1. Place the armature on a pair of V-blocks, and check the deflection by using a dial gauge.

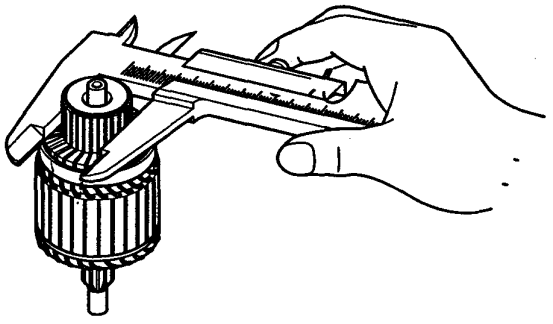
Standard value
Armature run-out : 0.05 mm (0.002 in.)
Limit
Armature run-out : 0.1 mm (0.0039 in.)



KFW2033A

2. Check the outer diameter of the commutator.

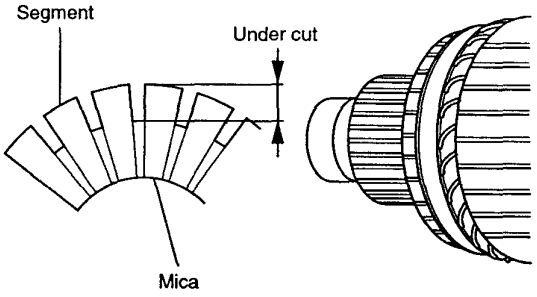
Standard value
Outer diameter of the commutator : 29.4 mm (1.157 in.)
Limit
Outer diameter of the commutator : 28.4 mm (1.118 in.)



KFW2034A

3. Check the depth of the undercut between segments.

Standard value
Depth of the undercut between segments :
0.5 mm (0.020 in.)
Limit
Depth of the undercut between segments :
0.2 mm (0.079 in.)

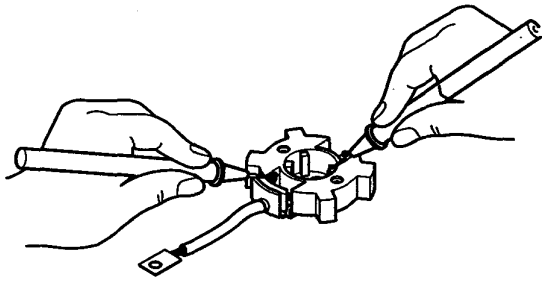


KFW2035A

BRUSH HOLDER

Check for continuity between the brush holder plate and the brush holder.

The normal condition is no continuity.

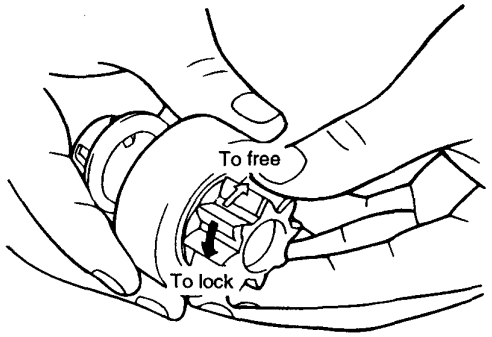


KFW2036A

OVERRUNNING CLUTCH

1. While holding clutch housing, rotate the pinion. Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction. If clutch does not function properly, replace the overrunning clutch assembly.

2. Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.



EBA9024E

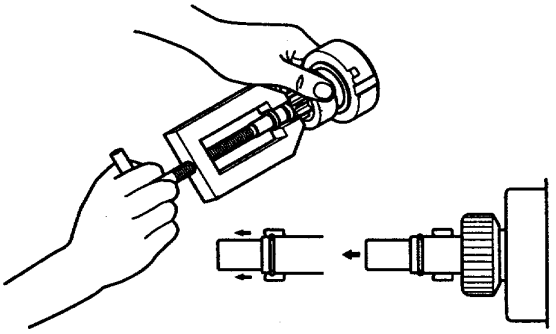
FRONT AND REAR BRACKET BUSHING

Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.

REASSEMBLY EF7F1BEA

STOP RING AND SNAP RING

Using a suitable tool, pull overrunning clutch stop ring over snap ring.



KFW2043A

CLEANING E6C2AF86

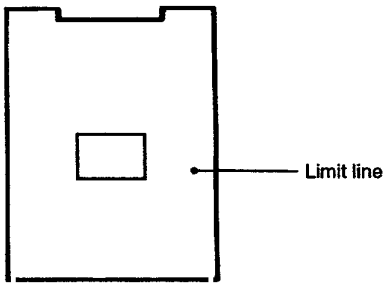
STARTER MOTOR PARTS

1. Do not immerse parts in cleaning solvent: Immersing the yoke and field coil assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

REPLACEMENT EBFEEEEF

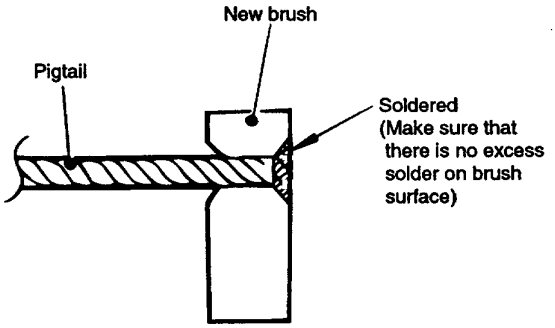
BRUSHES AND SPRINGS

1. Brushes that are worn out, or oil-soaked, should be replaced.
2. When replacing field coil brushes, crush worn out brush with pliers, taking care not to damage pigtail.



EBA9027A

3. Sand the pigtail end with sandpaper to ensure good soldering.
4. Insert the pigtail into hole provided in the new brush and solder it. Make sure that the pigtail and excess solder do not come out onto the brush surface.
5. When replacing the ground brush, slide the brush from brush holder by prying retaining the spring back.



EBA9027B

PREHEATING SYSTEM

SPECIFICATIONS E73E410A

GLOW PLUG

Rated voltage	DC11V
Operating voltage range	DC6V ~ DC16V

GLOW PLUG RELAY

Rated voltage	DC 12V
Operating voltage range	DC 9V ~ DC 16V
Operating temperature range	-40°C ~ 120°C
Rated load current	DC 12V, 70A

TIGHTENING TORQUE

Items	Nm	kg·cm	lb·ft
Glow plug	15 - 20	150 - 200	11 - 14
Glow plug plate attaching nut	1 - 1.5	10 - 15	0.7 - 1.1

SEALANTS AND ADHESIVES

Items	Specified sealant and adhesive
Water temperature sensor	3M Adhesive Nut Locking 4171 or equivalent

INSPECTION EA5AE80A

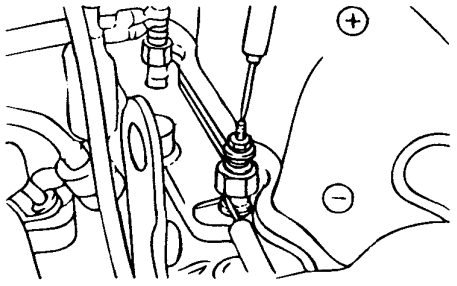
Conditions before inspection :
Battery voltage : 12V

1. Connect voltmeter between glow plug plate and plug body (ground).
2. Check indicated value on voltmeter with ignition switch ON.
3. Check that preheat indication lamp lights for about 6 seconds and indicatesbattery voltage (about 9V or over) for about 36 seconds immediately afterignition switch is turned on. [At cooling water temperature 20°C (68°F)]

   NOTE

   Continuity time varies depending upon cooling water temperature.

4. After checking 3, set ignition switch at START position.
5. The system is normal if battery voltage (about 9V or over) is generatedfor about 6 seconds during engine cranking and after start operation. [atcooling water temperature 20°C (68°F)]
6. WWhen the voltage or continuity time is not normal, check the terminalvoltage in glow control unit, and single parts.



B7AD7645

Fuel System [DIESEL]

GENERAL

SYSTEM OVERVIEW ..... FLA- 2
SPECIFICATION FLA-32
SERVICE STANDARD FLA-32
TIGHTENING TORQUES FLA-33
TROUBLESHOOTING FLA-34

DIESEL CONTROL SYSTEM

GENERAL FLA-53
GENERAL DIAGNOSTIC FLA-53
AIR FLOW SENSOR FLA-69
ENGINE COOLANT TEMP. SENSOR FLA-74
CAMSHAFT POSITION SENSOR FLA-77
CRANKSHAFT POSITION SENSOR FLA-79
INJECTOR FLA-81
RAIL PRESSURE SENSOR FLA-84
FUEL TEMPERATURE SENSOR FLA-86
EGR SOLENOID VALVE FLA-88
RAIL PRESSURE CONTROL VALVE FLA-90
ACCELERATION POSITION SENSOR FLA-92

GENERAL

SYSTEM OVERVIEW EE7D45EE

FIELD OF APPLICATION

The in-line fuel-injection pump's main area of application is still in all sizes of commercial-vehicle diesel engines, stationary diesel engines, locomotives and ships. Injection pressures of up to approx. 1350 bar are used to generate output powers of up to about 160 kW per cylinder.

Over the years, a wide variety of different requirements, such as the installation of direct-injection (DI) engines in small delivery vans and passenger cars, have led to the development of various diesel fuel-injection systems which are aligned to the requirements of a particular application. Of major importance in these developments are not only the increase in specific power, but also the demand for reduced fuel consumption, and the call for lower noise and exhaust-gas emissions. Compared to conventional cam-driven systems, the Bosch "Common Rail" fuel-injection system for direct-injection (DI) diesel engines provides for considerably higher flexibility in the adaptation of the injection system to the engine, for instance :

- Extensive area of application (for passenger cars and light commercial vehicles with output powers of up to 30kW/cylinder, as well as for heavy-duty vehicles, locomotives, and ships with outputs of up to approx. 200kW/cylinder,
- High injection pressures of up to approx. 1400 bar.
- Variable start of injection,
- Possibility of pilot injection, main injection, and post injection,
- Matching of injection pressure to the operating mode.

FUNCTIONS

Pressure generation and fuel injection are completely decoupled from each other in the "Common Rail" accumulator injection system. The injection pressure is generated independent of engine speed and injected fuel quantity. The fuel is stored under pressure in the high-pressure accumulator (the "Rail") ready for injection. The injected fuel quantity is defined by the driver, and the start of injection and injection pressure are calculated by the ECU on the basis of the stored maps. The ECU then triggers the solenoid valves so that the injector (injection unit) at each engine cylinder injects accordingly. The ECU and sensor stages of such a CR fuel-injection system comprise :

- ECU,
- Crankshaft-speed sensor,
- Camshaft-speed sensor,
- Accelerator-pedal sensor,
- Rail-pressure sensor,
- Coolant sensor and
- Air-mass meter.

Using the input signals from the above sensors, the ECU registers the driver's requirements (accelerator-pedal setting) and defines the instantaneous operating performance of the engine and the vehicle as a whole. It processes the signals which have been generated by the sensors and which it receives via data lines. On the basis of this information, it can then intervene with open and closed-loop controlling action at the vehicle and particularly at the engine. The engine speed is measured by the crankshaft-speed sensor, and the camshaft-speed sensor determines the firing sequence (phase length). The electrical signal generated across a potentiometer in the accelerator-pedal module informs the ECU about how far the driver has depressed the pedal, in other words about his (her) torque requirement.

The air-mass meter provides the ECU with data on the instantaneous air flow in order that combustion can be adapted so as to comply with the emissions regulations. Insofar as the engine is equipped with an exhaust-gas turbocharger and boost-pressure control, the boost-pressure sensor also measures boost-pressure. At low outside temperatures and with the engine cold, the ECU applies the data from the coolant-temperature and air-temperature sensors to adapt the setpoint values for start of injection, post injection, and further parameters to the particular operating conditions. Depending upon the vehicle in question, in order to comply with the increasing demands for safety and comfort, further sensors and data lines provide inputs to the ECU.
Fig. 1 shows an example of a 4-cylinder diesel engine fitted with a fuel-injection installation using the "Common Rail" accumulator injection system. Various components are shown.

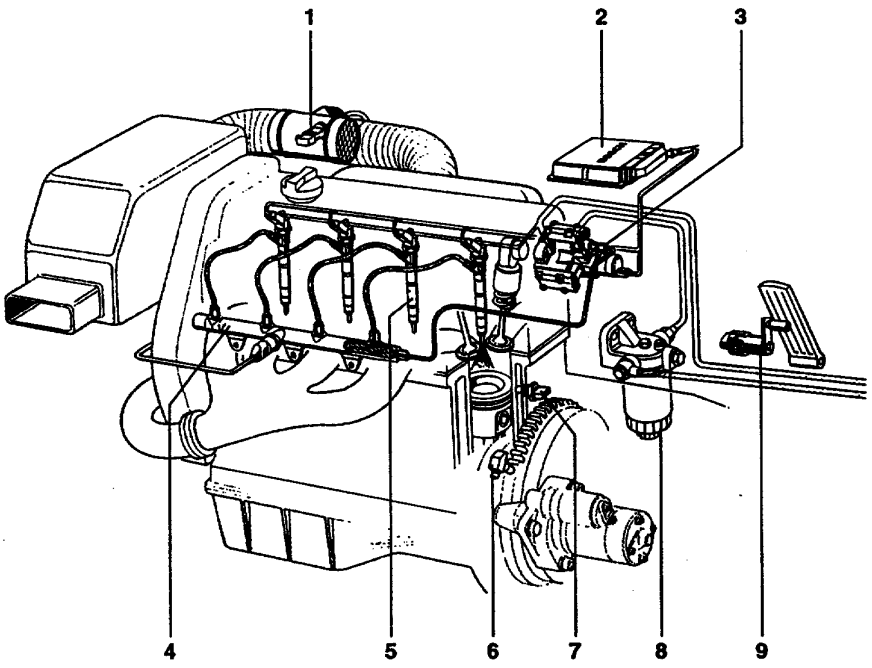
BASIC FUNCTIONS

The basic functions control the injection of the diesel fuel at the right moment, in the right quantities, and with the correct injection pressure. They ensure that the diesel engine not only runs smoothly, but also economically.

AUXILIARY FUNCTIONS

Auxiliary closed and open-loop control functions serve to improve both the exhaust-gas emission and fuel-consumption figures, or are used for increasing safety, comfort, and convenience. Examples here are Exhaust-Gas Recirculation (EGR), boost-pressure control, vehicle-speed control, and electronic immobilizer etc. The CAN bus system permits the exchange of data with other electronic systems in the vehicle. During vehicle inspection in the workshop, a diagnosis interface permits evaluation of the stored system data.

[Fig. 1]



Common Rail accumulator injection system on a -4cylinder diesel engine

1. Air-mass meter
2. ECU
3. High-pressure pump
4. High-pressure accumulator (rail)
5. Injectors
6. Crankshaft-speed sensor
7. Coolant-temperature sensor
8. Fuel filter
9. Accelerator-pedal sensor

NOTE
This drawing is not exactly same with real lay-out.

EFHB071A

INJECTION CHARACTERISTICS

CONVENTIONAL INJECTION CHARACTERISTICS

With conventional injection systems, using distributor and in-line injection pumps, fuel injection today comprises only the main injection phase - without pilot and post-injection phases (Fig. 1). On the solenoid-valve-controlled distributor pump though, developments are progressing towards the introduction of a pilot-injection phase. In conventional systems, pressure generation and the provision of the injected fuel quantity are coupled to each other by a cam and a pump plunger. This has the following effects upon the injection characteristics :

- The injection pressure increases together with increasing speed and injected fuel quantity.
- During the actual injection process, the injection pressure increases and then drops again to the nozzle closing pressure a the end of injection.

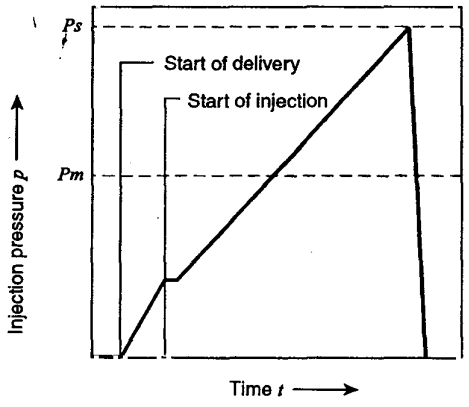
The consequences are as follows :
- Smaller injected fuel quantities are injected with lower pressures than larger injected fuel quantities (refer to Fig. 1)
- The peak pressure is more than double that of the mean injection pressure, and
- In line with the requirements for efficient combustion, the rate-of discharge curve is practically triangular.

The peak pressure is decisive for the mechanical loading of a fuel-injection pump's components and drive. On conventional fuel-injection systems it is decisive for the quality of the A/F mixture formation in the combustion chamber.

[Fig. 1]

Rate-of-discharge curve for conventional fuel injection

Pm Mean injection pressure, *Ps* Peak pressure.



EFHB081A

INJECTION CHARACTERISTICS WITH COMMON RAIL

Compared to conventional injection characteristics, the following demands are made upon an ideal injection characteristic:

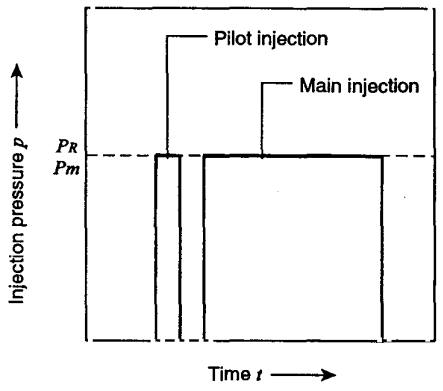
- Independently of each other, injected fuel quantity and injection pressure should be definable for each and every engine operating condition (provides more freedom for achieving ideal A/F mixture formation)
- At the beginning of the injection process, the injected fuel quantity should be as low as possible (that is, during the ignition lag between the start of injection and the start of combustion).

These requirements are complied with in the Common rail accumulator injection system with its pilot and main-injection features (Figs. 2 and 4).
The Common Rail system is a modular system, and essentially the following components are responsible for the injection characteristic :
- Solenoid-valve-controlled injectors which are screwed into the cylinder head,
- Pressure accumulator (rail), and
- High-pressure pump

[Fig. 2]

Rate-of-discharge curve for Common Rail fuel injection

Pm Mean injection pressure, *PR* Rail pressure.



EFHB082A

The following components also also required in order to operate the system:
- Electronic control unit (ECU),
- Crankshaft-speed sensor, and
- Camshaft-speed sensor (phases sensor).

For passenger-car systems, a radial-piston pump is used as the high-pressure pump for pressure generation. Pressure is generated independently of the injection process. The speed of the high-pressure pump is coupled directly to the engine speed with a non-variable transmission ratio. In comparison with conventional injection systems, the fact that delivery is practically uniform, means that not only is the Common Rail high-pressure pump much smaller, but also that its drive is not subject to such high pressure-loading peaks.
The injectors are connected to the rail by short lines and, essentially, comprise a nozzle, and a solenoid valve which is energized by the ECU to switch it on (start of injection). When the solenoid valve is switched off (de-energized) injection ceases. Presuming constant pressure, the injected fuel quantity is directly proportional to the length of time the solenoid valve is energized. It is completely independent of the engine or pump speed (time-controlled fuel injection).
The required high-speed solenoid switching is achieved by using high voltages and currents. This means that the solenoid-valve triggering stage in the ECU must be designed accordingly.The start of injection is controlled by the angle-time control system of the EDC (Electronic Diesel Control). This uses a sensor on the crankshaft to register engine speed, and a sensor on the camshaft for phase detection (working cycle).

PILOT INJECTION

Pilot injection can be advanced by up to 90° crankshaft (90°ks) referred to TDC. If the start of injection occurs less than 40°ks BTDC, fuel can be deposited on the surface of the piston and the cylinder walls, and can lead to unwanted dilution of the lube-oil. With pilot injection, a small amount of diesel fuel (1...4 mm^3) is injected into the cylinder to "precondition" the combustion chamber. Combustion efficiency can be improved as a result, and the following effects are achieved :

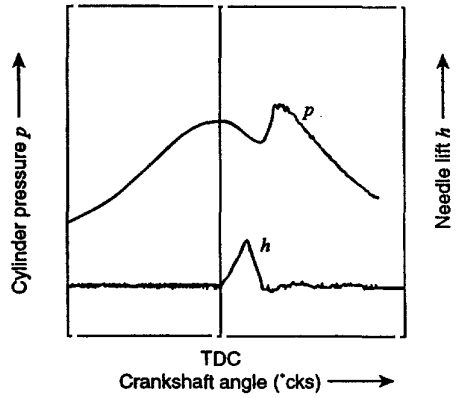
- The compression pressure is increased slightly due to pilot reaction and partial combustion, this in turn leads to
- The main-injection ignition delay being reduced, and
- A reduction of combustion-pressure rise and of the combustion-pressure peaks (softer combustion).

These effects reduce the combustion noise, the fuel consumption, and in many cases the exhaust-gas emissions as well. In the case of a rate-of-discharge curve without pilot injection (Fig. 3), in line with the compression only a slight, flat pressure rise is evident just before TDC, after which it peaks relatively sharply at the point of maximum pressure. The steep pressure increase together with the sharp peak contribute considerably to the diesel engine's combustion noise. As shown by the rate-of-discharge curve with pilot injection, (Fig. 4), pressure in the vicinity of TDC reaches a somewhat higher value, and the combustion-pressure increase is less rapid.
Since it reduces the ignition delay, pilot injection makes an indirect contribution to the generation of engine torque. The specific fuel consumption can increase or decrease as a function of the start of main injection and the time between the pilot and main injection sequences.

[Fig. 3]

Needle lift in the injector nozzle, and rate-of-discharge curve without pilot injection

hHE Needle lift for main injection.



EFHB091A

MAIN INJECTION

The energy for the engine's output work comes from the main injection sequence. This means that essentially the main injection is responsible for the development of the engine's torque. With the Common Rail accumulator fuel-injection system, the injection pressure remains practically constant throughout the whole of the injection process.

SECONDARY INJECTION

With certain versions of NOx catalytic converter, secondary injection can be applied for NOx combustion (reduction). It follows the main injection process and is timed to take place during the expansion or exhaust cycle up to 200cks after TDC. Secondary injection introduces a precisely metered quantity of fuel to the exhaust gas.

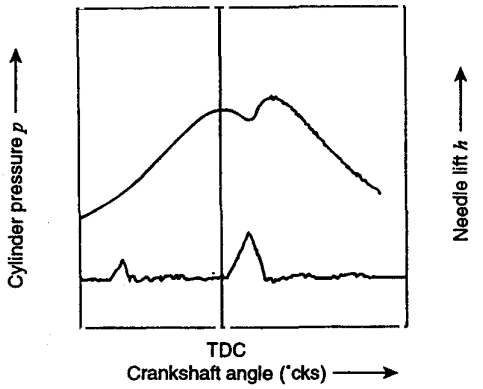
In contrast to the pilot and main injection processes, the injected fuel does not combust but instead vaporises due to the residual heat in the exhaust gas. During the exhaust cycle, the resulting mixture of exhaust gas and fuel

is forced out through the exhaust valves and into the exhaust-gas system. Part of the fuel though is returned for combustion via the EGR system and has the same effects as very advanced pilot injection. Provided suitable NOx catalytic converters are fitted, these utilise the fuel in the exhaust gas as a reduction agent to lower the NOx content in the exhaust gas.

[Fig. 4]

Needle lift in the injector nozzle, and rate-of-discharge curve with pilot injection

h_{VE} Needle lift for pilot injection.
h_{HE} Needle lift for main injection.



EFHB101A

Since very late secondary injection leads to dilution of the engine lube oil, it must be approved by the engine manufacture.

EXHAUST-GAS REDUCTION

MIXTURE FORMATION AND COMBUSTION BEHAVIOR

Compared to SI engines, diesel engines burn low-volatility (high-boiling) fuel, and not only prepare the air/fuel mixture in the period between injection and start of combustion, but also during the actual combustion process. The result is a less homogenous mixture. The diesel engine always operates with excess air ($\lambda > 1$). Fuel consumption, and the emissions of soot, CO, and HC increase if there is insufficient excess air. The A/F mixture formation is defined by the following parameters :

- Injection pressure,
- Rate of discharge (injection time),
- Spray distribution (number of spray jets, spray cross-section, spray direction),
- Start of injection,
- Air movement, and
- Air mass.

These quantities all have an effect upon the engine's emissions and fuel consumption. High combustion temperatures and high levels of oxygen concentration lead to increased NOx generation. Soot emissions rise due to lack of air and poor A/F mixture formation.

MEASURES AT THE ENGINE

The configuration of the combustion chamber and air-intake tract can have a positive effect upon the exhaust-gas emissions. If the air movement in the combustion chamber is carefully matched to the fuel jets leaving the nozzle, this promotes efficient mixing of air and fuel and thus complete combustion of the injected fuel. In addition, positive effects are achieved with a homogenous mixture of air and exhaust gas and a cooled EGR tract. Four-valve techniques and turbochargers with variable-turbine geometry (VTG) also contribute to lower emissions and higher power density.

EXHAUST-GAS RECIRCULATION (EGR)

Without EGR, NOx emissions are excessive from the emission-control legislation standpoint, whereas soot emissions are within limits. Exhaust-gas recirculation (EGR) is a method for reducing the emissions of NOx without drastically increasing the engine's soot output. This can be implemented very efficiently with the CR system thanks to the excellent A/F mixture formation resulting from the high injection pressures. With EGR, a portion of the exhaust gases are diverted into the intake tract during part-load operation. This not only reduces the oxygen content, but also the rate of combustion and the peak temperature at the flame front, with the result that NOx emissions drop. If too much exhaust gas is recirculated though (exceeding 40% of the intake air volume), the soot, CO, and HC emissions, as well as the fuel consumption rise due to the lack of oxygen.

INFLUENCE OF FUEL INJECTION

Start of injection, rate-of discharge curve, and atomization of the fuel also have an influence upon fuel consumption and upon exhaust-gas emissions.

START OF INJECTION

Due to lower process temperatures, retarded fuel-injection reduces the NOx emissions. But if it is too far retarded, HC emissions and fuel consumption increase, as do soot emissions under high loading conditions. If the start of injection deviates by only 1°ks (crankshaft) from the desired value, NOx emissions can increase by as much as 5%. Whereas a deviation of 2°ks in the advance (early) direction can lead to a 10 bar increase in the cylinder peak pressure, a deviation of 2°ks in the retarded (late) direction can increase the exhaust-gas temperature by 20°. Such high sensitivity demands utmost accuracy when adjusting the start of injection.

RATE-OF-DISCHARGE CURVE

The rate-of discharge curve defines the variations in fuel mass flow during a single injection cycle (from start of injection till end of injection). The rate-of-discharge curve determines the mass of fuel delivered during the combustion lag (between start of injection and start of combustion). Furthermore, since it also influences the distribution of the fuel in the combustion chamber it also has an effect upon the efficiency of the air utilization. The rate-of-discharge curve must climb slowly in order that fuel injection during the combustion lag is kept to a minimum. This fuel, namely, combusts suddenly as soon as combustion is initiated with the attendant negative effects upon engine noise and NOx emissions. The rate-of-discharge curve must drop-off sharply in order to prevent poorly atomized fuel leading to high HC and soot emissions, and increased fuel consumption during the final phase of combustion.

FUEL ATOMIZATION

Finely atomized fuel promotes the efficient mixing of air and fuel. It contributes to a reduction in HC and soot emissions. High injection pressure and optimal geometrical configuration of the nozzle injection orifices lead to good atomization. To prevent visible soot emission, the injected fuel quantity must be limited in accordance with the intake air quantity. This necessitates excess air in the order of at least 10...40% (λ =1.1 ...1.4). Once the nozzle needle has closed, the fuel in the injection orifices can vaporize (in the case of sac-hole (blind-hole) nozzles the fuel vaporizes in the sac-hole volume) and in the process increase the HC emissions. This means that such (harmful) volumes must be kept to a minimum.

FUEL SYSTEM

The fuel system in a "Common Rail" fuel-injection system (Fig. 1) comprises a low-pressure stage for the low-pressure delivery of fuel, a high-pressure stage for the high-pressure delivery, and the ECU (11).

LOW-PRESSURE DELIVERY

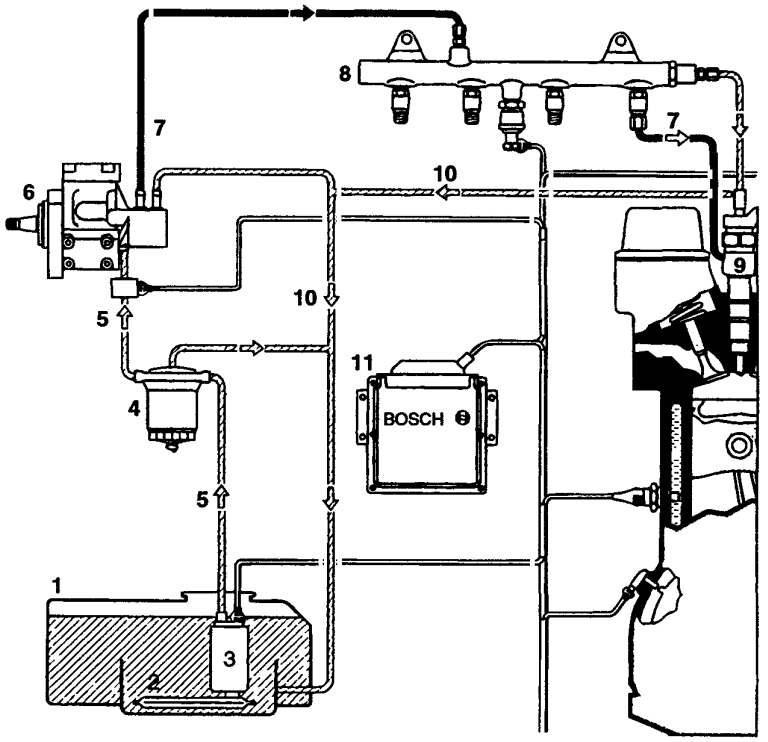
The low-pressure stage of the Common Rail fuel system incorporates :

- Fuel tank with pre-filter,
- Presupply pump,
- Fuel filter, and
- Low-pressure fuel lines.

FUEL LINES FOR THE LOW-PRESSURE STAGE

As an alternative to steel pipes, flame-inhibiting steel-braid-armoured flexible fuel lines can be used for the low-pressure stage. They must be routed so that they cannot be damaged mechanically, and fuel which has dripped or evaporated must not be able to accumulate, nor must it be able to ignite. When the vehicle twists, or the engine moves etc., this must have no derogatory effects upon fuel-line function. All parts which carry fuel must be protected against the effects of heat. In the case of buses, fuel lines must not be located in the passenger compartment or in the driver's cab, nor may fuel be delivered by force of gravity.

[Fig. 1]



Fuel system for a Common Rail fuel-injection system

1. Fuel tank
2. Pre-filter
3. Presupply pump
4. Fuel filter
5. Low-pressure fuel lines
6. High-pressure pump
7. High-pressure fuel lines
8. Rail
9. Injector
10. Fuel-return line
11. ECU

EFHB121A

Low-pressure system components

PRESUPPLY PUMP

The presupply pump is either an electric fuel pump with pre-filter, or a gear-type fuel pump. The pump draws the fuel from the fuel tank and continually delivers the required quantity of fuel in the direction of the high-pressure pump.

FUEL FILTER

Inadequate filtering can lead to damage at the pump components, delivery valves, and injector nozzles. The fuel filter cleans the fuel before it reaches the high-pressure pump, and thereby prevents premature wear at the pump's sensitive components.

HIGH-PRESSURE DELIVERY

The high-pressure stage of the fuel system in a Common Rail installation comprises :

- High-pressure pump with pressure-control valve,
- High-pressure fuel lines,
- The rail as the high-pressure accumulator with rail-pressure sensor, pressure-limiting valve, and flow limiter, injectors, and
- Fuel-return lines.

High-pressure-system components

HIGH-PRESSURE PUMP

The high-pressure pump pressurises the fuel to a system pressure of up to 1,350bar. This pressurized fuel then passes through a high-pressure line and into the tubular high-pressure fuel accumulator (rail).

HIGH-PRESSURE ACCUMULATOR (RAIL)

Even after an injector has taken fuel from the rail in order to inject it, the fuel pressure inside the rail remains practically constant. This is due to the accumulator effect arising from the fuel's inherent elasticity. Fuel pressure is measured by the rail-pressure sensor and maintained at the desired level by the pressure-control valve.

INJECTORS

The nozzles of these injectors open when the solenoid valve is triggered and permit the flow of fuel. They inject the fuel directly into the engine's combustion chamber. The excess fuel which was needed for opening the injector nozzles flows back to the tank through a collector line. The return fuel from the pressure-control valve and from the low-pressure stage is also led into this collector line together with the fuel used to lubricate the high-pressure pump.

FUEL LINES IN THE HIGH-PRESSURE SECTION

These fuel lines carry the high-pressure fuel. They must therefore be able to permanently withstand the maximum system pressure and, during the pauses in injection, the sometimes high-frequency pressure fluctuations which occur. They are therefore manufactured from steel tubing. Normally, they have an outside diameter of 6 mm and an internal diameter of 2.4 mm. The injection lines between the rail and the injectors must all be of the same length. The differences in length between the rail and the individual injectors are compensated for by using slight or pronounced bends in the individual lengths of tubing. Nevertheless, the injection lines should be kept as short as possible.

DESIGN AND FUCTION OF THE COMPONENTS

LOW-PRESSURE STAGE

The low-pressure stage (Fig. 1) provides enough fuel for the high-pressure section. The most important components are :

- Fuel tank,
- Pre-supply pump with prefilter,
- Low-pressure fuel lines for supply and return,
- Fuel filter and
- Low-pressure area of the high-pressure pump.

PRE-SUPPLY PUMP

It is the pre-supply pump's job to maintain an adequate supply of fuel to the high-pressure pump. This applies

- In every operating state,
- At the necessary pressure, and
- Throughout the complete service life.

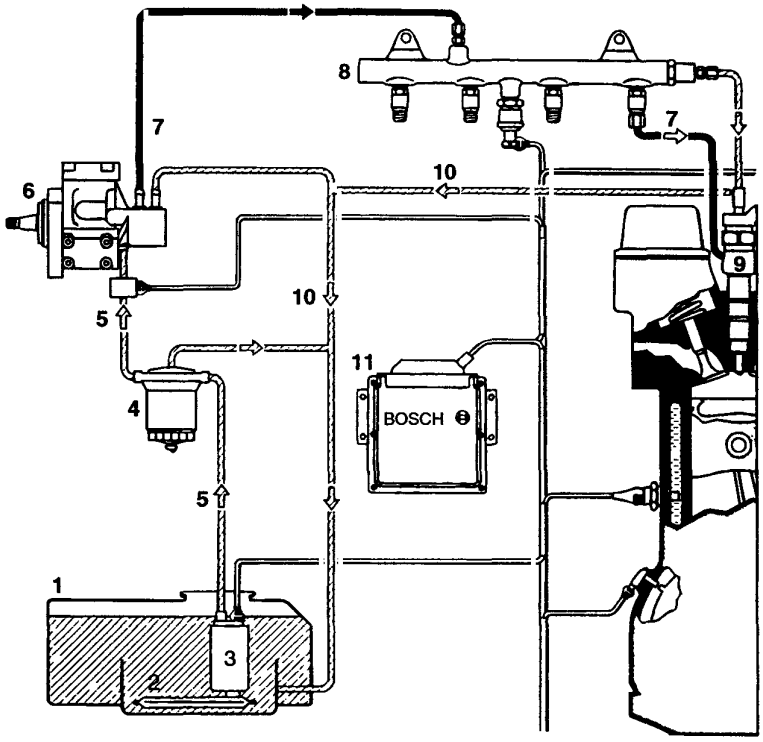
At present, there are two possible versions. An electric roller-cell fuel pump is the standard solution. An alternative is the mechanically driven gear-type fuel pump.

ELECTRIC FUEL PUMP

The electric fuel pump is only used in passenger cars and light commercial vehicles. It is not only responsible for delivering the fuel to the high-pressure pump, but within the framework of system monitoring it must also interrupt the flow of fuel in case of an emergency. Beginning with the engine cranking process, the electric fuel pump runs continuously independent of engine speed. This means that the pump permanently delivers fuel from the fuel tank, and through the filter to the high-pressure pump. Excess fuel can flow back to the tank through an overflow valve.

A safety circuit is provided to prevent the delivery of fuel should the ignition be on with the engine stopped. Electric fuel pumps are available as in-line or in-tank versions. In-line fuel pumps are installed outside the tank in the fuel line between the tank and the fuel filter. They are attached to the vehicle's floor assembly. In-tank fuel-pump versions on the other hand are installed in the fuel tank itself using a special mounting. Apart from the electrical and hydraulic connections to the outside, this mounting usually incorporates a fuel strainer, a fuel-level indicator, and a swirl pot which acts as a fuel reservoir.

[Fig. 1]



Fuel system for a Common Rail fuel-injection system

1. Fuel tank
2. Pre-filter
3. Presupply pump
4. Fuel filter
5. Low-pressure fuel lines
6. High-pressure pump
7. High-pressure fuel lines
8. Rail
9. Injector
10. Fuel-return line
11. ECU

EFHB121A

An electric fuel pump comprises the three function elements :
- Pumping element,
- Electric motor, and
- End cover.

FUEL FILTER

Contaminants in the fuel can lead to damage at the pump components, delivery valves, and injection nozzles. This, therefore, necessitates the use of a fuel filter which is specifically aligned to the requirements of the particular injection system, otherwise faultless operation and a long service life cannot be guaranteed. Diesel fuel can contain water either in bound form (emulsion) or in free form (e.g. condensation of water due to temperature change). If this water enters the injection system, it can lead to damage as a result of corrosion. Similar to other injection systems, the Common Rail also needs a fuel filter with water reservoir, from which the water must be drained at regular intervals. The increasing number of diesel engines used in passenger cars, has led to the demand for an automatic water warning device which indicates by means of a warning lamp when water must be drained (this is binding in those countries in which there is a high level of water in the fuel).

HIGH-PRESSURE STAGE

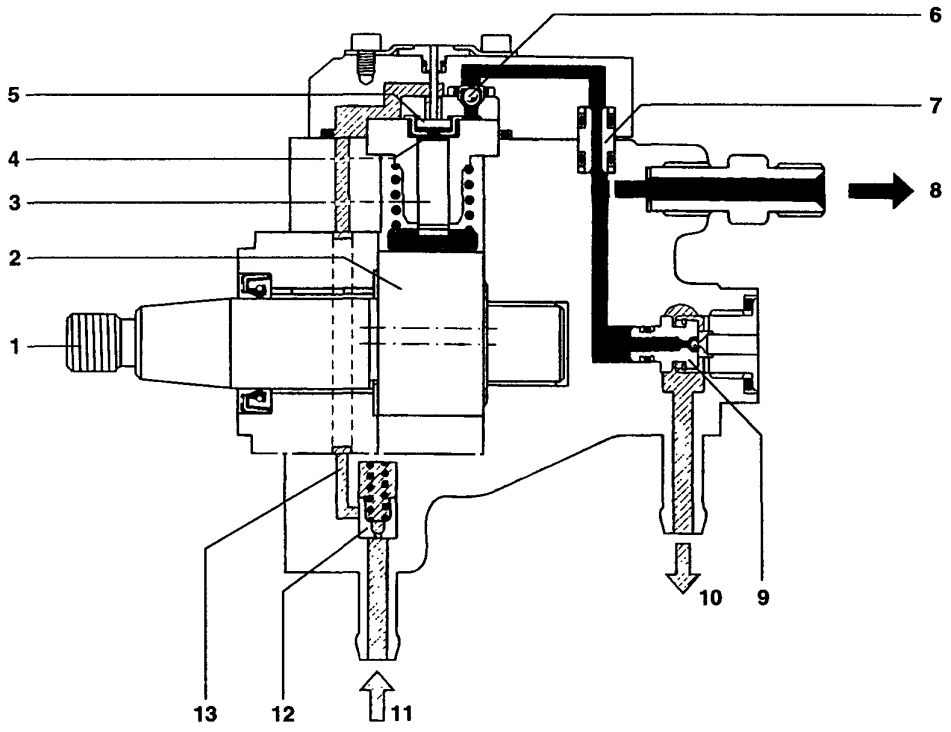
In addition to high-pressure generation, fuel distribution and fuel-metering also take place in the high-pressure stage (Fig. 1). The most important components are :
- High-pressure pump with element shutoff valve and pressure-control valve,
- High-pressure accumulator,
- Rail-pressure sensor,
- Pressure-limiter valve,
- Flow limiter and
- Injectors.

HIGH-PRESSURE PUMP

Assignments

The high-pressure pump (Figs. 7 and 8) is the interface between the low-pressure and the high-pressure stages. Under all operating conditions, it is responsible for providing adequate high-pressure fuel throughout the vehicle's complete service life. This also includes the provision of extra fuel as needed for rapid starting and for rapid build-up of pressure in the rail. The high-pressure pump continually generates the system pressure as needed in the high-pressure accumulator (rail). This means therefore, that in contrast to conventional systems, the fuel does not have to be specially compressed for each individual injection process.

[Fig. 7]



High-pressure pump (schematic, longitudinal section)

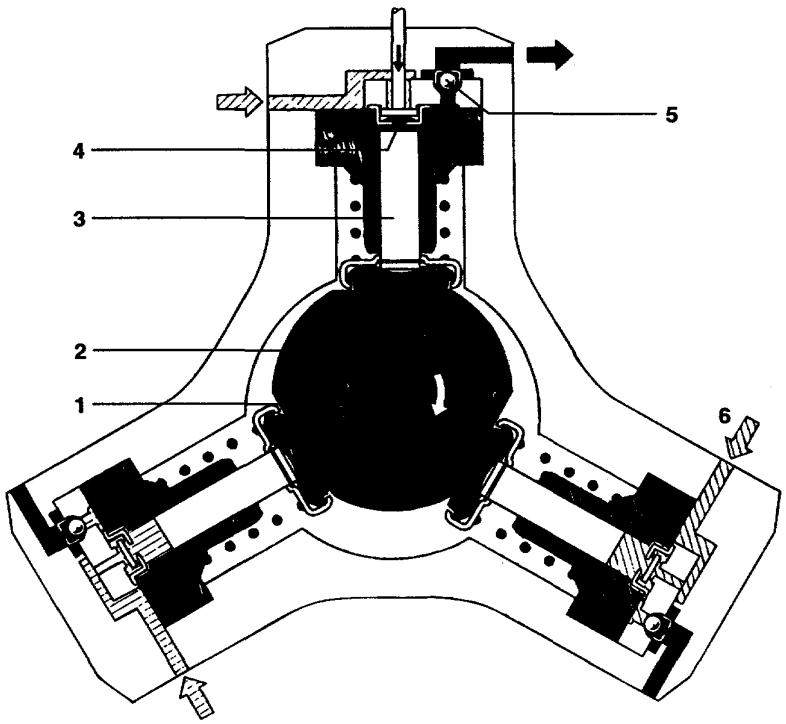
1. Driveshaft
2. Eccentric cam
3. Pumping element with pump plunger
4. Pumping-element chamber
5. Suction valve
6. Outlet valve
7. Seal
8. High-pressure connection to the rail
9. Ball valve
10. Fuel return
11. Fuel inlet from the presupply pump
12. Safety valve with throttle bore
13. Low-pressure passage to the pumping element

EFHB172A

DESIGN AND CONSTRUCTION

The high-pressure pump is installed preferably at the same point on the diesel engine as a conventional distributor pump. It is driven by the engine (at half engine speed, but max. 3000 min-1) through a coupling, gearwheel, chain, or toothed belt, and lubricated by the diesel fuel which it pumps. Depending on available space, a pressure-control valve is installed directly on the high-pressure pump or remote from it. Inside the high-pressure pump, the fuel is compressed with three radially arranged pump pistons which are at an angle of 120?to each other. Since three delivery stokes take place for every revolution, only low peak drive torques are generated so that the stress on the pump drive remains uniform. With 16Nm, the torque is only about 1/9 of that required to drive a comparable distributor pump. This means that Common Rail places less loading on the pump drive than is the case with conventional injection system. The power required to drive the pump climbs in proportion to the pressure set in the rail and to the pump's speed (delivery quantity). For a 2-liter engine turning at rated speed, and with a set pressure of 1,350 bar in the rail, the high-pressure pump requires 3.8kW presuming a mechanical efficiency of approx. 90%. The higher power demand (higher than theoretically necessary) results from the leak-fuel and control quantities at the injector, and from the fuel return through the pressure-control valve.

[Fig. 8]



High-pressure pump (schematic, cross-section)

1. Driveshaft
2. Eccentric cam
3. Pumping element with pump piston
4. Inlet valve
5. Outlet valve
6. Inlet

EFHB181A

METHOD OF OPERATION

Via a filter with water separator, the presupply pump pumps fuel from the tank to the high-pressure pump through the fuel inlet (Fig. 7) and the safety valve. It forces the fuel through the safety valve's throttle bore and into the high-pressure pump's lubrication and cooling circuit. The driveshaft with its eccentric cams moves the three pump plungers up and down in accordance with the shape of the cam. As soon as the delivery pressure exceeds the safety valve's opening pressure (0.5 ... 1.5bar), the pre-supply pump can force fuel through the high-pressure pump's inlet valve into the pumping-element chamber whose pump piston is moving downwards (suction stroke). The inlet valve closes when the pump piston passes through BDC and, since it is impossible for the fuel in the pumping-element chamber to escape, it can now be compressed beyond the delivery pressure. The increasing pressure opens the outlet valve as soon as the rail pressure is reached, and the compressed fuel enters the high-pressure circuit. The pump piston continues to deliver fuel until it reaches TDC (delivery stroke), after which the pressure collapses so that the outlet valve closes. The fuel remaining in the pumping-element chamber relaxes and the pump piston moves downwards again. As soon as the pressure in the pumping-element chamber drops below the presupply-pump pressure, the inlet valve opens and the pumping process starts again.

FUEL-DELIVERY RATE

Since the high-pressure pump is designed for large delivery quantities, excess high-pressure fuel is delivered during idle and part-load operation. This excess fuel is returned to the tank via the pressure-control valve. The compressed fuel relaxes in the tank, and the energy is lost which was used for compressing the fuel in the first place. In addition to the unnecessary heating up of the fuel, overall efficiency is also reduced. To a certain extent, this loss of efficiency can be compensated for by switching off one of the pumping elements.

TRANSMISSION RATIO

The high-pressure pump's delivery rate is proportional to its rotational speed. And this, in turn, is a function of the engine speed. During the injection-system application-engineering work on the engine, the transmission ratio is defined so that on the one hand the amount of excess fuel is not too high, and on the other, the fuel requirements can still be satisfied during WOT operation. Referred to the crankshaft, transmission ratios of 1:2 and 2:3 are possible.

HIGH-PRESSURE ACCUMULATOR (RAIL)

ASSIGNMENTS

The high-pressure accumulator (the Rail in Fig. 10) stores the fuel at high pressure. At the same time, the pressure oscillations which are generated due to the high-pressure pump delivery and the injection of fuel are damped by the rail volume. This high-pressure accumulator is common to all cylinders, hence its name "common rail". Even when large quantities of fuel are extracted, the common rail maintains its inner pressure practically constant. This ensures that the injection pressure remains constant from the moment the injector opens.

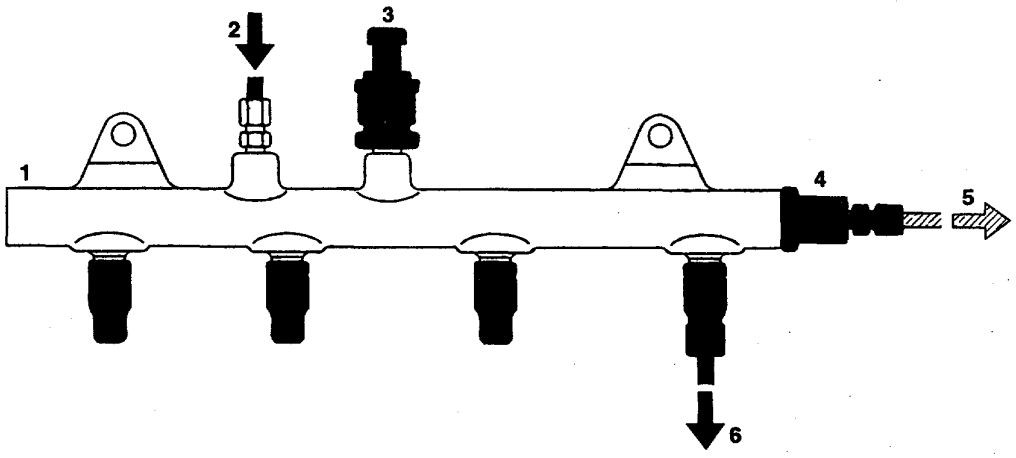
DESIGN AND CONSTRUCTION

In order to comply with the wide variety of engine installation conditions, the rail with its flow limiters and the provisions for attaching rail-pressure sensor, pressure-control valve, and pressure-limiter valve is available in a number of different designs.

FUNCTION

The available rail volume is permanently filled with pressurized fuel. The compressibility of the fuel resulting from the high pressure is utilised to achieve the accumulator effect. When fuel leaves the rail for injection, the pressure in the high-pressure accumulator remains practically constant. Similarly, the pressure variations resulting from the pulsating fuel supply from the high-pressure pump are compensated for.

[Fig. 10]



High-pressure accumulator (rail

1. Rail
2. Inlet from the high-pressure pump
3. Rail-pressure sensor
4. Return from the rail to the fuel tank
5. Line to the injector

EFHB211A

RAIL-PRESSURE SENSOR

ASSIGNMENT

In order to output a voltage signal to the ECU which corresponds to the applied pressure, the rail-pressure sensor must measure the instantaneous pressure in the rail :

- With adequate accuracy, and
- As quickly as possible

DESIGN AND CONSTRUCTION

The rail-pressure sensor (Fig. 12) comprises the following components :

- An integrated sensor element welded to the pressure fitting,
- A printed-circuit board (pcb) with electrical evaluation circuit, and
- A sensor housing with electrical plug-in connection.

The fuel flows to the rail-pressure sensor through an opening in the rail, the end of which is sealed off by the sensor diaphragm. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element (semiconductor device) for converting the pressure to an electric signal is mounted on this diaphragm. The signal generated by the sensor is inputted to an evaluation circuit which amplifies the measuring signal and sends it to the ECU.

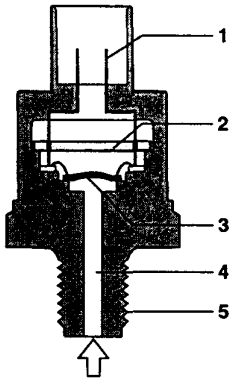
FUNCTION

The rail-pressure sensor (Fig. 12) operates as follows : When the diaphragm's shape changes, the electrical resistance of the layers attached to the diaphragm also change. The change in shape (approx. 1 mm at 1500bar) which results from the buildup of system pressure, changes the electrical resistance and causes a voltage change across the 5V resistance bridge. This voltage change is in the range 0 ... 70mV (depending upon the applied pressure) and is amplified by the evaluation circuit to 0.5 ... 4.5V. The precise measurement of rail pressure is imperative for correct system functioning. This is one of the reasons for the very tight tolerances which apply to the rail-pressure sensor during pressure measurement. In the main operating range, the measuring accuracy is approx. ± 2% of full-scale reading. If the rail-pressure sensor should fail, the pressure-control valve is triggered "blind" using an emergency (limp-home) function and fixed values.

[Fig. 12]

Rail-pressure sensor (schematic)

1. Electric connections
2. Evaluation circuit
3. Diaphragm with sensor element
4. High-pressure connection
5. Mounting thread



EFHB231A

Pressure limiter valve

ASSIGNMENT

The pressure limiter valve has the same job as an overpressure valve. In case of excessive pressure, the pressure limiter valve limits the rail pressure by opening an escape passage. The pressure limiter permits a short-time maximum rail pressure of 1500 bar.

DESIGN AND CONSTRUCTION

The pressure-limiter valve is a mechanical device comprising the following components :

- Housing with external thread for screwing to the rail,
- A connection to the fuel-tank return line,
- A movable plunger, and
- A spring.

At the connection end to the rail, the housing is provided with a passage which is closed by the cone-shaped end of the plunger coming up against the sealing seat inside the housing. At normal operating pressures (up to 1350bar), a spring forces the plunger against the seat and the rail remains closed. As soon as the maximum system pressure is exceeded, the plunger is forced up by the rail pressure against the force of the spring. The fuel under high pressure can now escape, whereby it flows through passages into the plunger's interior from where it is led through a collector line back to the fuel tank. When the valve opens. fuel leaves the rail so that the rail pressure drops.

Injectors

ASSIGNMENT

The start of injection and the injected fuel quantity are adjusted by electrically triggered injectors. These injectors supersede the nozzle-and-holder assembly (nozzle and nozzle-holder). Similar to the already existing nozzle-holder assemblies in direct-injection (DI) diesel engines, clamps are preferably used for installing the injectors in the cylinder head. This means that the Common Rail injectors can be installed in already existing DI diesel engines without major modifications to the cylinder head.

DESIGN AND CONSTRUCTION

The injector (Fig. 16) can be sub-divided into a number of function blocks :

- The hole-type nozzle,
- The hydraulic servo-system, and
- The solenoid valve.

Referring to Fig. 16, fuel is fed from the high-pressure connection, to the nozzle through the passage, and to the control chamber through the feed orifice. The control chamber is connected to the fuel return via a bleed orifice which is opened by the solenoid valve.
With the bleed orifice closed, the hydraulic force applied to the valve control plunger exceeds that at the nozzle-needle pressure shoulder. As a result, the needle is forced into its seat and seals off the high-pressure passage from the combustion chamber.

When the injector's solenoid valve is triggered, the bleed orifice is opened. This leads to a drop in control-chamber pressure and, as a result, the hydraulic pressure on the plunger also drops. As soon as the hydraulic force drops below the force on the nozzle-needle pressure shoulder, the nozzle needle opens and fuel is injected through the spray holes into the combustion chamber. This indirect control of the nozzle needle using a hydraulic force-amplification system is applied because the forces which are necessary for opening the needle very quickly cannot be directly generated by the solenoid valve. The so-called control quantity needed for opening the nozzle needle is in addition to the fuel quantity which is actually injected, and it is led back to the fuel-return line via the control chamber's orifices.
In addition to the control quantity, fuel is also lost at the nozzle-needle and valve-plunger guides. These control and leak-off fuel quantities are returned to the fuel tank via the fuel return and the collector line to which overflow valve, high-pressure pump, and pressure-control valve and also connected.

METHOD OF OPERATION

The injector's operation can be subdivided into four operating states with the engine running and the high-pressure pump generating pressure :
- Injector closed (with high pressure applied),
- Injector opens (start of injection),
- Injector opened fully, and
- Injector closes (end of injection).

These operating states result from the distribution of the forces applied to the injector's components. With the engine at standstill and no pressure in the rail, the nozzle spring closes the injector.

INJECTOR CLOSED (AT-REST STATUS)

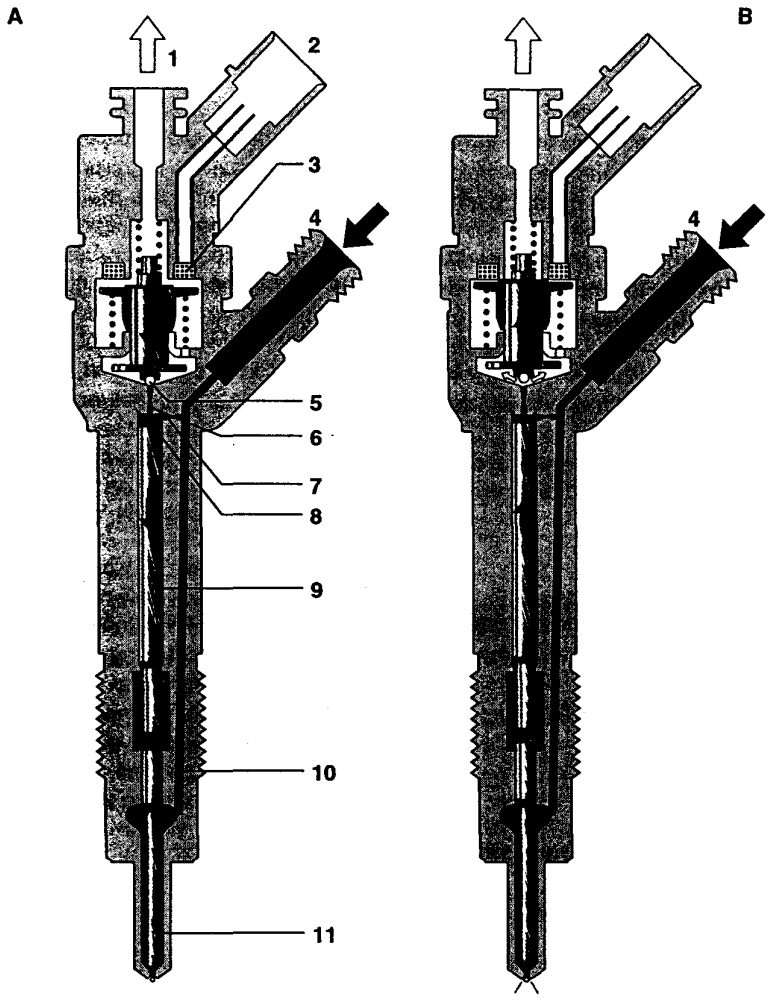
In the at-rest state, the solenoid valve is not energized and is therefore closed (Fig. 16a). With the bleed orifice closed, the valve spring forces the armature's ball onto the bleed-orifice seat. The rail's high pressure builds up in the valve control chamber, and the same pressure is also present in the nozzle's chamber volume. The rail pressure applied at the control plunger's end face, together with the force of the nozzle spring, maintain the nozzle in the closed position against the opening forces applied to its pressure stage.

INJECTOR OPENS (START OF INJECTION)

The injector is in its at-rest position. The solenoid valve is energized with the pickup current which serves to ensure that it opens quickly (Fig. 16b). The force exerted by the triggered solenoid now exceeds that of the valve spring and the armature opens the bleed orifice. Almost immediately, the high-level pick-up current is reduced to the lower holding current required for the electromagnet. This is possible due to the magnetic circuit's air gap now being smaller. When the bleed orifice opens, fuel can flow from the valve-control chamber into the cavity situated above it, and from there via the fuel return to the fuel tank, The bleed orifice prevents complete pressure balance, and the pressure in the valve control chamber sinks as a result. This leads to the pressure in the valve-control chamber being lower than that in the nozzle's chamber volume which is still at the same pressure level as the rail. The reduced pressure in the valve-control chamber causes a reduction in the force exerted on the control plunger, the nozzle needle opens as a result, and injection starts.

The nozzle needle's opening speed is determined by the difference in the flow rate through the bleed and feed orifices. The control plunger reaches its upper stop where it remains supported by a cushion of fuel which is generated by the flow of fuel between the bleed and feed orifices. The injector nozzle has now opened fully, and fuel is injected into the combustion chamber at a pressure almost equal to that in the fuel rail. Force distribution in the injector is similar to that during the opening phases.

[Fig. 16]



Injector (schematic)

A. Injector closed (at-rest status)
B. Injector opened (injection)
1. Fuel return
2. Electrical connection
3. Triggering element (solenoid valve)
4. Fuel inlet (high pressure) from the rail
5. Valve ball
6. Bleed orifice
7. Feed orifice
8. Valve control chamber
9. Valve control plunger
10. Feed passage to the nozzle
11. Nozzle needle

EFHB261A

INJECTOR CLOSES (END OF INJECTION)

As soon as the solenoid valve is no longer triggered, the valve spring forces the armature downwards and the ball closes the bleed orifice. The armature is a 2-piece design. Here, although the armature plate is guided by a driver shoulder in its downward movement, it can "overspring" with the return spring so that it exerts no downwards-acting forces on the armature and the ball. The closing of the bleed orifice leads to pressure buildup in the control chamber via the input from the feed orifice. This pressure is the same as that in the rail and exerts an increased force on the control plunger through its end face. This force, together with that of the spring, now exceeds the force exerted by the chamber volume and the nozzle needle closes. The nozzle needle's closing speed is determined by the flow through the feed orifice. Injection ceases as soon as the nozzle needle comes up against its bottom stop again.

SYSTEM CONTROL USING EDC

SYSTEM BLOCKS

The Electronic Diesel Control (EDC) for Common Rail comprises three major system blocks :

1. Sensors and setpoint generators for registration of the operating conditions and the desired values. These convert a variety of physical parameters into electrical signals.
2. The ECU for generating the electrical output signals by processing the information using specified arithmetic operations (control algorithms)
3. Actuators to convert the ECU's electrical output signals into mechanical parameters.

SENSOR (FIG.12)

CRANKSHAFT-SPEED SENSOR

The piston position in the combustion chamber is decisive in defining the start of injection. All the engine's pistons are connected to the crankshaft by connecting rods (conrods). A sensor on the crankshaft can therefore provide information on the position of all the pistons. The rotational speed defines the number of crankshaft rotations per minute. This important input variable is calculated in the ECU using the signal from the inductive crankshaft-speed sensor.

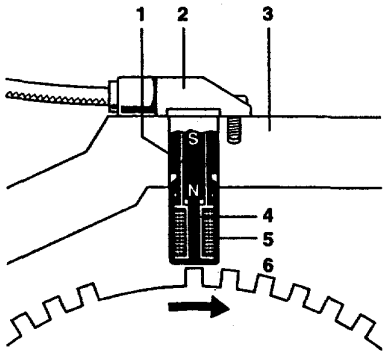
SIGNAL GENERATION

A 60-tooth ferromagnetic trigger wheel is attached to the crankshaft. On the actually used trigger wheel 2 teeth are missing. The large gap is allocated to a defined crankshaft position for cylinder 1. The crankshaft-speed sensor registers the trigger wheel's tooth sequence. It comprises a permanent magnet and a soft-iron core with a copper winding (Fig. 1). The magnetic flux in the sensor changes as the teeth and gaps pass by, and a sinusoidal AC voltage is generated the amplitude of which increases sharply in response to higher engine (crankshaft) speeds. Adequate amplitude is already available from speeds as low as 50 min-1.

[Fig. 1]

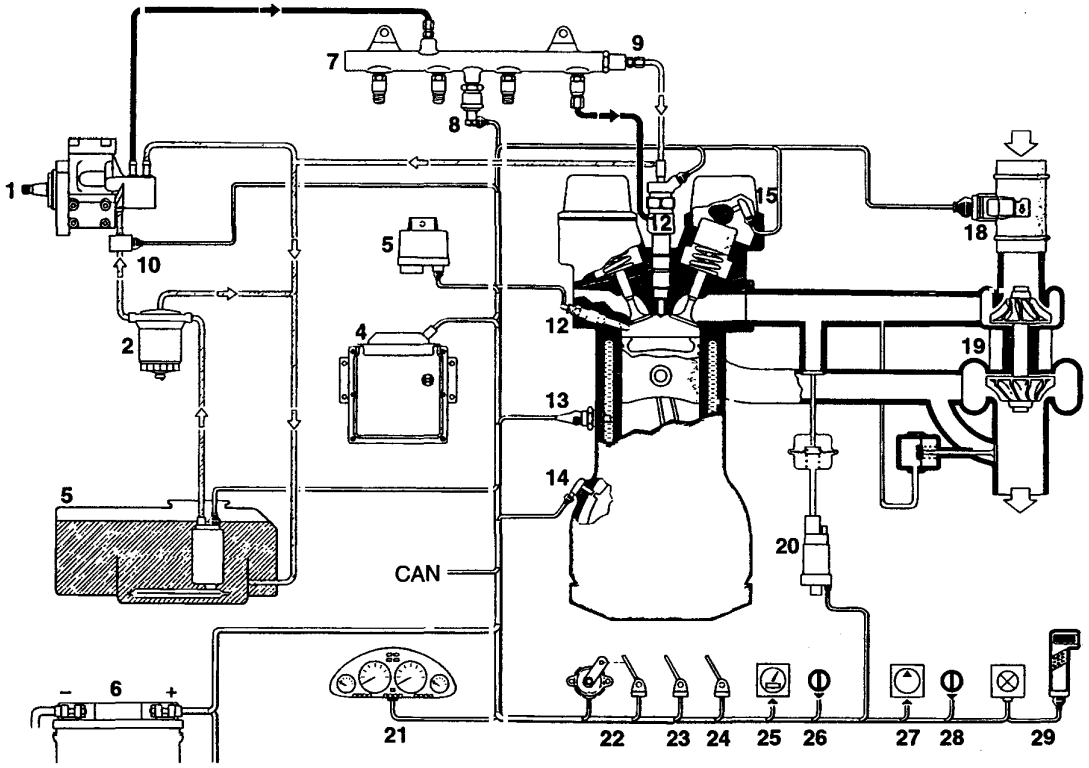
Crankshaft-speed sensor

1. Permanent magnet
2. Housing
3. Engine crankcase
4. Shoft-iron core
5. Winding
6. Trigger wheel



EFHB301A

[Fig. 12]



System overview of a Common Rail injection system and a variety of system components

1. High-pressure pump
2. Fuel filter
3. Fuel tank with preliminary filter and presupply pump
4. ECU
5. Glow control unit
6. Battery
7. High-pressure accumulator (rail)
8. Rail-pressure sensor
9. Pressure limiter valve
10. Fuel-temperature sensor
11. Injector
12. Sheathed-element glow plug
13. Coolant-temperature sensor
14. Crankshaft sensor
15. Camshaft sensor
16. Intake-air temperature sensor
17. Boost-pressure sensor (BPS)
18. Air-mass meter
19. Turbocharger
20. EGR positioner
21. Instrument panel with display for fuel consumption, engine speed etc.
22. Accelerator-pedal sensor
23. Brake contacts
24. Clutch switch
25. Road-speed sensor
26. Operator unit for vehicle-speed controller
27. Air-conditioner compressor
28. Air-conditioner operator unit
29. Diagnosis display with connection for diagnostic unit

EFHB411A

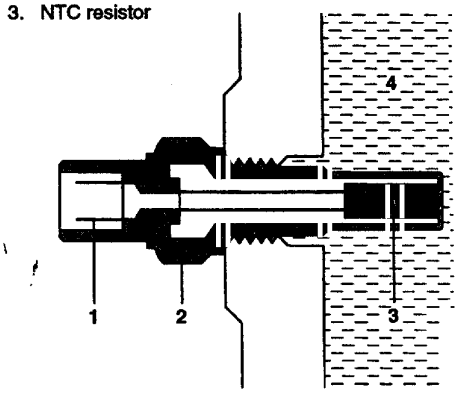
CAMSHAFT-SPEED SENSOR

The camshaft controls the engine's intake and exhaust valves. It turns at half the speed of the crankshaft. When a piston travels in the directions of TDC, the camshaft position determines whether it is in the compression phase with subsequent ignition, or in the exhaust phase. The information cannot be generated from the crankshaft position during the starting phase. During normal engine operation on the other hand, the information generated by the crankshaft sensor suffices to define the engine status. In other words, this means that if the camshaft sensor should fail while the vehicle is being driven, the ECU still receives information on the engine status from the crankshaft sensor.

The camshaft sensor utilises the Hall effect when establishing the camshaft position. A tooth of ferromagnetic material is attached to the camshaft and rotates with it. When this tooth passes the semiconductor wafers of the camshaft sensor, its magnetic field diverts the electrons in the semiconductor wafers at right angles to the direction of the current flowing through the wafers. This results in a brief voltage signal (Hall voltage) which informs the ECU that cylinder 1 has just entered the compression phase.

[Fig. 3]

Coolant-temperature sensor (schematic)
1. Electrical connections
2. Housing
3. NTC resistor



EFHB321A

TEMPERATURE SENSORS

Temperature sensors are installed at a number of different points :

- In the coolant circuit, to establish engine temperature by way of the coolant temperature (Fig. 3),
- In the intake manifold to measure the temperature of the intake air,
- In the engine lube oil to measure the oil temperature (optional), and
- In the fuel-return line to measure the fuel temperature (optional).

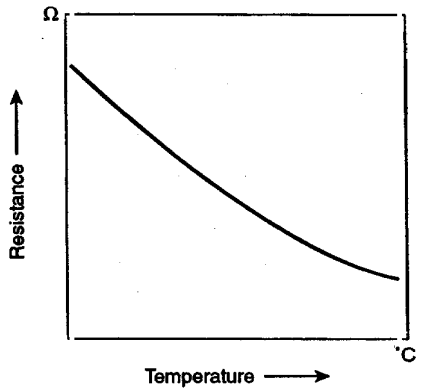
The sensors are equipped with a temperature-dependent resistor with a negative temperature coefficient (NTC) which is part of a voltage-divider circuit across which 5V are applied.
The voltage drop across the resistor is inputted into the ECU through an analog-to-digital converter (ADC) and is a measure for the temperature. A characteristic curve is stored in the ECU microcomputer which defines the temperature as a function of the given voltage value (Fig. 4).

HOT-FILM AIR-MASS METER

Particularly during dynamic operation, precise compliance with the correct A/F ratio is imperative in order to comply with the exhaust-gas limits as stipulated by law. This necessitates the use of sensors which precisely register the air-mass flow actually being drawn in by the engine at a particular moment. This load sensor's measuring accuracy must be completely independent of pulsation, reverse flow, EGR, variable camshaft control, and changes in the intake-air temperature.

[Fig. 4]

Characteristic curve of a temperature sensor (NTC)



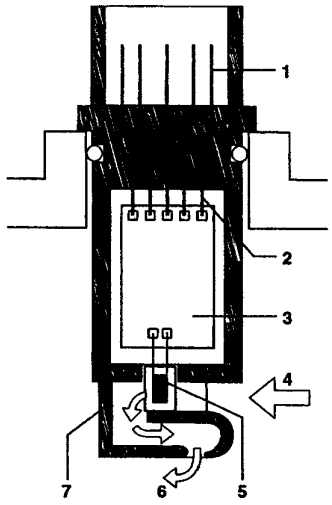
EFHB322A

A hot-film air-mass meter was selected as being most suitable for complying with the above stipulations. The hot-film principle is based on the transfer of heat from a heated sensor element to the air-mass flow (Fig. 5). A micromechanical measuring system is utilised which permits registration of the air-mass flow and detection of flow direction. Reverse flows are also detected in case of strongly pulsating air flow.
The micromechanical sensor element is located in the plug-in sensor's flow passage (Fig. 5,). The plug-in sensor can be installed in the air filter or in a measuring tube in the engine's air intake duct.

[Fig. 5]

Hot-film air-mass meter (schematic)

1. Electrical connections
2. Internal connections
3. Evaluation electronics (hybrid circuit)
4. Air inlet
5. Sensor element
6. Air outlet
7. Housing



EFHB331A

There are a variety of different-sized measuring tubes available, depending upon the maximum air throughput reqauired by the engine. The signal voltage curve, as a function of the air mass flow, is divided into signal ranges for forward flow and reverse flow. In order to increase measuring accuracy, the measuring signal is referred to a reference voltage outputted by the engine management. The characteristic curve has been designed so that during diagnosis in the workshop and open circuit conductor, for instance, can be detected with the help of the engine management.
A temperature sensor can be incorporated for measuring the intake-air temperature.

ACCELERATOR-PEDAL SENSOR

In contrast to conventional distributor and in-line injection pumps, with EDC the driver's acceleration input is no longer transmitted to the injection pump by Bowden cable or mechanical linkage, but is registered by an accelerator-pedal sensor and transmitted to the ECU (this is also known as drive-by wire). A voltage is generated across the potentiometer in the accelerator-pedal sensor as a function of the accelerator-pedal setting. Using a programmed characteristic curve, the pedal's position is then calculated from this voltage.

ECU

ASSIGNMENT AND METHOD OF OPERATION

The ECU evaluates the signals it receives from the external sensors and limits them to the permissible voltage level.

From this input data, and from stored characteristic maps, the ECU microprocessors calculate the injection times and the instants of injections, and convert these times to signal characteristics which are adapted to the movements of the engine pistons and crankshaft. The specified accuracy and the engine's high dynamic response demands high levels of computing power.
The output signals from the ECU microprocessors are used to trigger driver stages which provide adequate power for switching the actuators rail-pressuresure control and element switch-off. In addition, actuators for engine function are triggered (e.g. EGR actuator, and the relay for the electric fuel pump), as well as those for further auxiliary functions such as blower relay, auxilary-heater relays, glow relay, air-conditioner). The driver stages are proof against short-circuit and destruction due to brief electrical overloading. Errors of this type, and open-circuit or unplugged lines, are reported to the microprocessor. Diagnosis functions in the injector driver stages detect faulty signal characteristics, and in addition a number of the output signals are transferred via interfaces for use in other systems in the vehicle. And within the framework of a special safety concept, the ECU monitors the complete fuel-injection system.
Injector triggering places particularly heavy demands on the driver stages. In the injector, the current from the driver stage generates a magnetic force in the triggering element which is applied to the injector's high-pressure system. In order to ensure very tight tolerances, and high reproducibility of the injected fuel quantity, this coil must be triggered with steep current flanks. This necessitates high voltages being made available in the ECU.
A current control circuit divides the energisation time (injection time) into a pickup-current phase and a hold phase. It must operate so accurately that the injector guarantees reproducible injection under all operating conditions. In addition, it must reduce the power loss in the ECU and the injectors.

OPERATING CONDITIONS

High demands are made upon the ECU regarding

- The surrounding (ambient) temperatures (in normal cases from -40 ... +85°C),
- The resistance to fuels and lubricants etc.,
- The resistance to humidity, and
- Mechanical loading.

Very high demands are also made upon electromagnetic compatibility (EMC) and upon the radiation of HF interference signals.

DESIGN AND CONSTRUCTION

The ECU has a metal housing. The sensors, the actuators, and power supply are connected to the ECU through a multi-pole plug-in connector. The power components which directly trigger the actuators are integrated in the ECU in such a manner that they can efficiently dissipate

their heat to the ECU housing. Both sealed and non-sealed versions of the ECU are available.

OPERATING-STATE CONTROL

In order that the engine operates with optimum combustion in every operating state, the ECU in each case calculates the appropriate injected fuel quantity. In the process, a number of parameters must be taken into account (Fig. 6).

START QUANTITY

For starting, the injected fuel quantity is calculated as a function of temperature and cranking speed. The start quantity is injected from the moment the starting switch is turned to "Start" (Fig. 6, Pos. A) until the engine has reached a given minimum speed. The driver has no influence upon the start quantity.

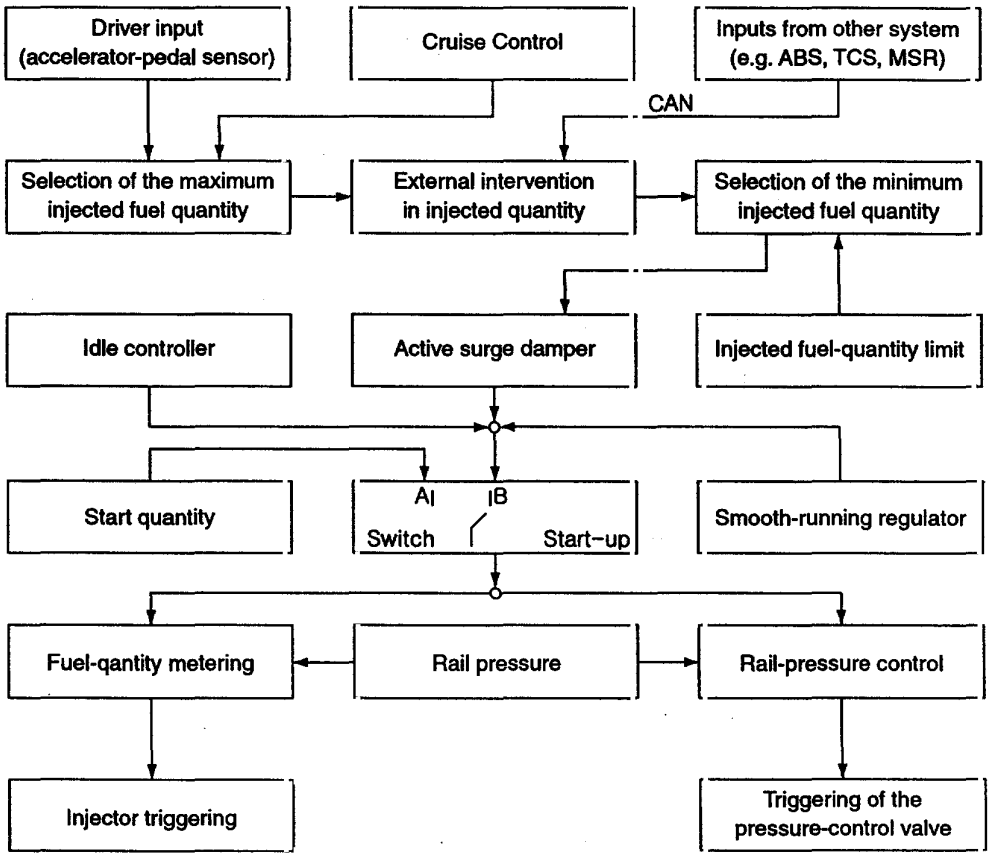
DRIVE MODE

When the vehicle is being driven normally (Fig. 6, stating switch in Pos. B), the injected fuel quantity is calculated from the accelerator-pedal setting (accelerator-pedal sensor) and the engine speed. Calculation utilises the driving map so that the driver input and the engine O.P power are optimally matches to each other.

[Fig. 6]

Calculation in the ECU of the injected fuel quantity

Starting-switch position A : Start
Starting-switch position B : Drive mode



EFHB351A

IDLE-SPEED CONTROL

At idle, fuel consumption depends for the most part on engine efficiency and idle speed. Since a considerable portion of a vehicle's fuel consumption in dense traffic conditions is attributable to this operating state, it is obvious that idle speed must be kept to a minimum. The idle speed though, must be set so that no matter what the operating conditions, it does not drop so far under load that the engine runs roughly or even stops. This applies for instance when the vehicle electrical system is loaded, when the air-conditioner is switched on, when a gear is engaged on an automatic transmission, or when the power steering is in operation. In order to regulate to the desired idle speed, the idle controller varies the injected fuel quantity until the actual engine speed equals the desired idle speed. Here, the desired idle speed and the control characteristic are influenced by the selected gear and by the engine temperature (coolant-temperature sensor). In addition to the external load moments must also be taken into account and compensated for by the idle-speed control. These change minimally but steadily throughout the vehicle's service life, as well as being highly dependent upon temperature.

SMOOTH-RUNNING CONTROL

Due to mechanical tolerance and ageing, there are differences in the torques generated by the engine's individual cylinders. This leads to rough or irregular running, particularly at idle. The smooth-running (cylinder-balancing) control measures the engine-speed changes every time a cylinder has "fired" and compares them with each other. The injected fuel quantity of reach cylinder is then adjusted in accordance with the measured differences in engine speed between the individual cylinders, so that each cylinder makes the same contribution to the torque generated by the engine. The smooth-running control is only operative in the lower engine-speed range.

VEHICLE-SPEED CONTROLLER

The vehicle-speed controller (Cruise Control) comes into operation when the vehicle is to be driven at a constant speed. It controls the vehicle speed to that inputted by the driver at the operator unit in the instrument panel. The injected fuel quantity is increased or reduced until the actual speed equals the set speed. While the Cruise Control is in operation, the control process is interrupted if the driver depresses the clutch, or applies the brakes. If the accelerator pedal is pressed, the vehicle can be accelerated beyond the speed which has been set with the Cruise Control. As soon as the accelerator pedal is released, the Cruise Control regulates the speed back down again to the previous set speed. Similarly, if the Cruise Control has been switched off, the driver only needs to press the reactivate key in order to again select the last speed which had been set.

CONTROLLING THE INJECTED FUEL QUANTITY LIMIT

There are a number of reasons why the fuel quantity desired by driver (or the maximum physically possible quantity) must not be injected.

These include:
- Excessive pollutant emissions,
- Excessive soot emissions,
- Mechanical overloading due to excessive torque or engine speed, or
- Thermal overload as a result of excessive coolant, lube-oil, or turbocharger temperature.

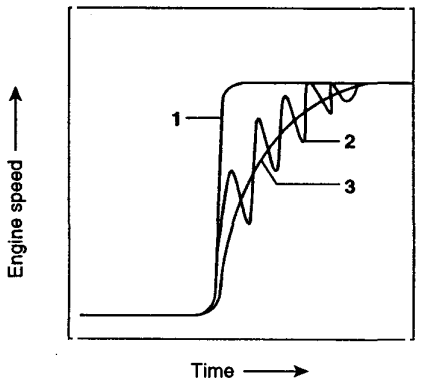
The limit for the injected fuel quantity is formed from a number of input variables, for instance intake air mass, engine speed, and coolant temperature.

ACTIVE SURGE-DAMPING CONTROL

When the accelerator pedal is abruptly depressed or released, this causes the injected fuel quantity to change rapidly with the result that there is also a rapid change in the torque developed by the engine. These abrupt load changes lead to the resilient engine mountings and the drivertrain generating bucking oscillations which result in fluctuations of engine speed (Fig. 7).

[Fig. 7]

Active surge damper
1. Sudden accelerator-pedal movement (driver input)
2. Engine-speed curve without active surge-damping control
3. With active surge-damping control



EFHB361A

The active surge-damper reduces these periodic speed fluctuations by varying the injected fuel quantity at the same frequency as the periodic speed fluctuations :
Less fuel is injected when the speed increases, and more when it decreases. This effectively damps the surge movements.

ENGINE SWITCH OFF

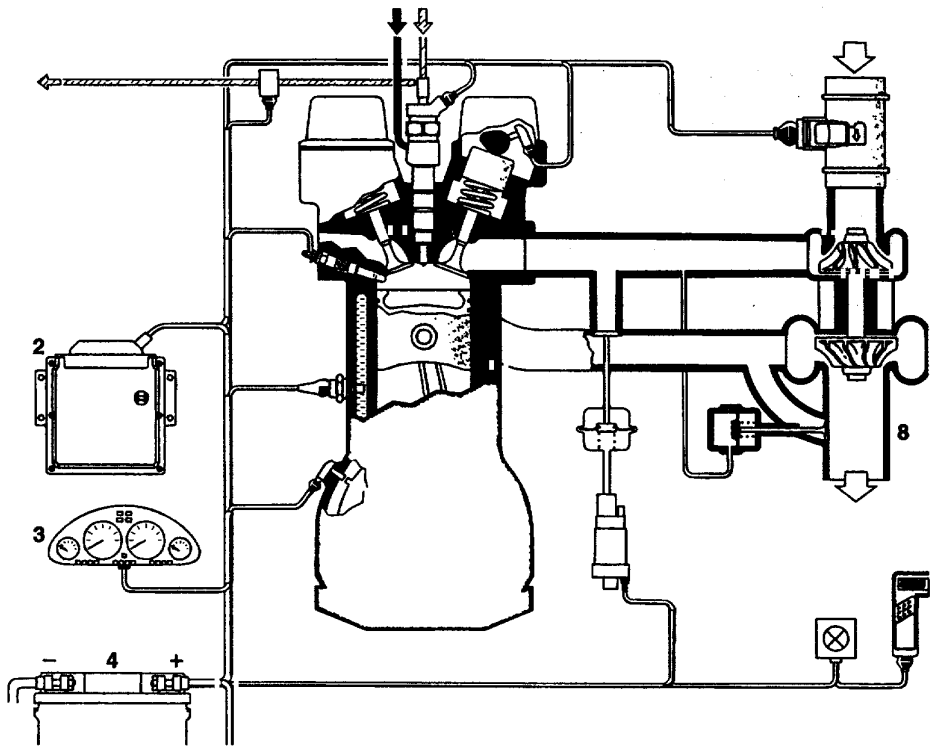
The diesel engine operates according to the "auto-ignition" principle. This means that it can only be switched off by interupting its supply of fuel. In the case of the "Electronic Diesel Control (EDC)", the engine is switched off by ECU stipulating "injected fuel quantity zero". The system also features a number of additional (redundant) switch-off paths.

ACTUATORS (FIG. 8)

INJECTOR

Special injectors with hydraulic servo system and electrical triggering element (solenoid valve) are used with the Common Rail system in order to achieve efficient start of injection and precise injected fuel quantity. At the start of injection, a high pickup current is applied to the injector so that the solenoid valve opens quickly. As soon as the nozzle needle has travelled its complete stroke, and the nozzle has opened completely, the energizing current is reduced to a lower holding value. The injected fuel quantity is now defined by the injector opening time and the rail pressure. Injection is terminated when the solenoid valve is no longer triggered and closes as a result.

[Fig. 8]



High-pressure pump (schematic, longitudinal section)

1. Glow control unit
2. ECU
3. Instrument panel with displays for fuel consumption, engine speed etc.
4. Battery
5. Glow plug
6. Injector
7. EGR positioner
8. Turbocharger

EFH8371A

INTEGRATED DIAGNOSIS

SENSOR MONITORING

For sensor monitoring, the integrated diagnosis facility checks whether they are being supplied with power, and whether their O/P signals are plausible (within the permitted range, e.g. temperature between -40 und 150°C). Where possible, the redundancy principle is applied for important signals. That is, in case of malfunction a switch is made to another similar signal.

MONITORING MODULE

In addition to the microcontroller, the ECU also incorporates a monitoring module. The ECU and the monitoring module monitor each other. If a malfunction is detected, either of them can switch off the injection independent of the other.

MALFUNCTION DETECTION

Malfunction detection is only possible within the monitoring range of a given sensor. A signal path is classified as faulty when an error is present for longer than a predefined period. In such cases, the error is stored in the ECU's error memory together with details of the environmental conditions which prevailed when the error/malfunction occurred (e.g. coolant temperature, engine speed etc.). For a large number of errors/malfunctions, it is possible for the "OK again" status to be established. Here, the signal path must be identified as intact for a defined period of time.

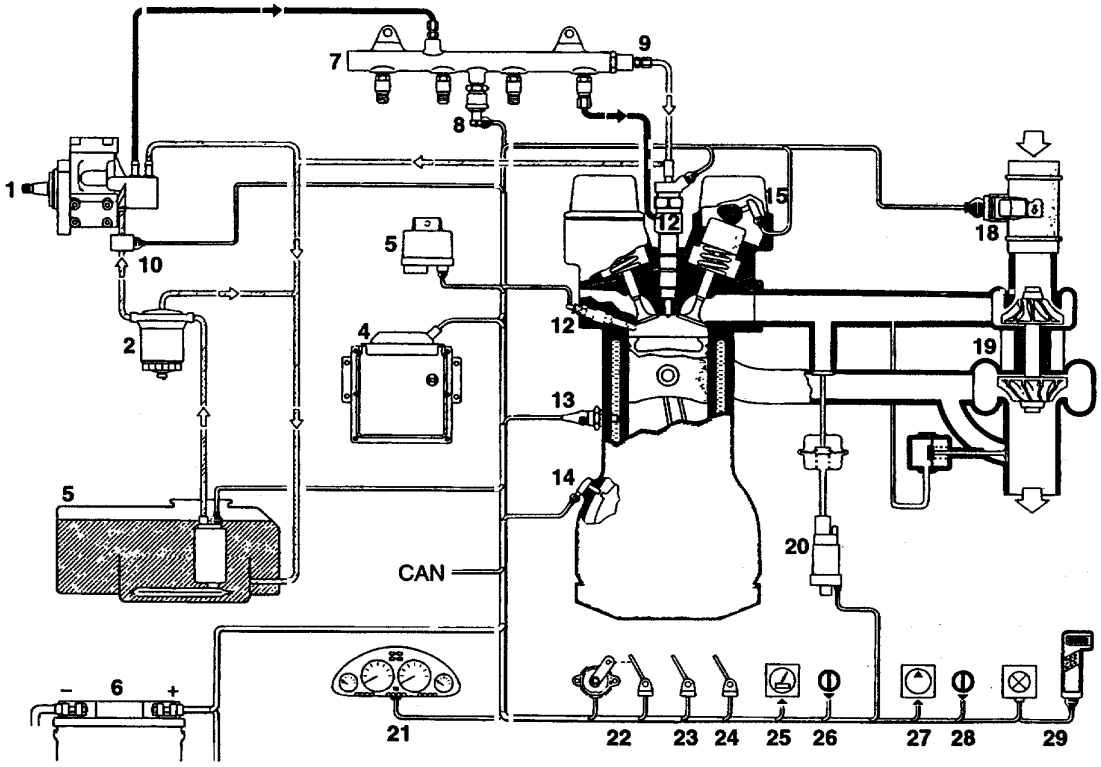
ERROR PROCEDURE

If a sensor's permitted output-signal range is violated, a switch is made to a substitute value. This procedure is applied for the following input signals :

- Battery voltage,
- Coolant, air, and lube-oil temperature,
- Charge-air pressure,
- Atmospheric pressure and intake-air quantity.

In addition, in case of non-plausible signals from the accelerator-pedal sensor and/or the brakes, a substitute accelerator-pedal sensor signal is applied.

[Fig. 12]



System overview of a Common Rail injection system and a variety of system components

1. High-pressure pump
2. Fuel filter
3. Fuel tank with preliminary filter and presupply pump
4. ECU
5. Glow control unit
6. Battery
7. High-pressure accumulator (rail)
8. Rail-pressure sensor
9. Pressure limiter valve
10. Fuel-temperature sensor
11. Injector
12. Sheathed-element glow plug
13. Coolant-temperature sensor
14. Crankshaft sensor
15. Camshaft sensor
16. Intake-air temperature sensor
17. Boost-pressure sensor (BPS)
18. Air-mass meter
19. Turbocharger
20. EGR positioner
21. Instrument panel with display for fuel consumption, engine speed etc.
22. Accelerator-pedal sensor
23. Brake contacts
24. Clutch switch
25. Road-speed sensor
26. Operator unit for vehicle-speed controller
27. Air-conditioner compressor
28. Air-conditioner operator unit
29. Diagnosis display with connection for diagnostic unit

EFHB411A

ELECTRONIC DIESEL CONTROL - EDC

TECHNICAL REQUIREMENTS

The reduction of fuel consumption along with an increase in power output or torque, are the decisive factors behind present-day developments in the diesel fuel-injection field. In the past years this has led to an increase in the use of direct-injection (DI) diesel engines. Compared to prechamber or whirl-chamber engines, the so-called indirect-injection (IDI) engines, the DI engine operates with far higher injection pressures. This leads to improved mixture formation, and fuel combustion is more complete. In the DI engine, the improved mixture formation and the fact that there are no overflow losses between prechamber/whirl chamber and the main combustion chamber results in a fuel-consumption reduction of 10...15% compared to the IDI engine. In addition, modern-day engines are subject to more severe requirements with regard to exhaust-gas and noise emissions.

This has led to higher demands being made on the injection system and its control :

- High injection pressures,
- Structured rate-of-discharge curve,
- Variable start of injection,
- Pilot injection,
- Adaptation of injected fuel quantity, boost pressure, and injected fuel quantity to the given operating state,
- Temperature-dependent start quantity,
- Load-independent idle-speed control,
- Cruise control,
- Closed-loop-controlled exhaust-gas recirculation (EGR), and
- Reduced tolerances and higher accuracy throughout the vehicle's useful life.

Conventional mechanical (flyweight) governors use a number of add-on devices to register the various operating conditions, and ensure that mixture formation is of high quality. Such governors, though, are restricted to simple open-loop control operations at the engine, and there are many important actuating variables which they cannot register at all or not quickly enough.

SYSTEM OVERVIES

In the past years, the marked increase in the computing power of the micro-controllers available on the market has made it possible for the EDC (Electronic Diesel Control) to comply with the above-named stipulations. In contrast to diesel-engined vehicles with conventional in-line or distributor injection pumps, the driver of an EDC controlled vehicle has no direct influence, for instance through the accelerator pedal and Bowden cable, upon the injected fuel quantity. On the contrary, the injected fuel quantity is defined by a variety of actuating variables, e.g. operating state driver input, pollutants emission, etc. This of course means that an extensive safety concept must be implemented that detects errors and malfunctions and, depending upon their severity, initiates appropriate countermeasures (e.g. limitation of torque, or emergency (limp-home) running in the idle-speed range) EDC also permits the exchange of data with other electronic systems in the vehicle (e.g. with the traction control system (TCS), and with the electronic transmission-shift control). This means that it can be integrated in the overall vehicle system.

EDC DATA PROCESSING

INPUT SIGNALS

Together with the actuators, the sensors represent the interface between the vehicle and its data-processing unit the ECU.

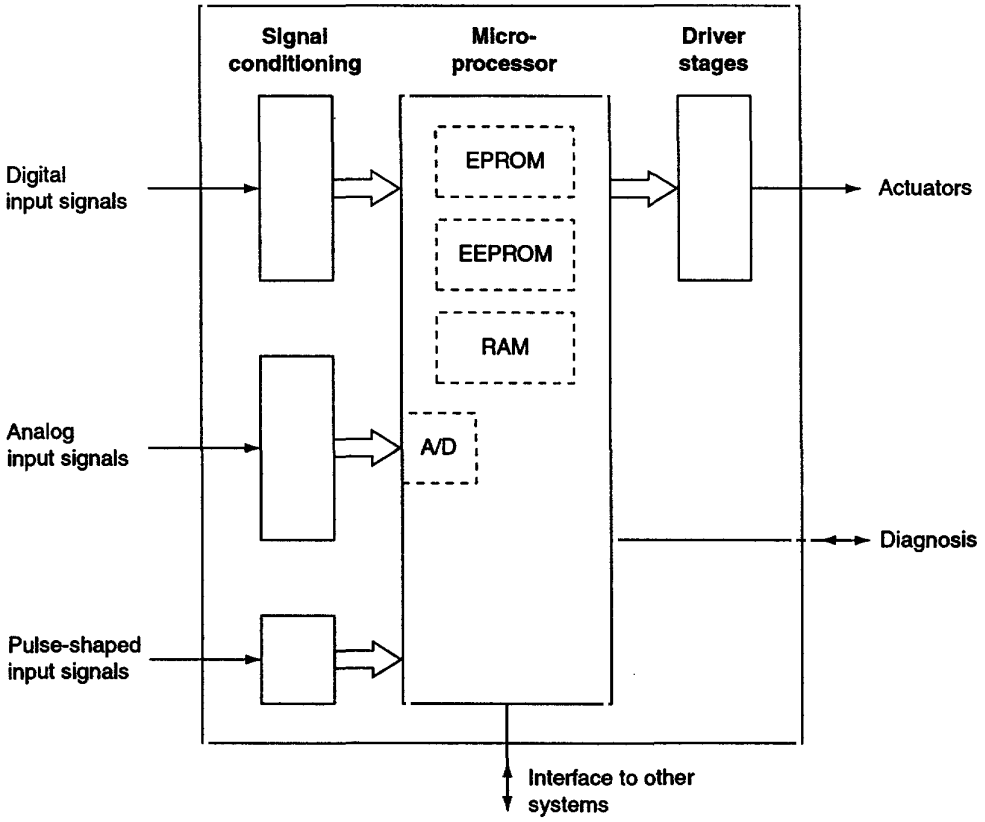
The signals from the sensors are passed to the ECU (or to several ECU's) via protective circuitry and, where necessary, via signal transducers and amplifiers (Fig. 1) :

- Analog input signals (e.g. information from analog sensors on the quantity of air drawn in by the engine, engine and intake-air temperatures, battery voltage, etc.) are converted to digital values by an A/D converter in the ECU microprocessor.
- Digital input signals (e.g. On/Off switching signals, or digital sensor signals such as the rotational-speed pulses from a Hall sensor) acan be processed directly by the microprocessor.
- In order to suppress interference pulses, the pulse-shaped input signals from inductive sensors which carry information on engine speed and reference mark are conditioned by a special circuit in the ECU and converted to square-wave from.

Depending upon the level of integration, signal conditioning can take place completely or partially in the sensor. The operating conditions encountered at its installation point determine the sensor's loading.

[Fig. 1]

Signal processing in the ECU



EFHB431A

SIGNAL CONDITIONING

Protective circuitry is used to limit the incoming signals to a maximum voltage level. The effective signal is freed almost completely of superimposed interference signals by means of filtering, and is then amplified to match it to the ECU input voltage.

SIGNAL PRESSING IN THE ECU

The ECU microprocessors (Fig. 1) mostly process the input signals digitally, and therefore need a special program. This is stored in a Read Only Memory (ROM or Flash-EPROM).
In addition, engine-specific curves and engine-management maps are stored in a Flash-EPROM. Immobilizer data, calibration and manufacturing data, as well as data on errors/malfunctions which may have occurred during operation are stored in a non-volatile read/write memory (EEPROM).

Due to the large number of engine and equipment variants, the ECU's are provided with a so-called variant code. Using this code, a selection of the maps stored in the Flash-EPROM takes place at the manufacturer or in the workshop, in order to provide the specific functions required for the vehicle variant in question. This selection is also stored in the EEPROM.
Other ECU variants are designed so that complete data sets can be programmed into the Flash-EPROM at the end of vehicle production. This reduces the number of different ECU types required by the vehicle manufacturer.
A volatile random access memory (RAM) is needed to store variable data such as calculations data and signal values. In order to function correctly, the RAM requires a permanent power supply. In other words, it loses its complete data stock when the ECU is switched off via the ignition switch or when the vehicle battery is disconnected. In such cases, the adaptation values (values which have been learnt regarding engine and operating conditions)

would have to be re-established when the ECU is switched on again. To prevent this, the adaptation values are stored in an EEPROM and not in a RAM.

OUTPUT SIGNALS

With their output signals, the microprocessors trigger output stages which usually are powerful enough for direct connection to the actuators. The triggering of the individual actuators is dealt with in the particular system decription. These output stages are proof against short-circuit to ground or to battery voltage, as well as against destruction due to electrical overload. Such faults are recognized by the output stages and reported to the microprocessor. This also applies to conductor open-circuits. In addition, a number of the output signals are transmitted through interfaces to other systems in the vehicle.

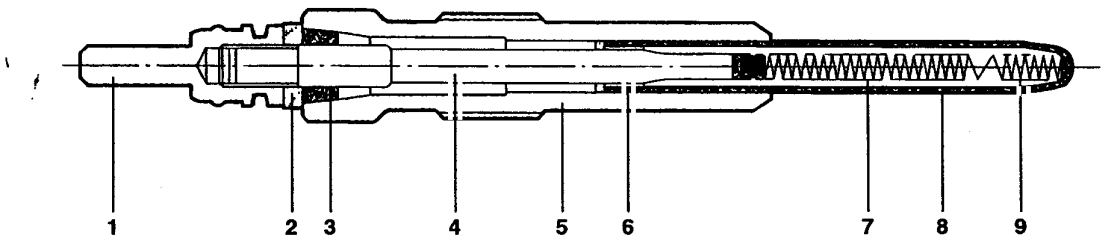
START-ASSIST SYSTEMS

Sin leakage and heat losses reduce the pressure and the temperature of the A/F mixture at the end of the compression stroke, the diesel engine is more difficult to start and the mixture more difficult to ignite than it is when hot. These facts make it particularly important that start-assist systems are used. The minimum starting temperature depends upon the engine type. Pre-chamber and swirl-chamber engines are equipped with a sheathed-element glow plug in the auxiliary combustion chamber which functions as a "hot spot" On small direct-injection (DI) engines, this "hot spot" is located on the combustion chamber's periphery. Large DI truck engines on the other hand have the alternative of using air preheating in the intake manifold (flame start) or special, easily ignitable fuel (Start Pilot) which is sprayed into the intake air. To day, the start-assist systems use sheathed-element glow plugs practically without exception.

SHEATHED-ELEMENT GLOW PLUG

The sheathed-element glow plug's tubular heating element is so firmly pressed into the glow-plug shell that a gas-tight seal is formed. The element is a metal tube which is resistant to both corrosion and hot gases, and which contains a heater (glow) element embedded in magnesium-oxide powder (Fig. 1). This heater element comprises two series-connected resistors: the heater filament in the glow-tube tip, and the control filament. Whereas the heater filament maintains virtually constant electrical resistance regardless of temperature, the control filament is made of material with a positive temperature coefficient (PTC). On newer-generation glow plugs (GSK2), its resistance increases even more rapidly with rising temperature than was the case with the conventional S-RSK glow plug. This means that the newer GSK2 glow plugs are characterized by reaching the temperature needed for ignition far more quickly (850°C in 4s). They also feature a lower steady-state temperature (Fig. 2) which means that the glow plug's temperature is limited to a non-critical level. The result is that the GSK2 glow plug can remain on for up to 3 minutes following engine start. This post-glow feature improves both the warm-up and run-up phases with considerable improvements in noise and exhaust-gas emissions.

[Fig. 1]



Sheathed-element glow plug GSK2

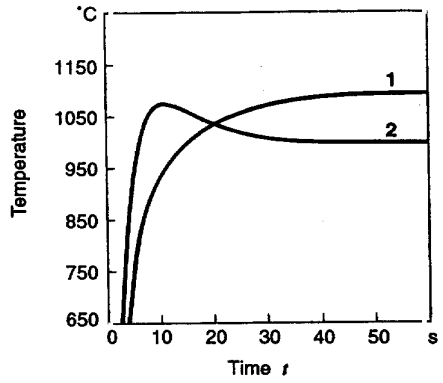
1. Electrical connector terminal
2. Insulating washer
3. Double gasket
4. Terminal pin
5. Glow-plug shell
6. Heater seal
7. Heater and control filament
8. Glow tube
9. Filling power

EFHB481A

[Fig. 2]

Sheathed-element glow plugs: Temperature-time diagram

1. S-RSK
2. GSK2



EFHB491A

FLAME GLOW PLUG

The flame glow plug burns fuel to heat the intake air. Normally, the injection system's supply pump delivers fuel to the flame plug through a solenoid valve. The flame plugs's connection fitting is provided with a filter, and a metering device which permits passage of precisely the correct amount of fuel appropriate to the particular engine. This fuel then evaporates in an evaporator tube surrounding the tubular heating element and mixes with the intake air. The resulting mixture ignites on the 1000°C heating element at the flame-plug tip.

GLOW CONTROL UNIT

For triggering the glow plugs, glow control unit (GZS) is provided with a power relay and a number of electronic switching blocks. These, for instance, control the glow duration of the glow plugs, or have safety and monitoring functions. Using their diagnosis functions, more sophisticated glow control units are also able to recognise the failure of individual glow plugs and inform the driver accordingly. Multiple plugs are used as the control inputs to the ECU. In order to avoid voltage drops, the power supply to the glow plugs is through suitable threaded pins or plugs.

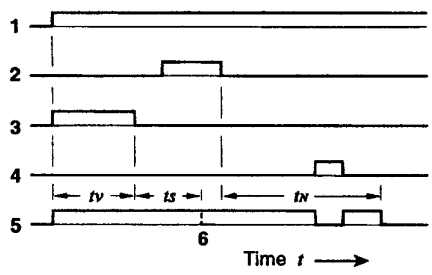
FUNCTIONAL SEQUENCE

The diesel engine's glow plug and starter switch, which controls the preheat and starting sequence, functions in a similar manner to the ignition and starting switch on the spark-ignition (SI) engine. Switching to the "ignition on" position starts the preheating process and the glow-plug indicator lamp lights up. This extinguishes to indicate that the glow plugs are hot enough for the engine to start, and cranking can begin. In the following starting phase, the droplets of injected fuel ignite in the hot, compressed air. The heat released as a result leads to the initiation of the combustion process (Fig. 3). In the warm-up phase following a successful start, post-heating contributes to faultless engine running (no misfiring) and therefore to practically smokeless engine run-up and idle. At the same time, when the engine is cold, preheating reduces combustion noise. A glow-plug safety switchoff prevents battery discharge in case the engine cannot be started. The glow-control relay can be coupled to the ECU of the Electronic Diesel Control (EDC) so that information available in the EDC control unit can be applied for optimum control of the glow plugs in accordance with the particular operating conditions. This is yet another possibility for reducing the levels of blue smoke and noise.

[Fig. 3]

Typical preheating sequence

1. Glow-plug and starter switch
2. Starter
3. Glow-plug indicator lamp
4. Load switch
5. Glow plugs
6. Self-sustained engine operation, *tv* Pre-heating time, *ts* Ready to start, *tN* Post-heating time



EFHB492A

SPECIFICATION E48790E2

Input sensors	
Mass air flow sensor	HFM5 (Hot Film Sensor)
Intake air temperature sensor	Thermistor type
- Resistance	2.28 ~ 2.56 kΩ at 20°C (68°F) 0.300 ~ 0.380 kΩ at 80°C (176°F)
Engine coolant temperature sensor	Thermistor type
- Resistance	2.31 ~ 2.59 kΩ at 20°C (68°F) 0.314 ~ 0.331 kΩ at 80°C (176°F)
Vehicle speed sensor	Hall effect type
Campshaft position sensor	Hall effect type
Crankshaft position sensor	Magnetic sensor
Accel position sensor	Variable resistor type
Fuel pressure sensor	Piezo electricity type
Fuel temperature sensor	Thermistor type
- Resistance	2.27 ~ 2.73 kΩ at 20°C (68°F) 0.322 ~ 0.389 kΩ at 80°C (176°F)
Fuel tank capacity	45 liter
Fuel filter	High pressure type
Fuel pump	Electrical, in-tank type
- Driven by	Electric motor
Fuel pressure at high pressure side	1350 bar.
Injectors	Electromagnetic type

SERVICE STANDARD E7D8DD8F

Curb idle speed (rpm)	N-range	A/CON : OFF	800 ± 100
		A/CON : ON	800 ± 100

TIGHTENING TORQUES

Item	Nm	kg·cm
Delivery pipe (Common Rail) installation	8 ~ 10	80 ~ 100
Engine coolant temperature sensor	20 ~ 40	200 ~ 400
Throttle body - nut flange	7 ~ 11	70 ~ 110
Throttle body - bolt flange	7 ~ 11	70 ~ 110
Fuel filter mounting bolts	9 ~ 14	90 ~ 140
Accelerator arm bracket bolts	8 ~ 12	80 ~ 120
Pipe from rail to Injector 1/2/3/4	25 ~ 29	250 ~ 290
Rail pressure sensor	31 ~ 41	310 ~ 410
Clamp bolt for Injector	25 ~ 29	250 ~ 290
Retaining bolt for high pressure pump	13 ~ 18	130 ~ 180
Flange bolt - EGR Sonenoid valve	7 ~ 11	70 ~ 110
Self locking nut - EGR valve gasket	25 ~ 30	250 ~ 300
Bolt - EGR pipe gasket	20 ~ 30	200 ~ 300
CMP sensor mounting bolt	4 ~ 6	40 ~ 60
CKP - bolt	4 ~ 6	40 ~ 60
Oil pressure switch	15 ~ 26	150 ~ 260
Pipe between rail and pump	18 ~ 23	180 ~ 230
Function block	7 ~ 11	70 ~ 110
Rail bolt	18 ~ 28	180 ~ 280
Rail pressure regulator	5.1	51

SEALANT EA7C6EEB

Engine coolant temperature sensor	THREE BOND TB 2403

TROUBLESHOOTING EB828B87

FUEL INJECTION SYSTEM

Symptom	Probable cause	Remedy
Engine does not start	Cranking speed too low	Repair starting system or charge or replace battery so that engine cranks at a minimum of 150 rpm.
	No voltage at glo plug bus	If test light shows no voltage at bus with key at "ON" position, test relay and wiring.
	Glow plug faulty	Test and, if necessary, replace glow plug.
	Air in fuel system	Bleed fuel system.
	Injection pump not delivering fuel	If no fuel emerges from a loosenes injection pipe during cranking, check timing belt and fuel supply from filter.
	Injection pipes misconnected	Connect pipes in correct location
	Injection timing incorrect	Adjust injection timing.
	Faulty injection	Check and, if necessary, replace injectors.
	Engine mechanical faults, as described earlier under this heading	Test compression and, if necessary, repair engine.
	Faulty injection pump	Try to start engine with new pump installed. If necessary, replace pump permanently. Check and, if necessary, adjust the idle speed.
Idle speed incorrect of idle rough or irregular	Loose fuel hose between filter and injection pump	Tighten, if necessary, and repair.
	Air in fuel system	Bleed fuel system.
	Inadequate fuel supply owing to clogged fuel filter, or fuel return line and injection pipes leaking, dirty, kinked, or squeezed at connections	Inspect and, if necessary, replace lines and hoses or replace fuel filter
	Faulty injection	Check and, if necessary, repair or replace injection injectors.
	Injection timing incorrect	Adjust injection timing.
	Engine mechanical faults, as described earlier under this heading	Test compression and, if necessary, repair engine.
	Faulty injection pump	Try engine at idle with new pump installed. If necessary, replace pump permanently.
	Engine lugging in too high a gear	Observe correct shift speeds.

Symptom	Probable cause	Remedy
Smoky exhaust (black, blue or white)	Engine not reaching correct operating temperature	Check and, if necessary, replace cooling system thermostat.
	Maximum rpm incorrect	Check and, if necessary, replace injection pump.
	Faulty injection nozzles	Check and, if necessary, repair or replace injection nozzles.
	Injection timing incorrect	Adjust injection timing.
	Restricted exhaust system	Check exhaust system for dents and obstructions
	Engine mechanical faults, as described earlier under this heading	Test compression and, if necessary, repair engine.
	Faulty injection pump	Observe exhaust with new pump installed if necessary, replace pump permanently.
Poor power output, slow acceleration (speedometer accurate, clutch not slipping)	Maximum rpm incorrect	Check and, if necessary, replace injection pump.
	Air cleaner filter dirty	Clean or replace air cleaner filter.
	Inadequate fuel supply owing to clogged fuel filter, or fuel return line and injection pipes leaking, dirty, kinked, or squeezed at connections	Inspect and, if necessary, replace lines and hoses, replaced fuel filter.
	Air in fuel system	Bleed fuel system.
	Faulty injection nozzles	Check and, if necessary, repair or replace injection nozzles.
	Injection timing incorrect	Adjust injection timing.
	Engine mechanical faults, as described earlier under this heading	Test compression and, if necessary, repair engine.
	Faulty injection pump	Check acceleration and speed with new pump installed. If necessary, replace pump permanently.
Excessive fuel consumption	Air cleaner filter dirty	Clean or replace air cleaner filter
	Fuel leaks	Check and, if necessary, replace or tighten all pipes, hoses and connections.
	Return pipe and hose blocked	Check return line for kinks and dents. Replace faulty lines. If line is clogged, blow it out with compressed air, then bleed fuel system.
	Faulty injection nozzles	Check and, if necessary, repair or replace injection nozzles.
	Engine mechanical faults, as described earlier under this heading	Test compression and, if necessary, repair engine.
	Faulty injection pump	Check fuel consumption with new pump installed, if unnecessary, replace pump permanently.

ENGINE CONTROL

Symptom	Probable cause	Remedy
Engine does not stop	Faulty starting switch operation	Correct or replace part
	Broken harness between starting switch and fuel cut solenoid	Replace harness

TROUBLESHOOTING

Trouble condition	Probable cause	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Injector faulty	Replace Injectors
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Starter switch faulty	Replace ignition switch
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

FUEL TANK AND FUEL LINE

Symptom	Probable cause	Remedy
Engine malfunctions due to insufficient fuel supply	Bent or kinked fuel pipe or hose	Repair or replace
	Clogged fuel pipe or hose	Clean or replace
	Clogged fuel filter of in-tank fuel filter	Replace
	Water in fuel filter	Replace the fuel filter or clean the fuel tank and fuel lines
	Dirty or rusted fuel tank interior	Clean or replace
	Malfunctioning fuel pump (Clogged filter in the pump)	Replace
When the fuel filter warning lamp illuminates	Water has accumulated in the fuel filter	Remove the water accumulated in the fuel filter as below - Unscrew the mounting bolt on the fuel filter and raise fuel filter up - Loosen the drain plug at the bottem of the fuel filter - Tighten the drain plug when water no longer comes out

TROUBLESHOOTING GUIDE CHART

Trouble symtoms / Check items	Engine will not start	Engine shut off and then restart	Engine starts only with difficult	High idle no throttle take-up	Knocking on accel. (warm-up phases)	Vibration at idle	Reduced power	Engine does not run smothly, misfiring, knocking	Bucking
Self-diagnosis	1	1	1	1	1	1	1	1	1
Immobilizer	2								
Vehicle supply volt.	3		2					9	3
Main Relay	4	3	3					11	4
Fuse/plug wiring harness	5	2						8	2
Terminal 15	6	4	4					10	5
Crankshaft Position Sensor	7							12	
NO fuel	8								
Wrong fuel	9	5	7			2	4	3	
Lack of fuel								2	
Air in fuel system	10	6	8			3		4	
Low-pressure circuit(fuel)	11	7	13			4	5	7	
High-pressure circuit(fuel)	16	8	14			14	19	16	
Fuel filter	12		9			5	6	5	
Electric fuel pump	15		11					6	
Fuel pre-heater	13		10			6	7		
Pressure Regulator Valve	18	9	16			13		15	
Incorrect connection of injector	14		17		3	11		13	
Injector	17	10	19		4	10	18	14	
Mechanical componenet (compression, valve clearance...)	19		20				20	19	9
ECU defective	20								
TDC sensor			5						
Water Temp. Sensor			15		2		15		
Loss of coolant									
Glow-plug system			16						

TROUBL1

Trouble symtoms / Check items	Engine will not start	Engine shut off and then restart	Engine starts only with difficult	High idle no throttle take-up	Knocking on accel. (warm-up phases)	Vibration at idle	Reduced power	Engine does not run smothly, misfiring, knocking	Bucking
Rail Pressure Sensor	23		18			12	17	17	
Accel. Position Sensor				2			8		
Mechanical fault in accel.				3			9		
EGR						7	10		
HFM5 (Air Flow Meter)						9	14		
Air filter clogged			12			8	3		
Vacuum system leaking							2		
Turbocharger defective							11		
Waste-gate valve connection							12		
Fuel Temp. Sensor							16		
Checking belt tension								18	
Clutch switch									6
Brake switch									7
Vehicle speed signal									8
Checking oil level									
Radiator fan									
Radiator defective or clogged									
IG switch defective									
AC compress. SW									
AC SW									
Plug contacts			6						
Connection between turbo. and In-mani. Leaking			6				13		
High pressure pump	24		21				23		

TROUBL2

Trouble symtoms / Check items	Engine overrun, Accel.	White/Blue smoke	Clouds of black smoke	Engine overheating	Can not shut off with IG key	Diagnosis lamp not go out or flickers	AC cannot be switched on	RAD. Fan constantly in operation
Self-diagnosis	1	1	1	1	1	1	1	1
Immobilizer								
Vehicle supply volt.								
Main Relay								
Fuse/plug wiring harness					4	2	2	4
Terminal 15					3			
Crankshaft Position Sensor								
NO fuel								
Wrong fuel				2				
Lack of fuel								
Air in fuel system		3						
Low-pressure circuit(fuel)		6						
High-pressure circuit(fuel)	7							
Fuel filter		4						
Electric fuel pump								
Fuel pre-heater		5						
Pressure Regulator Valve	6							
Incorrect connection of injector								
Injector								
Mechanical componenet (compression, valve clearance...)			7	7				
ECU defective					5			
TDC sensor								
Water Temp. Sensor	8	2	6	3			5	3
Loss of coolant				6				
Glow-plug system								

TROUBL3

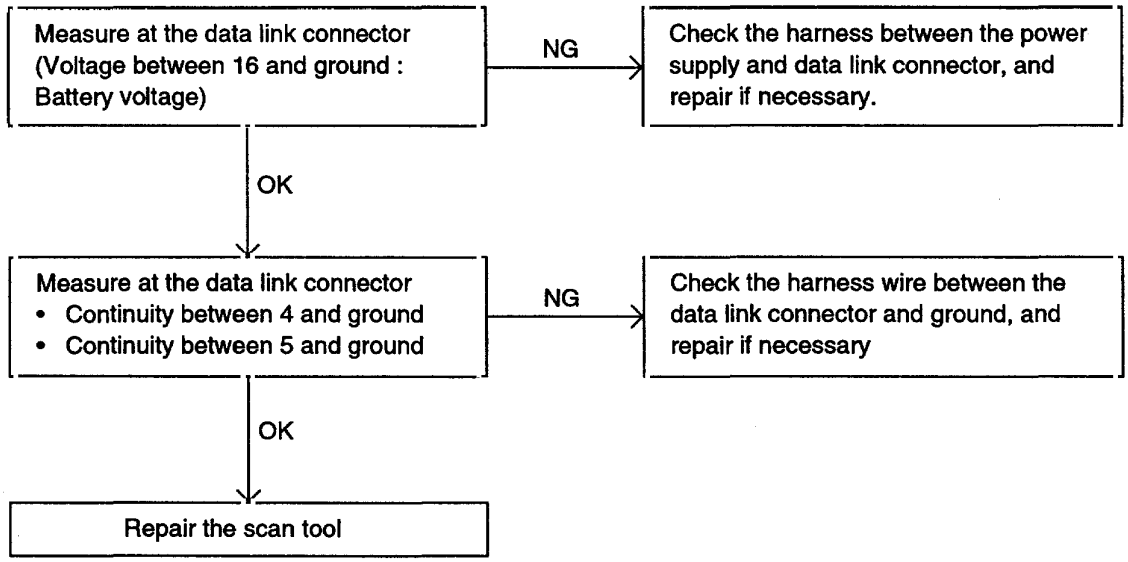
Trouble symtoms / Check items	Engine overrun, Accel.	White/Blue smoke	Clouds of black smoke	Engine overheating	Can not shut off with IG key	Diagnosis lamp not go out or flickers	AC cannot be switched on	RAD. Fan constantly in operation
Rail Pressure Sensor								
Accel. Position Sensor	3						6	
Mechanical fault in accel.	2							
EGR			3					
HFM5 (Air Flow Meter)			5					
Air filter clogged			2					
Vacuum system leaking			4					
Turbocharger defective	4							
Waste-gate valve connection	5							
Fuel Temp. Sensor	9							
Checking belt tension								
Clutch switch								
Brake switch								
Vehicle speed signal								
Checking oil level		7						
Radiator fan				4				
Radiator defective or clogged				5				
IG switch defective					2			
AC compress. SW							4	2
AC SW							3	
Plug contacts								
Connection between turbo. and In-mani. Leaking								

TROUBL4

TROUBLESHOOTING PROCEDURES

PROBLEM

Communication with scan tool is not possible.
(Communication with all system is not possible)

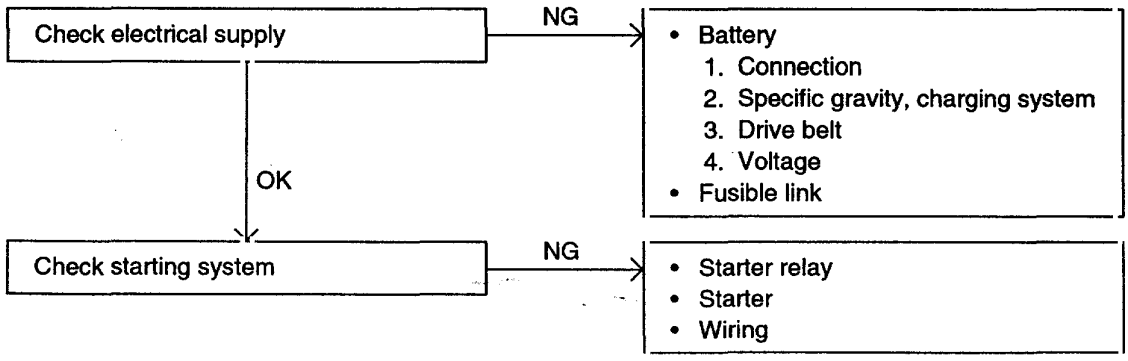


EFDB110A

SCAN TOOL COMMUNICATION WITH ECM IS NOT POSSIBLE

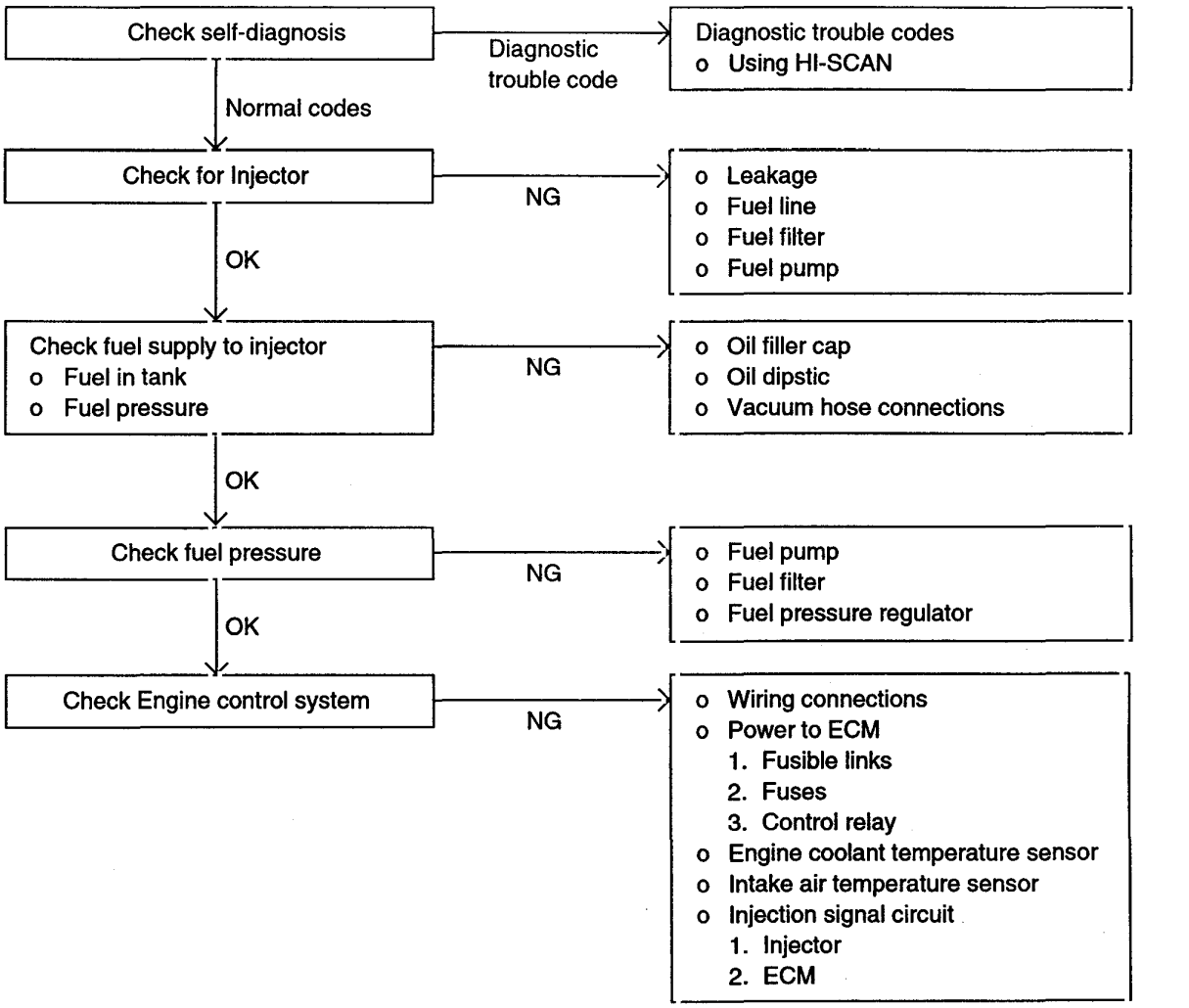
Comment	Probable cause
One of the following causes may be suspected. • No power supply to ECM • Defective ground circuit of ECM • Defective ECM • Improper communication line between ECM and scan tool	• Malfunction of ECM power supply circuit • Malfunction of the ECM • Open circuit between ECM and DLC

ENGINE WILL NOT START



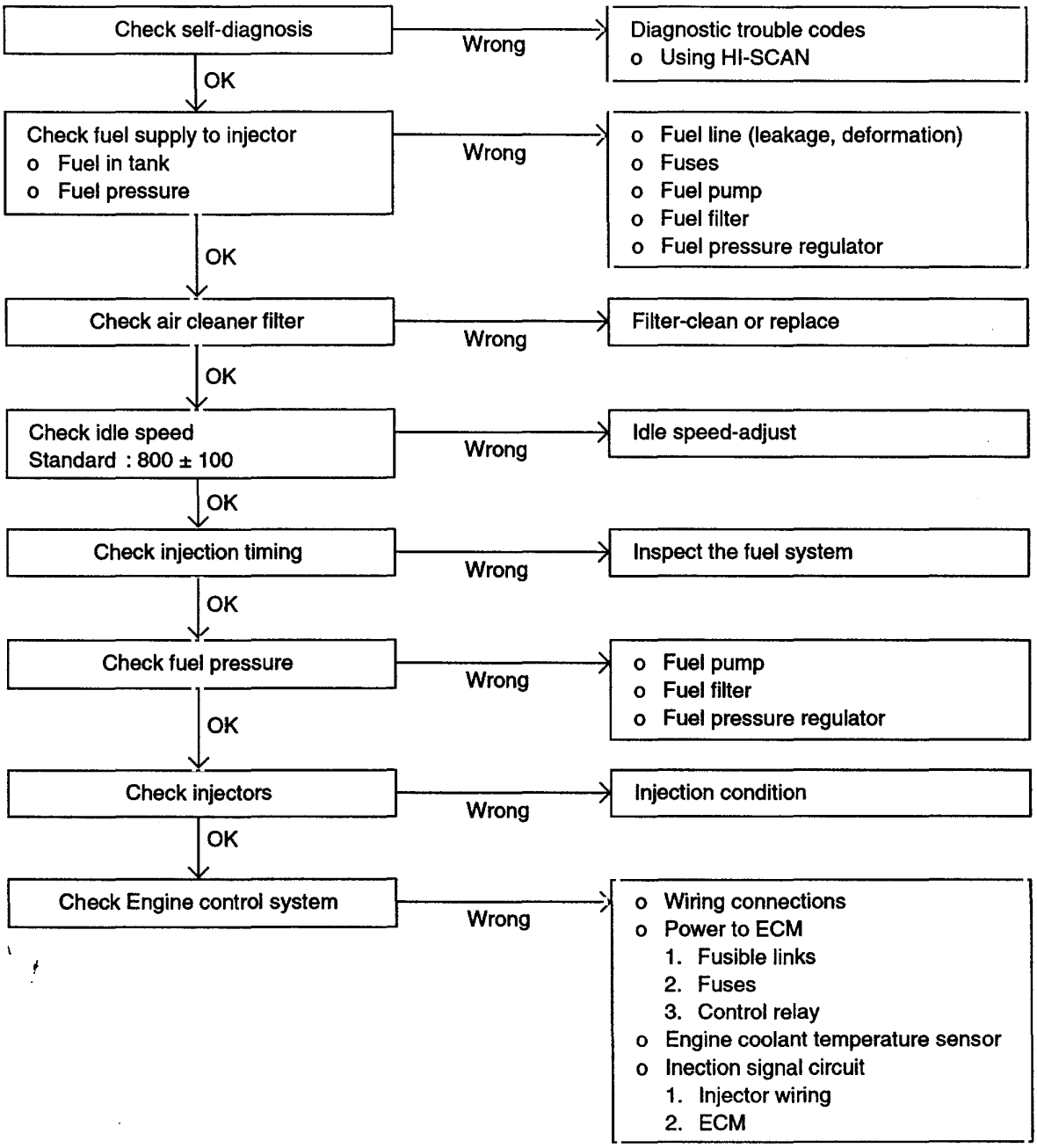
EFDB112A

HARD TO START (CRANKS OK)



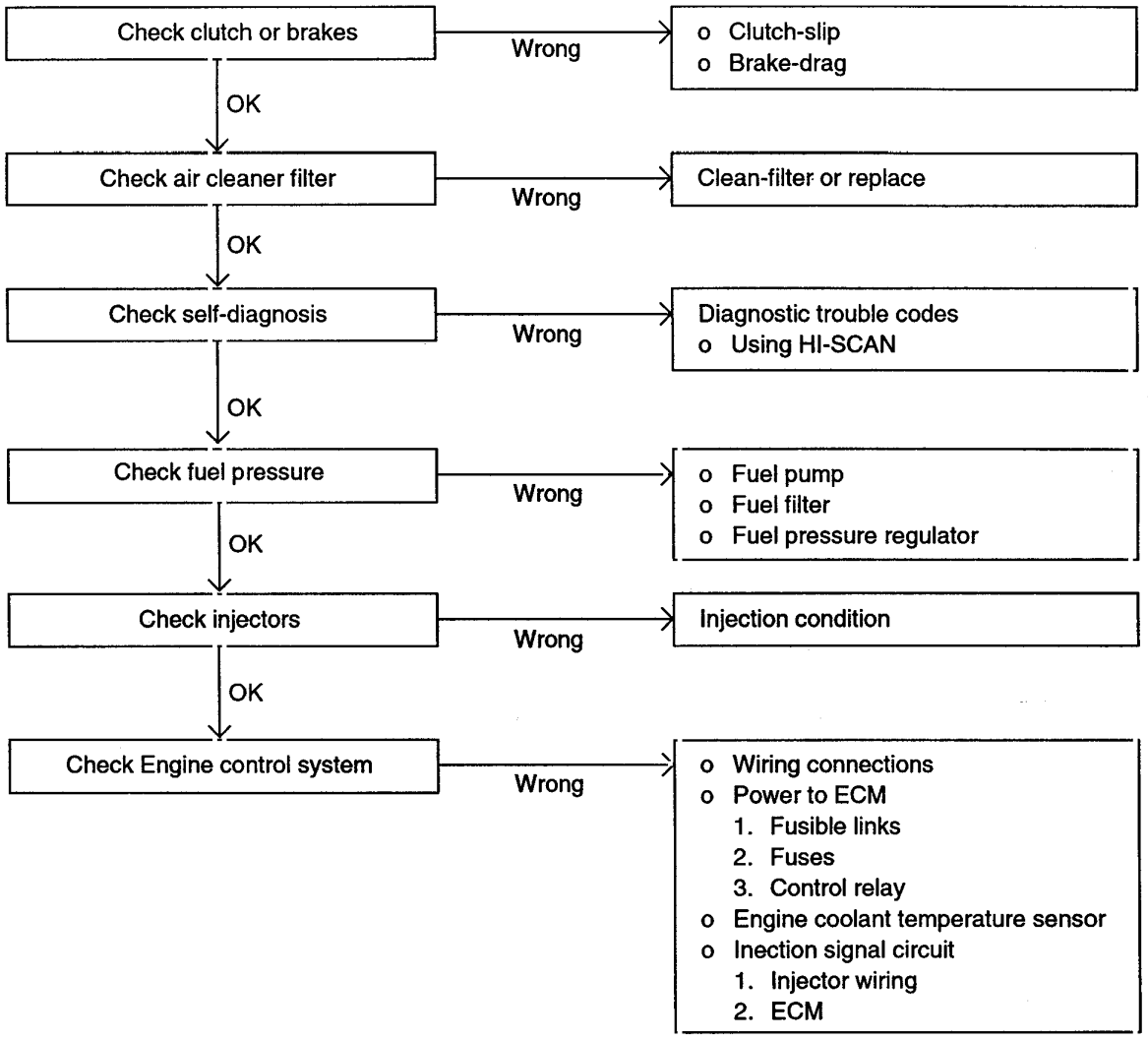
EFDB113A

ROUGH IDLE OR ENGINE STALLS



EFDB114A

ENGINE HESITATES OR ACCELERATES POORLY



EFDB115A

DTC CODES AND CC CODES FOR D-ENGINE

DTC NO.	CC Code	MIL	Description	Ambient Condition
P0601			**EEPROM and configuration**	
	C019		Line : open circuit	Engine speed
	C021		Dataset selection not fit with the EEPROM	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
P0340		O	**CMP/ENGINE SPEED SENSOR-MAL**	
	C002		Signal above upper limit	Engine speed
	C003		General error	Acc. Pedal
	C004		Plausibility error	Fuel Quantity
	C001		Signal below lower limit	Eng. Water temp.
				Syncronization state
P1645			**CAPACITOR 1 VOLTAGE-MAL**	
	C002		Signal above upper limit	Engine speed
	C001		Signal below lower limit	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
P0190		O	**FUEL RAIL P.SENSOR-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
	C003		General error	Fuel pressure
				Rail press. regulator
				Eng. Water temp.
P1181		O	**FUEL PRESSURE MONITORING-MAL**	
	C005		Maximum pressure exceeded	Engine speed
	C006		Minimum pressure at engine speed too low	Fuel Quantity
	C008		DRV sticking	Fuel pressure
	C009		Leakage of Fuel	Rail press. regulator
	C010		Governor deviation at engine speed too high	Eng. Water temp.
P0560			**BATTERY VOLTAGE**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage

DTC NO.	CC Code	MIL	Description	Ambient Condition
P0120		O	**THROTTLE POSI. SENSOR-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
	C003		General error	Eng. Water temp.
	C004		Plausibility error	Brake switch
				Accel pedal sensor 1
P0220		O	**THROTTLE POSI. SENSOR2-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
	C003		General error	Eng. Water temp.
	C004		Plausibility error	Accel pedal sensor 1
				Accel pedal sensor 2
P1639			**MONITORING ADC-MAL**	
	C004		Plausibility error	Engine speed
	C002		Signal above upper limit	Acc. Pedal
	C003		General error	Fuel Quantity
				Eng. Water temp.
				Battery voltage
P0115			**ENGINE COOLANT TEMP.-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
	C004		Plausibility error	Air temp. sensor
				Eng. Water temp.
				Battery voltage
P0180		O	**FUEL TEMP. SENSOR-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
				Air temperature
				Eng. Water temp.
				Battery voltage
P0110			**INT. AIR TEMP. CIRCUIT-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
				Air temperature
				Eng. Water temp.
				Battery voltage

DTC NO.	CC Code	MIL	Description	Ambient Condition
P1170			**ATMOSPHERIC PRESS. SENSOR-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
				Atmospheric press. SNSR
				Air temperature
				Eng. Water temp.
P0100			**AIR FLOW SENSOR CIRCUIT-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Fuel Quantity
	C003		General error	Air mass meter
				EGR actuator
				Atmospheric press. SNSR
P1526			**SENSOR SUPPLY VOLTAGE-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
P1638			**MICROCONTROLLER-MAL**	
	C022		Microcontroller error	Engine speed
	C023		Fuel cut-off monitoring error	Acc. Pedal
	C024		Microcontroller watch-dog error	Fuel Quantity
	C025		Gate array communication error	Eng. Water temp.
				Battery voltage
P0500			**VEHICLE SPEED SENSOR-MAL**	
	C002		Signal above upper limit	Engine speed
	C004		Plausibility error	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Vehicle speed sensor
P0403			**EGR SOLENOID-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
	C010		Governor deviation at engine speed too high	Air mass meter
				EGR actuator
				Atmospheric press. SNSR

DTC NO.	CC Code	MIL	Description	Ambient Condition
P1613			**VOLTAGE(IN ECU) REGULATOR-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
P1635			**WATER HEATER RELAY-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Air temp. sensor
				Eng. Water temp.
				Battery voltage
				Blower switch
P1325			**GLOW RELAY-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Air temp. sensor
				Eng. Water temp.
				Start Bit
				Glow relay
P1629			**GLOW INDICATOR LAMP-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Air temperature
				Eng. Water temp.
				Start Bit
				Glow relay
P0230			**ELECTRIC FUEL PUMP RELAY-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Air temperature
	C004		Plausibility error	Eng. Water temp.
				Start Bit
				Elec. fuel pump relay
P1180			**RAIL PRESSURE REGULATOR-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Acc. Pedal
	C003		General error	Fuel Quantity
				Fuel pressure
				Rail press. regulator

DTC NO.	CC Code	MIL	Description	Ambient Condition
P1622			**A/C RELAY-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Battery voltage
				A/C ON signal switch
				Air-condition relay
P1624			**RADIATOR COOLING FAN-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	A/C Medium switch
				A/C Pressure switch
				Radiator cooling fan
				A/C Condensor fan
P1625			**A/C CONDENSOR FAN-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	A/C Medium switch
				A/C Pressure switch
				Radiator cooling fan
				A/C Condensor fan
P1623			**ENG. CHK LAMP-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Air temp. sensor
				Eng. Water temp.
				Battery voltage
				Eng. CHK lamp
P0703			**BRAKE SWITCH-MAL**	
	C004		Plausibility error	Engine speed
				Acc. Pedal
				Fuel Quantity
				Vehicle speed sensor
				Brake switch
P0704			**CLUTCH SWITCH-MAL**	
	C004		Plausibility error	Engine speed
				Acc. Pedal
				Fuel Quantity
				Vehicle speed sensor
				Clutch switch

DTC NO.	CC Code	MIL	Description	Ambient Condition
P1616			**MAIN RELAY-MAL**	
	C004		Plausibility error	Engine speed
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
				Ignition switch
P1652			**IG SWITCH-MAL**	
	C004		Plausibility error	Engine speed
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
				Ignition switch
P0600			**CAN DIAGNOSIS-MAL**	
	C019		Line : open circuit	Engine speed
				Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Vehicle speed sensor
P1609			**IMMOBILIZER-MAL**	
	C013		Immobilizer line faulty	Engine speed
	C014		Invalid Tester request	Fuel Quantity
	C015		EEPROM faulty-non plausible VSP data	Eng. Water temp.
	C016		Transponder faulty	Immobilizer status lamp
	C017		Smatra faulty	Start Bit
	C026		Authentication not successful	
	C027		EEPROM faulty for KEY ID block & IMMO data block	
P1530			**MAX. VEHICLE SPEED LIMITING-MAL**	
	C003		General error	Engine speed
				Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Vehicle speed sensor
P0203		O	**INJECTOR CIRCUIT MAL-CYL 3**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Eng. Water temp.
				Battery voltage
				Copacitor 1 voltage

DTC NO.	CC Code	MIL	Description	Ambient Condition
P0202		O	**INJECTOR CIRCUIT MAL-CYL 2**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Eng. Water temp.
				Battery voltage
				Copacitor 1 voltage
P0201		O	**INJECTOR CIRCUIT MAL-CYL 1**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Eng. Water temp.
				Battery voltage
				Copacitor 1 voltage
P1653			**ERROR CHECK AFTER IG OFF-MAL**	
				Eneine speed
				Acc. Pedal
				Fuel Quantity
				Eng. Water temp.
				Battery voltage
P1633			**IMMOBILIZER STATUS LAMP-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Eng. Water temp.
				Immobilizer status lamp
				Start Bit
P1634			**CRUISE CONTROL LAMP-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Vehicle speed sensor
				Cruise control lamp
				Cruise control status
				Cruise control quantity
P1660			**CRUISE CONTROL SWITCH-MAL**	
	C001		Signal below lower limit	Engine speed
	C002		Signal above upper limit	Vehicle speed sensor
	C003		General error	Cruise control lamp
	C004		Plausibility error	Cruise control status
				Cruise control quantity

DTC NO.	CC Code	MIL	Description	Ambient Condition
P1190			**INTAKE THROTTLE ACTUATOR-MAL**	
	C018		Line : short circuit	Engine speed
	C019		Line : open circuit	Fuel Quantity
				Air mass meter
				EGR actuator
				Inlet throttle actuator

DIESEL CONTROL SYSTEM

GENERAL EEF23AFB

1. Test drive: Test drive means a certain driving cycle or pattern that includes the ambient conditions when a fault was occured. Before driving, erase the stored fault code with Hi-scan.

2. Limp home mode : ECU switches to limp home mode in the event of failure of the important input/output signals.
   The result is as follows.
   - Reduced power and lower maximum speed.
   - EGR function disabled.

3. Emergency shut off
   For safety reasons, ECU effects emergency shut off of the engine if the following system components fail.
   - Injectors
   - Engine speed sensor
   - Pressure regulator
   - Fuel leakage

4. Attention
   Never work on injection system with engine running or within 30 seconds after shutting off the engine. High pressure pump, rail, injectors and high pressure pipes are subjected to high pressure even after the engine has been switched off.

5. Safety measures
   If it is necessary to run the engine for certain test steps (ex. Call up the actual values at the actuator test), the test equipment is to be set up such that mechanic does not have to be within possible range of high pressure jets when performing test.
   People who are using pacemakers should not be closer than 30cm to ECU or wiring harness within the engine is running, since the high currents in the CR system produce considerable magnetic fields.
   - Acutuator test can be performed only if engine speed is "ZERO".

GENERAL DIAGNOSTICS E2FF0703

ECU : ENGINE CONTROL UNIT

1. Possible DTC

   1) P0601 (Perform and configuration)

   2) P1647(Threshold voltage)

   3) P1639 (Monitoring ADC)
      - CC-CODE: C002
        Check the ground connection from APS ground to ECU pin
        (APS pin #6 - ECU pin #79)
        (APM pin #5 - ECU pin#79)

   4) P1526 (Sensor supply voltage 1 for APS1, AFS)

   5) P1527 (Sensor supply voltage 2, APS2, RPS)
      - Check the short circuit of sensor supply line to GND or Bat. ECU should not be exchanged for these errors.

   6) P1569 (Actual current of pressure regulator valve)

   7) P1638 (Microcontroller)

   8) P1613 (Voltage regulator monitoring of voltage regulator in 2 different tests)

2. If these faults are encountered, cancel the fault memory and perform the test drive. Replace ECU if fault code is stored again.

ECU : CAPACITOR VOLTAGE 1

1. Possible DTC : P1645
   Capacitor in ECU charges for activating the injectors.
   First check the wiring of injectors to ECU.
   Rectify the additionally stored faults. Cancel the fault memory and perform the test drive.
   Replace ECU if fault code is stored again.

CKP : CRANKSHAFT POSITION SENSOR

1. Possible DTC :P0335

2. Actual value for evaluation : Engine warm > 80°C, aircondition off
   - Required idling speed

800 ± 100 rpm

* CC-CODE
- Substitute reaction is performed anyhow.
- NOTE : When excessive engine oil is filled up, for instance 2 times of normal amount, engine can be run more than 6000rpm (i.e. dieseling) in this case error can be memorized but this should be neglected.

1) C004 (Plausibility error)
   - This error is reduntant to DTC340 can occur only if DTC340 CC-Code C004 occurred.
   - Measure the signal rate between present engine speed(k) and previous engine speed(k-1). If the rate is out of the standard, it is detected as an error.
   - Possible causes of trouble:
     a) Contact resistance
     b) CKP defective
     c) Metal abrasion or dirt at sensor
     d) Incorrect installation position or sensor loose
     e) Wheel - CKP sensor

3. Measure the resistance of sensor at the detached plug pin1 to pin 2

650 ~ 1000Ω at 20°

4. Attach the plug.

5. Record the signal profile from pin1 to GND. Engine idling.
   Using oscillocope :
   - CMP signal
   - CKP signal

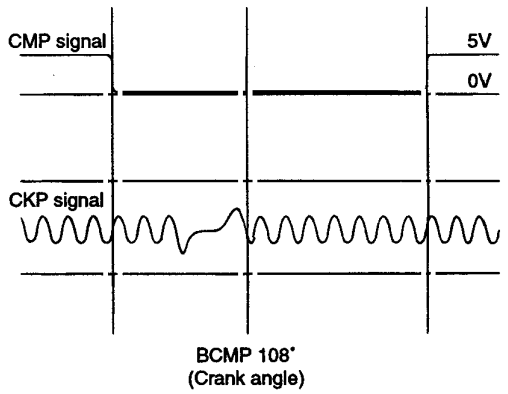
   Wiring check:

ECU	CKP
Pin 69	Pin 1
Pin 100	Pin 2
Pin 101	Pin 3

6. If wiring is OK and signal profile doesn't correspond to set value (Min. 1.65V), check the sensor for dirt (possibly abrasion or some metallic parts), proper installation position and tight fit.
   Measure the gap between sensor wheel and sensor:

1 ± 0.5 mm

Gap cannot be adjusted. Check the sensor wheel for damage.



EFHB201C

CMP : TOP DEAD CENTER SENSOR

1. Possible DTC: P0340
   * CC-CODE

   1) C001 (Signal below the lower limit - No signal)
      - Possible causes of trouble :
        A) Open circuit. Broken line
        B) Short circuit to GND line
        C) CMP sensor defective
        D) Incorrect installation position or sensor loose

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) CMP sensor defective
        B) Inteference on signal line from other component (Alternator, Injector lines)

   3) C003 (General error)
      - 2 time turns of camshaft signal are exceed the upper or lower window limit of camshaft set signal, then error is detected.
      - Possible causes of trouble:
        A) CMP sensor defective
        B) Incorrect installation position or sensor loose
        C) Air gap between sensor to sensing wheel is too wide

4) C004 (Plausibility error)
   - When the limit between angular velocity of crankshaft signal sensing stubs and frequency multiplier of inner ECU is exceed the set value, error is detected.
   - Possible causes of trouble:
     A) Contact resistance
     B) CMP sensor defective
     C) Incorrect installation position or sensor loose
     D) Camshaft and crankshaft misarrangement
     E) Inteference on signal line from other component (Alternator, Injector lines)

2. Measure the supply voltage of sensor pin 3 to pin 1

Set value : 8 ~ 15V

3. Use an oscilloscope to record signal profile from pin2 to GND. Engine idling.

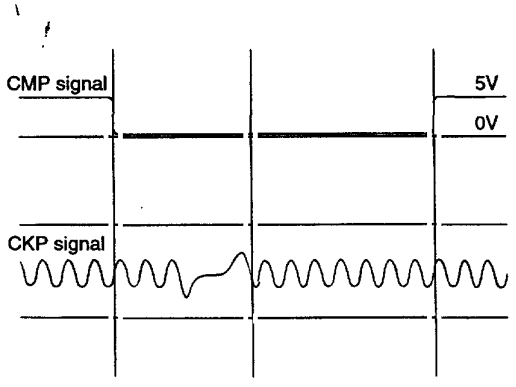
Set value : Square wave (5V)

CMP signal
CKP signal

4. Check wiring if CMP sensor signal is not OK.
Wiring check:

ECU	CMP
Pin 104	Pin 1
Pin 103	Pin 2
B (+)	Pin 3

5. Check the camshaft and crankshaft arrangement if applicable at the present of CKP and CMP signal.



EFHB201C

RPS : RAIL PRESSURE SENSOR

1. Possible DTC: P0190
Actual value for evaluation : Engine warm at approx. 80°C. Engine idling.

Set value : 220 ~ 300 bar
Typical value : 260 bar

Rail pressure in limp home mode (fault state) :

Approx. 400 bar

Vehicle can be driven in limp home mode.

* CC-CODE

1) C001 (Signal below the lower limit- No signal)
   - Possible causes of trouble:
     A) Open circuit, contact resistance, or short circuit to GND line
     B) RPS defective
     C) ECU - sensor supply voltage 2 : DTC1527 C001

2) C002 (Signal above the upper limit)
   - Possible causes of trouble:
     A) Short circuit to Bat(+) line
     B) RPS defective
     C) ECU - sensor supply voltage 2 : DTC1527 C002

3) C003 (General error)
Rail pressure sensor error is determined by comparison of rail pressure regulator operation current value to rail pressure sensor output.
   - Possible causes of trouble:
     A) Short circuit to Bat(+) line or to GND
     B) ECU - sensor supply voltage 2 : DTC1527
     The CC-Code from this error reports the error source.

2. Measure the supply voltage of RPS with ignition on.
Pin 3(+) to pin 1(-)

Set value : 4.5 ~ 5.5V

3. Signal voltage measurement
If supply voltage set value is attained, measure the voltage from pin 2 to GND with ignition on.

Set value : Approx. 0.5V
Engine idling set value : 1V
Voltage increases with increasing pressure : Max. 4.5V

4. If set values are attained : Ignition off, pull off the plug of control unit and sensor. Then check the following wiring for open/ short circuit.

ECU	CMP
Pin 90	Pin 3
Pin 91	Pin 2
Pin 92	Pin 1

5. If the signal voltage set value is not attained, replace RPS.

6. Note the followings

   1) Always renew the sealing washer (soft iron sealing ring) even if the old sensor is re-used

   2) When removing seal, take care not to damage sealing surface.

   3) When installing RPS, apply sealing washer with grease if necessary.

   4) Replace the faulty fuel rail assembly in case of new model vehicle within a year, or replace the faulty parts of vehicle of which model year is more than a year.

Tightening torque : 35 ± 2Nm

RAIL PRESSURE MONITORING

1. Possible DTC: P1181

2. Actual value for evaluation: Conform actual value of RPS

   * CC-CODE

   1) C005 (Max. pressure excceed)
      C008 (Actuator sticks in closed position)
      - Possible causes of trouble :
        A) Rail pressure sensor (RPS) defective
        B) Pressure regulator valve defective
        C) Injectors defective
        D) High pressure pump defective

   2) C006 (Min.pressure at low engine speed)
      C009 (Leakage), C010 (Governor deviation at high engine speed)
      - Possible causes of trouble :
        A) Rail pressure sensor (RPS) defective
        B) Pressure regulator valve defective
        C) Injectors defective
        D) High pressure pump defective
        E) Leakage

3. Any additionally stored faults are to be rectified first. Cancel the fault memory and then perform the test drive. Start by checking above-mentioned components if fault code is stored again.

4. Visually check the pipes, rail and connections for leakage.

5. Check the low pressure circuit.
   - Possible causes of trouble: Leakage, fuel filter clogged, electric fuel pump

   1) Connect the pressure gauge between fuel filter and high pressure pump. Ignition on. Fuel pump delivery for 30 seconds.

Pressure > 3.5 bar

Opening pressure at overflow valve of fuel filter is too high Replacle the valve

Pressure < 1.5 bar

Block the hose between overflow valve and return flow collector

Pressure > 3.5 bar

Overflow valve defective

Pressure < 3.5 bar

Check the electric fuel pump

   2) Connect the pressure gauge to the entire return fuel line toward the tank
      Ignition on. (High pressure pump delivery)

Pressure < 1 bar : Return line clogged

   3) Connect the pressure gauge to upstream of filter
      Ignition on. (High pressure pump delivery)

Pressure < 2.8 bar : Filter or inlet clogged

6. Check the high pressure circuit
   - Possible causes of trouble: Leakage, rail pressure sensor, regulator, injectors, high pressure pump

   1) Visually inspect for leakage and check all connectors

   2) Block the fuel return line of function block

   3) Pull off the electric connector of all injectors. Connect the self-diagnosis tester (HI-SCAN)

   4) Ignition on. Operate starting motor for 5 seconds

Actual value read out : Rail pressure
Actual value < 150 bar :
High pressure pump defective

BATTERY VOLTAGE

1. Possible DTC: P0560

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Open circuit in wiring / Short circuit to GND line
        B) Contact resistance
        C) Fuse defective
        D) Plug contacts
        E) Main relay
        F) Battery defective
        G) Alternator charge defective

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) 24V battery connected
        B) Alternator over-charging

   3) C004 (Plausibility error)
      - Possible causes of trouble :
        A) Rail pressure sensor defective
        B) Pressure regulator valve defective
        C) Battery defective

2. Check ECU plug and wiring plug contact condition.

3. After ignition on, check the supply voltage of ECU pin 4 to GND and of ECU pin 5 to GND.

Set value : 8 ~ 15V

4. If set value is not attained, check the main relay of pin 30 to GND.

Set value : 8 ~ 15V

5. If set value is not attained, check fuses.

6. Measure the supply voltage of ECU pin 13 to GND

Set value : 8 ~ 15V

7. Check GND wires from ECU pin 1,2,3 for open and short circuit.

8. Check the battery voltage

9. Check the alternator charge condition

APS : ACCELERATION POSITION SENSOR 1

1. Possible DTC: P0120 (Accel position sensor 1)
   Actual value for evaluation : Ignition on

Idle set value : 0%
Full throttle : 100%

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Short circuit to GND line
        B) APS defective
        C) ECU defective (Sensor supply voltage): DTC P1526 C001

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) Short circuit to Bat line
        B) APS defective
        C) ECU defective (Sensor supply voltage): DTC P1526 C002

   3) C003 (General error)
      Possible causes of trouble :
      - Possible causes of trouble :
        A) ECU defective (Sensor supply voltage): DTC P1526

   4) C004 (Plausibility error with brake signal)
      When depressing accel pedal (not at idle), brake switch signal is shown "ON" for a certain time, error is detected.
      - Possible causes of trouble :
        A) Brake switch defective
        B) APS defective
        C) ECU defective (Sensor supply voltage); DTC P1526

2. Check the sensor supply voltage with ignition on.
   Sensor 1: Pin 2(+) and pin 3(-), Sensor 2 : Pin 1 (+) and pin 5(-) (with APM)

Set value : 4.5 ~ 5.5V

   Sensor 1: Pin 4(+) and pin 5(-), Sensor 2 : Pin 1 (+) and pin 6(-) (with APM)

Set value : 4.5 ~ 5.5V

3. If set value is not attained: Ignition off. ECU and sensor plug off. Check wiring for short or open circuit. Check the following wiring.

ECU	APS 1
Pin 76	Pin 5
Pin 77	Pin 2
Pin 78	Pin 4

4. If connecting leads are OK, measure the signal voltage of sensor.

Pin 4(+) and Pin 3(-) set value At idle : 0.6 ~ 0.9V At full throttle : 3.6 ~ 4.6V

APS : ACCELERATION POSITION SENSOR 2

1. Possible DTC: P0220 (Accel position sensor 2)

2. Actual value for evaluation : Ignition on

Idle set value : 0% Full throttle : 100%

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Short circuit to GND line
        B) APS defective
        C) ECU defective (Sensor supply voltage): DTC P1527 C001

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) Short circuit to Bat line
        B) APS defective
        C) ECU defective (Sensor supply voltage): DTC P1527 C002

   3) C003 (General error)
      APS sensor operation power error (ECU)
      - Possible causes of trouble :
        A) ECU defective (Sensor supply voltage): DTC P1527

   4) C003 (Plausibility error with brake signal)
      When comperative value between accel pedal sensor signal and accel pedal sensor signal 2 exceed the set deviation, error is detected.
      - Possible causes of trouble :
        A) APS defective
        B) ECU defective (Sensor supply voltage): DTC P1527

3. Check the voltage supply of sensors with ignition on
   Sensor 1: Pin 2(+) and pin 3(-), Sensor 2 : Pin 1 (+) and pin 5(-) (with APM)

Set value : 4.5 ~ 5.5 V

   Sensor 1: Pin 4(+) and pin 5(-), Sensor 2 : Pin 1 (+) and pin 6(-) (with APS)

Set value : 4.5 ~ 5.5V

4. If set value is not attained: Ignition off. ECU and sensor plug off.
   Check wiring for short or open circuit.
   Check the following wiring.

ECU	APS 1
Pin 79	Pin 6
Pin 80	Pin 5
Pin 81	Pin 1

5. If connecting leads are OK, measure the signal voltage of sensor.

Sensor 2 : Pin 6(+) and Pin 5(-) set value
At idle : 0.25 ~ 0.6V
At full throttle : 1.6 ~ 2.5V

WTS : WATER TEMPERATURE SENSOR

1. Possible DTC: P0115
   Actual value for evaluation: Set value, approx. 80°C (with engine warm)

   Evaluation display :

   A temperature reading < -40°C indicates an open circuit in the signal line
   A temperature reading > 120°C indicates a short circuit to GND in the signal line

   NOTE

   Radiator fan starts up if temperature sensor is defective or plug pulled off.

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Short circuit to GND line
        B) Contact resistance
        C) WTS defective
        D) ECU defective

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) Short circuit to Bat(+) line, open circuit in wiring
        B) WTS defective
        C) ECU defective

   3) C004 (Plausibility error)
      After ignition on, cooling water temperature is not arrived at the set value within set time, error is detected.
      - Possible causes of trouble :
        A) Contact resistance
        B) WTS defective
        C) ECU defective
        D) Thermostat defective

2. Measure the resistance of sensor at pin 1 (+) and pin 3 (-)

Set value at 0 ~ 40°C : 1.1 ~ 5.8kΩ
Set value at 60 ~ 100°C : 180 ~ 590Ω

3. Repeat the measurement directly at sensor if set values are not attained.

4. If set values are attained at sensor, check wiring from ECU pin 84 and pin 85 to sensor.

FTS : FUEL TEMPERATURE SENSOR

1. Possible DTC: P0180

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble:
        A) Short circuit to GND line
        B) Contact resistance
        C) FTS defective
        D) ECU defective

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble:
        A) Short circuit to Bat(+) line, Open circuit in wiring
        B) WTS defective
        C) ECU defective

2. Measure the resistance of sensor at pin 1 (+) and pin 2 (-)

Set value at 0 ~ 40°C : 1 ~ 7kΩ
Set value at 70 ~ 90°C : 390 ~ 240Ω

3. Repeat the measurement directly at sensor if set values are not attained.
   If set values are attained at sensor, check wiring from ECU pin 82 and pin 83 to sensor.

ATS : AIR TEMPERATURE SENSOR

1. Possible DTC: P0110 (Air temperature sensor)

   Air temperature sensor is integrated into HFM5. Actual value for evaluation: Set value., Ambient temperature

   Evaluation display:

A temperature reading < -40°C indicates an open circuit in the signal line A temperature reading > 120°C indicates a short circuit to GND in the signal line

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Short circuit to GND line
        B) Contact resistance
        C) HFM5 defective
        D) ECU defective

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble:
        A) Short circuit to Bat line, Open circuit in wiring
        B) ATS in HFM5 defective
        C) ECU defective

2. Measure the resistance of temperature sensor at the detached ECU plug.

Set value at 0 ~ 30°C : 1.5 ~ 6kΩ Set value at approx. 50°C : 750 ~ 920kΩ

3. If set values are not attained , repeat the measurement at temperature sensor in air flow sensor pin 1 to pin 3.
   If set values are attained at sensor, check wiring from ECU pin 86 to sensor pin 1 and ECU pin 88 to sensor pin 3.

4. Replace HFM5 if set value is not attained at air temperature sensor.

APS : ATMOSPHERIC PRESSURE SENSOR

1. Possible DTC: P1170

Set value : Atmospheric pressure tolerance : +/-30hPa

   Possible actual value : approx. 1000hPa at sea level

   NOTE

   Atmospheric pressure sensor is located in ECU

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal), C002 (Signal above the upper limit)
      Possible causes of trouble: Defective atmospheric pressure sensor in ECU

2. Call up the actual values

3. Cancel the fault memory and perform the test drive

4. Replace ECU if fault memory cannnot be cancelled or if fault is set again.

HFM5 (AIR FLOW SENSOR)

1. Possible DTC: P0100 (Air flow sensor)

   Actual value for evaluation: Engine idling, or enine warm at approx.80°C

Set value : 450 ~ 510mg/stroke (without EGR) 280 ~ 360MG/STROKE (without EGR)

   * CC-CODE

   1) C001 (Signal below the lower limit- No signal)
      - Possible causes of trouble :
        A) Short circuit to GND line or Open circuit in wiring
        B) Contact resistance
        C) HFM5 defective
        D) ECU defective (Sensor supply voltage) : DTC P1526 C001

   2) C002 (Signal above the upper limit)
      - Possible causes of trouble :
        A) Short circuit to GND line or Open circuit in wiring
        B) HFM5 defective
        C) ECU defective (Sensor supply voltage) : DTC P1526 C002

3) C003 (General error)
Sensor operation power (from ECU) error
- Possible causes of trouble :
  A) Open circuit in wiring / short circuit
  B) ECU defective (Sensor supply voltage)

2. Check the HFM5 supply voltage

Pin 2 - GND / Pin 2 - Pin 3 : 8 ~ 15V
Pin 4 - GND / Pin 4 - Pin 3 : 4.5 ~ 5.5V

3. If set values are not attained : Ignition off, pull off ECU plug.
Check the following wiring

ECU	Sensor
Pin 97	Pin 2, Pin 4
Pin 89	Pin 5
Pin 88	Pin 3

4. Measure the signal voltage of sensors if connecting leads are OK.

5. Measure the voltage of plug pin 5 to pin 3 at idle.

Set value (engine warm) : 1.7 ~ 2.2V
Throttle burst set value : Voltage increases

6. Replace HFM5 if signal voltage set values are not attained.

VEHICLE SPEED SIGNAL

1. Possible DTC : P0500

* CC-CODE

1) C001 (Signal below the lower limit- No signal)
- Possible causes of trouble :
  A) Interference from other component
  B) Vehicle speed sensor defective

2) C004 (Plausibility error)
While injection fuel and engine rpm is supported by above the upper limit, if vehicle speed is below the set value error is detected.
- Possible causes of trouble :
  A) Clutch switch defective
  B) Vehicle speed sensor defective

2. Check wiring between ECU pin 49 and vehicle speed sensor.

SOLENOID VALVE FOR EGR VALVE

1. Possible DTC : P0403

* CC-CODE

1) When feedback governing exceeds the set value in comparison of aim value with the actual value.
- Possible causes of trouble :
  A) Solenoid valve sticks
  B) Vacuum source/ pipe/ hose

2) C018 (Line : Short circuit)
- Possible causes of trouble :
  A) Short circuit to Bat line, Open circuit in wiring

3) C019 (Line : Open circuit)
- Possible causes of trouble :
  A) Short circuit to GND line

2. Check wiring between ECU pin 16 and solenoid valve.

3. Check wiring between supply voltage line and solenoid valve.

4. Check for leaks in vacuum hose to EGR valve and solenoid valve.

5. Pull off the plug of solenoid valve, measure the resistance of solenoid valve.

Set value : 14 ~ 17Ω

6. Measure the frequency of control voltage :

300 Hz

7. Check whether vacuum is provided by vacuum source.
Check mode : Keep engine at 1500rpm for 20 seconds and then conduct the measurement as it is.

Set value > 650 mmHg

8. Pull off the vacuum hose from EGR valve.
Check for presence of vacuum.

9. Check the mechanical components of solenoid valve if vacuum is present but engine speed does not change.

10. If valve stick is in closed position or C019 occurs, then black smoke arises.

ADDITIONAL WATER HEATER

1. Possible DTC : P1635

   * CC-CODE

   1) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line, Open circuit in wiring
        B) Fuse defective
        C) Open circuit. Contact resistance
        D) Additional water heater relay defective

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line, Open circuit in wiring
        B) Fuse defective
        C) Contact resistance
        D) Additional water heater relay defective

2. Measure the voltage at relay pin 85 to GND.

Set value :
8 ~ 15V (OFF)
0V (ON)

3. Check the additional water heater relay wiring

4. Measure the supply voltage at relay pin. 87 to GND.

Set value : 8 ~ 15V

5. Check the additional water heater relay wiring

6. Check wiring between ECU pin 23 and additional water heater relay.

7. If wiring and fuse is OK, replace the additional water heater relay.

NOTE

FO vehicle of which mounting combustive heater reveals the above trouble code normally. So please ignore the code.

GLOW RELAY AND GLOW LAMP

1. Possible DTC: P1325 (Glow relay) P1329 (Glow indicator lamp)

   * CC-CODE

   1) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line, open circuit
        B) Fuse defective
        C) Contact resistance
        D) Glow time control
        E) Glow plug indicator lamp

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to GND line
        B) Fuse defective
        C) Contact resistance
        D) Glow time control
        E) Glow plug indicator lamp

NOTE

Golw plug idicator lamp lights briefly for self test when Ignition switch is turned on.

2. Activate the lamp by way of actuator diagnosis.
   If check lamp does not flash: Check the fuse.
   Check glow lamp wiring.

3. Activate the lamp by way of actuator diagnosis.
   If relay is not switched : Check the fuse.
   Measure the supply voltage at relay pin. 2 to GND.

Set value : 8 ~ 15V

Check glow lamp wiring.
Measure the supply voltage at relay pin. 3 to GND.

Set value : 8 ~ 15V

Check glow lamp wiring.

4. If wiring and fuse is OK, replace the glow relay.

5. After replace the glow relay, perform the test again.

EFP : ELECTRIC FUEL PUMP

1. Possible DTC : P0230

   * CC-CODE

   1) C004 (Plausibility error)
      After run mode or fuel cut off mode, if rail pressure does not drop below the set value within set time, error is deteced.
      - Possible causes of trouble :
        A) Contact resistance
        B) EFP relay defective
        C) EFP defective

   2) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line, open circuit in wiring
        B) EFP relay defective
        C) EFP defective

   3) C019 (Line : Open circuit)
      When EFP runs for a second or longer and ignition switch is turned on :
      Line to EFP relay was short circuit to GND.
      Measure the sensor resistance of pin 1 (+) and pin 2 (-).
      - Possible causes of trouble :
        A) Short circuit to Bat line, Open circuit in wiring
        B) Contact resistance
        C) EFP relay defective
        D) EFP defective
        E) ECU power stage short circuited

2. EFP runs for approx. 1 second after switching on ignition. (Delivery noise can be heard)

3. Check the fuse in engine compartment if EFP does not run.

4. Ignition off. Check wiring between ECU pin 24 and EFP relay pin 86.
   Jump pin 30 and pin 87 at relay frame with fused measurement lead.
   Ignition on. EFP must run for apporx. 1 second.

5. Replace the relay if EFP runs.

6. Check the supply voltage of EFP.
   Voltage is applied to EFP for approx. 1 second when ignition switch is turned on.

Set value : 8 ~ 15V

7. Replacle the EFP if set value is attained

PRV : PRESSURE REGULATOR VALVE

1. Possible DTC: P1180
   Feature: Depending on the rail pressure to be set, PRV is actuated by ECU with a PWM (Pulse with modulated).

2. When PRV is replaced

Tightening torque : 5 ± 1Nm

   • Replace the faulty fuel rail assembly in case of new model vehicle within a year, or replace the faulty parts of vehicle of which model year is more than a year.

   * CC-CODE

   1) C003 (General error)
      After run mode or fuel cut off mode, if rail pressure does not drop below the set value within set time, error is deteced.
      - Possible causes of trouble :
        A) Short circuit
        B) Contact resistance
        C) PRS defective
        D) EFP relay continuously active
        E) Pressure regulator valve defective
        F) High pressure pump
        G) ECU

   2) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line, Open circuit in wiring
        B) WTS defective

   3) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to GND line, Open circuit

3. Pull off PRV plug
   Check wiring between ECU pin 108, pin 109 and PRV.

4. Measure the resistance of PRV

Approx. set value : 2.3 ± 0.23Ω

5. Check RPS if preceding test is OK.

6. Examine the system for leaks if rail pressure sensor is OK.

7. Check the high pressure circuit

   1) Visually inspect for leakage and check all connectors.

   2) Block the fuel return line of the function block.

   3) Pull off the electirc connector from all injectors and connect the self diagnosis tester (HI-SCAN).

   4) Ignition on, and operate starting motor for 5 seconds.
      - Actual value read out : Rail pressure
      - Actual value < 100 bar : High pressure pump defective or air in the system

A/C COMPRESSOR RELAY

1. Possible DTC : P1622

   * CC-CODE

   1) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line
        B) A/C compressor relay defective

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to GND line, Open circuit
        B) A/C compressor relay defective
        C) Pressure switch defective
        D) A/C compressor magnetic clutch

2. Ignition on
   Measure the voltage at compressor relay (A/C compressor) pin 86 to GND.

Set value : 8 ~ 15V

3. If set value is not attained , check the fuse

4. Measure the voltage at compressor relay (A/C compressor) pin 30 to GND.

Set value : 8 ~ 15V

   If set value is not attained, check the supply voltage.

5. Check wiring from compressor relay pin 87 to plug of compressor.
   Check wiring between relay pin 85 to ECU pin 21.

6. Check wiring between pressure switch to ECU pin 51, pin 52.

7. Check A/C compressor magnetic clutch if proceeding tests do not reveal the cause of trouble.

COOLING FAN

1. Possible DTC : P1624 P1625

   * CC-CODE

   1) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line
        B) Fuse defective
        C) Relay defective
        D) Resistance continuity defective
        E) Fan motors defective

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to GND line, Open circuit
        B) Fuse defective
        C) Relay defective
        D) Series resistors defective
        E) Fan motors defective

   The fan relays are in 3 kinds

   The first relay (FAN 1): Speed 1 (both fans)
   The second and thrid relays : Speed 2 (each fan)

   Fan speed 1 :

   Measure the supply voltage at relay pin 85 to the ground with ignition on.

Set value : 8 ~ 15V

   Check the fuse, if set value is not attained.
   Ignition off.
   Check wiring between ECU pin 20 and relay pin 85 if wiring is OK, check the relay.

2. Measure the series resistances.

3. If fans do not start up despite actuation, check the fuse.

4. Measure the resistance of wiring between relay pin 87 and GND.

5. Fan speed 2
   Additional checks.
   Measure the supply voltage of relays pin 85 to GND with ignition on.

Set value : 5 ~ 15V

6. Ignition off
   Check wiring of relays pin 86 to ECU PIN 19.
   Check wiring of relays pin 87 to GND.

ENGINE CHECK LAMP

1. Possible DTC :P1623

   * CC-CODE

   1) C018 (Line : Short circuit)
      - Possible causes of trouble :
        A) Short circuit to Bat line

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) Short circuit to GND line, Open circuit

2. Perform the actuator diagnosis.

3. If lamp does not flash, measure the supply voltage at engine check lamp to GND with ignition on.

Set value : 8 ~ 15V

4. Check the fuse if set value is not attained.
   Check the actuation lead of fault lamp.
   Check wiring between engine check lamp and ECU pin 110 for open circuit and short circuit.
   Lamp is defective if all preceding tests are OK.

BRAKE SWITCH

1. C004 (Plausibility error)

   * CC-CODE

   1) C004 (Plausibility error)
      After ignition on, brake signal 1, and signal 2 are different each other, error is detected.
      Without being concerned with brake signal 1, if only brake signal 2 is turned on continuously for set time, error is detected.
      - Possible causes of trouble :
        A) Open circuit in wiring , Short circuit
        B) Fuse defective
        C) Poor connection
        D) Switch defective

   2) Brake switch 1
      Measure the supply voltage at switch pin 2 to GND with ignition on.

Set value : 8 ~ 15V

   Check the fuse if set value is not attained.

2. Ignition off
   Measure the supply voltage at the detached plug. Depress the brake.

3. Check wiring between switch pin 1 and ECU pin 59.

   Brake switch 2 (Redundant brake switch)

   Measure the supply voltage at switch pin 4 to GND with ignition on.

Set value : 8 ~ 15V

   Check the fuse if set value is not attained.

4. Ignition off
   Measure the resistance of switch at the detached plug.
   Depress the brake.

5. Check wiring between switch pin 3 and ECU pin 4.

CLUTCH SWITCH

* MT vehicle Only

1. Possible DTC: P704

   * CC-CODE

   1) C004 (Plausibility error)
      Without changing of clutch signal, if vehicle speed is above the set value , error is detected.
      - Possible causes of trouble :
        A) Open circuit in wiring, Short circuit
        B) Fuse defective
        C) Poor connection
        D) Switch defective

   2) Measure the voltage at switch pin (ECU side) to GND with ignition on.

Set value : 8 ~ 15V

2. Check wiring if set value is not attained.

   Ignition off

   Measure the resistance of switch at the detached plug.

Set value : ---- > 1 MΩ

   Depress the clutch pedal.

Set value : 0 ~ 1Ω

3. Check wiring between switch and ECU pin 61.

4. Clutch disengage
   Clutch engage // Signal on

MAIN RELAY

1. Possible DTC: P1616

   * CC-CODE

   1) C004 (Plausibility error)
      Without changing of ignition switch position "ON" → "OFF", If main relay is turned off, error is detected.
      Before ECU is shut off, if ignition switch and main relay are turned off, error is detected
      - Possible causes of trouble :
        A) Open circuit in wiring, Short circuit
        B) Contact resistance
        C) Fuse defective
        D) Main relay defective

2. After ignition on, check the supply voltage of ECU pin 4 to GND and ECU pin 5 to GND.

Set value : 8 ~ 15V

3. If set value is not attained , check wiring an fuses.

4. If wiring and fuses are OK, replace the main relay.

IGNITION SWITCH

1. Possible DTC : P1652

   * CC-CODE

   1) C004 (Plausibility error)
      After ignition off, if ignition switch signal keeps "OFF" continuously, error is detected.
      - Possible causes of trouble :
        A) Open circuit in wiring, Short circuit
        B) Contact resistance
        C) Fuse defective
        D) Switch defective

2. Measure the voltage at switch from ECU pin 58 to GND with ignition on.

Set value : 8 ~ 15V

Check wiring and fuse if set value is not attained.
Ignition off
Measure the resistance of switch at the detached plug.

MAXIMUM VEHICLE SPEED LIMITATION

1. Possible DTC: P1530

   1) C003 (General error)
      In comparision of maximum vehicle speed set value with actual vehicle speed , if it exceeds set value, error is detected.
      - Possible causes of trouble :
        A) Vehicle speed sensor defective
        B) ECU defective

2. Check wiring between ECU pin 49 and vehicle speed sensor.

INJECTOR

1. Possible DTC:
   - P0201 (Sylinder #1 Injector)
   - P0202 (Sylinder #2 Injector)
   - P0203 (Sylinder #3 Injector)

   * CC-CODE

   1) C018 (Line : Short circuit)
      Engine can be severely damaged due to continuous fuel injection.
      - Possible causes of trouble :
        A) Short circuit of high side line to Bat
        B) Shrot circuit of low side line to GND
        C) Injectors
        D) Injector voltage (ECU)

   2) C019 (Line : Open circuit)
      - Possible causes of trouble :
        A) High side line or low side line broken
        B) Contact resistance
        C) Injectors
        D) Injector voltage (ECU)

2. Ignition off. Check wiring between ECU and injectors.

	Injector 1 / ECU	Injector 2 / ECU	Injector 3 / EUC
Pin No.	1 / 114 2 / 117	1 / 121 2 / 118	1 / 120 2 / 118

Measure the resistance of injectors with plug disconnected.

Set value : 0.3 ~ 0.6Ω (at room temperature)

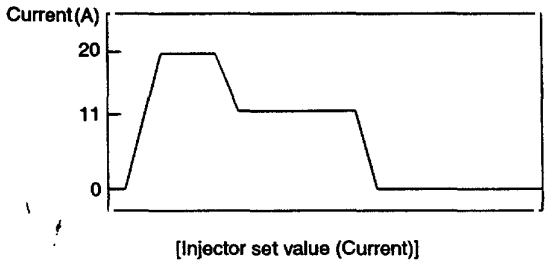
3. Check the actuation of injectors with clip- on ammeter of Motortester.
   Clip-on ammeter must satisfy the following conditions.

Measuring range > 25A Bandwidth > 100 kHz

4. Attach the plug to injector
   Fasten clip-on ammeter around lead to pin 2 of corresponding injector.
   Allow the engine to idle. Set value : Refer to the following Fig. Injector set value(current) on next page.

   NOTE
   - *Length of holding current phase (Max. 12A) is governed by engine speed, injection time, and changes on acceleration.*
   - *The first current curve shows the pre-injection.*

5. Check whether injector injects fuel. To do so, pull off the injector plug in each case and connect to replacement injector.
   If change to engine running results, injector is injecting.
   If no change to engine running results injector is not injecting.
   This test cannot however establish whether an injetor is injecting correct quantity.
   If necessary, all injectors have to be replaced.



[Injector set value (Current)]

EFHB201D

AFTER RUN TEST

1. After run test conditions
   1) Ignition switch : "ON" → "OFF".
   2) Engine rpm is within set value.
   3) Actual vehicle speed is below the set value.
   4) Rail pressure sensor and vehicle speed sensor is OK.

2. Possible DTC: P1653
   - When energizing time is "0" after run test mode, if engine rpm is not below the set value within set time , error is detected.
   - When injector power stage is shut off, if engine rpm is not below the set time within set time, error is detected.
   - Possible causes of trouble :
     A) Open circuit in wiring, or Short circuit
     B) Poor connection
     C) ECU

   Several tests are implemented in ECU after switching off the Ignition.

   This fault entry occurs if ECU detects any faults during these tests.

3. Start by rectifying any other stored faults.
   Then cancel the fault memory and perform the test drive.

4. Measure the supply voltage at ECU pin 114 (Cylinder #1 injector) to ECU Pin 117 and ECU pin 120 (Cylinder # 3 injector), pin 121 (Cylinder # 2 injector) to ECU Pin 118 with ignition off.

Set value : 0V

   Check wiring if set value is not attained.

5. If wiring is OK , replace ECU.

REMOVAL AND INSTALLATION OF INJECTOR

ATTENTION

- Fuel system is subject to extremely high pressure (1350 bar).
- Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
- Always pay attention to safety precautions.
- Ensure the absolute cleanliness.
- Never remove the injectors.

1. Removal
   1) Disconnect the negative battery (-) terminal.
   2) Pull off the injector electric connector.
   3) Unfasten the high pressure pipe at rail and injector.
   4) Press in clip to back leak rail by hand and pull out back leak rail.
   5) Attach the connection of back leak rail. Never fit without clip.
   6) Remove the copper sealing ring.
2. Before re-installing injector, clean the cylinder head bore and sealing surface.
   1) Insert the brush.
   2) Clean the sealing surface and blow out.
3. Installaion
   1) Insert a new copper sealing ring (if necessary, apply small quantity of grease to bond it to injector).
   2) Install the injector (do not touch the nozzle tip) and sliding clamp with clamp bolt.
   3) Screw the clamp bolt .

Tightening torque : 2.7 ± 0.2 kg·m

   4) Install the high pressure pipes.

Tightening torque : 1.8 ~ 2.3 kg·m

- When mounting the high pressure pipes, fix the hexagon component of high pressure fuel injection parts not to squeeze heavily the high pressure fuel injection parts.

   5) Attach the connection of back leak rail. Never fit without clip.
   6) Check the tightness of back leak rail by tugging it.
   7) Attach the electric connector.
   8) Re-connect the negative battery(-) terminal.
   9) Start the engine and check the high pressure circuit for leaks.
4. Read out the fault memory and cancel the faults stemming from the detached injector plug.

HIGH PRESSURE PUMP

ATTENTION

1. Fuel system is subject to extremely high pressure (1350 bar).
2. Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
3. Always pay attention to safety precautions.
4. Ensure the absolute cleanliness.

INSTALLATION

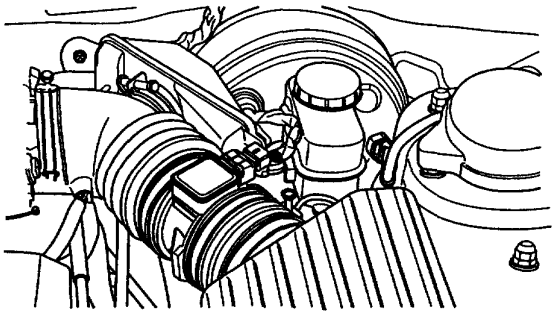
1. Insert the coupling into the pump.
2. Lightly apply the grease to O-ring and install the pump in cylinder head. At this time, turn the pump until the shaft stub of the pump engages the camshaft.
3. Apply the medium- strength screw locking compound to the bolt threads.
4. Install the retaining bolts with washers and tighten to

1.3 ~ 1.8 kg·m

5. Install the high pressure pipe

1.8 ~ 2.3 kg·m

AIR FLOW SENSOR (MAF AND IAT)

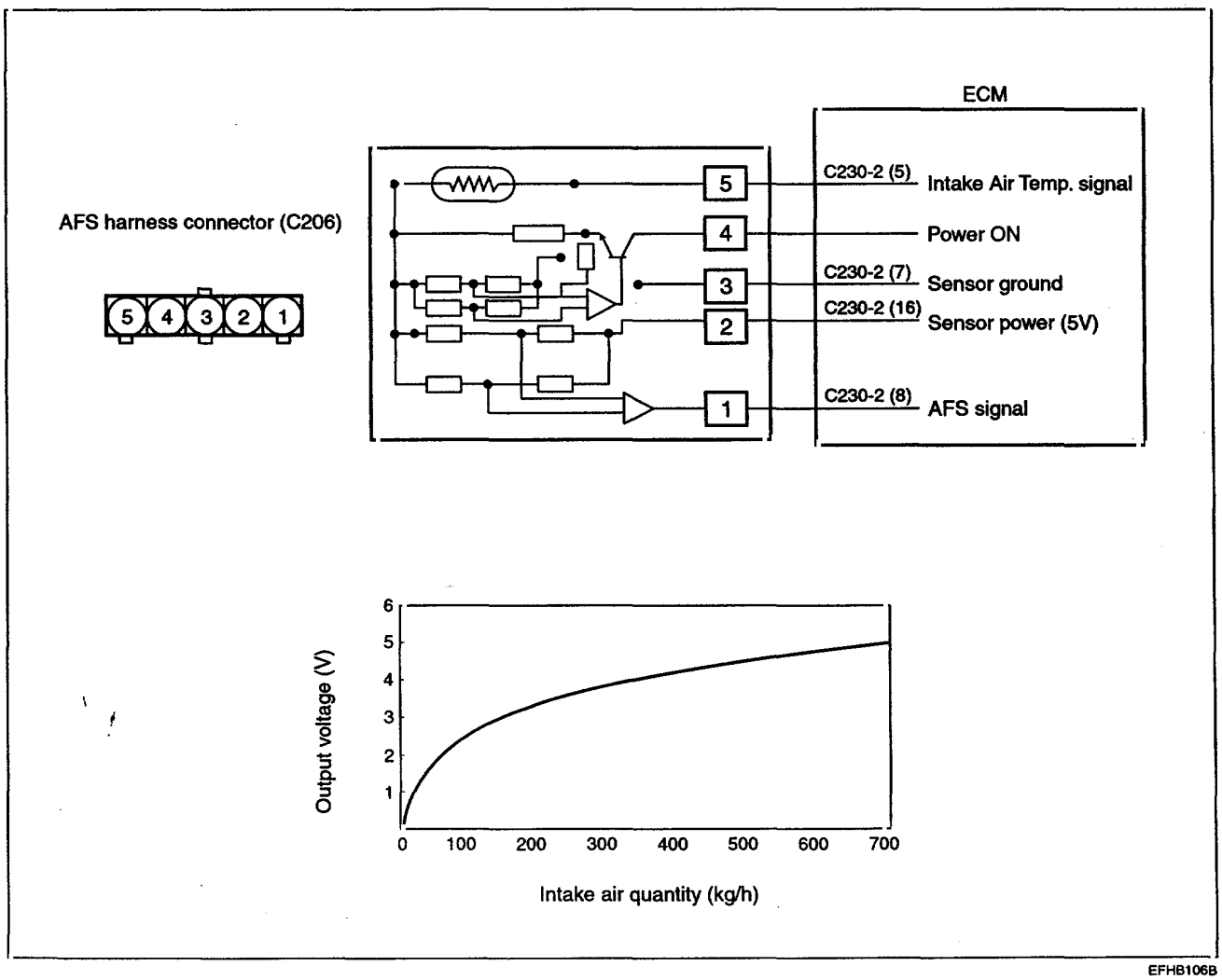


KFW5010A

AIR FLOW SENSOR (AFS) E53D2DAD

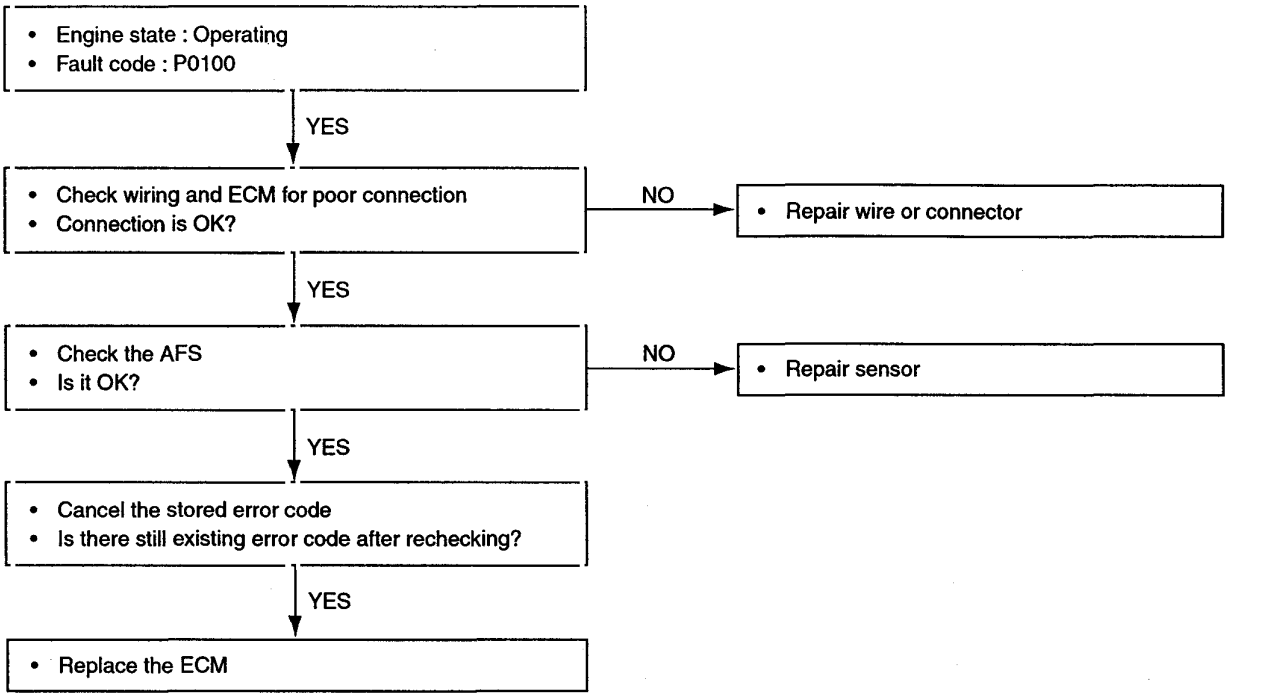
AFS uses the features of sensor heater, after HOT FILM units calculate the intake air quantity, then send the signal to ECM.
AFS might be combined to measure the intake air temperature.

[CIRCUIT DIAGRAM]



EFHB106B

TEST PROCEDURE



EFHB106C

TROUBLESHOOTING HINTS

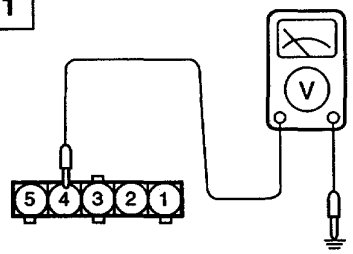
1. When Ignition switch is turned on, if AFS output voltage is not "0" (engine stops), inspect the malfunction of AFS and ECM.
2. Even it no AFS malfunction occurs, check the mounting direction of AFS.

NOTE

- *In case of new vehicle (mileage : below 500km) AFS air quantity is above approx.10%.*
- *Use correct digital voltmeter.*
- *Before inspection, warming up the engine till the engine coolant temperature is up to 80 ~ 90°C.*

AFS HARNESS INSPECTION PROCEDURES

1



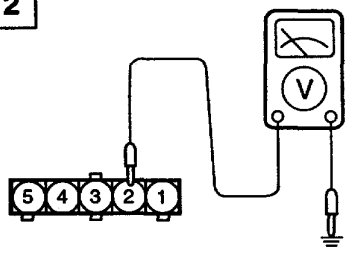
Measure the power supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : Battery voltage

OK ⇨ **2**

NG ⇨ Repair the harness

EFHB108B

2



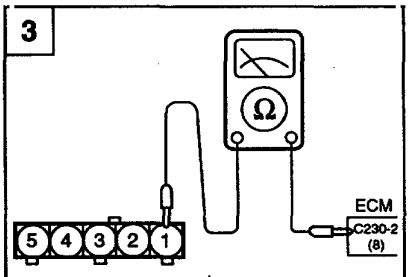
Measure the sensor power voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : 4.8 ~ 5.3V

OK ⇨ **3**

NG ⇨ Repair the harness

EFHB109B

3



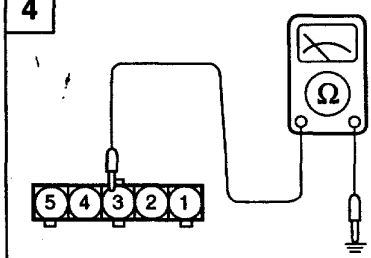
Check for a short wiring, or a short circuit between AFS and ECM harness
- Connector : Disconnected

OK ⇨ **4**

NG ⇨ Repair the harness

EFHB110B

4



Check for continuity of the ground sensor
- Connector : Disconnected

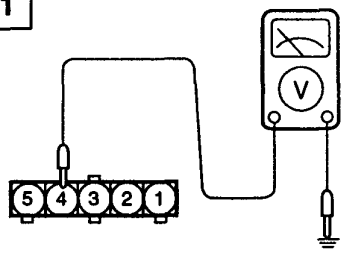
OK ⇨ **END !**

NG ⇨ Repair the harness

EFHB111B

INTAKE AIR TEMPERATURE SENSOR HARNESS INSPECTION PROCEDURES

1



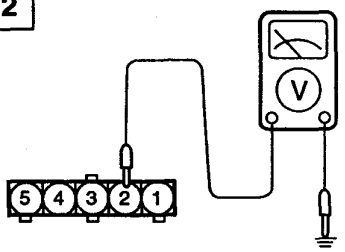
Measure the power supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : Battery voltage

OK ⇨ **2**

NG ⇨ Repair the harness

EFHB108B

2



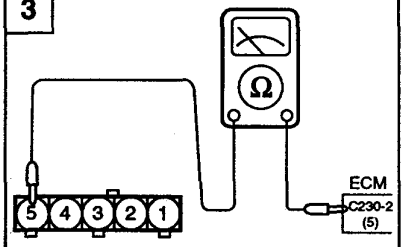
Measure the sensor power voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : 4.8 ~ 5.3V

OK ⇨ **3**

NG ⇨ Repair the harness

EFHB109B

3



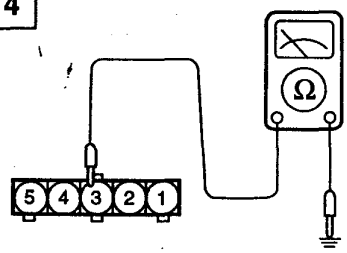
Check for a short wiring, or a short circuit between ECM and intake air temperature sensor
- Connector : Disconnected

OK ⇨ **4**

NG ⇨ Repair the harness

EFHB114B

4



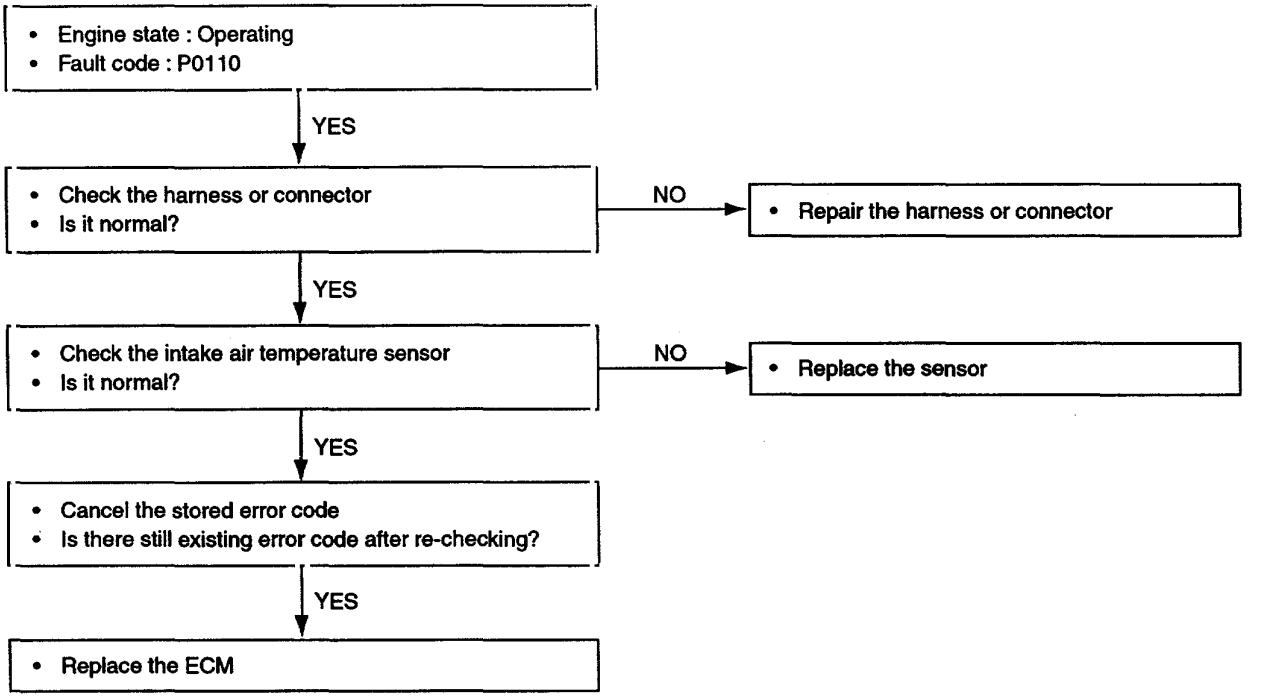
Check for continuity of the ground sensor
- Connector : Disconnected

OK ⇨ **END !**

NG ⇨ Repair the harness

EFHB111B

TEST PROCEDURE (INTAKE AIR TEMPERATURE SENSOR)



EFHB106D

SENSOR INSPECTION

1. Inspect the resistance of sensor using a multi-tester.
2. Measure the resistance between intake air temperature sensor and terminal.

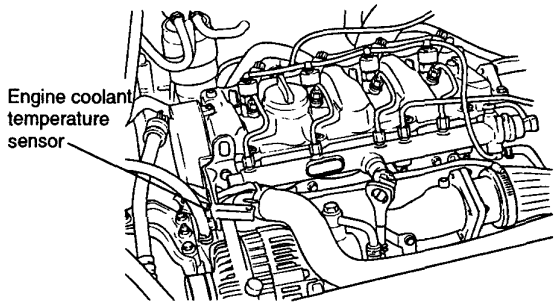
CONDITION	TEMPERATURE (°C)	RESISTANCE (kΩ)
Ignition switch ON	0	5.12 ~ 5.89
	20	2.29 ~ 2.55
	40	1.09 ~ 1.24
	80	0.31 ~ 0.37

3. If resistance value is out of standard, replace the intake air temperature sensor (built in AFS) assembly.

ENGINE COOLANT TEMPERATURE SENSOR (ECT)

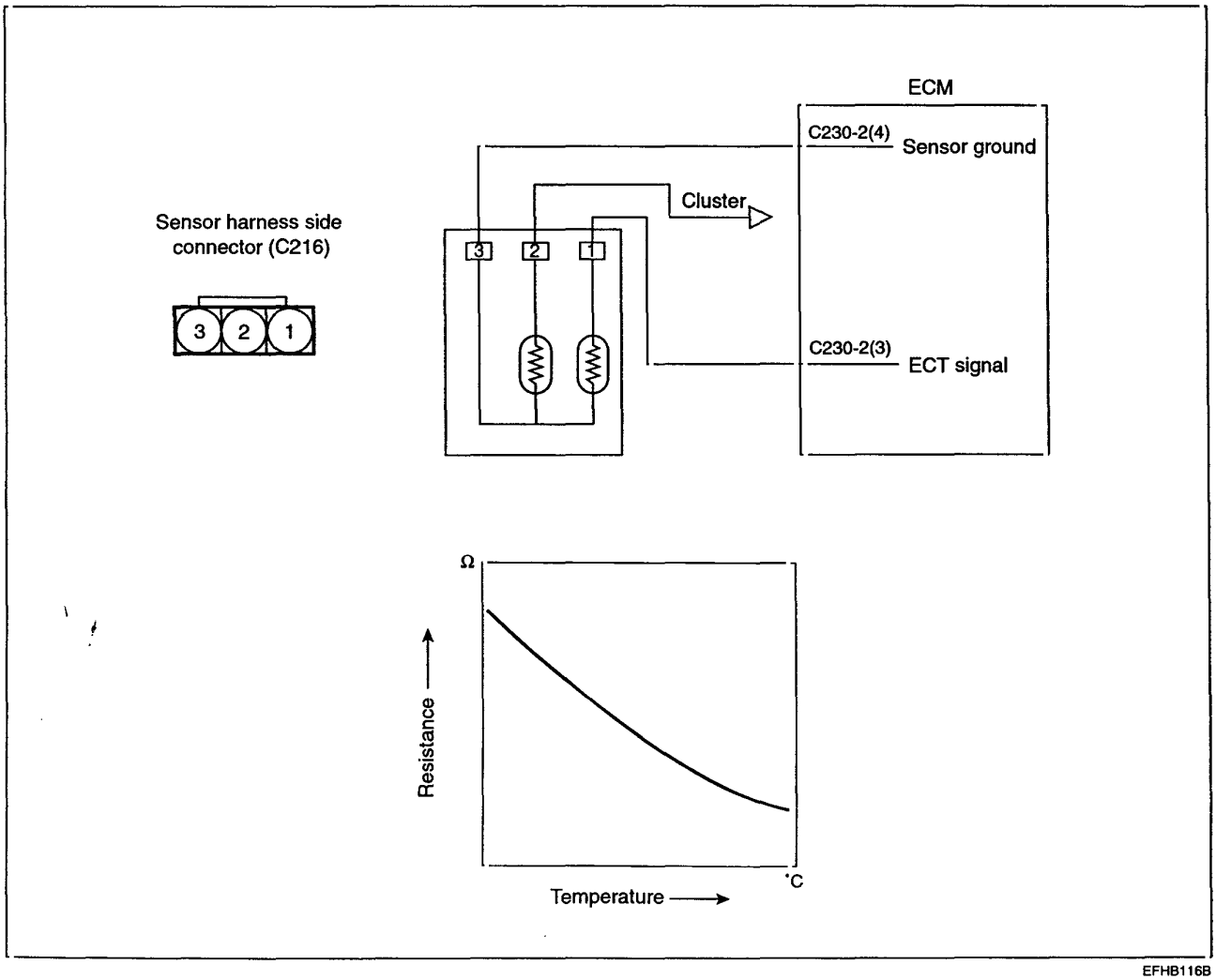
ENGINE COOLANT TEMPERATURE SENSOR (ECT) E96AD3AD

The engine coolant temperature sensor located in the engine coolant passage of the cylinder head. It detects the engine coolant teperature and relays signals to the ECU. It employs a thermistor, which is sensitive to changes in temperature. The electric resistance of a thermistor decreases in response to temperature rise. The ECU judges engine coolant temperture by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.



EFHB101B

[CIRCUIT DIAGRAM]

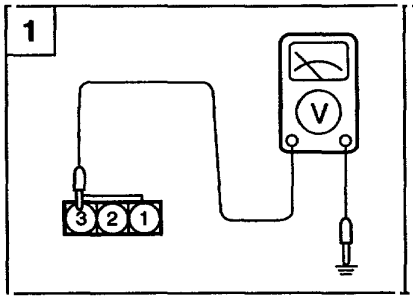


EFHB116B

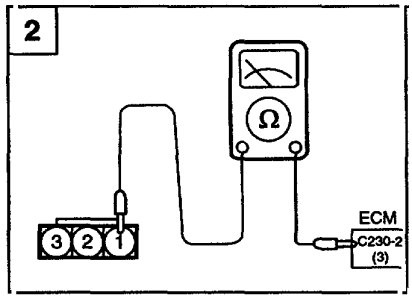
TROUBLESHOOTING HINTS

When idling speed is not appropriate or blacksmoke arises it is likely to be a defect of engine coolant temperature sensor.

HARNESS INSPECTION PROCEDURES

1 	Check for continuity of the ground sensor • Connector : Disconnected	OK ⇨ NG ⇨	2 Repair the harness

EFHB117B

2 	Check for a short wiring or a short circuit between ECM and ECT sensor • ECM Connector : Disconnected • ECT sensor Connector : Disconnected	OK ⇨ NG ⇨	END ! Repair the harness

EFHB118B

SENSOR INSPECTION

USING HI-SCAN

Check item	Data display	Check conditions	Coolant temp.	Set value (HI-SCAN)
Engine coolant temperature sensor	Sensor temperature	• Ignition switch : ON or engine running	-20°C	-20°C
			0°C	0°C
			20°C	20°C
			40°C	40°C
			80°C	80°C

USING MULTITESTER

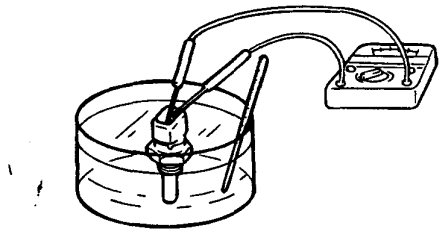
1. Remove the engine coolant temperature sensor from the engine coolant passage of the cylinder head.
2. With the temperature sensing portion of the engine coolant temperature sensor immersed in hot water, check resistance.

   1) ECT sensor

Temperature (°C)	Resistance (kΩ)
-20	14.13 ~ 16.83
0	5.790
20	2.31 ~ 2.59
40	1.148
60	0.586
80	0.322

   2) Gauge unit

Temperature (°C)	Resistance (Ω)
60	125
85	42.6 ~ 54.2
110	22.1 ~ 26.2
125	15.2



EFDA711C

3. If the resistance deviates from the standard value greatly, replace the sensor.

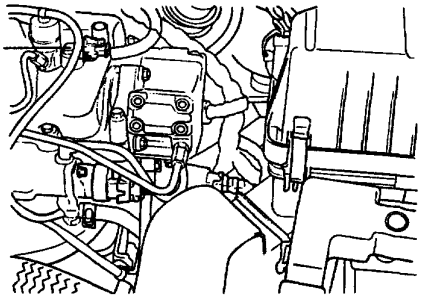
INSTALLATION

1. Apply sealant THREEBOND TB 2403 or equivalent to threaded portion.
2. Install engine coolant temperature sensor and tighten it to specified torque.

Tightening torque : 2.0 ~ 4.0 kg·m

3. Connect the harness connector securely.

CAMSHAFT POSITION SENSOR (CMP)

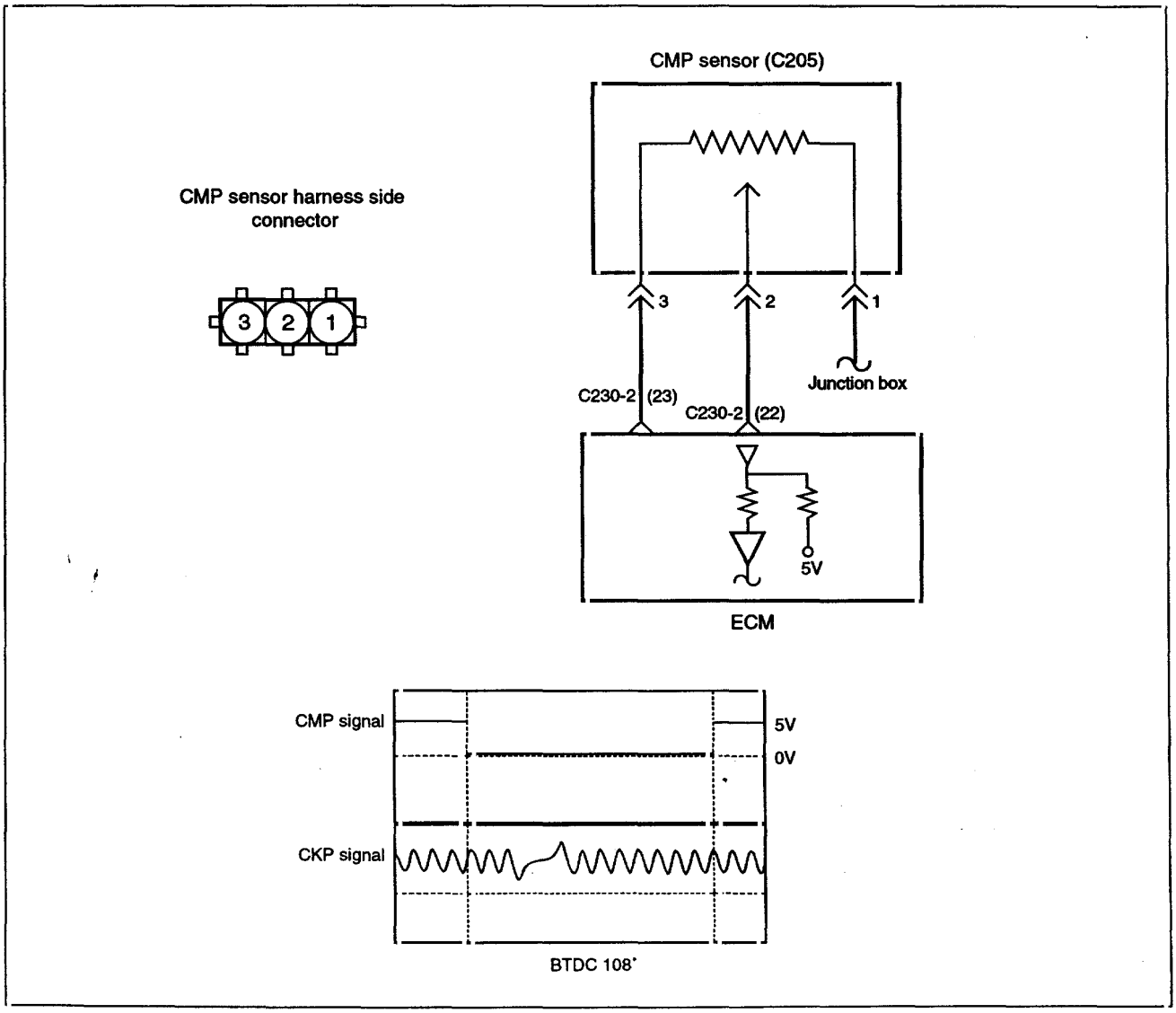


EFHB102B

CAMSHAFT POSITION SENSOR (CMP) E5EA0010

CMP senses the CMP(Camshaft Position Sensor) point of NO.1,4 cylinder on its compression stroke. Its signal is fed to ECM to be used to determine the sequence of fuel injection.
Crank angular sesor senses the crank angular of each cylinder, and input the pulse signal to ECM. Its signal is fed to ECM to be used to determine the engine speed and adjust the fuel injection timing and ignition timing.

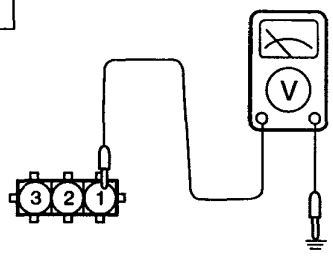
[CIRCUIT DIAGRAM]



EFHB119B

HARNESS INSPECTION PROCEDURES

1



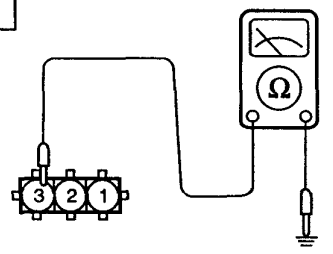
Measure the power supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : Battery voltage

OK ⇨ **2**

NG ⇨ Repair the harness

EFHB121B

2



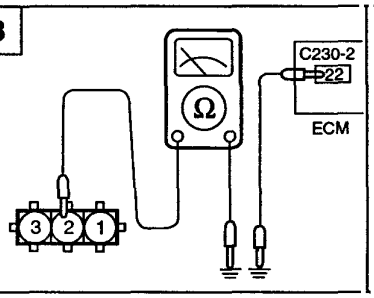
Check for continuity of the ground sensor
- Connector : Disconnected

OK ⇨ **3**

NG ⇨ Repair the harness

EFHB122B

3



Check for a short wiring or a short circuit to ground between TDC sensor and ECM.
- Connector : Disconnected

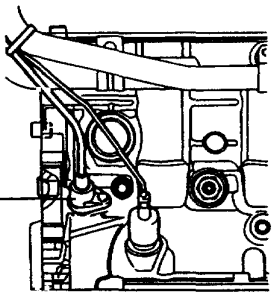
OK ⇨ **END !**

NG ⇨ Repair the harness

EFHB123B

CRANKSHAFT POSITION SENSOR (CKP)

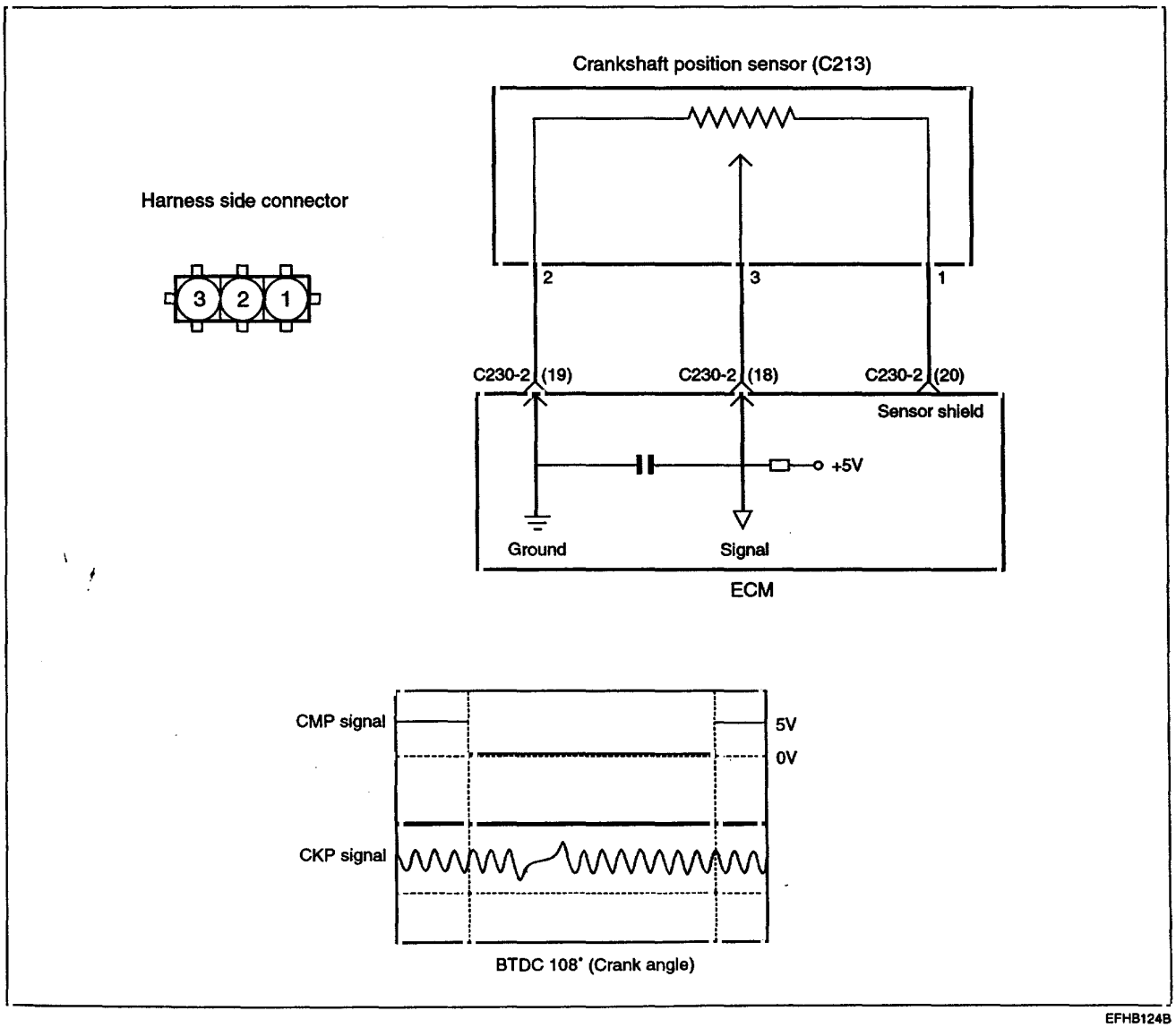
CRANKSHAFT POSITION SENSOR (CKP) E167E720



EFHB103B

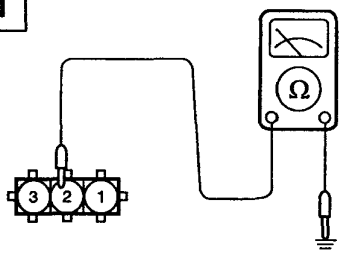
Piston position on combustion chamber is the substantial to define the starting of injection timing. All engine pistons are connected to crankshaft by connecting rod. Sensor on crankshaft can supply the informations concerning all piston positions, revolution speed is defined by revolutin per minute of crankshaft. Prior input variable is determined at ECM by using signal from induced crankshaft speed sensor.

[CIRCUIT DIAGRAM]

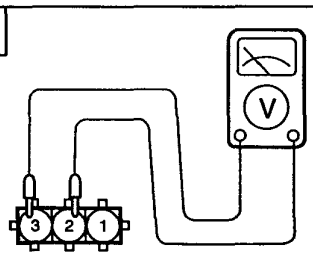


EFHB124B

[HARNESS INSPECTION PROCEDURES

1 	Check for continuity of the ground sensor • Connector : Disconnected	OK ⇨ NG ⇨	2 Repair the harness

EFHB125B

2 	Measure the sensor signal voltage • Engine : Idle • Peak voltage : Min. 1.5V	OK ⇨ NG ⇨	END ! Repair the harness

EFHB126B

SENSOR INSPECTION

1. Remove the crankshaft position sensor connector.
2. Measure the resistance between terminal NO.1 and NO.2.

Standard value : 0.65 ~ 1.00 kΩ

3. If the resistance deviates from the standard value greatly, replace the sensor.

Clearance between crankshaft position sensor and CKP wheel : 0.5 ~ 1.5 mm

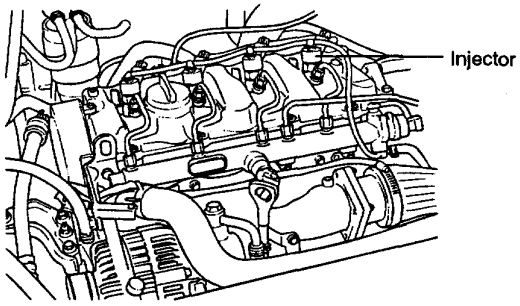
4. Install the sensor observing the specified torque.

Specified torque : 0.4 ~ 0.6 kg·m

INJECTOR

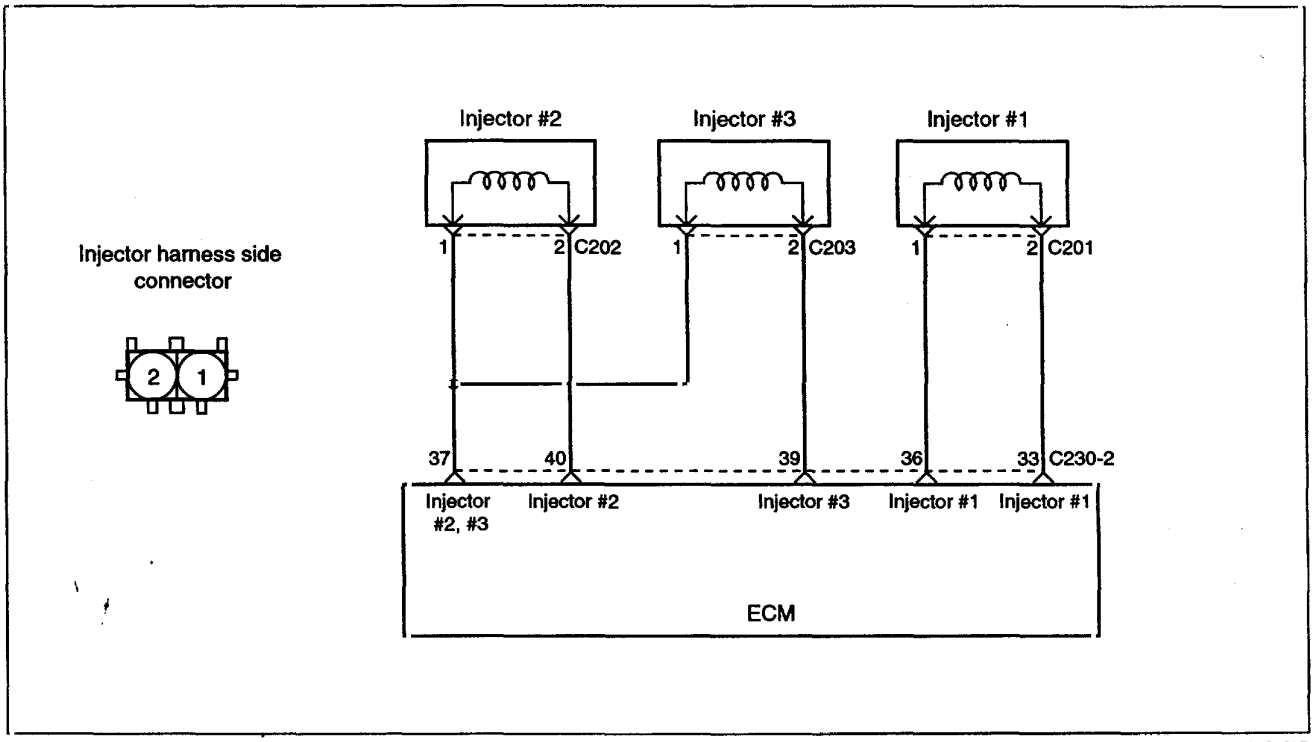
INJECTOR EECB6D36

Special injectors with hydraulic servo-system and electrical triggering element (solenoid valve) are used with the Common Rail system in order to achieve efficient start of injection and precise injected fuel quantity. At the start of injection, a high pickup current is applied to the injector so that the solenoid valve opens quickly. As soon as the nozzle needle has travelled its complete stroke, and the nozzle has opened completely, the energizing current is reduced to a lower holding value. The injected fuel quantity is now defined by the injector opening time and the rail pressure. Injection is terminated when the solenoid valve is no longer triggered and closes as a result.



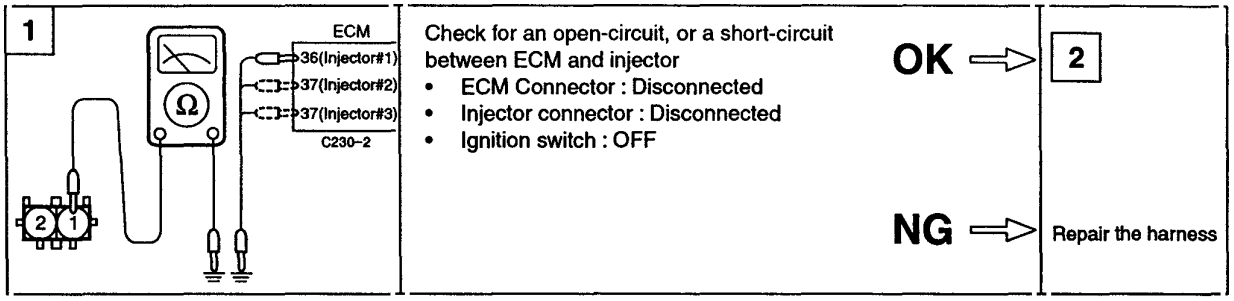
EFHB101C

[CIRCUIT DIAGRAM]

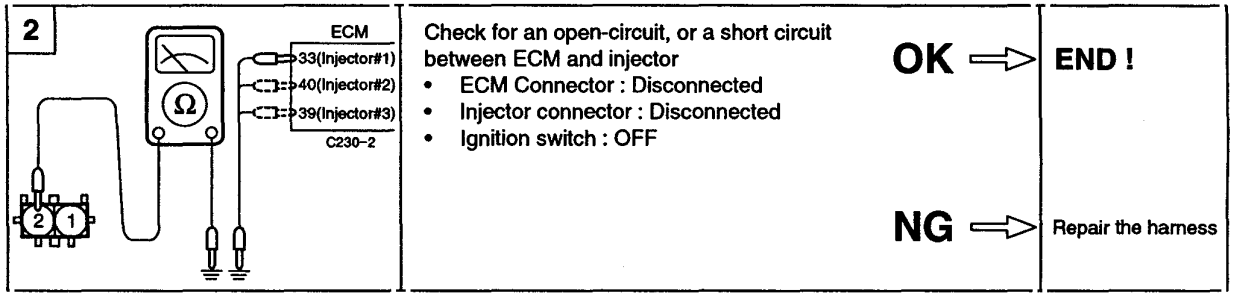


EFHC127B

HARNESS INSPECTION PROCEDURES



EFHC128B



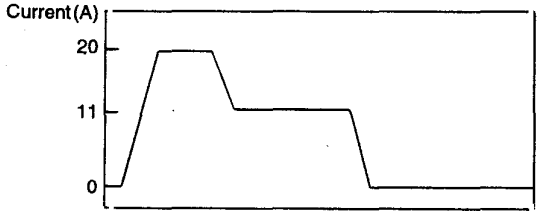
EFHC128C

INJECTOR OPERATION INSPECTION

1. Using a clip-on ammeter of motor tester, check actuation of injector. Clip-on ammeter must satisty the following conditions.

Measuring range > 25A Bandwidth > 100kHz

2. Attach the plug to the injector. Fasten clip-on ammeter around lead to pin.2 of corresponding injector. Allow engine to be at idle.
   Refer to the set value(current) as following figure.



[Injector set value (Current)]

EFHB201D

NOTE

- *Length of holding current phase (max.12A) is governed by engine speed, injection time and changes on velocity.*
- *The first current curve shows the pre-injection.*

3. Check the injector for injecting of fuel. As checking procedure, detach the injector plug from each boxes and connect to replaced injector.
   If change to enine running results, injector is injecting.
   If no change to engine running results, injector is not injecting.
   This test cannot however establish whether an injector is injecting an correct quantity.
   If necessary, all injectors have to be replaced.

4. Measure the supply voltage at ECM pin 33(Cylinder #1 Injector), to pin 36 and pin 39(Cylinder #3 Injector), pin 40(Cylinder #2 Injector) to pin 37 with ignition OFF.

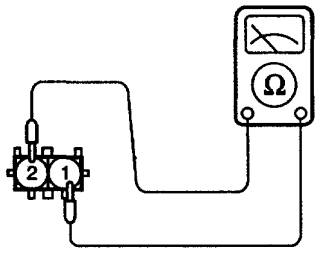
Set value : 0V

5. Check wiring if set value is not attained. If wiring is OK, replace the ECM.

MEASURE THE RESISTANCE BETWEEN TERMINALS

1. Detach the connector from injector.
2. Measure the resistance between terminals.

Specified value : 0.3 ~ 0.6Ω (at 20°C)



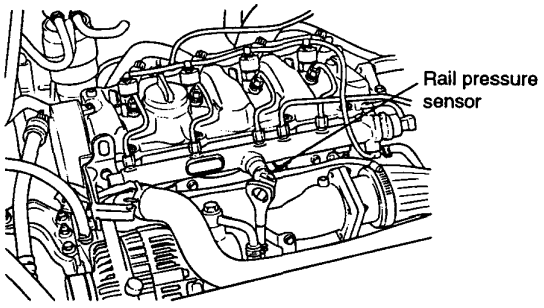
EFHB201Z

3. Connect the connector to the injector.

RAIL PRESSURE SENSOR (RPS)

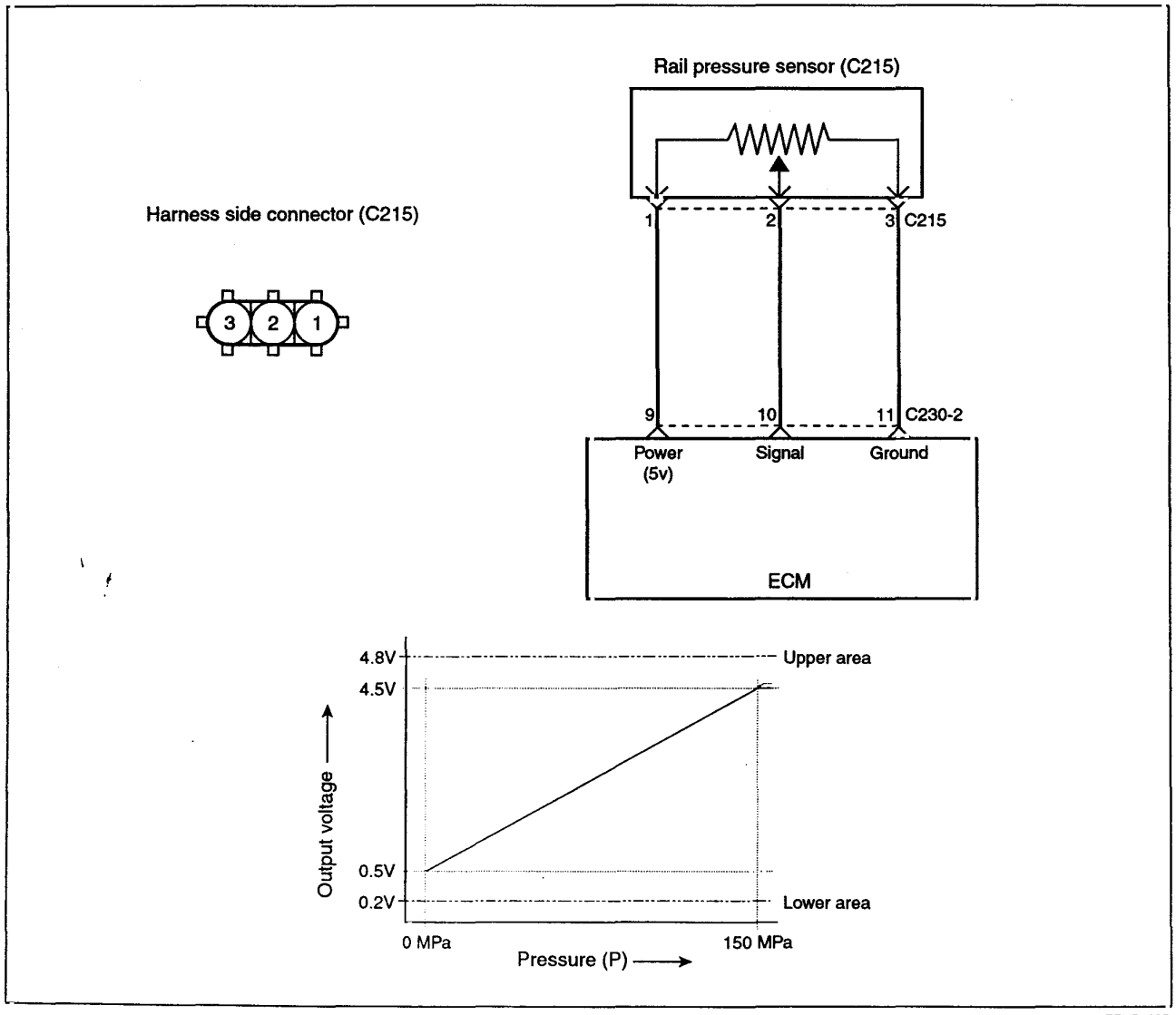
RAIL PRESSURE SENSOR (RPS) EBEDFB35

In order to output a voltage signal to the ECM which corresponds to the applied pressure, the rail-pressure sensor must measure the instantaneous pressure in the rail.
The fuel flows to the rail-pressure sensor through an opening in the rail, the end of which is sealed off by the sensor diaphragm. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element (semiconductor device) for converting the pressure to an electric signal is mounted on this diaphragm. The signal generated by the sensor is inputted to an evaluation circuit which amplifies the measuring signal and sends it to the ECM.



EFHB101D

[CIRCUIT DIAGRAM]



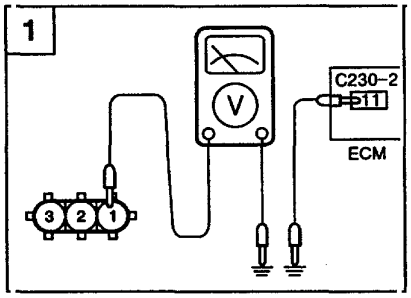
EFHB129B

SENSOR INSPECTION

USING HI-SCAN

Check item	Data display	Check conditions	Set value	Standard value
Rail pressure sensor	Rail pressure value	Engine at idle	220 ~ 300 bar	260 bar

HARNESS INSPECTION PROCEDURES

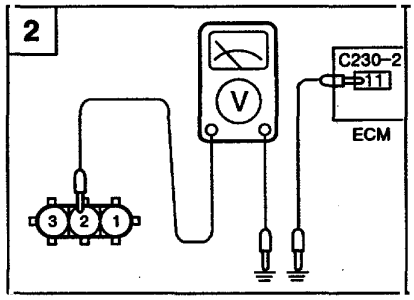


Measure the power supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : 4.5 ~ 5.5V

OK ⇒ 2

NG ⇒ Repair the harness

EFHB130B

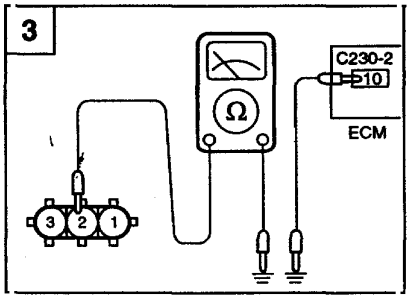


Measure the voltage of RPS harness side connector #2 terminal to the ground with ignition on.
- Set value : 0.5V
- Engine idling set value : 1.1 ~ 1.5V
- Voltage increases with inereasing pressure : Max. 4.5V

OK ⇒ 3

NG ⇒ Repair the harness

EFHB131B



Check for an open circuit, or a short circuit between ECM and rail pressure sensor.
- Connector : Disconnected
- Ignition switch : OFF

OK ⇒ END !

NG ⇒ Repair the harness

EFHB131C

SENSOR REPLACEMENT

1. Replace the RPS if signal voltage exceeds the set value.
2. Note the followings.
   1) Always renew the sealing washer (soft iron sealing ring) even if old sensor is re-used.
   2) When removing seal, take care not to damage sealing surface.
   3) When installing RPS, provide the sealing washer with grease if necessary.
   4) Tightening torque is 35 ± 2 Nm.

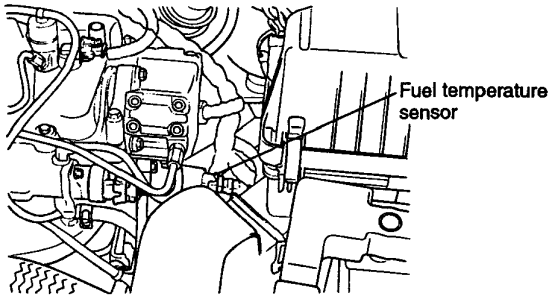
NOTE

Replace the faulty fuel rail assembly in case of new model vehicle within a year, or replace the faulty parts of vehicle of which model year is more than a year.

FUEL TEMPERATURE SENSOR (FTS)

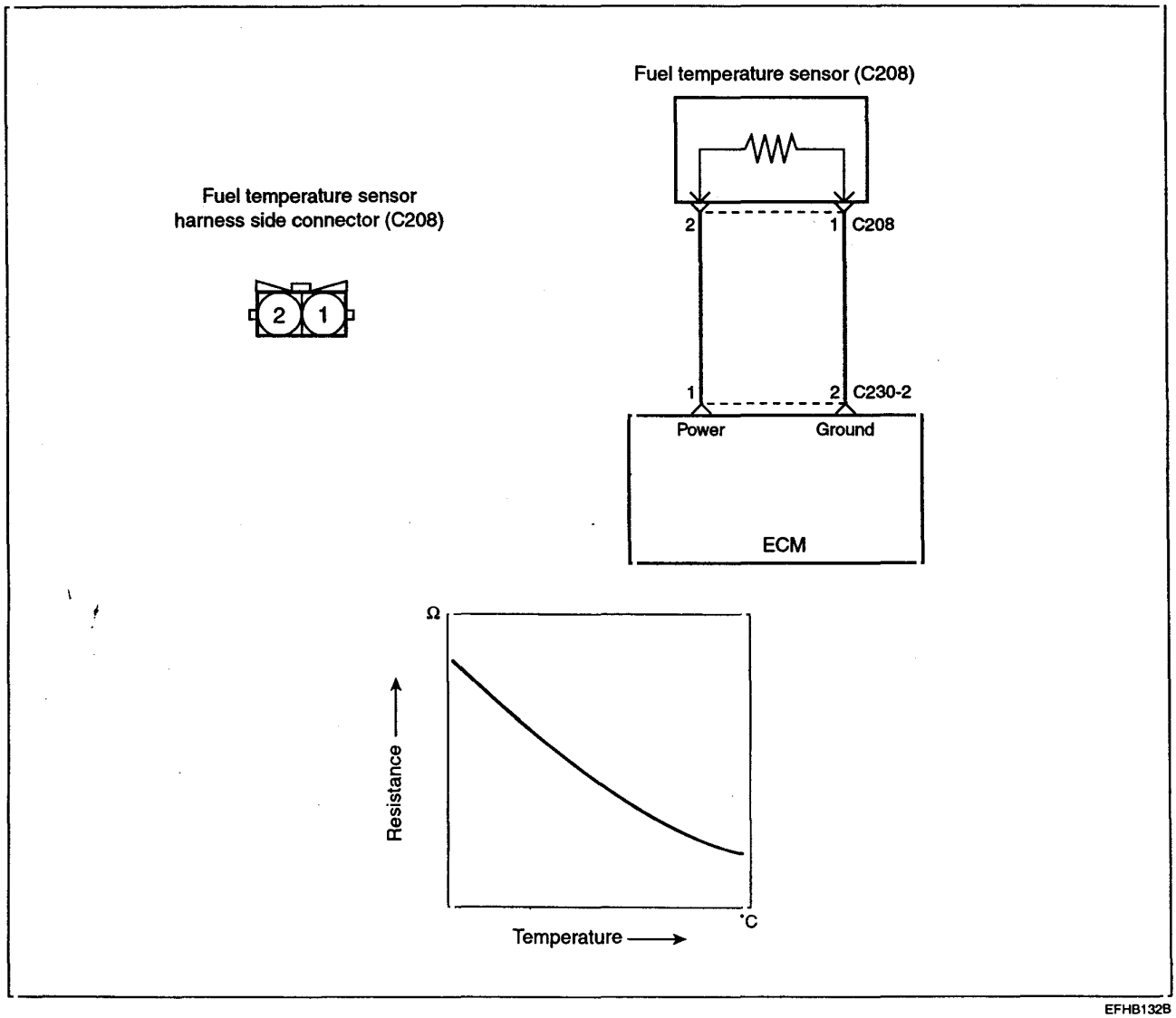
FUEL TEMPERATURE SENSOR (FTS) EE8D4AC0

The fuel temperature sensor is equipped with a temperature-dependent resistor with a negative temperature coefficient (NTC) which is part of a voltage-divider circuit across which 5V are applied.
The voltage drop across the resistor is inputted into the ECM through an analog-to-digital converter (ADC) and is a measure for the temperature. A characteristic curve is stored in the ECM microcomputer which defines the temperature as a function of the given voltage value.



EFHB102C

[CIRCUIT DIAGRAM]



EFHB132B

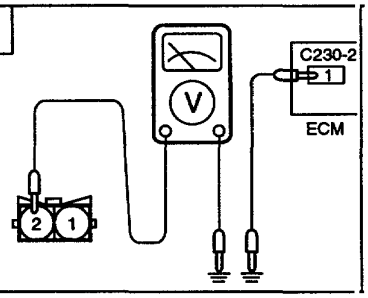
SENSOR INSPECTION

USING VOLTMETER

Check item	Output data	Check condition	Fuel temperature (°C)	Resistance (kΩ)
Fuel temperature sensor	Fuel temperature	Ignition switch : ON or START	-30	22.22 ~ 31.78
			-20	13.24 ~ 18.10
			0	5.18 ~ 6.60
			20	2.27 ~ 2.73
			40	1.059 ~ 1.281
			60	0.538 ~ 0.650
			80	0.322 ~ 0.298
			100	0.185 ~ 0.167
			120	0.097 ~ 0.127

HARNESS INSPECTION PROCEDURES

1



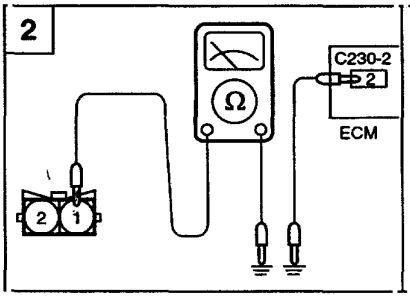
Measure the supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage : 4.8 ~ 5.2V

OK ⇒ 2

NG ⇒ Repair the harness

EFHB133B

2



Check for an open circuit, or a short circuit to the ground between ECM and fuel temperature sensor.
- ECM Connector : Disconnected
- Fuel temperature sensor connector : Disconnected

OK ⇒ END !

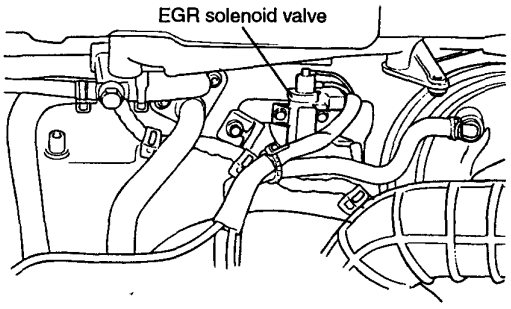
NG ⇒ Repair the harness

EFHB134B

EGR SOLENOID VALVE

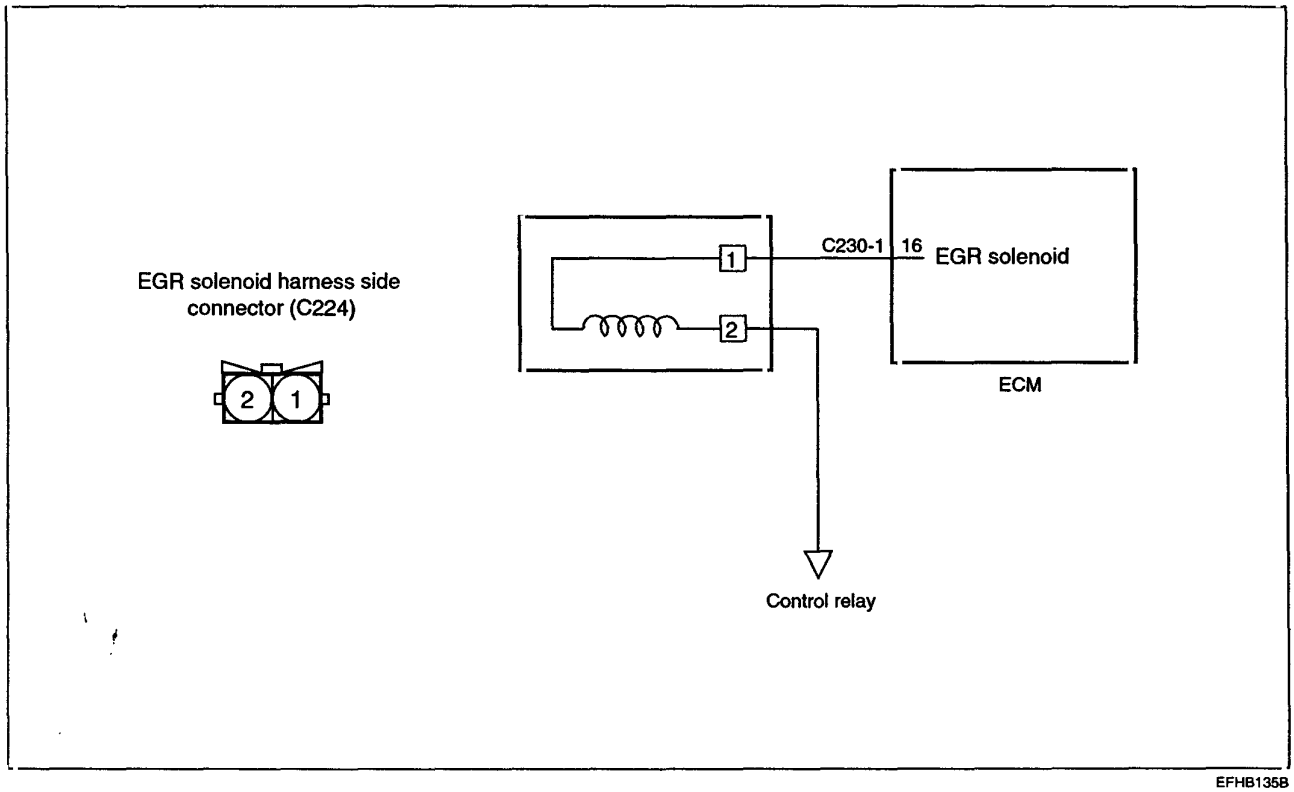
EGR SOLENOID VALVE ECE317DA

With exhaust-gas recirculation (EGR) a portion of the exhaust gas is led into the engine's intake tract. Up to a certain degree, an increasing portion of the residual exhaust gas content has a positive effect upon energy conversion and therefore upon the exhaust-gas emissions. Depending upon the engine's operating point, the air/gas mass drawn into the cylinders can be composed of up to 40% exhaust gas.
For ECM control, the actual drawn-in fresh-air mass is measured and compared at each operating point with the air-mass setpoint value. Using the signal generated by the control circuit, the EGR valve opens so that exhaust gas can flow into the intake tract.



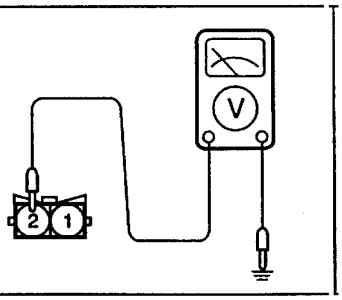
EFHB104B

[CIRCUIT DIAGRAM]

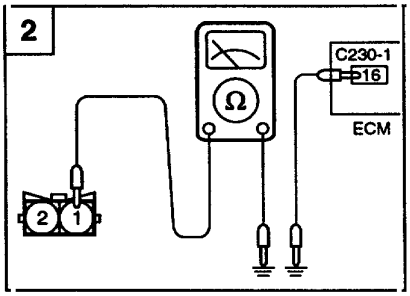


EFHB135B

HARNESS INSPECTION PROCEDURES

1 	Measure the supply voltage • Connector : Disconnected • Ignition switch : ON • Voltage(V) : Battery voltage	OK ⇒ NG ⇒	2 Repair the harness

EFHB136B

2 	Check for an open circuit, or a short circuit to the ground between ECM and EGR solenoid valve. • Connector : Disconnected	OK ⇒ NG ⇒	END ! Repair the harness

EFHB137B

EGR SOLENOID VALVE INSPECTION

USING HI-SCAN

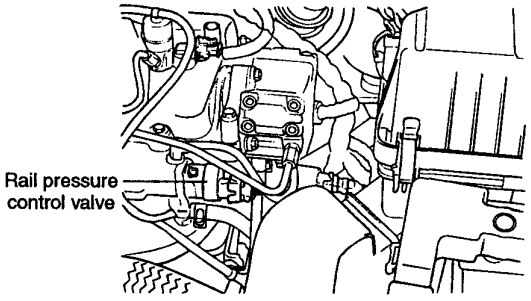
Check item	Check condition	Engine condition	Standard value
EGR solenoid valve	Solenoid valve OFF → ON	Ignition switch : ON	Check the sound for proper operation

USING VOLTMETER

Check item	Specified value
EGR solenoid valve resistance	14 ~ 17Ω

RAIL PRESSURE CONTROL VALVE

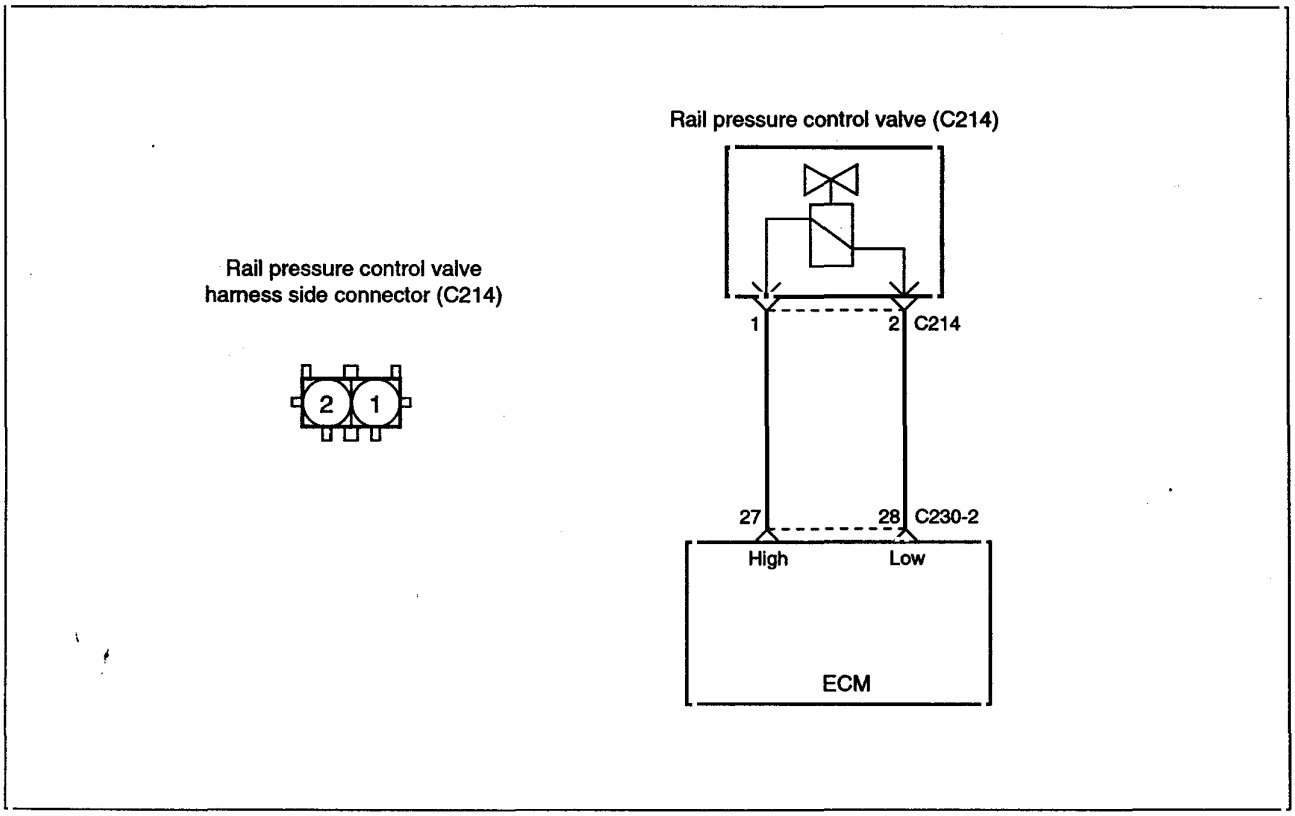
RAIL PRESSURE CONTROL VALVE E6293D54



EFHB102D

The rail pressure-control valve sets the correct pressure in the rail as a function of engine loading, and maintains it at this level.
If the rail pressure is excessive, the pressure-control valve opens and a portion of the fuel returns from the rail to the fuel tank via a collector line.
If the rail pressure is too low, the pressure-control valve closes and seals off the high-pressure stage from the low-pressure stage.

[CIRCUIT DIAGRAM]

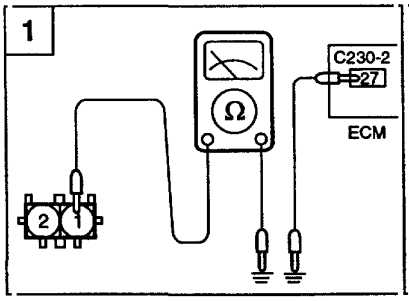


EFHB138B

TROUBLESHOOTING HINTS

At after run test mode or fuel cut mode, if within set time engine rpm is not dropped below the lower set value, error is detected.
The reasons are short circuit, connecting resistance, faulty rail pressure sensor, continuity of fuel pump relay, faulty rail pressure control valve, defective high pressure pump, ECM fault, etc.

HARNESS INSPECTION PROCEDURES

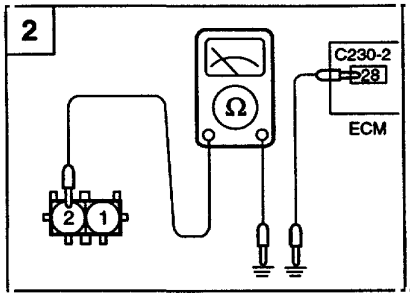


Check for an open circuit, or a short circuit to the ground between ECM and pressure control valve.
- Connector : Disconnected

OK ⇨ 2

NG ⇨ Repair the harness

EFHB139B



Check for an open circuit, or a short circuit to the ground between ECM and pressure control valve.
- Connector : Disconnected

OK ⇨ END !

NG ⇨ Repair the harness

EFHB140B

RAIL PRESSURE CONTROL VALVE INSPECTION

USING VOLTMETER

Check item	Set value (Ω)
Rail pressure control valve resistance	2.07 ~ 2.53Ω

RAIL PRESSURE CONTROL VALVE REPLACEMENT

1. Replace the rail pressure control valve if signal voltage exceeds the set value.
2. Tightening torque for this replacement is 5 ± 1Nm.

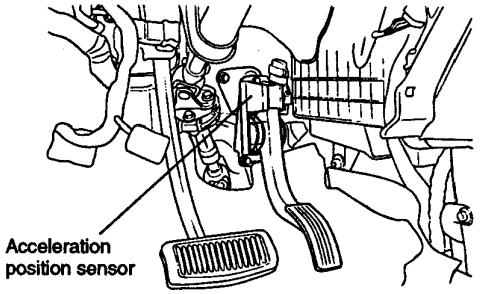
NOTE

Replace the faulty fuel rail assembly in case of new model vehicle within a year, or replace the faulty parts of vehicle of which model year is more than a year.

ACCELERATION POSITION SENSOR (APS)

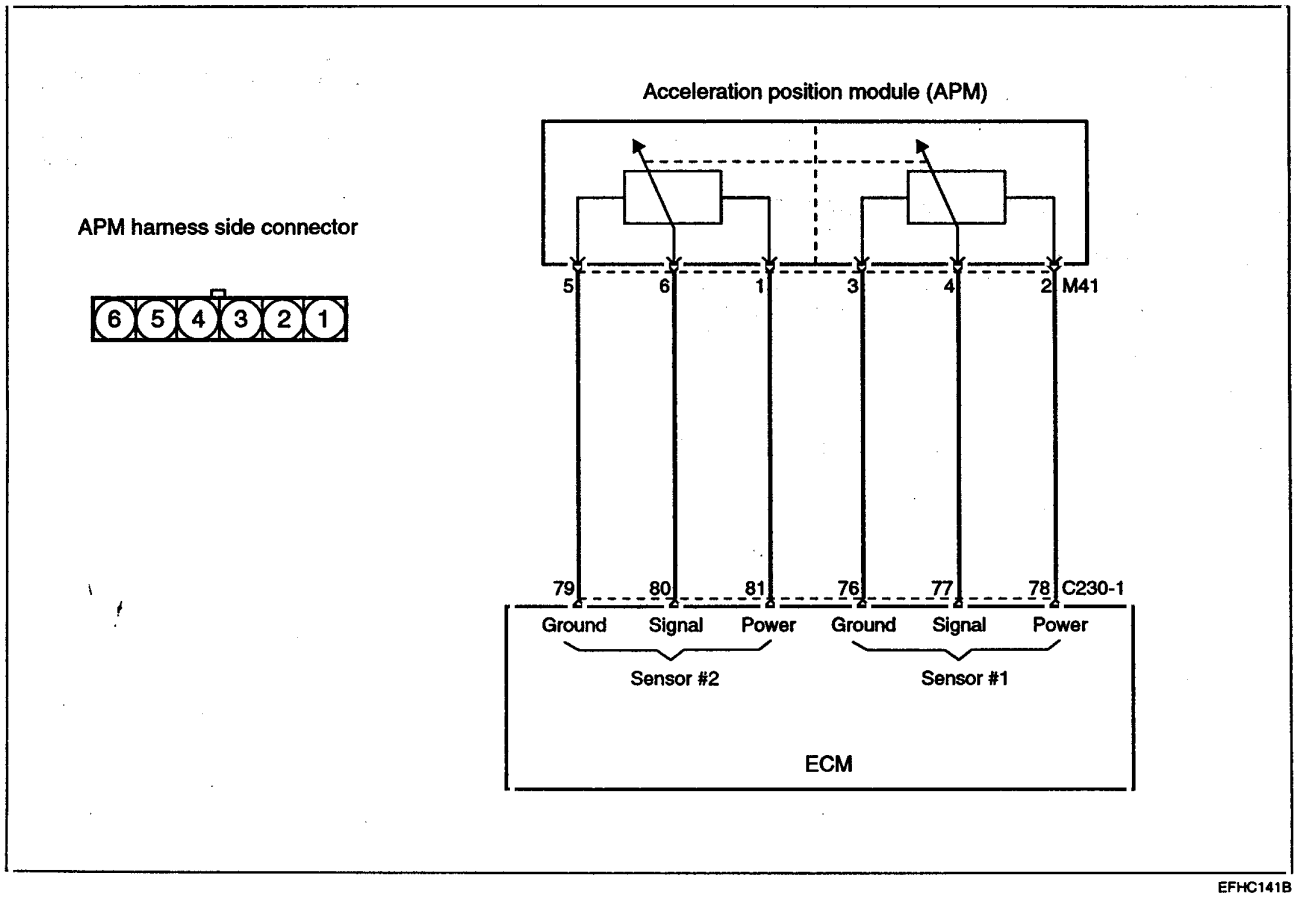
ACCELERATION POSITION SENSOR (APS) EA53DBD3

In contrast to conventional distributor and in-line injection pumps, with EDC the driver's acceleration input is no longer transmitted to the injection pump by Bowden cable or mechanical linkage, but is registered by an acceleration position sensor and transmitted to the ECM (this is also known as drive-by-wire).
A voltage is generated across the potentiometer in the acceleration position sensor as a function of the accelerator-pedal setting. Using a programmed characteristic curve, the pedal's position is then calculated from this voltage.



EFHB105B

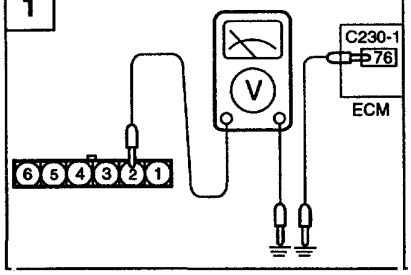
[CIRCUIT DIAGRAM]



EFHC141B

HARNESS INSPECTION PROCEDURES

1



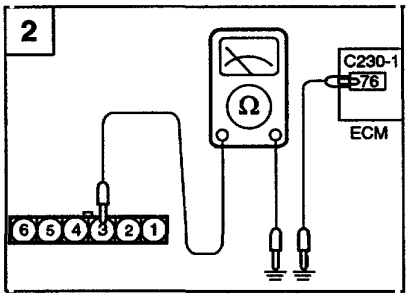
Measure the sensor supply voltage
- Connector : Disconnected
- Ignition switch : ON
- Voltage(V) : 4.5 ~ 5.5V

OK ⇨ **2**

NG ⇨ Repair the harness

EFHB145B

2



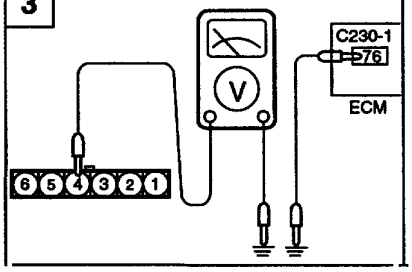
Check for an open circuit, or a short circuit between ECM and acceleration position sensor
- Connector : Disconnected
- Ignition switch : OFF

OK ⇨ **3**

NG ⇨ Repair the harness

EFHB146B

3



If contact lead is OK, measure the sensor signal voltage
- at idle : 0.6 ~ 0.9V
- at full throttle : 3.6 ~ 4.6V

OK ⇨ **END !**

NG ⇨ Repair the harness

EFHB147B

Fuel System

GENERAL

SPECIFICATIONS ..... FL - 2
SERVICE STANDARD ..... FL - 3
SEALANT ..... FL - 3
SPECIAL TOOLS ..... FL - 4
BASIC TROUBLESHOOTING ..... FL - 5
INSPECTION ..... FL - 8
REPLACEMENT ..... FL -11
MFI SYSTEM INSPECTION ..... FL -12

MPI CONTROL SYSTEM

COMPONENTS ..... FL -19
MANIFOLD ABSOLUTE PRESSURE SENSOR ..... FL -24
INTAKE AIR TEMP. SENSOR ..... FL -26
ENGINE COOLANT TEMP SENSOR ..... FL -28
THROTTLE POSITION SENSOR ..... FL -30
CAMSHAFT POSITION SENSOR ..... FL -33
CRANKSHAFT POSITION SENSOR ..... FL -35
HEATED OXYGEN SENSOR ..... FL -37
INJECTOR ..... FL -40
IDLE SPEED CONTROL ACTUATOR ..... FL -43
VEHICLE SPEED SENSOR ..... FL -45
KNOCK SENSOR ..... FL -47
ENGINE CONTROL MODULE ..... FL -49
A/CON SWITCH AND RELAY ..... FL -50
PURGE SOLENOID VALVE ..... FL -52
ECM CONTROL RELAY ..... FL -54
IGNITION COIL ..... FL -56
FUEL PUMP ..... FL -58
ACCELERATION SENSOR ..... FL -61

FUEL DELIVERY SYSTEM

FUEL INJECTOR
- COMPONENTS ..... FL -63
- REMOVAL ..... FL -63
- INSPECTION ..... FL -64
- INSTALLATION ..... FL -64

THROTTLE BODY
- COMPONENTS ..... FL -65
- REMOVAL ..... FL -66
- INSPECTION ..... FL -66

FUEL TANK
- COMPONENTS ..... FL -67
- REMOVAL ..... FL -68
- INSPECTION ..... FL -68
- INSTALLATION ..... FL -69

ACCELERATOR PEDAL
- COMPONENTS ..... FL -70
- REMOVAL ..... FL -71
- INSPECTION ..... FL -71
- INSTALLATION ..... FL -71

DTC TROUBLESHOOTING PROCEDURES

P0106~P0108 ..... FL -72
P0112/P0113 ..... FL -75
P0116~P0118 ..... FL -78
P0121~P0123 ..... FL -83
P0130/P0136 ..... FL -87
P0131/P0137 ..... FL -91
P0132/P0138 ..... FL -95
P0133/P0134 ..... FL -98
P0171/P0172 ..... FL -102
P0261~P0271 ..... FL -105
P0300 ..... FL -108
P0301~P0304 ..... FL -111
P0325 ..... FL -113
P0335/P0336 ..... FL -116
P0340 ..... FL -118
P0420 ..... FL -121
P0444/P0445 ..... FL -123
P0506/P0507 ..... FL -125
P1307~P1309 ..... FL -128
P1506/P1508 ..... FL -131
P1505/P1507 ..... FL -133

GENERAL

SPECIFICATIONS

(1.3ℓ , 1.5ℓ , 1.6ℓ) ED3AF1CF

Items	Specifications
Engine displacement	1.3ℓ , 1.5ℓ , 1.6ℓ
Engine Management System (EMS)	BOSCH
Fuel tank	
- Capacity	45ℓ (11.9 U.S. gal., 9.9 Imp.gal.)
Fuel filter	High pressure type
Fuel pump	Electrical, in-tank type
Throttle body	
- Throttle position sensor (TP Sensor)	Variable resister type
- Output voltage at idle	0.3 ~ 0.9V
- Output voltage at fully open	4.5 ~ 5.2V
Input sensors	
Manifold absolute pressure(MAP) sensor	
- Type	Piezo-Resistivity type
- Output voltage	0 ~ 5V
Knock sensor	Piezoelectric type
Intake Air Temperature sensor (IAT Sensor)	Thermistor type
- Voltage	3.3 ~ 3.7V at 20°C (68°F)
EVAP Canister Purge solenoid valve	Duty type
- Resistance	26Ω
Engine coolant temperature sensor (ECT Sensor)	Thermistor type
- Voltage	3.44V ± 0.3 at 20°C (68°F) 1.25V ± 0.3 at 80°C (176°F)
Heated oxygen sensor (HO2S)	Zirconia sensor (Heated)
- Output voltage (V)	0 ~ 1V
Vehicle speed sensor	Hall effect sensor
Camshaft position sensor (CMP Sensor)	Hall effect sensor
- Output voltage (V)	0 ~ 5V
Crankshaft position sensor (CKP Sensor)	Magnetic inductive type
- Output frequency (Hz)	Idle rpm : 600 ~ 900Hz 3000 rpm : 2700 ~ 3300Hz
Output actuators	
Injector	
- Type	Electromagnetic type
- Number	4
- Coil resistance (Ω)	15.9 ± 0.35Ω
Fuel pressure regulator	
- Regulator pressure	350 kPa (3.5 kg/cm², 49.8 psi)
Idle speed control actuator (ISC Actuator)	
- Type	Double coil type
- Control frequency (Hz)	100Hz

SERVICE STANDARD EE60BD6E

Items	Engine	Specifications	Condition
Basic idle RPM	SOHC	800 ± 100	A/CON "ON" or "OFF (N-range)
	DOHC	750 ± 100	A/CON "ON" or "OFF (N-range)
Ignition timing (°) (at idle RPM)	SOHC	9° ± 5°	A/CON "OFF" (N-range)
	DOHC	9° ± 5°	A/CON "OFF" (N-range)

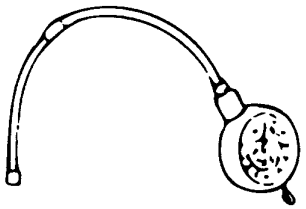
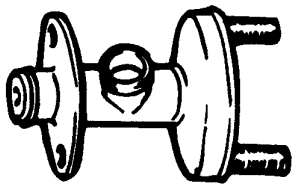
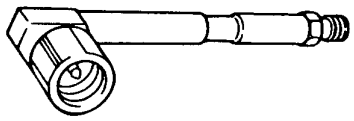
TIGHTENGING TORQUE

Items	Nm	Kg·cm	lb·ft
Delivery pipe installation	10 ~ 15	100 ~ 150	7 ~ 11
Heated oxygen sensor	50 ~ 60	500 ~ 600	37 ~ 44
Crankshaft position sensor installation bolts	9 ~ 11	90 ~ 110	7 ~ 8
Knock sensor installation bolt	16 ~ 25	160 ~ 250	12 ~ 18
Engine coolant temperature sensor (SOHC)	15 ~ 20	150 ~ 200	11 ~ 15
Engine coolant temperature sensor (DOHC)	25 ~ 30	250 ~ 300	18 ~ 22
Throttle position sensor installation bolts	1.5 ~ 2.5	15 ~ 25	1.1 ~ 1.8
Throttle body to surge tank bolts	15 ~ 20	150 ~ 200	11 ~ 15
Accelerator arm bracket	8 ~ 12	80 ~ 120	5.8 ~ 7.2
Fuel pressure gauge to fuel filter	25 ~ 35	250 ~ 350	18 ~ 26
Intake manifold	15 ~ 20	150 ~ 200	11 ~ 15
Accelerator bracket	8 ~ 12	80 ~ 120	5.8 ~ 7.2
MFI control relay	7 ~ 11	70 ~ 110	5.2 ~ 8.1

SEALANT E36EA377

Engine coolant temperature sensor assembly	LOCTITE 962T or equivalent
Engine coolant temperature sender	Three bond No.2310 or equivalent

SPECIAL TOOLS EBC88E0A

Tool (Number and name)	Illustration	Application
09353-24100 Fuel pressure gauge & hose	 C5324100	Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure.
09353-38000 Fuel pressure gauge adaptor	 C5338000	
09353-24000 Fuel pressure gauge connector	 C5324000	

BASIC TROUBLESHOOTING E6A4AAEA

When checking for engine trouble, it is important to start with an inspection of the basic systems. If one of the following conditions exists; (A) engine start failure, (B) unstable idling or (C) poor acceleration, begin by checking the following basic systems :

1. Power supply
   - Battery
   - Fusible link
   - Fuse
2. Body ground
3. Fuel supply
   - Fuel line
   - Fuel filter
   - Fuel pump
4. Ignition system
   - Spark plug
   - High-tension cable
   - Ignition coil
5. Emission control system
   - PCV system
   - Vacuum leak
6. Others
   - Ignition timing
   - Idle speed

Trouble with the MFI system is often caused by poor contact of the harness connectors. It is important to check all harness connectors and verify that they are securely connected.

TROUBLESHOOTING GUIDE CHART

Main Symptoms / Sub-Symptoms / Check points	STARTING							Poor Idling					Poor Driving	
	Unable to start			Difficult to start										
	Engine does not turn over	Starter runs but engine does not turn over	Incomplete combustion	Engine turns over	Always	When the engine is cold	When the engine is hot	Incorrect fast idle	High idle speed	Low idle speed	Rough idling	Engine hesitates or accelerates poorly	Surging	Knocking
Starter relay	1													
Starter	2	2		1										
Park/Neutral SW [A/T] or Clutch start SW [M/T]	3													
Flywheel [M/T] or Drive plate [A/T]		4												
Mass air flow sensor circuit			3							3	10	7		
Idle speed control actuator			4		3	3	3	3	3	2	7			2
Fuel pressure regulator			5		5	5	5				4	11	1	
ECT sensor circuit			6		4	1	1	2	2	1	2	8	6	
Compression			7		8						8	5		
Piston rings			8		9						9			
Ignition timing					10						11	14		
Timing mark			9								12			
Injectors			10		13	8	8		7	4	13	15	4	
PCM			11		14	9	9	4	8	5	14	16	5	
A/C circuit				2					6					
Connecting rod bearing				3										
Crankshaft bearing				4										
Fuel quality					1	2	2				1	3	3	
Spark plugs					2						3	4	2	
Fuel pump					6	6	6				5	12		
Fuel lines					7	7	7				6	13		
Ignition circuit			2		11									3
Intake air temp. sensor circuit					12	4	4		4			9		1
Accelerator pedal link								1	1					
TP Sensor circuit									5			6		
Cylinder head											15			
Clutch [M/T]												1		
Brakes not releasing properly												2		
Oxygen sensor circuit												10		
Crankshaft position sensor		3												
Battery voltage		1	1											

EFDA007A

Main Symptoms / Sub-Symptoms / Check points	Engine Stalls				Others			Refueling
	Soon after starting	After accelerator pedal is depressed	After accelerator pedal is released	During A/C ON	Excessive fuel consumption	Engine overheats	Engine too cool	Hard to refuel Overflowing spit-Back
Fuel quality	1							
Fuel pressure regulator	2	4			2			
Fuel pump	3							
Fuel lines	4	5						
ISC actuator	5		1	2				
MAF sensor circuit	6	1	2		13			
ECT sensor circuit	7				11			
Injectors	8	6			10			
ECM	9	7	3	3	17			
TP Sensor circuit		2			12			
Spark plug		3			6	8		
A/C circuit				1	14			
Fuel leakage					1			
Accelerator pedal link					3			
Clutch [M/T]					4			
Brakes drag when pedal released					5			
Compression					7			
Piston ring					8			
Ignition timing					9			
Oxygen sensor circuit					15			
Intake air temp. sensor circuit					16			
Coolant leakage						1		
Cooling fan						2	1	
Thermo switch						3		
Radiator and radiator cap						4	2	
Thermostat						5		
Timing belt						6		
Engine coolant pump						7		
Oil pump						9		
Cylinder head						10		
Cylinder block						11		
ECT sender						12	3	
Crankshaft position sensor	11	8	4	4				
Fill vent valve hose-clogging								1
Canister fillter-Contamination								2
Fuel shut off valve-operation								3

EFDA007B

NOTE

The number herein means the check order.

INSPECTION EF2FD001

SERVICE ADJUSTMENT PROCEDURES

IDLE SPEED

NOTE

Before adjusting, check that the spark plugs, injectors, idle speed control actuator (ISC actuator), compression etc. are normal.

CHECK CONDITIONS

- Engine coolant temperature is 80 to 95°C (176 to 205°F).
- Lights, electric cooling fan and all accessories are off.
- Transaxle is in neutral ("P" or "N" range for A/T vehicles).
- Steering wheel is in a straight forward position (Vehicles with power steering).

1. Install a tachometer to the primary coil side or connect the scan tool to the data link connector.
2. Start and run the engine at curb idle speed.
3. Run the engine for more than 5 seconds at an engine speed of 2,000 to 3,000 rpm. Then, run the engine at idle for 2 minutes.
4. Read the idling rpm.

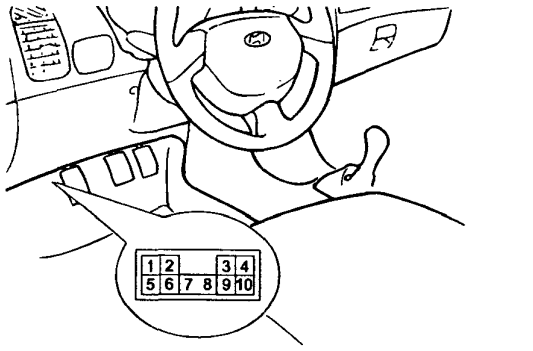
Idle speed
SOHC : 800 ± 100 rpm
DOHC : 750 ± 100 rpm

FUEL PUMP OPERATING CHECK

1. Turn the ignition switch OFF.
2. Apply battery voltage to the fuel pump drive connector to check that the pump operates.

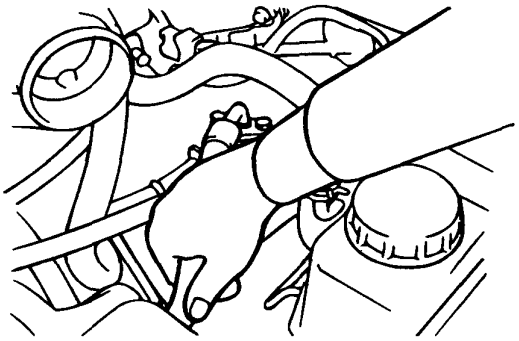
NOTE

The fuel pump is an in-tank type and its operation is hard to hear without removing the fuel tank cap.



EFDD003C

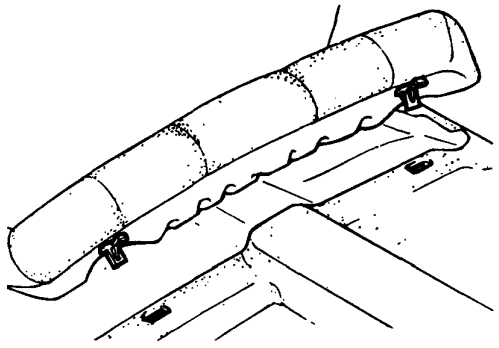
3. Pinch the hose to check that fuel pressure is felt.



EFDA011B

FUEL PRESSURE TEST

1. Press the two taps under the rear seat and raise the seat, then detach the inspection panel of the fuel pump.

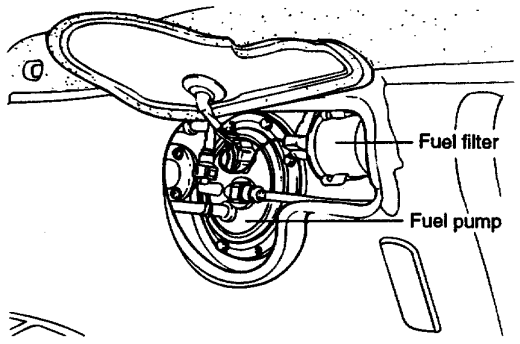


EFDA013A

2. To reduce the internal pressure of the fuel lines and hoses, first start the engine with the fuel pump disconnected and wait until it stops by itself.

NOTE

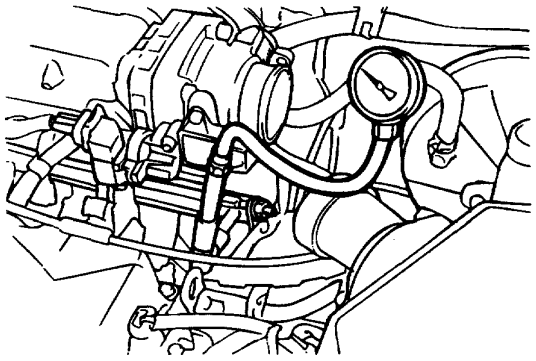
Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose, otherwise fuel will spill out.



EFDA013B

3. Disconnect the battery negative (-) terminal and then connect the fuel pump harness connector.

4. Using the fuel pressure gauge adapter (09353-24000, 09353-24100, 09353-38000), install the fuel-pressure gauge to the fuel filter. Tighten the bolt to the specified torque.



EFPD013C

Tightening Torque
Fuel pressure gauge to fuel filter :
25 ~ 35 Nm (250 ~ 350 kg·cm, 18 ~ 26 lb·ft)

5. Connect the battery's negative (-) terminal.

6. Apply battery voltage to the terminal for the pump drive and activate the fuel pump. Then, with fuel pressure applied, check that there is no fuel leak from the pressure gauge or connections.

7. Start the engine and let it idle.

8. Measure the fuel pressure.

Standard value :350 kPa (3.5 kg/cm², 49.8 psi)

9. If the result of the measurements made in steps (7) and (8) are not within the standard value, use the table below to determine the probable cause, and make the necessary repairs.

Condition	Probable cause	Remedy
Fuel pressure too low	a. Clogged fuel filter. b. Fuel leak on the return side, caused by poor seating of the fuel-pressure regulator.	a. Replace fuel filter. b. Replace fuel pump.
Fuel pressure too high	a. Sticking fuel-pressure regulator. b. Clogged or bent fuel return hose or pipe.	a. Replace fuel pump. b. Repair or replace hose or pipe.

10. Stop the engine and check for a change in the fuel pressure gauge reading, which should hold for approximately 5 minutes. If the gauge indication drops, observe the rate of drop. Determine and remove the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	a. Injector leak.	a. Replace injector.
Fuel pressure drops immediately after engine is stopped	a. The check valve within the fuel pump is open.	a. Replace fuel pump.

11. Reduce the pressure in the fuel line.
12. Disconnect the hose and the gauge.

⚠ ***CAUTION***

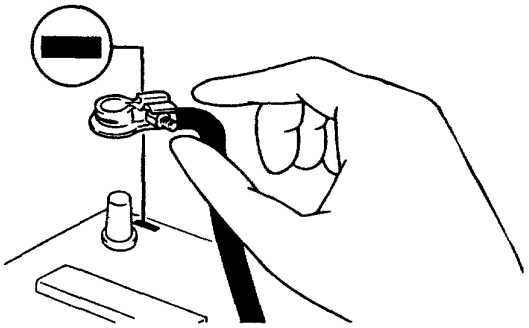
Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual fuel pressure in the fuel line.

13. Replace the O-ring at the end of the hose.
14. Connect the fuel hose to the delivery pipe and tighten with the specified torque.
15. Check for fuel leaks.

REPLACEMENT E4DAA35C

FUEL FILTER AND PUMP REPLACEMENT

1. Reduce the internal pressure of the fuel lines and hoses by completing the following operations.
   - After removing the rear seat cushion, disconnect the fuel pump harness.
   - Start the engine. Allow it to stop by itself, then turn the ignition switch OFF.
   - Disconnect the battery negative (-) terminal.
   - Connect the fuel pump harness connector.



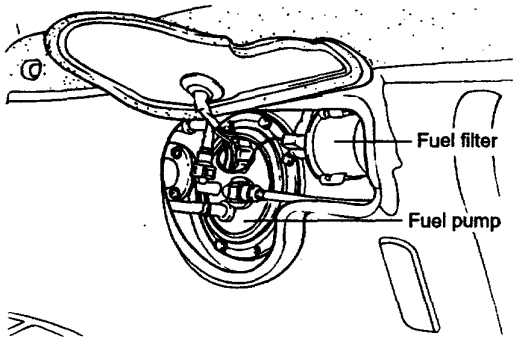
EFDA023A

2. Remove the eye bolts while holding the fuel filter nuts securely.

   ⚠ ***CAUTION***

   Cover the fuel filter with a shop towel to avoid residual gasoline from splashing.

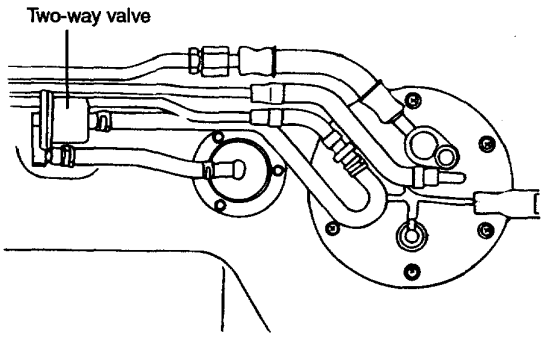
3. Remove the fuel filter mounting bolts, then remove the fuel filter from the fuel filter clamp.
4. After replacing the fuel filter, check for fuel leaks.



EFDA013B

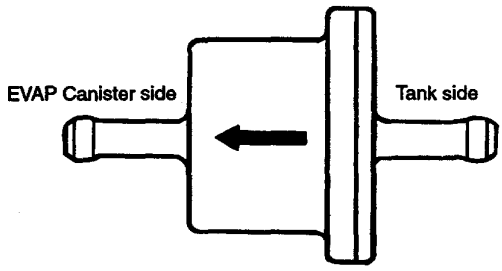
OVERFILL LIMITER (TWO-WAY VALVE) REPLACEMENT

1. Disconnect the vapor hoses, and then remove the overfill limiter.



EFDA025A

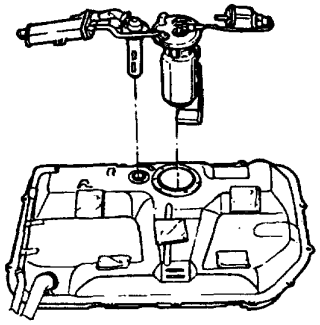
2. Connect the overfill limiter in the correct direction.



EFDA025B

FUEL SENDER REPLACEMENT

1. Remove the fuel tank cap to lower the fuel tank's internal pressure.
2. Remove the fuel sender installation screws, then remove the fuel sender from the fuel tank.



EFDA112A

MFI SYSTEM INSPECTION E2C563F4

If the MFI system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability.

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the MFI system components with the HI-SCAN.

NOTE

- *Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.*
- *Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.*
- *The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.*
- *When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.*
- *When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.*

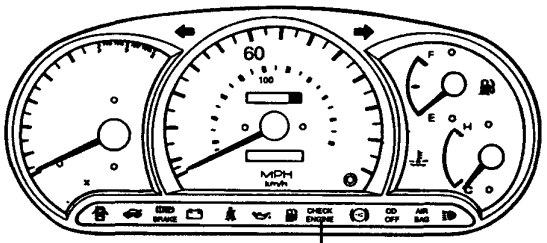
MALFUNCTION INDICATOR LAMP (MIL)

[EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turn on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Catalyst
- Fuel system
- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature Sensor
- Engine Coolant Temperature Sensor
- Throttle Position Sensor
- Upstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor
- Camshaft Position Sensor
- Purge Control Solenoid Valve
- Vehicle Speed Sensor
- Idle Control Valve
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage



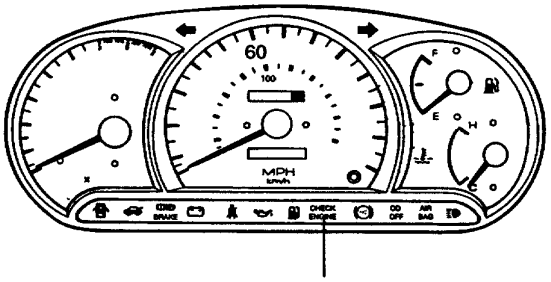
EFDA009D

[EXCEPT EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turn on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Manifold absolute pressure sensor (MAP sensor)
- Throttle position sensor (TP Sensor)
- Engine coolant temperature sensor (ECT Sensor)
- Idle speed control actuator (ISC Actuator)
- Injectors
- ECM



EFDA009D

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.

2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

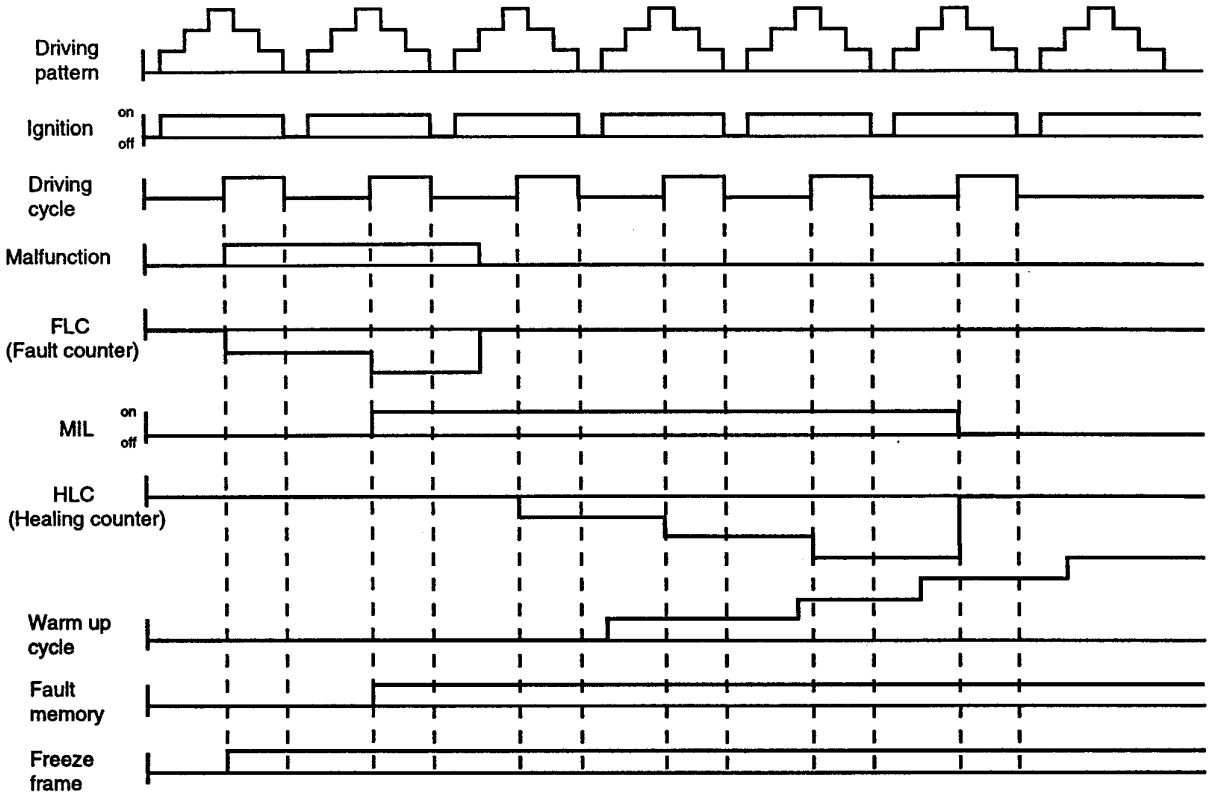
SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity,it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN.Diagnostic trouble codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or the engine control module (ECM) connector is disconnected or by HI-CAN.

NOTE

If a sensor connector is disconnected with the ignition switch turned on,the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

THE RELATION BETWEEN DTC AND DRIVING PATTERN



EFDA017A

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.
4. A diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTE

- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.*

DIAGNOSTIC TROUBLE CODES (EOBD)

DTC NO.	CONTENT	Memory	MIL
P0030	HO2S Heater Current Malfunction (Bank 1, Sensor 1)	O	O
P0031	HO2S Heater Circuit Low (Bank 1, Sensor 1)	O	O
P0032	HO2S Heater Circuit High (Bank 1, Sensor 1)	O	O
P0036	HO2S Heater Circuit Malfunction (Bank 1, Sensor 2)	O	X
P0037	HO2S Heater Circuit Low (Bank 1, Sensor 2)	O	O
P0038	HO2S Heater Circuit High (Bank 1, Sensor 2)	O	O
P0106	MAP Sensor Rationality	O	O
P0107	MAP Sensor Range Check Low	O	O
P0108	MAP Sensor Range Check High	O	O
P0112	Intake Air Temperature Circuit Low Input	O	O
P0113	Intake Air Temperature Circuit High Input	O	O
P0116	Engine Coolant Temperature Sensor Circuit Range/Performance Problem	O	O
P0117	Engine Coolant Temperature Circuit Low Input	O	O
P0118	Engine Coolant Temperature Circuit High Input	O	O
P0121	Throttle Position Sensor Circuit Range/Performance Problem	O	X
P0122	Throttle Position Sensor Circuit Low Input	O	O
P0123	Throttle Position Sensor Circuit High Input	O	O
P0130	O2 Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0131	HO2S Circuit Low Input (Bank 1, Sensor 1)	O	O
P0132	HO2S Circuit High Input (Bank 1, Sensor 1)	O	O
P0133	HO2S Circuit Slow Responsive (Bank 1, Sensor 1)	O	O
P0134	O2 Sensor Circuit No Activity Detected	O	O
P0136	O2 Sensor Circuit Malfunction (Bank 1, Sensor 2)	O	O
P0137	HO2S Circuit Low Input (Bank 1, Sensor 2)	O	O
P0138	HO2S Circuit High Input (Bank 1, Sensor 2)	O	O
P0140	HO2 Range Check	O	O
P0171	Fuel System Too Lean (Bank 1)	O	O
P0172	Fuel System Too Rich (Bank 1)	O	O
P0230	Fuel Pump Circuit Malfunction	O	X
P0261	Injector Circuit Low Input (Cylinder -1)	O	O
P0264	Injector Circuit Low Input (Cylinder -2)	O	O
P0267	Injector Circuit Low Input (Cylinder -3)	O	O
P0270	Injector Circuit Low Input (Cylinder -4)	O	O
P0262	Injector Circuit High Input (Cylinder -1)	O	O
P0265	Injector Circuit High Input (Cylinder -2)	O	O
P0268	Injector Circuit High Input (Cylinder -3)	O	O
P0271	Injector Circuit High Input (Cylinder -4)	O	O

DTC NO.	CONTENT	Memory	MIL
P0300	Random Misfire Detected	O	O
P0301	Misfire Detected (Cylinder -1)	O	O
P0302	Misfire Detected (Cylinder -2)	O	O
P0303	Misfire Detected (Cylinder -3)	O	O
P0304	Misfire Detected (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction (Bank 1)	O	X
P0335	Crankshaft Position Sensor Circuit Malfunction	O	O
P0336	Crankshaft Position Sensor Circuit Out Of Range	O	O
P0340	Camshaft Position Sensor Circuit Malfunction	O	O
P0420	Main catalyst efficiency deterioration (Bank 1)	O	O
P0444	EVAP Emission Control System Purge Control Valve Circuit Open	O	O
P0445	EVAP Emission Control System Purge Control Valve Circuit Shorted	O	O
P0501	Vehicle Speed Sensor Range/Performance	O	O
P0506	Idle RPM Lower than Expected	O	O
P0507	Idle RPM Higher than Expected	O	O
P0562	System Voltage Low	O	O
P0563	System Voltage High	O	O
P0605	Internal CONTROL module ROM error	O	O
P1307	Acceleration Sensor Malfunction	O	O
P1308	Acceleration Sensor Signal Check Low	O	O
P1309	Acceleration Sensor Signal Check High	O	O
P1505	Idle Charge Actuator Signal Low of Coil #1	O	O
P1506	Idle Charge Actuator Signal High of Coil #1	O	O
P1507	Idle Charge Actuator Signal Low of Coil #2	O	O
P1508	Idle Charge Actuator Signal High of Coil #2	O	O
P1586	Encoding Signal Circuit Not Rational	O	O
P1690	Immobilizer SMATRA Error	O	X
P1691	Immobilizer Antena Error	O	X
P1693	Immobilizer Transponder Error	O	X
P1694	Engine ECM Signal Error	O	X
P1695	EEPROM Error	O	X

DIAGNOSTIC TROUBLE CODES (NON-EOBD)

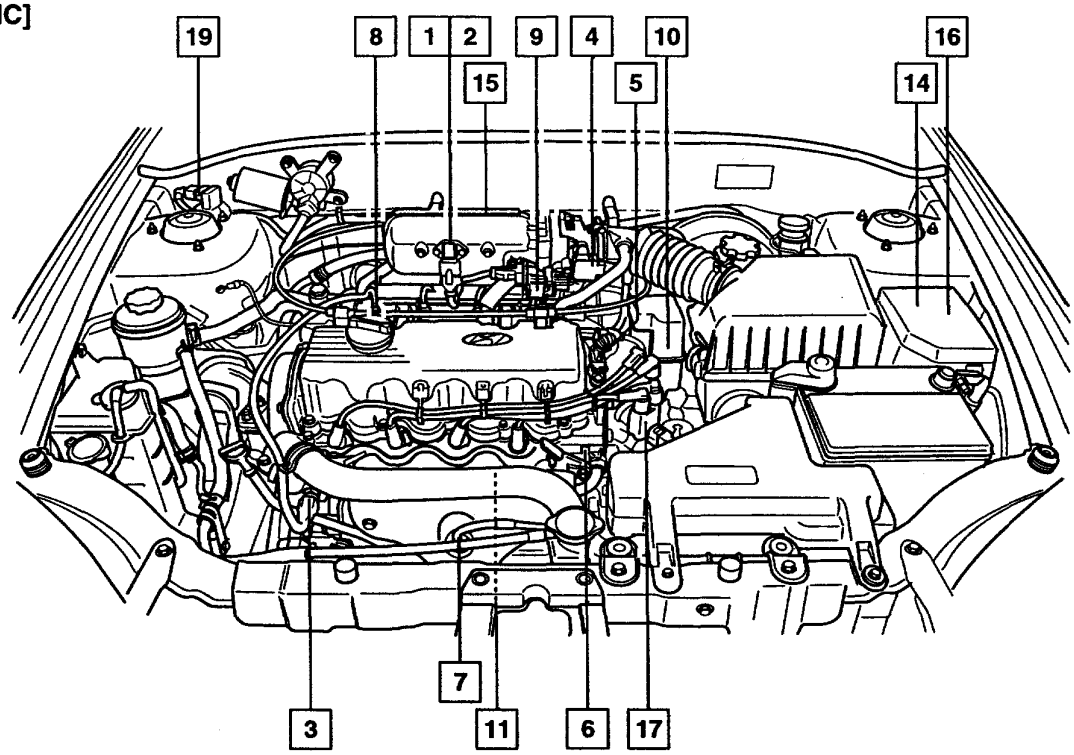
DTC NO.	CONTENT	Memory	MIL
P0031	HO2S Heater Circuit Low (Bank 1, Sensor 1)	O	X
P0032	HO2S Heater Circuit High (Bank 1, Sensor 1)	O	X
P0107	MAP Sensor Range Check Low	O	O
P0108	MAP Sensor Range Check High	O	O
P0112	Intake Air Temperature Circuit Low Input	O	X
P0113	Intake Air Temperature Circuit High Input	O	X
P0116	Engine Coolant Temperature Sensor Circuit Range/Performance Problem	O	X
P0117	Engine Coolant Temperature Circuit Low Input	O	O
P0118	Engine Coolant Temperature Circuit High Input	O	O
P0121	Throttle Position Sensor Circuit Range/Performance Problem	O	X
P0122	Throttle Position Sensor Circuit Low Input	O	O
P0123	Throttle Position Sensor Circuit High Input	O	O
P0130	O2 Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	X
P0131	HO2S Circuit Low Input (Bank 1, Sensor 1)	O	X
P0132	HO2S Circuit High Input (Bank 1, Sensor 1)	O	X
P0133	HO2S Circuit Slow Responsive (Bank 1, Sensor 1)	O	X
P0134	O2 Sensor Circuit No Activity Detected	O	X
P0171	Fuel System Too Lean (Bank 1)	O	X
P0172	Fuel System Too Rich (Bank 1)	O	X
P0230	Fuel Pump Circuit Malfunction	O	X
P0261	Injector Circuit Low Input (Cylinder -1)	O	O
P0264	Injector Circuit Low Input (Cylinder -2)	O	O
P0267	Injector Circuit Low Input (Cylinder -3)	O	O
P0270	Injector Circuit Low Input (Cylinder -4)	O	O
P0262	Injector Circuit High Input (Cylinder -1)	O	O
P0265	Injector Circuit High Input (Cylinder -2)	O	O
P0268	Injector Circuit High Input (Cylinder -3)	O	O
P0271	Injector Circuit High Input (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction (Bank 1)	O	X
P0335	Crankshaft Position Sensor Circuit Malfunction	O	X
P0336	Crankshaft Position Sensor Circuit Out Of Range	O	X
P0340	Camshaft Position Sensor Circuit Malfunction	O	X
P0501	Vehicle Speed Sensor Range/Performance	O	X
P0506	Idle RPM Lower than Expected	O	X
P0507	Idle RPM Higher than Expected	O	X
P0562	System Voltage Low	O	X
P0563	System Voltage High	O	X

DTC NO.	CONTENT	Memory	MIL
P0605	Internal CONTROL module ROM error	O	X
P1505	Idle Charge Actuator Signal Low of Coil #1	O	O
P1506	Idle Charge Actuator Signal High of Coil #1	O	O
P1507	Idle Charge Actuator Signal Low of Coil #2	O	O
P1508	Idle Charge Actuator Signal High of Coil #2	O	O
P1586	Encoding Signal Circuit Not Rational	O	X
P1690	Immobilizer SMATRA Error	O	X
P1691	Immobilizer Antena Error	O	X
P1693	Immobilizer Transponder Error	O	X
P1694	Engine ECM Signal Error	O	X
P1695	EEPROM Error	O	X

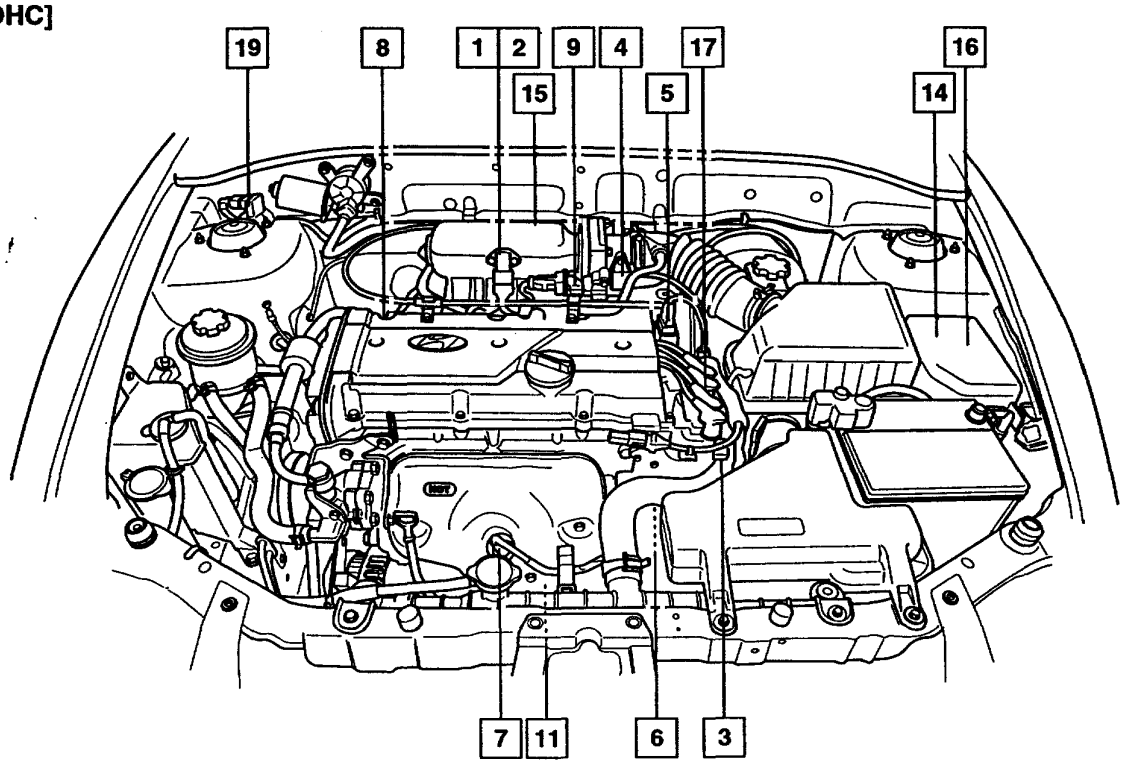
MFI CONTROL SYSTEM

COMPONENTS E76500A5

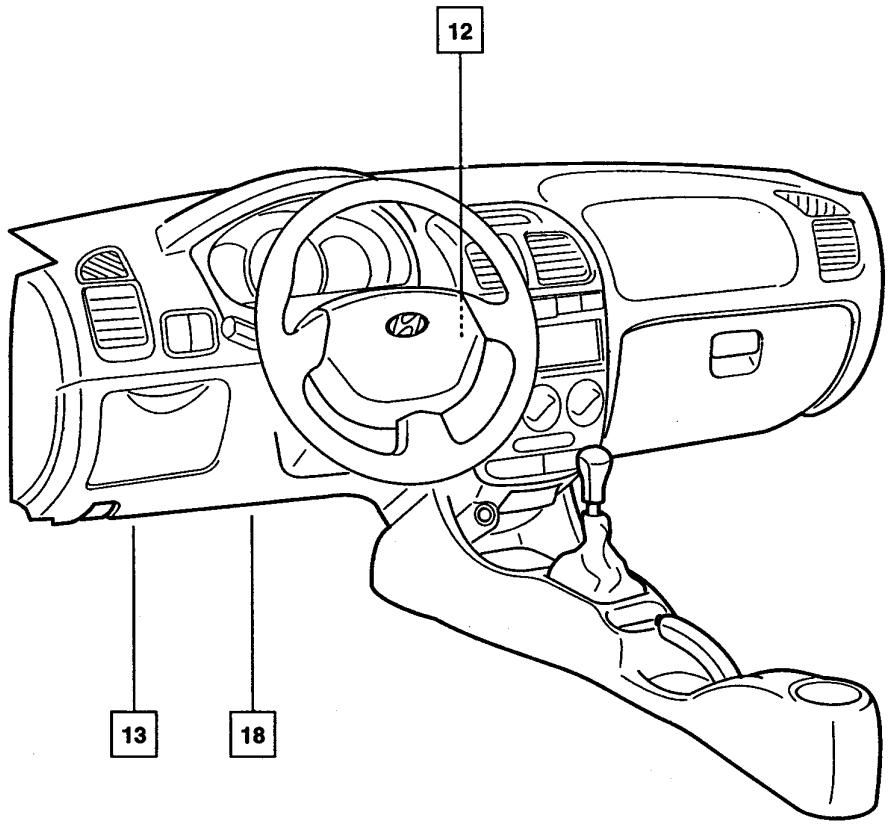
[SOHC]



[DOHC]



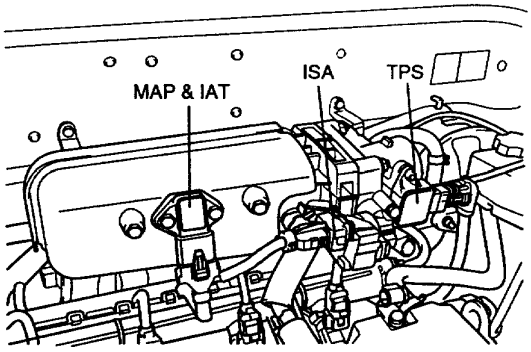
EFDD701A



1	Manifold Absolute Pressure(MAP) Sensor
2	Intake Air Temperature(IAT) Sensor
3	Engine Coolant Temperature(ECT) Sensor
4	Throttle Position Sensor (TPS)
5	Camshaft Position(CMP) Sensor
6	Crankshaft Position(CKP) Sensor
7	Heated Oxygen Sensor (HO2S)
8	Injector
9	Idle Speed Actuator (ISA)
10	Vehicle speed sensor (VSS)
11	Knock sensor
12	Ignition switch
13	Engine Control Module (ECM)
14	A/CON Relay
15	Purge Control Solenoid Valve (PCSV)
16	MFI control relay
17	Ignition coil
18	Data link connector
19	Acceleration sensor

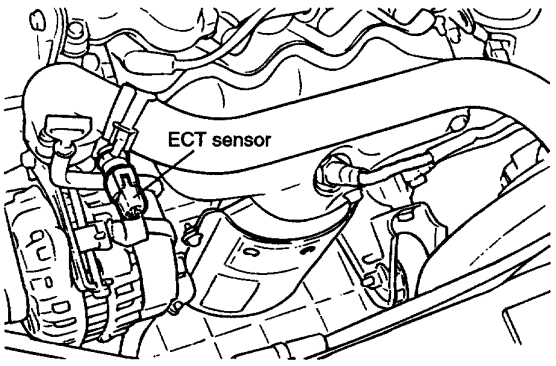
EFDD301Z

[1], [2], [4], [9]



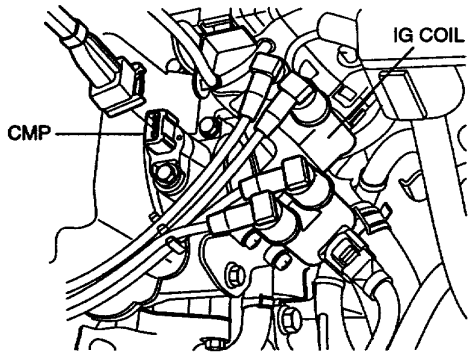
EFDD301L

[3]



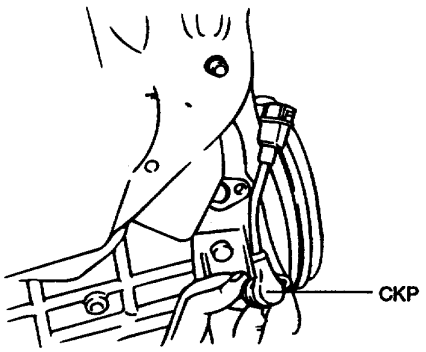
EFDA301D

[5], [17]



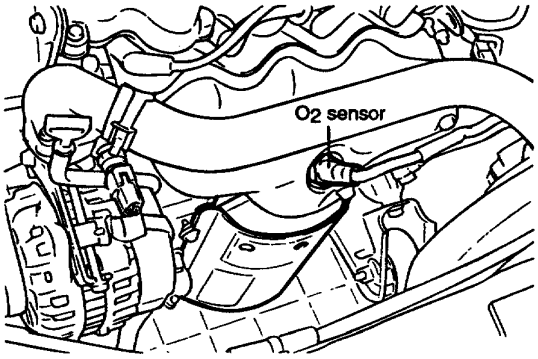
KFPC008D

[6]



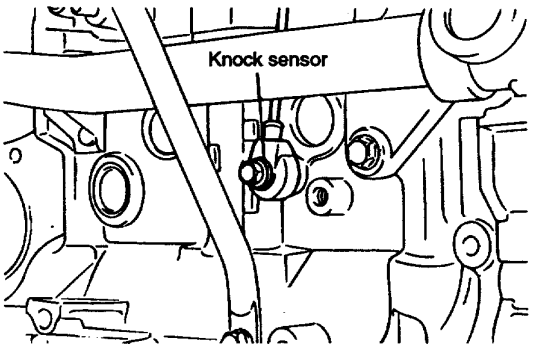
KFPD701E

[7]



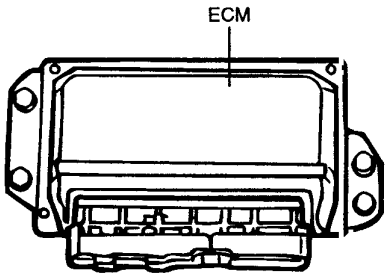
EFDA301K

[11]



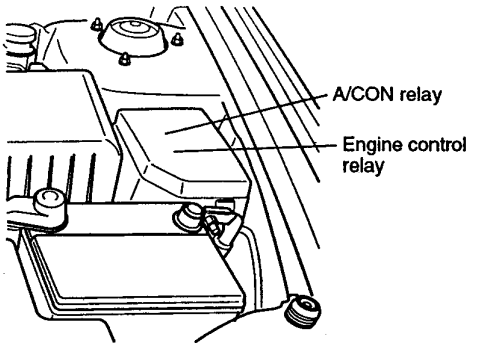
EFDA701C

[13]



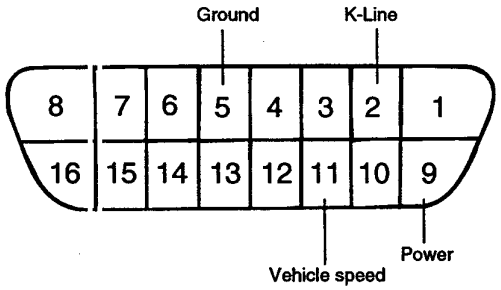
EFDA301H

[14], [16]



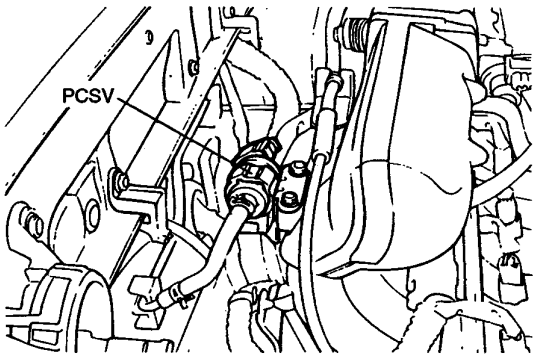
EFDD735A

[18]



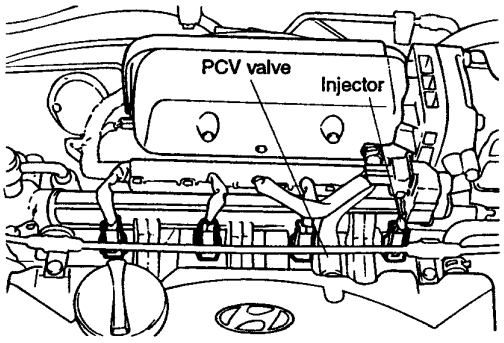
EEDB002B

[15]



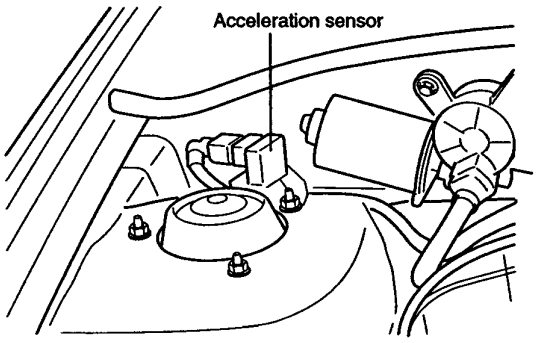
EEDA204A

[8]



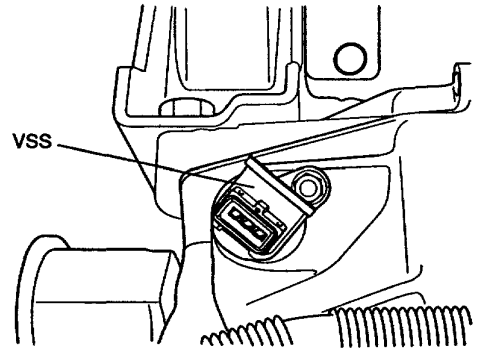
EEDA105B

[19]



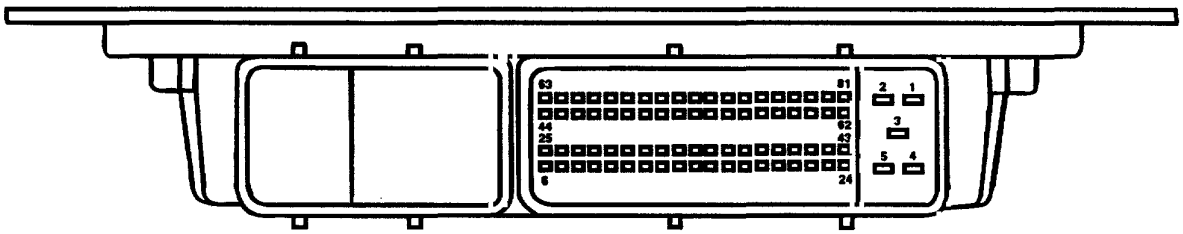
EFDD745A

[10]



EFPD183A

ECM PIN NUMBER CONFIGURATION

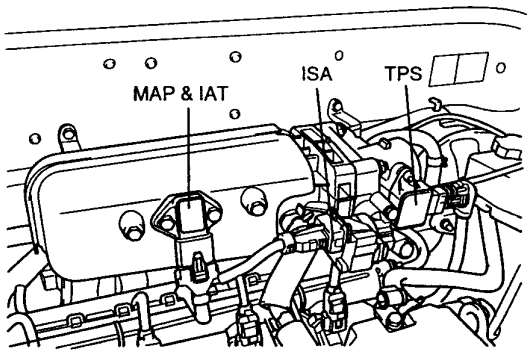


ECM HARNESS PIN NUMBER CONFIGURATION

1	2	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63
	3	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
		43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
4	5	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6

EFDA301Q

MAP SENSOR

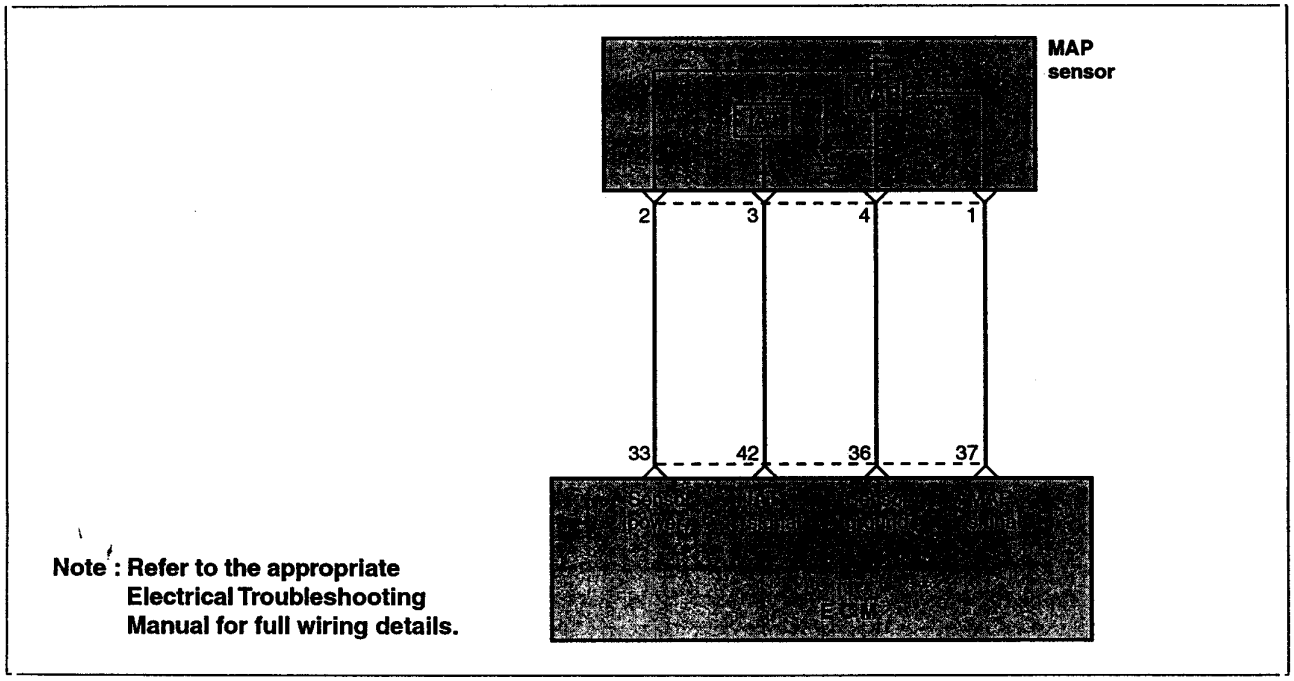


EFDD301L

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR) E2E6D8B0

The manifold absolute pressure (MAP) sensor is a pressure sensitive variable resistor. It measures changes in the intake manifold pressure which result from engine load and speed changes, and converts this to a voltage output. The MAP sensor is also used to measure barometric pressure at start up, and under certain conditions, allows the ECM to automatically adjust for different altitudes. The ECM supplies 5 volts to the MAP sensor and monitors the voltage on a signal line. The sensor provides a path to ground through its variable resistor. The MAP sensor input affects fuel delivery and ignition timing controls in the ECM.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD502A

TROUBLESHOOTING HINTS

The MIL (Malfunction Indicator Lamp) is ON or the DTC (Diagnostic Trouble Code) is displayed on the HI-SCAN under the following conditions;

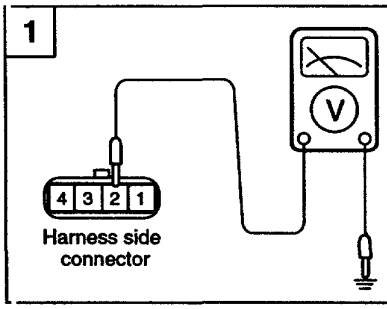
1. When the manifold pressure is 118mb or lower for 0.1 second after turning the ignition key ON.
2. When the manifold pressure is 118mb or lower while the RPM is below 1980rpm.
3. When the manifold pressure is 986mb or higher and the rpm is 2400rpm or more while the accelerator pedal is released (such as when a vehicle is moving down on a sloping road).

USING HI-SCAN

Check item	Data display	Check conditions	Engine state	Test specification
MAP sensor	Intake manifold pressure	• Engine coolant temperature : 80 to 95° (176 to 205°F) • Lamps, electric cooling fan, accessory units : ALL OFF • Transaxle : Neutral (P range for vehicle with A/T) • Steering wheel : Neutral	IG. KEY "ON"	800 ~ 1080 mb
			Idle	190 ~ 390 mb

HARNESS INSPECTION PROCEDURES

1



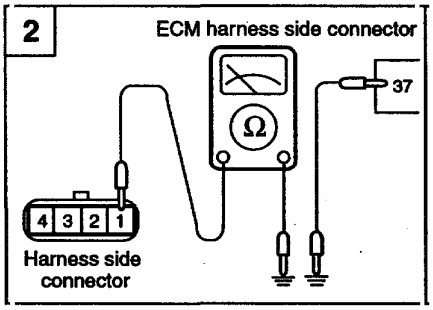
Measure the power supply voltage.
- Connector : Disconnected
- Ignition switch : ON
- Voltage (V) : 4.8 ~ 5.2V

OK ⇒ 2

NG ⇒ Repair the harness.

EFDA707A

2



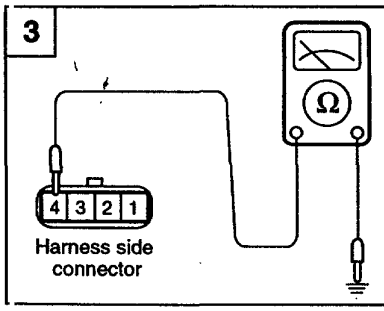
Check for an open-circuit, or a short-circuit to ground between the engine control module and MAP sensor.
- MAP sensor circuit : Disconnected
- Engine control module connector : Disconnected

OK ⇒ 3

NG ⇒ Repair the harness.

EFPD707B

3



Check for continuity of the ground circuit.
- Connector : Disconnected

OK ⇒ END!

NG ⇒ Repair the harness.

EFDA707C

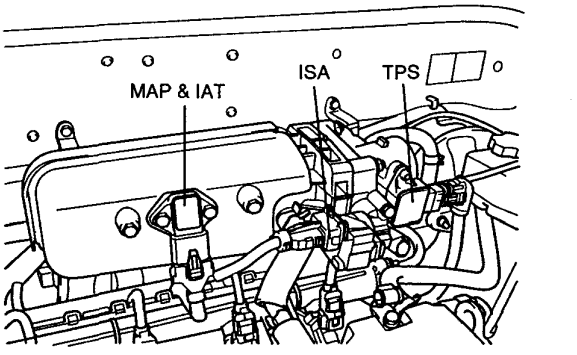
SENSOR INSPECTION

1. Measure the voltage between terminals 1 and 4 of the MAP sensor connectors.
   Terminal 4 : MAP sensor ground
   Terminal 1 : MAP sensor output

Engine state	Test specification
Ignition SW. ON.	4 ~ 5V
At idle	1.14 ± 0.4V

2. If the voltage deviates from the standard value, replace the MAP sensor assembly.

INTAKE AIR TEMPERATURE (IAT) SENSOR

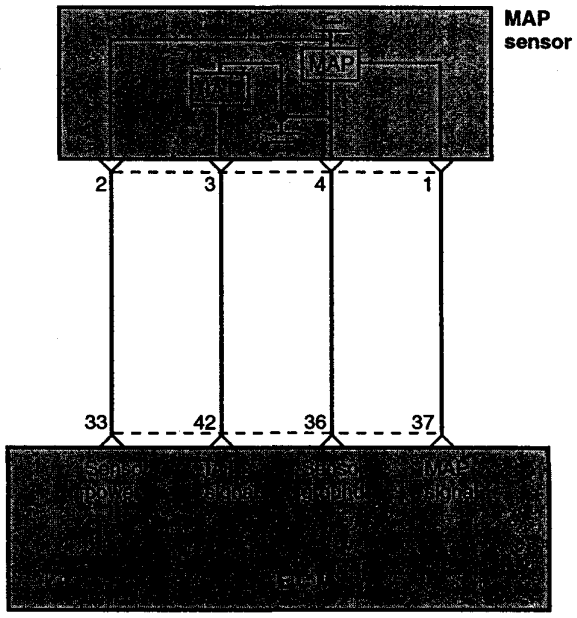


EFDD301L

INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR) EFEBBDBA

The intake air temperature sensor (IAT Sensor), built-in type in the MAP sensor, is a resistor-based sensor which detects the intake air temperature. According to the intake air temperature information from the sensor, the ECM will control the necessary amount of fuel injection.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD502A

TROUBLESHOOTING HINTS

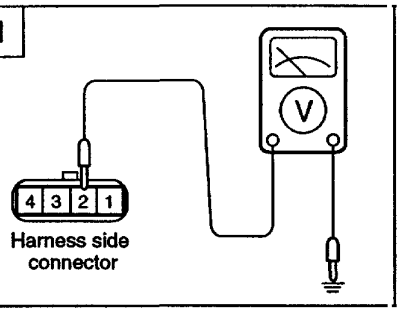
The MIL is ON or the DTC is displayed on the HI-SCAN under the following condition;

- When the intake air temperature is detected below -40°C or higher than 120°C.

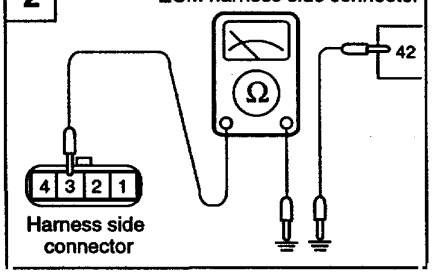
USING HI-SCAN

Check item	Data display	Check conditions	Engine state	Test specification
Intake air temperature sensor	Air temperature	Ignition switch : ON or engine running	When 0°C (32°F)	4.0 ~ 4.4V
			When 20°C (68°F)	3.3 ~ 3.7V
			When 40°C (104°F)	2.5 ~ 2.9V
			When 80°C (176°F)	1.0 ~ 1.4V

HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage of the IAT Sensor. • Connector : Disconnected • Ignition switch : ON • Voltage : 4.8 ~ 5.2V	OK ⇒ NG ⇒	2 Repair the harness.

EFDA709A

2 ECM harness side connector 	Check for an open-circuit, or a short-circuit to ground between the engine control module and the IAT sensor. • ECM connector : Disconnected • IAT sensor connector : Disconnected	OK ⇒ NG ⇒	END! Repair the harness.

EFPD709B

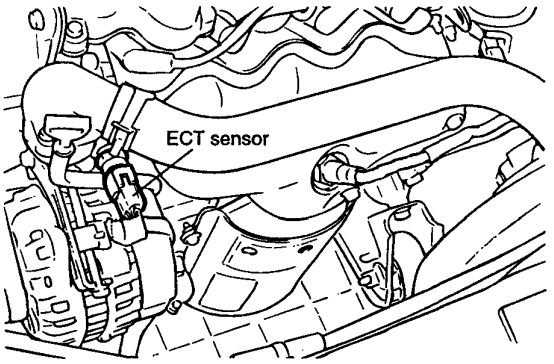
SENSOR INSPECTION

1. Using a multimeter, measure the IAT sensor resistance between terminals 3 and 4.

IG. SW.	Temperature °C	Resistance (kΩ)
ON	0 (32)	4.5 ~ 7.5
	20 (68)	2.0 ~ 3.0
	40 (104)	0.7 ~ 1.6
	80 (176)	0.2 ~ 0.4

2. If the resistance deviates from the standard value, replace the intake air temperature sensor assembly.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

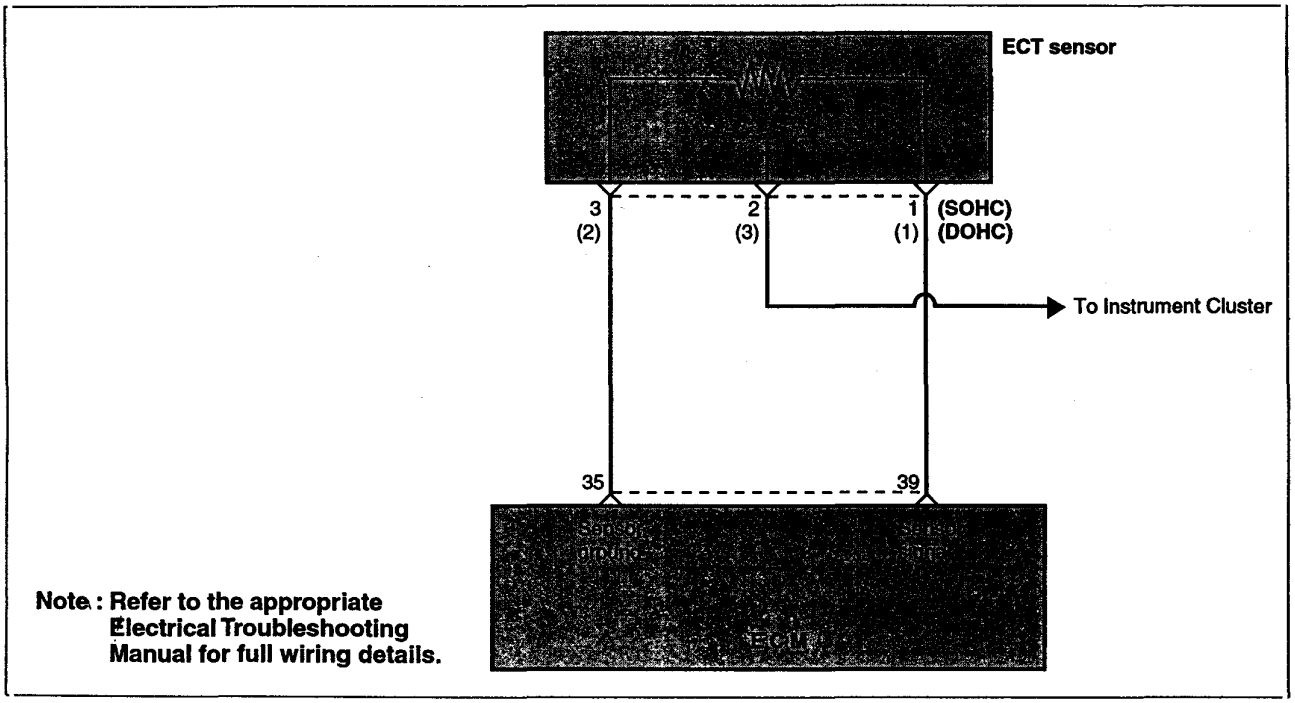


EFDA301D

ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR) EA2AC33C

The engine coolant temperature sensor is located in the engine coolant passage of the cylinder head. It detects the engine coolant temperature and relays signals to the ECM. It employs a thermistor which is sensitive to changes in temperature. The electric resistance of a thermistor decreases in response to temperature rise. The ECM judges engine coolant temperature by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.

CIRCUIT DIAGRAM



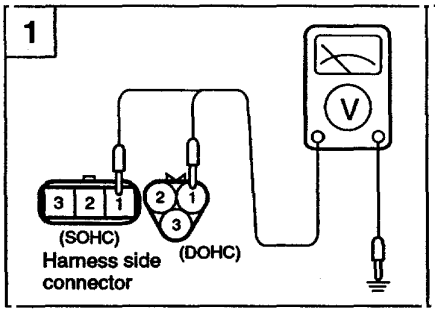
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD511A

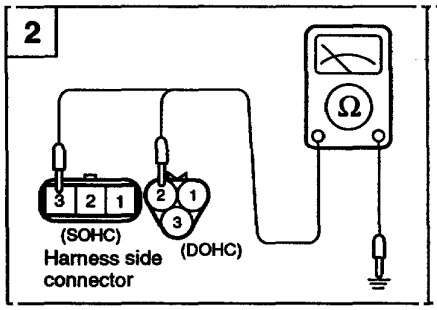
USING HI-SCAN

Check item	Data display	Check conditions	Engine state	Test specification
Engine coolant temperature sensor	Sensor temperature	Ignition switch : ON or engine running	When 0°C (32°F)	4.27V ± 0.3
			When 20°C (68°F)	3.44V ± 0.3
			When 40°C (104°F)	2.72V ± 0.3
			When 80°C (176°F)	1.25V ± 0.3

HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage. • Connector : Disconnected • Ignition switch : ON • Voltage : 4.8 ~ 5.2V	OK ⇨ NG ⇨	2 Repair the harness.

EFPD711A

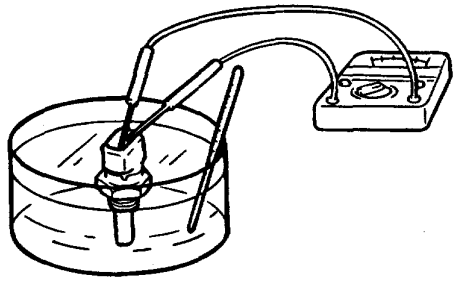
2 	Check for continuity of the ground circuit. • Connector : Disconnected	OK ⇨ NG ⇨	END! Repair the harness.

EFPD711B

SENSOR INSPECTION

1. Remove the engine coolant temperature sensor from the intake manifold.
2. With the temperature sensing portion of the engine coolant temperature sensor immersed in hot water, check resistance.

Temperature °C (°F)	Resistance (kΩ)
-30 (-22)	22.22 ~ 31.78
-10 (14	8.16 ~ 10.74
0 (32)	5.18 ~ 6.60
20 (68)	2.27 ~ 2.73
40 (104)	1.059 ~ 1.281
60 (140)	0.538 ~ 0.650
80 (176)	0.298 ~ 0.322
90 (194)	0.219 ~ 0.243



EFDA711C

3. If the resistance deviates from the standard value greatly, replace the sensor.

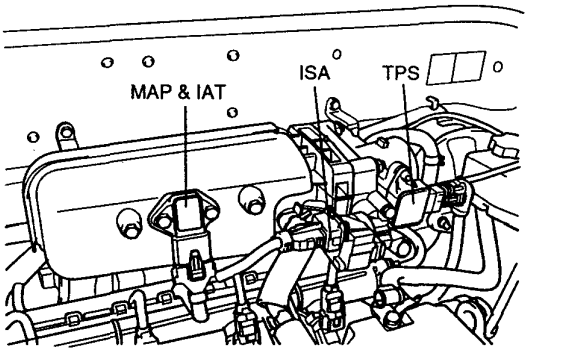
INSTALLATION

1. Apply sealant LOCTITE 962T or equivalent to threaded portion.
2. Install engine coolant temperature sensor and tighten it to specified torque.

Tightening torque
Engine coolant temperature sensor
SOHC: 15~20 Nm (150~200 kg·cm, 11~15 lb·ft)
DOHC: 25~30 Nm (250~300 kg·cm, 18~22 lb·ft)

3. Connect the harness connector securely.

THROTTLE POSITION (TP) SENSOR

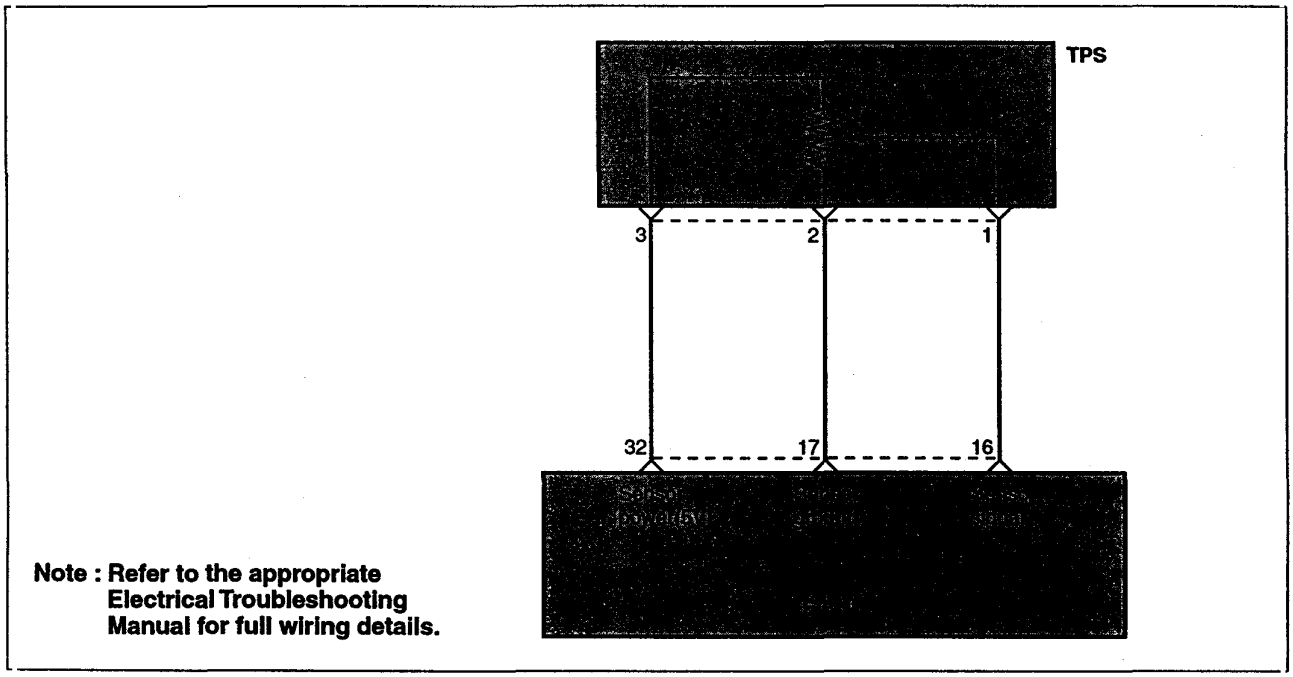


EFDD301L

THROTTLE POSITION SENSOR (TPS) E5CC7A3B

The TP Sensor is a rotating type variable resistor that rotates with the throttle body's throttle shaft to sense the throttle valve angle. As the throttle shaft rotates, the throttle angle of the TP Sensor changes and the ECM detects the throttle valve opening based on the TPS output voltage.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD516A

TROUBLESHOOTING HINTS

1. The TPS signal is important for the control of an automatic transaxles. Shift shock and other trouble may occur if the sensor is faulty.
2. If the idle condition or acceleration is abnormal, check the TPS connector. (When the TPS connector is not connected properly, the current data on HI-SCAN can show that the idle state remains off, although the accelerater pedal is released. This results in the improper idle or acceleration.)
3. Input voltage from throttle position sensor is below 0.1V or above 4.7V when ignition switch is turned on.

USING HI-SCAN

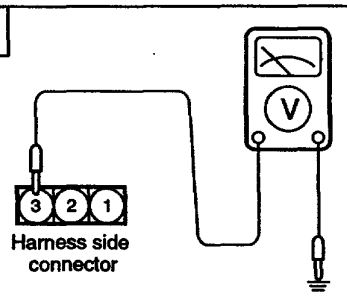
Check item	Data display	Check condition	Test specification
Throttle position sensor	Throttle angle	At idle rpm	5° ~ 16°
		Gradually open	Increases
		Wide open throttle	80° ~ 98°

USING VOLTMETER

Check item	Check condition	Test specification
Throttle position sensor output voltage (TP Sensor side connector No.1 or ECM harness side connector No.16)	At idle rpm	0.25 ~ 0.8V
	Wide open throttle	4.0 ~ 4.8V

HARNESS INSPECTION PROCEDURES

1



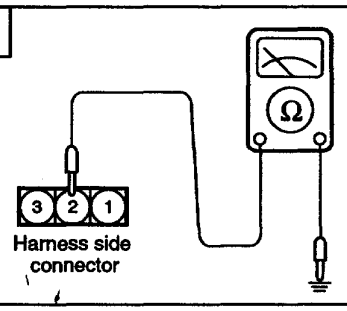
Measure the power supply voltage of the throttle position sensor.
- Connector : Disconnected
- Ignition switch : ON
- Voltage : 4.8 ~ 5.2V

OK ⇒ 2

NG ⇒ Repair the harness.

EFDA713A

2



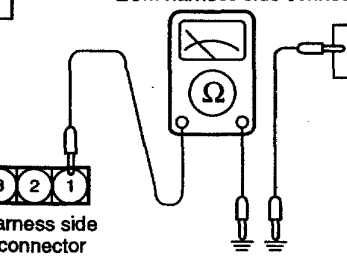
Check for continuity of the ground circuit.
- Connector : Disconnected

OK ⇒ 3

NG ⇒ Repair the harness.

EFDA713B

3



Check for an open-circuit, or a short-circuit to ground between the engine control module and the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control module connector: Disconnected

OK ⇒ END!

NG ⇒ Repair the harness.

EFPD713C

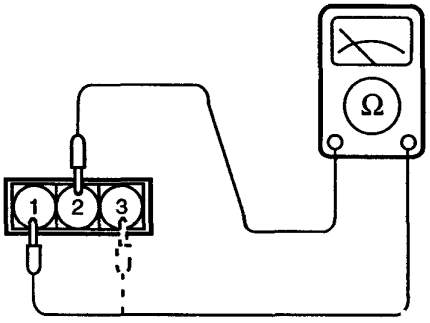
SENSOR INSPECTION

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between terminals 2 (sensor ground) and terminal 3 (sensor power).

Standard value :0.7 ~ 3.0 kΩ

3. Connect an analog ohmmeter between terminals 2 (sensor ground) and terminal 1 (sensor output).
4. Operate the throttle valve slowly from the idle position to the full open position, and check that the resistance changes smoothly in proportion with the throttle valve opening angle.
5. If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

Tightening torque
Throttle position sensor :
1.5 ~ 2.5 Nm (15 ~ 25 kg·cm, 1.1 ~ 1.8 lb·ft)

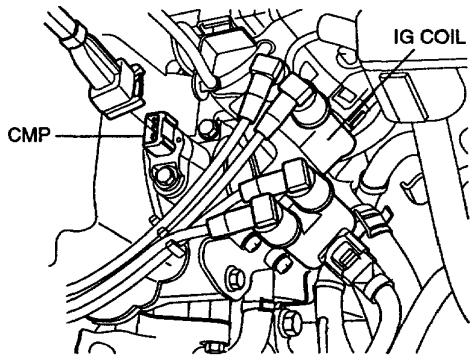


EFDA713D

CAMSHAFT POSITION SENSOR

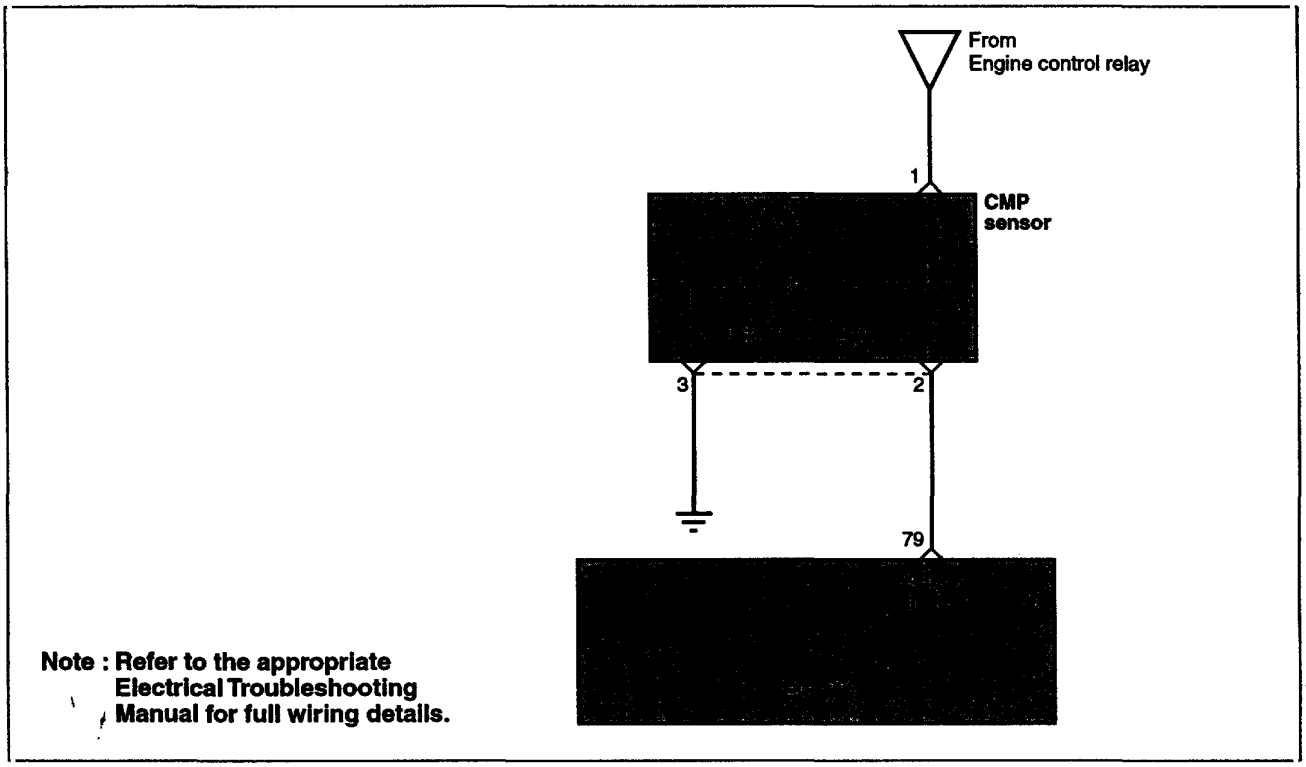
CAMSHAFT POSITION SENSOR (CMP SENSOR) E06C284E

The camshaft position sensor (CMP Sensor) senses the TDC point of No.1 cylinder on its compression stroke. Its signal is fed to the ECM to be used to determine the sequence of fuel injection.



KFPC006D

CIRCUIT DIAGRAM



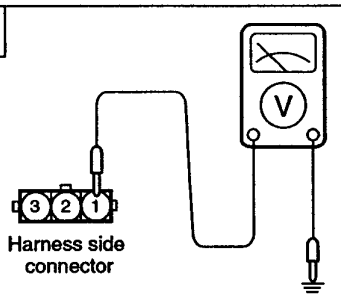
EFPD566A

USING VOLTMETER

Check item	Check condition	Test specification
Camshaft position sensor output voltage	At idle rpm	0 ~ B+ (5 ~ 8 Hz)
	3000 rpm	0 ~ B+ (24 ~ 26 Hz)

HARNESS INSPECTION PROCEDURES

1



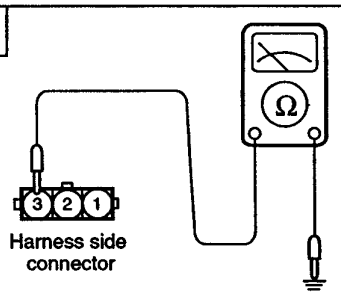
Measure the power supply voltage.
- Connector : Disconnected
- Ignition switch : ON
- Voltage (V) : Battery voltage

OK ⇒ **2**

NG ⇒ Repair the harness.

EFDA715A

2



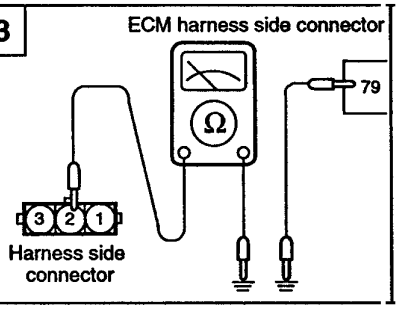
Check for continuity of the ground circuit.
- Connector : Disconnected

OK ⇒ **3**

NG ⇒ Repair the harness.

EFDA715B

3



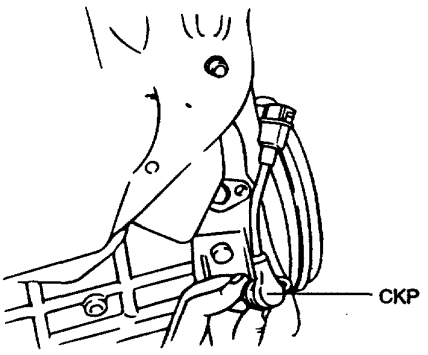
Check for an open-circuit, or a short-circuit to ground between the engine control module and the camshaft position sensor.
- Camshaft position sensor connector: Disconnected
- Engine control module connector: Disconnected

OK ⇒ **END!**

NG ⇒ Repair the harness.

EFPD715C

CRANKSHAFT POSITION SENSOR

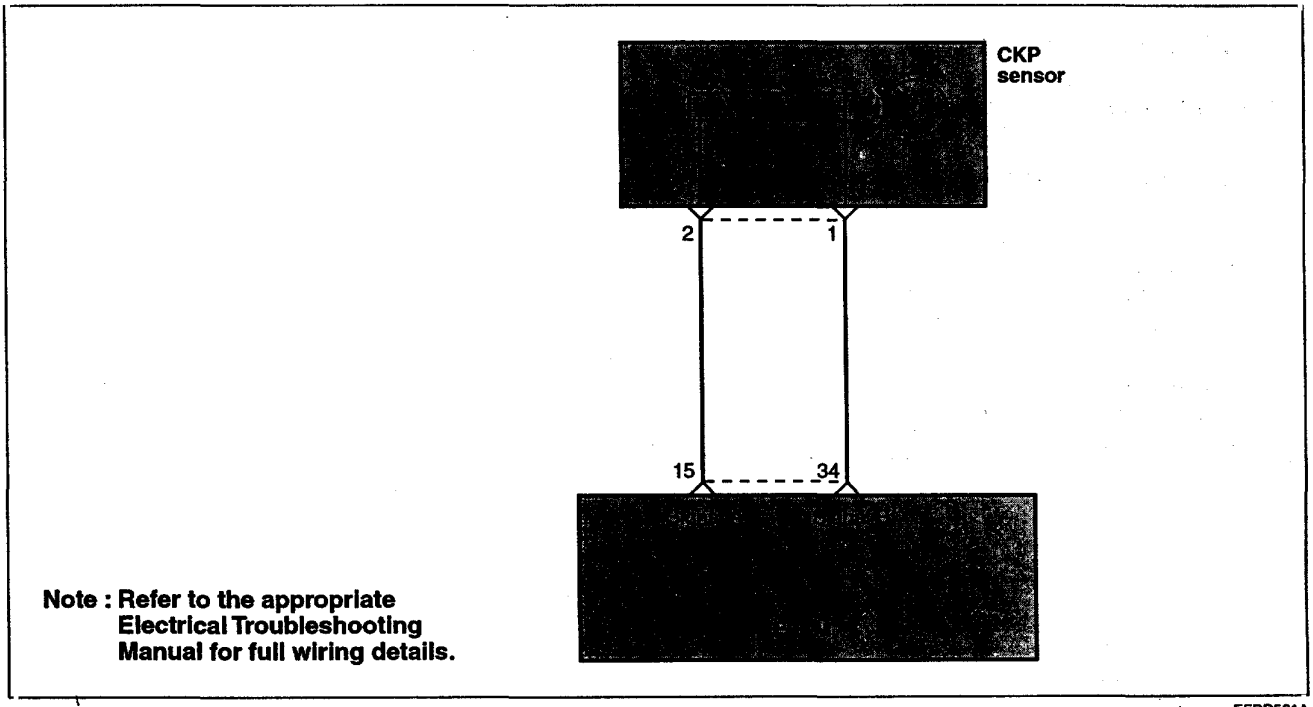


KFPD701E

CRANKSHAFT POSITION SENSOR (CKP SENSOR) ED519D58

The crankshaft position sensor, consisted of a magnet and coil, is located next to flywheel. The voltage signal from this crankshaft position sensor is relayed to the ECM to indicate engine RPM and the position of the crankshaft.

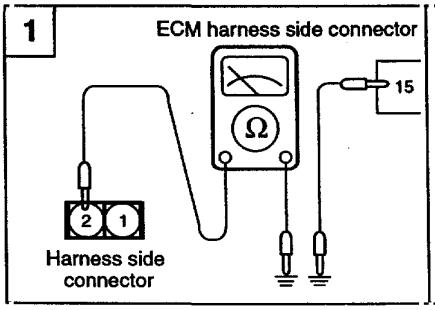
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFDD561A

HARNESS INSPECTION PROCEDURES

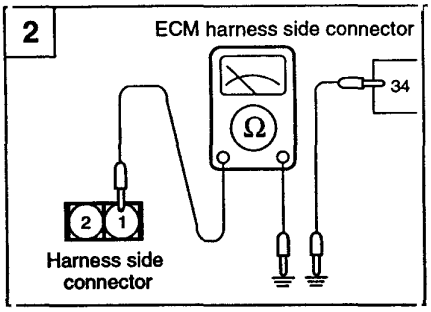


Check for an open-circuit, or a short-circuit to ground between the ECM and the crankshaft position sensor.
- ECM connector : Disconnected
- Crankshaft position sensor connector: Disconnected

OK ⇨ 2

NG ⇨ Repair the harness.

EFPD717A

2 	Check for an open-circuit, or a short-circuit to ground between the ECM and the crankshaft position sensor. • ECM connector : Disconnected • Crankshaft position sensor connector: Disconnected	OK ⇨	END!
		NG ⇨	Repair the harness.

EFPD717B

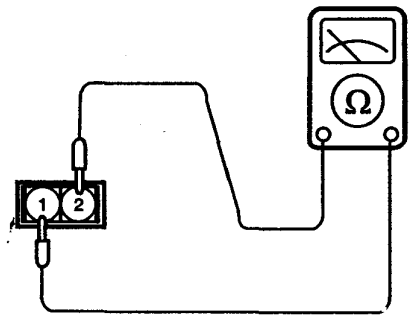
SENSOR INSPECTION

1. Disconnect the crankshaft position sensor connector.
2. Measure the resistance between terminals 1 and 2.

Standard value :0.486 ~ 0.594kΩ at 20°C (68°F)

3. If the resistance deviates far from the standard value, replace the sensor.

- **Standard value**
  Clearance between the crankshaft position sensor and crankshaft position sensor wheel :
  0.5 ~ 1.5 mm (0.020 ~ 0.059 in.)
- **Tightening torque**
  Crankshaft position sensor :
  9 ~ 11 Nm (90 ~ 110 kg·cm, 7 ~ 8 lb·ft)

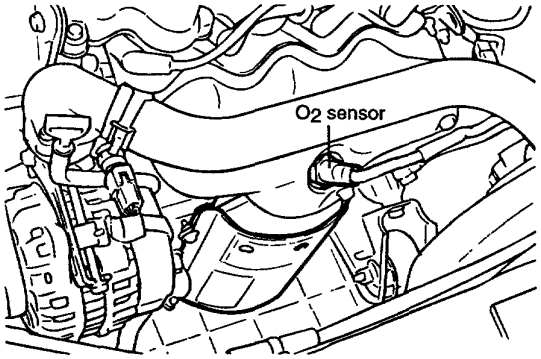


EFDD717C

HEATED OXYGEN SENSOR (HO2S)

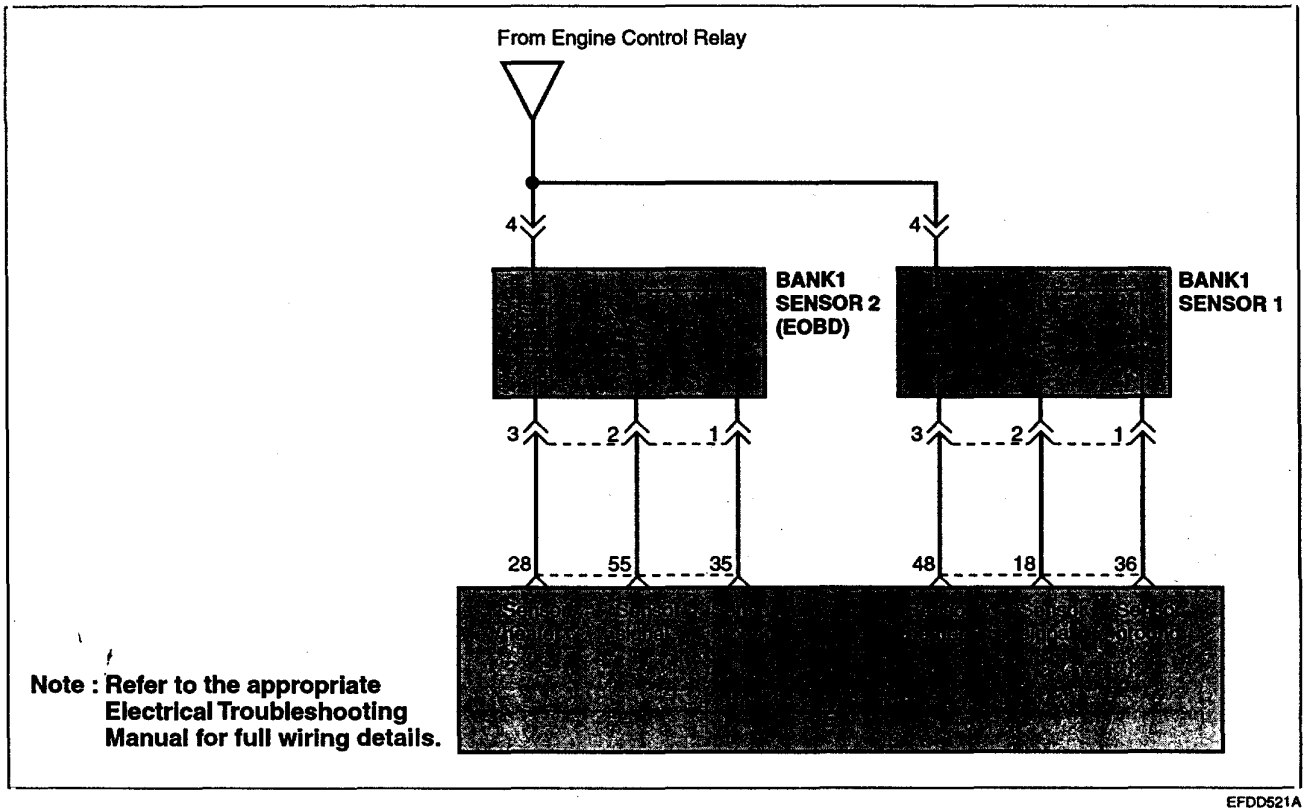
HEATED OXYGEN SENSOR (HO2S) ED22ED23

The heated oxygen sensor senses the oxygen concentration in the exhaust gas, then converts it into a voltage and then sends this to the ECM. The heated oxygen sensor gives an output of about 800mV when the air fuel ratio is richer than the theoretical ratio and output of about 100mV when the ratio is leaner (higher oxygen concentration in exhaust gas.) The ECM controls fuel injection based on this signal so that the air fuel ratio is maintained at the theoretical ratio.



EFDA301K

CIRCUIT DIAGRAM



EFDD521A

TROUBLESHOOTING HINTS

1. If the heated oxygen sensor is defective, abnormally high emissions may occur.
2. If the heated oxygen sensor check is normal but the sensor output voltage is out of specification, check for the following items related to the air fuel ratio control system :
   - Faulty injector.
   - Air leaks in the intake manifold.
   - Faulty mass air flow sensor, purge valve and engine coolant temperature sensor.
   - Wiring connection problem.

USING VOLTMETER/HI-SCAN

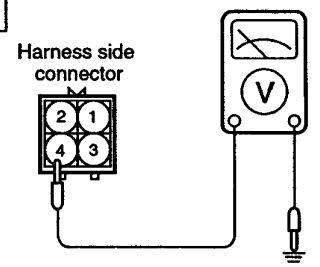
Check item	Check condition	Engine condition	Test specification
Heated oxygen sensor output voltage	Warm-up	When decelerating suddenly from 4000 rpm	A. 200mV or lower
		When engine is suddenly raced	B. 600 ~ 1000mV

NOTE

If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O_2 sensor service data in the HI-SCAN will display values in the A range.
When you suddenly press on the acclerator pedal down, the voltage will reach B range.
When you let the engine idle again, the voltage will fluctuate between ranges A and B. In this case, the O_2 sensor can be determined as good.

HARNESS INSPECTION PROCEDURES

1



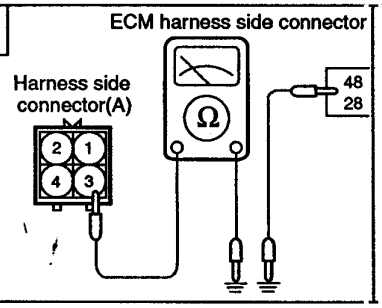
Measure the power supply voltage of the heated oxygen sensor.
- Connector : Disconnected
- Ignition switch : ON
- Voltage (V) : Battery voltage

OK ⇨ 2

NG ⇨ Repair the harness.

EFDD719A

2



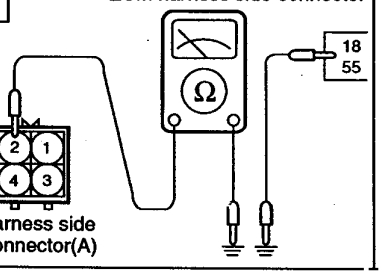
Check for an open-circuit, or a short-circuit to ground between the engine control module and the heated oxygen sensor.
- Heated oxygen sensor connector: Disconnected
- ECM connector : Disconnected

OK ⇨ 3

NG ⇨ Repair the harness.
(B1/S1)
A3 - ECM:48
(B1/S2)
A3 - ECM:28

EFDD719B

3

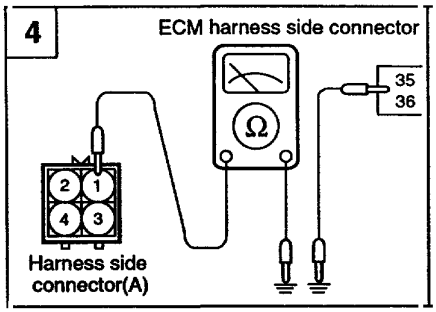


Check for an open-circuit, or a short-circuit to ground between the engine control module and the heated oxygen sensor.
- Heated oxygen sensor connector: Disconnected
- ECM connector : Disconnected

OK ⇨ 4

NG ⇨ Repair the harness.
(B1/S1)
A2 - ECM:18
(B1/S2)
A2 - ECM:55

EFDD719C

4 	Check for continuity to ground circuit. • Connector : Disconnected	OK ⇨	END!
		NG ⇨	Repair the harness. (B1/S1) A1 - ECM:36 (B1/S2) A1 - ECM:35

EFDD719D

SENSOR INSPECTION

NOTE

1. *Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 205°F).*
2. *Use an accurate digital voltmeter.*

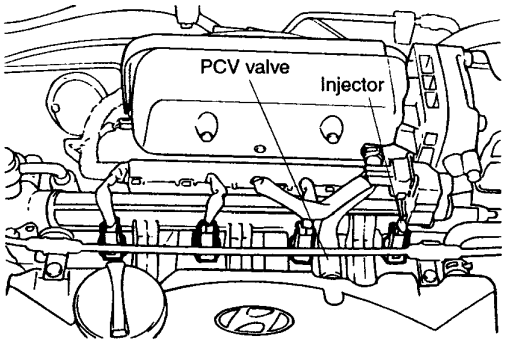
Replace the oxygen sensor if there is a malfunction

Tightening torque
Heated oxygen sensor :
50 ~ 60 Nm (500 ~ 600 kg·cm, 37 ~ 44 lb·ft)

INJECTOR

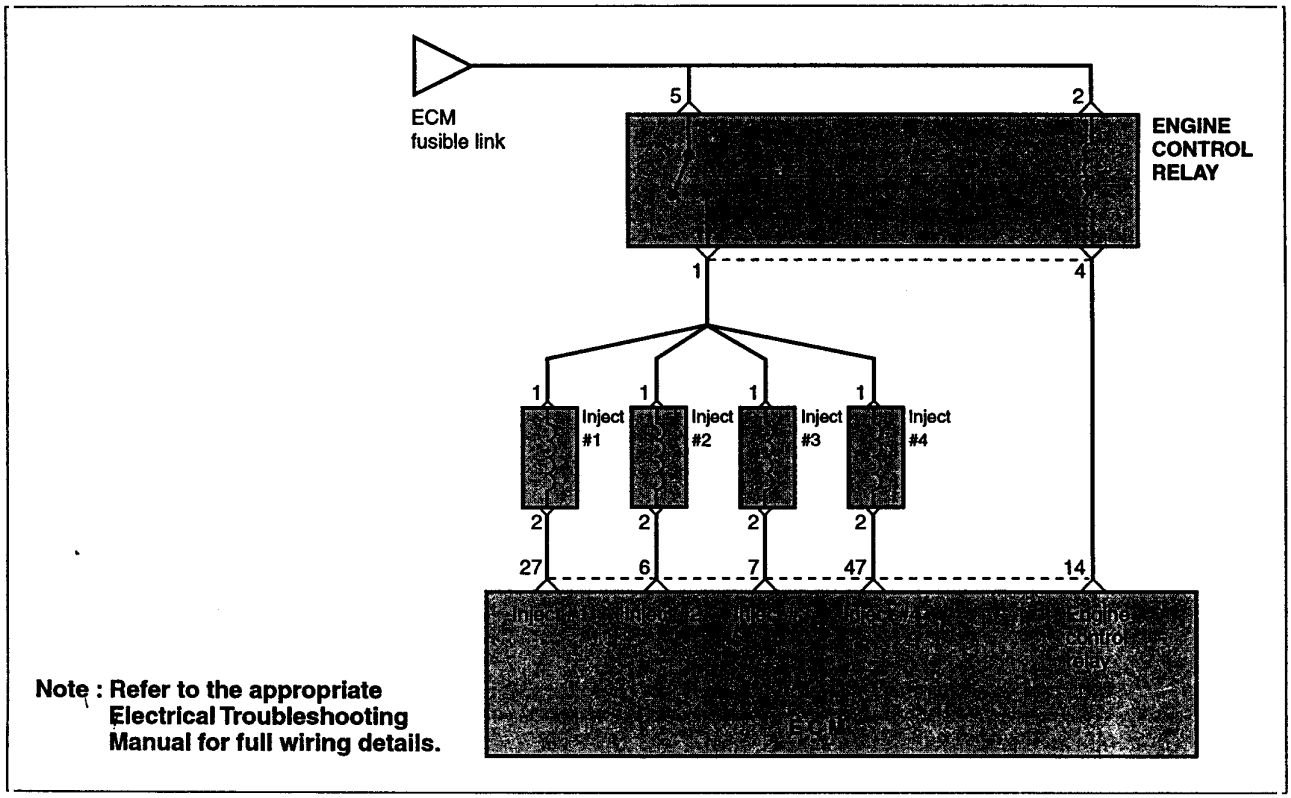
INJECTORS E20E5CCA

The injectors inject fuel according to a signals from the ECM. The volume of fuel injected by the injector is determined by the time during which the solenoid valve is energized.



EEDA105B

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD541A

TROUBLESHOOTING HINTS

1. If the engine is difficult to start when it is hot, check low for fuel pressure and injector leaks.
2. If the injector does not operate when the engine is cranked, then check the following :
   - Faulty power supply circuit to the ECM or faulty ground circuit.
   - Faulty MFI control relay.
   - Faulty crankshaft position sensor or camshaft position sensor.
3. If engine idle remains unchanged when fuel injection to the cylinders is cut one after another, check for the following items about such cylinder :
   - Injector and harness.
   - Spark plug and high tension cable.
   - Compression pressure.
4. If the injection system is OK but the injector drive time is out of specification, check for the following items :
   - Poor combustion in the cylinder (faulty spark plug, ignition coil, compression pressure, etc.)

5. The MIL is on or the DTC is displayed on the HI-SCAN under the following condition.
   - When the injector itself is faulty.

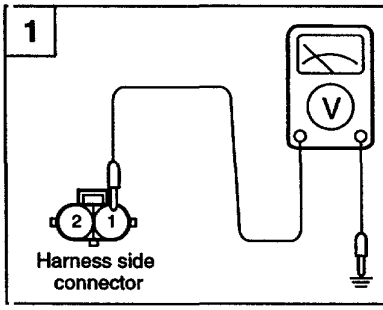
USING HI-SCAN

Check item	Data display	Check conditions	Engine state	Test specification
Injectors	Injector duration	• Engine coolant temperature : 80 to 95°C (176 to 205°F) • Lamps, electric cooling fan, accessory units : ALL OFF • Transaxle : Neutral (P range for vehicle with A/T) • Steering wheel : Neutral	Idle rpm	1.5 ~ 4.5 ms
			2000 rpm	
			3000 rpm	
			Racing	Increasing

Check item	Check condition	HI-SCAN display	Type
Injector • Actuator test	Start the engine	01. No.1 Injector	Activate
		02. No.2 Injector	Activate
		03. No.3 Injector	Activate
		04. No.4 Injector	Activate

HARNESS INSPECTION PROCEDURES

1



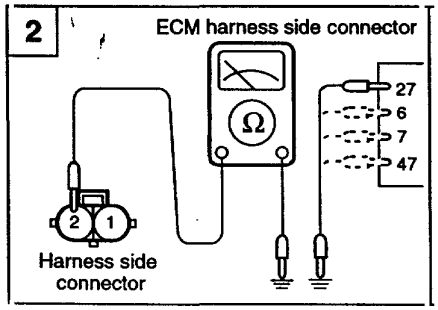
Measure the power supply voltage of the injector.
- Connector : Disconnected
- Ignition switch : ON
- Voltage (V) : Battery voltage

OK ⇒ **2**

NG ⇒ Repair the harness.

EFPD721A

2



Check for an open-circuit, or a short-circuit to ground between the engine control module and the injector.
- ECM connector : Disconnected
- Injector connector : Disconnected

OK ⇒ **END!**

NG ⇒ Repair the harness.

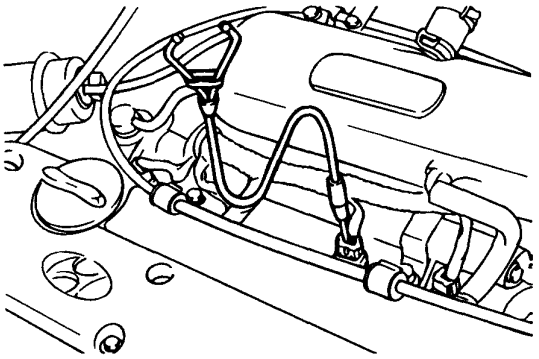
EFPD721B

INJECTOR INSPECTION

OPERATION CHECK

Using a HI-SCAN :

- Activate the fuel injectors in sequence.
- Check the operating time of the injectors.



EFDA721C

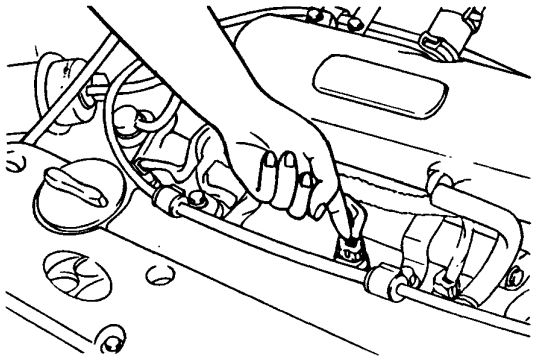
Operation Sound Check

1. Using a stethoscope, check the injectors for a clicking sound at idle. Check that the sound is produced at shorter intervals as the engine speed increases.

   NOTE

   Ensure that the sound from an adjacent injector is not being transmitted along the delivery pipe to an inoperative injector.

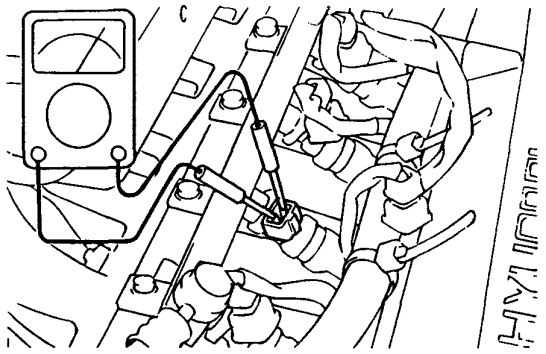
2. If a stethoscope is not available, check the injector operation with your finger.
   If no vibrations are felt, check the wiring connector, injector, or injection signal from ECM.



EFDA721D

RESISTANCE MEASUREMENT BETWEEN TERMINALS

1. Disconnect the connector of the injector and measure the resistance betweenthe two terminals.



EFDA721E

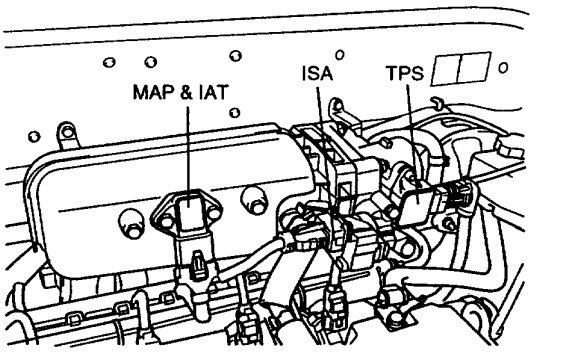
Standard value :15.9 ± 0.35Ω [at 20°C (68°F)]

2. Re-connect the connector to the injector.

IDLE SPEED CONTROL (ISC)

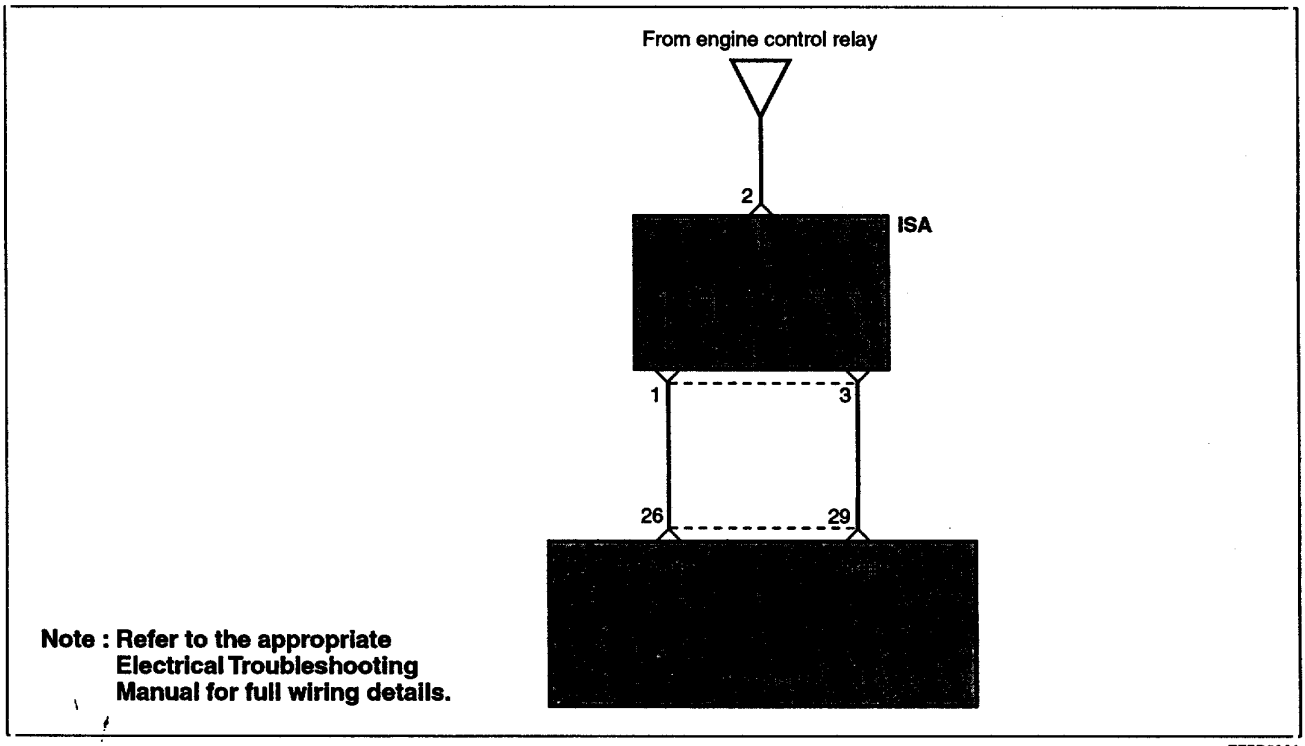
IDLE SPEED CONTROL ACTUATOR (ISC ACTUATOR) E3BDEBDC

The idle speed actuator is a double coil type driven by separate driver stages in the ECM. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different angles of the motor. A by-pass hose line is positioned, in parallel to the throttle valve where the idle speed actuator is inserted.



EFDD301L

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD586A

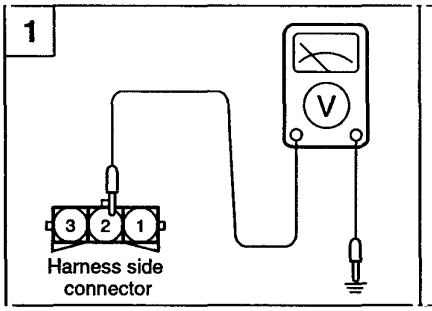
TROUBLESHOOTING HINTS

Open or short circuit is observed in idle air control system when ignition switch is turned on.

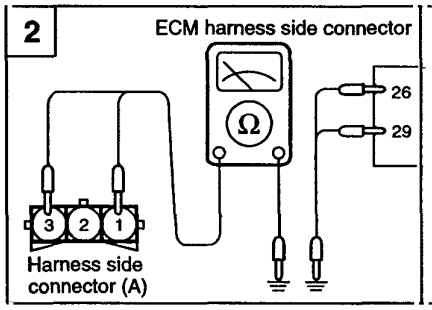
USING HI-SCAN

Check item	Check condition	Engine condition	Test specification
Idle speed control actuator • Actuator test	Start the engine	ISCV	Activate

HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage of the injector. • Connector : Disconnected • Ignition switch : ON • Voltage (V) : Battery voltage	OK ⇨ NG ⇨	2 Repair the harness.

EFPD723A

2 	Check for an open-circuit, or a short-circuit to ground between the ECM and the idle speed control actuator. • ECM connector : Disconnected • Idle speed actuator connector: Disconnected	OK ⇨ NG ⇨	END! Repair the harness. A1 - ECM:26 A3 - ECM:29

EFPD723B

ACTUATOR INSPECTION

RESISTANCE MEASUREMENT BETWEEN TERMINALS

1. Disconnect the connector at the idle speed control actuator.
2. Measure the resistance between terminals.

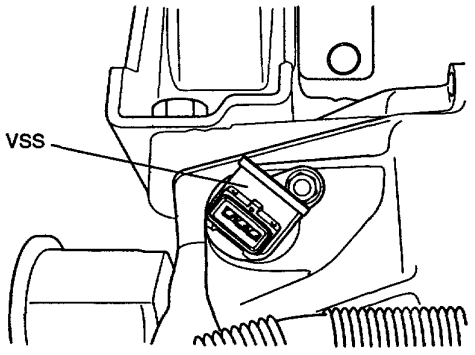
Standard value
Terminal 1 and 2 : 10.5 ~ 14Ω
Terminal 2 and 3 : 10 ~ 12.5Ω [at 20°C (68°F)]

3. Connect the connector to the idle speed control actuator.

VEHICLE SPEED SENSOR (VSS)

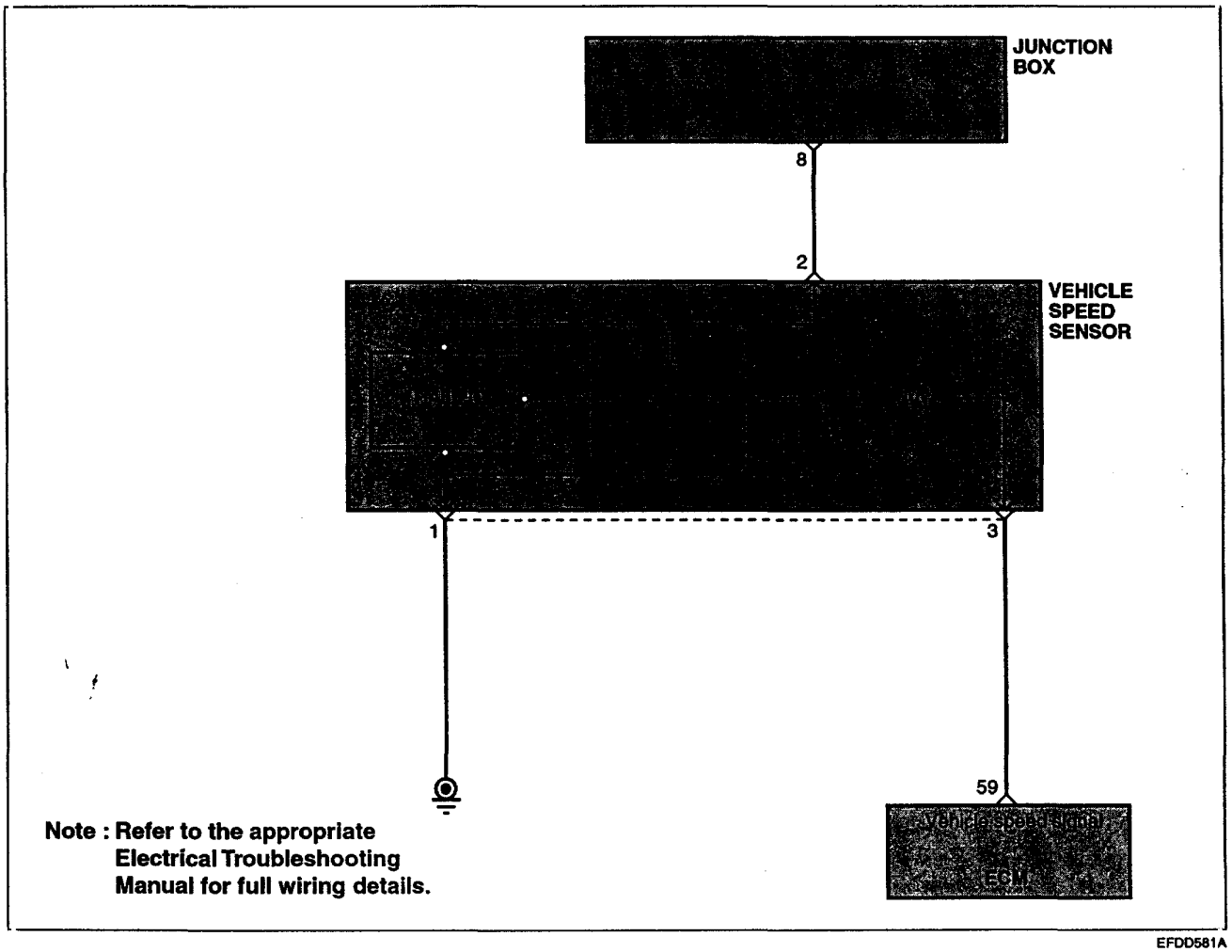
VEHICLE SPEED SENSOR EEDF10DC

The vehicle speed sensor is a hall effect sensor that is attached on the output shaft of transaxle. The sensor converts the transaxle gear revolutions into a pulse signal which is sent to the ECM.



EFPD183A

CIRCUIT DIAGRAM



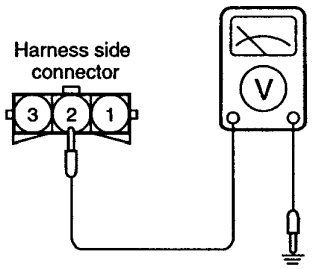
EFDD581A

TROUBLESHOOTING HINTS

If there is an open or short circuit in the vehicle speed sensor signal circuit,the engine may stall when the vehicle decelerates to a stop.

HARNESS INSPECTION PROCEDURES

1



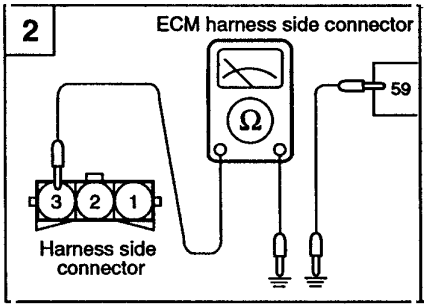
Measure the power supply voltage of the VSS.
- Connector : Disconnected
- Ignition switch : ON
- Voltage (V) : Battery voltage

OK ⇨ **2**

NG ⇨ Repair the harness.

EFDD581B

2



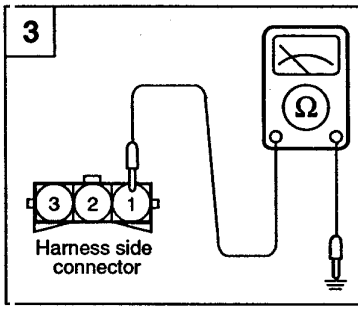
Check for an open-circuit, or a short-circuit to ground between the ECM and the VSS.
- ECM connector : Disconnected
- VSS connector : Disconnected

OK ⇨ **3**

NG ⇨ Repair the harness.

EFDD581C

3



Check for an open-circuit between VSS and ground.
- VSS connector : Disconnected

OK ⇨ **END!**

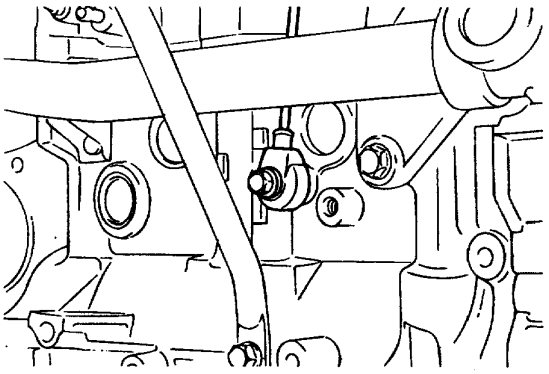
NG ⇨ Repair the harness.

EFDD581D

KNOCK SENSOR (KS)

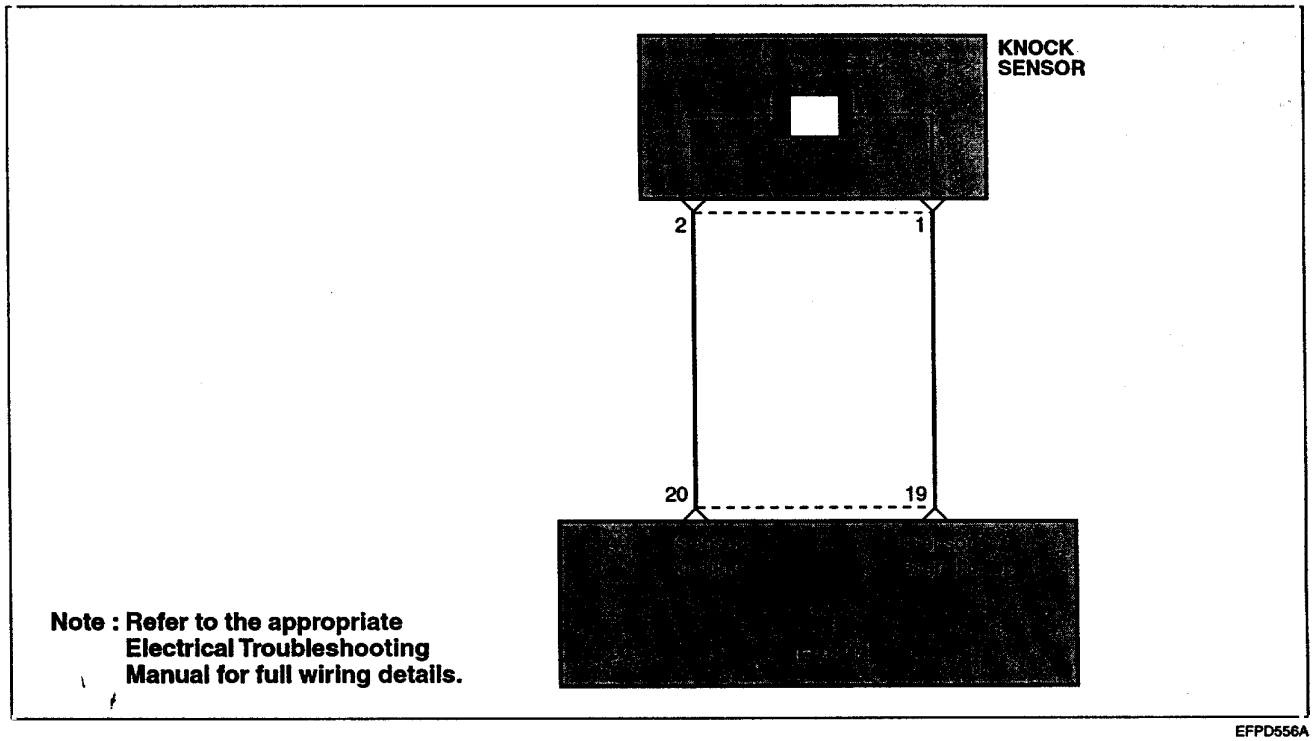
KNOCK SENSOR EBEF6F78

The knock sensor is attached to the side of the cylinder block to sense engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is relayed to the ECM. If engine knocking occurs, ignition timing is retarded to suppress it.



EFDA727A

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD556A

HARNESS INSPECTION PROCEDURE

SENSOR INSPECTION

1. Disconnect the knock sensor connector and measure resistance between terminals 1 and 2.

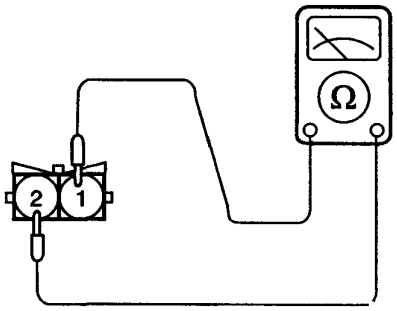
Standard value :about 5MΩ [at 20°C (68°F)]

2. If the resistance is continuous, replace the knock sensor.

Tightening torque
Knock sensor :
16 ~ 25 Nm (160 ~ 250 kg·cm, 12 ~ 18 lb·ft)

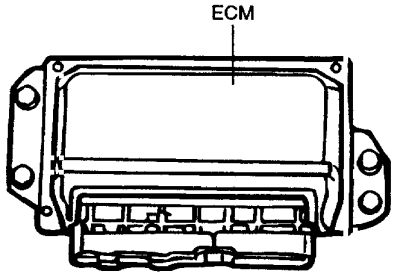
3. Measure the capacitance between terminals 1 and 2.

Standard value : 800 ~ 1600 pF



EFDA727D

ENGINE CONTROL MODULE (ECM)

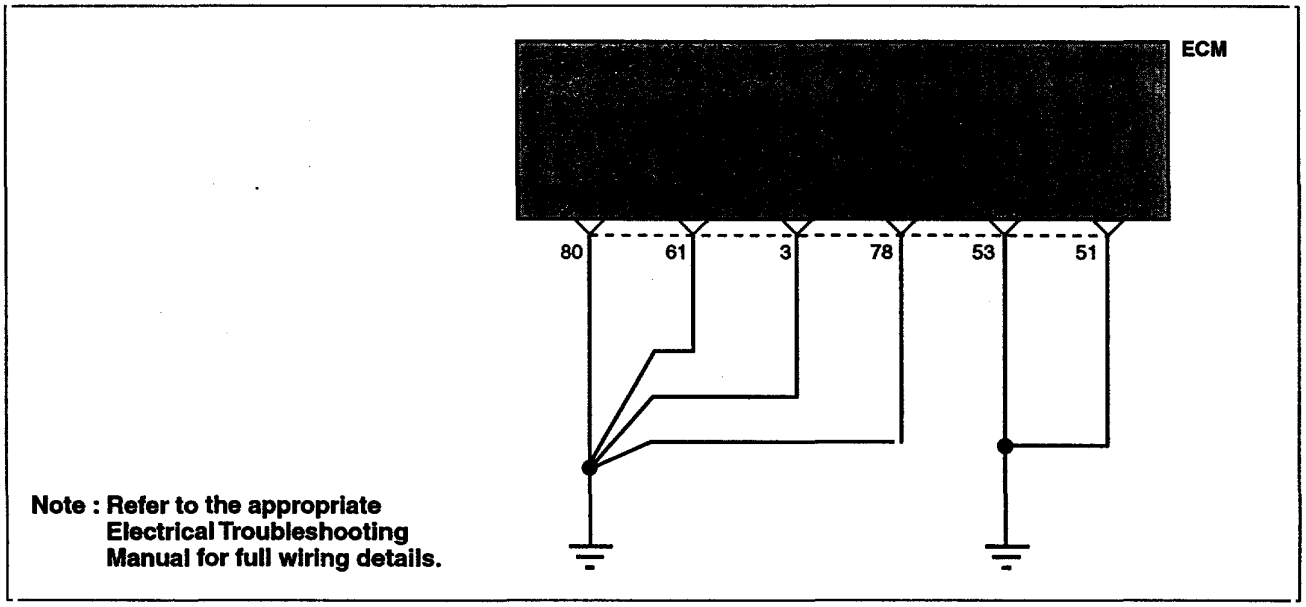


EFDA301H

ENGINE CONTROL MODULE (ECM) - POWER GROUND E8D6357F

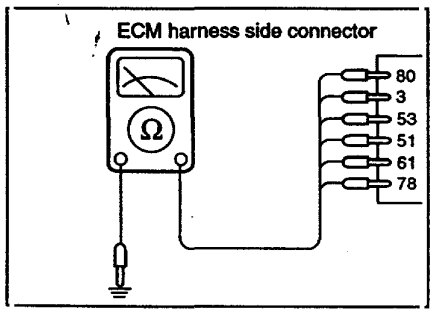
Check the ground condition of the engine control module.

CIRCUIT DIAGRAM



EFDD673A

HARNESS INSPECTION PROCEDURE



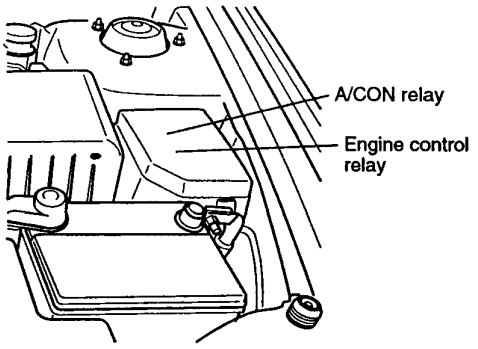
Check for continuity of the ground circuit.
- ECM connector : Disconnected

OK ⇨ **END!**

NG ⇨ Repair the harness.

EFDD733A

AIR CONDITIONING SWITCH AND RELAY

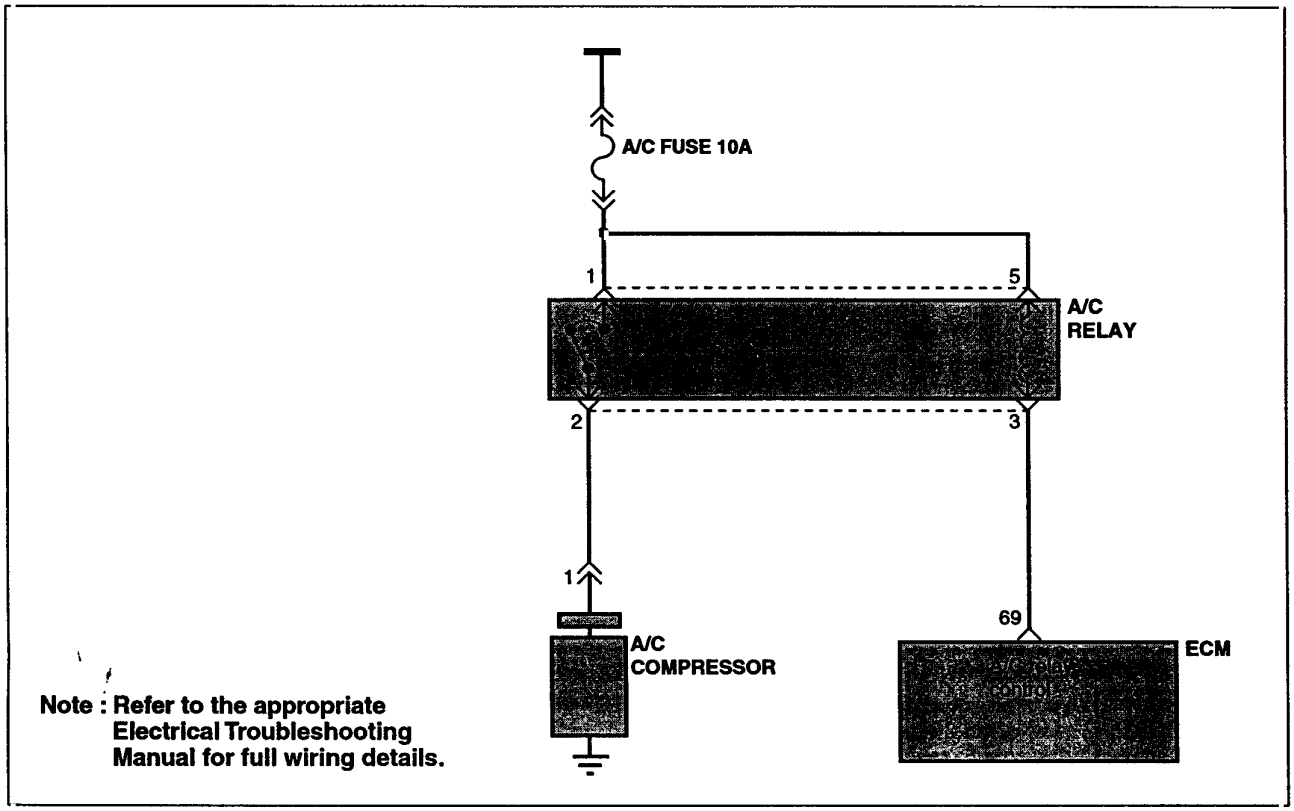


EFDD735A

AIR CONDITIONING SWITCH AND RELAY E1134382

The air conditioning switch relays battery voltage to the ECM when the air conditioning is turned on. When the air conditioning ON signal is input, the ECM drives the ISC Actuator and turns ON the ignition power transistor. Then, the air conditioning power relay coil is energized to turn on the relay switch, which activates the compressor magnetic clutch.

CIRCUIT DIAGRAM



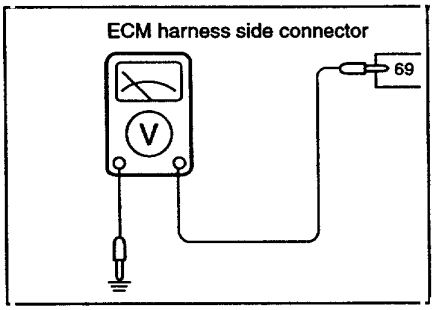
EFDD675A

USING HI-SCAN

Check item	Data display	Check condition	Air conditioning switch	Normal indicator
Air conditioning switch	Switch state (ON/OFF)	Engine : Idling (air compressor is running when air conditioning switch is ON)	OFF	OFF
			ON	ON

Check item	Data display	Check condition	Air conditioning switch	Normal indicator
Air conditioning compressor	Air conditioning compressor	Engine : Idling after warm-up	OFF	OFF (compressor clutch non-activation)
			ON	ON

HARNESS INSPECTION



Measure the power supply voltage of the air condition circuit.
- Air condition switch : ON
- Engine control unit connector: Disconnected
- Ignition switch : ON
- Voltage : Battery voltage

OK ⇨ **END!**

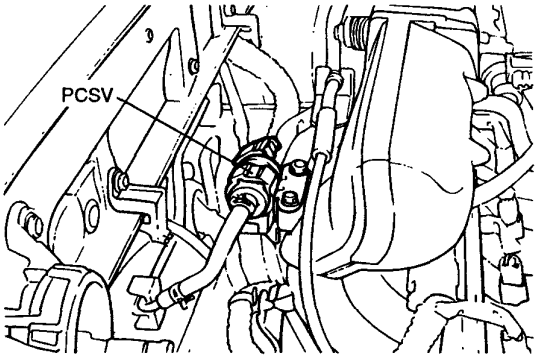
NG ⇨ Check the air conditioning circuit

EFPD735B

AIR CONDITIONING INSPECTION

Refer to GROUP-HA service adjustment procedures.

EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE

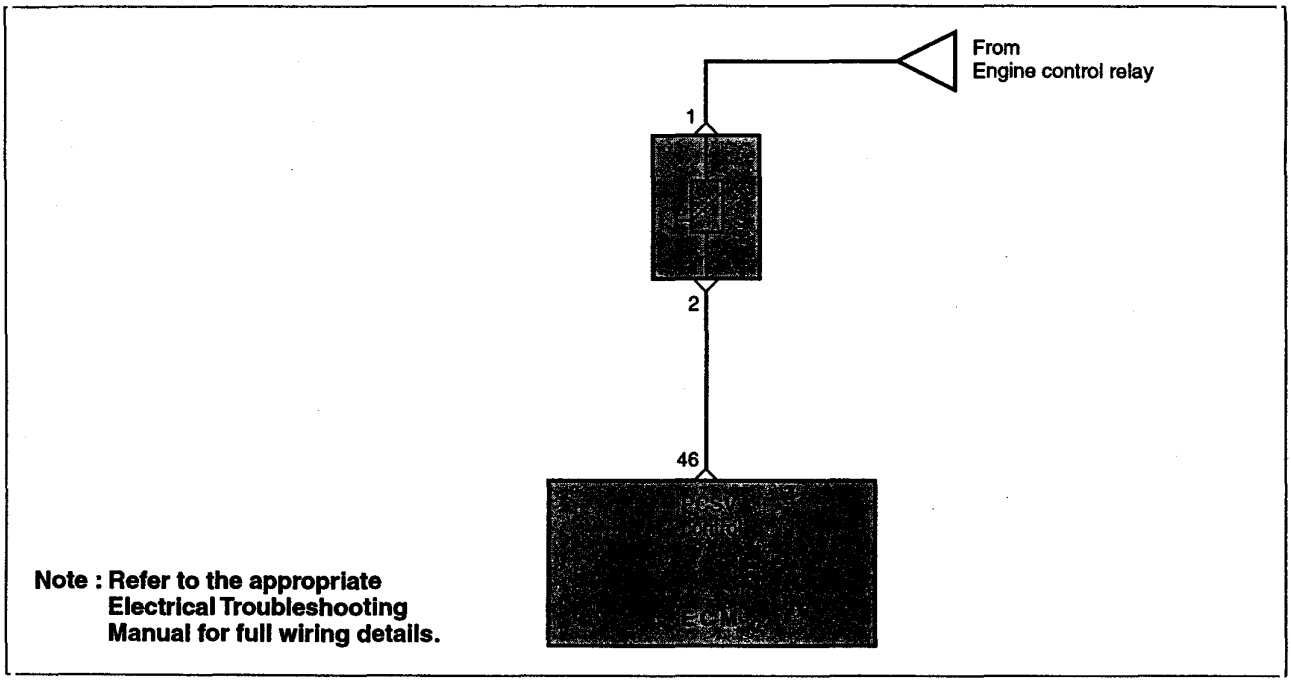


EEDA204A

PURGE SOLENOID VALVE E547E181

The evaporative emission canister purge solenoid valve is a duty control type, which controls the flow of purge air from the evaporative emission canister.

CIRCUIT DIAGRAM



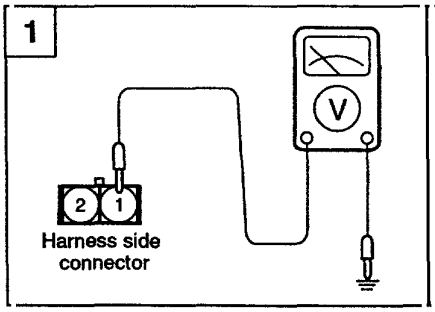
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD576A

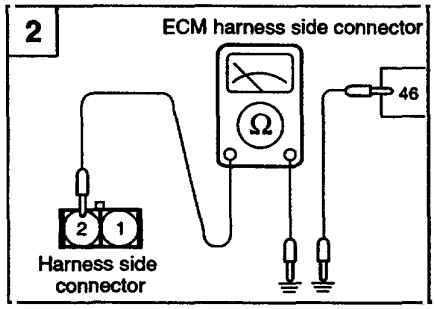
USING HI-SCAN

Check item	Check condition	HI-SCAN display	Type
Evaporative emission canister purge solenoid valve • Actuator test	Start the engine	Purge valve	Activate

HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage. • Connector : Disconnected • Ignition switch : ON • Voltage : Battery voltage	OK ⇒ NG ⇒	2 Repair the harness.

EFDA737A

2 	Check for an open-circuit, or a short-circuit to ground between the evaporative emission canister purge solenoid valve and the engine control module. • Engine control module connector : Disconnected • Evaporative emission canister purge solenoid valve connector : Disconnected	OK ⇒ NG ⇒	END! Repair the harness.

EFPD737B

ACTUATOR INSPECTION

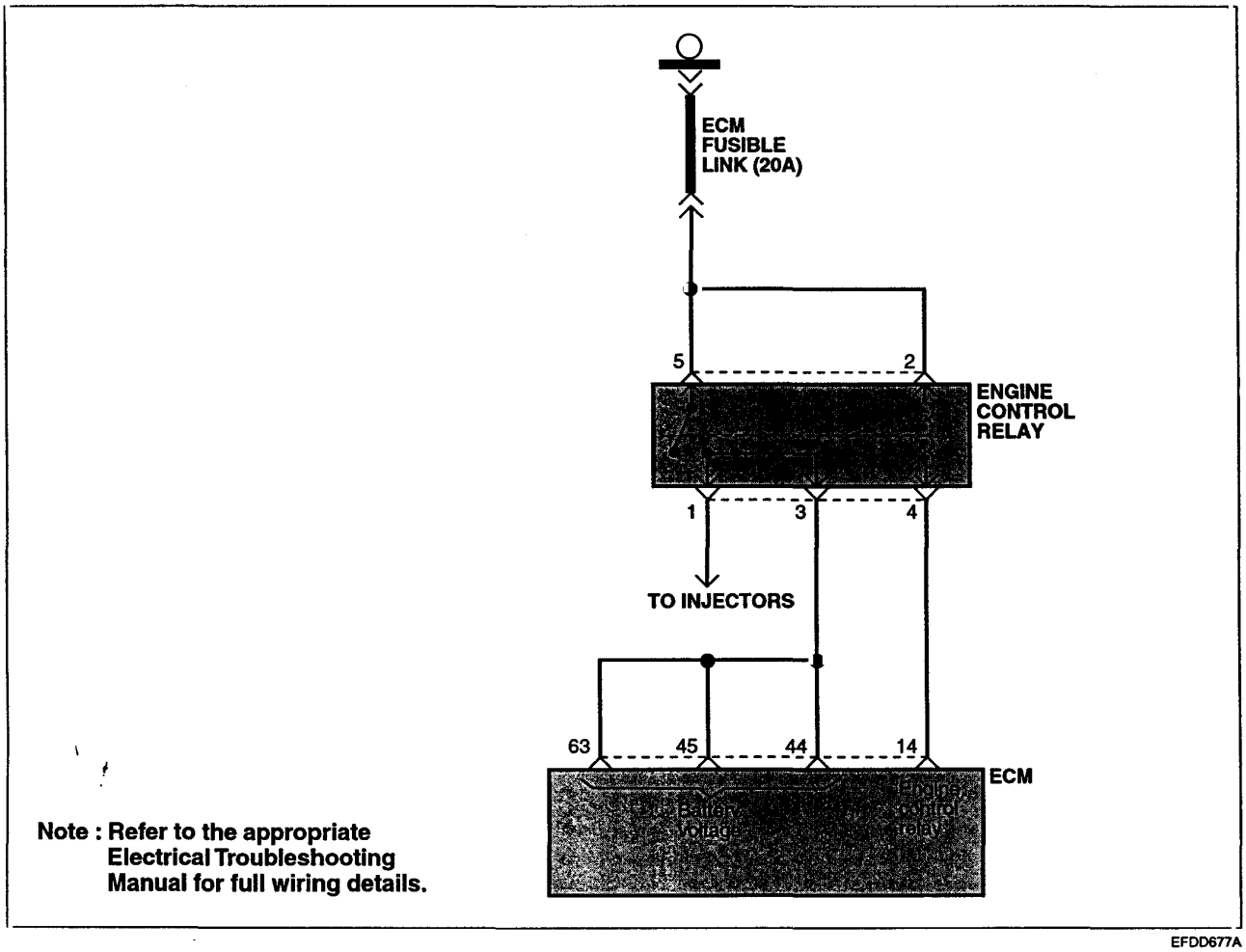
Refer to GROUP EC-Evaporative Emission System.

ENGINE CONTROL MODULE (ECM) CONTROL RELAY

MFI CONTROL RELAY E1D738F5

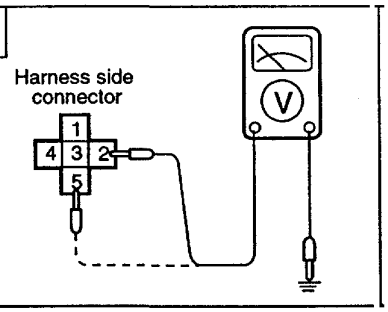
When the ignition switch is on, battery power is supplied to the ECM, the injectors, the MAP sensor, etc. While the ignition switch is turned on, current flows from the ignition switch through the current relay coil to ground.

CIRCUIT DIAGRAM

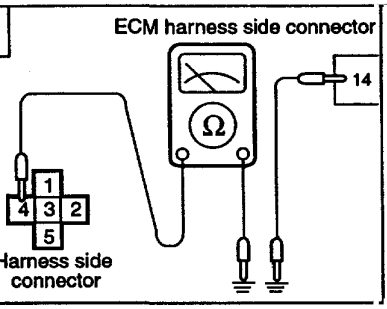


EFDD677A

HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage of the MFI control relay. • MFI control relay connector : Disconnected • Voltage (V) : Battery voltage	OK ⇨	2
		NG ⇨	Repair the harness.

EFPD739A

2 	Check for open-circuit or short-circuit to ground between the engine control module and the MFI control relay. • ECM connector : Disconnected • MFI control relay : Disconnected	OK ⇨	END!
		NG ⇨	Repair the harness.

EFPD739B

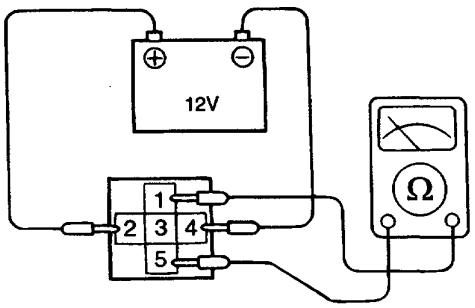
MFI CONTROL RELAY INSPECTION

1. Check continuity of relay contacts between terminals 5 (+) and 1 (-).

Relay coil (between terminal 2 & 4)	Continuity
When de-energized	No
When energized	Yes

2. If faulty, replace the MFI control relay.

Tightening torque
MFI control relay :
7 ~ 11 Nm (70 ~ 110 kg·cm, 5.2 ~ 8.1 lb·ft)

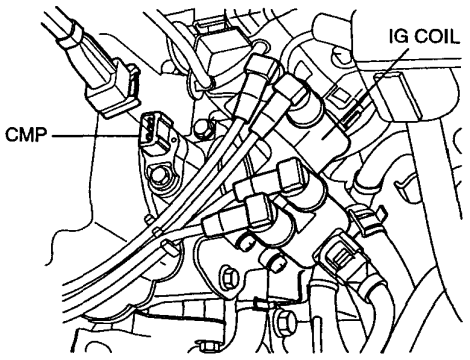


EFDA739C

IGNITION COIL

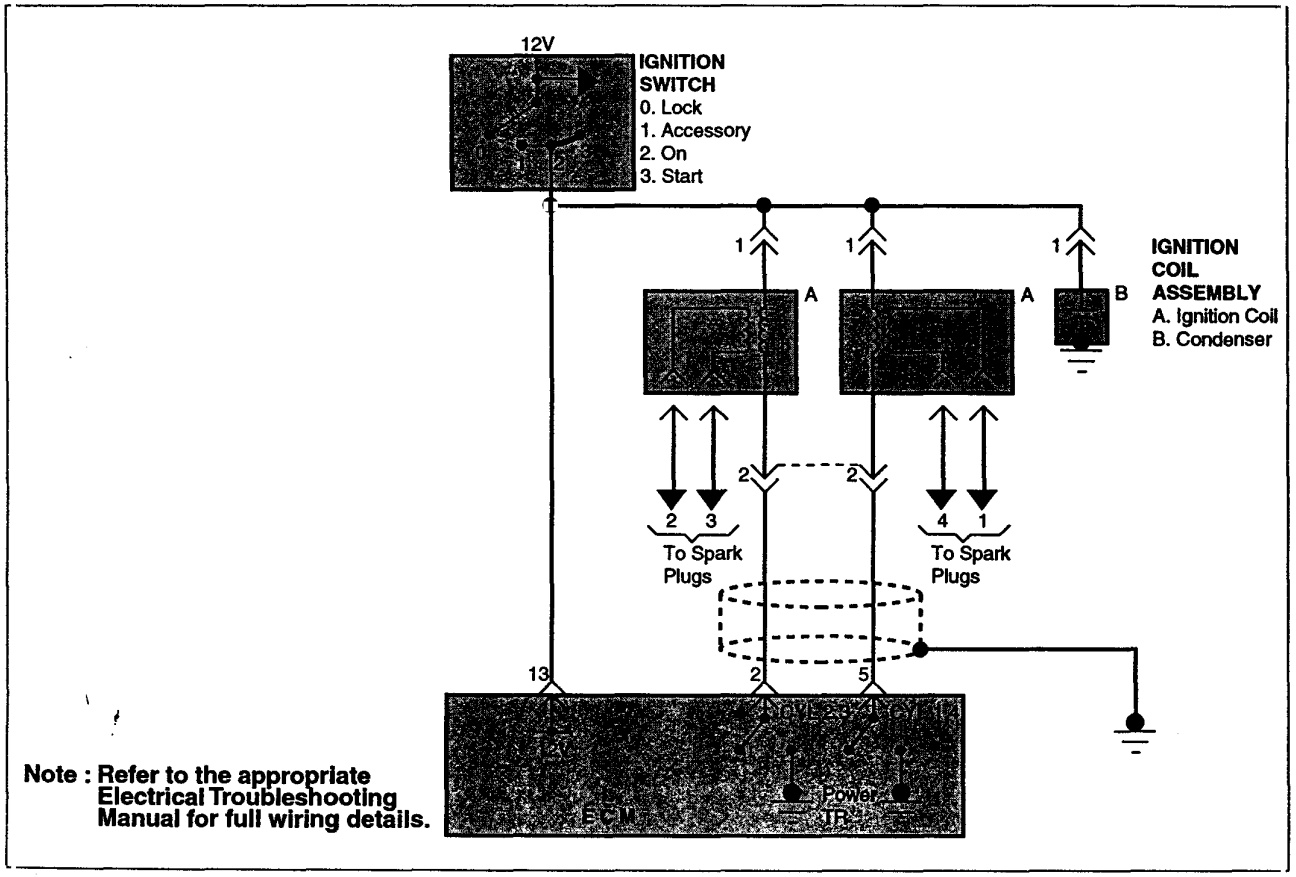
IGNITION COIL E74C0DAD

When the ignition power transistor is turned ON by a signal from the ECM, the ECM sends a signal to the ignition coil, then the primary current is shut off and a high voltage is induced in the secondary coil.



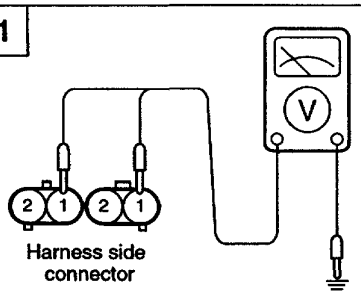
KFPC008D

CIRCUIT DIAGRAM

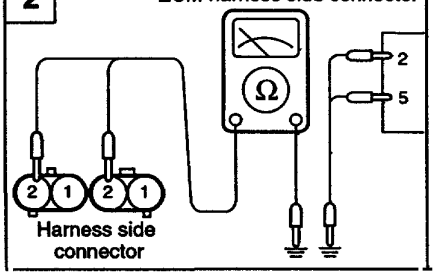


EFPD546A

HARNESS INSPECTION PROCEDURES

1  	Measure the power supply voltage of the ignition coil. • Connector : Disconnected • Ignition switch : ON • Voltage (V) : Battery voltage	OK ⇨ NG ⇨	2 Repair the harness.

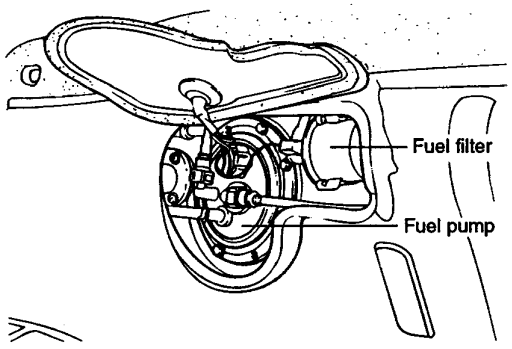
EFPD741A

2  	Check for an open-circuit, or a short-circuit to ground between the ignition coil and the engine control module. • Engine control module connector: Disconnected • Power transistor connector: Disconnected	OK ⇨ NG ⇨	END! Repair the harness.

EFPD741B

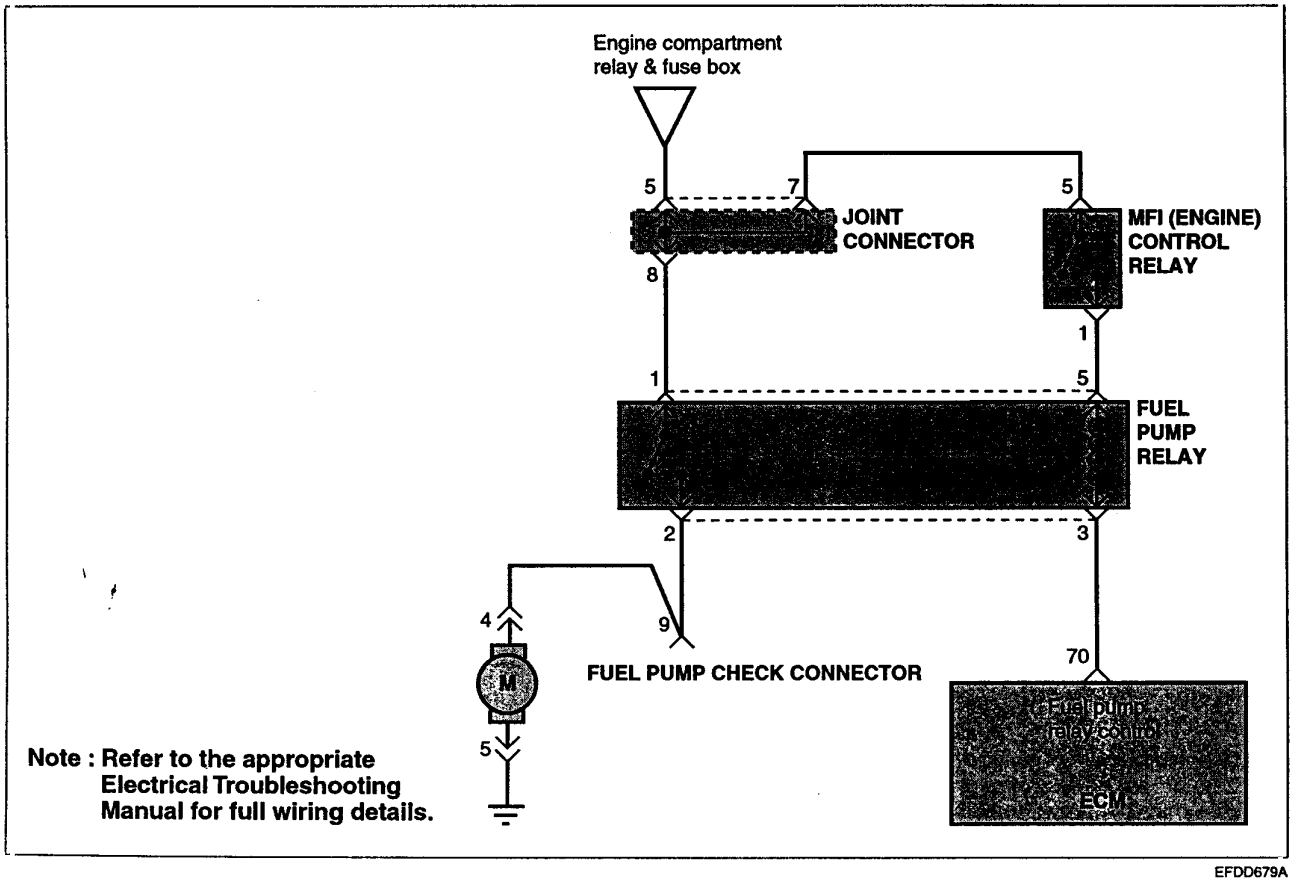
FUEL PUMP

FUEL PUMP EAFA130F



EFDA013B

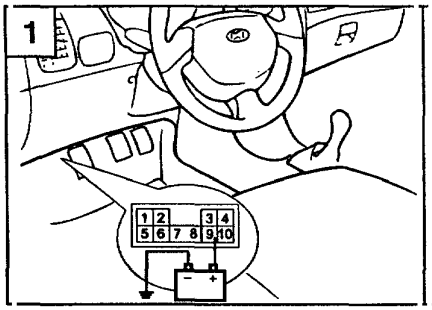
CIRCUIT DIAGRAM



EFDD679A

HARNESS INSPECTION PROCEDURES

1



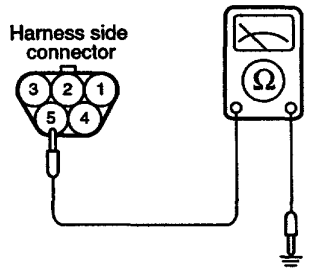
Check the fuel pump.
- Apply battery voltage to the checking terminal and operate the pump.

OK ⇒ 4

NG ⇒ 2

EFDD743A

2



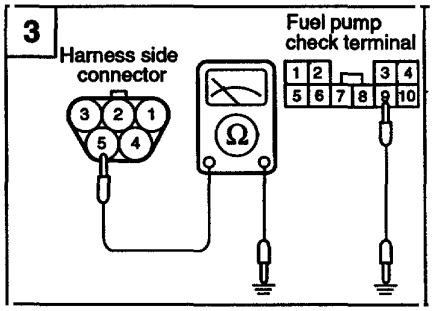
Check the ground circuit of the fuel pump.
- Connector : Disconnected

OK ⇒ 3

NG ⇒ Repair the harness.

EFPD743B

3



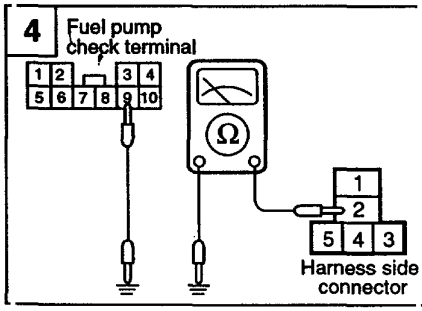
Check for continuity between the fuel pump and the check terminal.
- Connector : Disconnected

OK ⇒ 4

NG ⇒ Repair the harness.

EFPD743C

4

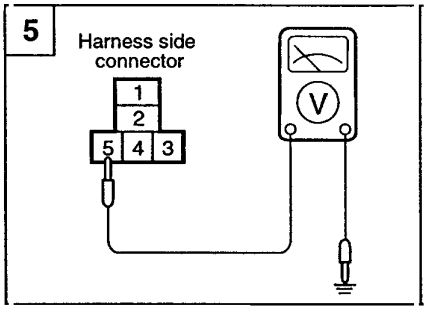


Check for continuity between the check terminal and the fuel pump control relay terminal.
- Control relay connector : Disconnected

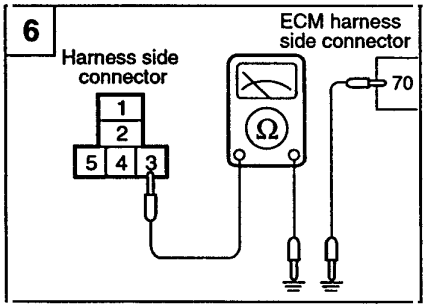
OK ⇒ 5

NG ⇒ Repair the harness.

EFPD743D

5 	Measure the power supply voltage of the control relay. • Control relay connector : Disconnected • Ignition switch : START • Voltage (V) : System voltage	OK ⇨	6
		NG ⇨	Repair the harness.

EFPD743E

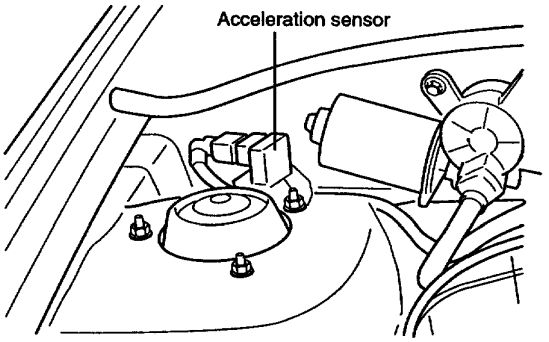
6 	Check for an open-circuit or a short-circuit to ground between the control relay and the ECM. • Control relay connector : Disconnected • ECM connector : Disconnected	OK ⇨	END!
		NG ⇨	Repair the harness.

EFPD743F

ACCELERATION SENSOR

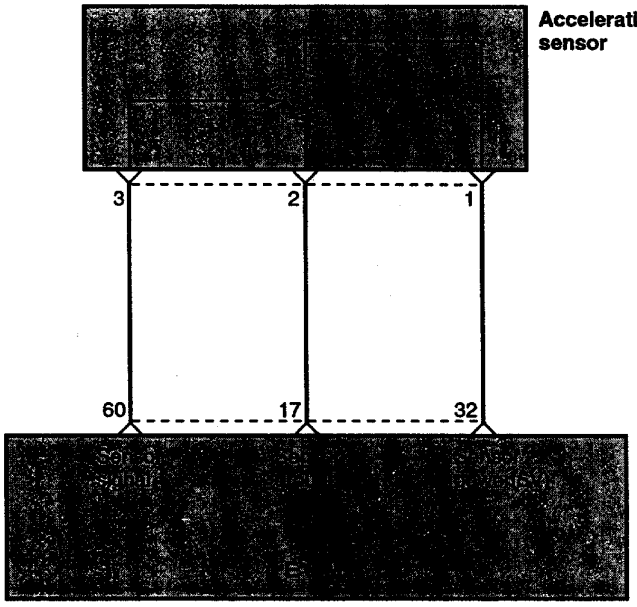
ACCELERATION SENSOR EED22A1B

The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.



EFDD745A

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

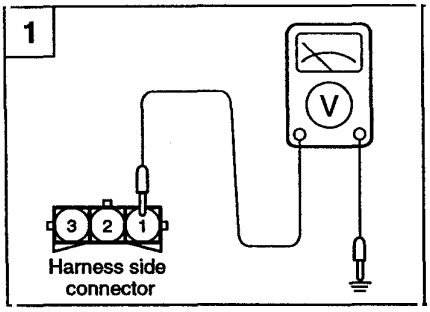
EFPD606A

USING VOLTMETER

Check item	Check condition	Test specification
Acceleration sensor output voltage	While idling	2.3 ~ 2.7V
	IG. OFF	0V

HARNESS INSPECTION PROCEDURES

1



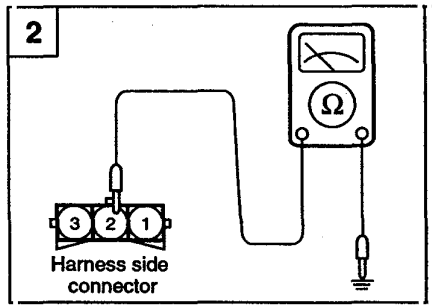
Measure the sensor voltage(5V) of the acceleration sensor.
- o Sensor connector : Disconnected
- o ECM connector : Connected

OK ⇒ **2**

NG ⇒ Repair the harness.

EFPD745B

2



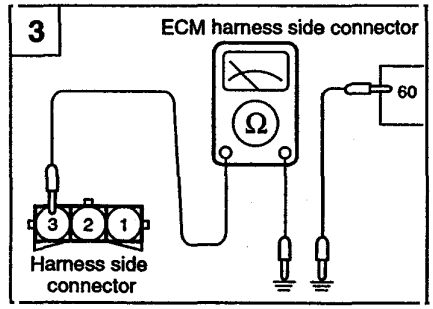
Check for continuity of the ground circuit.
- Connector : Disconnected

OK ⇒ **3**

NG ⇒ Repair the harness.

EFPD745C

3



Check for an open-circuit, or a short-circuit to ground between the ECM and the acceleration sensor.
- Acceleration sensor connector : Disconnected
- Engine control module connector Disconnected

OK ⇒ **END!**

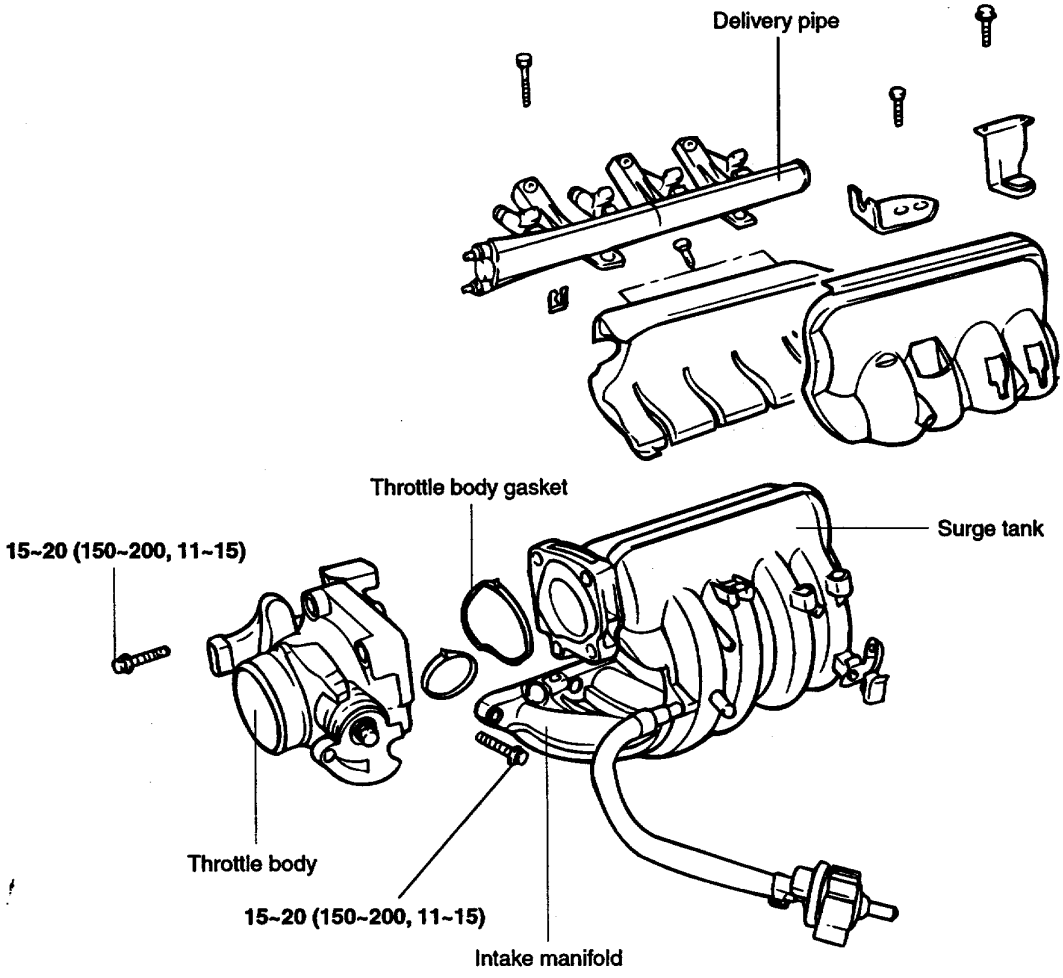
NG ⇒ Repair the harness.

EFPD745D

FUEL DELIVERY SYSTEM

FUEL INJECTOR

COMPONENTS EBC9FFCD



TORQUE : Nm (kg·cm, lb·ft)

ECDA087A

REMOVAL EA0AA5DE

1. Release residual pressure from the fuel line to prevent fuel from spilling.

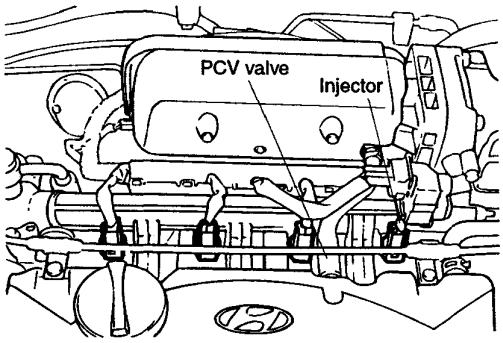
⚠ ***CAUTION***

Cover the hose connection with rags to prevent splashing of fuel that could be caused by residual pressure in the fuel line.

2. Remove the delivery pipe with the fuel injectors.

⚠ *CAUTION*

- ***Be careful not to drop any injectors when removing the delivery pipe.***
- ***Be aware that fuel may flow out when removing the injector.***



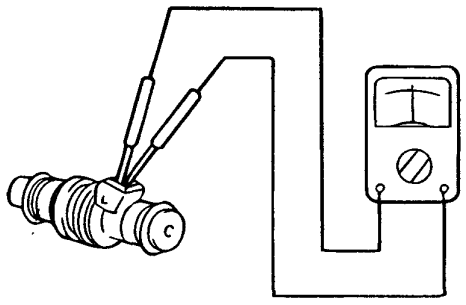
EEDA105B

INSPECTION EEEA4069

1. Measure the resistance of the injectors between the terminals using an ohmmeter.

Resistance : 15.9 ± 0.35Ω [at 20°C (68°F)]

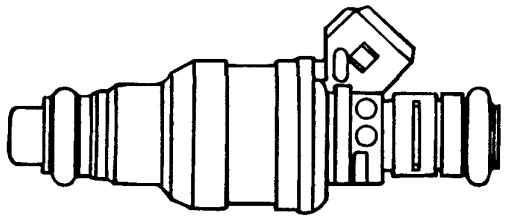
2. If the resistance is not within specifications, replace the injector.



EFDA805A

INSTALLATION EDAAD25B

1. Install a new grommet and O-ring to the injector.
2. Apply a coating of solvent, spindle oil or gasoline to the O-ring of the injector.

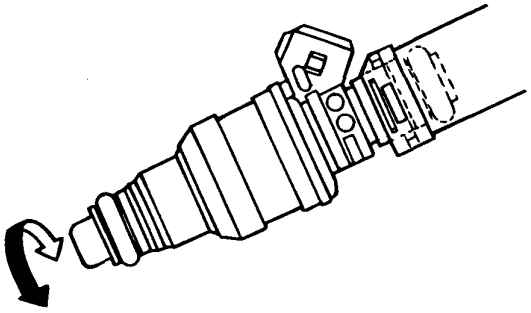


EFDA807A

3. While turning the injector to the left and right, fit it on to the delivery pipe.
4. Be sure the injector turns smoothly.

📝 *NOTE*

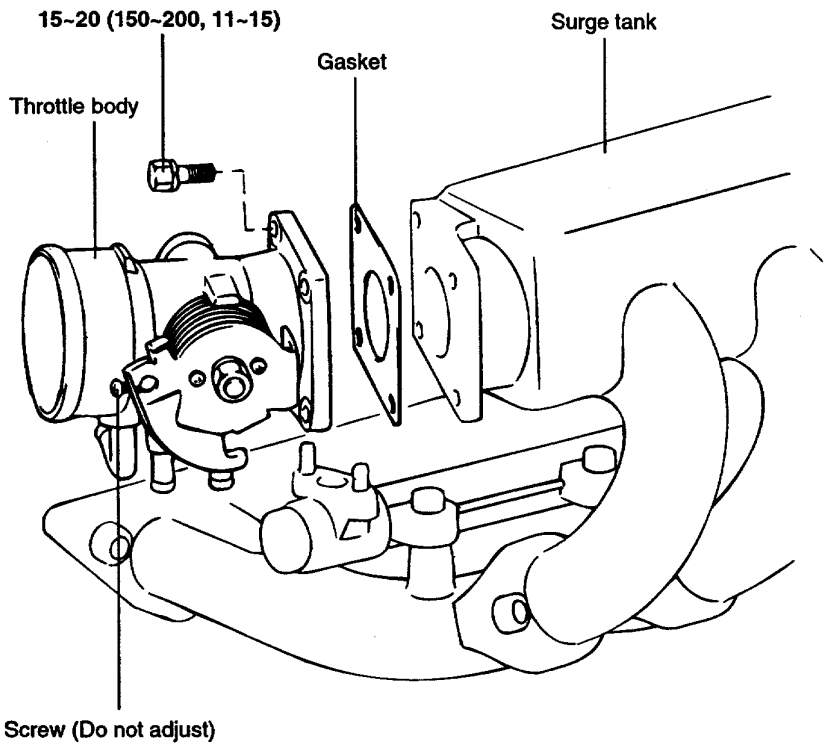
If it does turn smoothly, the O-ring may be jammed: Remove the injector and re-insert it into the delivery pipe and recheck.



EFDA807B

THROTTLE BODY

COMPONENTS E455C87D



TORQUE : Nm (kg·cm, lb·ft)

EFDD809A

REMOVAL EF88757D

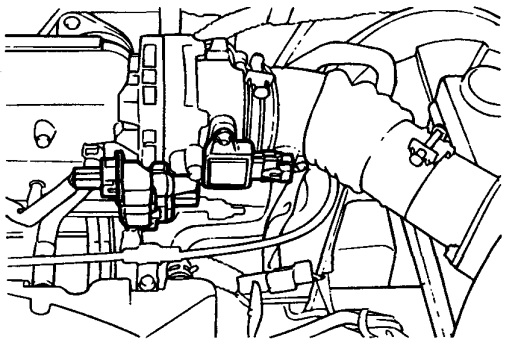
⚠ ***CAUTION***

The throttle valve must not be removed.

Remove the throttle position sensor.

NOTE

Except when necessary for replacement, the throttle position sensor must not be removed.



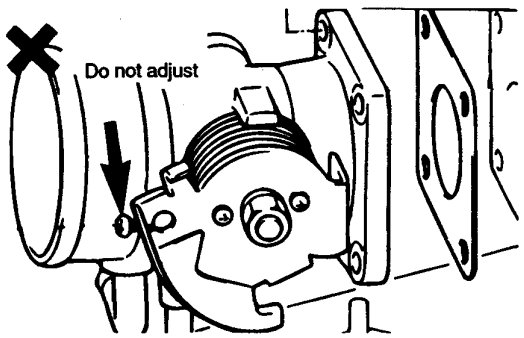
EFDA301M

INSPECTION EC99B3E9

1. Check the throttle body for cracks.
2. Check for restriction in the vacuum port or passage.
3. Check for interference when moving the accelerator cable.

⚠ ***CAUTION***

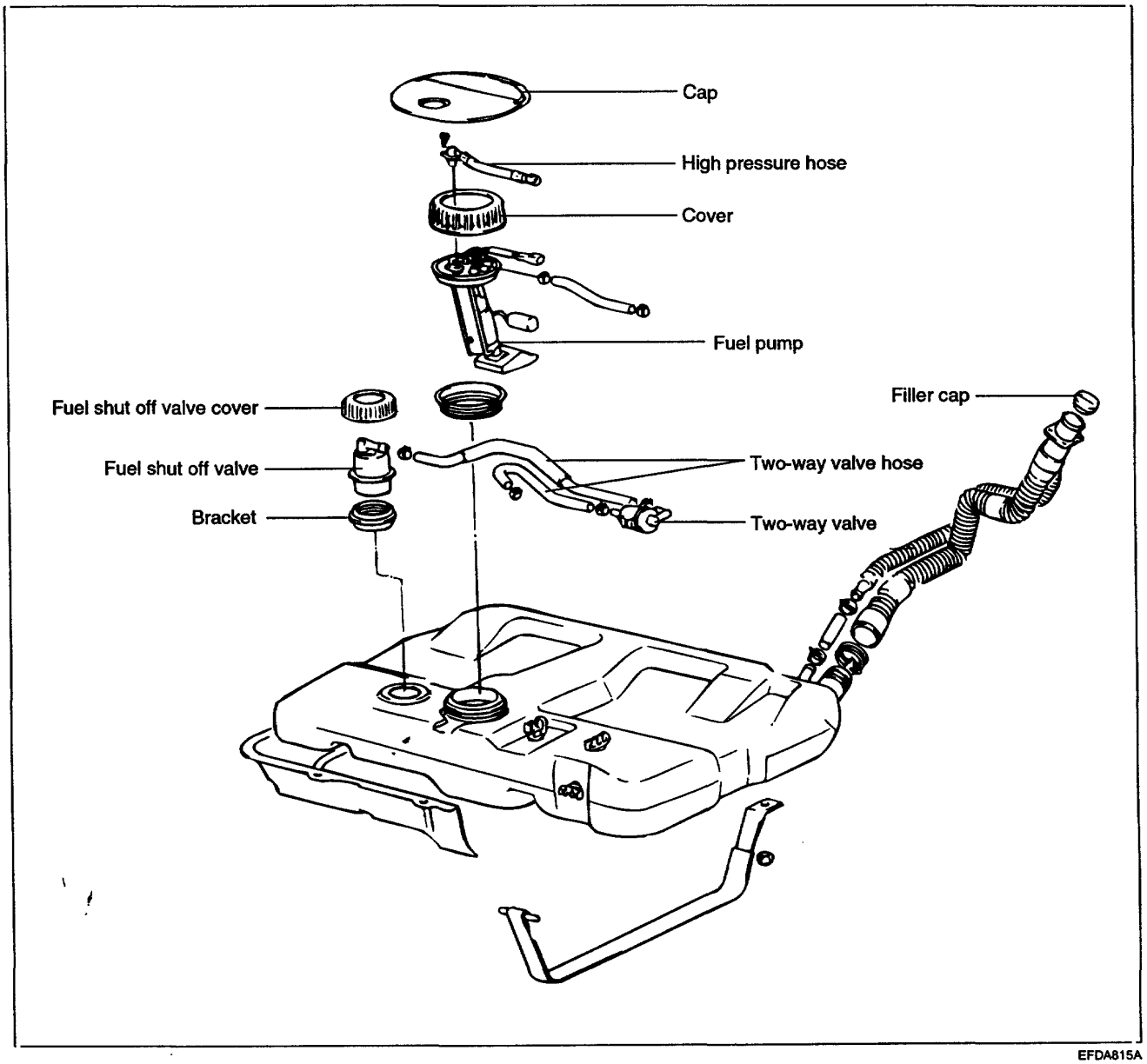
- ***Throttle valve set screw was adjusted in the production line with the air volume (0.516 ± 5% g/sec) during idling. So please DO NOT ADJUST IT voluntarily.***
- ***When the idle rpm is out of specification, check the relevant sensors and their input or output value first.***
- ***The throttle body does not need to be cleaned because carbon in throttle body does not affect the system's operation at all.***



EFDA813A

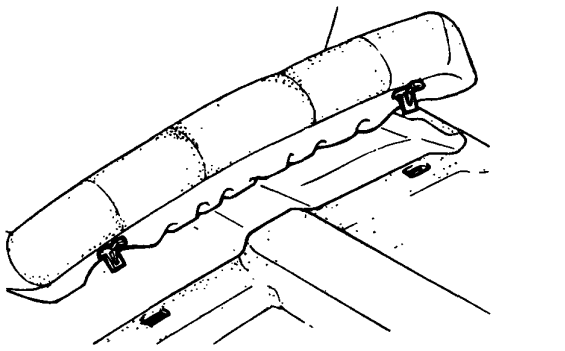
FUEL TANK

COMPONENTS E08D9AFA



REMOVAL E3CB0893

1. Press the two taps under the rear seat and raise the seat, then detach the inspection panel of the fuel pump.



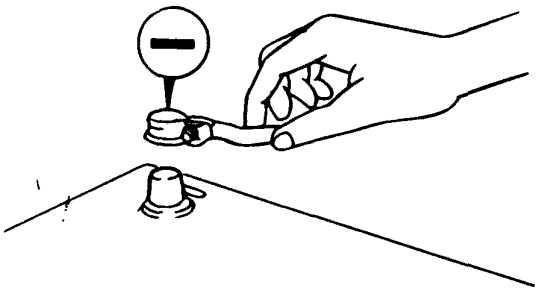
EFDA013A

2. To reduce the internal pressure of the fuel lines and hoses, first start the engine with the fuel pump disconnected and wait until it stops by itself.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose, otherwise fuel will spill out.

3. Disconnect the battery cable from the negative terminal of the battery.



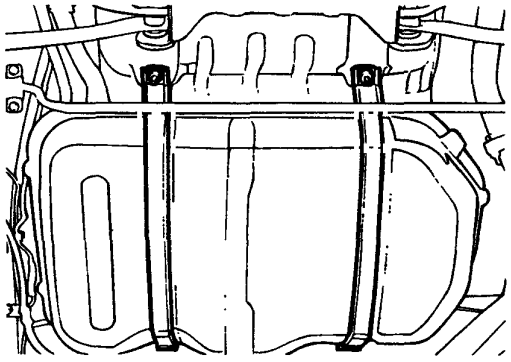
EFDA817B

4. Disconnect the high pressure hose from the fuel filter output side, and disconnect the tap for static electricity.

CAUTION

Cover the hose connection with a shop tower to prevent splashing of fuel that could be caused by residual pressure in the fuel line.

5. Lift up the vehicle.
6. Detach the fuel filler hose and leveling hose.
7. Support the fuel tank with a jack.
8. Remove the fuel tank bands.

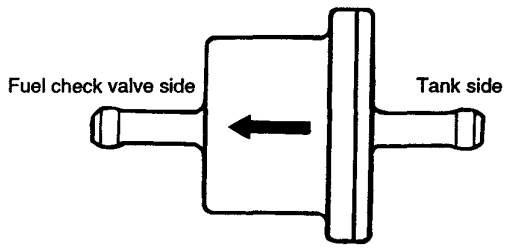


EFDA817C

9. Remove the fuel tank.

INSPECTION E6ACDB10

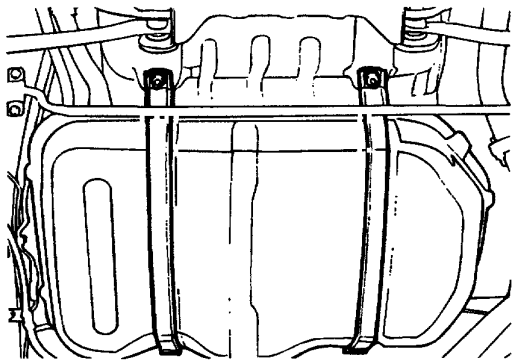
1. Check the hoses and the pipes for cracks or damage.
2. Check the fuel tank cap for proper operation.
3. Check the fuel tank for deformation, corrosion or cracking.
4. Check the inside of the fuel tank for dirt or foreign material.
5. Check the in-tank fuel filter for damage or restriction.
6. Test the two-way valve for proper operation
7. To check the two-way valve, lightly blow into the inlet and outlet. If air passes through after slight resistance, then the valve is good.



EFDA819A

INSTALLATION E1F41505

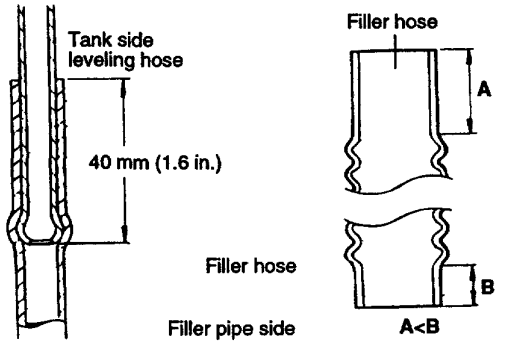
1. Confirm that the pad is fully bonded to the fuel tank, and install the fuel tank by tightening the self-locking nuts.



EFDA817C

2. Connect the leveling hose to the tank and at the filler neck by approximately 40mm (1.6 in.).

3. When connecting the filler hose, the end with the shorter straight pipe should be connected to the tank side.

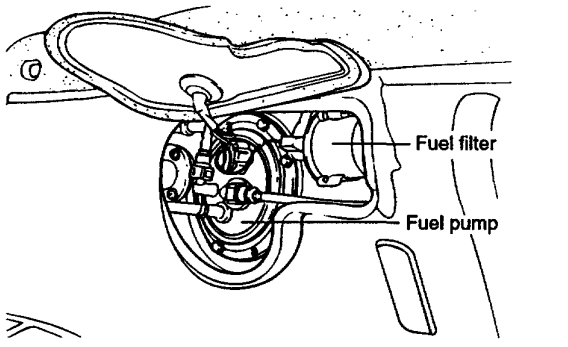


EFDA821A

4. Connect the vapor hose. When attaching the vapor hose to the line, be sure that the hose is attached as shown in the illustration.

5. Connect the high pressure hose to the fuel pump. Be careful that the fuel hose does not twist.

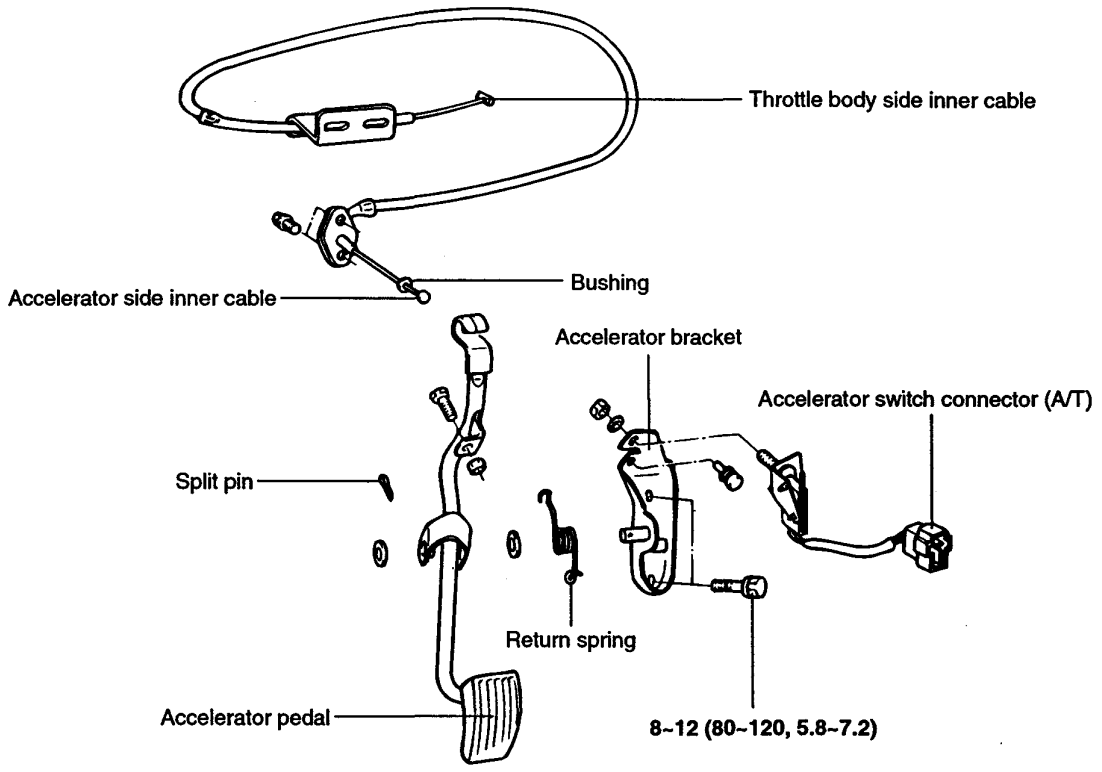
6. Connect the electrical fuel pump connector.



EFDA013B

ACCELERATOR PEDAL

COMPONENTS E8645A1E

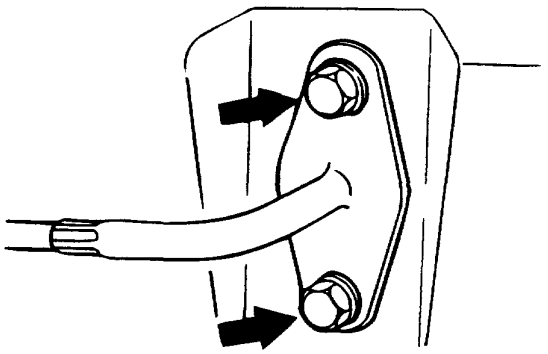


TORQUE : Nm (kg·cm, lb·ft)

EFDA831A

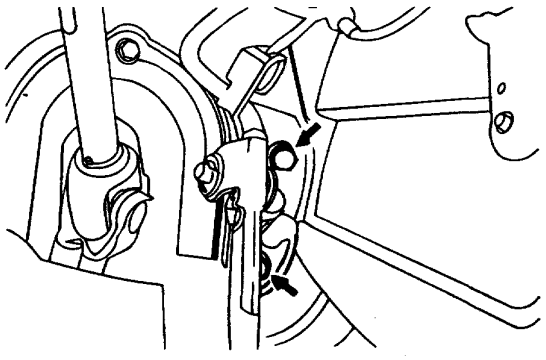
REMOVAL ED4FCEBC

1. Remove the bushing and inner cable of the accelerator arm side.



EFDA833A

2. After disconnecting the accelerator switch connector, loosen the bolts of the accelerator arm bracket and remove.



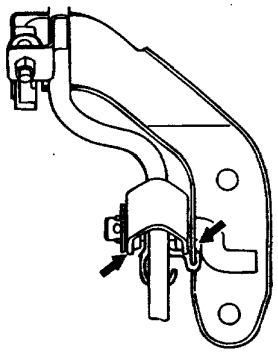
EFDA833B

INSPECTION ECF2333E

1. Check the inner and outer cable for damage.
2. Check the cable for smooth movement.
3. Check the accelerator arm for deformation.
4. Check the return spring for deterioration.
5. Check the connection of the bushing to end metal fitting.
6. Check that the accelerator switch operates properly.

INSTALLATION EF7B75B3

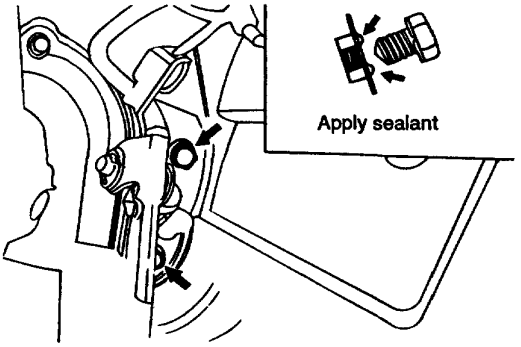
1. When installing the return spring and accelerator arm, apply multi-purpose grease around each moving point of the accelerator arm.



EFDA837A

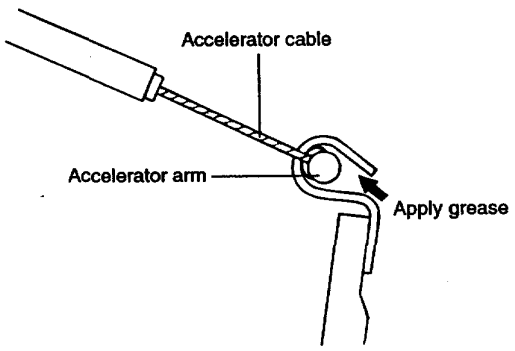
2. Apply sealant to the bolt mounting hole, and tighten the accelerator arm bracket.

Tightening torque
Accelerator arm bracket bolts :
8 ~ 12 Nm (80 ~ 120 kg·cm, 5.8 ~ 7.2 lb·ft)



EFDA837B

3. Securely install the resin bushing of the accelerator cable on the end of the accelerator arm.
4. Apply multipurpose grease around the cable end.



EFDA837C

DTC TROUBLESHOOTING PROCEDURES

[P0106/P0107/P0108] E86CC5A4

DTC	Diagnostic item
P0106	MAP Sensor Rationality
P0107	MAP Sensor Range Check Low
P0108	MAP Sensor Range Check High

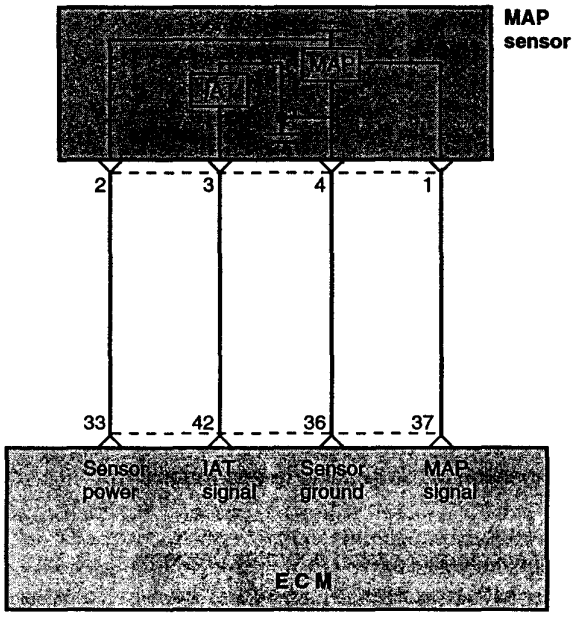
DESCRIPTION

The MAP sensor is essentially a strain gauge used to measure the pressure in the surge tank. Inside the sensor is a metal diaphragm with a small wire attached. The diaphragm flexes according to changes in pressure. When the diaphragm flexes, the wire attached to it stretches, changing the resistance of the wire. The Engine control Module (ECM) applies five volts to the MAP sensor and measures the voltage drop across the sensor. Sensor output is in volts and as pressure decreases, the voltage drop across the sensor increases. Since the MAP sensor is used as an air flow sensor, the sensor signal is an important input. The ECM uses the information to determine fuel amount and ignition timing.

FAILURE CONDITIONS

The MAP sensor outputs a voltage which corresponds to the pressure in the surge tank. The ECM checks whether this voltage is within a specified range. The ECM will set P0106 and the Malfunction Indicator Lamp (MIL) will turn on if the MAP sensor output voltage has continued to be 4.5V or higher - corresponding to a surge tank pressure of 114kPa (17psi) or higher - for 4 sec. or to be 1.95V or lower - corresponding to a surge tank pressure of 50kPa (7.4psi) or lower - for 4 sec.

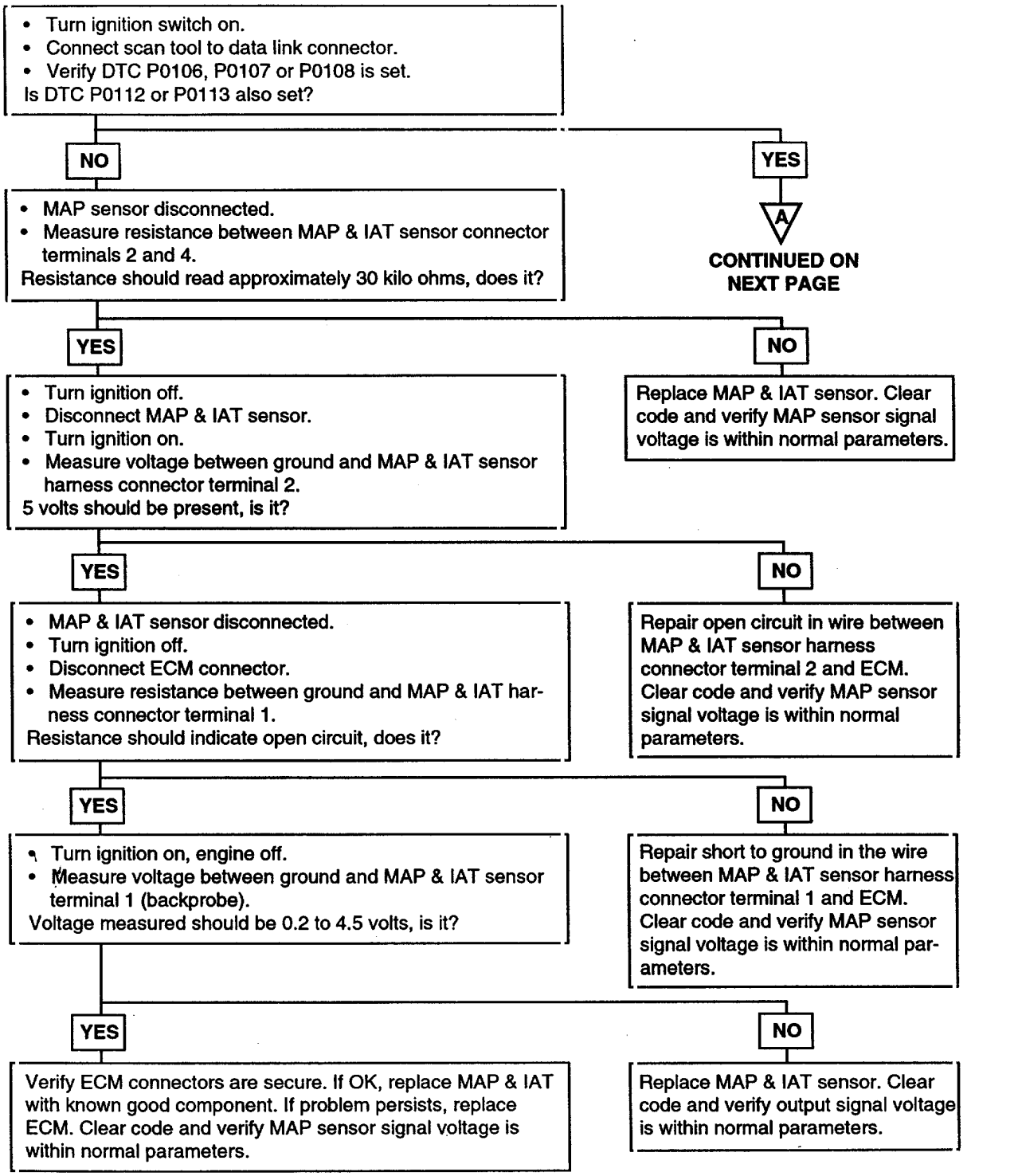
CIRCUIT DIAGRAM



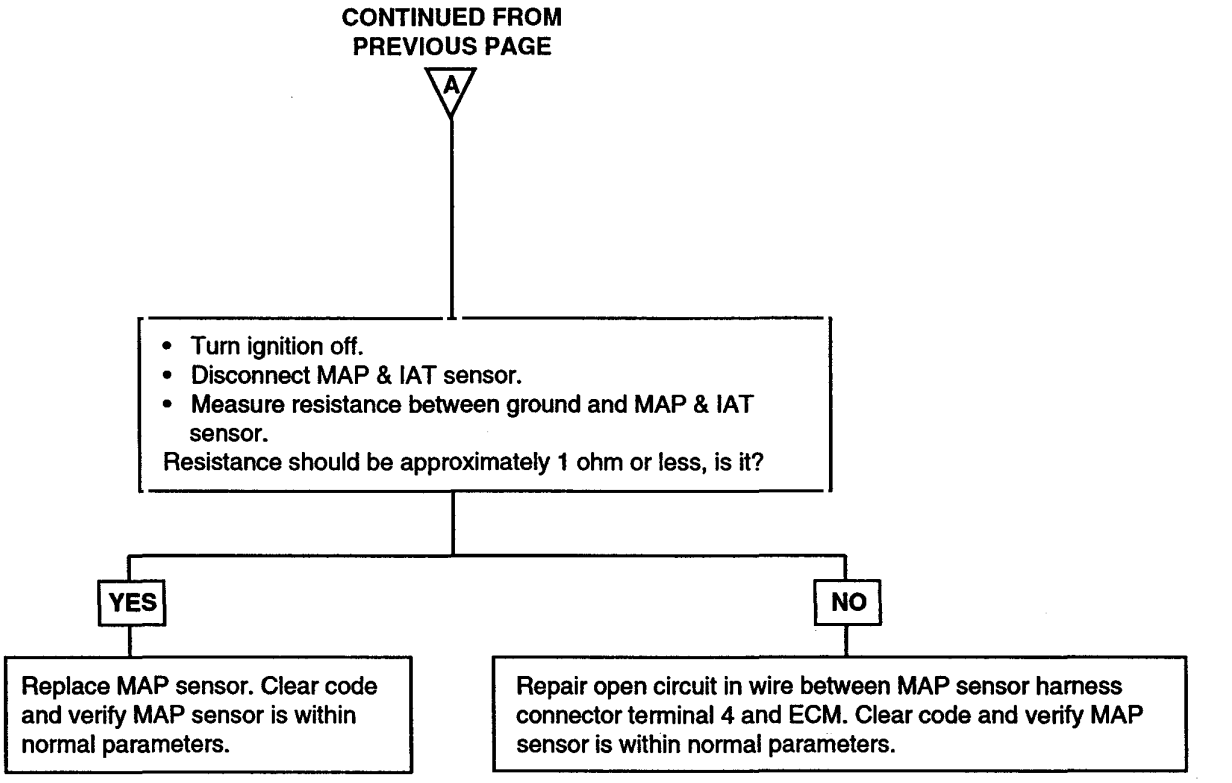
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD502A

TEST PROCEDURE



EFPD502B


CONTINUED FROM PREVIOUS PAGE
A
• Turn ignition off.
• Disconnect MAP & IAT sensor.
• Measure resistance between ground and MAP & IAT sensor.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
Replace MAP sensor. Clear code and verify MAP sensor is within normal parameters.
Repair open circuit in wire between MAP sensor harness connector terminal 4 and ECM. Clear code and verify MAP sensor is within normal parameters.

EFPD502C

[P0112/P0113] EAB15FB7

DTC	Diagnostic item
P0112	Intake Air Temperature Low Input
P0113	Intake Air Temperature High Input

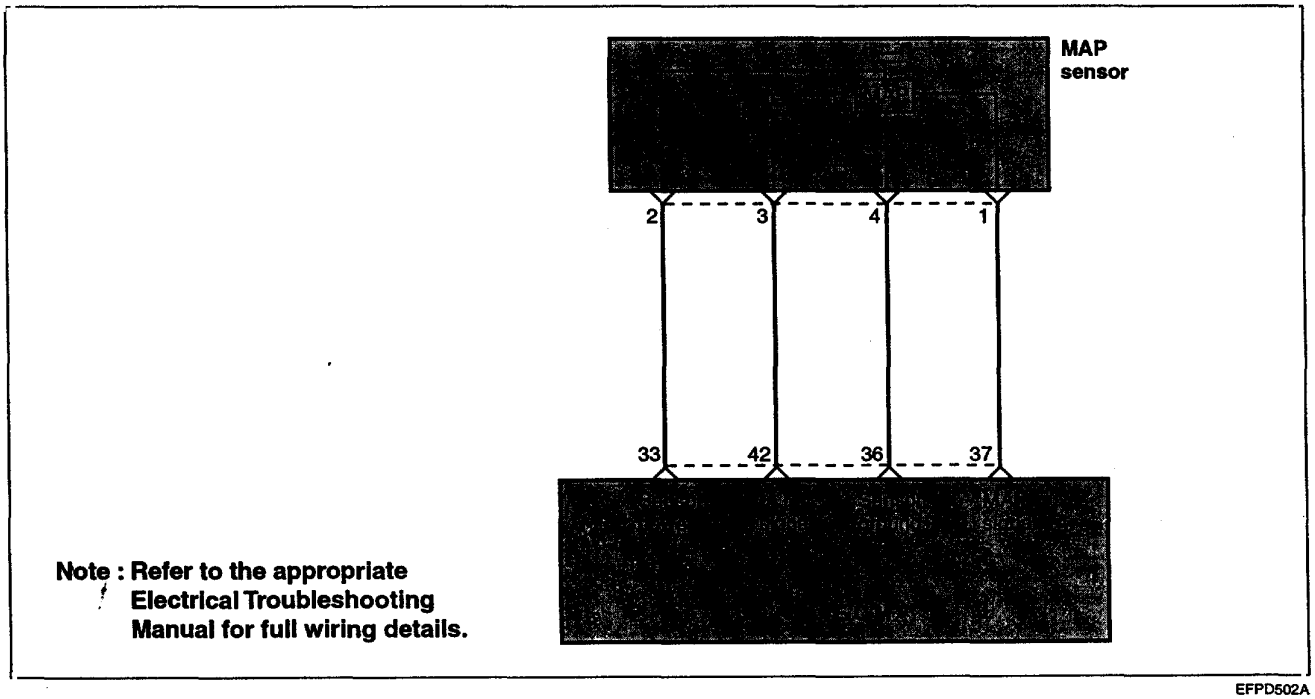
DESCRIPTION

The Intake air temperature (IAT) sensor is built-in to the MAP sensor. The IAT sensor is a variable resistor whose resistance changes as the temperature of the air flowing through the air intake changes. The Engine Control Module (ECM) uses the IAT sensor input to adjust fuel injector pulse width. When the temperature sensed is cold, the ECM enriches fuel mixture by increasing injector pulse width; as the air warms, the injector pulse width time is shortened.

FAILURE CONDITIONS

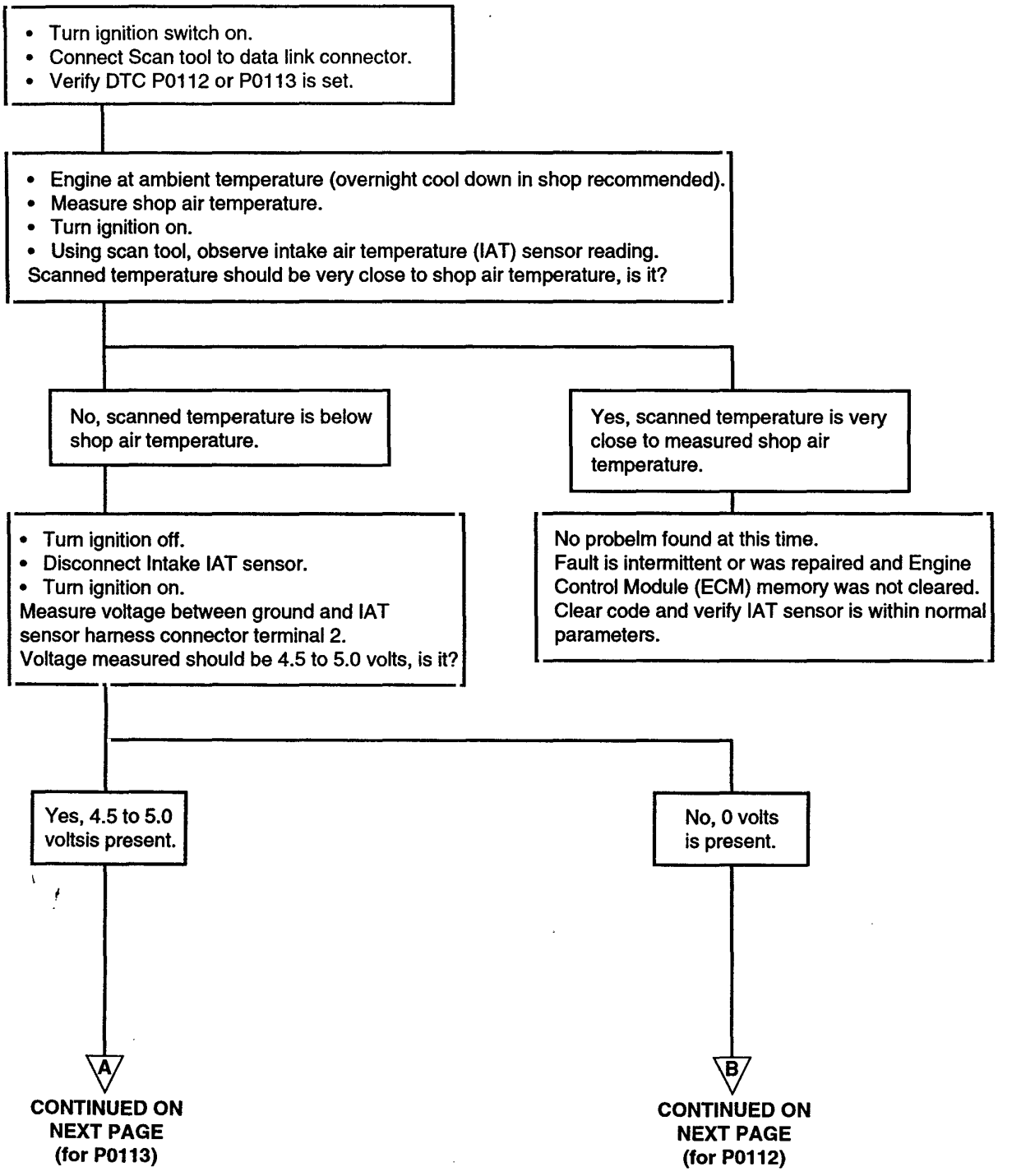
The ECM will set P0112 and the Malfunction Indicator Lamp (MIL) will turn on if the IAT sensor indicates a temperature lower than -49°F (-45°C) for 0.2 seconds during two driving cycles. This check is made after the engine has run for 4 minutes and 10 seconds and then idles for 30 seconds (with no fuel cut-off during a coast-down). This code indicates a lower than expected temperature is being read by the IAT sensor or ECM after the engine has been warmed up.

CIRCUIT DIAGRAM

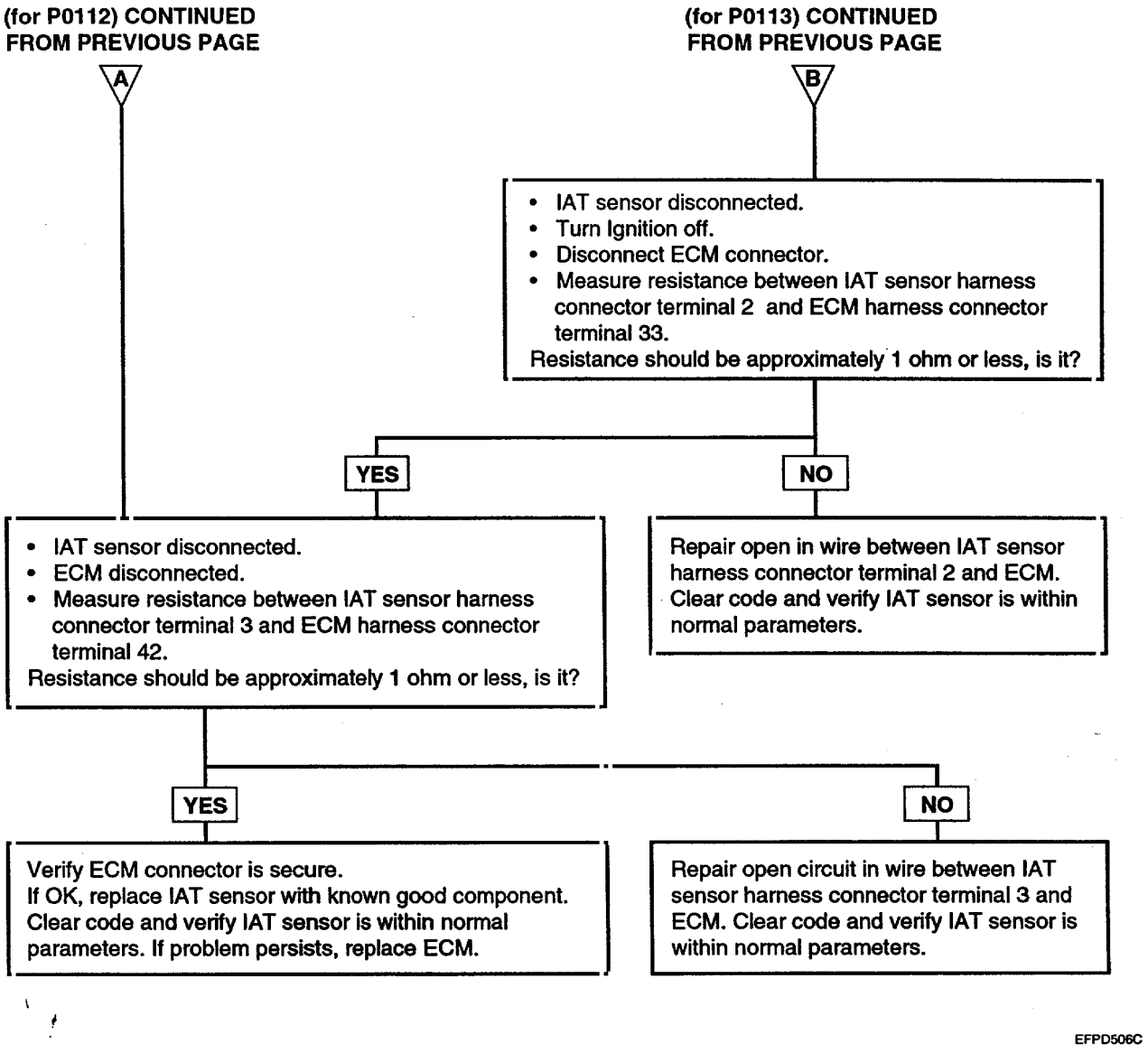


EFPD502A

TEST PROCEDURE



EFPD506B


(for P0112) CONTINUED
FROM PREVIOUS PAGE
A
(for P0113) CONTINUED
FROM PREVIOUS PAGE
B
• IAT sensor disconnected.
• Turn Ignition off.
• Disconnect ECM connector.
• Measure resistance between IAT sensor harness connector terminal 2 and ECM harness connector terminal 33.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
• IAT sensor disconnected.
• ECM disconnected.
• Measure resistance between IAT sensor harness connector terminal 3 and ECM harness connector terminal 42.
Resistance should be approximately 1 ohm or less, is it?
Repair open in wire between IAT sensor harness connector terminal 2 and ECM. Clear code and verify IAT sensor is within normal parameters.
YES
NO
Verify ECM connector is secure.
If OK, replace IAT sensor with known good component. Clear code and verify IAT sensor is within normal parameters. If problem persists, replace ECM.
Repair open circuit in wire between IAT sensor harness connector terminal 3 and ECM. Clear code and verify IAT sensor is within normal parameters.

EFPD506C

[P0116/P0117/P0118] EBCF734B

DTC	Diagnostic item
P0116	Engine Coolant Temperature Circuit Range/Performance Problem
P0117	Engine Coolant Temperature Low Input
P0118	Engine Coolant Temperature High Input

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is located in the coolant passage of the cylinder head. The ECT sensor is a variable resistor whose resistance changes as the temperature of the engine coolant flowing past the sensor changes.When coolant temperature is low, sensor resistance is high; when coolant temperature is high, sensor resistance is low.
The Engine Control Module (ECM) checks ECT sensor voltage and uses the information to adjust fuel injector pulse width and ignition timing. When the temperature sensed is very cold, the ECM enriches the fuel mixture and advances ignition timing. As coolant temperature rises, the ECM reduces the amount of enrichment and timing advance.

FAILURE CONDITIONS

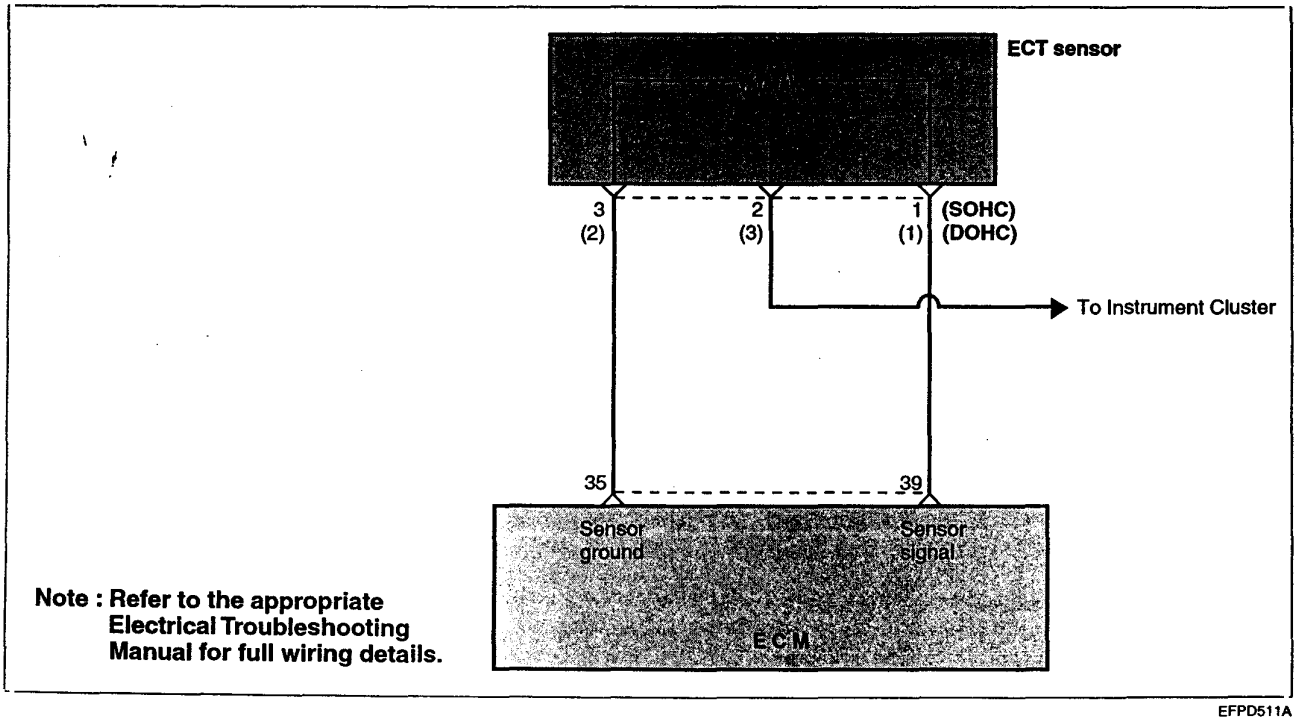
The ECM will set P0116 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor's actual performance curve falls more than 68°F (20°C) below the ECM's modal curve (based on fuel delivery, ambient air temperature and engine running time) for 0.2 seconds during two driving cycles. This code indicates uncharacteristic engine temperature performance being read by the ECT sensor or ECM.
The ECM will set P0117 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor reports a temperature below -49°F (-45°C) for 0.2 seconds during two driving cycles. The ECM will set P0118 and the MalfunctionIndicator Lamp (MIL) will turn on if the ECT sensor reports a temperature above 284°F (140°C) for 0.2 seconds during two driving cycles.

NOTE

The ECT sensor resistance varies with temperature as follows :

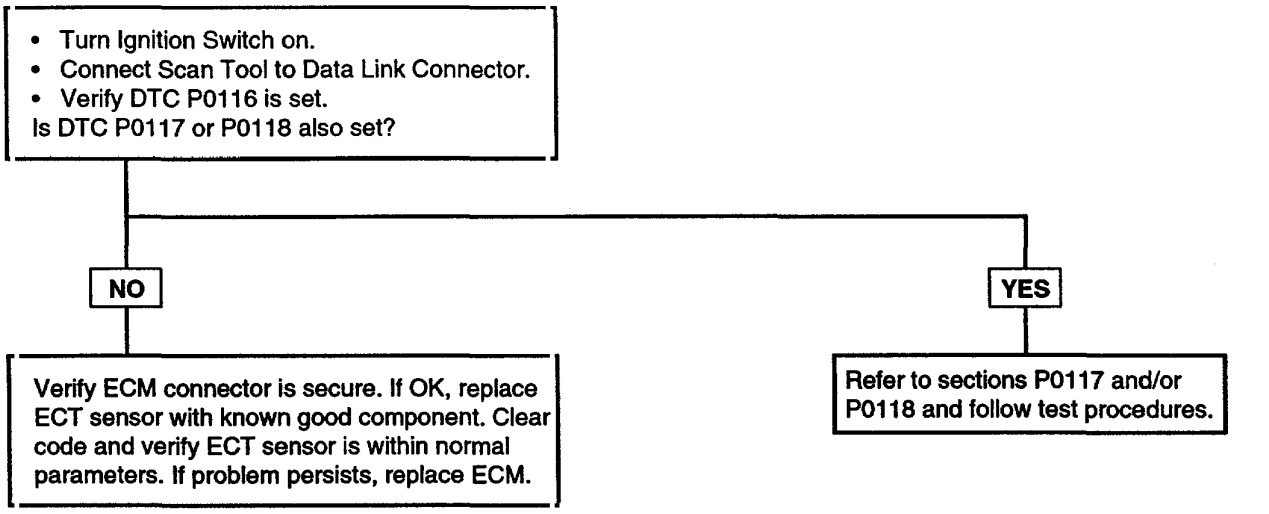
- *5900 ohms @ 32°F (0°C).*
- *2500 ohms @ 68°F (20°C).*
- *300 ohms @ 176°F (80°C).*

CIRCUIT DIAGRAM

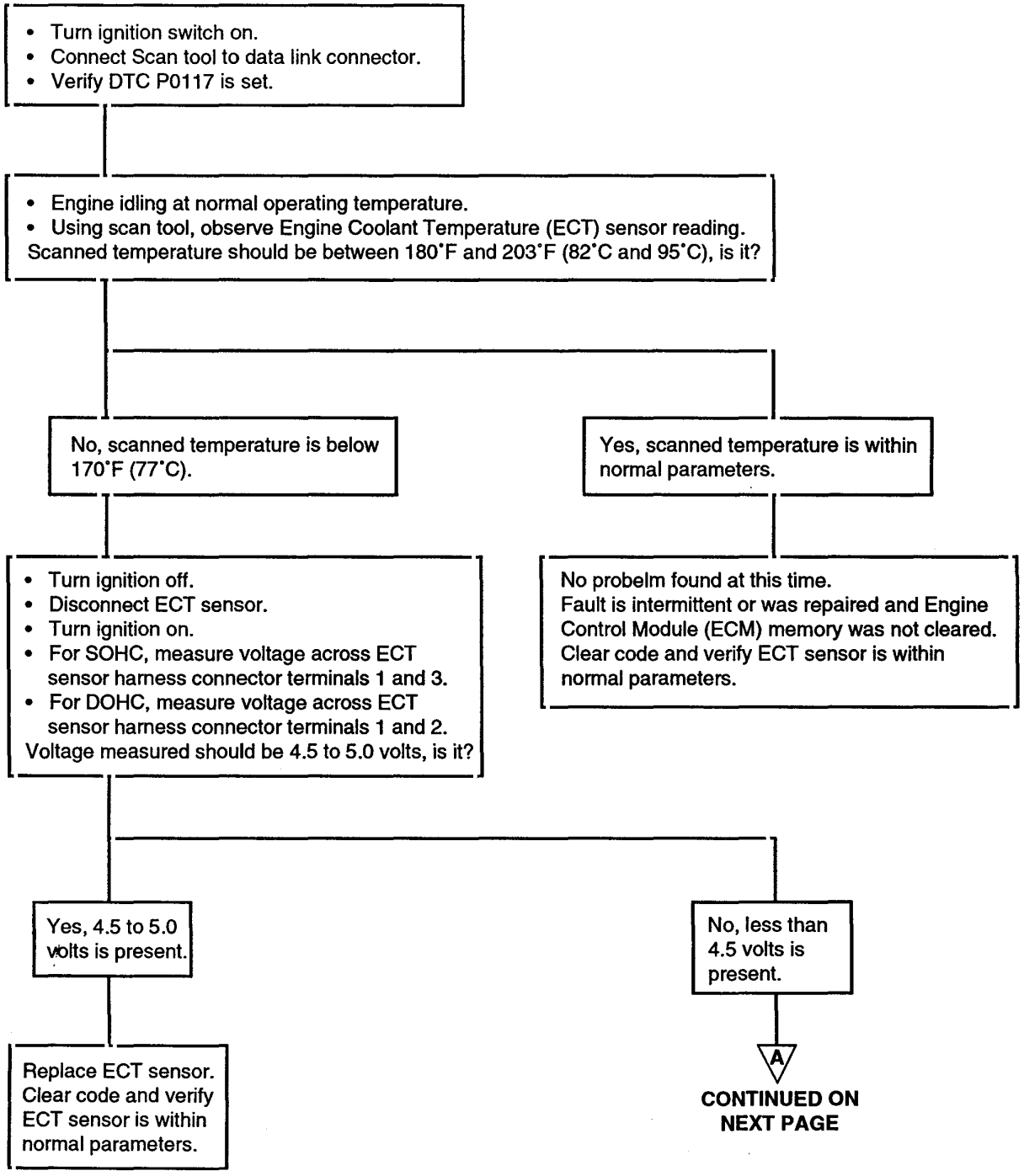


EFPD511A

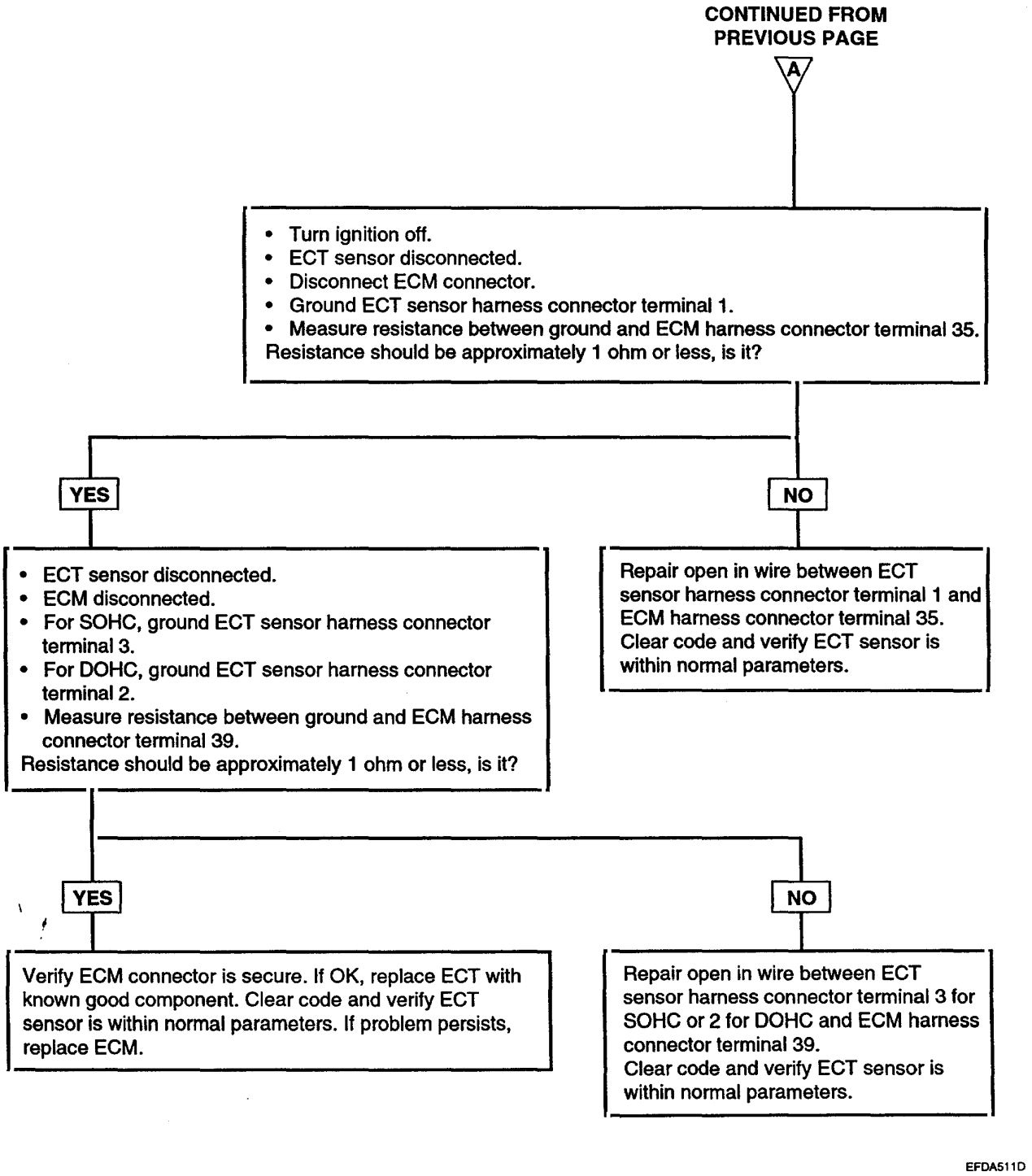
TEST PROCEDURE



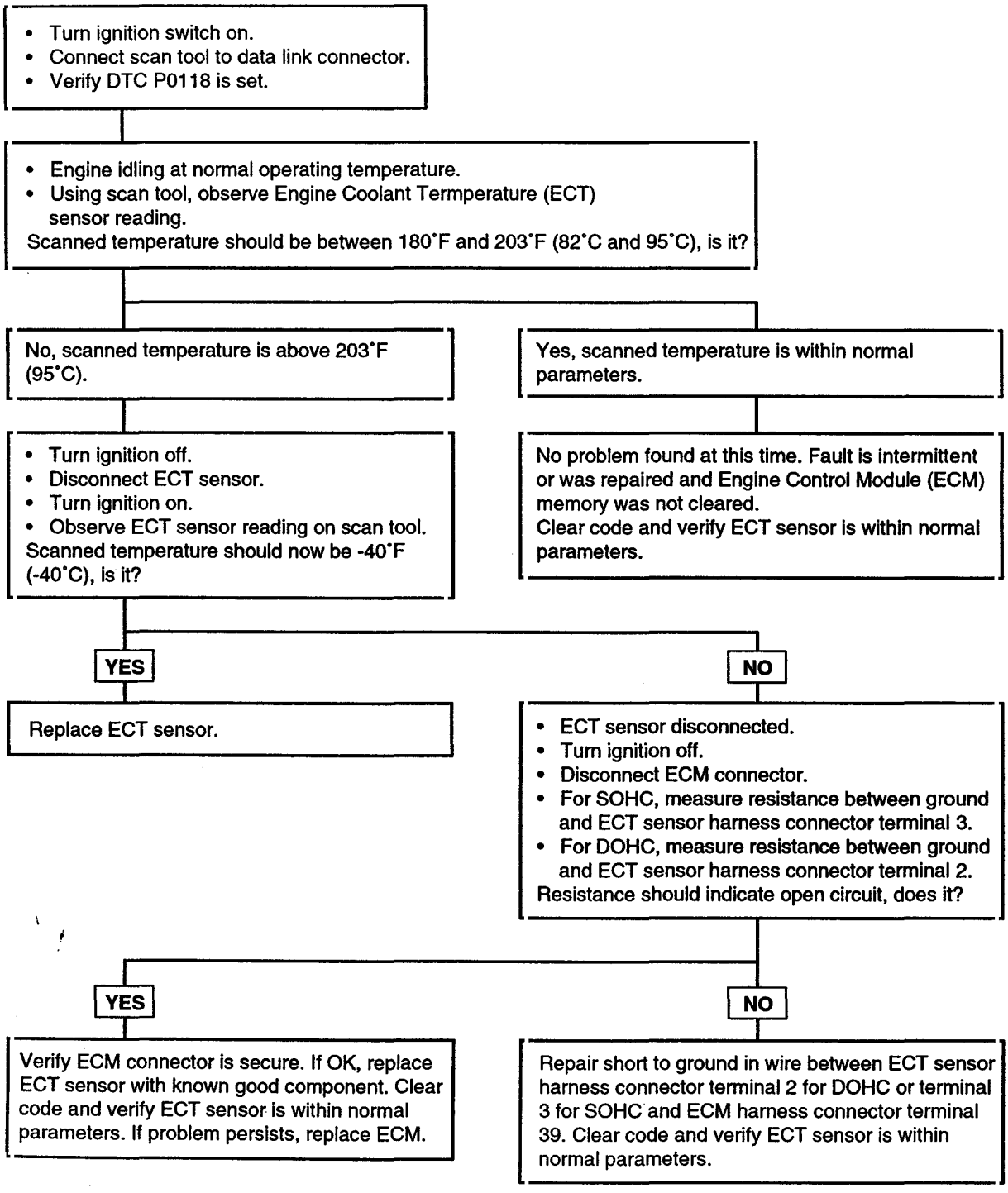
EFDA511B


• Turn ignition switch on.
• Connect Scan tool to data link connector.
• Verify DTC P0117 is set.
• Engine idling at normal operating temperature.
• Using scan tool, observe Engine Coolant Temperature (ECT) sensor reading.
Scanned temperature should be between 180°F and 203°F (82°C and 95°C), is it?
No, scanned temperature is below 170°F (77°C).
Yes, scanned temperature is within normal parameters.
• Turn ignition off.
• Disconnect ECT sensor.
• Turn ignition on.
• For SOHC, measure voltage across ECT sensor harness connector terminals 1 and 3.
• For DOHC, measure voltage across ECT sensor harness connector terminals 1 and 2.
Voltage measured should be 4.5 to 5.0 volts, is it?
No probelm found at this time.
Fault is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify ECT sensor is within normal parameters.
Yes, 4.5 to 5.0 volts is present.
No, less than 4.5 volts is present.
Replace ECT sensor.
Clear code and verify ECT sensor is within normal parameters.
A
CONTINUED ON NEXT PAGE

EFDA511C


CONTINUED FROM PREVIOUS PAGE
A
• Turn ignition off.
• ECT sensor disconnected.
• Disconnect ECM connector.
• Ground ECT sensor harness connector terminal 1.
• Measure resistance between ground and ECM harness connector terminal 35.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
• ECT sensor disconnected.
• ECM disconnected.
• For SOHC, ground ECT sensor harness connector terminal 3.
• For DOHC, ground ECT sensor harness connector terminal 2.
• Measure resistance between ground and ECM harness connector terminal 39.
Resistance should be approximately 1 ohm or less, is it?
Repair open in wire between ECT sensor harness connector terminal 1 and ECM harness connector terminal 35.
Clear code and verify ECT sensor is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace ECT with known good component. Clear code and verify ECT sensor is within normal parameters. If problem persists, replace ECM.
Repair open in wire between ECT sensor harness connector terminal 3 for SOHC or 2 for DOHC and ECM harness connector terminal 39.
Clear code and verify ECT sensor is within normal parameters.

EFDA511D


• Turn ignition switch on.
• Connect scan tool to data link connector.
• Verify DTC P0118 is set.
• Engine idling at normal operating temperature.
• Using scan tool, observe Engine Coolant Termperature (ECT) sensor reading.
Scanned temperature should be between 180°F and 203°F (82°C and 95°C), is it?
No, scanned temperature is above 203°F (95°C).
Yes, scanned temperature is within normal parameters.
• Turn ignition off.
• Disconnect ECT sensor.
• Turn ignition on.
• Observe ECT sensor reading on scan tool.
Scanned temperature should now be -40°F (-40°C), is it?
No problem found at this time. Fault is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify ECT sensor is within normal parameters.
YES
NO
Replace ECT sensor.
• ECT sensor disconnected.
• Turn ignition off.
• Disconnect ECM connector.
• For SOHC, measure resistance between ground and ECT sensor harness connector terminal 3.
• For DOHC, measure resistance between ground and ECT sensor harness connector terminal 2.
Resistance should indicate open circuit, does it?
YES
NO
Verify ECM connector is secure. If OK, replace ECT sensor with known good component. Clear code and verify ECT sensor is within normal parameters. If problem persists, replace ECM.
Repair short to ground in wire between ECT sensor harness connector terminal 2 for DOHC or terminal 3 for SOHC and ECM harness connector terminal 39. Clear code and verify ECT sensor is within normal parameters.

EFDA511E

[P0121/P0122/P0123] E8D645DB

DTC	Diagnostic item
P0121	TPS Voltage Does Not Agree with MAF Sensor
P0122	TPS Circuit Low Input
P0123	TPS Circuit High Input

DESCRIPTION

The Throttle Position sensor mounts on the side of the throttle body and is connected to the throttle valve shaft. The TPS is a variable resistor (potentiometer) whose resistance changes according to throttle valve shaft position. During acceleration, the TPS resistance decreases; during deceleration, the TPS resistance increases.
The Engine Control Module (ECM) applies a reference voltage to the TPS and then measures the voltage that is present on the TPS signal circuit. The ECM uses the TPS signal to adjust timing and injector pulse width. The TPS signal along with the MAF sensor signal is used by the ECM to calculate engine load.

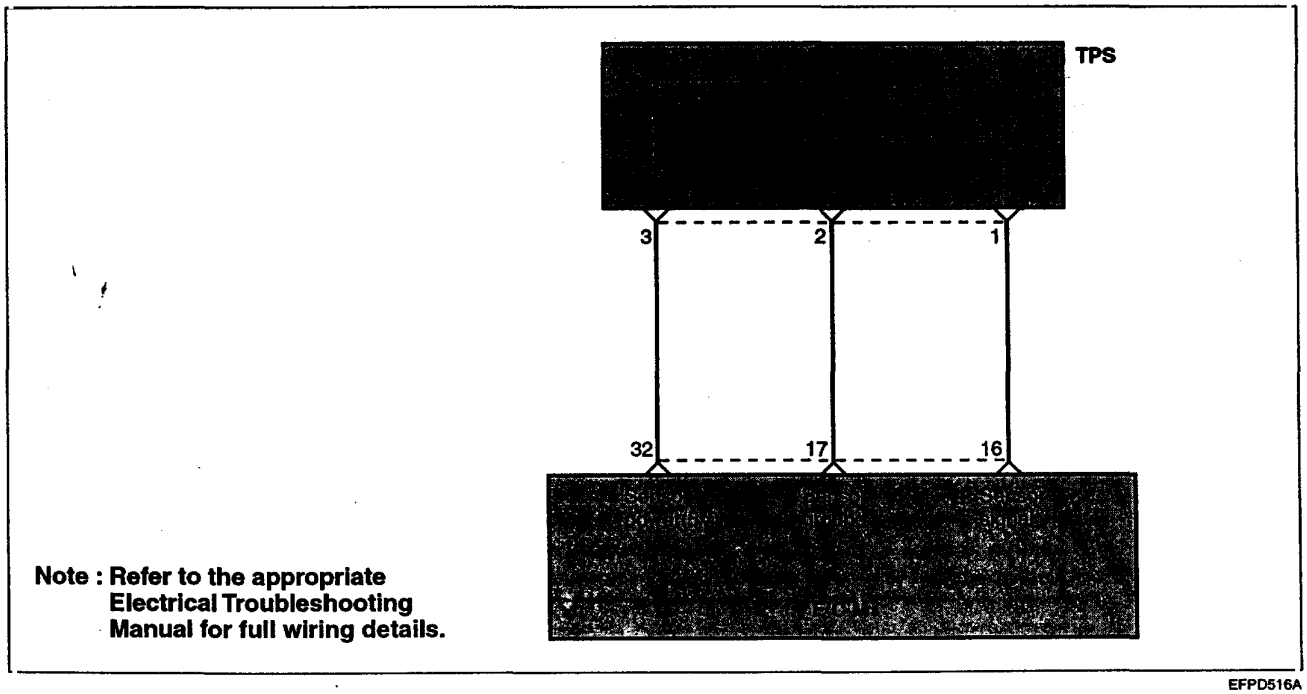
FAILURE CONDITIONS

The ECM will set P0121 and the Malfunction Indicator Lamp (MIL) will turn on if the engine load indicated by the Throttle Position (TP) sensor and the MAP sensor are different. This code indicates that the throttle position and air flow readings by the TPS and MAP sensor, or ECM, do not result in the expected engine load value.
The ECM will set P0122 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as less than 2.1 degrees for more than 0.2 seconds during 2-driving cycles. This code indicates an unusually low throttle position angle being read by the TP sensor or ECM.
The ECM will set P0123 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as greater than 105.4 degrees for 0.2 seconds during 2-driving cycles. This code indicates an unusually high throttle position angle being read by the TP sensor or ECM.

NOTE

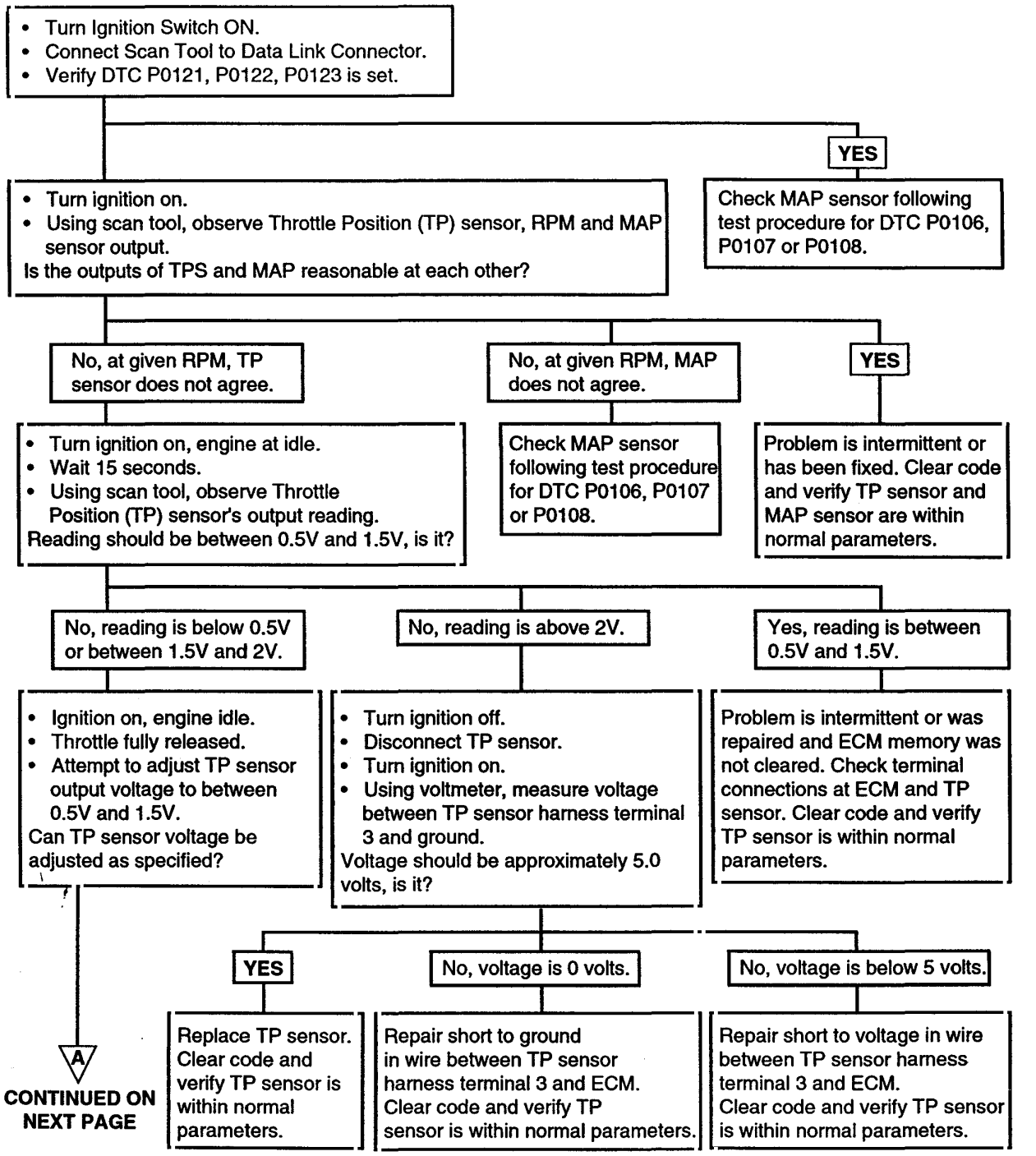
The standard resistance value between terminals 1 and 3 of the throttle position sensor is 1600~2500 ohms.

CIRCUIT DIAGRAM

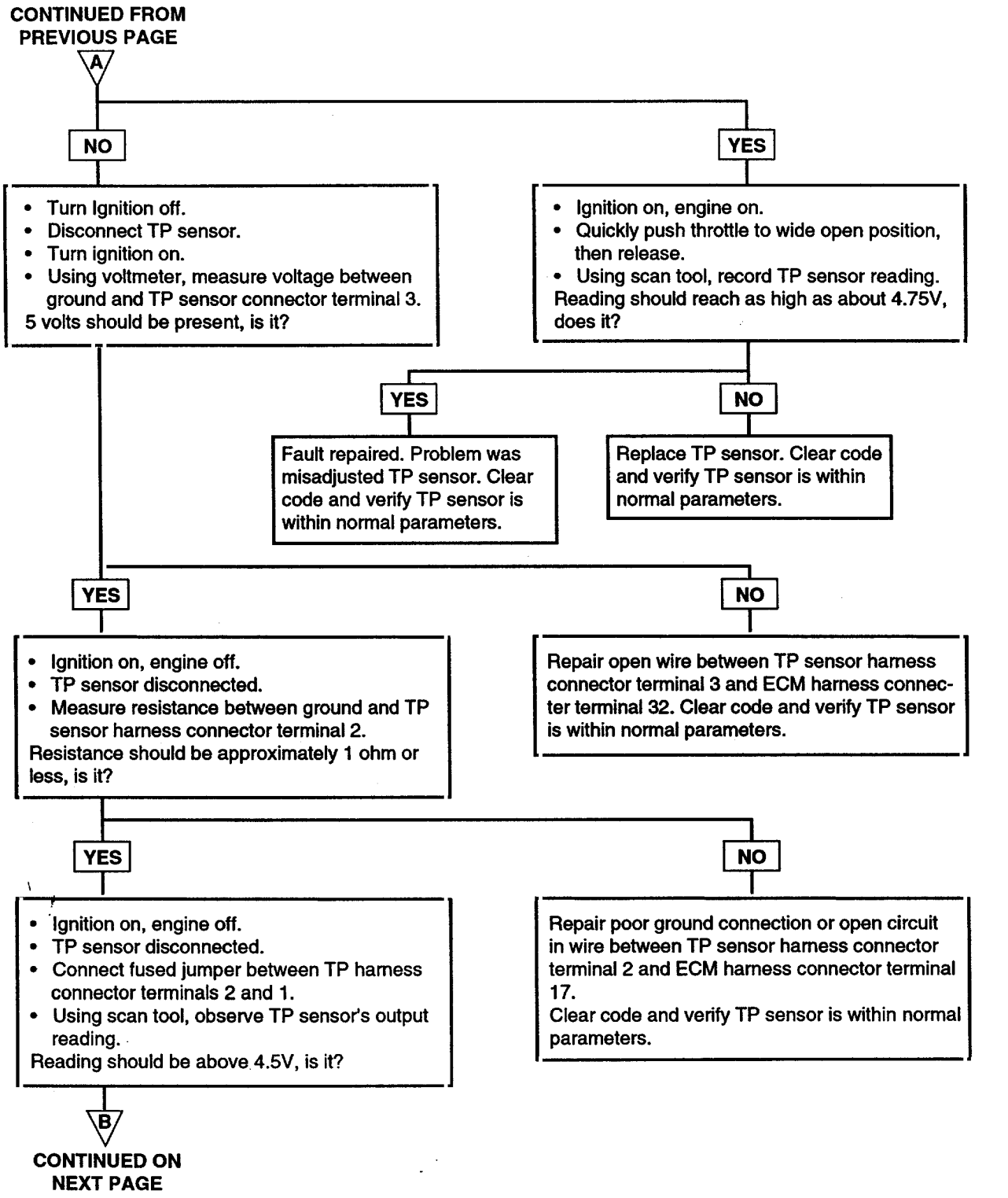


EFPD516A

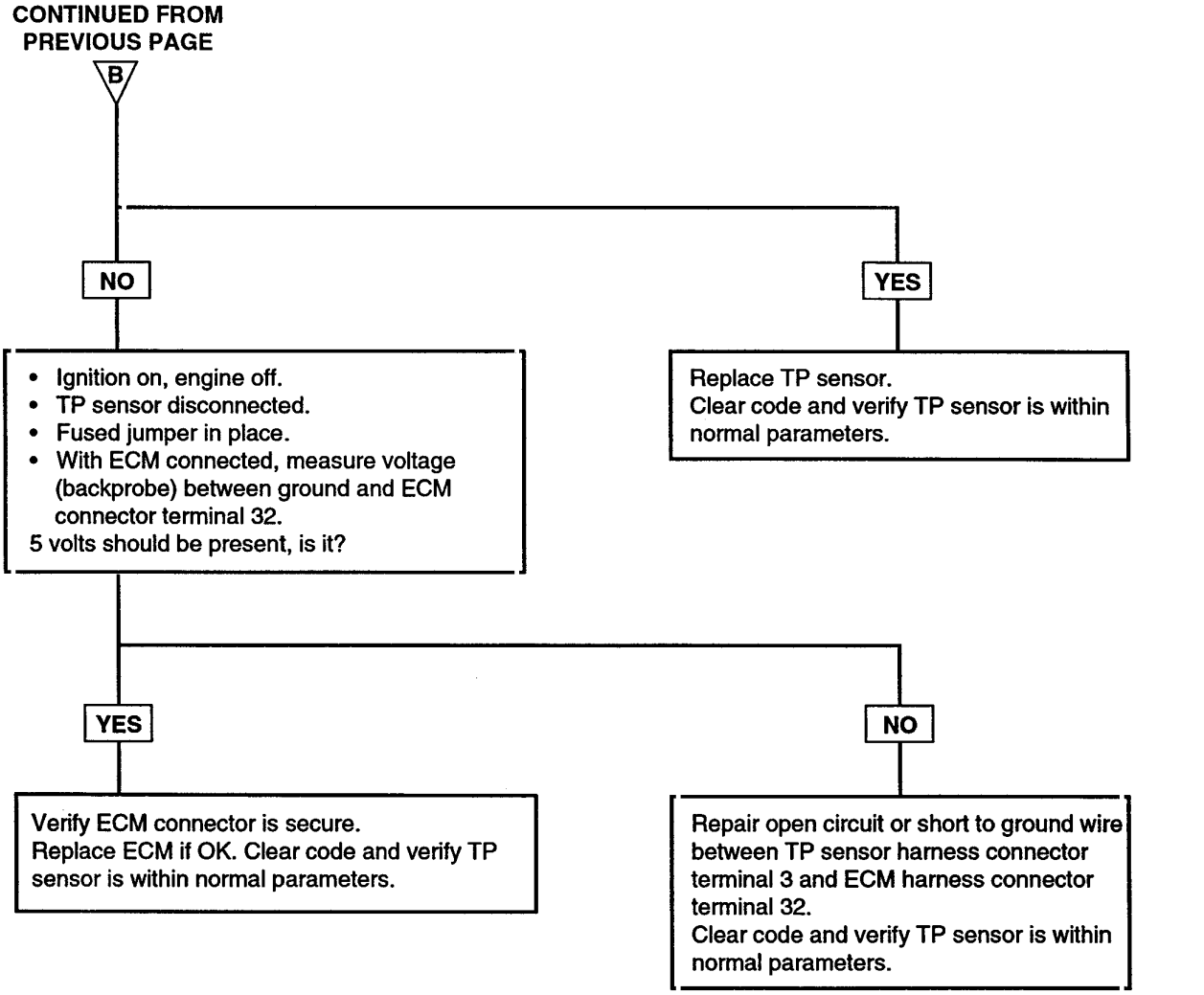
TEST PROCEDURE



EFPD516B


CONTINUED FROM PREVIOUS PAGE
A
NO
YES
• Turn Ignition off.
• Disconnect TP sensor.
• Turn ignition on.
• Using voltmeter, measure voltage between ground and TP sensor connector terminal 3.
5 volts should be present, is it?
• Ignition on, engine on.
• Quickly push throttle to wide open position, then release.
• Using scan tool, record TP sensor reading.
Reading should reach as high as about 4.75V, does it?
YES
NO
Fault repaired. Problem was misadjusted TP sensor. Clear code and verify TP sensor is within normal parameters.
Replace TP sensor. Clear code and verify TP sensor is within normal parameters.
YES
NO
• Ignition on, engine off.
• TP sensor disconnected.
• Measure resistance between ground and TP sensor harness connector terminal 2.
Resistance should be approximately 1 ohm or less, is it?
Repair open wire between TP sensor harness connector terminal 3 and ECM harness connecter terminal 32. Clear code and verify TP sensor is within normal parameters.
YES
NO
• Ignition on, engine off.
• TP sensor disconnected.
• Connect fused jumper between TP harness connector terminals 2 and 1.
• Using scan tool, observe TP sensor's output reading.
Reading should be above 4.5V, is it?
Repair poor ground connection or open circuit in wire between TP sensor harness connector terminal 2 and ECM harness connector terminal 17.
Clear code and verify TP sensor is within normal parameters.
B
CONTINUED ON NEXT PAGE

EFPD516C


CONTINUED FROM PREVIOUS PAGE
B
NO
YES
• Ignition on, engine off.
• TP sensor disconnected.
• Fused jumper in place.
• With ECM connected, measure voltage (backprobe) between ground and ECM connector terminal 32.
5 volts should be present, is it?
Replace TP sensor.
Clear code and verify TP sensor is within normal parameters.
YES
NO
Verify ECM connector is secure.
Replace ECM if OK. Clear code and verify TP sensor is within normal parameters.
Repair open circuit or short to ground wire between TP sensor harness connector terminal 3 and ECM harness connector terminal 32.
Clear code and verify TP sensor is within normal parameters.

EFPD516D

[P0130/P0136] E1BCDF8D

DTC	Diagnostic item
P0130	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 1)
P0136	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 2)

DESCRIPTION

The Engine Control Module (ECM) uses oxygen sensor signals to maintain the air fuel mixture at the ratio resulting in optimum fuel economy and reduced emissions. The amount of oxygen in the exhaust gases indicates, to the front oxygen sensor, whether the air fuel mixture being supplied to the engine cylinders is rich or lean. The readings of the rear oxygen sensor are used to indicate the efficiency of the catalytic converter. The ECM calculates catalytic converter efficiency by comparing the rear oxygen sensor signal to the front oxygen sensor signal.
A normal oxygen sensor signal will constantly fluctuate above and below 500 mV, with the front oxygen sensor signal frequency of at least 5Hz at 2500 RPM. Due to the effect of the catalytic converter, the rear oxygen sensor signal frequency will be lower than the front oxygen sensor signal frequency. If the rear oxygen sensor signal coincides with the front oxygen sensor signal a large percentage of the time, this indicates a loss in efficiency of the catalytic converter or a malfunction within the fuel system.

FAILURE CONDITIONS

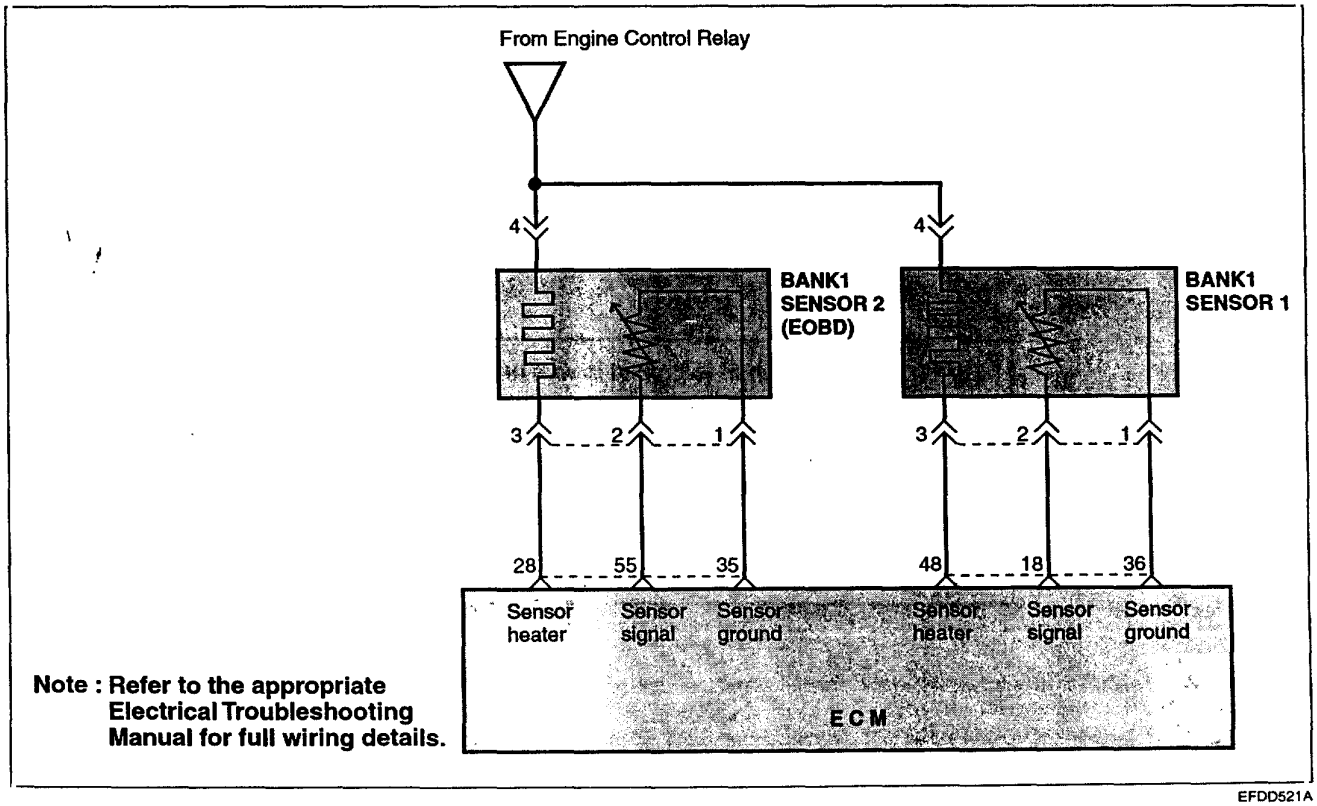
(FOR P0130)

After the engine runs, the ECM checks the front oxygen sensor once per driving cycle for 5 sec. If during two driving cycles the front oxygen sensor's output is not between 0 millivolts and +380 millivolts while the rear oxygen sensor's output is greater than 350 millivolts, the ECM will set a code and MIL will turn on. This code indicates uncharacteristic operation of the front oxygen sensor being read by the ECM.

(FOR P0136)

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor's output. If during two driving cycles the rear oxygen sensor's output is not between 400 millivolts and 500 millivolts, the ECM will set a code and MIL will turn on. This code indicates an uncharacteristic reading by the rear oxygen sensor or ECM after the engine has been warmed and run for 3 minutes.

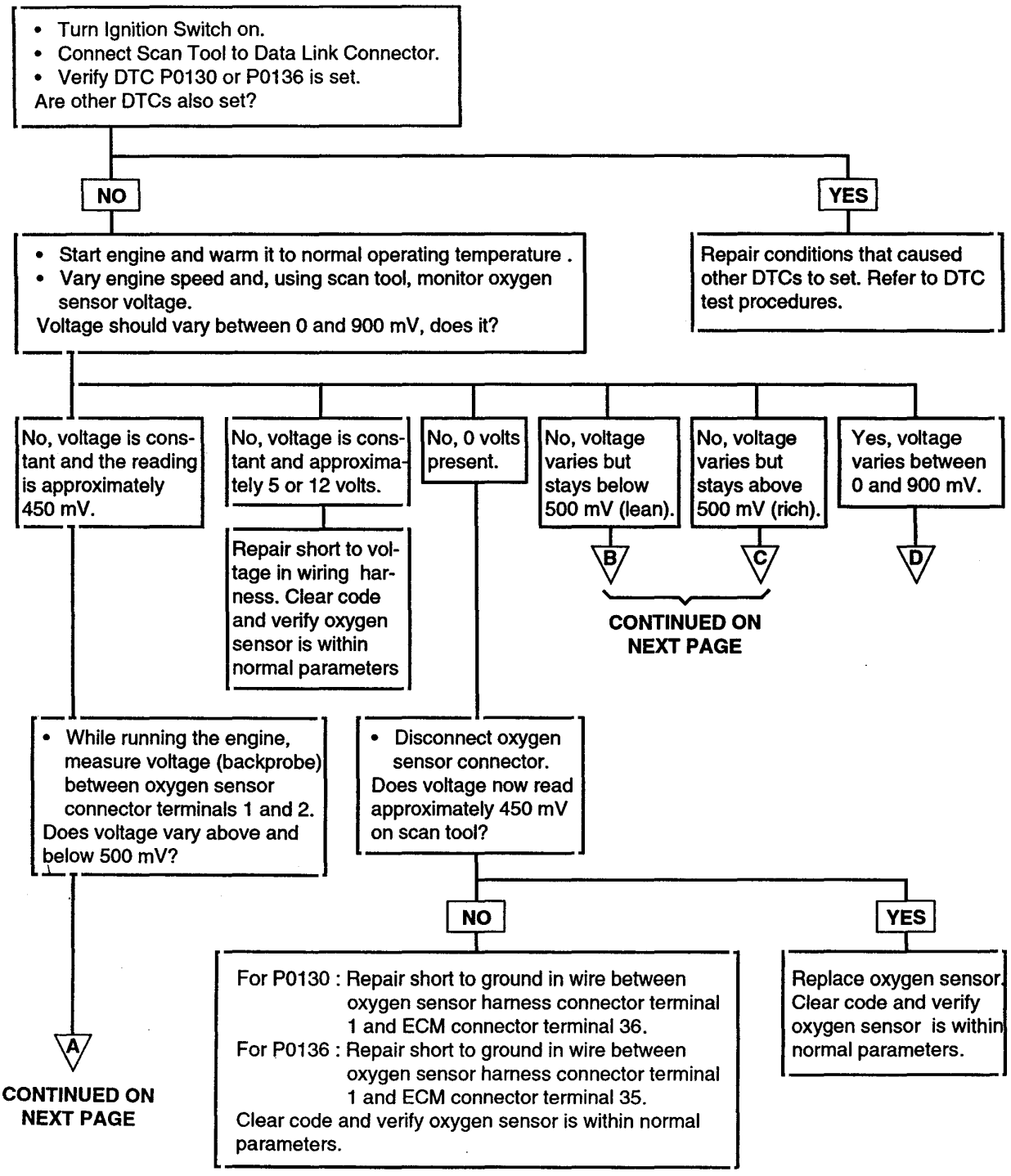
CIRCUIT DIAGRAM



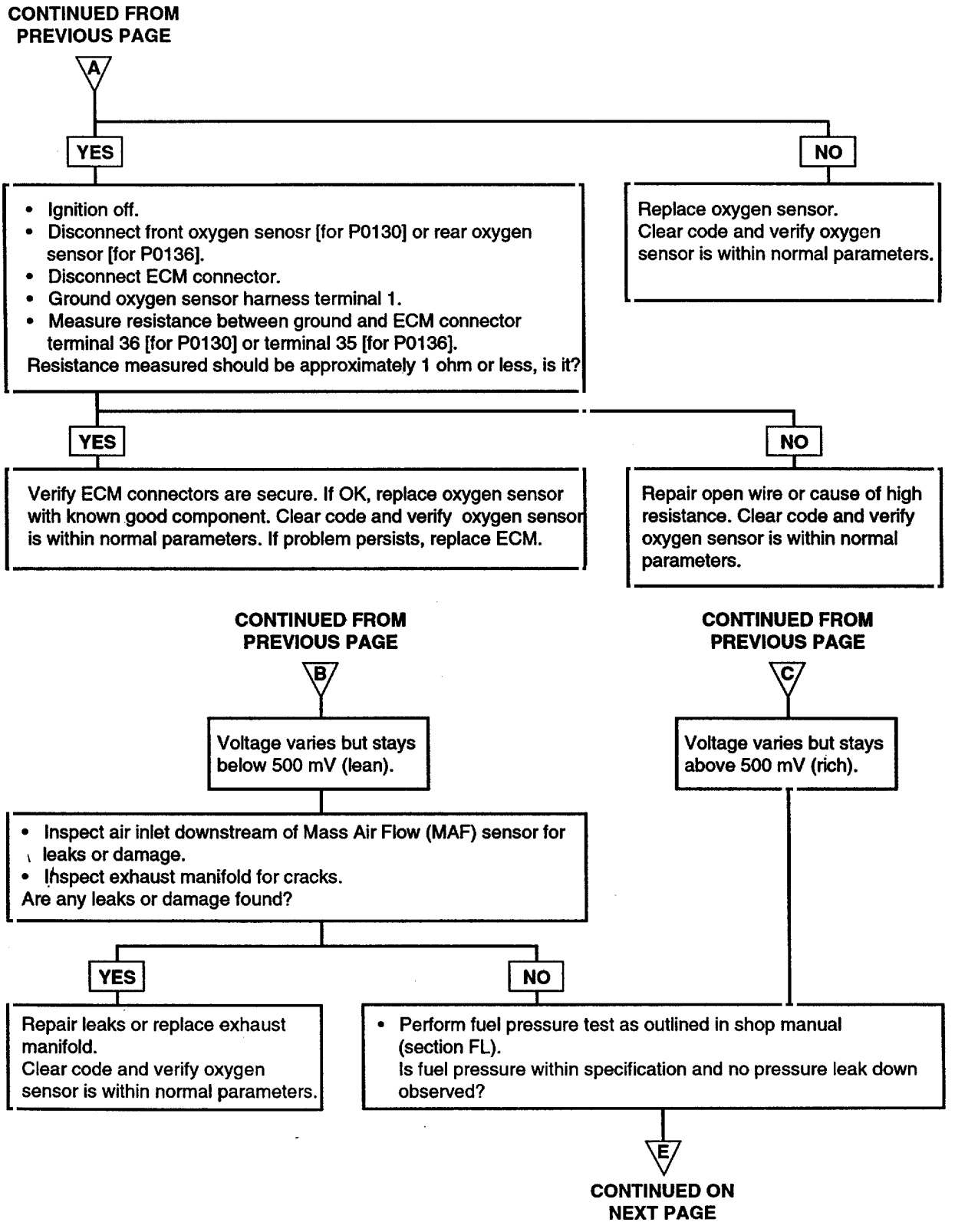
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFDD521A

TEST PROCEDURE



EFDA521B


CONTINUED FROM PREVIOUS PAGE
A
YES
NO
• Ignition off.
• Disconnect front oxygen senosr [for P0130] or rear oxygen sensor [for P0136].
• Disconnect ECM connector.
• Ground oxygen sensor harness terminal 1.
• Measure resistance between ground and ECM connector terminal 36 [for P0130] or terminal 35 [for P0136].
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor.
Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connectors are secure. If OK, replace oxygen sensor with known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.
Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays below 500 mV (lean).
CONTINUED FROM PREVIOUS PAGE
C
Voltage varies but stays above 500 mV (rich).
• Inspect air inlet downstream of Mass Air Flow (MAF) sensor for leaks or damage.
• Inspect exhaust manifold for cracks.
Are any leaks or damage found?
YES
NO
Repair leaks or replace exhaust manifold.
Clear code and verify oxygen sensor is within normal parameters.
• Perform fuel pressure test as outlined in shop manual (section FL).
Is fuel pressure within specification and no pressure leak down observed?
E
CONTINUED ON NEXT PAGE

EFPD521C

CONTINUED FROM PREVIOUS PAGE

D

Voltage varies between 0 and 900 mV.

CONTINUED FROM PREVIOUS PAGE

E

YES

- Ignition off.
- Disconnect ignition coil connector.
- Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine

Voltage drop measured should be less than 0.5 volts, is it?

NO

Follow diagnostic procedures outlined in shop manual.
Clear code and verify oxygen sensor is within normal parametes.

YES

- Disconnect negative battery terminal.
- Measure resistance between generator case and engine ground point.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Replace negative battery cable.
Clear code and verify oxygen sensor is within normal parameters.

YES

- If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0130 or P0136 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
- If Malfunction Indicator Lamp (MIL) was on and DTC P0130 or P0136 is set, replace oxygen sensor.
- Clear code and verify oxygen sensor is within normal parameters.

NO

Clean mating surfaces of generator housing and engine block.
Clear code and verify oxygen sensor is within normal parameters.

EFDA521D

[P0131/P0137] EB22FB9A

DTC	Diagnostic item
P0131	Oxygen Sensor Circuit Low Voltage (Bank 1, Sensor 1)
P0137	Oxygen Sensor Circuit Low Voltage (Bank 1, Sensor 2)

DESCRIPTION

Refer to DTC P0130 & P0136.

FAILURE CONDITIONS

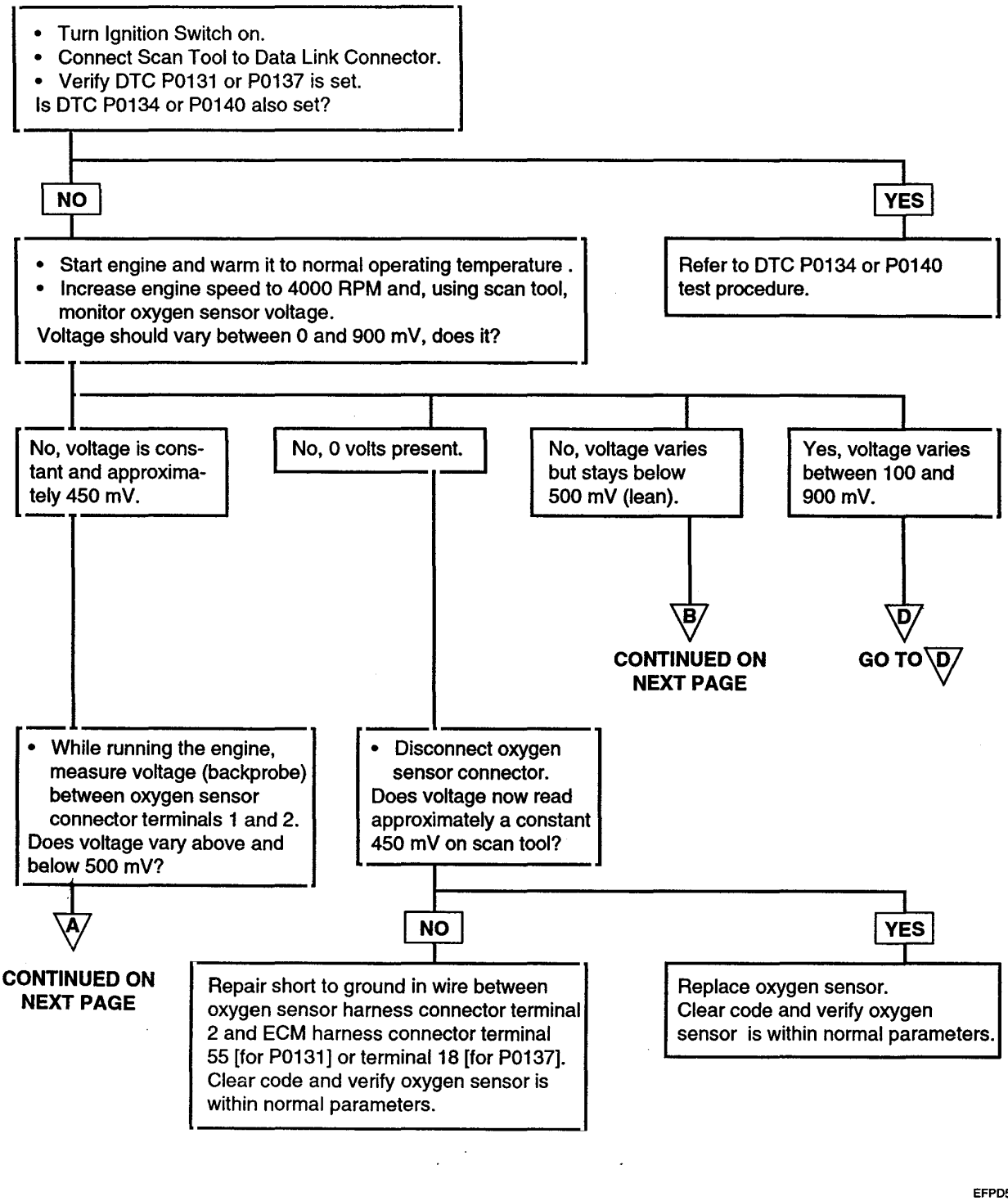
(FOR P0131)

After the Front Oxygen Sensor Heater is on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5 second intervals. If during two driving cycles the front oxygen sensor's output falls below 50 millivolts for 0.5 seconds, the ECM will set P0131 and MIL will turn on. This code indicates an unusually lean fuel air mixture being read by the front oxygen sensor or ECM.

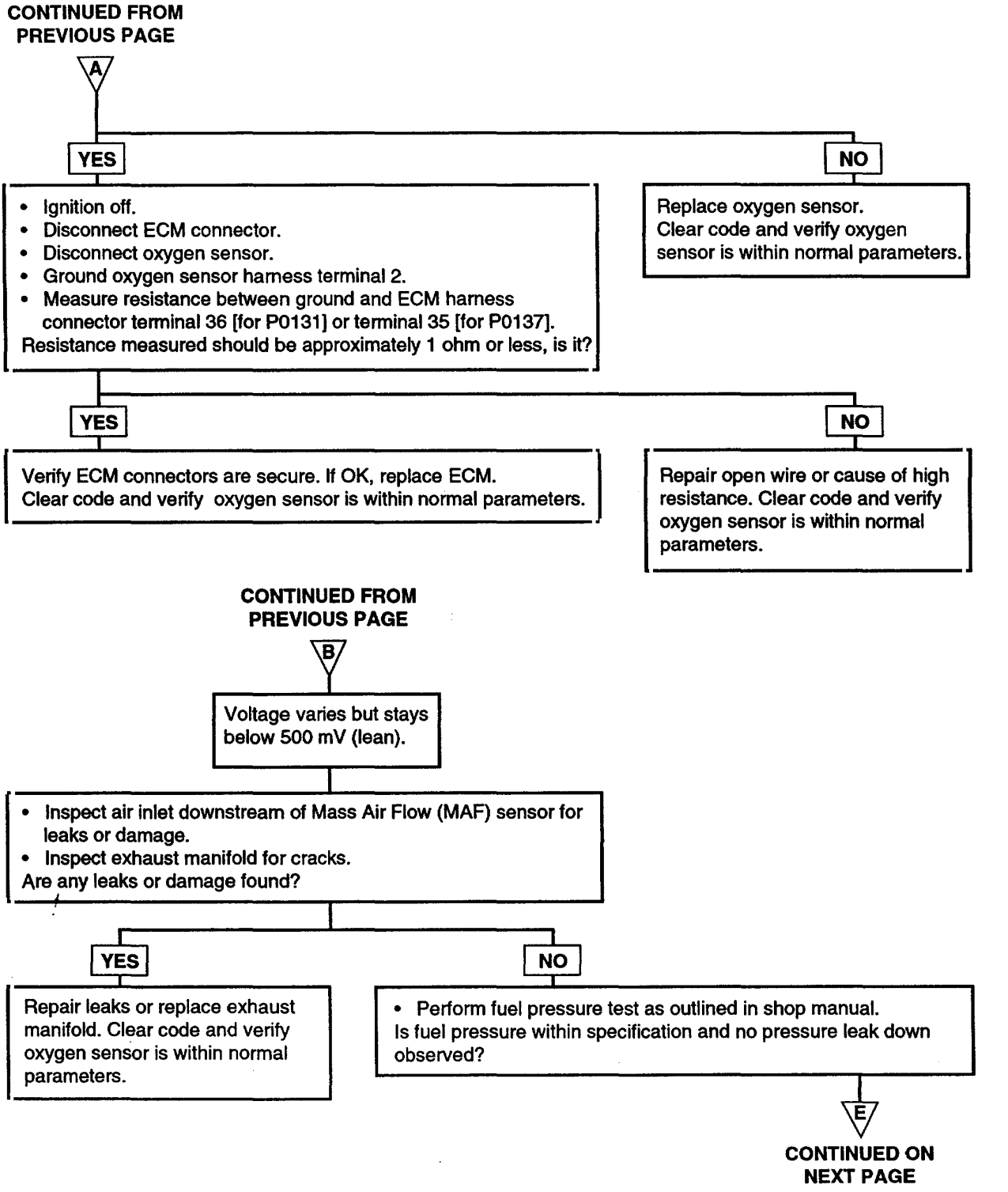
(FOR P0137)

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor's output for 0.5 seconds. If during 2 driving cycles the rear oxygen sensor's output falls below 50 millivolts, the ECM will set P0137 and MIL will turn on. This code indicates an extremely low voltage reading by the rear oxygen sensor or ECM.

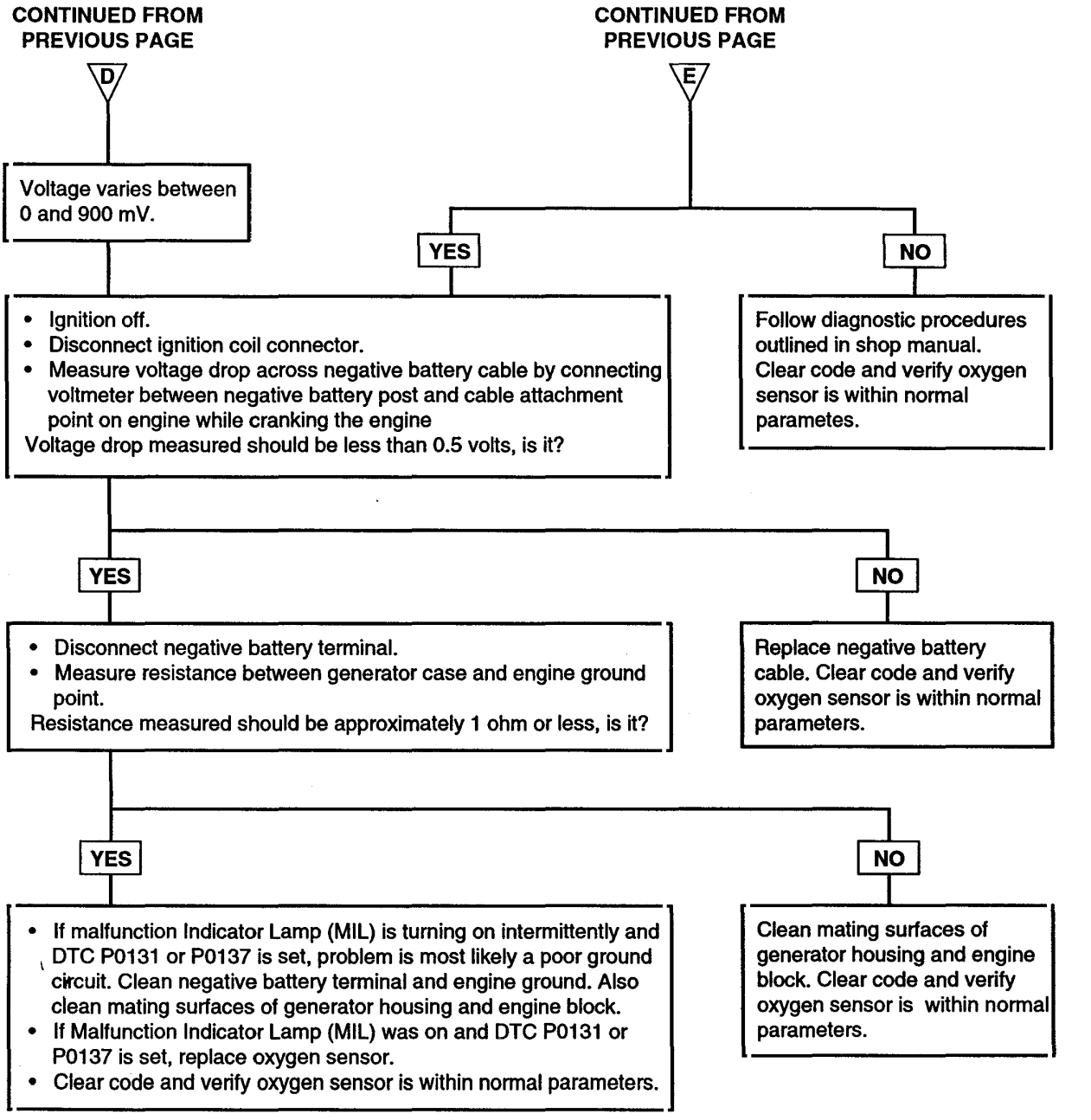
TEST PROCEDURE



EFPD526B


CONTINUED FROM PREVIOUS PAGE
A
YES
NO
• Ignition off.
• Disconnect ECM connector.
• Disconnect oxygen sensor.
• Ground oxygen sensor harness terminal 2.
• Measure resistance between ground and ECM harness connector terminal 36 [for P0131] or terminal 35 [for P0137].
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connectors are secure. If OK, replace ECM. Clear code and verify oxygen sensor is within normal parameters.
Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays below 500 mV (lean).
• Inspect air inlet downstream of Mass Air Flow (MAF) sensor for leaks or damage.
• Inspect exhaust manifold for cracks.
Are any leaks or damage found?
YES
NO
Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
E
CONTINUED ON NEXT PAGE

EFDA526C


CONTINUED FROM PREVIOUS PAGE
D
Voltage varies between 0 and 900 mV.
CONTINUED FROM PREVIOUS PAGE
E
YES
NO
• Ignition off.
• Disconnect ignition coil connector.
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine
Voltage drop measured should be less than 0.5 volts, is it?
Follow diagnostic procedures outlined in shop manual. Clear code and verify oxygen sensor is within normal parametes.
YES
NO
• Disconnect negative battery terminal.
• Measure resistance between generator case and engine ground point.
Resistance measured should be approximately 1 ohm or less, is it?
Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.
YES
NO
• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0131 or P0137 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
• If Malfunction Indicator Lamp (MIL) was on and DTC P0131 or P0137 is set, replace oxygen sensor.
• Clear code and verify oxygen sensor is within normal parameters.
Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFDA526D

[P0132/P0138] EC3FA8A5

DTC	Diagnostic item
P0132	Oxygen Sensor Circuit High Voltage (Bank 1, Sensor 1)
P0138	Oxygen Sensor Circuit High Voltage (Bank 1, Sensor 2)

DESCRIPTION

Refer to DTC P0130 & P0136.

FAILURE CONDITIONS

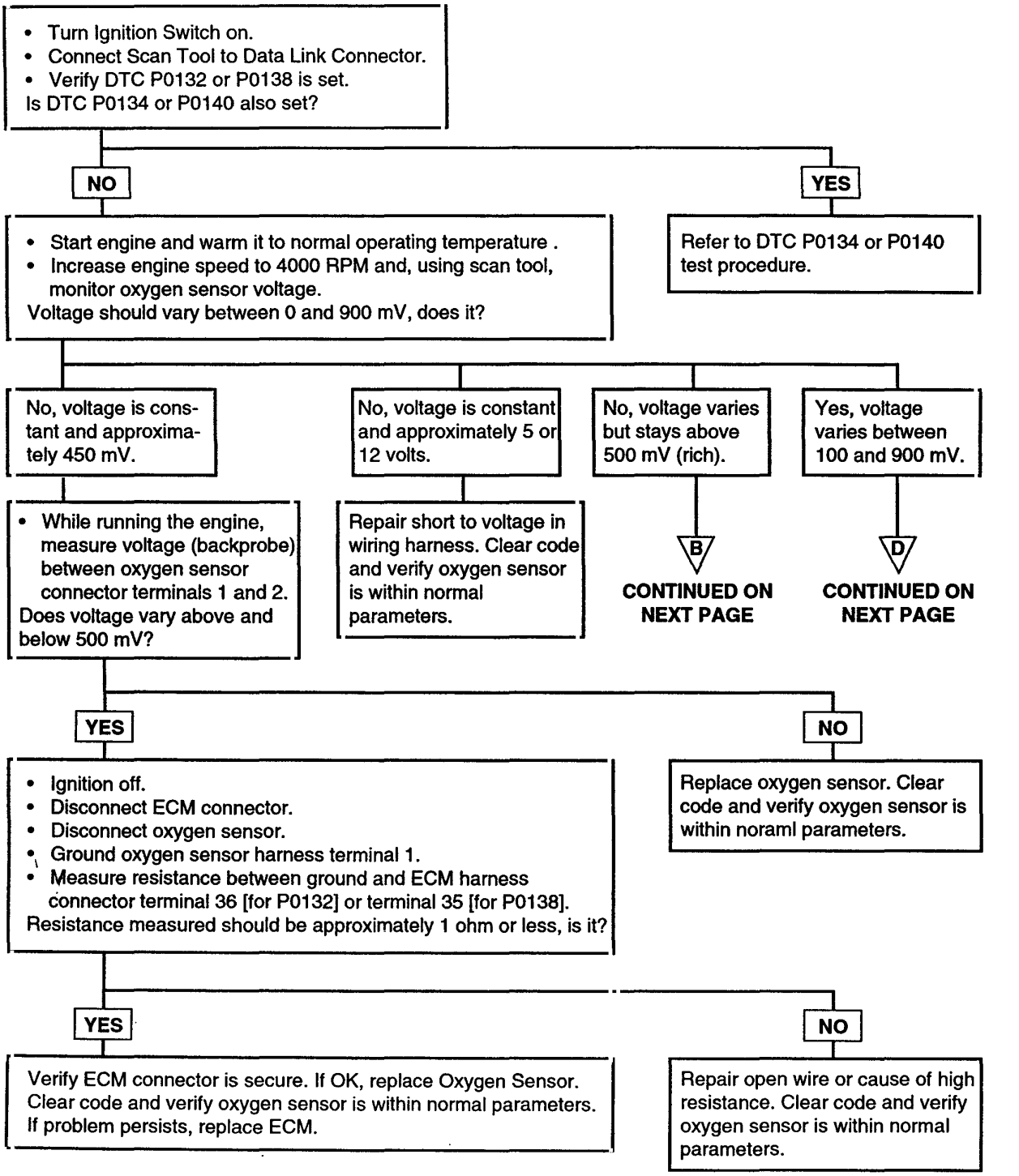
(FOR P0132)

After the Front Oxygen Sensor Heater has been on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5 second intervals. If during two driving cycles the front oxygen sensor's output exceeds 1.058 volts for 0.5 seconds, the ECM will set P0132 and MIL will turn on. This code indicates an extremely rich air fuel mixture being read by the front oxygen sensor or ECM.

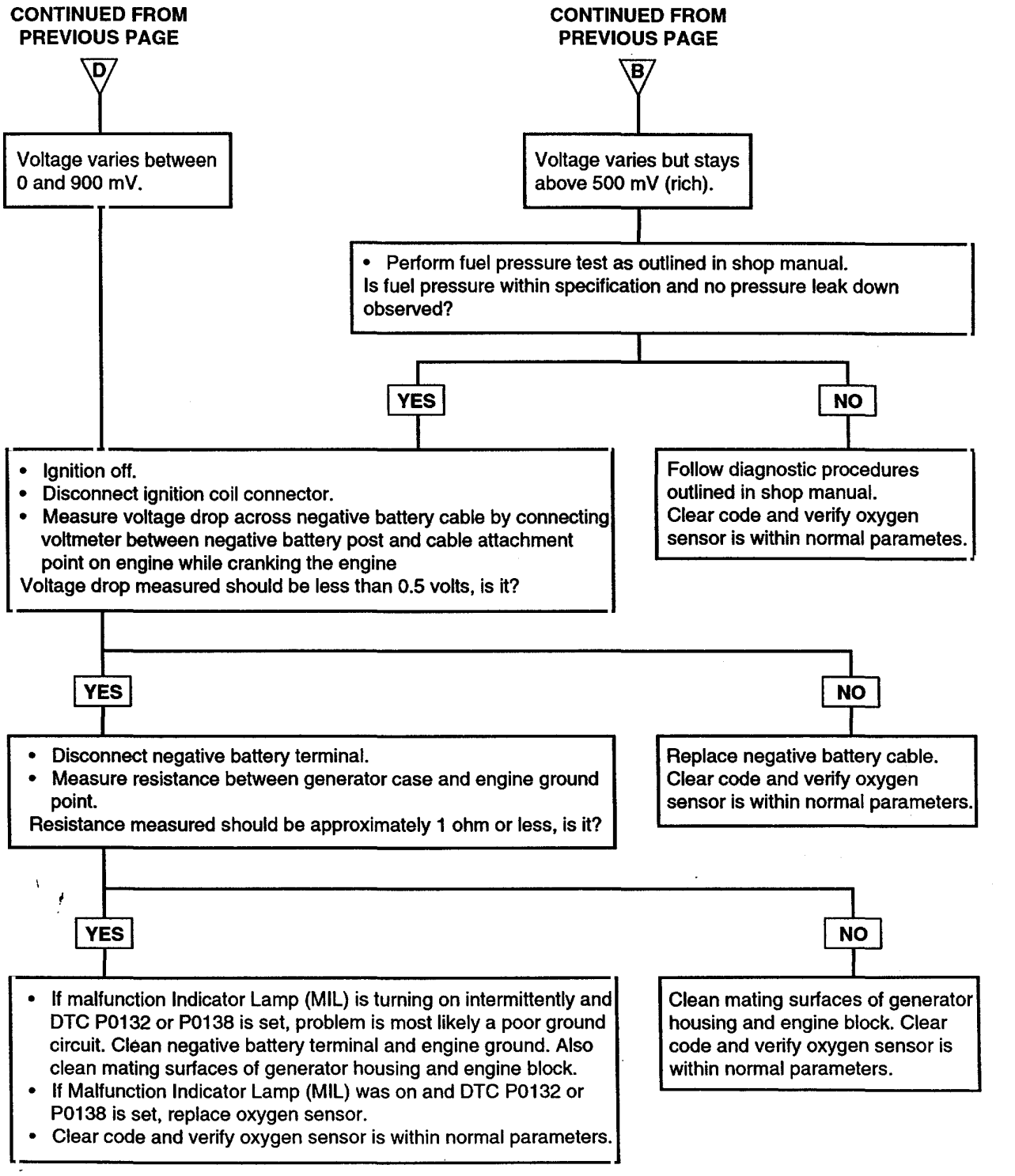
(FOR P0138)

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor for 0.5 seconds. If during two driving cycles the rear oxygen sensor's output is greater than 1.058 volts, the ECM will set P0138 and MIL will turn on. This code indicates an extremely high voltage reading by the rear oxygen sensor or ECM.

TEST PROCEDURE



EFPD531B


CONTINUED FROM PREVIOUS PAGE
D
Voltage varies between 0 and 900 mV.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays above 500 mV (rich).
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
YES
NO
• Ignition off.
• Disconnect ignition coil connector.
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine
Voltage drop measured should be less than 0.5 volts, is it?
Follow diagnostic procedures outlined in shop manual.
Clear code and verify oxygen sensor is within normal parametes.
YES
NO
• Disconnect negative battery terminal.
• Measure resistance between generator case and engine ground point.
Resistance measured should be approximately 1 ohm or less, is it?
Replace negative battery cable.
Clear code and verify oxygen sensor is within normal parameters.
YES
NO
• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0132 or P0138 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
• If Malfunction Indicator Lamp (MIL) was on and DTC P0132 or P0138 is set, replace oxygen sensor.
• Clear code and verify oxygen sensor is within normal parameters.
Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFDA531C

[P0133/P0134] EAAAD31E

DTC	Diagnostic item
P0133	Oxygen Sensor Circuit Slow Respones (Bank 1, Sensor 1)
P0134	Oxygen Sensor Circuit Inactive (Bank 1, Sensor 1)

DESCRIPTION

Refer to DTC P0130 & P0136.

FAILURE CONDITIONS

(FOR P0133)

The ECM will set P0133 and MIL will turn on if the ECM does not sense the following conditions during two driving cycles :

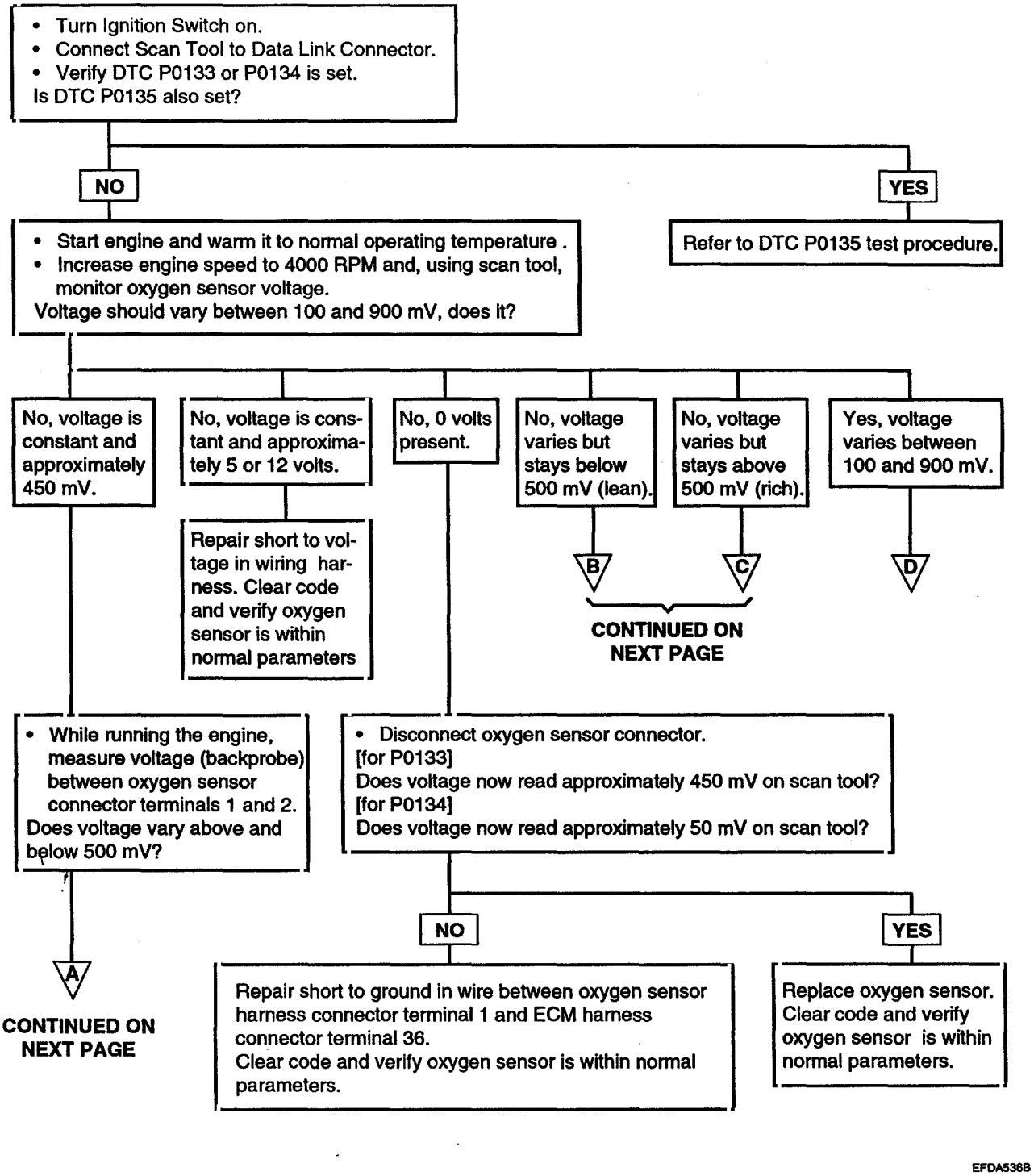
1. Over a period of 2 minutes, the ECM must sense a fuel compensation factor greater 85% or less than 95%.
2. The ECM must make some correction in the air/fuel ratio when :
   - Engine RPM is between 1600 and 3200 RPM.
   - Engine load range is between 1.35 and 3.4 milliseconds.
   - Catalyst temperature is above 372°C (702°F).
   - System is in closed loop.

This code indicates the engine air fuel ratio is not being adjusted by the front oxygen sensor signal or the ECM as expected to do so, or not adjusted as often as expected to do so once the engine is warmed or under normal engine use.

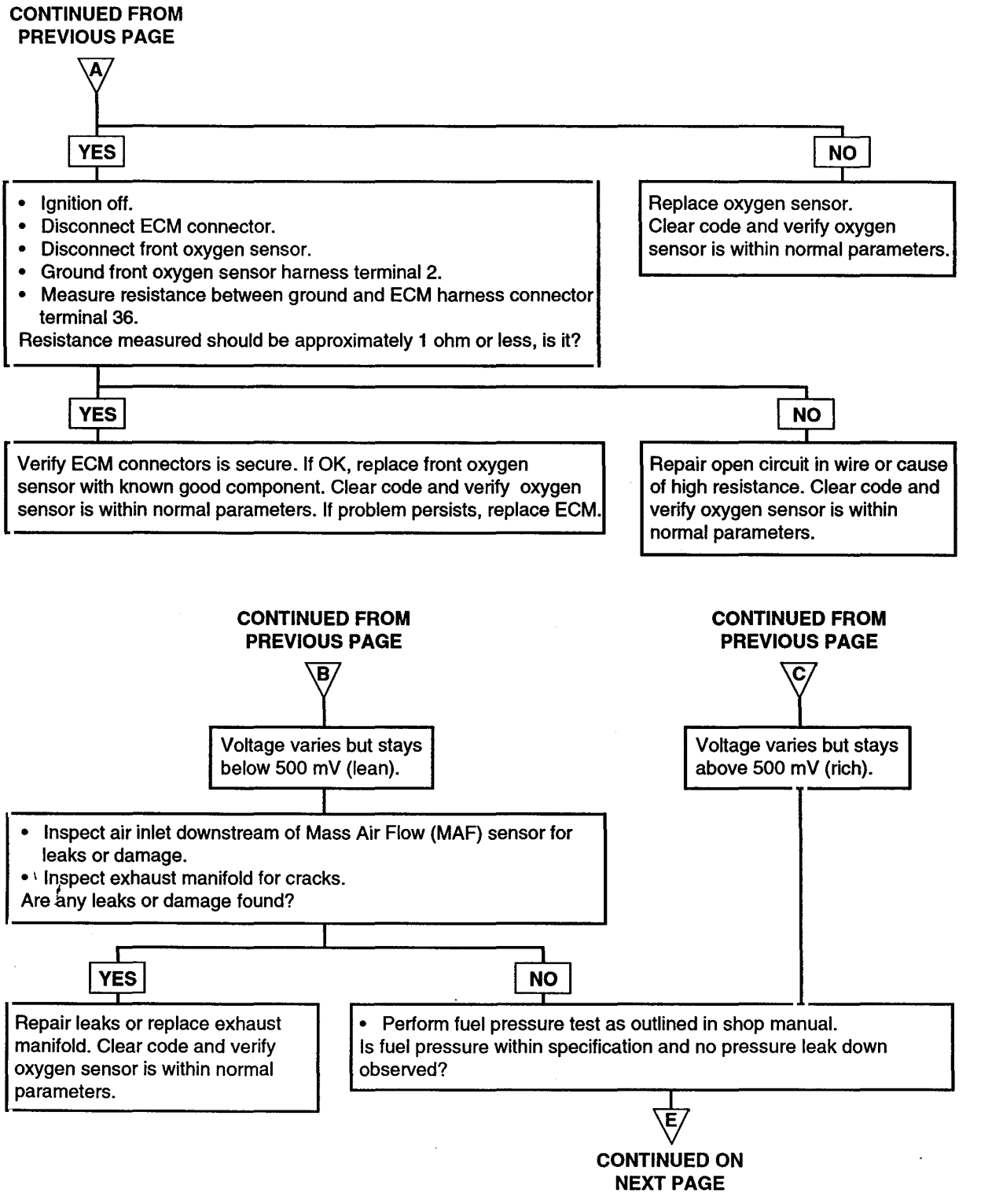
(FOR P0134)

After the engine runs for 3 minutes, the ECM checks the front oxygen sensor. If during 2 driving cycles the front oxygen sensor's output voltage is not between 400 and 600 millivolts for 5 seconds, the ECM will set a code and MIL will turn on. This code indicates the front oxygen sensor is not active within the expected range once the engine has been warmed.

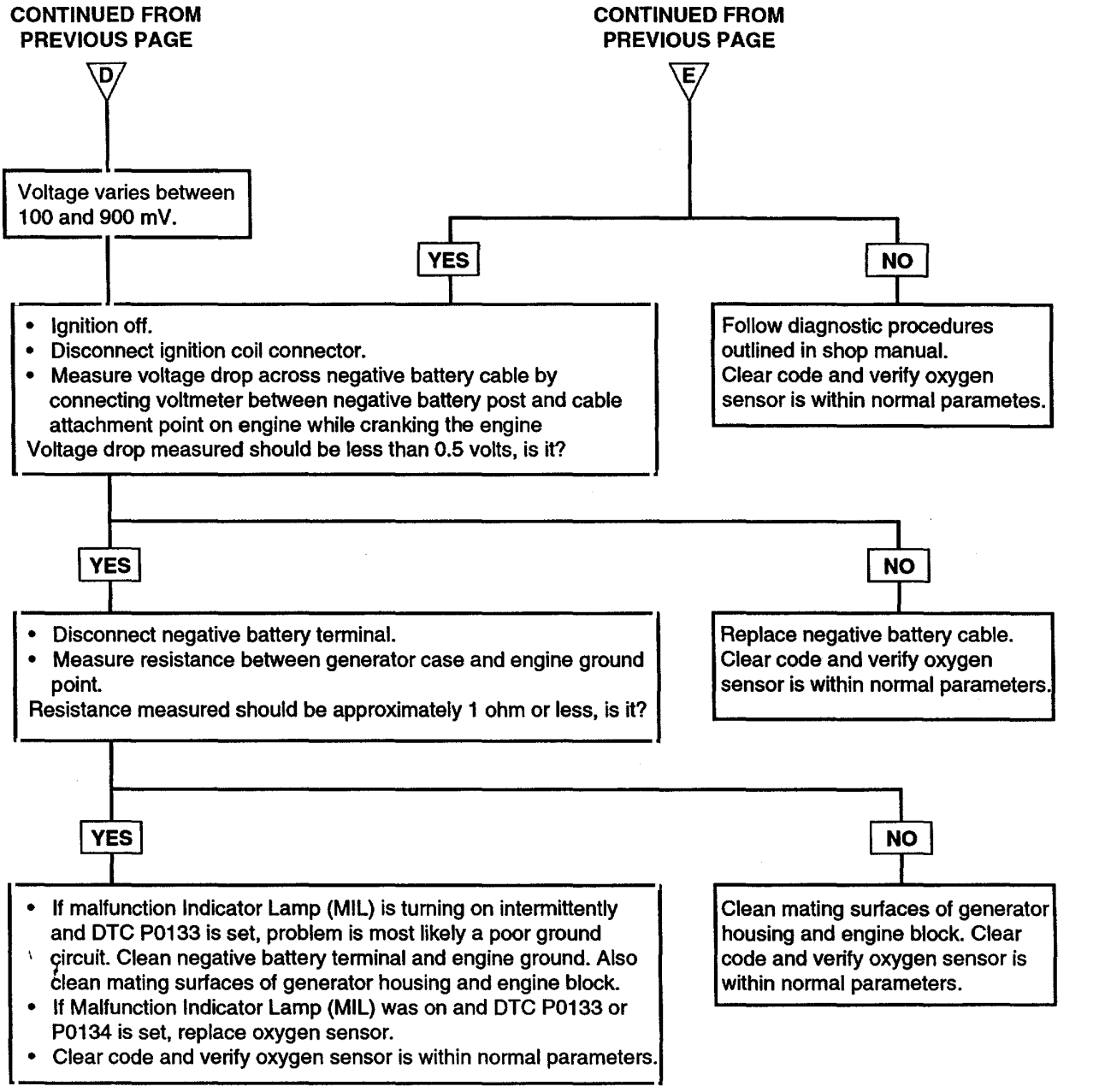
TEST PROCEDURE



EFDA536B


CONTINUED FROM PREVIOUS PAGE
A
YES
NO
• Ignition off.
• Disconnect ECM connector.
• Disconnect front oxygen sensor.
• Ground front oxygen sensor harness terminal 2.
• Measure resistance between ground and ECM harness connector terminal 36.
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor.
Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connectors is secure. If OK, replace front oxygen sensor with known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.
Repair open circuit in wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays below 500 mV (lean).
CONTINUED FROM PREVIOUS PAGE
C
Voltage varies but stays above 500 mV (rich).
• Inspect air inlet downstream of Mass Air Flow (MAF) sensor for leaks or damage.
• Inspect exhaust manifold for cracks.
Are any leaks or damage found?
YES
NO
Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
E
CONTINUED ON NEXT PAGE

EFDA536C


CONTINUED FROM PREVIOUS PAGE
D
CONTINUED FROM PREVIOUS PAGE
E
Voltage varies between 100 and 900 mV.
YES
NO
• Ignition off.
• Disconnect ignition coil connector.
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine
Voltage drop measured should be less than 0.5 volts, is it?
Follow diagnostic procedures outlined in shop manual. Clear code and verify oxygen sensor is within normal parametes.
YES
NO
• Disconnect negative battery terminal.
• Measure resistance between generator case and engine ground point.
Resistance measured should be approximately 1 ohm or less, is it?
Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.
YES
NO
• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0133 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
• If Malfunction Indicator Lamp (MIL) was on and DTC P0133 or P0134 is set, replace oxygen sensor.
• Clear code and verify oxygen sensor is within normal parameters.
Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFDA536D

[P0171/P0172] E30DA3B1

DTC	Diagnostic item
P0171	Fuel System Too Lean (Bank 1)
P0172	Fuel System Too Rich (Bank 2)

DESCRIPTION

The air/fuel control system, in addition to a number of sensors, includes the following components and systems :

- Intake air system.
- Exhaust system.
- Evaporative emissions control system (includes purge control solenoid valve).
- Fuel injectors.
- Fuel pressure regulator.
- Fuel pump.

For the air/fuel ratio to be within limits, all of the sensors, components and systems associated with the air/fuel control system must function within normal parameters.

FAILURE CONDITIONS

(FOR SHORT-TERM FUEL TRIM)

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the short-term fuel trim value goes 10% to 15% rich [for P0172] or if the short-term fuel trim additive value is less than 0.4 milliseconds, or 10% to 15% lean [for P0171] for 30 seconds during two driving cycles when the following conditions are met :

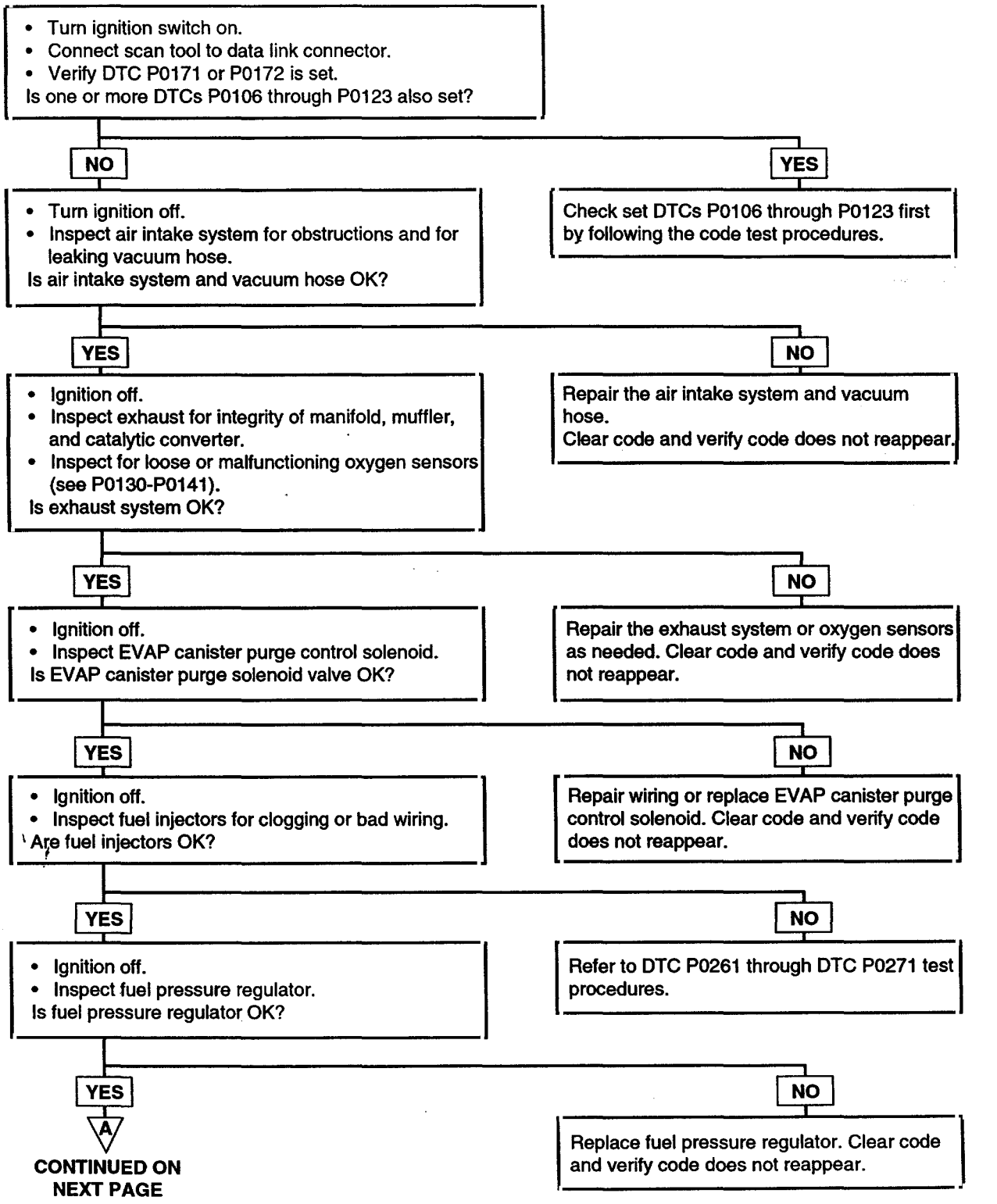
1. ECM is in closed loop operation.
2. Engine speed is below 1000 RPM.
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass air flow is less than 7.5 g/s [for P0172] or 5.5 g/s [for P0171].

(FOR LONG-TERM FUEL TRIM)

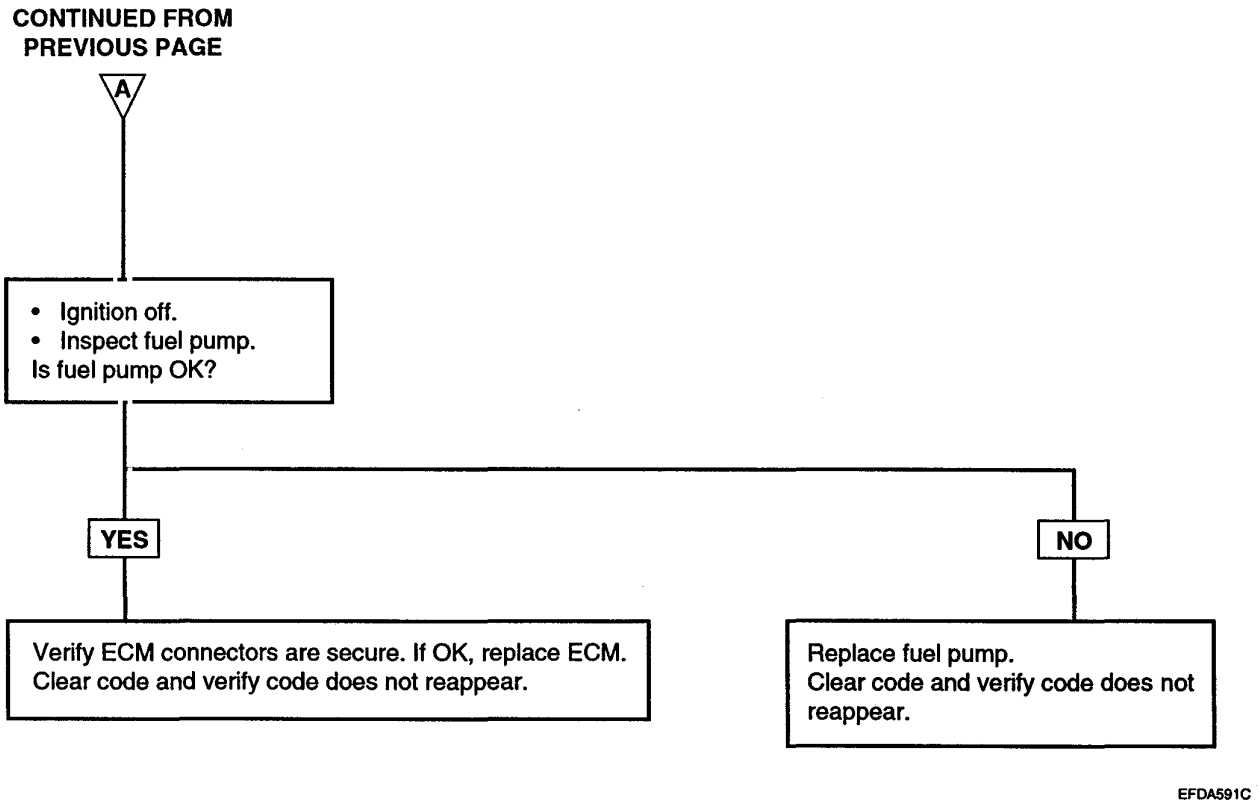
The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the long-term multiplicative value is less than 77% for 30 seconds [for P0172] or if the long-term fuel trim value goes to 10% to 15% lean [for P0171] for 30 seconds during two driving cycles when the following conditions are met :

1. Engine load exceeds 1.8 milliseconds.
2. ECM is in closed loop operation.
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass air flow is less than or 5.5 g/s.
6. Engine speed is below 1000 RPM.

TEST PROCEDURE



EFDD591B


CONTINUED FROM PREVIOUS PAGE
A
• Ignition off.
• Inspect fuel pump.
Is fuel pump OK?
YES
NO
Verify ECM connectors are secure. If OK, replace ECM. Clear code and verify code does not reappear.
Replace fuel pump. Clear code and verify code does not reappear.

EFDA591C

[P0261/P0262/P0264/P0265/P0267/P0268/P0270/P0271] E217E83B

DTC	Diagnostic item
P0261	Injector Circuit Low Input - Cylinder 1
P0262	Injector Circuit High Input - Cylinder 1
P0264	Injector Circuit Low Input - Cylinder 2
P0265	Injector Circuit High Input - Cylinder 2
P0267	Injector Circuit Low Input - Cylinder 3
P0268	Injector Circuit High Input - Cylinder 3
P0270	Injector Circuit Low Input - Cylinder 4
P0271	Injector Circuit High Input - Cylinder 4

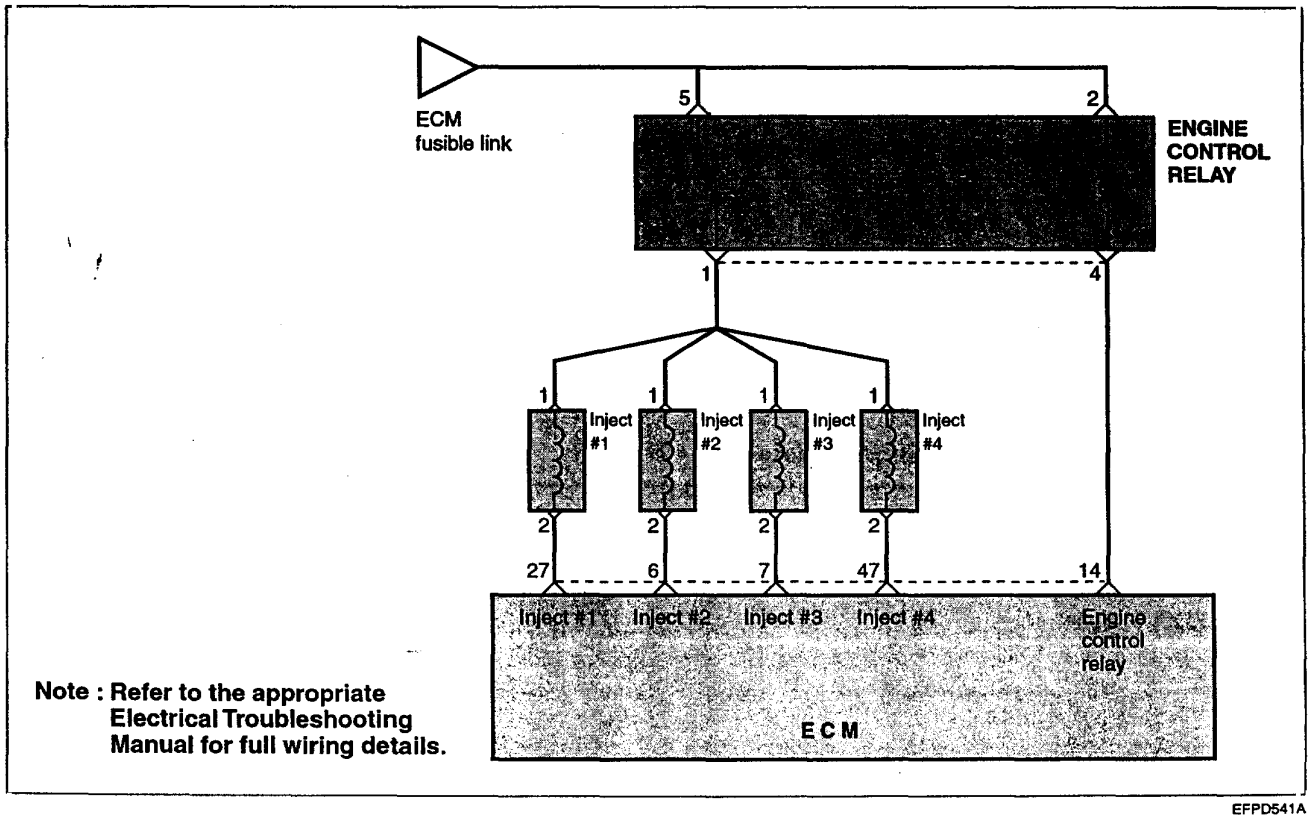
DESCRIPTION

The fuel injectors are solenoid operated valves. When a fuel injector solenoid is energized (pulsed) the injector needle valve opens, allowing pressurized fuel to pass through the injector and mix with air entering the engine. The Engine Control Module (ECM) controls injector timing and pulse width. The ECM pulses the fuel injectors based on information provided by its network of engine sensors. The ECM uses the crankshaft position sensor to determine when to pulse the injectors. Engine coolant temperature, intake air temperature, air flow, and throttle position data are all used by the ECM to calculate injector pulse width. The ECM also uses its network of sensors to determine whether all injectors should be pulsed at the same time (simultaneous injection) or each injector should be pulsed individually (sequential injection). Sequential injection is almost always used during normal engine operation. Simultaneous injection may be used when the engine is being cranked.

FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if an open circuit or short to ground is detected in the fuel injector circuit during two driving cycles.

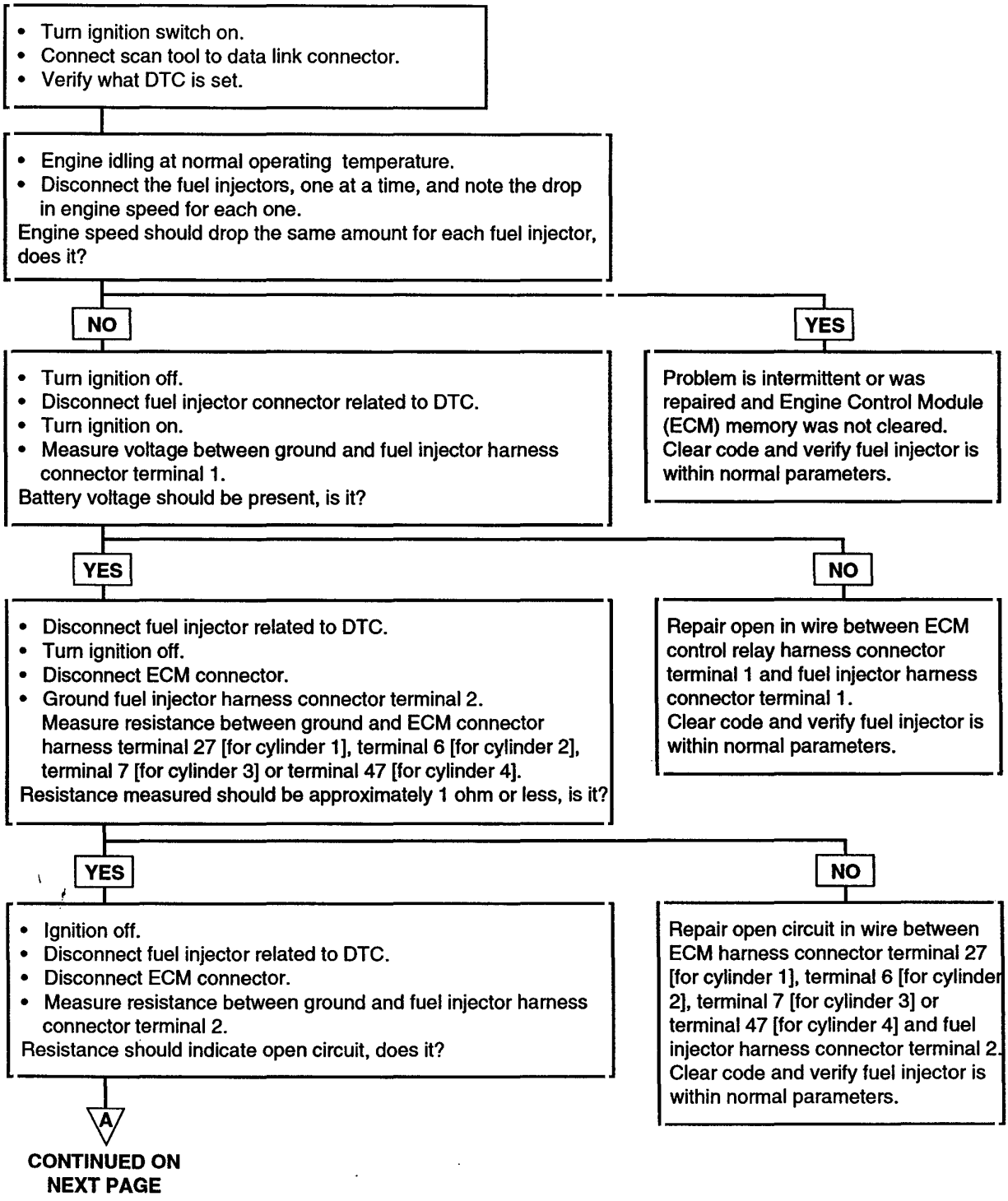
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

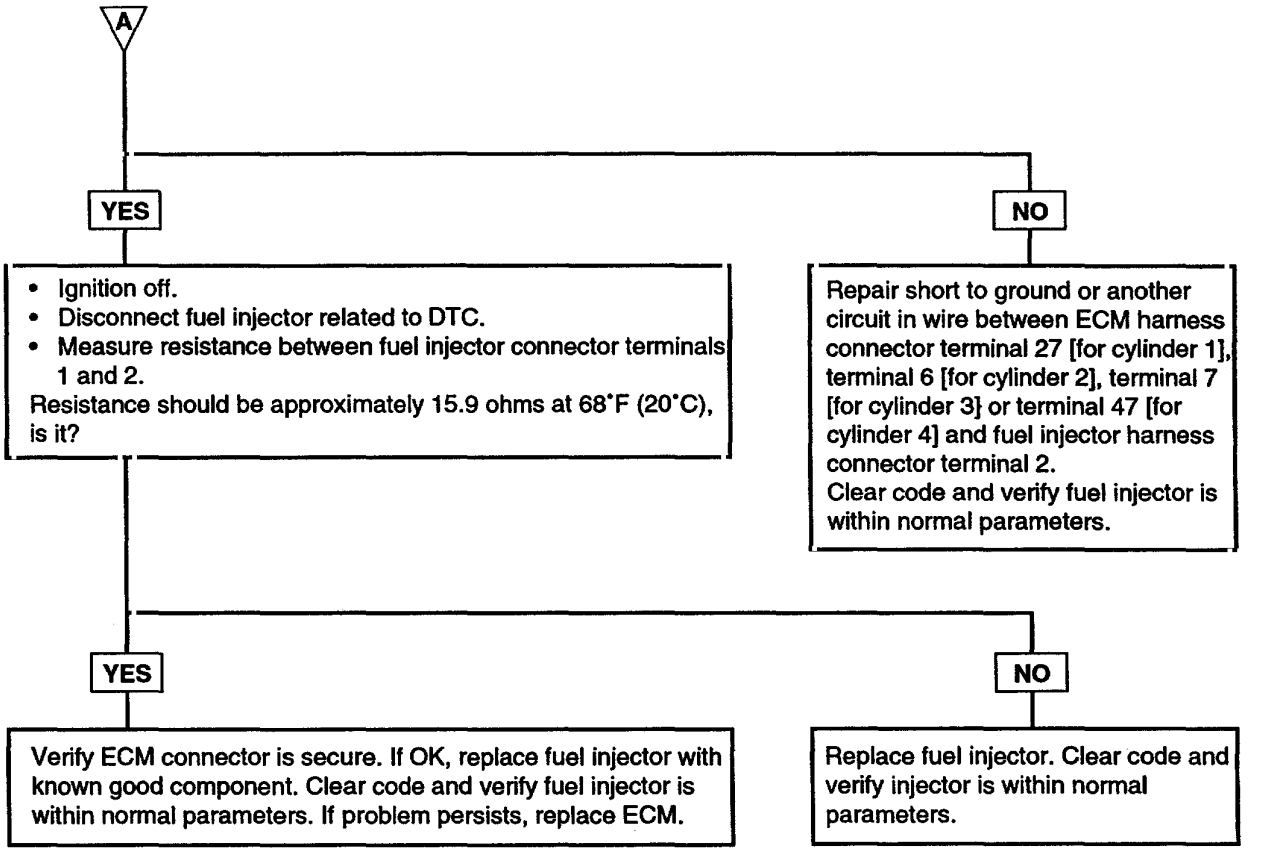
EFPD541A

TEST PROCEDURE



EFPD541B

CONTINUED FROM PREVIOUS PAGE



EFPD541C

[P0300] EB0A88E1

DTC	Diagnostic item
P0300	Random Misfire Detected

DESCRIPTION

With the ignition switch at ON or START, voltage is applied to the ignition coil. The ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coil. The ignition coil fires two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3.
The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike across the attached spark plugs.

FAILURE CONDITIONS

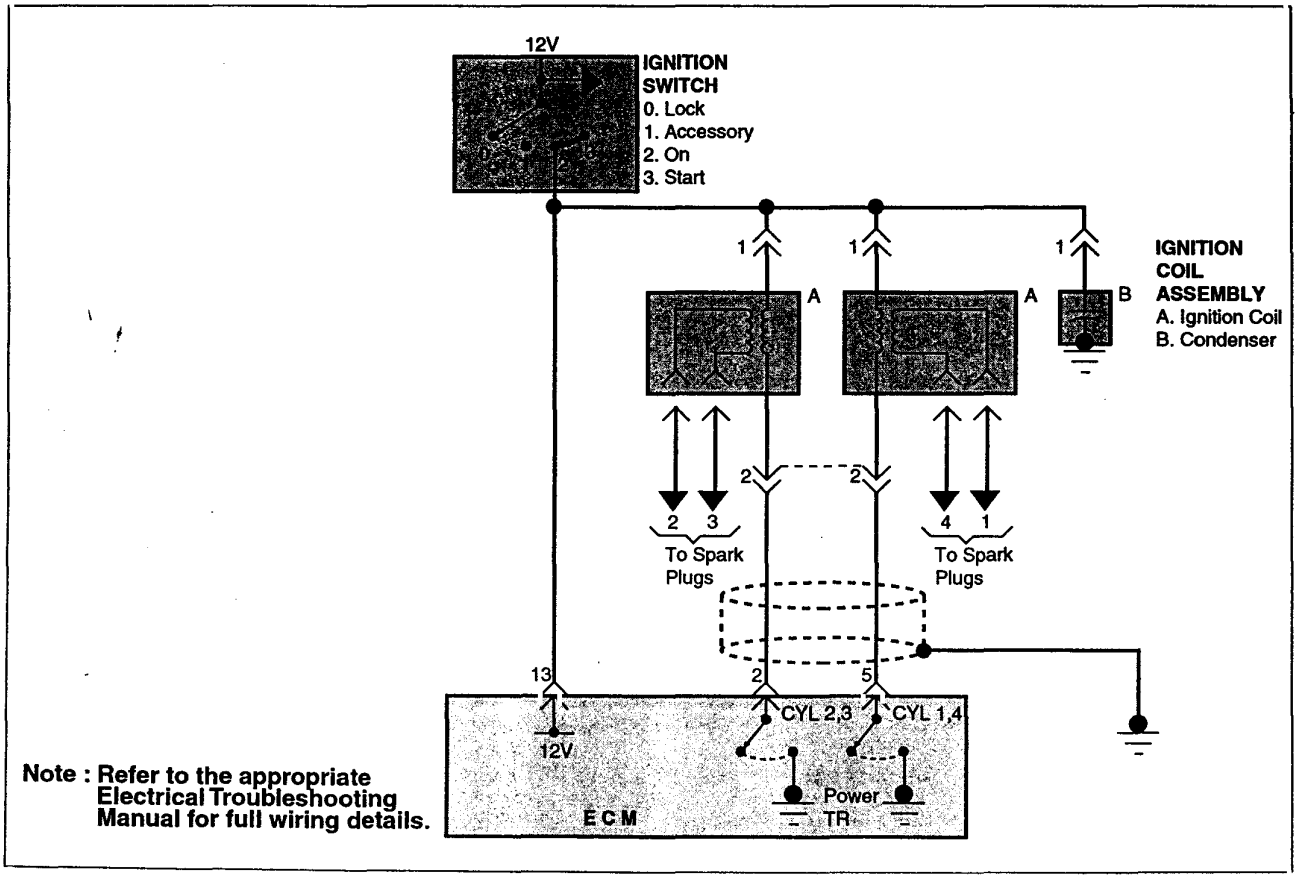
The ECM will set P0300 and the MIL will blink if 2 misfires per 100 revolutions are detected during two driving cycles.

The misfire rate is measured every 200 revolutions when the following conditions are met :

- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.
- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3g acceleration).

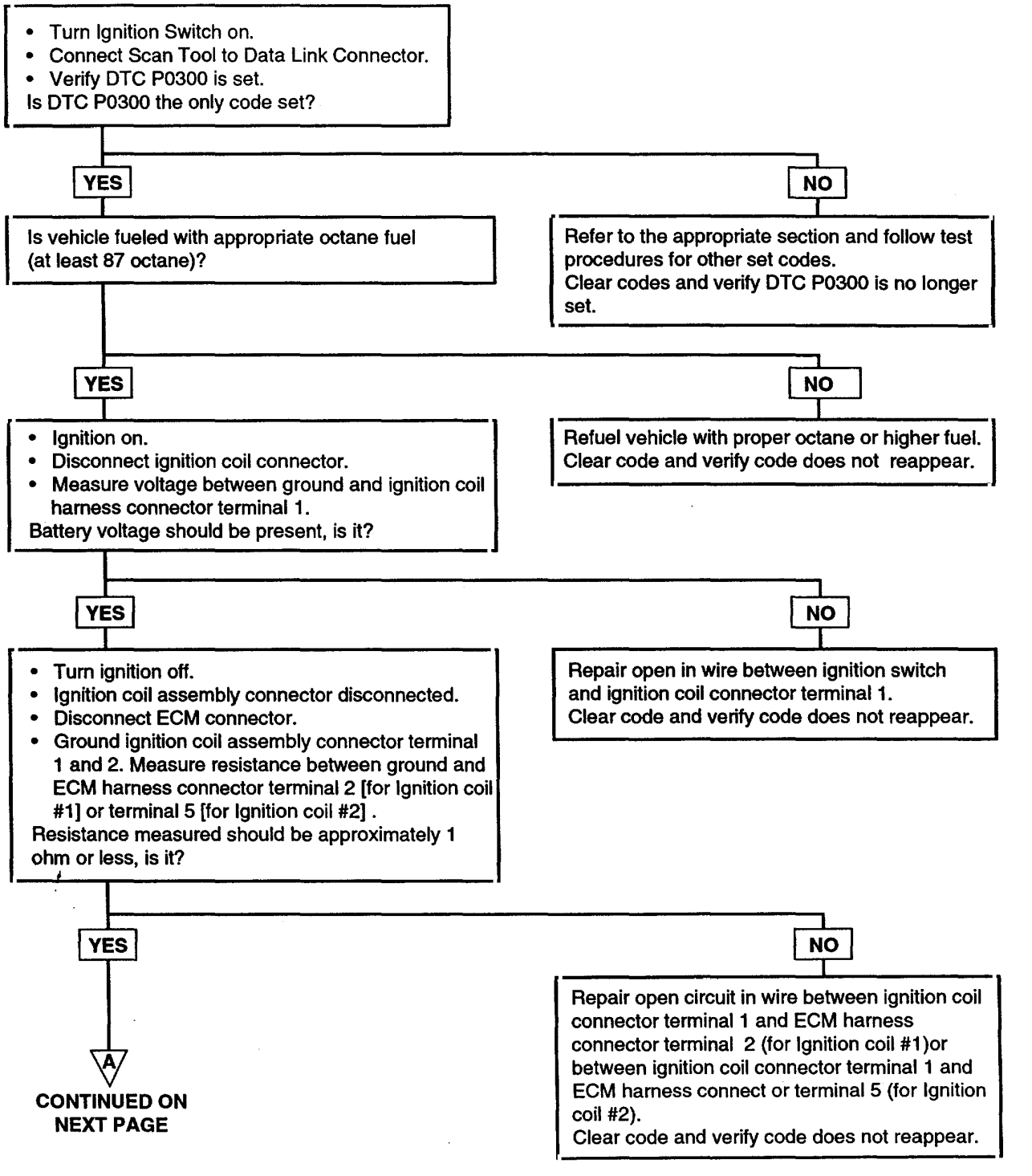
If the misfire rate increases to between 5%~25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

CIRCUIT DIAGRAM

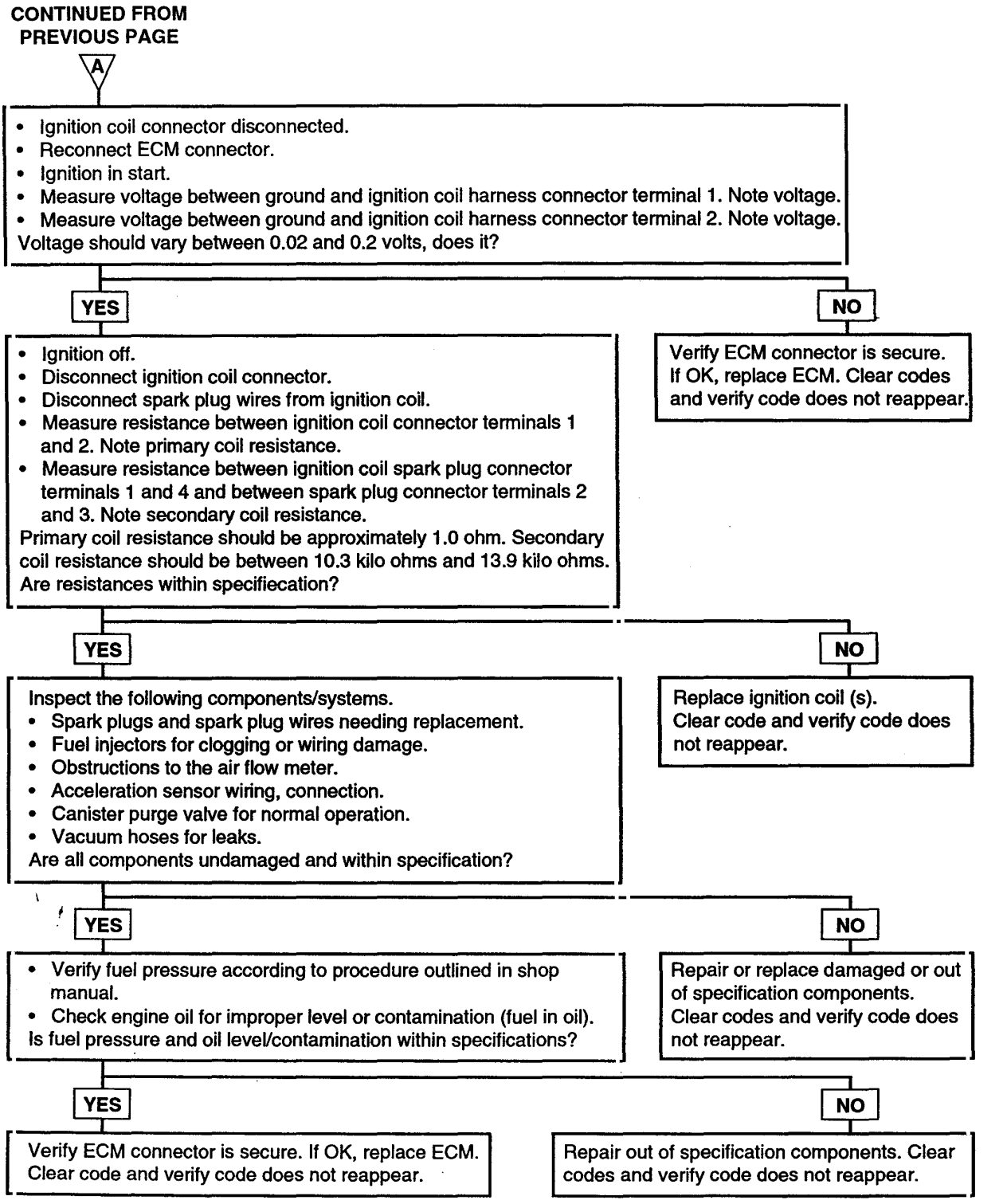


EFPD546A

TEST PROCEDURE



EFPD546B


CONTINUED FROM PREVIOUS PAGE
A
• Ignition coil connector disconnected.
• Reconnect ECM connector.
• Ignition in start.
• Measure voltage between ground and ignition coil harness connector terminal 1. Note voltage.
• Measure voltage between ground and ignition coil harness connector terminal 2. Note voltage.
Voltage should vary between 0.02 and 0.2 volts, does it?
YES
NO
• Ignition off.
• Disconnect ignition coil connector.
• Disconnect spark plug wires from ignition coil.
• Measure resistance between ignition coil connector terminals 1 and 2. Note primary coil resistance.
• Measure resistance between ignition coil spark plug connector terminals 1 and 4 and between spark plug connector terminals 2 and 3. Note secondary coil resistance.
Primary coil resistance should be approximately 1.0 ohm. Secondary coil resistance should be between 10.3 kilo ohms and 13.9 kilo ohms.
Are resistances within specifiecation?
Verify ECM connector is secure. If OK, replace ECM. Clear codes and verify code does not reappear.
YES
NO
Inspect the following components/systems.
• Spark plugs and spark plug wires needing replacement.
• Fuel injectors for clogging or wiring damage.
• Obstructions to the air flow meter.
• Acceleration sensor wiring, connection.
• Canister purge valve for normal operation.
• Vacuum hoses for leaks.
Are all components undamaged and within specification?
Replace ignition coil (s). Clear code and verify code does not reappear.
YES
NO
• Verify fuel pressure according to procedure outlined in shop manual.
• Check engine oil for improper level or contamination (fuel in oil).
Is fuel pressure and oil level/contamination within specifications?
Repair or replace damaged or out of specification components. Clear codes and verify code does not reappear.
YES
NO
Verify ECM connector is secure. If OK, replace ECM. Clear code and verify code does not reappear.
Repair out of specification components. Clear codes and verify code does not reappear.

EFDA546C

[P0301/P0302/P0303/P0304] EEABC585

DTC	Diagnostic item
P0301	Cylinder 1 Misfire Detected
P0302	Cylinder 2 Misfire Detected
P0303	Cylinder 3 Misfire Detected
P0304	Cylinder 4 Misfire Detected

DESCRIPTION

Refer to DTC P0300.

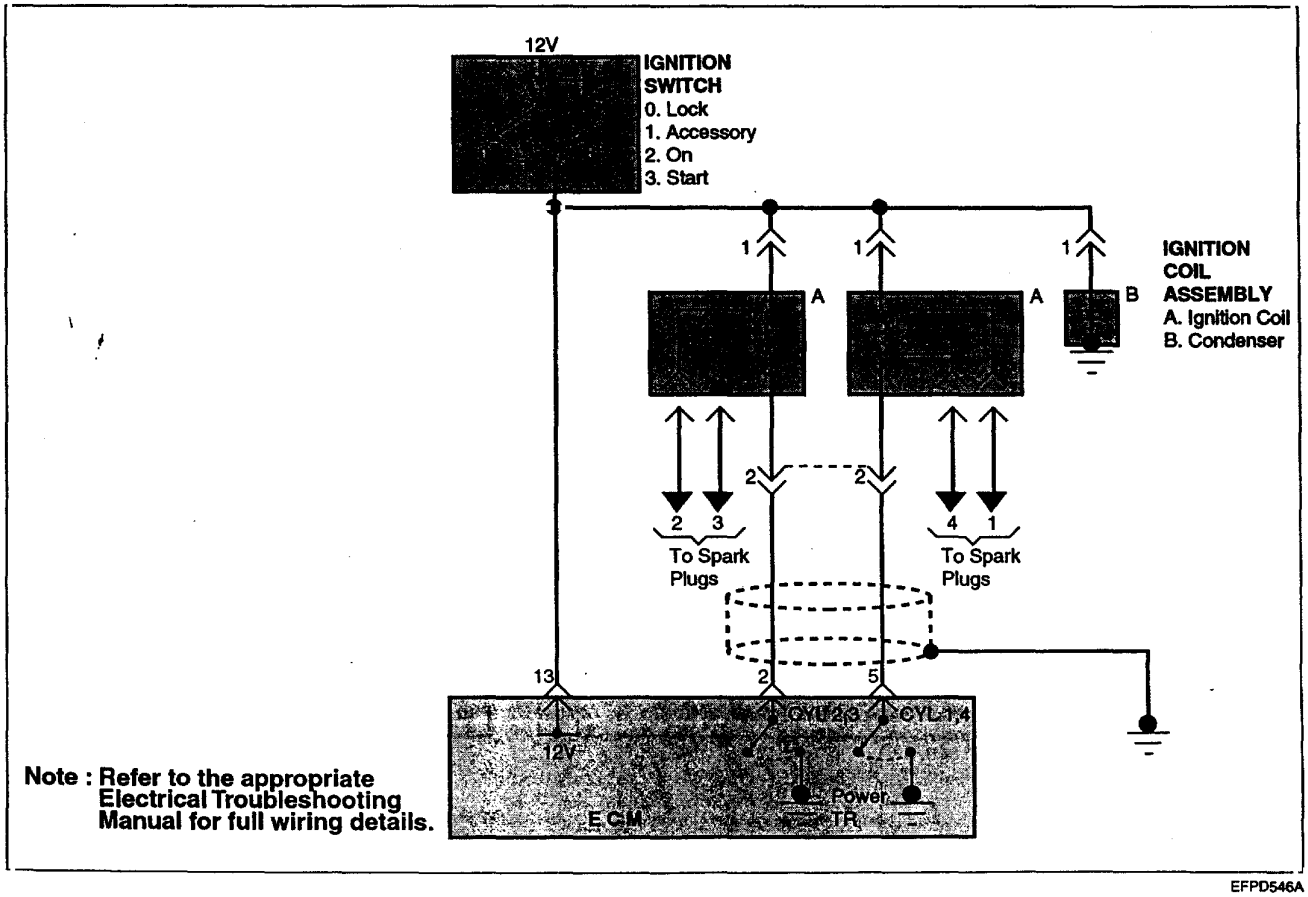
FAILURE CONDITIONS

The ECM will set P0301, P0302, P0303 or P0304 and MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditions are met :

- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.
- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3g acceleration).

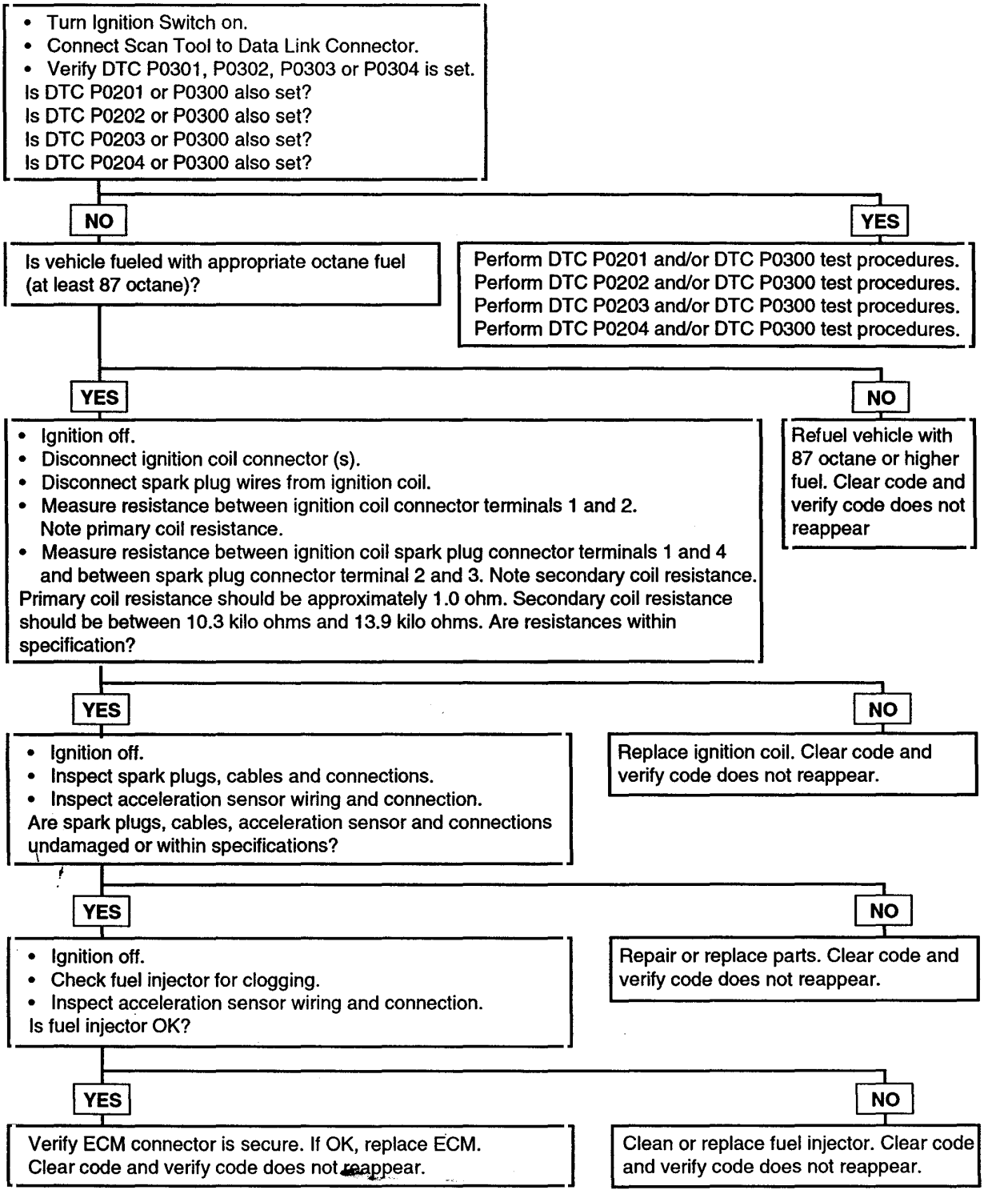
If the misfire rate increases to between 5%~25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

CIRCUIT DIAGRAM



EFPD546A

TEST PROCEDURE



EFDA551B

[P0325] ED9906AB

DTC	Diagnostic item
P0325	Knock Sensor Circuit Malfunction

DESCRIPTION

The knock sensor is attached to the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the sensor's piezo-electric element. This vibration pressure is then converted into a voltage signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing.

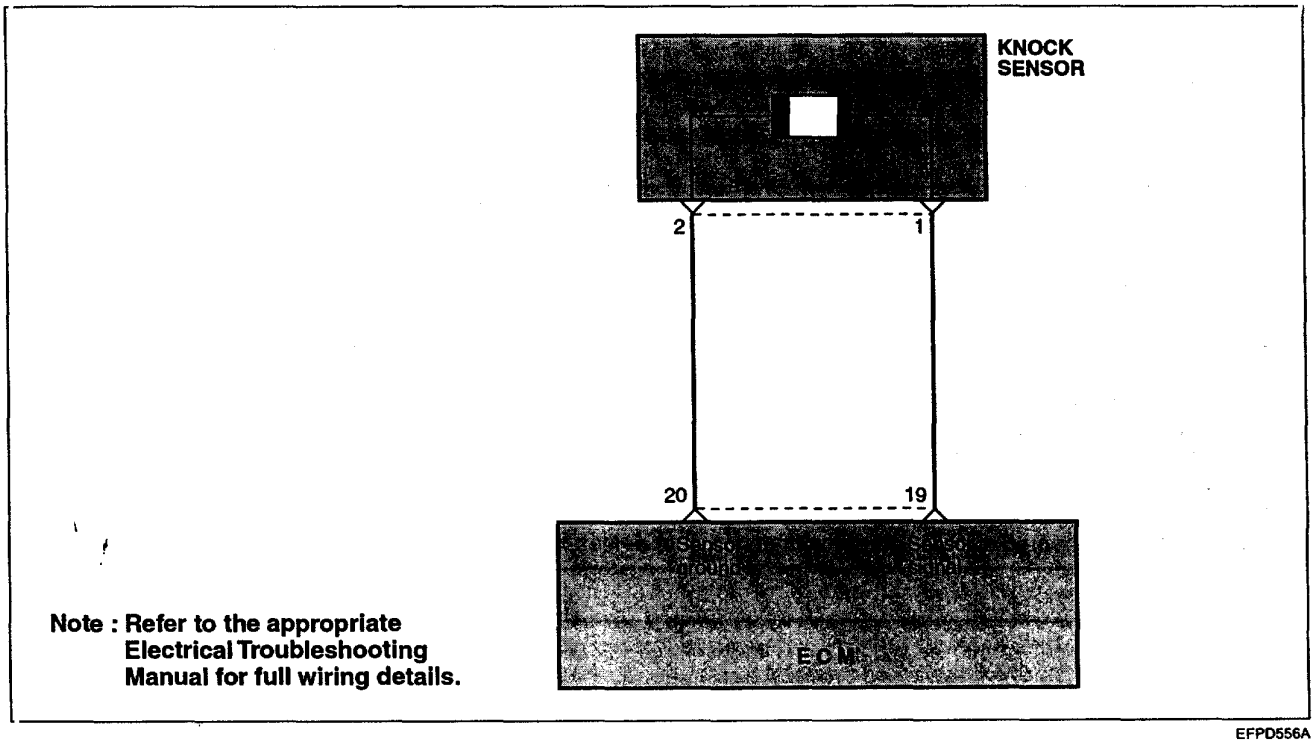
FAILURE CONDITIONS

The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the knock sensor's output voltage falls below 650 millivolts during a 4 second check when the following conditions are met :

- Starter is not engaged.
- Engine speed is above 3000 RPM.
- Engine coolant temperature is above 104°F (40°C).
- Engine load is greater than 2.5 milliseconds.

This code indicates an unexpected vibration is being read by the knock sensor or ECM under normal engine operation.

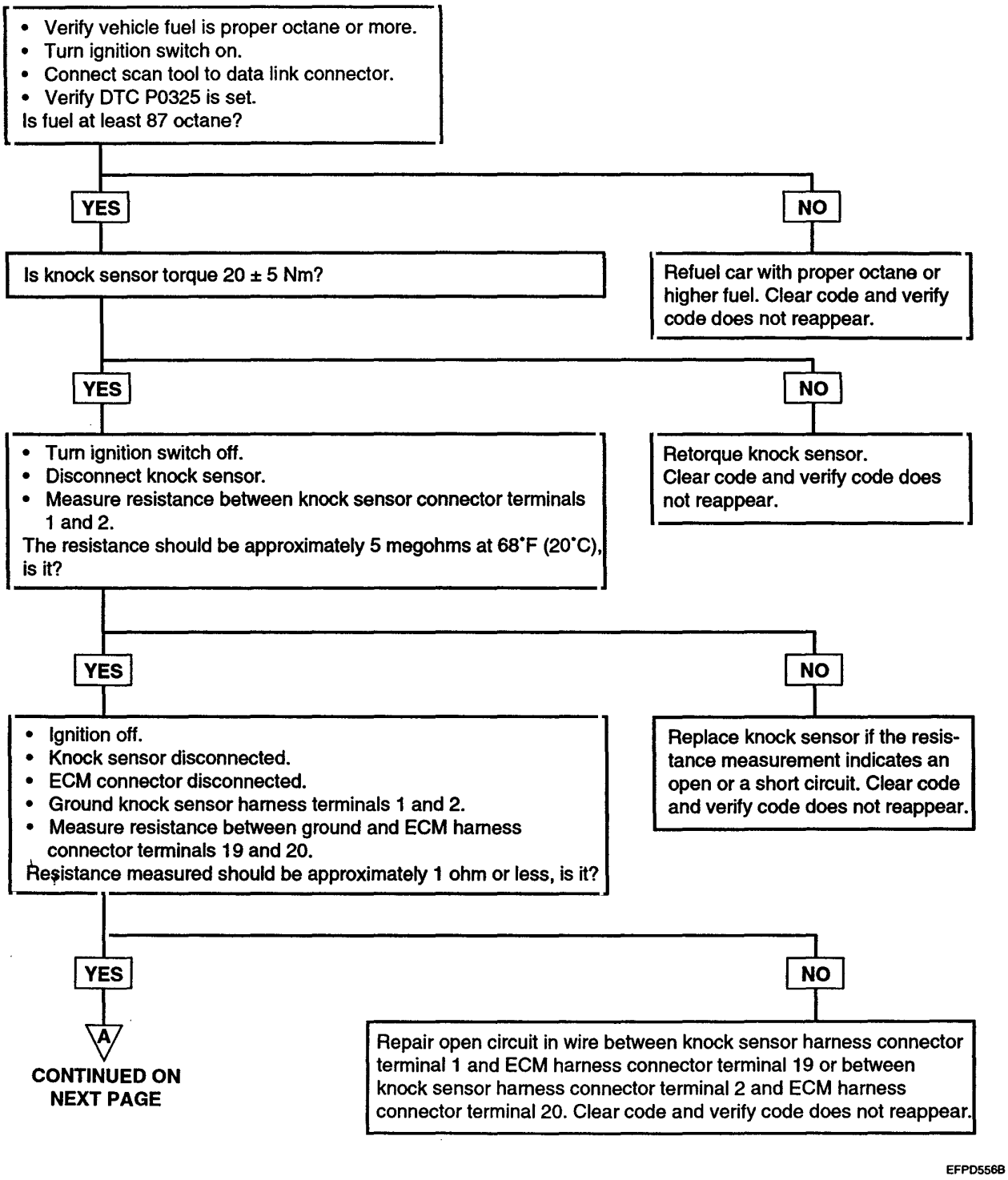
CIRCUIT DIAGRAM



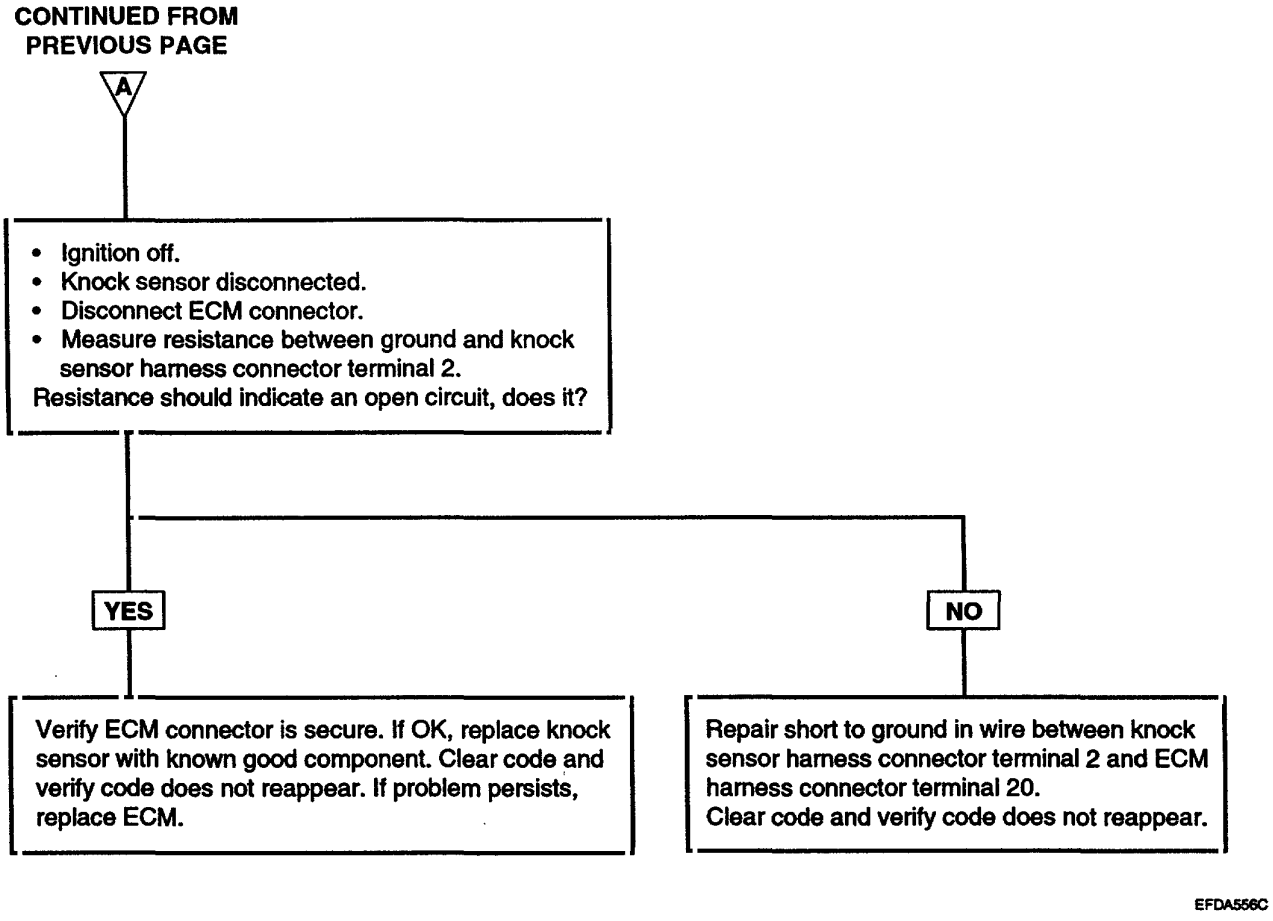
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD556A

TEST PROCEDURE



EFPD556B


CONTINUED FROM PREVIOUS PAGE
A
• Ignition off.
• Knock sensor disconnected.
• Disconnect ECM connector.
• Measure resistance between ground and knock sensor harness connector terminal 2.
Resistance should indicate an open circuit, does it?
YES
NO
Verify ECM connector is secure. If OK, replace knock sensor with known good component. Clear code and verify code does not reappear. If problem persists, replace ECM.
Repair short to ground in wire between knock sensor harness connector terminal 2 and ECM harness connector terminal 20.
Clear code and verify code does not reappear.
EFDA556C

[P0335/P0336] E28E7CB3

DTC	Diagnostic item
P0335	Crankshaft Position Sensor Circuit Malfunction
P0336	Crankshaft Position Sensor Circuit Out of Range

DESCRIPTION

The Crankshaft Position (CKP) sensor consists of a magnet and coil located next to the flywheel. The sensing wheel teeth are used by the CKP sensor to generate a signal. The voltage signal from CKP sensor allows the Engine Control Module (ECM) to determine engine RPM and crankshaft position.

FAILURE CONDITIONS

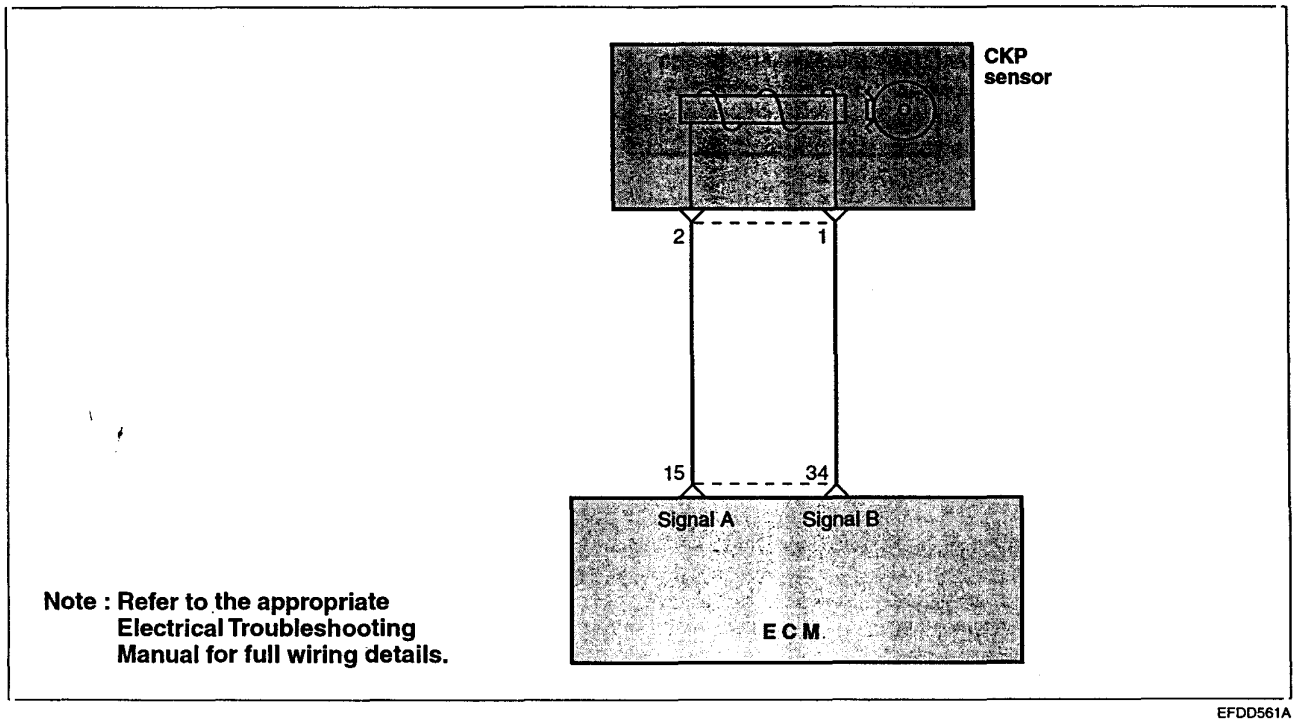
(FOR P0335)

The ECM will set P0335 and the MIL will turn on if the CKP signal voltage remains at 0.0 volts with the starter engaged for 4 seconds or 8 revolutions and the Camshaft Position (CMP) sensor signal indicating engine rotation. This check is made every time the engine starts. This code indicates no crankshaft signal is being read by the CKP sensor or the ECM while a CMP sensor signal verifies engine rotation.

(FOR P0336)

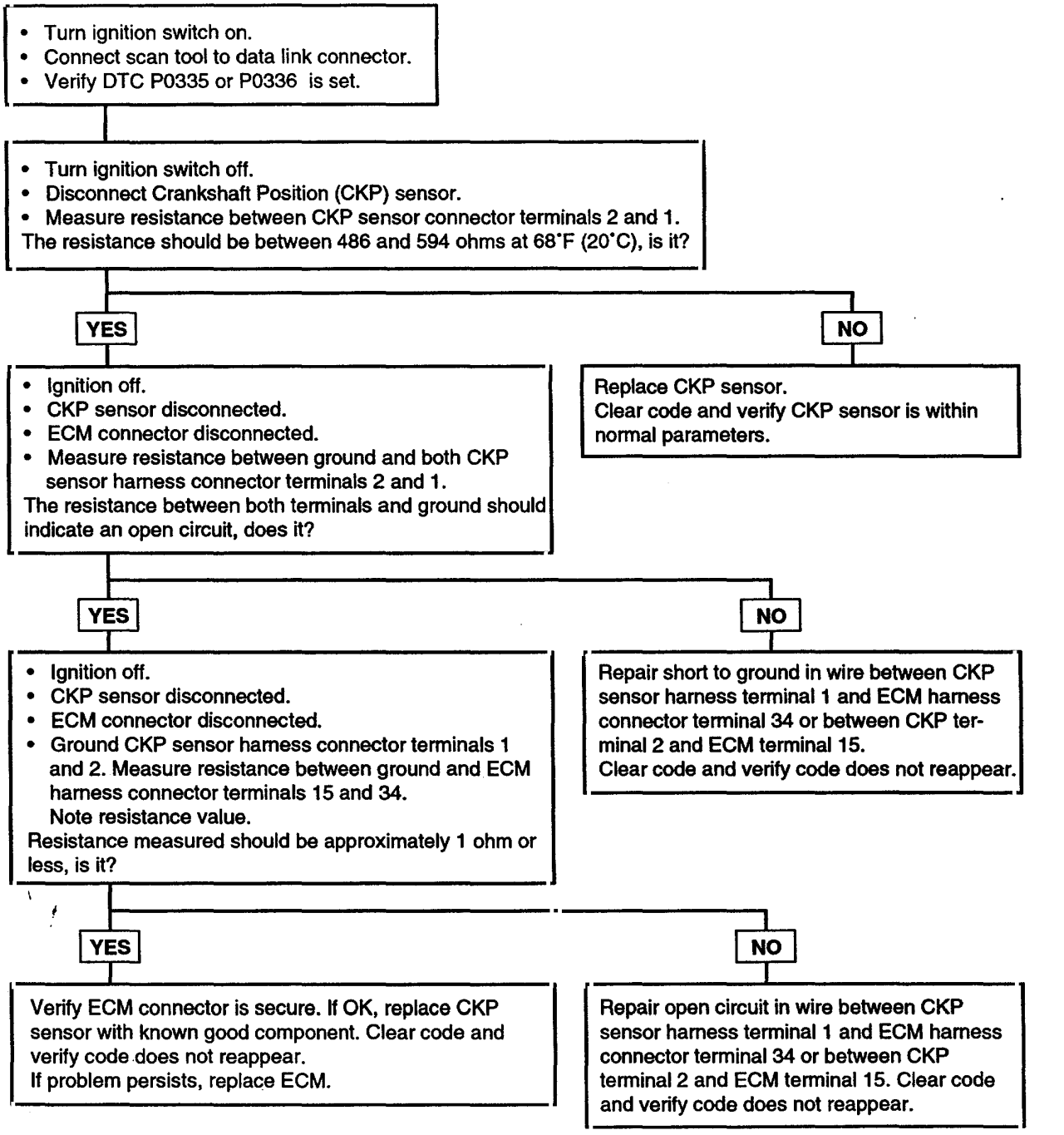
The ECM will set P0336 and the MIL will turn on immediately if the CKP sensor signal does not indicate the two missing teeth in exactly the same position on the tone wheel during two successive engine revolutions. This check is made for 5 seconds when the engine is running above 2000 RPM. This code indicates a problem with the crankshaft being read by the CKP sensor or ECM.

CIRCUIT DIAGRAM



EFDD561A

TEST PROCEDURE



EFPD561B

[P0340] E3F49ECF

DTC	Diagnostic item
P0340	Camshaft Position Sensor Circuit Malfunction

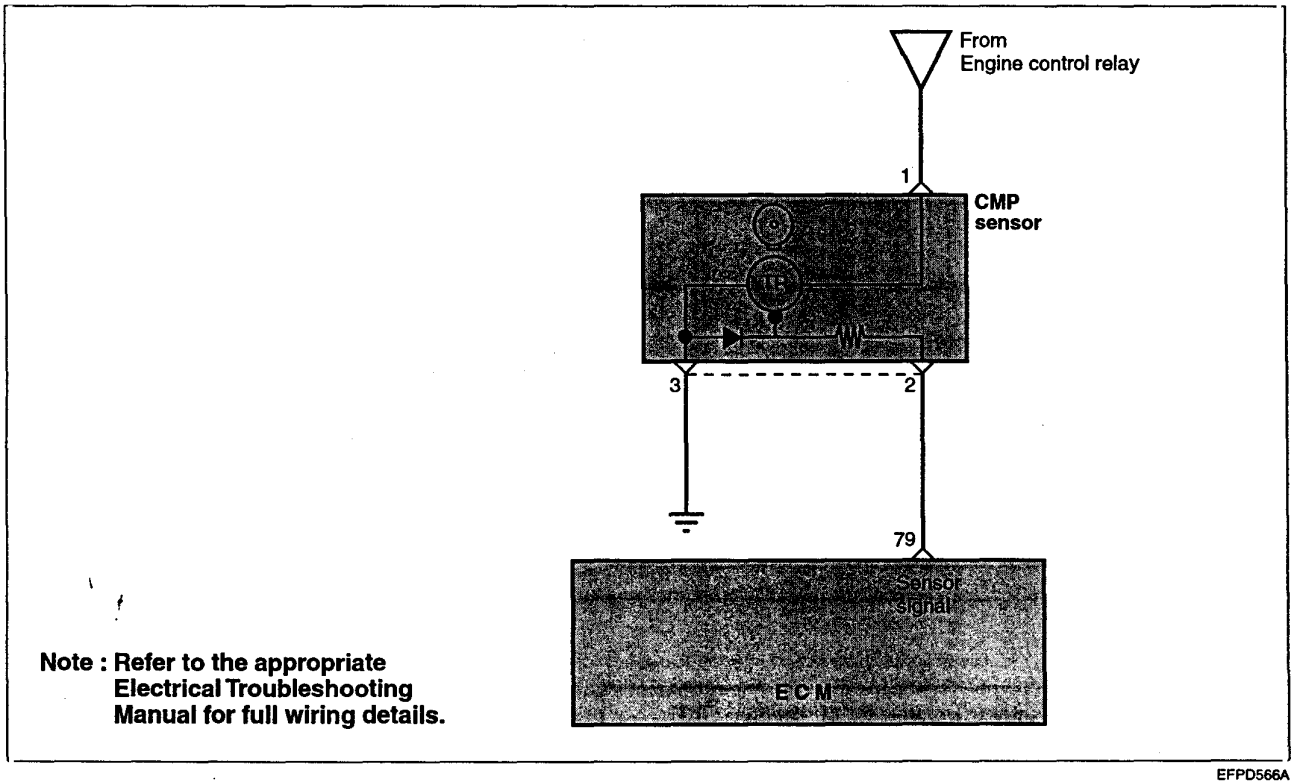
DESCRIPTION

The Camshaft Position (CMP) sensor senses the Top Dead Center (TDC) point of the #1 cylinder in the compression stroke. The CMP sensor signal allows the Engine Control Module (ECM) to determine the fuel injector sequence starting point.

FAILURE CONDITIONS

The ECM will set P0340 and the Malfunction Indicator Lamp (MIL) will turn on if during two driving cycles there is more than one CMP sensor signal during two engine revolutions when the engine speed is above 600 RPM. This code indicates unexpected camshaft position readings by the CMP sensor or ECM when the engine is rotating.
The ECM will also set P0340 and the Malfunction Indicator Lamp (MIL) will turn on if during two driving cycles there is no CMP sensor signal within 200 engine revolutions when the engine speed is above 600 RPM. This code indicates unexpected camshaft position readings by the CMP sensor or ECM when the engine is rotating.

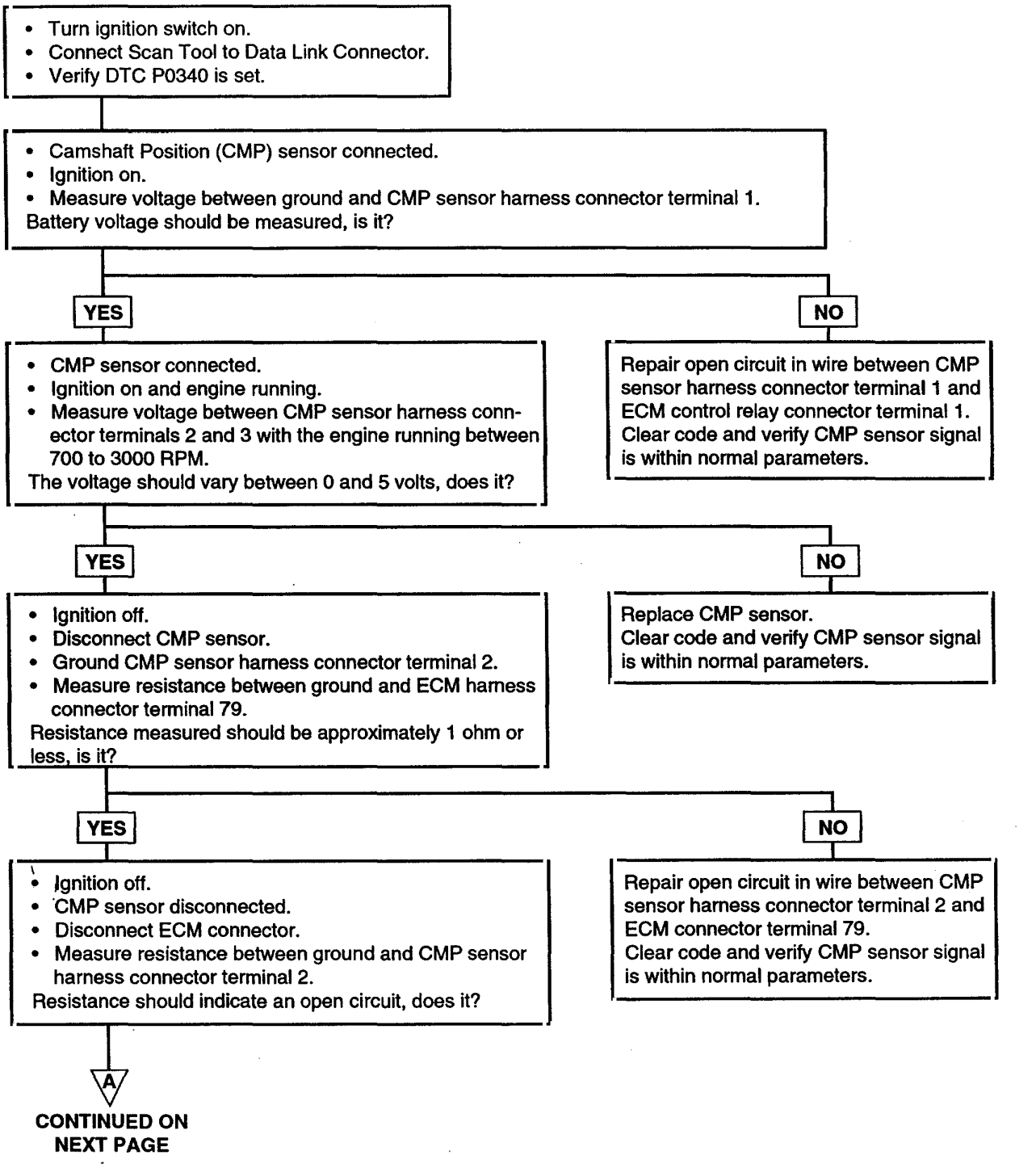
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

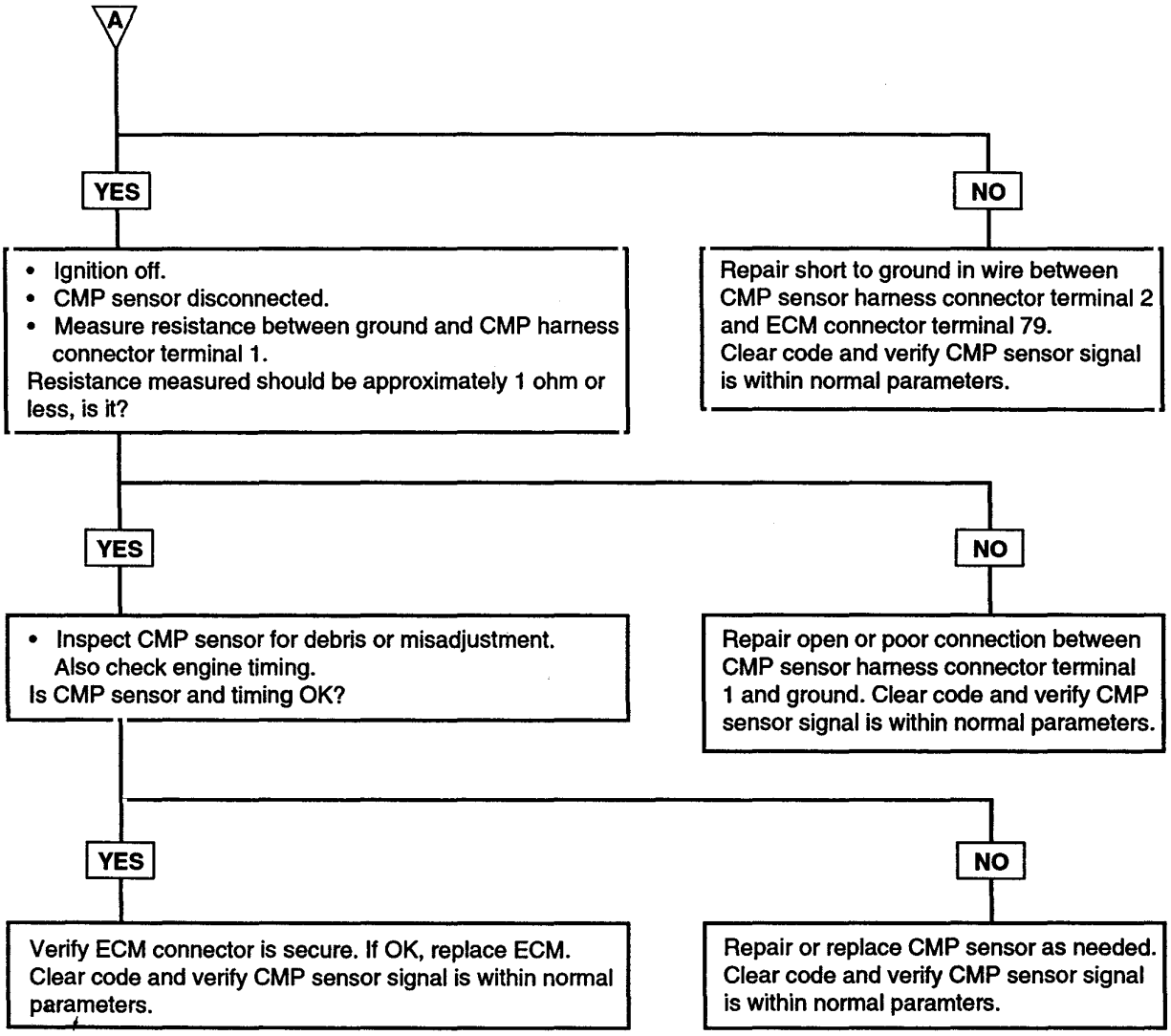
EFPD566A

TEST PROCEDURE



EFPD566B

CONTINUED FROM PREVIOUS PAGE



EFPD566C

[P0420] E8AD4D3C

DTC	Diagnostic item
P0420	Main Catalyst Efficiency Deterioration

DESCRIPTION

The catalyst's efficiency is demonstrated in its ability to oxidize CO and HC emissions. The Engine Control Module (ECM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert HC and CO into H2O and CO2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between front and rear sensor outputs.

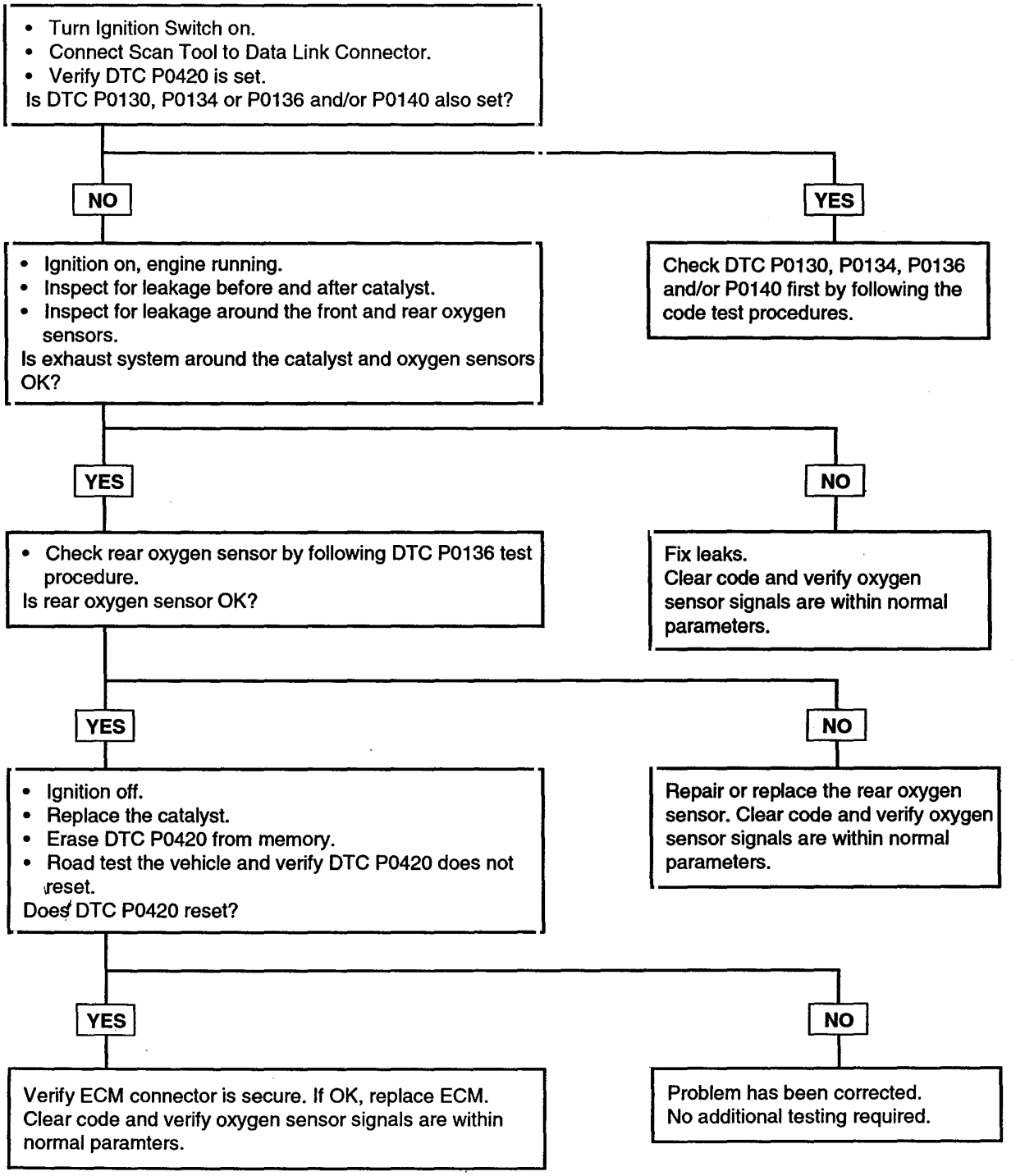
FAILURE CONDITION

The efficiency of the catalytic converter is measured by comparing the activity of the front and rear oxygen sensors. The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the front and rear oxygen sensor signals match more than 60% of the time in two of four 170 second monitoring periods during two driving cycles. The measurements are taken when the following conditions are met :

- The ECM is operating in closed loop.
- The engine speed is between 1800 and 3200 RPM.
- The catalyst temperature is above 702°F (372°C).
- The canister purge function is greater than 0.9.
- The vehicle is not shifting gears.
- The engine load is between 1.4 milliseconds and 4.5 milliseconds.

This code indicates that the catalytic converter has been found to have a low efficiency according to the readings of the front and rear oxygen sensors.

TEST PROCEDURE



EFPD571B

[P0444/P0445] EA210ADE

DTC	Diagnostic item
P0444	Purge Control Solenoid Valve Circuit Open
P0445	Purge Control Solenoid Valve Circuit Shorted

DESCRIPTION

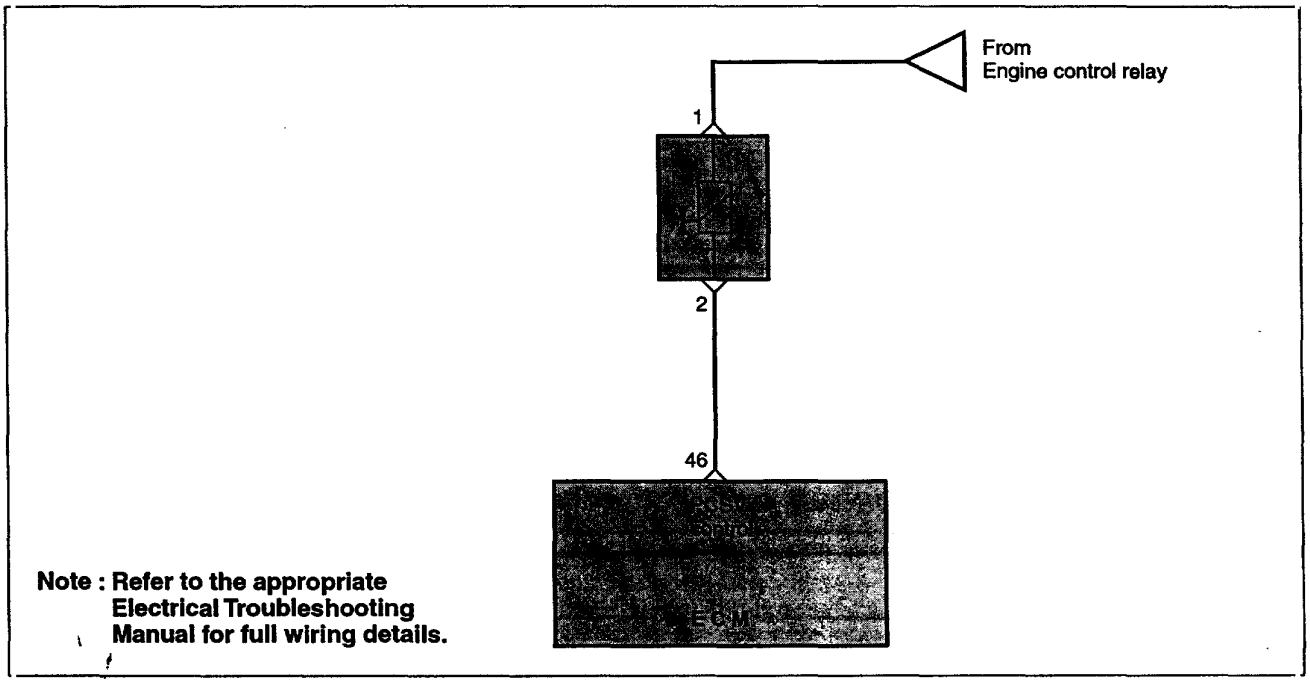
The purge control solenoid valve is part of the evaporative emission control system. The solenoid controls purge air from the evaporative emission canister.

FAILURE CONDITIONS

The ECM will set P0444 and the MIL will turn on if an open circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

The ECM will set P0445 and the MIL will turn on if a short circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD576A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0444 or P0445 is set.

- Turn ignition off.
- Disconnect purge control solenoid valve connector.
- Turn ignition on.
- Measure voltage between ground and purge control solenoid valve harness connector terminal 1.

Battery voltage should be present, is it?

YES

- Purge control solenoid valve disconnected.
- Disconnect ECM connector.
- Turn ignition off.
- Ground purge control solenoid valve harness connector terminal 2.
- Measure resistance between ground and ECM harness connector terminal 46.

Resistance measured should be approximatley 1 ohm or less, is it?

YES

- Ignition off.
- Purge control solenoid valve disconnected.
- Disconnect ECM connector.
- Measure resistance between ground and purge control solenoid valve harness connector terminal 2.

Resistance should indicate an open circuit, does it?

YES

- Ignition off.
- Purge control solenoid valve disconnected.
- Measure resistance between the purge control solenoid valve connector terminals 1 and 2.

Resistance should be approximately 26 ohms, is it?

YES

Verify ECM connector is secure. If OK, replace purge control solenoid valve with known good component. Clear code and verify purge control solenoid valve is within normal parameters. If problem persists, replace ECM.

NO

Repair open or short to ground in wire between ECM control relay connector terminal 1 and purge control solenoid valve connector terminal 1. Clear code and verify code does not reappear.

NO

Repair open in wire between ECM connector terminal 46 and purge control solenoid valve connector terminal 2. Clear code and verify code does not reappear.

NO

Repair short to ground or another circuit in the between ECM connector terminal 46 and purge control solenoid valve connector terminal 2. Clear code and verify code does not reappear.

NO

Replace purge control solenoid valve. Clear code and verify purge control solenoid valve is within normal parameters.

EFPD576B

[P0506/P0507] EEA2DDEF

DTC	Diagnostic item
P0506	Idle RPM Lower Than Expected
P0507	Idle RPM Higher Than Expected

DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

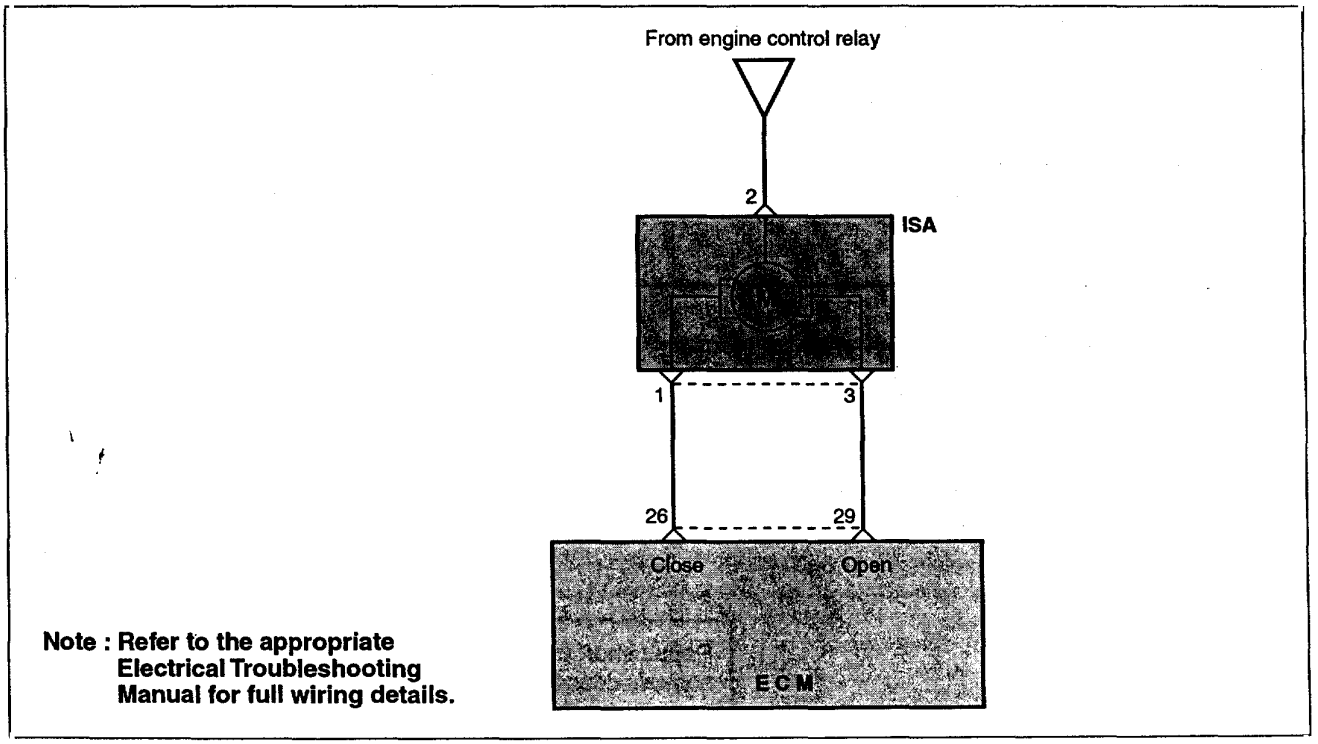
FAILURE CONDITIONS

The ECM will set P0506 or P0507 and the MIL will turn on if for 15 seconds. The ISC actuator driver circuit values and engine idle speed are not in agreement with values stored in the ECM during two driving cycles when the following conditions are met :

- The ISC actuator passes idle air at a rate above 4.1 g/s. [for P0506] or 1.7g/s [for P0507].
- Engine speed deviation is below 200 RPM.
- Vehicle speed is zero.
- Engine coolant temperature is above 167°F (75°C).

This code indicates the idle speed control actuator and the engine do not agree with the ECM on the idle speed value.

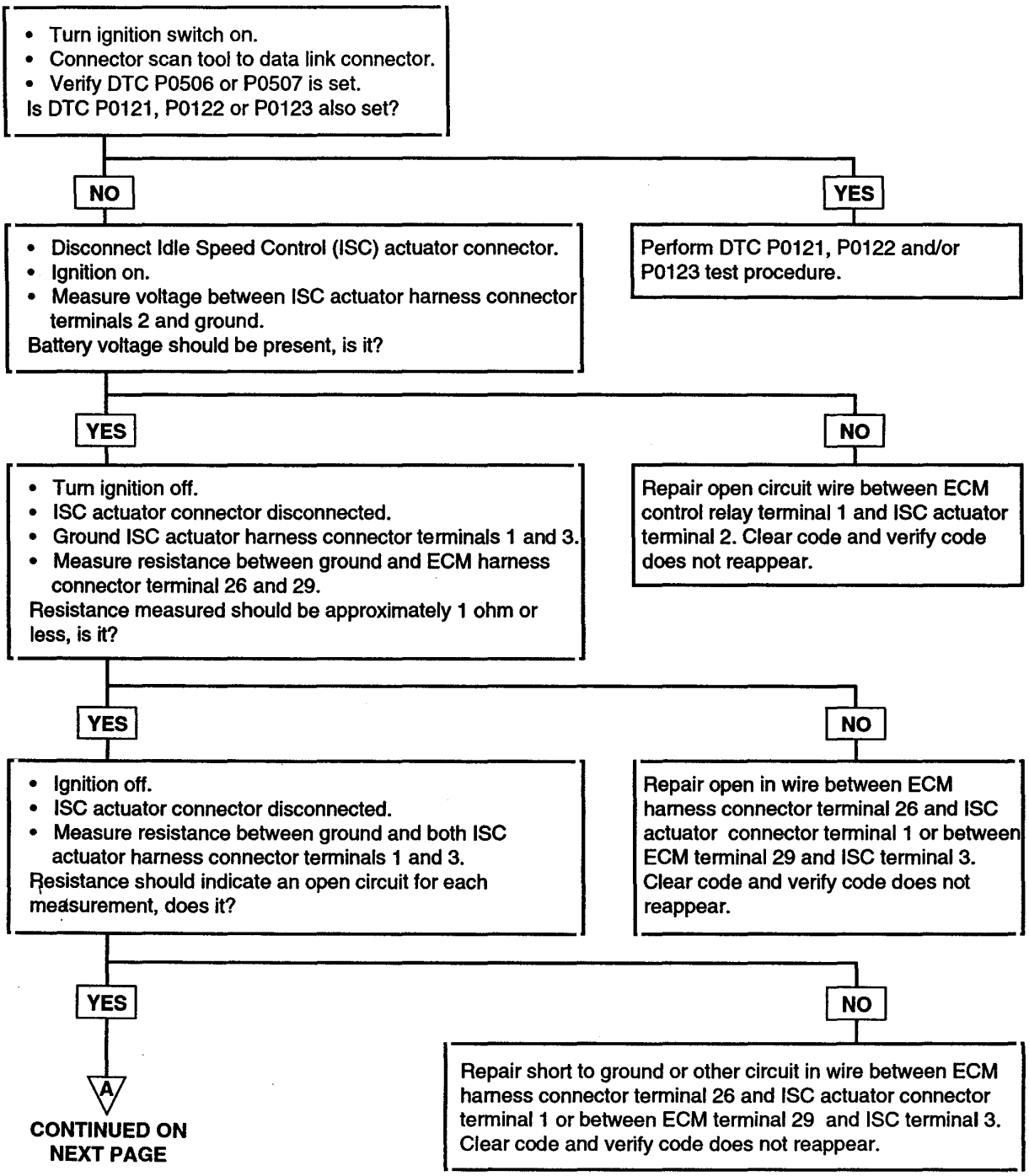
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

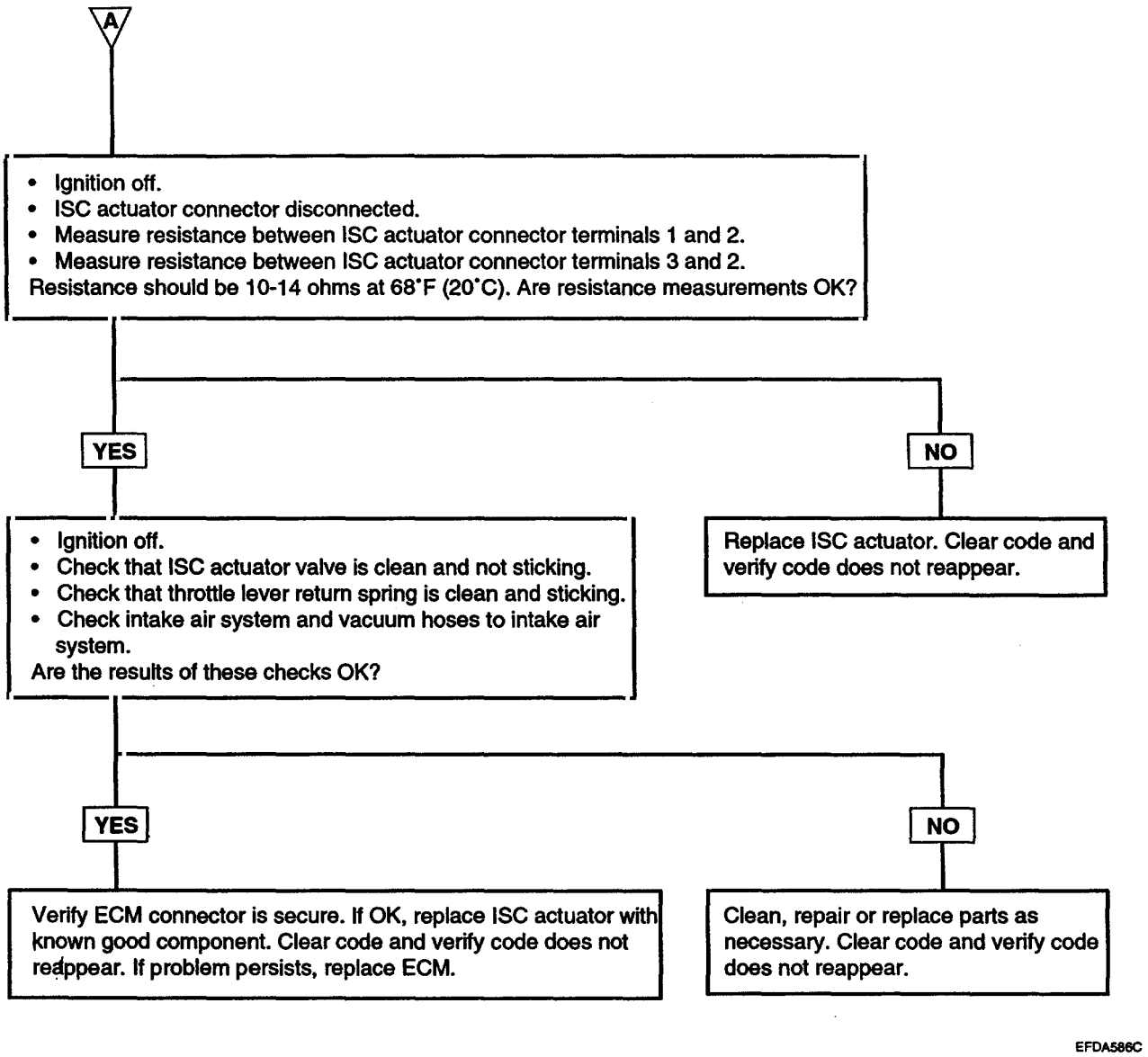
EFPD586A

TEST PROCEDURE



EFPD586B

CONTINUED FROM PREVIOUS PAGE



EFDA586C

[P1307/P1308/P1309] E11DAAAD

DTC	Diagnostic item
P1307	Acceleration Sensor Malfunction
P1308	Acceleration Sensor Signal Check Low
P1309	Acceleration Sensor Signal Check High

DESCRIPTION

The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.

FAILURE CONDITIONS

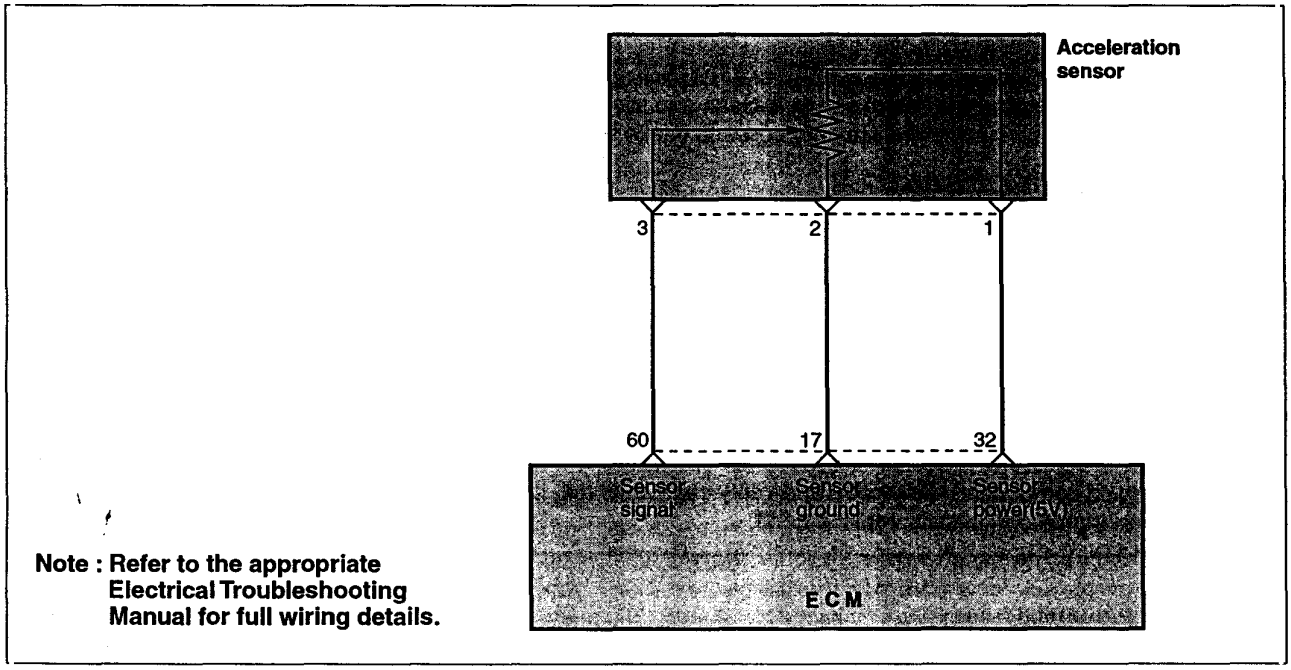
(FOR P1307)

The ECM will set a code and the MIL will turn on if the acceleration sensor signal is less than 1.5 or greater than 3.5 volts during two driving cycles. This code indicates an extremely rough or smooth road being sensed by the acceleration sensor or ECM.

(FOR P1308, P1309)

The ECM will set a code and the MIL will turn on if the acceleration sensor signal indicates an acceleration of 0.3g or greater when the vehicle speed is zero during two driving cycles. This code indicates some type of bump being read, with the car speed at zero, by the acceleration sensor or ECM.

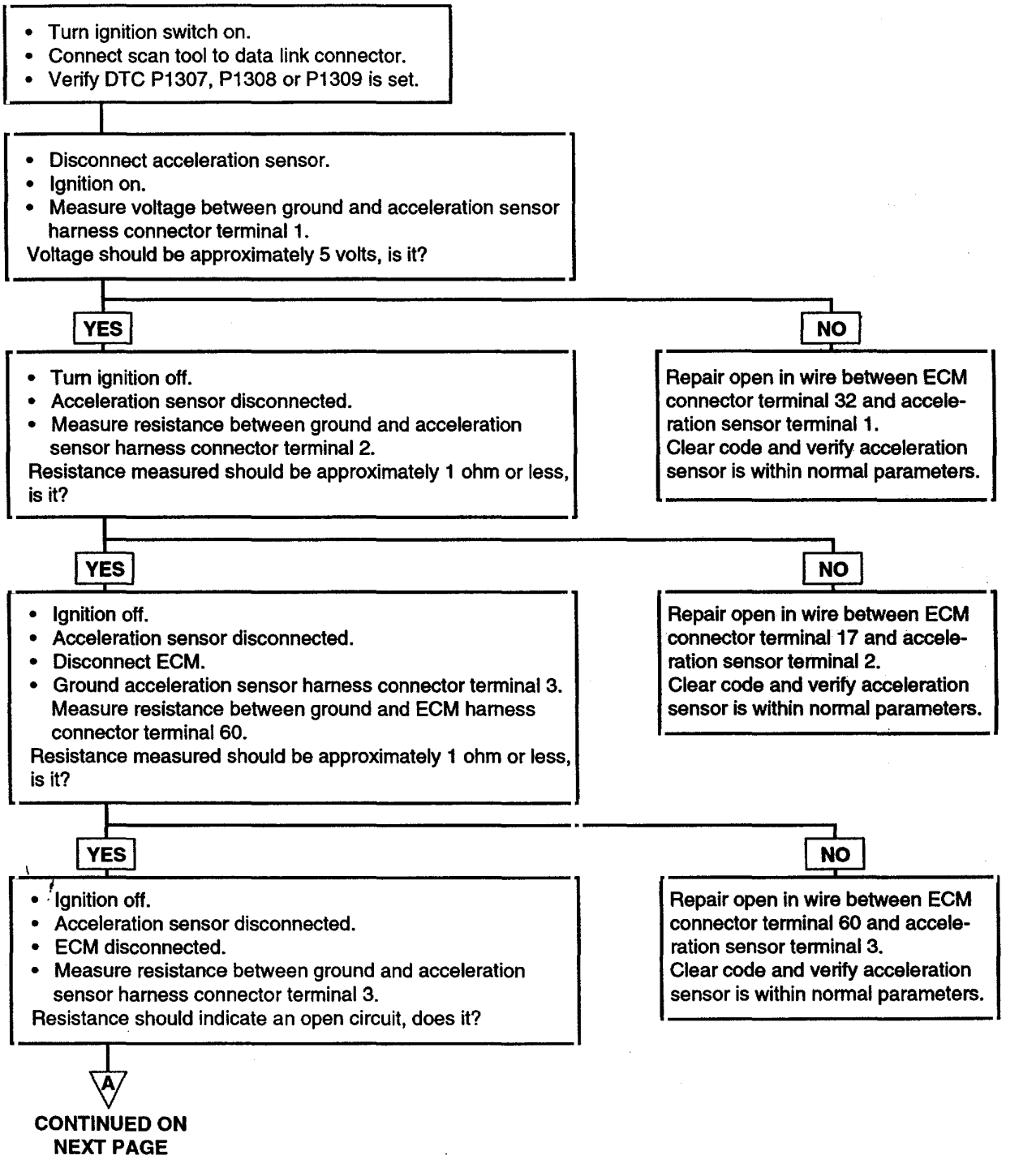
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD606A

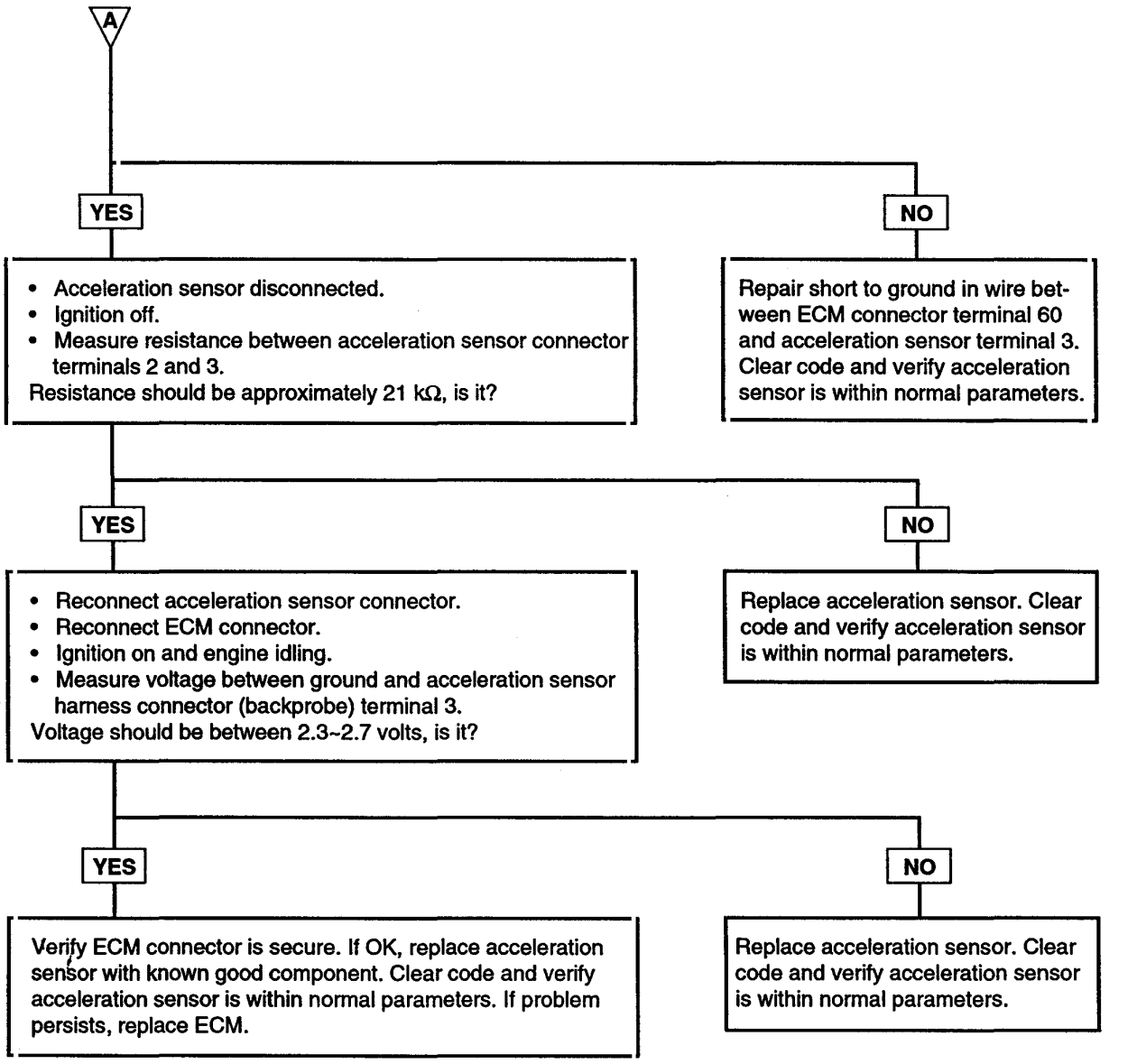
TEST PROCEDURE



CONTINUED ON NEXT PAGE

EFPD606B

CONTINUED FROM PREVIOUS PAGE



EFPD606C

[P1506/P1508] EFAFE084

DTC	Diagnostic item
P1506	Idle Charge Actuator Signal High of Coil #1
P1508	Idle Charge Actuator Signal High of Coil #2

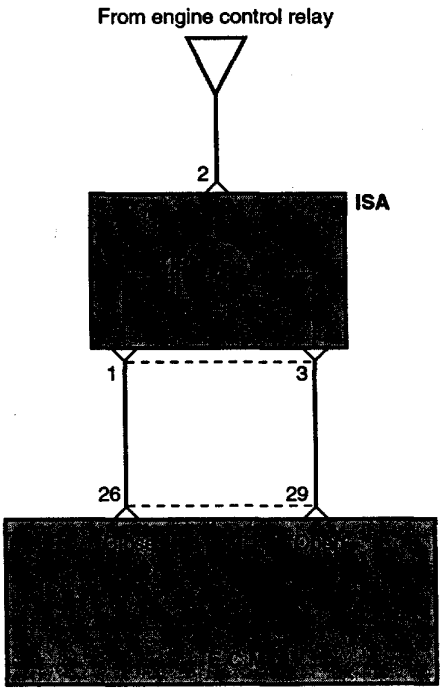
DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

FAILURE CONDITION

The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1506] or closing coil driver stage [for P1508] is shorted to battery voltage during two driving cycles.

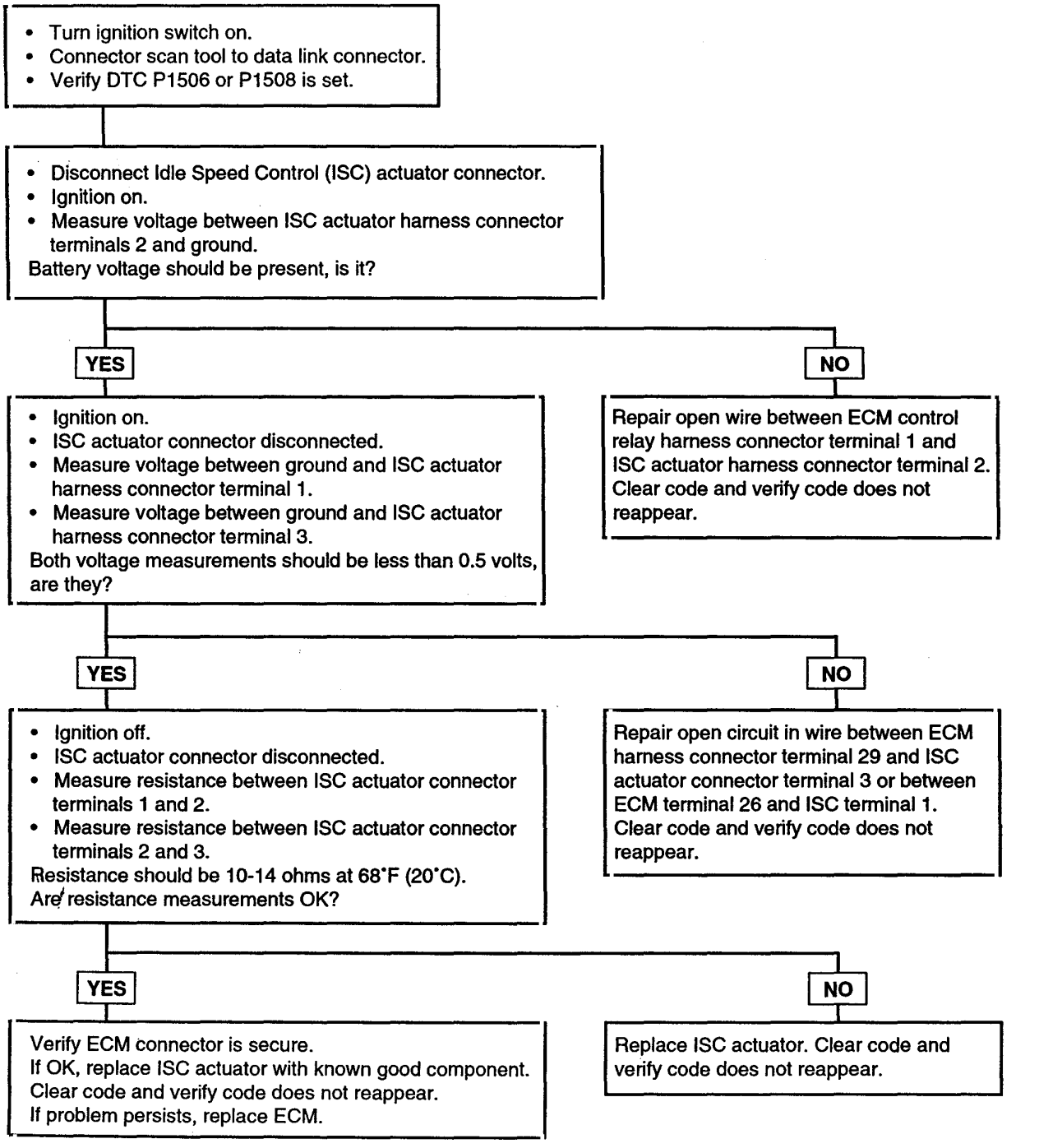
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFPD586A

TEST PROCEDURE



EFPD596B

[P1505/P1507] E017F5AF

DTC	Diagnostic item
P1505	Idle Charge Actuator Signal Low of Coil #1
P1507	Idle Charge Actuator Signal Low of Coil #2

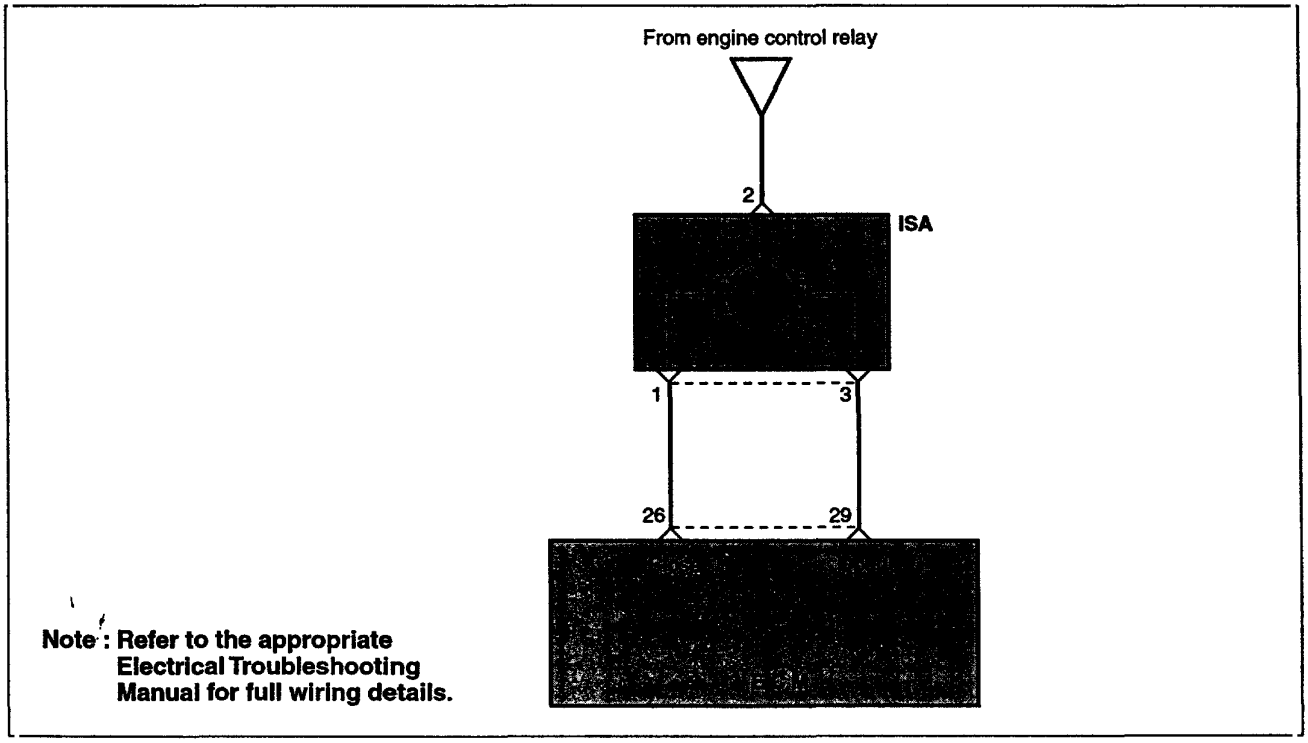
DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1505] or closing coil driver stage [for P1507] is open or shorted to ground during two driving cycles.

CIRCUIT DIAGRAM



EFPD586A

TEST PROCEDURE

- Turn ignition switch on.
- Connector scan tool to data link connector.
- Verify DTC P1505 or P1507 is set.

- Disconnect Idle Speed Control (ISC) actuator connector.
- Ignition on.
- Measure voltage between ISC actuator harness connector terminals 2 and ground.

Battery voltage should be present, is it?

YES

- Turn ignition off.
- ISC actuator connector disconnected.
- ECM connector disconnected..
- Ground ISC actuator harness connector terminal 1 or terminal 3.
- Measure resistance between ground and ECM harness connector terminal 29 or terminal 26.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Repair open wire between ECM control relay harness connector terminal 1 and ISC actuator terminal 2. Clear code and verify code does not reappear.

YES

- Ignition off.
- ISC actuator connector disconnected.
- ECM connector disconnected.
- Measure resistance between ground and ISC actuator harness connector terminals 1 or terminal 3.

Resistance should indicate an open circuit, does it?

NO

Repair open in wire between ECM harness connector terminal 29 or terminal 26 and ISC actuator connector terminal 1 or terminal 3. Clear code and verify code does not reappear.

YES

- Ignition off.
- ISC actuator connector disconnected.
- Measure resistance between ISC actuator connector terminal 1 and 2.
- Measure resistance between ISC actuator connector terminal 2 and 3.

Resistance should be 10~14 Ω at 68°F (20°C). Are resistance measurements OK?

NO

Repair short to ground in wire between ECM harness connector terminal 29 or terminal 26 and ISC actuator connector terminal 3 or terminal 1.
Clear code and verify code does not reappear.

YES

Verify ECM connector is secure. If OK, replace ISC actuator with known good component. Clear code and verify code not reappear. If problem persists, replace ECM.

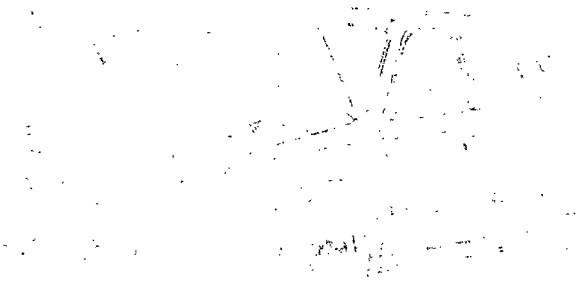
NO

Replace ISC actuator. Clear code and verify code does not reappear.

EFPD601B

General Information

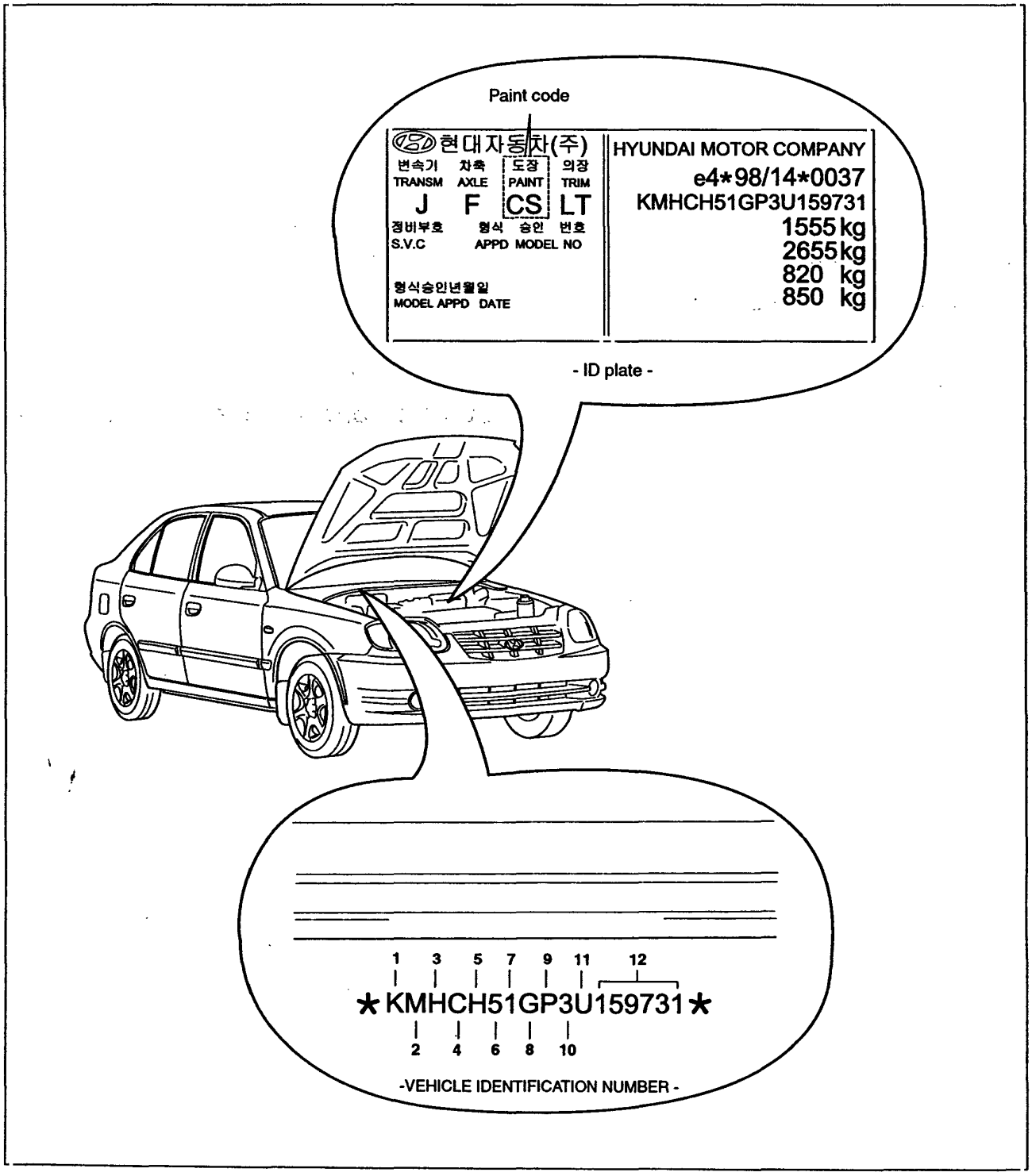
IDENTIFICATION NUMBER ..... GI - 2
LIFT SUPPORT POINT ..... GI - 8
TIGHTING TORQUE OF STANDARD PATRS ..... GI -9
LUBRICANTS ..... GI -10
SELECTION OF ENGINE OIL ..... GI -11
SRS SYSTEM COMPONENTS INFORMATION ..... GI -12
GENERAL SERVICE INFORMATION ..... GI -13
MAINTENANCE IMFORMATION ..... GI -20
OVERALL BODY DIMENSION ..... GI -26



GENERAL

IDENTIFICATION NUMBER ECCCCACF

VEHICLE IDENTIFICATION NUMBER LOCATION



EADC001A

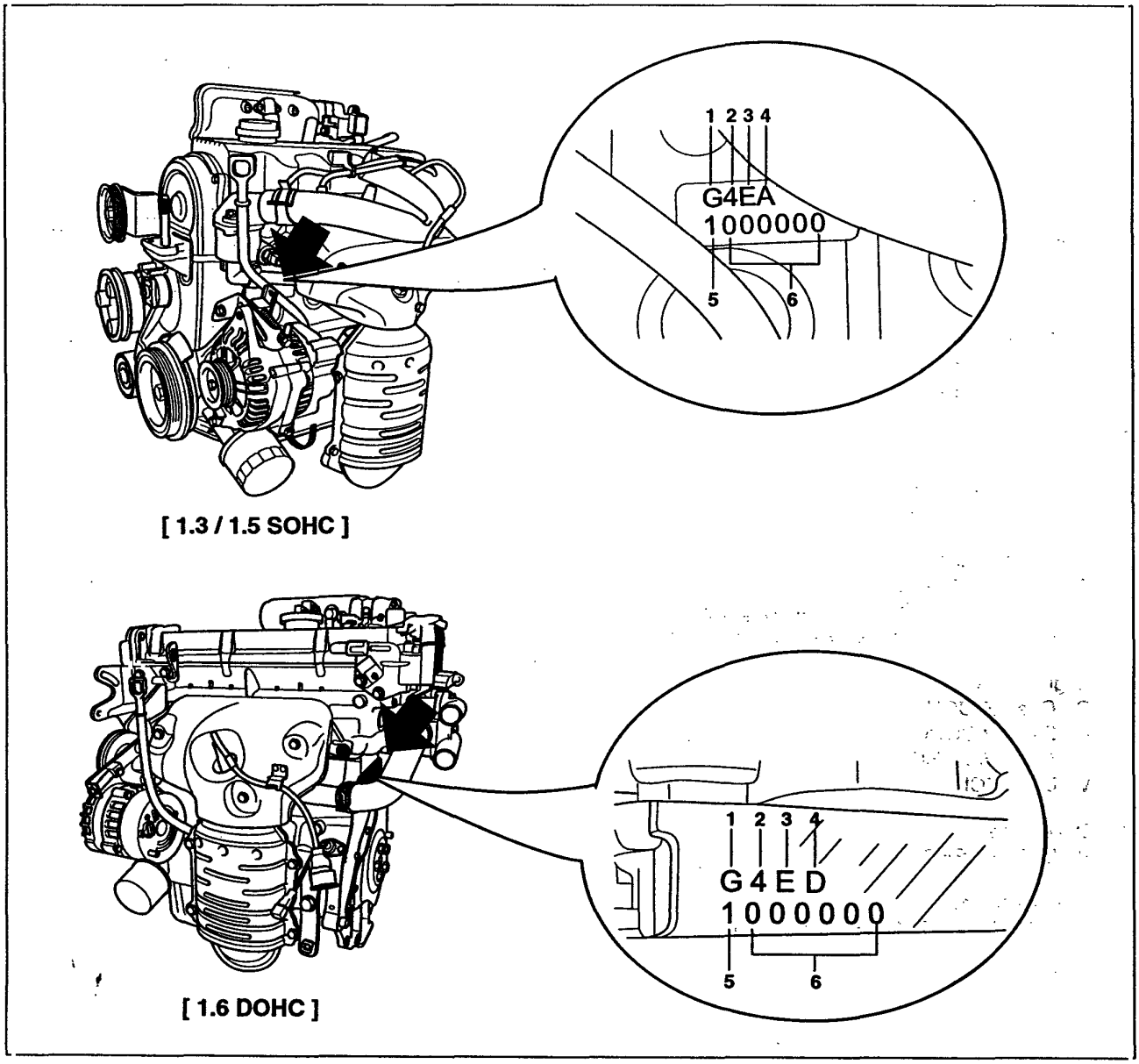
VEHICLE IDENTIFICATION NUMBER DESCRIPTION

1. Geographic zone
   K : Korea
2. Manufacturer
   M : Hyundai motor company
3. Vehicle type
   H : Passenger
4. Vehicle line
   C : Accent
5. Model & Series
   F : STANDAD (L)
   G : DELUXE (GL)
   H : SUPER DELUXE (GLS)
6. Body type
   3 : Sedan 3 - Door
   4 : Sedan 4 - Door
   5 : Sedan 5 - Door
7. Restraint system
   0 : Both side NONE
   1 : Active belt (Driver side + Passenger side)
   2 : Passive belt (Driver side + Passenger side)
8. Engine type
   C : Gas 1.6 DOHC
   F : Gas 1.3 SOHC
   G : Gas 1.5 SOHC
   V : D 1.5 TCI
9. Driver side
   P : LHD, R : RHD
10. Production year
    2 : 2002, 3 : 2003, 4 : 2004, 5 : 2005
11. Plant of production
    U : Ulsan (Korea)
12. Vehicle production sequence number
    000001 ~ 999999

PAINT CODE

CODE	COLOR
NW	Noble White
EB	Ebony Black
CS	Clean Silver
HL	Hiphop Red
IA	Vivid Yellow
YA	Potomac Bule
TI	Tundra Green
UA	Hof Gold
WS	Technical Gray
ZG	Mass Green

ENGINE IDENTIFICATION NUMBER LOCATION



EADD001B

ENGINE IDENTIFICATION NUMBER DESCRIPTION

1. Engine fuel
   G : Gasoline
   D : Diesel

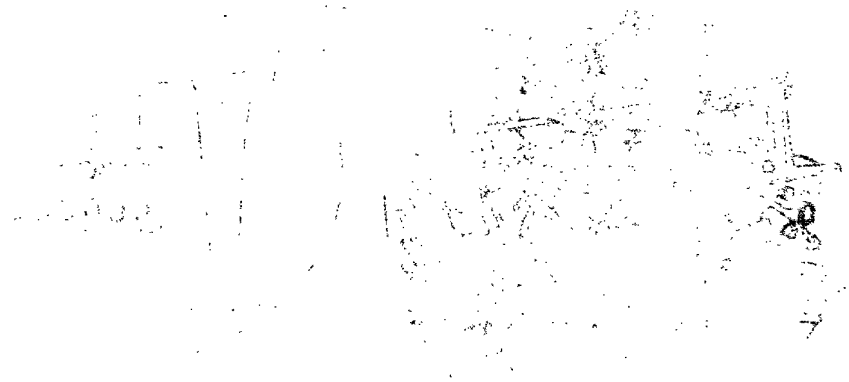
2. Engine range
   4 : In line 4 cycle 4 cylinder
   3 : In line 4 cycle 3 cylinder

3. Engine development order
   E : Alpha engine, D - engine

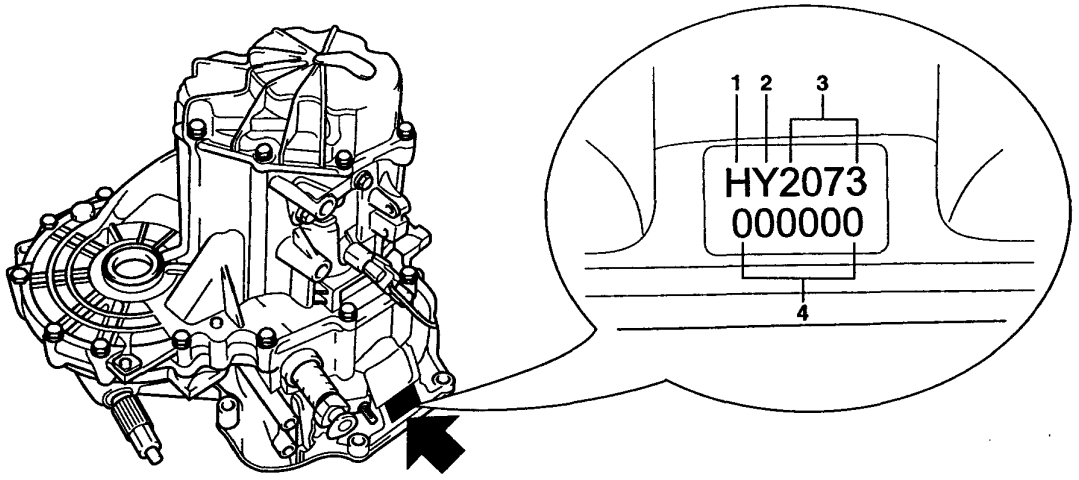
4. Engine capacity
   A : 1341 cc (Gasoline), 1493 cc (Diesel)
   B : 1495 cc
   D : 1599 cc

5. Production year
   X : 1999, Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003, 4 : 2004

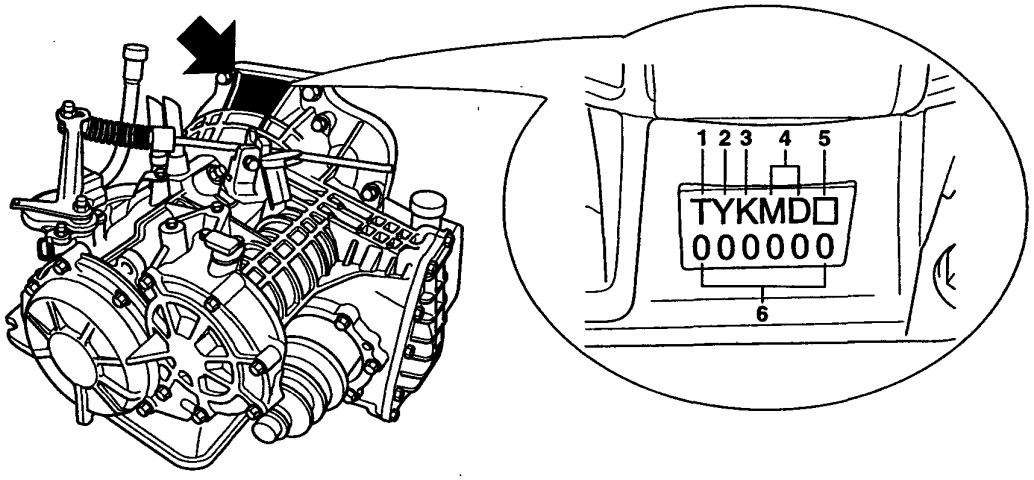
6. Engine production sequence number
   000001 ~ 999999



TRANSAXLE IDENTIFICATION NUMBER LOCATION



[MANUAL TRANSAXLE]



[AUTOMATIC TRANSAXLE]

EAPD030A

TRANSAXLE IDENTIFICATION NUMBER DESCRIPTION

MANUAL TRANSAXLE

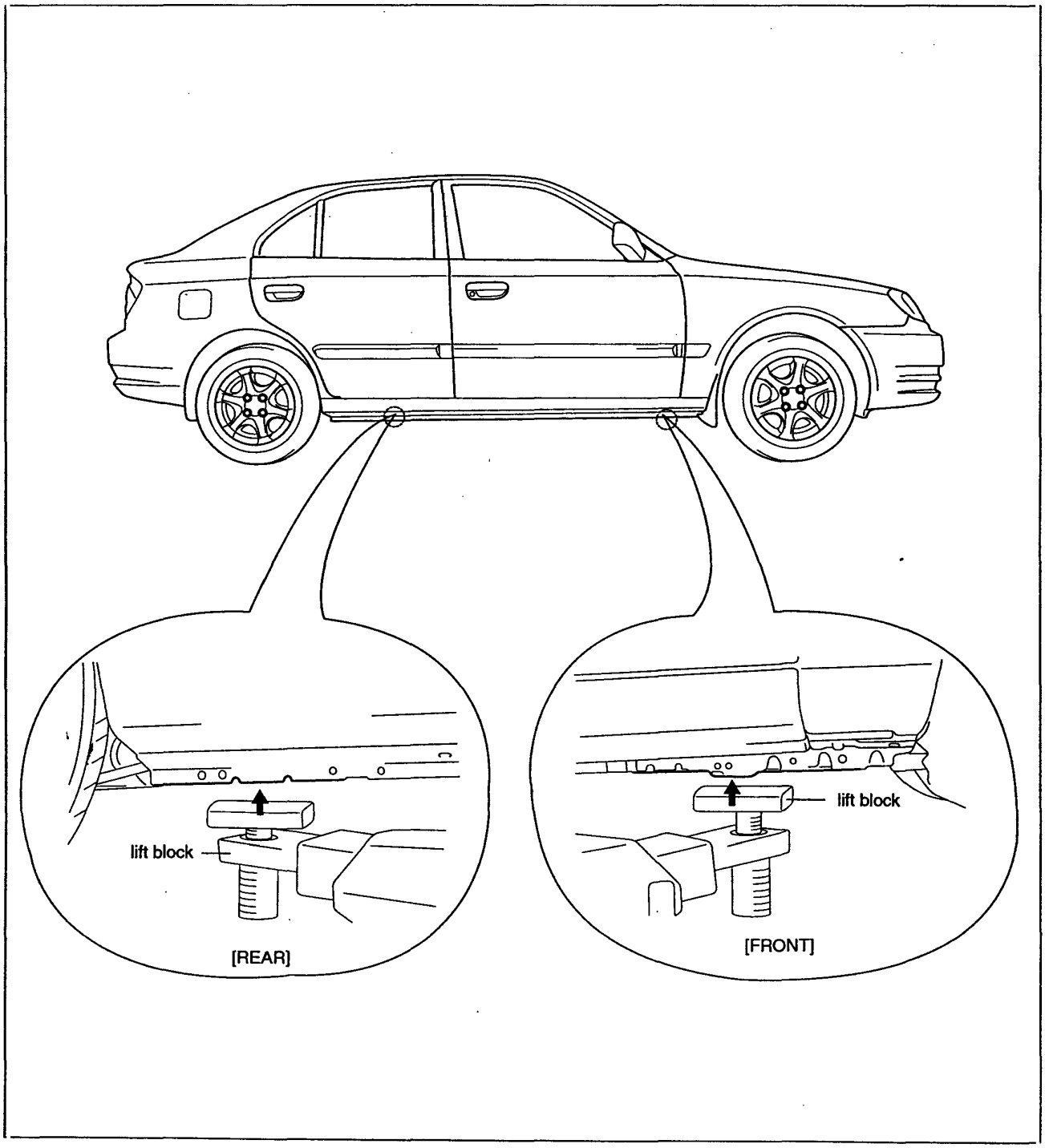
1. Model
   H : M5AF3
2. Production year
   W - 1998, X - 1999, Y - 2000, 1 - 2001,
   2 - 2002, 3 - 2003, 4 - 2004, 5 - 2005
3. Gear ratio
   2073 : 3.650
4. Transaxle production sequence number
   000000 ~ 999999

AUTOMATIC TRANSAXLE

1. T : A4AF3
2. Production year
   W - 1998, X - 1999, Y - 2000, 1 - 2001,
   2 - 2002, 3 - 2003, 4 - 2004, 5 - 2005
3. Gear ratio
   K : 3.443
   L : 3.656
   N : 4.041
4. Detailed classification
   AD : 1.5 SOHC
   CD : 1.3 SOHC
   ID : 1.6 DOHC
5. Spare
6. Transaxle production sequence number
   000000 ~ 999999

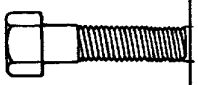
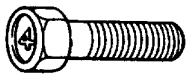
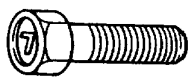
LIFT SUPPORT POINT EADD0020

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



EADD003B

TIGHTENING TORQUE TABLE OF STANDARD PARTS EADD0030

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
 EADA010R	 EADA010S	 EADA010T	 EADA010U
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

1. *The torques shown in the table are standard values under the following conditions :*
   - *Nuts and bolts are made of galvanized steel bar.*
   - *Galvanized plain steel washers are inserted.*
   - *All nuts, bolts, and plain washers are dry.*

2. *The torques shown in the table are not applicable :*
   - *When spring washers, toothed washers and the like are inserted.*
   - *If plastic parts are fastened.*
   - *If self - tapping screws or self - locking nuts are used.*
   - *If threads and surfaces are coated with oil.*

3. *If you reduce the torques in the table to the percentage inddcated below, under the following conditions, if will be the standard value.*
   - *If spring washers are used. : 85%*
   - *If threads and braring sufaces are stained with oil : 85%*

LUBRICANTS EADD0040

RECOMMENDED LUBRICANTS

Parts	Specifications
Engine oil	API Classification SG Above (SAE 10W/30, 5W/30) API Classification SH Above (SAE 7.4W/30) API Classification CE Above (Diesel)
Manual transaxle	API Classification GL - 4 (SAE 75W/90)
Automatic transaxle	GENUINE HYUNDAI transaxle oil, GENUINE DIAMOND ATF SP - III
Brake	DOT 3 or DOT 4
Cooling system	High quality ethylene glycol - Concentration level 40% (tropical) - Concentration level 50% (tropical)
Power steering	PSF - 3
Transaxle linkage, parking brake cable mechanism, hood lock and hook, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinges	Multipurpose grease NLGI grade #2

WARNING

- **Always use GL - 4 Classification for the manual transaxle (Do not use GL - 5 Classification)**
- **Always use Genuine Hyundai parts and recommended fluid.**

Using any other type of parts and fluid can cause serious damage of the vehicle.

LUBRICANTS CAPACITIES

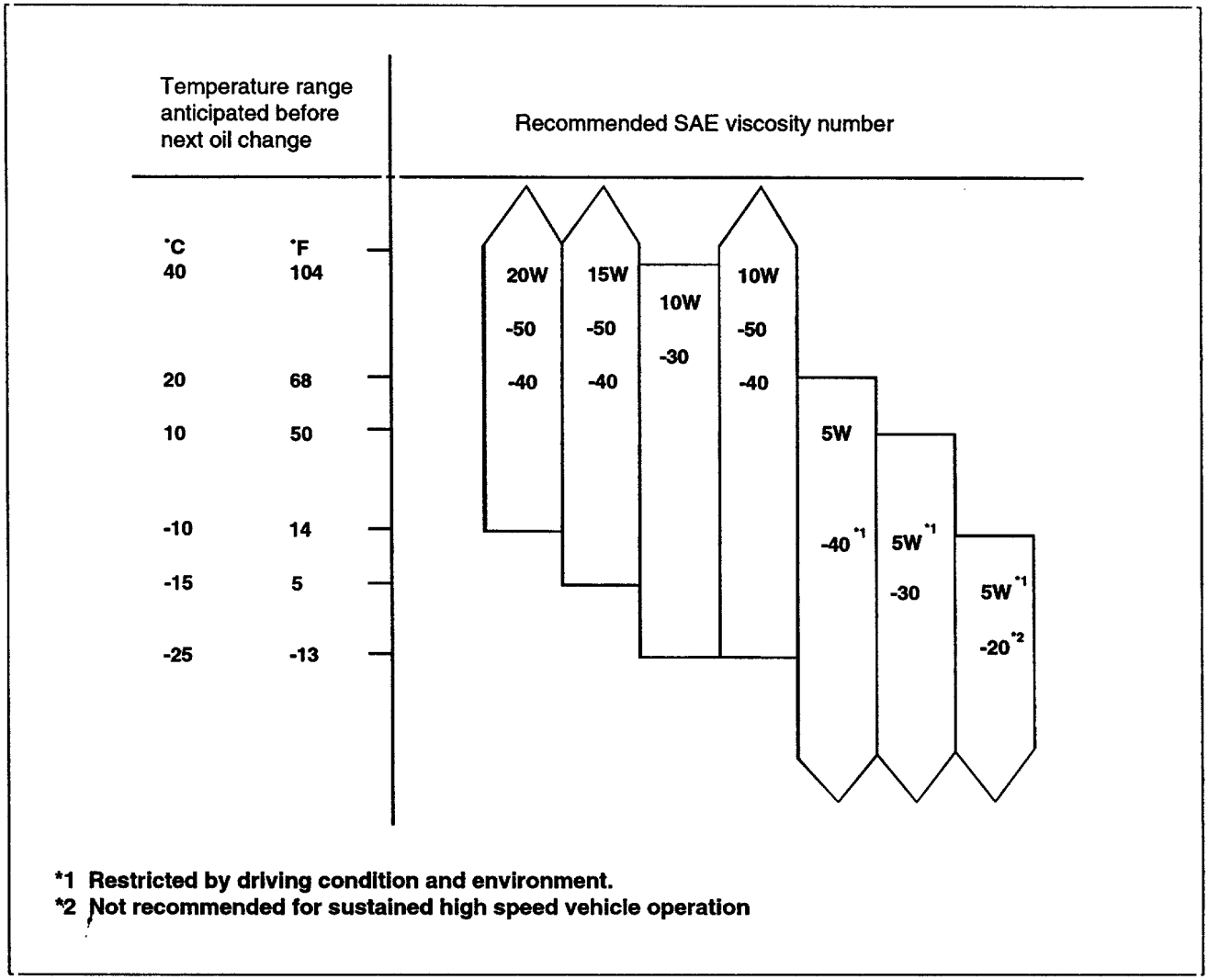
Description		Capacities		Diesel
		1.3	1.5/1.6	
Engine oil	Oil pan	3.0 (3.17, 2.64)		4.3 (4.54, 3.78)
	Oil filter	0.3 (0.32, 0.26)		0.5 (0.53, 0.44)
	Total	3.3 (3.49, 2.90)		4.8 (5.07, 4.22)
Cooling system		6.2 (6.55, 5.46)	6.5 (6.87, 5.72)	5.3 (5.60, 4.66)
Manual transaxle		2.5 (2.27, 1.89)		2.5 (2.27, 1.89)
Automatic transaxle		6.1 (6.45, 5.37)		6.1 (6.45, 5.37)
Power steering		0.9 (0.95, 0.79)		0.9 (0.95, 0.79)

liter (U.S. qus., Imp.qts.)

SELECTION OF ENGINE OIL EADD0050

Recommended API classification : SG OR SH ABOVE

Recommended SAE viscosity grades :



***1 Restricted by driving condition and environment.**
***2 Not recommended for sustained high speed vehicle operation**

EDA9990B

NOTE

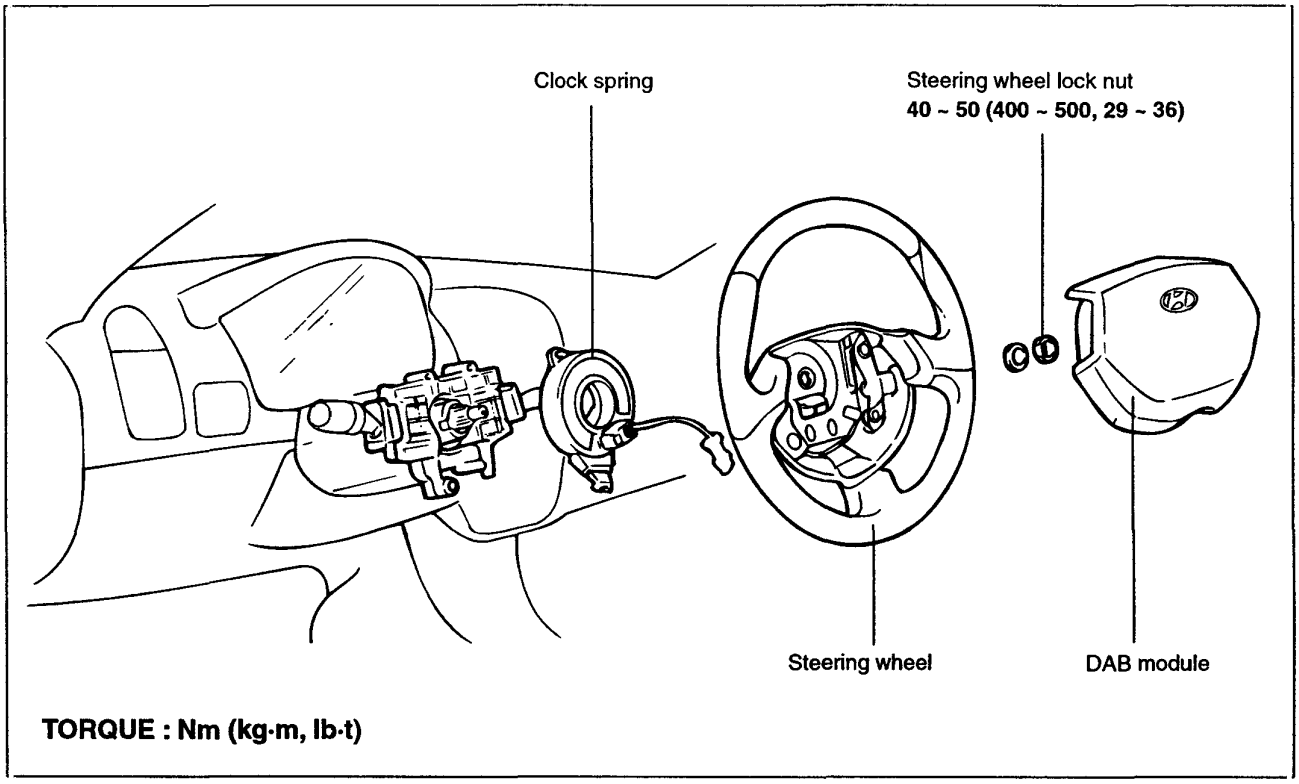
For best performance and maximum protection of all types of operation, select only those lubricants which :

1. *Satisfy the requirements of the API classification.*
2. *Have the proper SAE grade number for expected ambient temperature range.*

Lubricants which do not have both an SAE grade number and an API service classification on the container should not be used.

SRS SYSTEM COMPONENTS

IMFORMATION EADD0060



ERDA005A

CUSTOMER CAUTIONS

Failure to carry out service operations in the correct sequence could cause the airbag system to be deployed unexpectedly during servicing, and a serious accident to occur. Further if there is a mistake in servicing the airbag system, it is possible that the airbag may fail to operate when required. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following items carefully, then follow the correct procedures described in the repair manual.

1. Work must be started approx. 30 seconds or longer after the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected. (The airbag system is equipped with a back - up power source.)
   If work is started within 30 seconds when disconnecting the negative (-) battery cable of the battery, the airbag may be operative.)
   When the negative (-) terminal cable is disconnected from the battery, the clock and audio systems memories will be erased. Before starting work, record the setting of the audio memory system
   When work is finished, reset the audio system as before and adjust the clock.
2. Malfunction symptoms of the airbag system are difficult to comfirm, so diagnostic codes become the most important source of information when troubleshooting. When troubleshooting the airbag system, always read the diagnostic trouble coodes before disconnecting the battery.
3. Never use airbag parts from another vehicle. When replacing parts, replace them with new parts.
4. Never attempt to disassemble and repair the airbag modules, SRSCM, clock spring and Airbag wiring harness in order to reuse it.
5. If the SRSCM or airbag module have been dropped, or if there are cracks, dents or other defects in the case, bracket or connector, replace them with new ones.
6. After work on the airbag system is completed, reset the airbag warning lamp.

GENERAL SERVICE INFORMATION EADD0070

PROTECTION OF THE VEHICLE

Always be sure to cover fenders, seats, and floor areas before starting work.

⚠ *CAUTION*

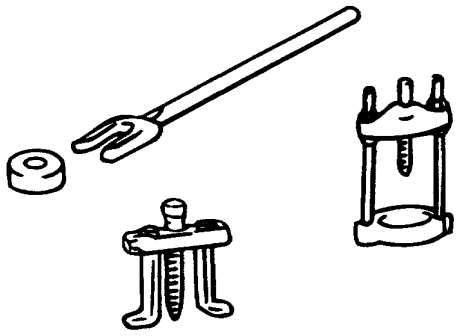
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

PREPARATION OF TOOLS AND MEASURING EQUIPMENT

Be sure that all necessary tools and measuring equipment are available before starting work.

SPECIAL TOOLS

Use special tools when they are required.



EAA9006A

REMOVAL OF PARTS

First find the cause of the problem and then determine whether removal or disassembly is required before starting the job.

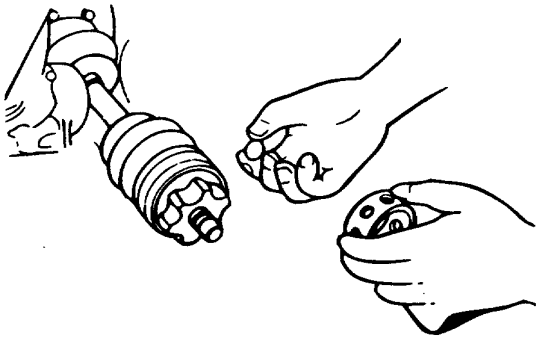


EADA010I

DISASSEMBLY

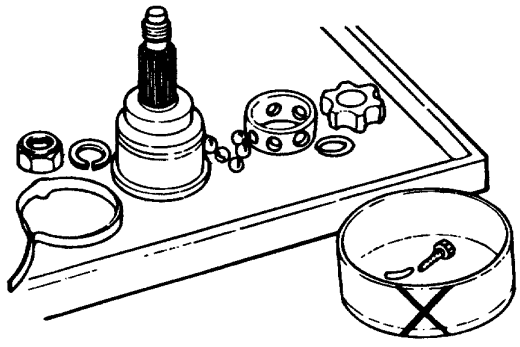
If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**
   Each part, when removed, should be carefully in spected for malfunction, deformation, damage, and other problems.



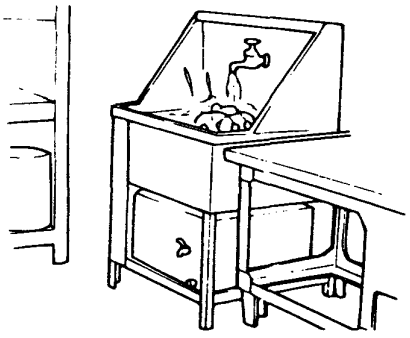
EADA010J

2. **Arrangement of parts**
   All disassembled parts should be carefully arranged for effective reassembly.
   Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



EAA9008B

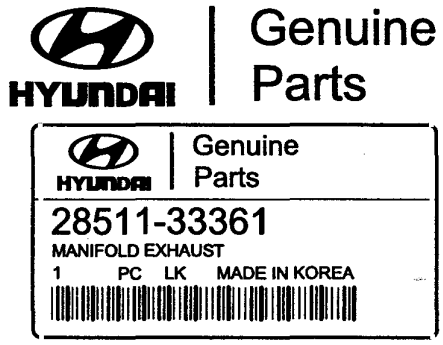
3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate mathod.



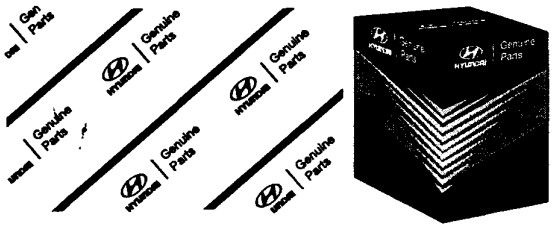
EADA010K

PARTS

When replacing parts, use HYUNDAI genuine parts.



EAPD101A

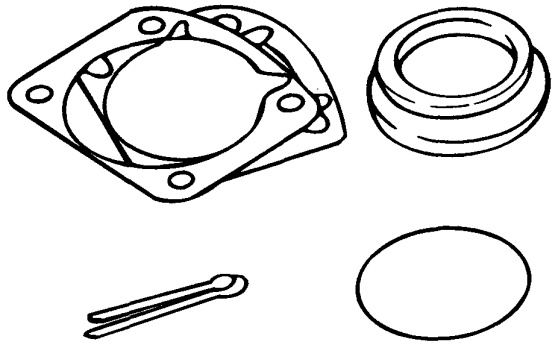


EAPD101B

REPLACEMENT

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
If removed, the following parts should always be replaced with new ones.

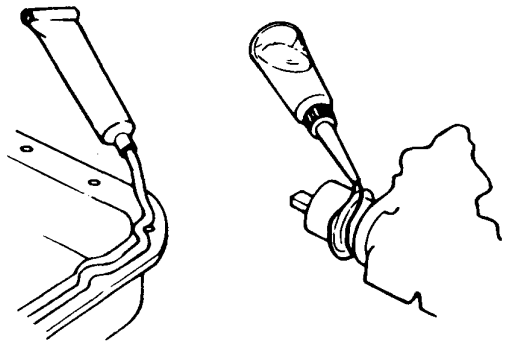
1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



EADA010N

Depending on their location.

7. Selalant should be applied to gaskets.
8. Oil should be applied to the moving components of parts.
9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc.) before assembly.



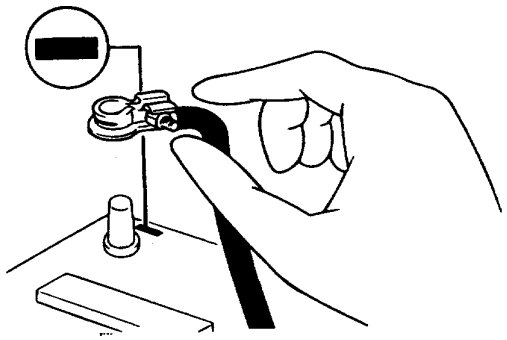
EADA010O

ADJUSTMENT

Use gauges and testers to adjust correctly the parts to standard values correctly.

ELECTRICAL SYSTEM

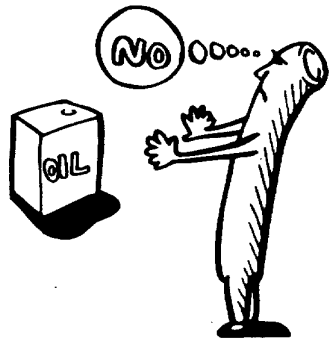
1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be cardful not to drop them or hit them against other parts.



EAA9011A

RUBBER PARTS AND TUBES

Always prevent gasoline or oil from touching rubber parts or tubing.



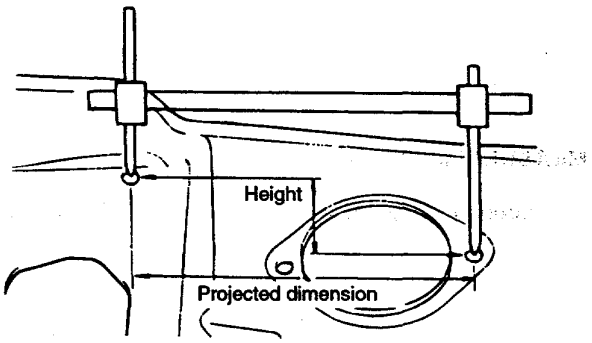
EADA010Q

MEASURING BODY DIMENSIONGS

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimensions and actual - measurement dimensions are used in this manual.

DIMENSIONS PROJECTED

1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surfaces.



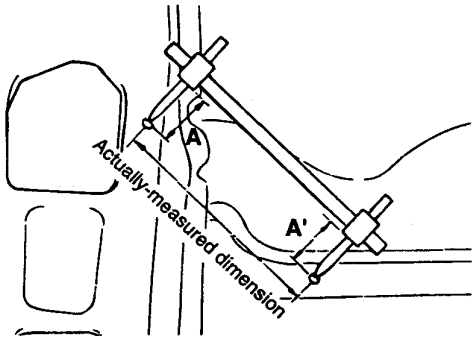
EADA011M

MEASURING ACTUAL DIMENSIONS

1. These dimensions indicate the actual linear distance between measurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

NOTE

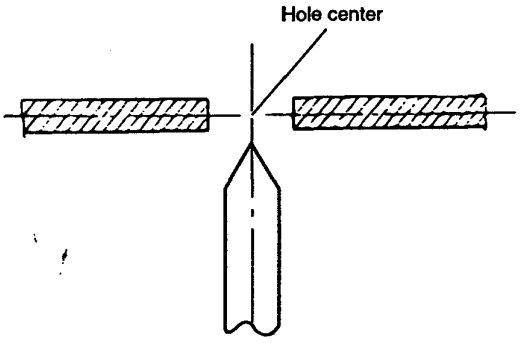
Check the probes and gauge itself to make sure there is no free play.



EADA011N

MEASUREMENT POINT

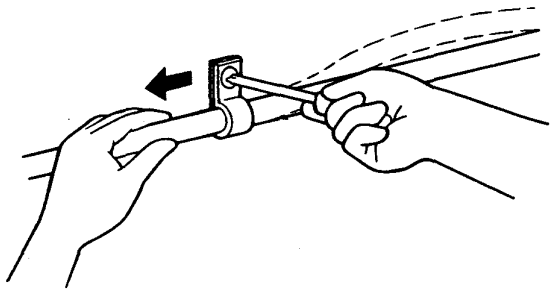
Measurements should be taken at the center fo the hole.



EADA011O

CHECKING CABLES AND WIRES

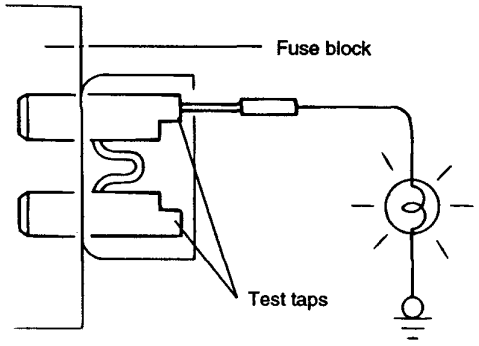
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between thier attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)
9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vegicle body and the engine.



EADA011B

CHECKING FUSES

A blade type fuse has test taps provided to allow checking the fuse itself without removing it from the fuse bliock. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative)



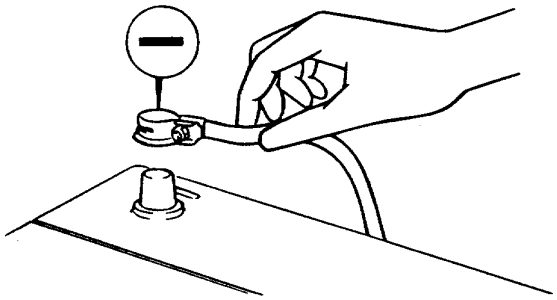
EAA9014B

SERVICING THE ELECTRICAL SYSTEM

1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

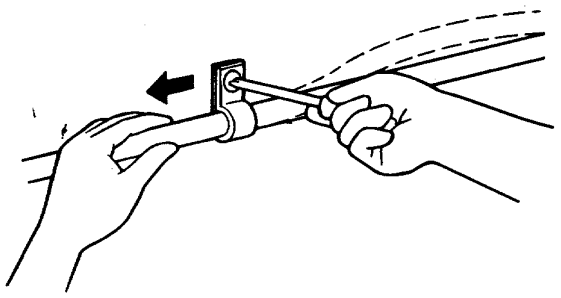
   NOTE

   In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. There fore, if necessary, read the diagnostic codes before removing the battery cable.



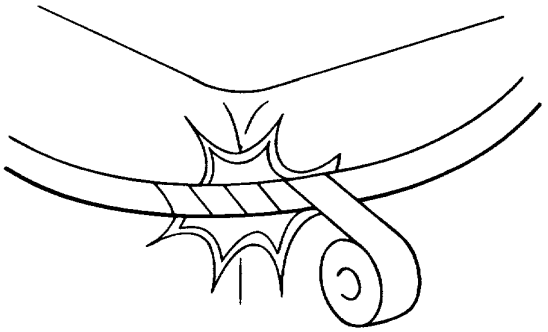
EADA011A

2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts, and then secure the harness by using a clamp.



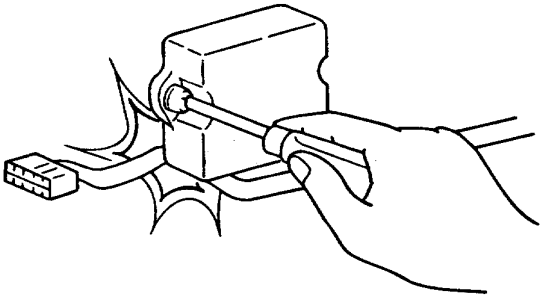
EADA011B

3. If any section of a wiring harness interferes with the edge of a part, or a corner, wrap the section of the harness with tape or something similar in order to protect it from damage.



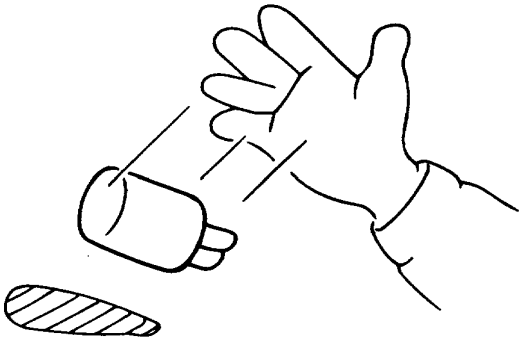
EADA011C

4. When installing any parts, be careful not to pinch or damage any of the wiring harnesses.



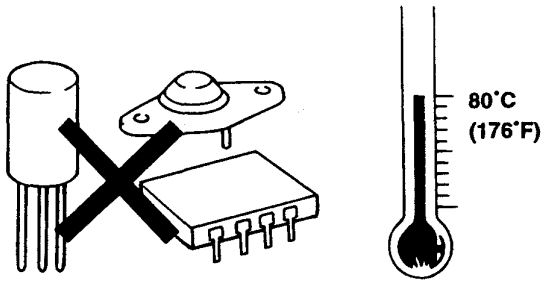
EADA011D

5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



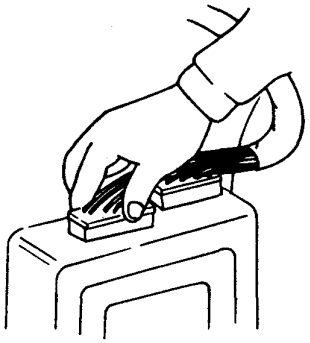
EADA011E

6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronicc parts beforehand.



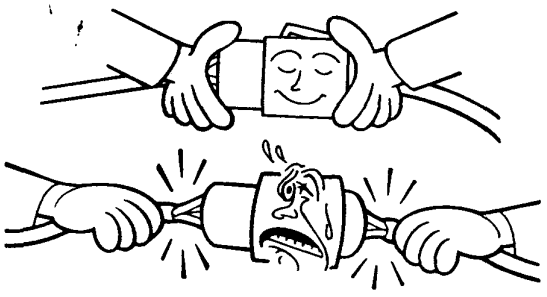
EADA011F

7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



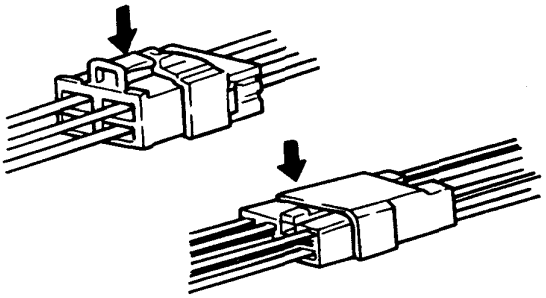
EADA011G

8. When disconnecting a connector, be sure to grip only the connector, not the wires.



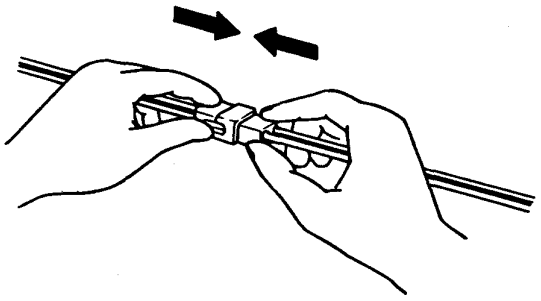
EADA011H

9. Disconnect connectors which have catches by pressing in the direction of the arrows shown the illustration.



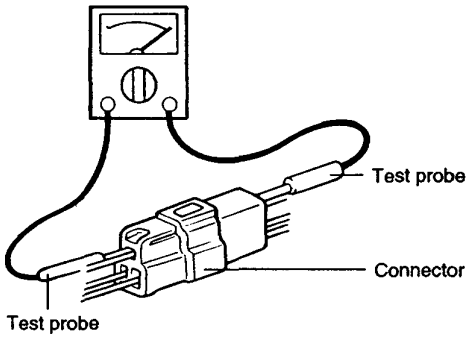
EADA011I

10. Connect connectors which have catches by inserting the connectors until they make a clicking sound.



EADA011J

11. When using a circuit tester to check continuity or voltage on connector terminals, insert the test probe into the harness side. If the connecs a sealed connector, insert the test probe through the hole in the rubber cap until it contacts the terminal, being careful not to damage the insulation of the wires.



EADA011K

12. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropriate wire size.

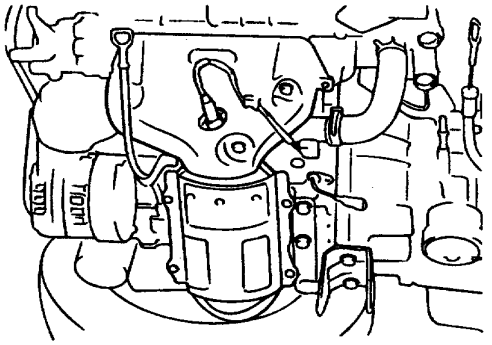
Norminal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3 mm²	AWG 22	-	5A
0.5 mm²	AWG 20	7A	13A
0.85 mm²	AWG 18	9A	17A
1.25 mm²	AWG 16	12A	22A
2.0 mm²	AWG 14	16A	30A
3.0 mm²	AWG 12	21A	40A
5.0 mm²	AWG 10	31A	54A

PRECAUTIONS FOR CATALYTIC CONVERTER

⚠ *CAUTION*

If a large amount of undurned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engie at fast idle for more than 10 minutes and at idle speed for more than 20 minutes.
3. Avoid start-jump tests. Do start-jumps only when absolutely necessary. Perform this test as rapidly as possible andm, while testing, never race the engine.
4. Do not measure engine compression for and extended time. Engine compression tests must be made as rapidly as possible.
5. Avoid coasting with the ignition turned off and during prolonged braking.
6. Do not dispose of a used catalytic converter together with parts contaminated with gasoline or oil.



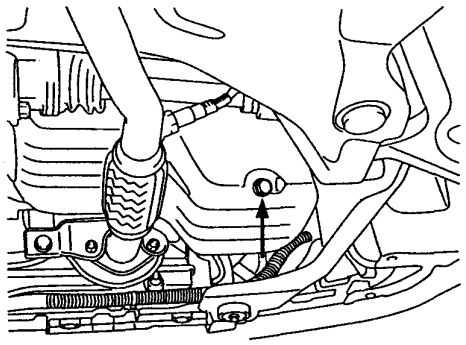
EAKA010E

MAINTENANCE IMFORMATION EADD0080

CHANGING ENGINE OIL

1. If the engine is cold, run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and drain plug. Drain the engine oil.
4. Tighten the drain plug to the specified torque.

Tightening torque
Oil pan drain plug :
35 ~ 45 Nm (350 ~ 450 kg.cm, 25 ~ 33 lb.ft)



KCPC001B

NOTE

Whenever tightening the oil drain plug, use a new drain plug gasket.

5. Fill new engine oil through the oil filler cap opening.

NOTE

Do not overfill, this will cause oil aeration and loss of oil pressure.

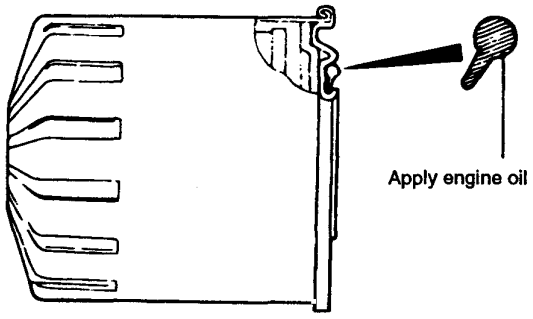
6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

REPLACING THE ENGINE OIL FILTER

1. Use a filter wrench to remove the oil filter.
2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.
3. Tighten the oil filter to the specified torque.

Tightening torque
Oil filter : 12 ~ 16 Nm (120 ~ 160 kg.cm, 9 ~ 12 lb.ft)

4. Start and run the engine and check for engine oil leaks.
5. After turning off the engine, check the oil level and add oil as necessary.

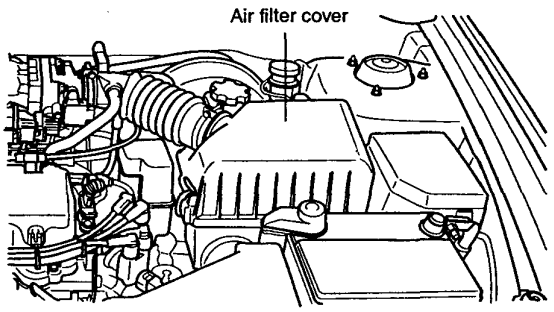


ECA9970B

REPLACING THE AIR CLEANER FILTER

The air cleaner filter will become dirty during use and the filtering efficiency will be substantially reduced. Replace with a new one as needed.

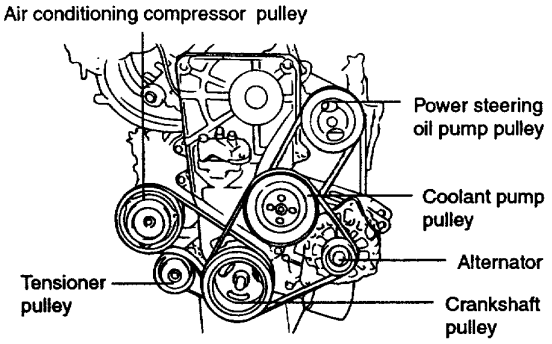
1. Disconnect the clip holding air cleaner filter cover.
2. Remove the air filter cover.
3. Remove the air cleaner filter.
4. Install a newair cleaner filter and replace the air cleaner filter cover.



EADC002C

ADJUSTING BELT TENSION

Refer to EM and EMA-Sections.



EAKA001B

COOLING SYSTEM

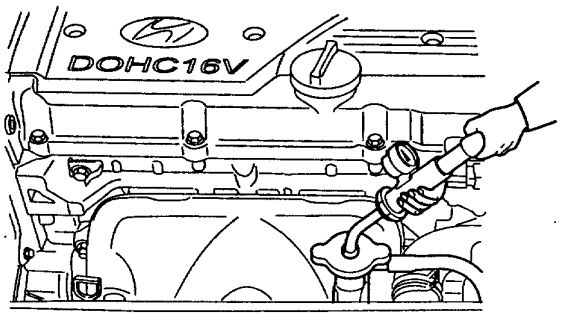
Check the cooling system for damaged hoses, loose or leaking connections, or other possible causes of coolant leaks.

ANTIFREEZE

The engine cooling system is provided with a mixture fo 50% ethylene glycol anti-freeze and 50% water (For the vehicles of tropical area, the engine cooling system is provided with a mixture of 40% ethylene glycol anti-freeze and 60% water at the time of manufacture.) Since the cylinder head and water pump body are made of aluminum alloy casting, be sure to use a 30 to 60% ethylene glycol antifreeze coolant to assure corrosion protection and freezing prevention.

⚠ ***CAUTION***

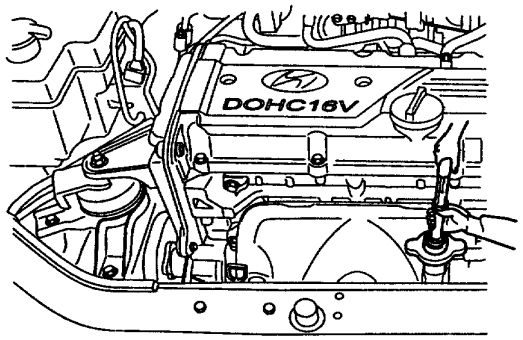
If the concentration of the antifreeze is below 30%, the anticorrosion property will be adversely affected. In additiom, if the concentration is above 60%, both the antifreeze and engine cooling properties will decrease,k adversely affecting the engine. For these reasons be sure to maintain the concentration level within the specified range.



KDPC001F

MEASURING OF ANTIFREEZE CONCENTRATION

Run the engine until the coolant is fully mixed. Drain some coolant (antifreeze), and then measure the temperature and specific gravity of the coolant. Determine it's concentration and safe working temperature. If the coolant is short of antifreeze, add antifreeze to a concentration of 50%. (Tropical Areas : 40%)



KDPC001E

REPLACING THE COOLANT

1. Set the temperature control lever to the hot position.
2. Remove the radiator cap.

⚠ ***CAUTION***

Remove the cap slowly. The system is pressurized and the coolant may be hot. Do not open the cap when the engine is hot.

3. Loosen the drain plug to drain the coolant.
4. Drain the coolant from the reserve tank.
5. After draining the coolant, tighten the drain plug securely.
6. Fill the radiator with the coolant up to its filler neck.
7. Fill the reserve tank with coolant to the MAX. line.
8. Warm up the engine until the thermostat opens, remove the radiator cap and check the coolant level.
9. When the radiator is filled up to its filler neck, install the radiator cap securely.
10. Fill the reserve tank with coolant up to the "FULL" line.

REPLACING IGNITION CABLES

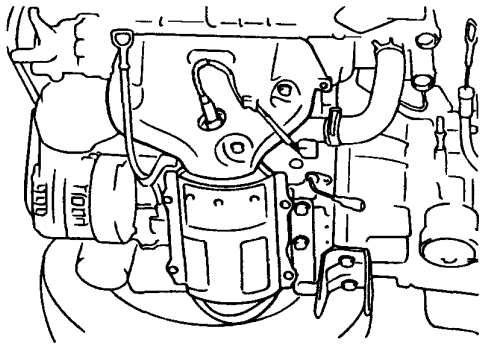
Ignition cables should be replaced periodically with new ones. After replacing, make sure that the ignition cables and terminals are properly connected and fully seated.

NOTE

When disconnecting an ignition cable, be sure to hold the cable cap. If the cable is disconnected by pulling on the cable alone, an open circuit might result.

REPLACING OXYGEN SENSOR

The oxygen sensor is a device which helps control the fuel mixture. If the oxygen sensor is damaged, the exhaust-gas cleaning efficiency as well as driveability deteriorate. Therfore, it should be replaced periodically with a new one.

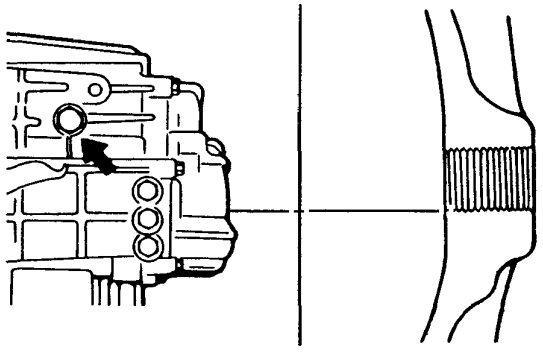


EAKA010E

MANUAL TRANSAXLE (INSPECT OIL LEVEL)

Inspect for leakage in each component and check the oil level by removing the filler plug. If the oil is contaminated, replace it with new oil.

1. With the vehicle parked on a level surface, remove the filler plug and make sure that the oil level is the same level as the plug hole.
2. Check that the transaxle oil is not dirty.



EAA9029A

TRANSAXLE OIL (REPLACE)

1. With the vehicle parked on a level surface, remove the magnetic plug to drain transaxle oil.
2. Replace the washer with a new one and reinstall the magnet plug.
3. Fill with transaxle oil (through the filler plug part) until the oil level is the same level as the plug hole.

INSPECTING STEERING LINKAGE

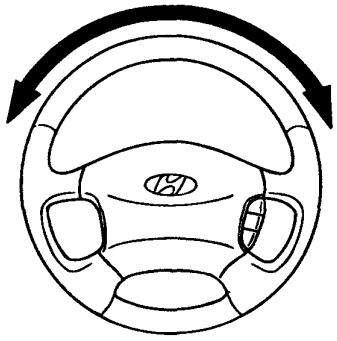
1. Check the steering wheel freeplay.

Maximum steering wheel freeplay : 30 mm (1.181 in.)

2. Check the steering linkage for looseness and damage.
   a. Tie rod ends must not have excessive play.
   b. Dust seals and boots must not be damaged.
   c. Boot clamps must be not loose.

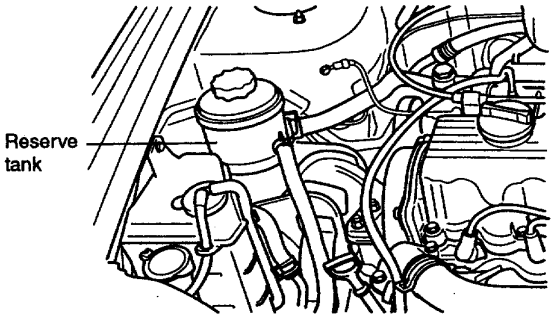
POWER STEERING FLUID LEVEL (INSPECT FLUID LEVEL)

1. Park the vehicle on a level surface, start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50°C (122°F).



ECHA062A

2. With the engine idling, turn the wheel all the way to the left and right several times. Check the fluid in the oil reservoir for foaming, and its level. Replenish the fluid in the oil reservoir through the oil filter if necessary.



EADC002D

POWER STEERING HOSES (CHECK FOR DETERIORATION OR LEAKS)

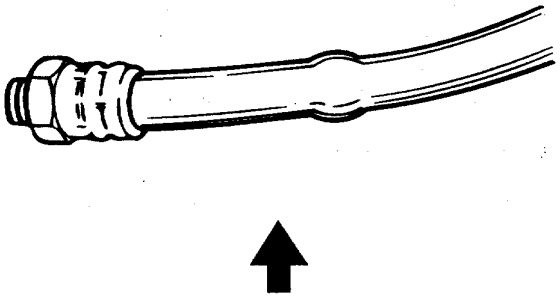
1. Check the hose connections for fluid leaks.
2. The power steering hoses should be replaced if there is severe surface cracking, pulling, scuffing or worn steps. Deterioration of the hoses could cause premature failure.

BALL JOINT AND STEERING LINKAGE SEALS, STEERING AND DRIVE SHAFT BOOTS

1. These components, which are permanently lubricated at the factory, do not require lubrication. Damaged seals and boots should be replaced to prevent leakage or contamination of the grease.
2. Inspect the dust covers and boots for proper sealing, leakage and damage. Replace them if defective.

INSPECTING BRAKE LINES

1. Check all brake lines and hoses for damage, wear, cracks, corrosion, leaks, bends, twists.
2. Check all clamps for tightness.
3. Check that the lines are clear of sharp edges, moving parts and the exhaust system.



EAA9033A

FRONT DISC BRAKE PADS

Check for fluid contamination and wear. Always replace brake pads in complete sets.

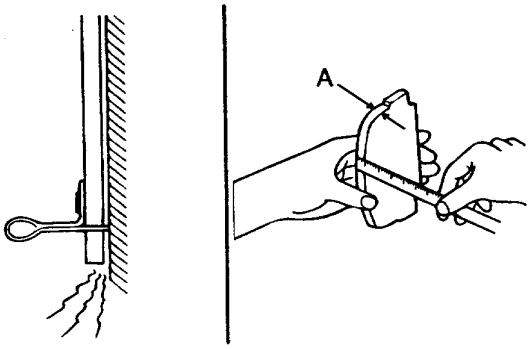
NOTE

If a squealing or scraping noise occurs from the brake during driving, check if the pad wear indicator is contacting the disc, if it is, the brake pad should be replaced.

CAUTION

The pads for the right and left wheels should be replaced at the same time. Never split or intermix brake pad sets. All pads must be replaced as a complete set.

Thickness of pad lining [limit] : 2.0mm (0.079 in.)



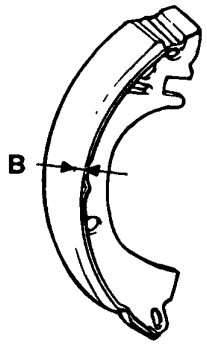
EAAC003A

REAR DRUM BRAKE LININGS AND REAR WHEEL CYLINDERS

1. Remove the brake drum and check the thickness of the brake shoe lining for wear. Check the automatic brake adjusting system by hand to see that it operates smoothly and gears are in proper mesh to each other. To assure smooth function, apply a very thin coat of grease to the friction surface of the adjuster and link shaft.
2. Inspect the wheel cylinder boots for fluid leaks. Visually check the boots for cuts, tears or heat cracks. (Asmall amount of fluid on the boot may not be a leak, but preservative fluid used at assembly.)

   Checking the brake shoes for wear.

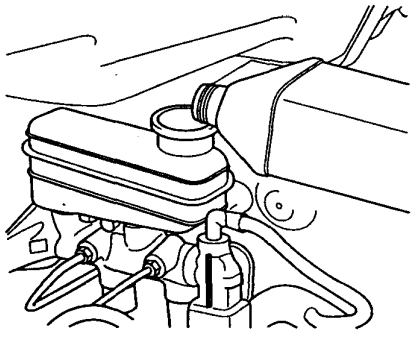
Thickness of lining [limit] : 0.8 mm (0.031 in.)



EAA9035A

CHECKING THE BRAKE FLUID LEVEL

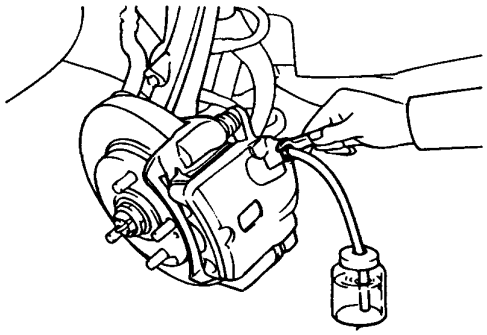
1. Check the level of the brake fluid in the reserve tank of the master cylinder.
2. The level should be between the "MAX" and "MIN" mark.
3. If the level is lower than the "MIN" mark, add fresh brake fluid up to the "MAX" mark.



KTBBR03A

CHANGING BRAKE FLUID

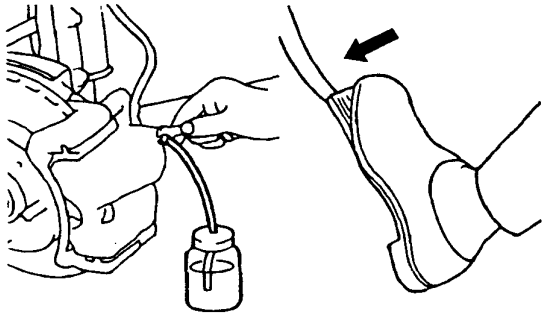
1. Refer to BR Section for air-bleeding procedures.
2. Connect a vinyl tube to the bleeder screw of each wheel cylinder. Put the other end of the vinyl tube in a vessel for receiving the brake fluid.
3. With a vehicle equipped with ABS (Anti-lock Brake System), refer to the BR-section.



EJKB007A

4. Depress the brake pedal a few times. Then loosen the bleeder screw (with the brake pedal still depressed), and tighten it after the brake fluid stops flowing.
5. Repeat the above operation until air bubbles are not in the brake fluid.
6. Repeat these steps for the other cylinders.
7. Add fresh brake fluid up to the "MAX" level in the reserve tank.

Brake fluid : DOT 3 or DOT 4



EAHA014B

CHECKING TIRE INFLATION PRESSURE

Check the tire inflation pressures as follows.

TIRE INFLATION PRESSURE (CHECK WITH TIRES COOL)

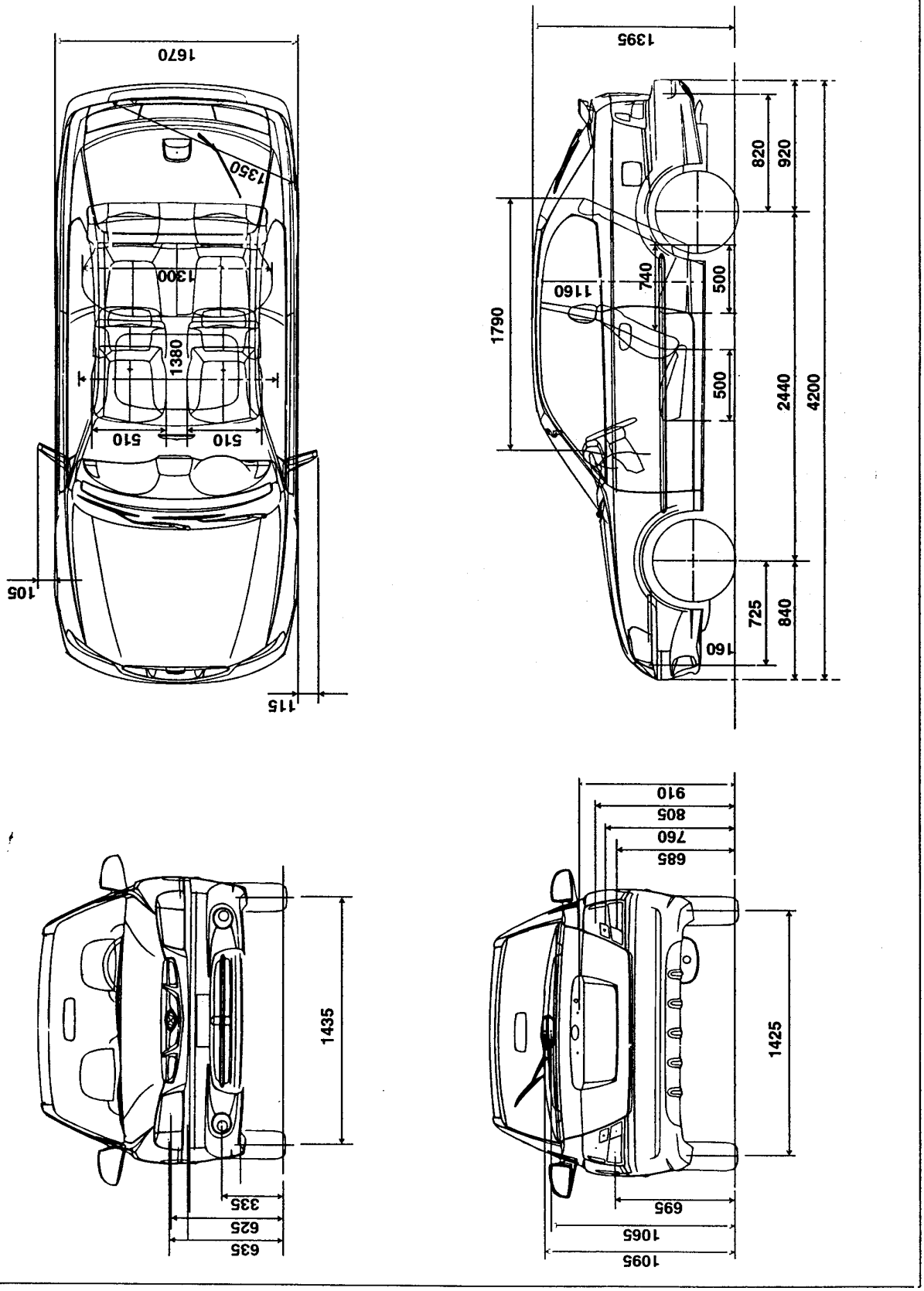
Tire Size	Tirepressure
175/70 R13	30 PSI
185/60 HR14	30 PSI
185/55 R 15	30 PSI

ROAD TEST

Drive the vehicle and check for abnormal conditions.

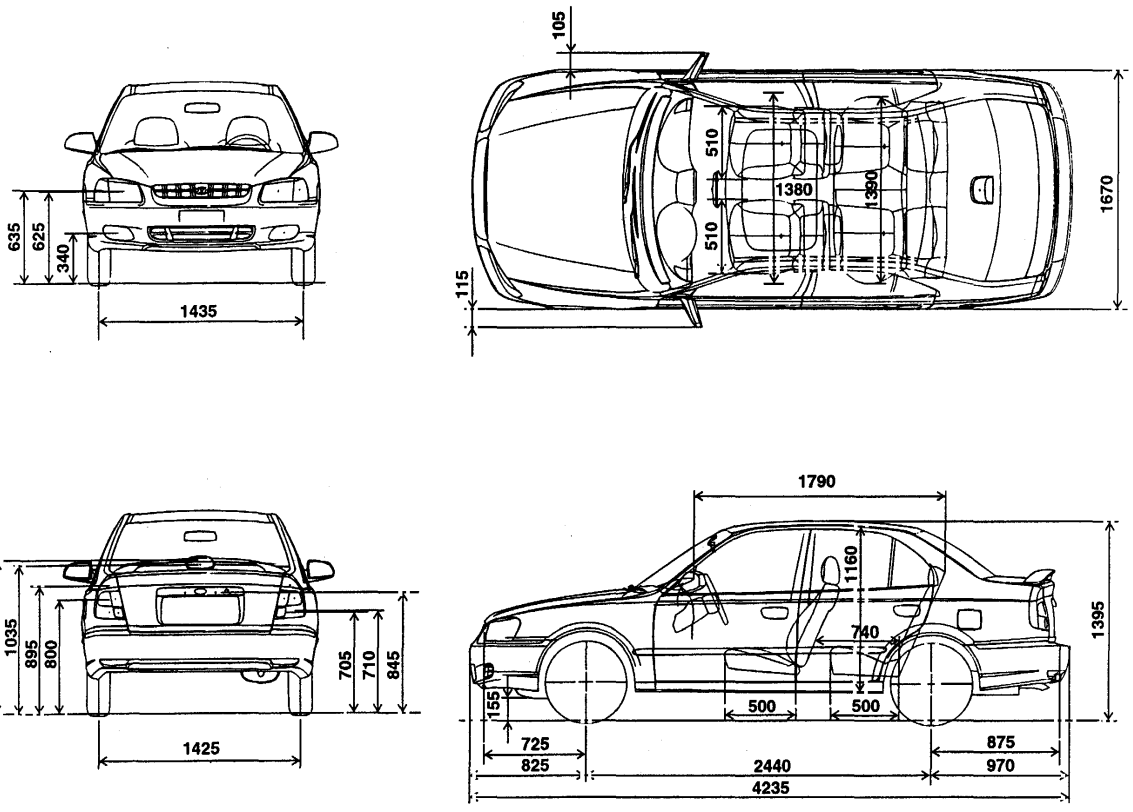
1. Check oil, fluid, fuel, water and exhaust gas leaks.
2. Check free play of clutch pedal and brake pedal.
3. Check the operation of brake booster.
4. Check the operation of service brake and parking brake systems.
5. Check the stroke of parking brake lever.
6. Check the driveability of engine.
7. Check the condition of instruments, gauges, indicators, exterior lamps, heater and ventilators.
8. Check for abnormal noises from each part.

OVERALL BODY DIMENSION EADD0090

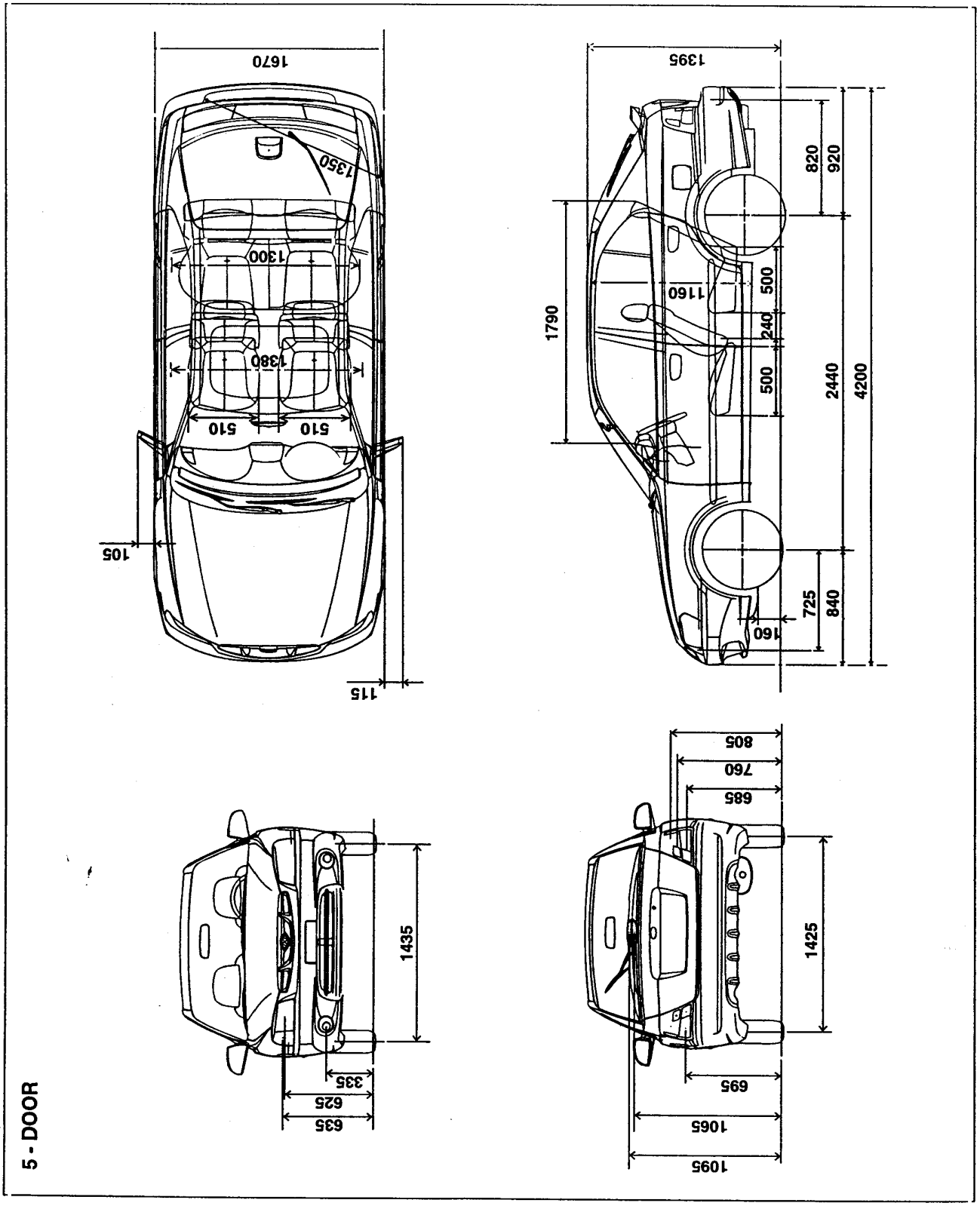


KADC101A

4 - DOOR



KA0C101B


1670
1350
1300
1380
510
510
105
115
1395
820
920
1790
1160
500
240
500
2440
4200
725
840
160
805
760
685
1435
335
625
635
1425
695
1065
1095
5 - DOOR

KADC101C

HARNESS LAYOUTS

AIR BAG HARNESS HL-4

CONTROL HARNESS HL-9

DOOR HARNESS HL-15

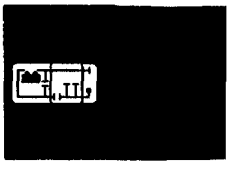
ENGINE HARNESS HL-6

INSTRUMENT HARNESS HL-8

MAIN HARNESS HL-2

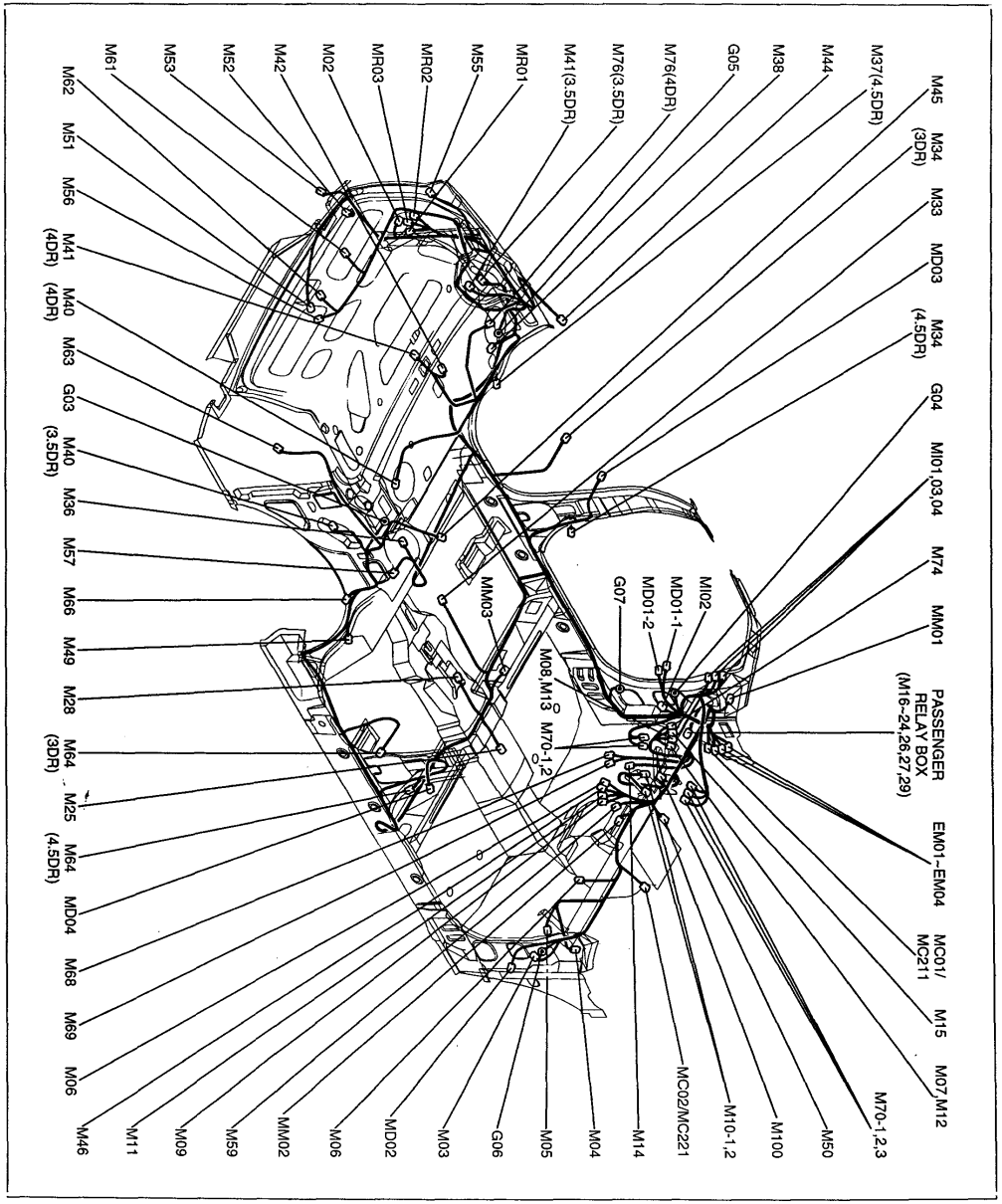
ROOF HARNESS HL-5

REAR (TAIL GATE) HARNESS HL-17



MAIN HARNESS EB3912E9

MAIN HARNESS (1)



E5DD001A

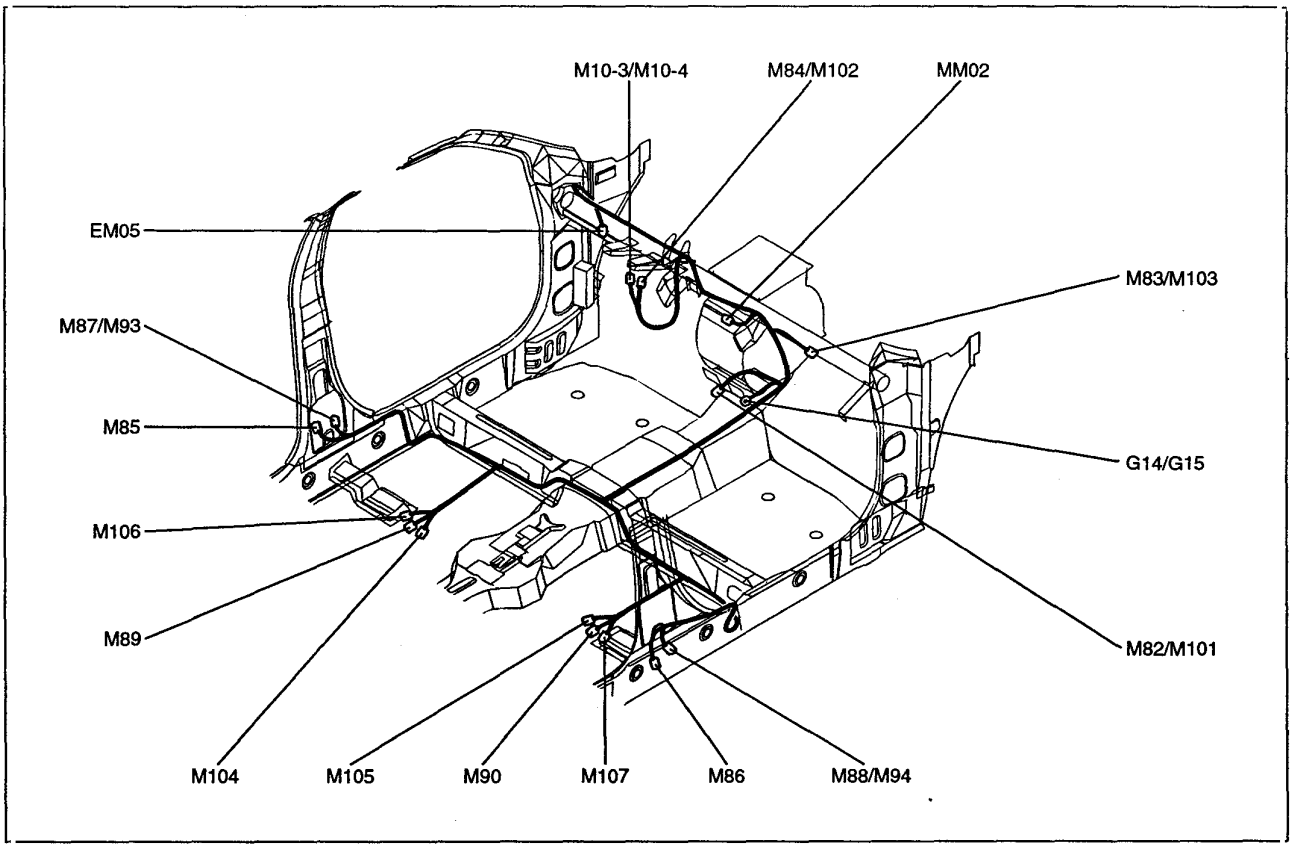
MAIN HARNESS (2)

M02	Power antenna
M03	A/T shift and key lock control module
M04	Blower resistor
M05	Blower motor
M06	Thermostatic switch (With thermistor)
M07	Chime bell
M08	Seat belt timer (W/O ETACS)
M09	Door warning switch
M10-1	Multifunction switch
M10-2	Multifunction switch
M11	Ignition switch
M12	Acoustic warning chime buzzer
M13	Defogger timer (W/O ETACS)
M14	Starter clutch pedal position switch (M/T)
M15	Front intermittent wiper timer (W/O ETACS)
M16	Head lamp relay
M18	Fuel pump relay
M19	Burglar alarm relay
M20	Rear fog lamp relay
M21	Flasher unit
M22	Power window relay
M24	Defogger relay (With ETACS)
M25	A/T shift lever
M26	Power door lock relay #1
M28	Parking brake switch
M29	Power door lock relay #2
M31	Joint connector
M33	Seat belt switch
M34	Left front door switch
M36	Fuel sender & fuel pump motor
M36-1	Fuel sender & fuel pump motor (Diesel)
M36-2	Fuel sender & fuel pump motor (Carburetor)
M37	Left rear door switch
M38	Left rear wheel sensor
M39	Left rear speaker (4 Door)
M40	Right rear speaker (4 Door)
M41	Trunk room lamp
M42	High-mounted stop lamp (4 Door)
M44	Rear window defogger (+) (4 Door)
M45	Rear window defogger (-) (4 Door)
M46	A/T key interlock solenoid
M49	Right rear door switch
M50	Stop lamp switch(Except Diesel)
M50-1	Stop lamp switch (Diesel)
M51	Trunk room lamp switch (4 Door)
M53	Rear fog lamp
M55	Left rear combination lamp
M56	Trunk key switch (4 Door)
M57	Fuel tank ground
M59	SMATRA (smart transponder antenna)
M60	Ignition key ill & Door warning switch
M61	Left license lamp (4 Door)
M62	Right license lamp (4 Door)
M63	Right rear combination lamp
M64	Right front door switch
M66	Right rear wheel sensor
M68	Data link connector
M69	Multipurpose check connector (With ETACS)
M70-1	ETACM
M70-2	ETACM
M71-1	Instrument cluster
M71-2	Instrument cluster
M74	Rear intermittent wiper relay
M76	Left rear speaker (3.5 Door)
M77	Right rear speaker (3.5 Door)
EM01	Connection with ENGINE harness
EM02	Connection with ENGINE harness
EM03	Connection with ENGINE harness
EM04	Connection with ENGINE harness
MC01	Connection with CONTROL harness (Except Diesel)
MC02	Connection with CONTROL harness (Except Diesel)
MC211	Connection with CONTROL harness (Diesel)
MC221	Connection with CONTROL harness (Diesel)
MD01-1	Connection with LH FRONT DOOR harness
MD01-2	Connection with LH FRONT DOOR harness
MD02	Connection with RH FRONT DOOR harness
MD03	Connection with LH REAR DOOR harness
MD04	Connection with RH REAR DOOR harness
MI01	Connection with INSTRUMENT harness
MI02	Connection with INSTRUMENT harness
MI03	Connection with INSTRUMENT harness
MI04	Connection with INSTRUMENT harness
MM01	Connection with ROOF harness
MM02	Connection with AIR BAG harness
MM03	Connection with SEAT WARMER EXT. harness
MR01	Connection with TAIL GATE harness (3.5 Door)
MR02	Connection with TAIL GATE harness (3.5 Door)
G03	Ground
G04	Ground
G05	Ground
G06	Ground
G07	Ground
Z01	Diode
Z02	Diode
Z03	Diode

SEAT WARMER EXT.

M95	Left front seat warmer switch
M96	Right front seat warmer switch
M97	Left front seat warmer
M98	Right front seat warmer
MM03	Connection with MAIN harness

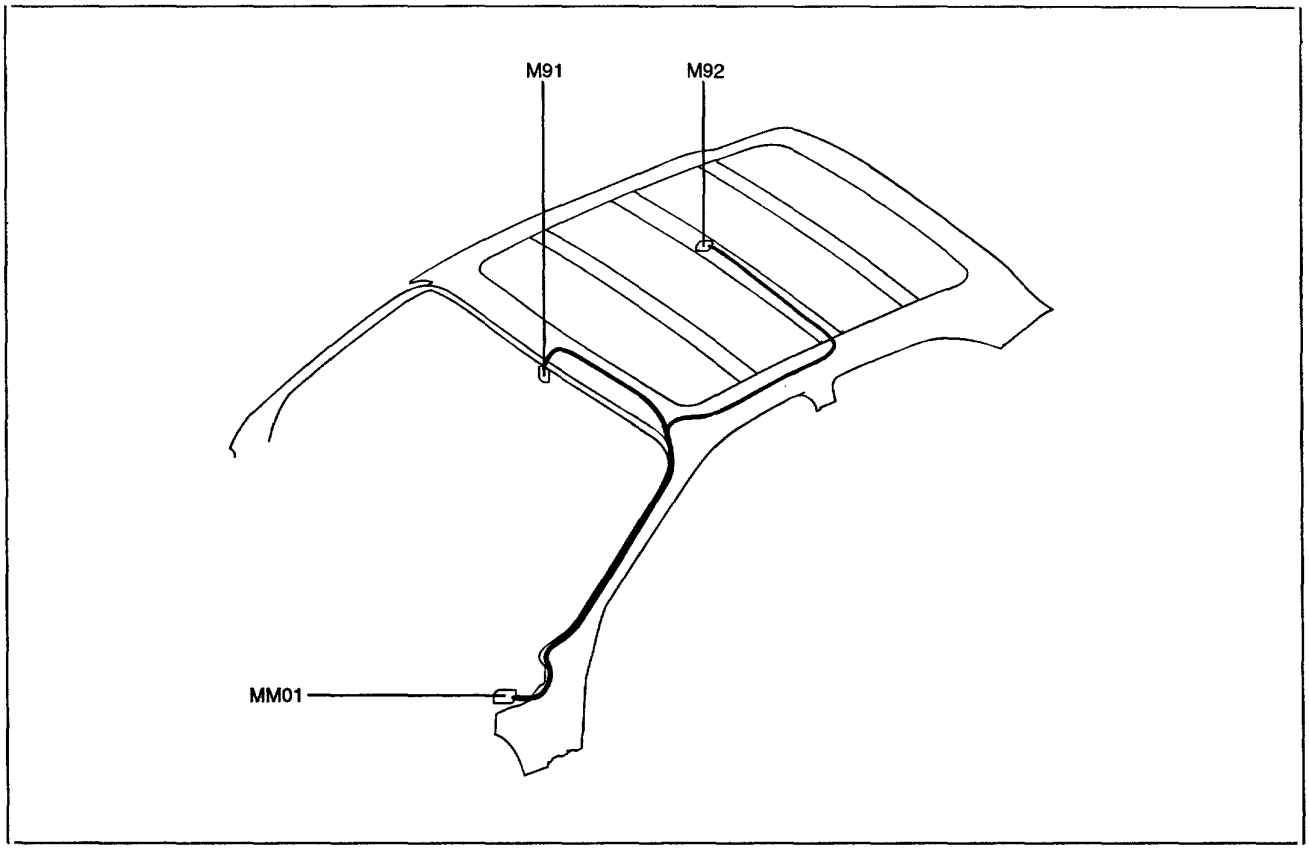
MAIN HARNESS (AIR BAG) (3)



E5DD001B

M10-3	Multifunction switch	M103	Passenger air bag (Dual-stage)
M10-4	Multifunction switch (Dual-stage)	M104	Driver seat belt buckle switch (Dual-stage)
M82	SRS control module	M105	Passenger seat belt buckle switch (Dual-stage)
M83	Passenger air bag	M106	Driver seat track position sensor (Dual-stage)
M84	Driver air bag	M107	Passenger seat track position sensor (Dual-stage)
M85	Driver seat belt pretensioner	EM05	Connection with ENGINE harness (Dual-stage)
M86	Passenger seat belt pretensioner	MM02	Connection with MAIN harness
M87	Driver satellite sensor	G14	Ground
M88	Passenger satellite sensor	G15	Ground (Dual-stage)
M89	Driver side air bag		
M90	Passenger side air bag		
M101	SRS control module (Dual-stage)		
M102	Driver air bag (Dual-stage)		

MAIN HARNESS (ROOF) (4)

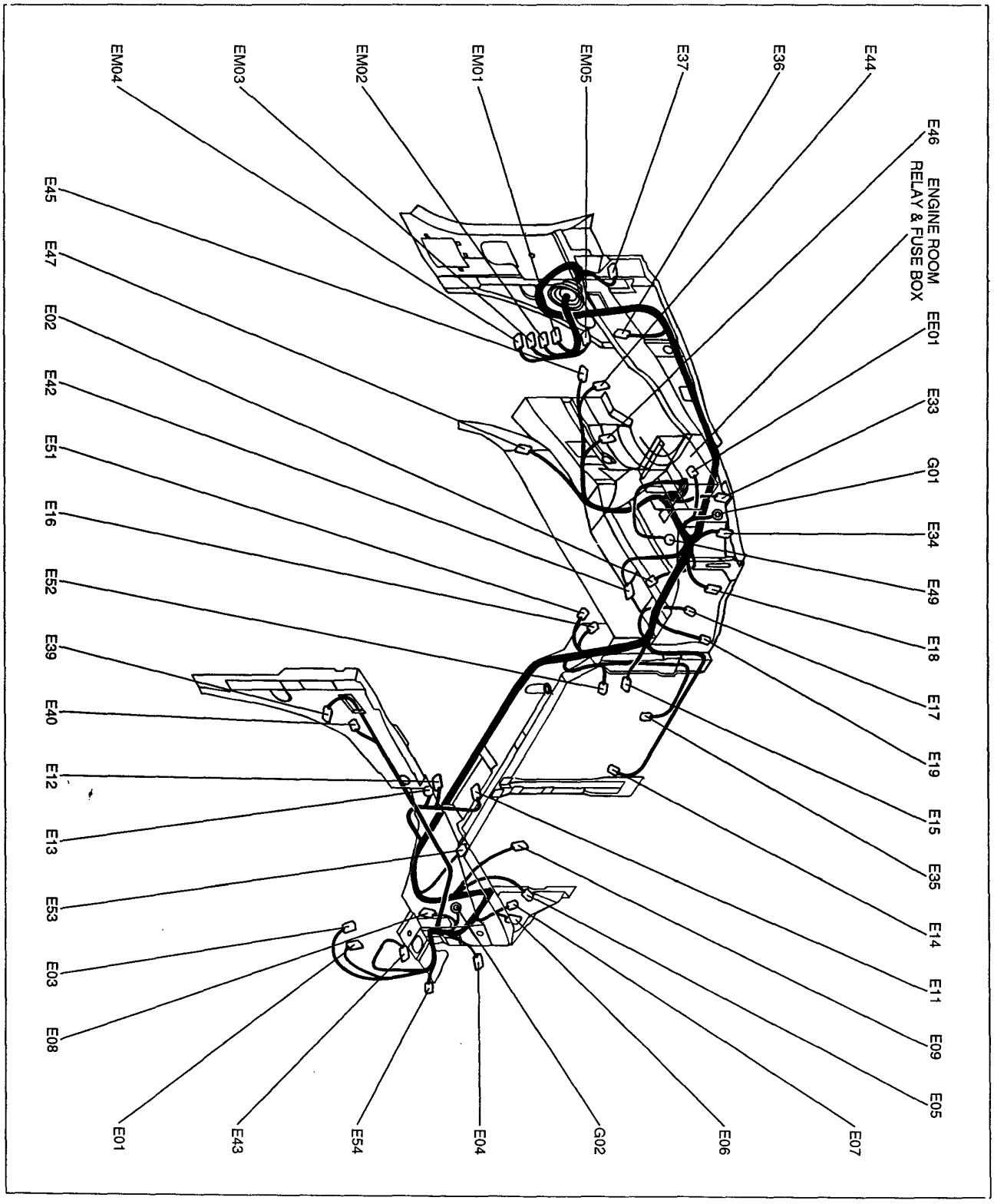


E5DD001C

M91	Courtesy lamp (With sunroof)	MM01	Connection with MAIN harness
M92	Courtesy lamp (W/O sunroof)		

ENGINE HARNESS EE3BF01B

ENGINE HARNESS (1)



E5DD002A

ENGINE HARNESS (2)

E01	Washer motor
E02	Ambient sensor (With Trip)
E03	Head lamp washer motor
E04	Right turn signal lamp
E05	Right position lamp
E06	Right head lamp
E07	Right head lamp leveling actuator
E08	Triple pressure switch
E09	Condenser fan motor
E11	Engine coolant temperature sender (Carburetor)
E12	Generator (L, S) (Except Diesel)
E12-1	Generator (L, S) (Diesel)
E13	Generator (B+) (Except Diesel)
E13-1	Generator (B+) (Diesel)
E14	High horn
E15	Radiator fan motor
E15-1	Radiator fan motor (Carburetor)
E16	Head lamp washer relay
E17	Left head lamp leveling acturator
E18	Left head lamp
E19	Left position lamp
E20	Pre-excitation resistor
E21	Fuel pump relay
E22	Front wiper relay (With ETACS)
E23	Blower relay
E24	Condenser fan relay #2
E25	Front fog lamp relay
E26	Radiator fan relay
E27	Start relay
E28	A/C relay
E29	Horn relay
E30	Tail lamp relay
E31	Condenser fan relay #1
E33	DRL control module
E34	Left turn signal lamp
E35	Low horn
E36	Left front wheel sensor
E37	Left side repeater lamp
E38	A/C compressor (Diesel)
E39	Right side repeater lamp
E40	Right front wheel sensor
E42	Left front fog lamp
E43	Right front fog lamp
E44	Hood switch
E45	Burglar alarm horn
E46	ABS bleeding connector
E47	ABS control module
E48	Joint connector
E49	Battery terminal
E50	Fuel pump check connector
E51	DRL resistor
E52	Driver front impact sensor (Dual-stage)
E53	Passenger front impact sensor (Dual-stage)
EC01	Connection with CONTROL harness (Except Diesel)
EC201	Connection with CONTROL harness (Diesel)
EE01	Connection with BATTERY CABLE harness (Except Diesel)
EE02	Connection with BATTERY CABLE harness (Diesel)
EM01	Connection with MAIN harness
EM02	Connection with MAIN harness
EM03	Connection with MAIN harness
EM04	Connection with MAIN harness
EM05	Connection with AIR BAG harness (Dual-stage)
G01	Ground
G02	Ground
Z04	Diode

BATTERY CABLE HARNESS (EXCEPT DIESEL)

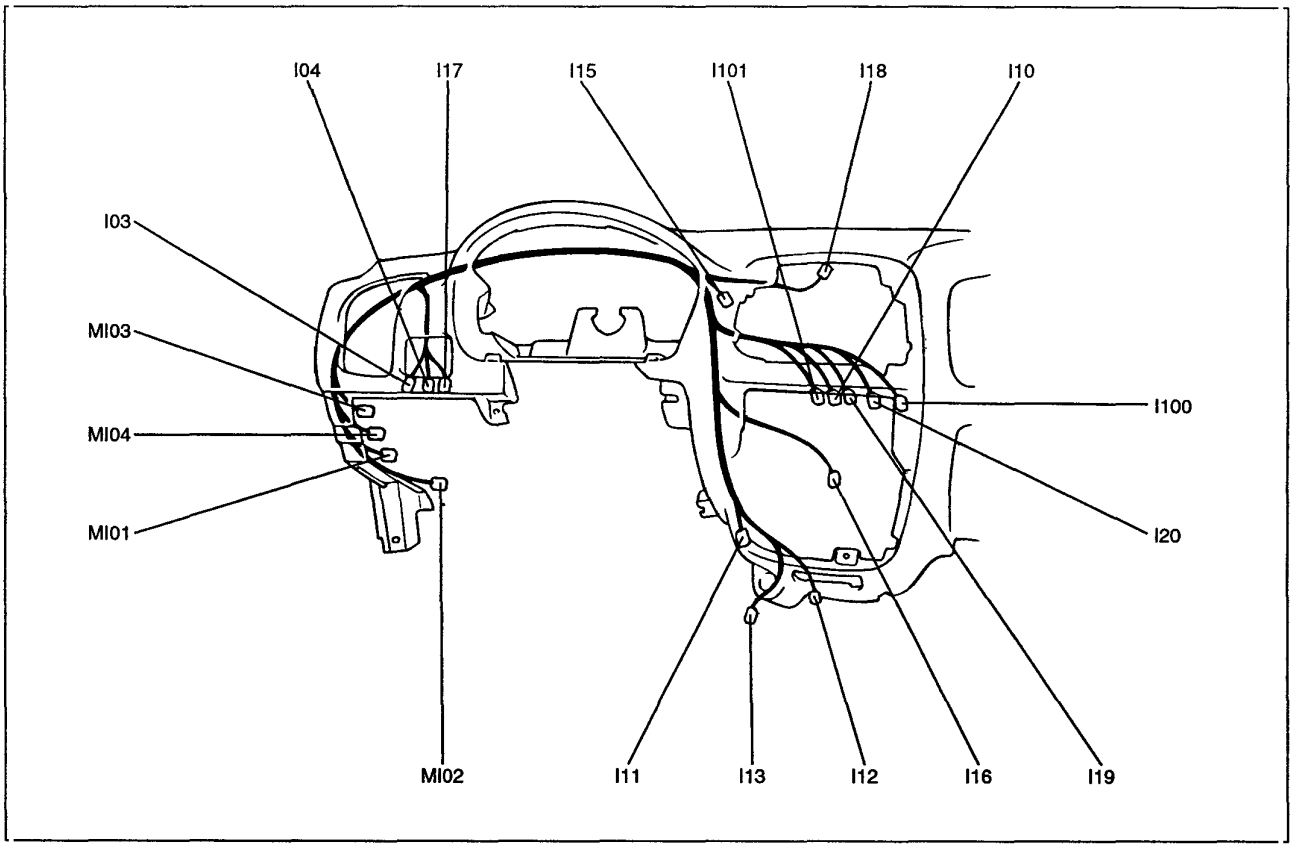
E32-1	Start motor (B+)
E32-2	Start motor solenoid (ST)
EE01	Connection with ENGINE harness

BATTERY CABLE HARNESS (DIESEL)

E54-1	Start motor (B+)
E54-2	Start motor solenoid (ST)
EE02	Connection with ENGINE harness

INSTRUMENT HARNESS E5502A56

INSTRUMENT HARNESS (1)

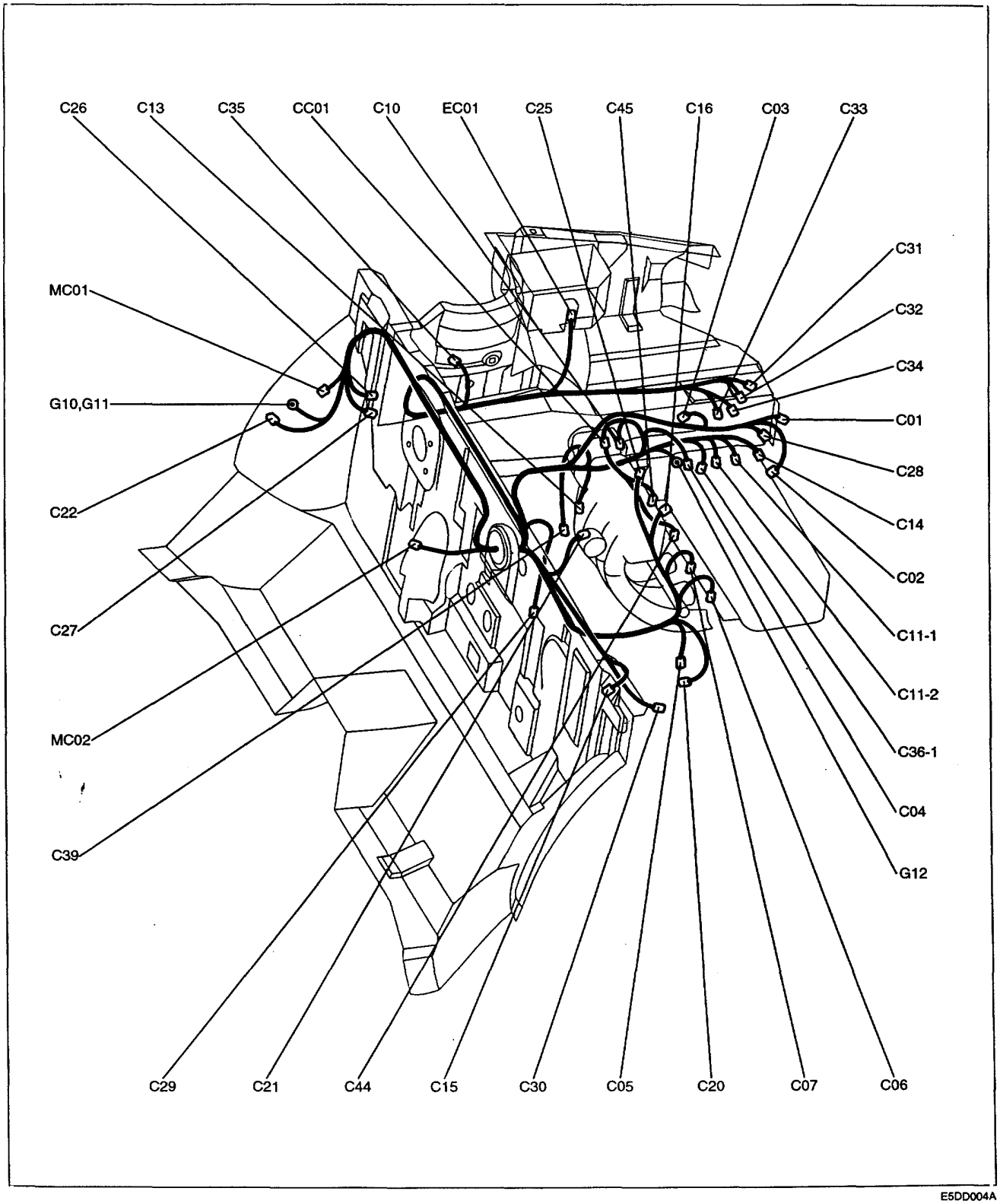


E5DD003A

I01	Rear fog lamp switch	I16	Audio
I02	Head lamp washer switch	I17	Rear wiper & Washer switch (3,5 Door)
I03	Rheostat	I18	Digital clock
I04	Head lamp leveling switch	I19	Hazard switch
I06-1	RDS Audio (EEC)	I20	Front fog lamp switch
I06-2	RDS Audio (EEC)	MI01	Connection with MAIN harness
I10	Defogger switch	MI02	Connection with MAIN harness
I11	Cigarette lighter	MI03	Connection with MAIN harness
I12	Blower switch	MI04	Connection with MAIN harness
I13	A/C switch	Z06	Diode
I15	Joint connector		

CONTROL HARNESS EC6BE138

CONTROL HARNESS (DOHC) (1)



E5DD004A

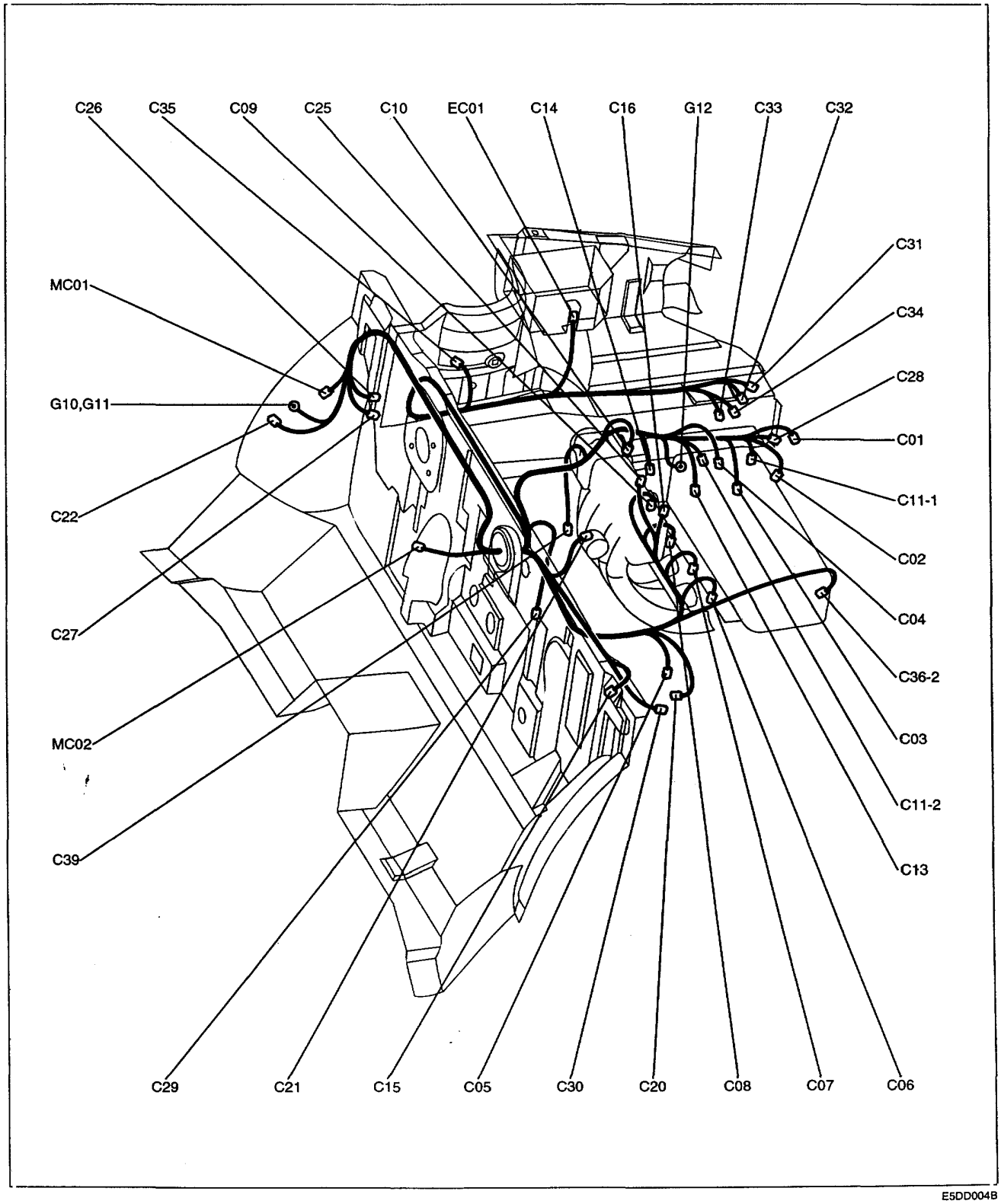
CONTROL HARNESS (DOHC) (2)

C01	Crankshaft position (CKP) sensor
C02	Oil pressure switch
C03	Back-up lamp switch (M/T)
C04	Camshaft position (CMP) sensor
C05	A/C compressor
C06	Injector #1
C07	Injector #2
C10	Throttle position sensor
C11-1	Ignition coil #1
C11-2	Ignition coil #2
C13	Kick down switch (A/T)
C14	Condenser
C15	Front wiper motor
C16	Manifold absolute pressure (MAP) sensor
C20	Knock sensor
C21	Purge control valve
C22	Engine control relay
C25	Idle speed actuator (ISA)
C26	ECM
C27	ECM
C28	Oxygen sensor (UP)
C29	Oxygen sensor (DOWN) (EOBD)
C30	Acceleration sensor (EOBD)
C31	A/T solenoid valve
C32	Oil temperature sensor
C33	A/T pulse generator
C34	Transaxle range switch
C35	Brake fluid level sensor
C36-1	Engine coolant temperature sensor & sender
C39	Vehicle speed sensor
CC01	Connection with INJECTOR harness
EC01	Connection with ENGINE harness
MC01	Connection with MAIN harness
MC02	Connection with MAIN harness
G10	Ground
G11	Ground
G12	Ground

INJECTION HARNESS

C44	Injector #3
C45	Injector #4
CC01	Connection with CONTROL harness

CONTROL HARNESS (SOHC) (3)

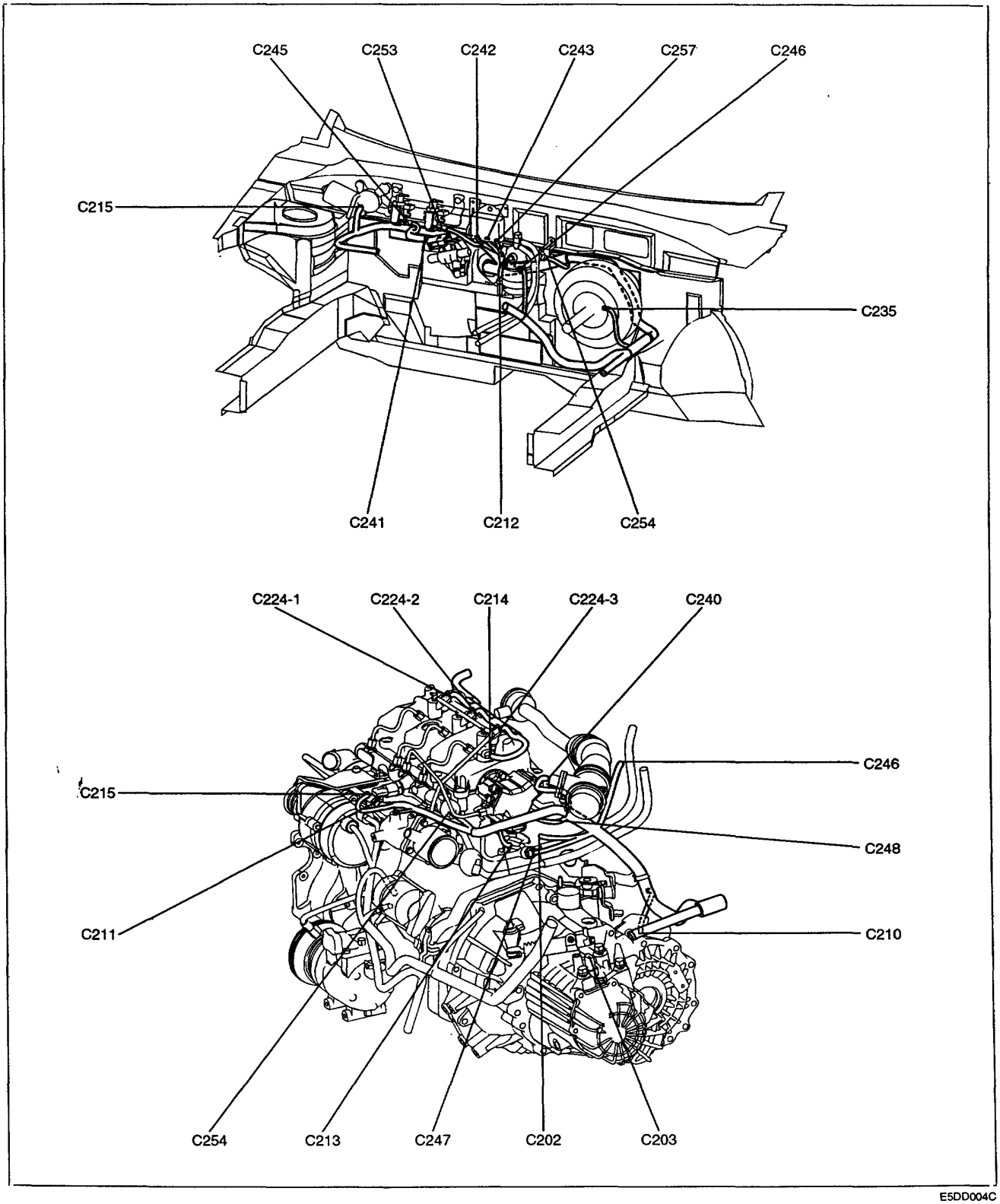


E5DD004B

CONTROL HARNESS (SOHC) (4)

C01	Crankshaft position (CKP) sensor
C02	Oil pressure switch
C03	Back-up lamp switch (M/T)
C04	Camshaft position (CMP) sensor
C05	A/C compressor
C06	Injector #1
C07	Injector #2
C08	Injector #3
C09	Injector #4
C10	Throttle position sensor
C11-1	Ignition coil #1
C11-2	Ignition coil #2
C13	Kick down switch (A/T)
C14	Condenser
C15	Front wiper motor
C16	Manifold absolute pressure (MAP) sensor
C20	Knock sensor
C21	Purge control valve
C22	Engine control relay
C25	Idle speed actuator (ISA)
C26	ECM
C27	ECM
C28	Oxygen sensor (UP)
C29	Oxygen sensor (DOWN) (EOBD)
C30	Acceleration sensor (EOBD)
C31	A/T solenoid valve
C32	Oil temperature sensor
C33	A/T pulse generator
C34	Transaxle range switch
C35	Brake fluid level sensor
C36-2	Engine coolant temperature sensor & sender
C39	Vehicle speed sensor
EC01	Connection with ENGINE harness
MC01	Connection with MAIN harness
MC02	Connection with MAIN harness
G10	Ground
G11	Ground
G12	Ground

CONTROL HARNESS (DIESEL) (5)



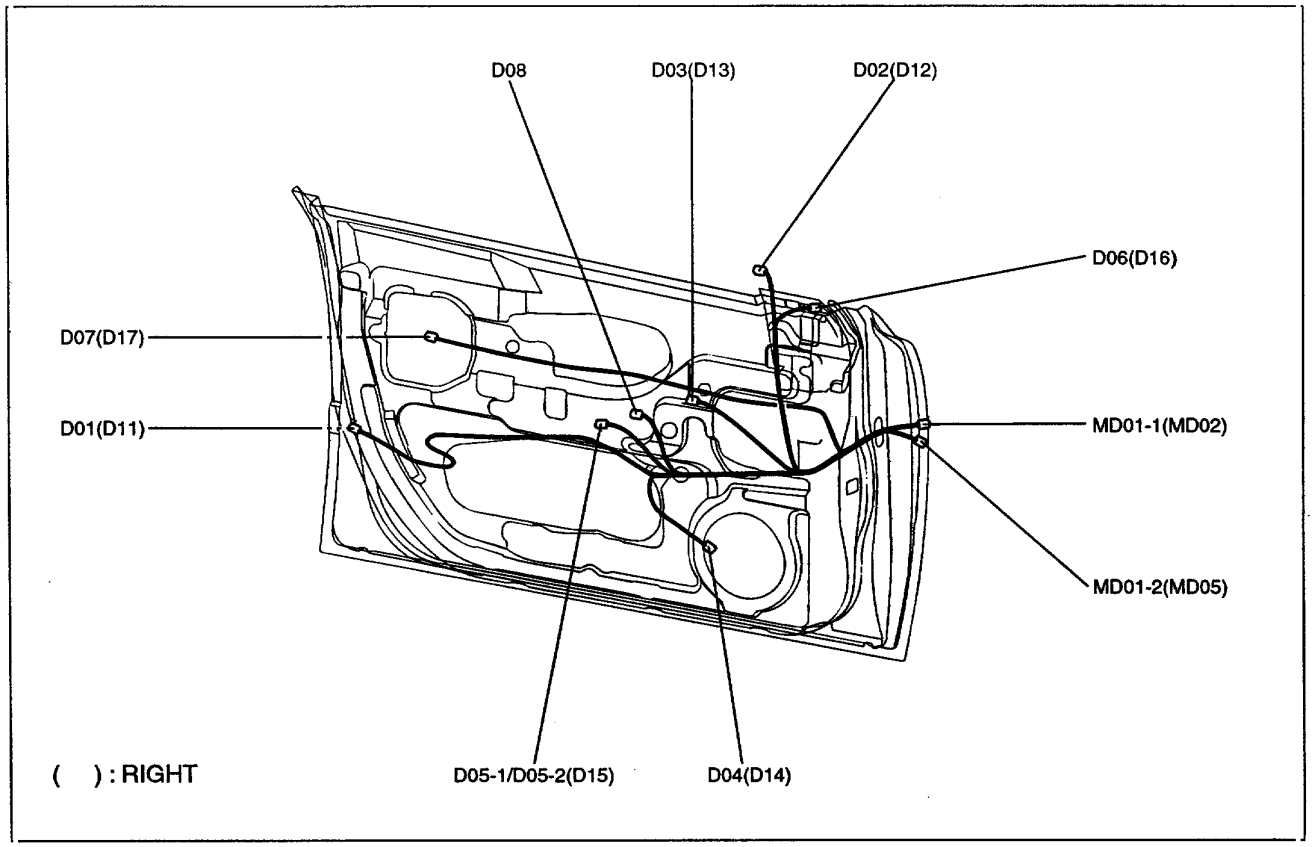
E5DD004C

CONTROL HARNESS (DIESEL) (6)

C202	Oil pressure switch
C203	Back-up lamp switch (M/T)
C208	Accel position sensor
C210	Vehicle speed sensor
C211	ECT sensor & sender
C213	Crankshaft position sensor
C214	Camshaft position sensor
C215	Front wiper motor
C224-1	Injector #1
C224-2	Injector #2
C224-3	Injector #3
C233-1	ECM
C233-2	ECM
C235	Brake oil level sensor
C240	Mass air flow sensor
C241	Heater assembly
C242	Heater relay #1
C243	Heater relay #2
C245	EGR actuator
C246	Fuel filter heater
C247	Fuel temperature sensor
C248	Glow plug
C249	Glow plug relay
C251	Thermo switch
C252	Water sensor
C253	Throttle plate actuator
C254	Rail pressure regulator
C256	Rail pressure sensor
C257	Fuel filter relay
C259	Engine control relay
EC201	Connection with ENGINE harness
MC211	Connection with MAIN harness
MC221	Connection with MAIN harness
G29	Ground

DOOR HARNESS E3DE1F75

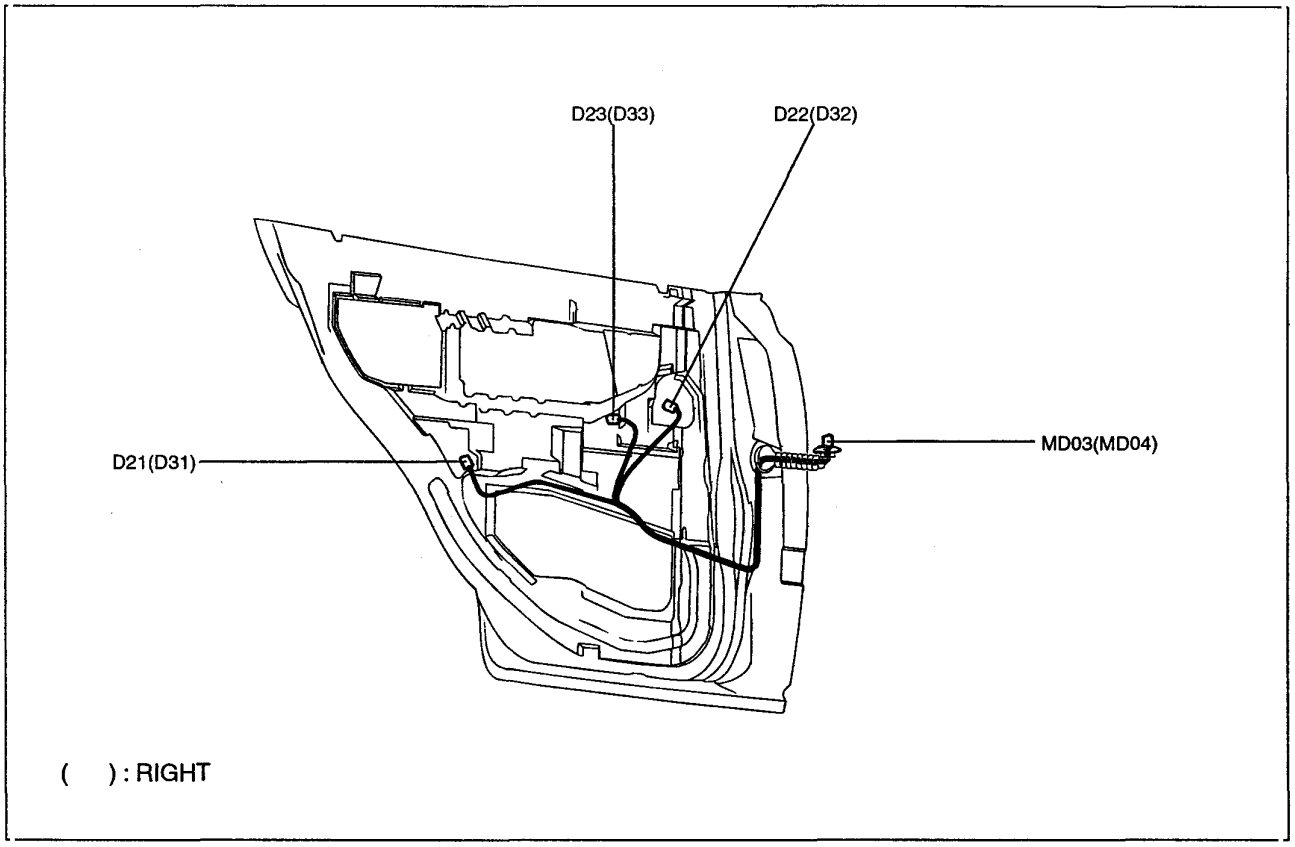
DOOR HARNESS (FRONT) (1)



E5DD005A

D01	Left front door lock actuator	D05-1	Left front power window switch (FR+RR)
D11	Right front door lock actuator	D05-2	Left front power window switch (FR)
D02	Left power outside mirror motor & Defogger	D15	Right front power window switch
D12	Right power outside mirror motor & Defogger	D06	Left tweeter speaker
D03	Left front power window motor	D16	Right tweeter speaker
D13	Right front power window motor	D08	Power outside mirror switch
D04	Left front speaker	MD01-1	Connection with LH MAIN harness
D14	Right front speaker	MD01-2	Connection with LH MAIN harness
		MD02	Connection with RH MAIN harness

DOOR HARNESS (REAR) (2)

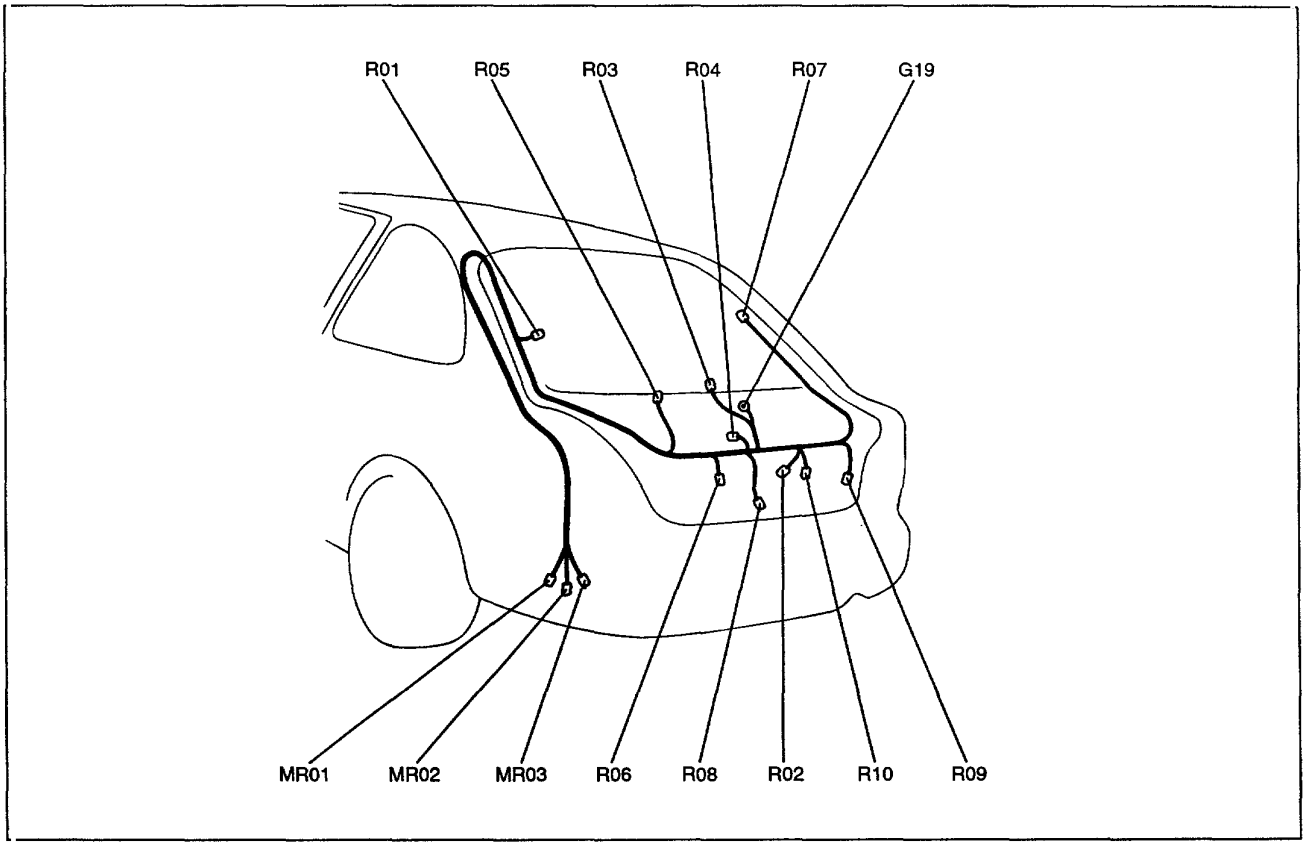


E5DD0005B

D21	Left rear door lock actuator	D23	Left rear power window switch
D31	Right rear door lock actuator	D33	Right rear power window switch
D22	Left rear power window motor	MD03	Connection with MAIN harness
D32	Right rear power window motor	MD04	Connection with MAIN harness

REAR HARNESS EDF9FDB1

REAR HARNESS (TAIL GATE) (1)



E5DD006A

R01	Rear window defogger (+)	R07	Rear window defogger (-)
R02	Right license lamp	R08	Tail gate switch
R03	High-mounted stop lamp (Glass)	MR01	Connection with MAIN harness
R04	High-mounted stop lamp (Spoiler)	MR02	Connection with MAIN harness
R05	Rear wiper motor	G19	Ground
R06	Left license lamp		

MEMO

Heating, Ventilation and Air Conditioning

GENERAL
- SPECIFICATIONS ..... HA -2
- SPECIAL TOOLS ..... HA -3
- TROUBLESHOOTING ..... HA -4

AIR CONDITIONING SYSTEM
- GENERAL ..... HA -6
- DIAGNOSIS ..... HA -12
- REFRIGERATION CYCLE ..... HA -15

A/C COMPRESSOR CONTROLS(MANUAL)
- CONDENSER
  - COMPONENTS ..... HA -16
  - REMOVAL ..... HA -17
  - INSTALLATION ..... HA -17
  - INSPECTION ..... HA -17
- TRIPLE PRESSURE SWITCH
  - OPERATION ..... HA -18
- COMPRESSOR
  - COMPONENTS ..... HA -19
  - REMOVAL ..... HA -22
  - DISASSEMBLY ..... HA -22
  - REASSEMBLY ..... HA -24
  - INSTALLATION ..... HA -26
  - OPERATION ..... HA -28

HEATER
- HEATER UNIT
  - COMPONENTS ..... HA -29
  - REMOVAL ..... HA -30
  - DISASSEMBLY AND REASSEMBLY.. HA -31
  - INSTALLATION ..... HA -31
- DUCT
  - COMPONENTS ..... HA -32

EVAPORATOR
- EVAPORATOR UNIT
  - COMPONENTS ..... HA -33
  - REMOVAL ..... HA -34
  - DISASSEMBLY AND REASSEMBLY.. HA -35
  - INSTALLATION ..... HA -35
- A/C AIR FILTER
  - REPLACEMENT ..... HA -36

BLOWER CONTROLS
- BLOWER UNIT
  - COMPONENTS ..... HA -37
  - REMOVAL ..... HA -38
  - DISASSEMBLY AND REASSEMBLY.. HA -39
  - INSTALLATION ..... HA -39
- BLOWER MOTOR
  - INSPECTION ..... HA -40
- BLOWER RESISTOR
  - INSPECTION ..... HA -41

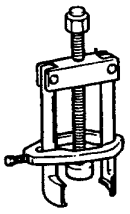
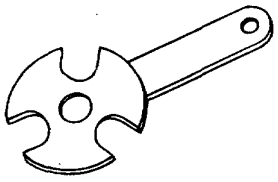
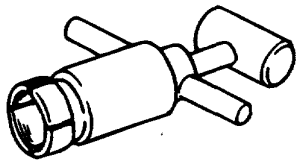
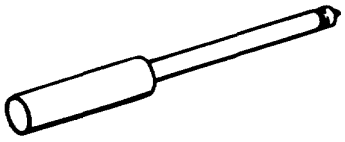
BLOWER AND A/C CONTROLS(MANUAL)
- SCHEMATIC DIAGRAM ..... HA -42
- CONTROL PANEL
  - COMPONENTS ..... HA -45
  - REMOVAL AND INSTALLATION ..... HA -47
  - DISASSEMBLY AND REASSEMBLY.. HA -47

GENERAL

SPECIFICATIONS K3125E7E

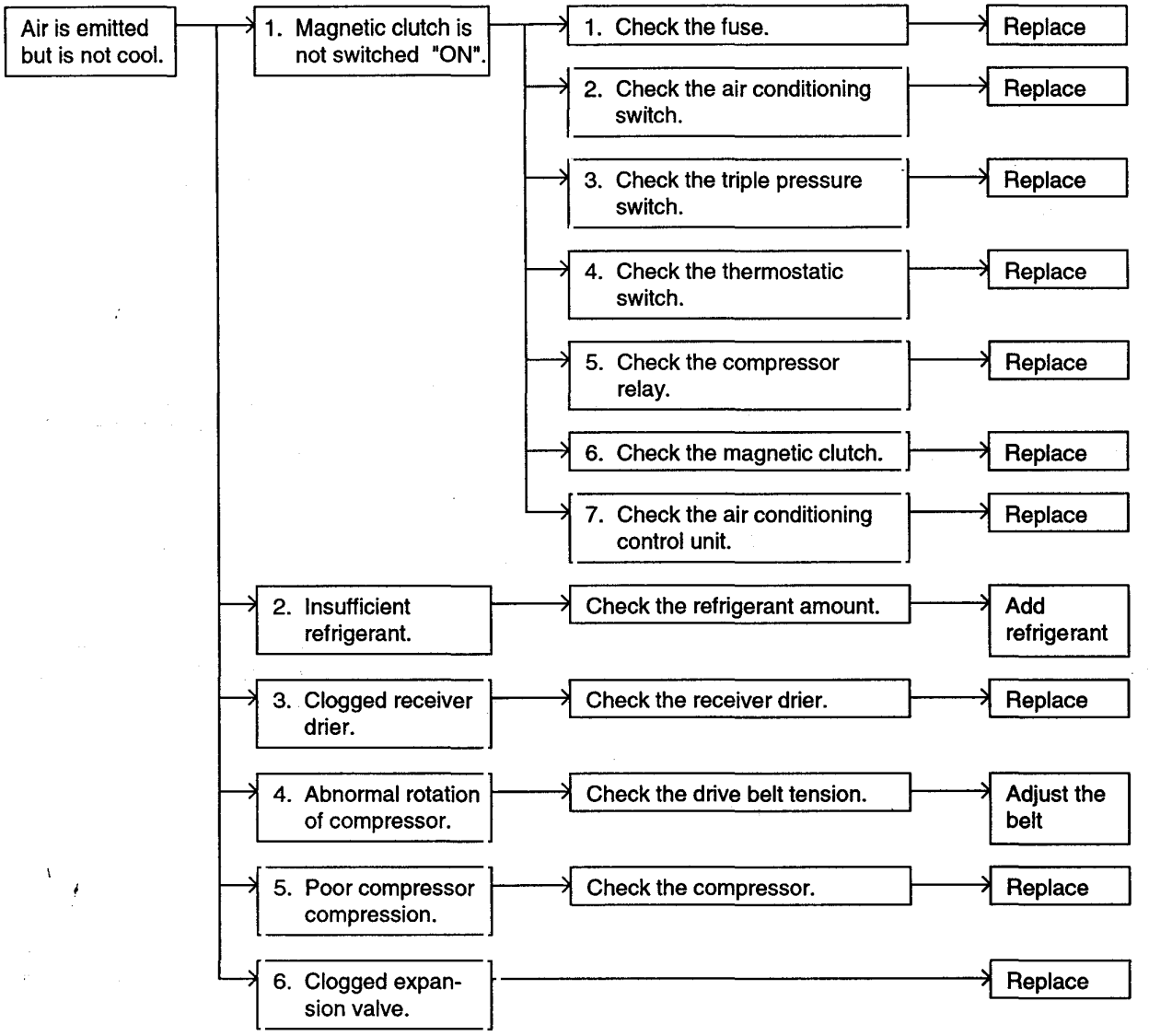
Item		Specification
Heater	Type	Air mix type
	Capacity (Kcal/h)	4,500 ± 10%
Air conditioning	**Evaporator** - Cooling capacity (Kcal/h) - Working pressure	 4,100 ± 10% 35~42.2kgf/cm² (Min. 28.1kgf/cm²)
	Compressor - Type - Oil capacity - Piston displacement	 Swash plate (HS-15) FD 46XG (PAG) 180±10cc 154cc/rev
	Condenser - Heat capacity	 A/T : 11,800 ± 5% Kcal/h M/T : 9,400 ± 5% Kcal/h
	Magnetic clutch - Voltage & wattage - Torque	 D.C 12.8, Max 54W 4.4 kg·m
	Refrigerant & capacity	R-134a (550±25g) DSL : 600±25g
	Triple pressure switch	**High pressure** - OFF 32kgf/cm² - ON 26kgf/cm²
		Middle pressure - OFF 14kgf/cm² - ON 18kgf/cm²
		Low pressure - OFF 2.0kgf/cm² - ON 2.25kgf/cm²
	Thermostat	OFF 1.5 ± 0.6°C ON 3.0 ± 0.6°C
Heater control assembly		Rotary Cable Type

SPECIAL TOOLS K975FD75

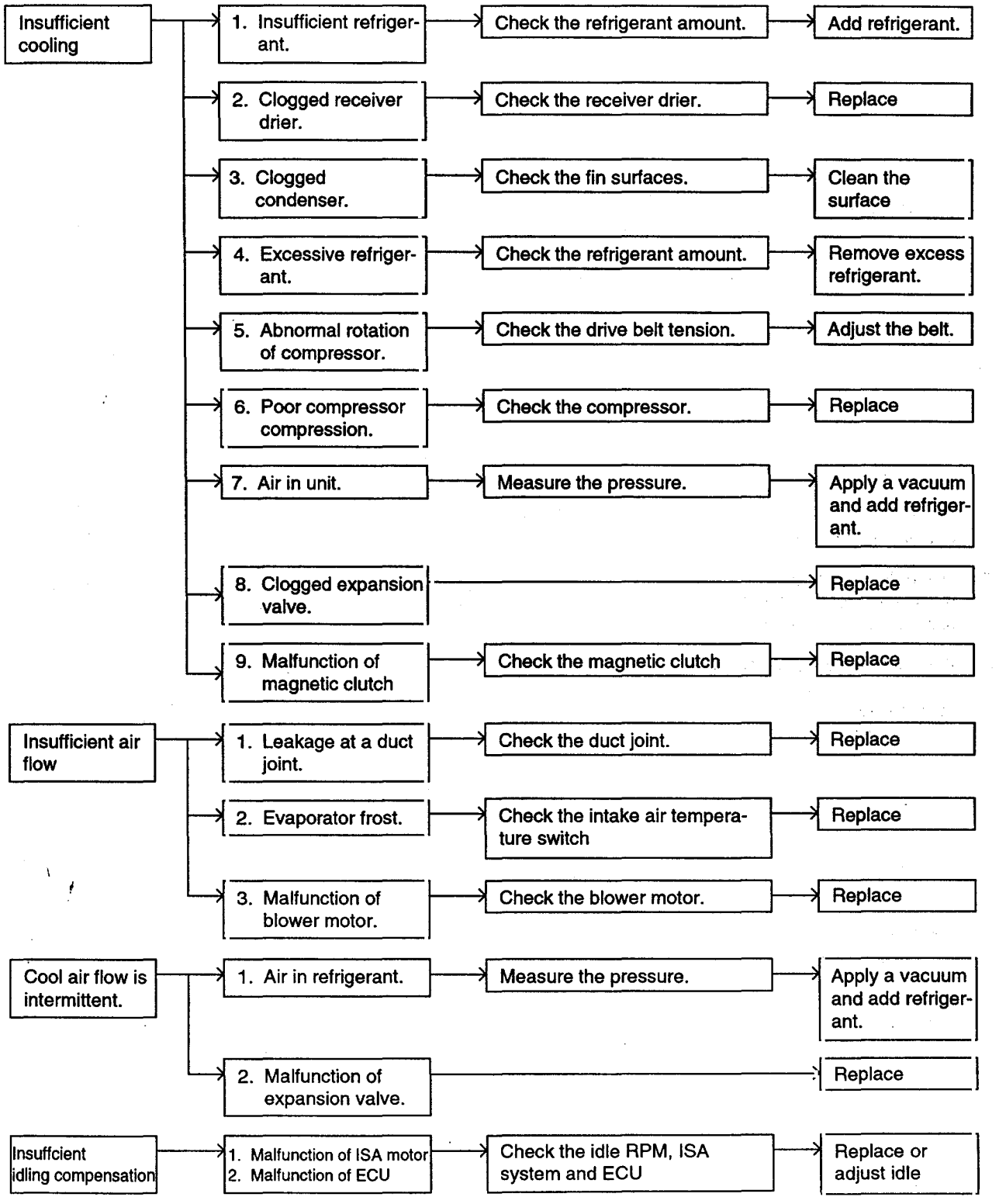
Tool (Number and name)	Illustration	Use
09455-34000 Bearing and gear puller	 EQA9002B	Removal of field coil
09977-34000 Pressure plate bolt remover	 EQDA002A	Removal of pressure plate
09977-33700 Shaft seal remover and installer	 EQDA002B	Removal and installation of shaft seal
09977-33800 Snap ring remover	 EQDA002C	Removal of snap ring

TROUBLESHOOTING KE0EA9BE

The following diagnostic charts have been developed as a quick reference for determining the cause of the malfunction.



EQHA010A


Insufficient cooling
1. Insufficient refrigerant.
Check the refrigerant amount.
Add refrigerant.
2. Clogged receiver drier.
Check the receiver drier.
Replace
3. Clogged condenser.
Check the fin surfaces.
Clean the surface
4. Excessive refrigerant.
Check the refrigerant amount.
Remove excess refrigerant.
5. Abnormal rotation of compressor.
Check the drive belt tension.
Adjust the belt.
6. Poor compressor compression.
Check the compressor.
Replace
7. Air in unit.
Measure the pressure.
Apply a vacuum and add refrigerant.
8. Clogged expansion valve.
Replace
9. Malfunction of magnetic clutch
Check the magnetic clutch
Replace
Insufficient air flow
1. Leakage at a duct joint.
Check the duct joint.
Replace
2. Evaporator frost.
Check the intake air temperature switch
Replace
3. Malfunction of blower motor.
Check the blower motor.
Replace
Cool air flow is intermittent.
1. Air in refrigerant.
Measure the pressure.
Apply a vacuum and add refrigerant.
2. Malfunction of expansion valve.
Replace
Insuffcient idling compensation
1. Malfunction of ISA motor
2. Malfunction of ECU
Check the idle RPM, ISA system and ECU
Replace or adjust idle

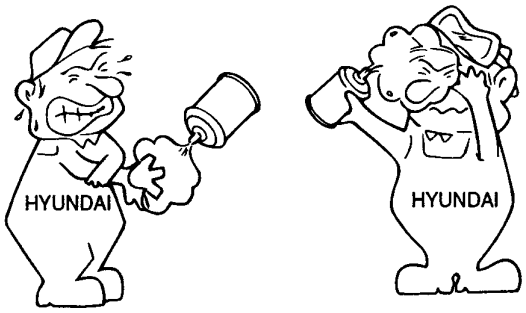
EQPD010B

AIR CONDITIONING SYSTEM

GENERAL KF0B5EF4

WHEN HANDLING REFRIGERANT

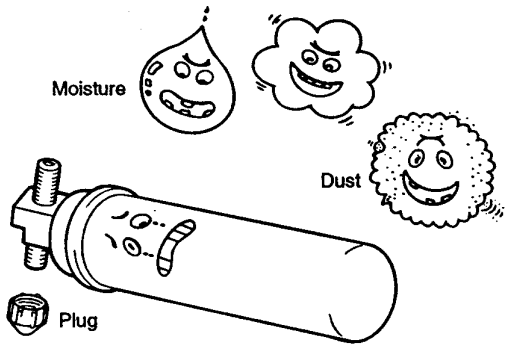
1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52°C (126°F).
4. A electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended the lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed :
   - When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   - When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   - Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   - Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.



EQDA010A

WHEN REPLACING PARTS ON A/C SYSTEM

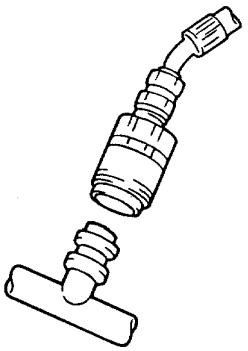
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to preventintrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



EQDA010B

WHEN INSTALLING CONNECTING PARTS

1. BOLT/NUT COUPLING TYPE
   1) Lubricate each connecting parts with compressor oil so as to tighten them easily, enough to prevent refrigerant leaks.
   2) Use two wrenches not to twist the tube.
   3) Tighten them to the specified torque.



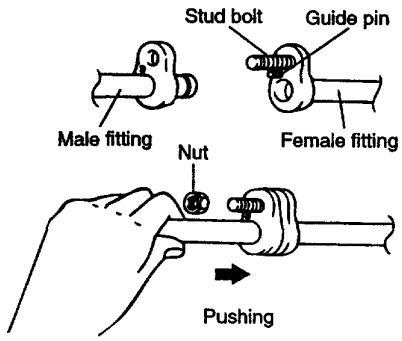
KQDA012A

2. FLANGE WITH GUIDE PIN TYPE

1) Check the O-ring for missing and damage, then lubricate it with compressor oil.

2) Push the pipe as shown in the illustration and tighten the nub by hand.

3) Tighten the nut to the specified torque.



EQDA010C

COMPRESSOR OIL

The oil used to lubricate the compressor circulates in the system while the compressor is operating. Whenever replacing any component of the system or when a large amount of gas leakage occurs, add oil to maintain the original total amount of oil.

Single : 170~190cc

1. HANDLING OF OIL

1) The oil should be free from moisture, dust, metal filings, etc.

2) Do not mix oils.

3) The moisture content in the oil increases when exposed to air for prolonged periods. After use, seal the container immediately.

2. OIL RETURN OPERATION
To check the oil level or add oil, idle engine for 20~30 minutes and setting the heater control set to maximum cooling and blower level, to return the lubricant to compressor.

3. CHECKING AND ADDING COMPRESSOR OIL
In order to add oil to an operating compressor, check the compressor oil using the following procedure:

1) Perform the oil return operation, stop the engine, discharge the refrigerant, and dismantle the compressor from vehicle.

2) Discharge oil from the system line outlet.

NOTE

If compressor is cold, sometimes it can be hard to drain the oil. Warm up the compressor (approx. 40~50°C) to drain the oil.

3) Check the amount of the discharged oil. If it is less than 70cc, it means there is a little leak of oil. Perform the leakage test on each system connection, and repair or replace faulty parts if necessary.

4) Check oil for contamination and set the oil level in the following procedure:

WHEN OIL IS CLEAN

Discharge	Setting
Above 70cc	Oil level is normal, add equal amount of discharged oil.
Below 70cc	Oil level is low, add 70cc of oil.

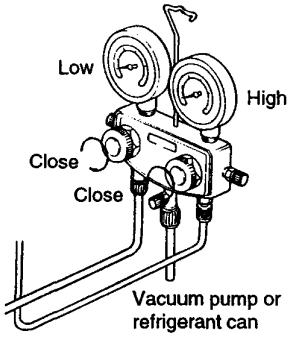
INSTALLATION OF MANIFOLD GAUGE SET

CAUTION

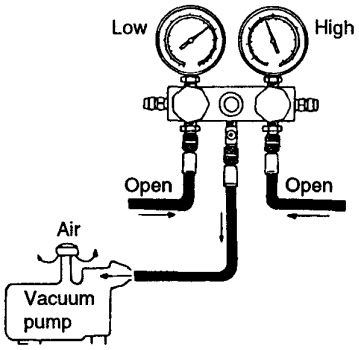
When connecting the manifold gauge set, be sure to observe all safety precautions.

1. Close both hand valves of the manifold gauge fittings.

2. Install the charging hoses of the gauge set to the fittings. Connect the low-pressure hose to the low-pressure service port, and the high-pressure hose to the high-pressure service port. Tighten the hose nuts by hand.



EQHA030A



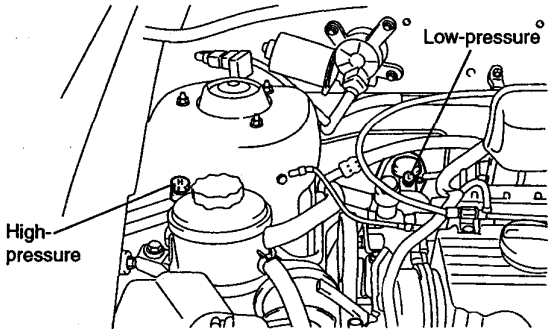
EQDA013A

NOTE

When charging the refrigerant, do it after removing the engine cover and the air intake hose.

REFRIGERANT DISCHARGING PROCEDURE

1. Connect the manifold gauge set to the system.



EQDD012A

2. Put a towel under the open end of the center hose.
3. Open the high pressure valve slowly to discharge the refrigerant.

NOTE

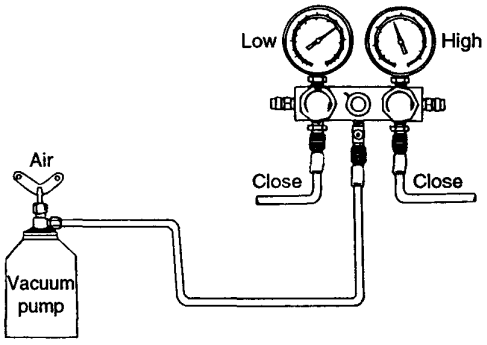
If discharging the refrigerant too fast, compressor oil may drain from the system.

4. Check if the towel is stained with oil. If so, gently close the valve.
5. If the manifold gauge reading drops below 3.5kg·cm², open the low pressure valve slowly.
6. Open the high and low pressure valves slowly in order to drop the system pressureuntil the gauge indicates 0kg·cm².

EVACUATING REFRIGERANT

NOTE

It is necessary to evacuate the air conditioning system any time the system has been opened. Evacuation is necessary to rid the system of all air and moisture that may have been allowed to enter the unit. After installation of a component, the system should be evacuated for approximately 15 minutes. A component in service that has been opened for repair should be evacuated for 30 minutes.



EQDA014A

1. Engine should be off.
2. Connect a manifold gauge set to the compressor gauge fittings. Close both high and low pressure valves.
3. Make sure the refrigerant has been discharged from the system.
4. Connect the center hose of the gauge set to the vacuum pump inlet.
5. Start the vacuum pump and then open the high and low manifold pressure valves.
6. After about ten minutes, check that the low pressure gauge reads more than 94,39 kPa (0.96 kg·cm², 13.7 psi) of vacuum. If negative pressure can not be obtained, there is a leak in the system. In this case, repair the leak as follows:

1) Close both manifold valves and stop the vacuum pump.

2) Charge the system with a can of refrigerant [about 0.4 kg (0.9 lb)]. Refer to Charging Refrigerant.

3) Check for refrigerant leakage with a leak detector. Repair any leakage found. Refer to Checking Refrigerant Leak.

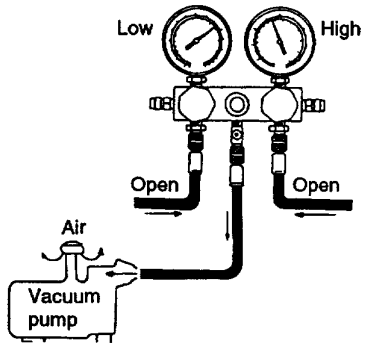
4) Discharge refrigerant again, and then evacuate the system. If no leaks are found, continue evacuating the system.

7. Start the vacuum pump.

8. Open both manifold pressure valves to obtain 94.39 kPa (0.96 kg·cm², 13.7 psi) of vacuum.

9. After the low pressure manifold gauge indicates close to 94.39 kPa (0.96 kg·cm², 13.7 psi), continue evacuating for 15 minutes.

10. After evacuating for 15 minutes, close both manifold pressure valves and stop the vacuum pump. Disconnect the hose from the vacuum pump. The system is now ready for charging.



EQDA013A

HANDLING THE REFRIGERANT SERVICE TAP VALVE

1. Before connecting the valve to the refrigerant container, turn the handle fully counterclockwise.

2. Turn the disc counterclockwise until it reaches its highest position.

3. Connect the center hose to the valve fitting. Turn the disc fully clockwise by hand.

4. Turn the handle clockwise to make a hole in the sealed top.

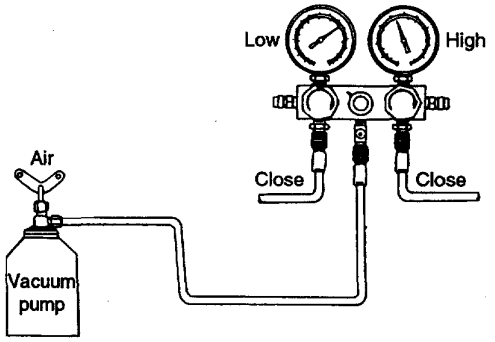
5. Loosen the center hose nut connected to the center fitting of the manifold gauge.

6. Allow air to escape for a few seconds, and then tighten the nut.

CHARGING REFRIGERANT SYSTEM (VAPOR)

NOTE

This step is to charge the system through the low pressure side with the refrigerant in a vapor state. When the refrigerant container is placed upright, refrigerant will enter the system as a vapor.



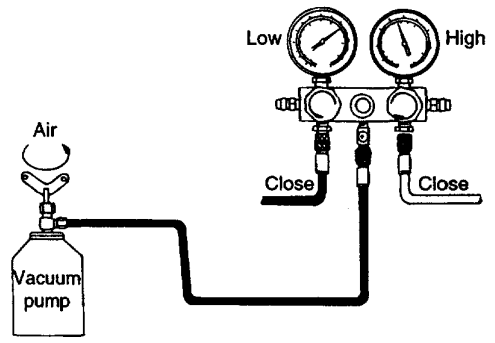
EQDA014A

1. Install the refrigerant can tap valve as described in Handling the Refrigerant Tap Valve section.

2. Open the low pressure valve. Adjust the valve so that the low pressure gauge does not read over 412 kPa (4.2 kg·cm², 60 psi).

3. Put the refrigerant in a pan of warm water (about 40°C or 104°F) to keep vapor pressure in the container slightly higher than vapor pressure in the system.

4. Run the engine at fast idle and operate the air conditioning.



EQDA014B

NOTE

Be sure to keep the container upright to prevent liquid refrigerant from being charged into the system through the suction side, resulting in possible damage to the compressor.

5. Charge the system to the specified amount. Then close the low pressure valve.

Specified amount : 550±25g

6. When refrigerant charging speed is slow, immerse the refrigerant can in heated water. (a temperature of approx. 40°C (104°F)).

WARNING

- **Under any circumstances, the refrigerant must not be warmed in water heated to a temperature of over 52°C (126°F).**
- **A blow torch or stove must never be used to warm up the can.**

CHARGING THE REFRIGERANT SYSTEM (LIQUID)

NOTE

This step is to charge an empty system through the high pressure side with refrigerant in a liquid state. When the refrigerant container is held upside down, refrigerant will enter the system as a liquid.

CAUTION

Never run the engine when charging the system through the high pressure side. Do not open the low pressure valve when the system is being charged with liquid refrigerant.

1. Close both high and low pressure valves completely after the system is evacuated.
2. Install the refrigerant can tap valve as described in "Handling the Refrigerant Service Tap Valve" section.
3. Open the high pressure valve fully and keep the container upside down.
4. Charge the system to the specified amount by weighing the refrigerant with a scale. Overcharging will cause discharge pressure (high side) to rise. Then, close the high pressure valve.

Specified amount : 550±25g

5. After the specified amount of refrigerant has been charged into the system, close the manifold gauge valve.
6. Confirm that there are no leaks in the system by checking with a leak detector. Refer to Checking for Refrigerant Leak.

NOTE

Conducting a performance test prior to removing the manifold gauge is good service practice.

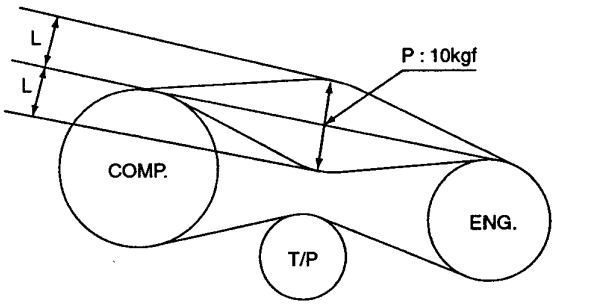
CHECKING FOR REFRIGERANT LEAKS

Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector.
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.

AMOUNT OF DEFLECTION OF BELT

Item	Deflection L (mm)
New one	5~5.5
Used one	6~7
After driving	8

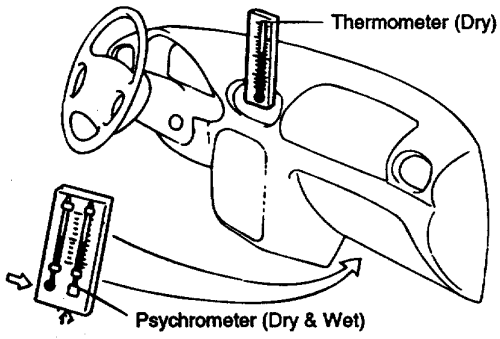


EQDD019B

PERFORMANCE TEST

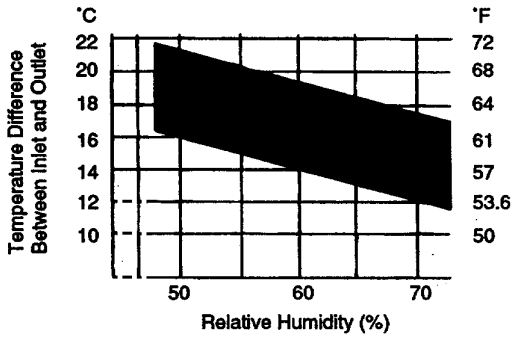
1. Install the manifold gauge set.
2. Run the engine at 2,000 rpm and set the controls for maximum cooling and high blower speed.
3. Keep all windows and doors open.

4. Place a dry-bulb thermometer in the cool air outlet.
5. Place a psychrometer close to the inlet of the cooling unit.
6. Check that the reading on the high pressure gauge is 1,373-1,575 kPa (14-16kg·cm², 199-228 psi). If the reading is too high, pour water on the condenser. If the reading to too low, cover the front of the condenser.



EQDA016A

7. Check that the reading on the dry-bulb thermometer at the air inlet is 25~35°C (77~95°F).
8. Calculate the relative humidity from the psychrometric graph by comparing the wet-and dry-bulb reading of the psychrometer at the air inlet.
9. Measure the dry-bulb temperature at the cool air outlet, and calculate the difference between the inlet dry-bulb and outlet dry-bulb temperatures.
10. Check that the intersection of the relative humidity and temperature difference is within the block hard line. If the intersection is within the block hard line, cooling performance is satisfactory.



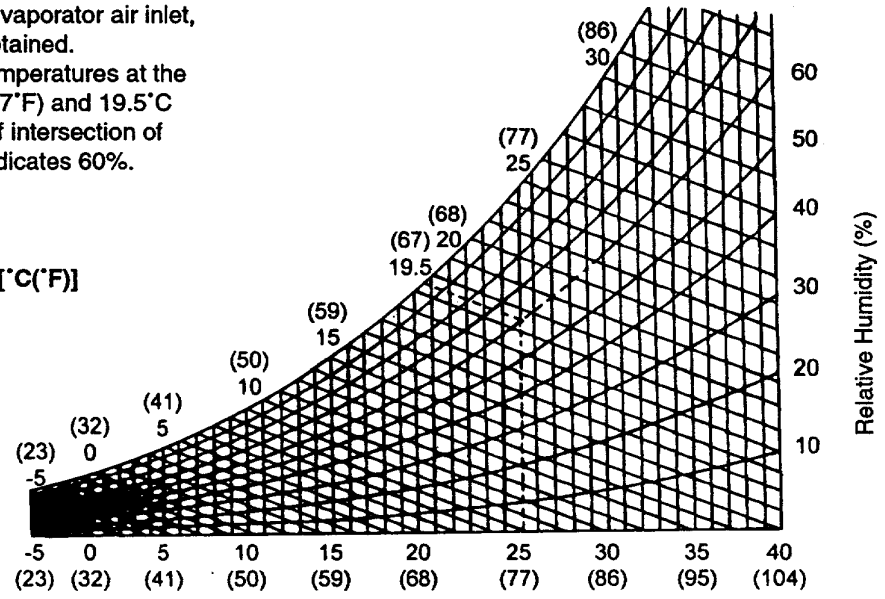
EQDA016C

HOW TO READ THE GRAPH :

After measuring the temperatures of the wet and dry-bulb thermometers at the evaporator air inlet, relative humidity (%) can be obtained.
Example : Dry-and wet-bulb temperatures at the evaporator air inlet are 25°C (77°F) and 19.5°C (67°F) respectively, the point of intersection of the dotted lines in the graph indicates 60%.

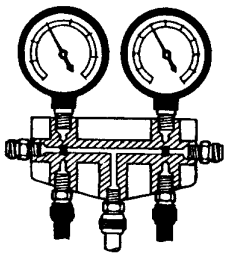
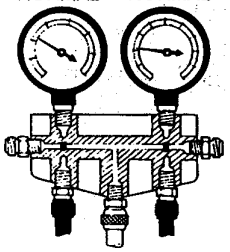
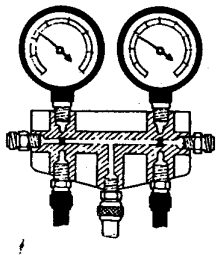
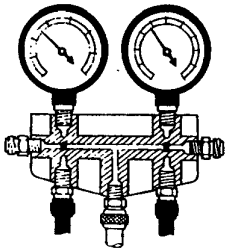
WET-BULB TEMPERATURE [°C(°F)]

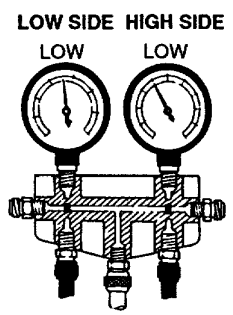
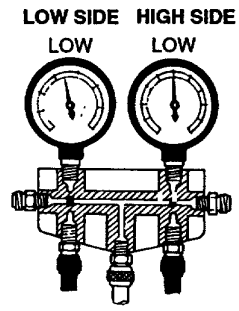
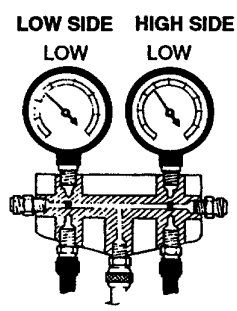
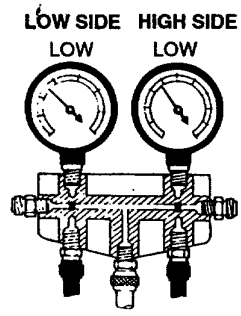
100 (212)
90 (194)
80 (176)
70 (158)
60 (140)
50 (122)
40 (104)
30 (86)
20 (68)
10 (50)

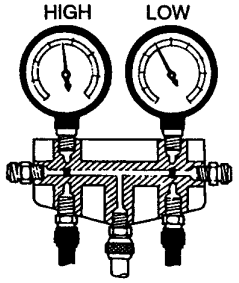
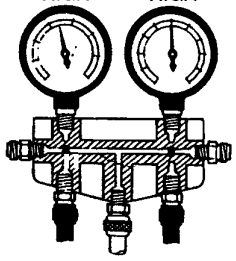
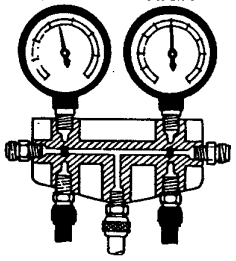
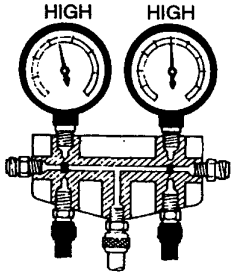


EQA9019B

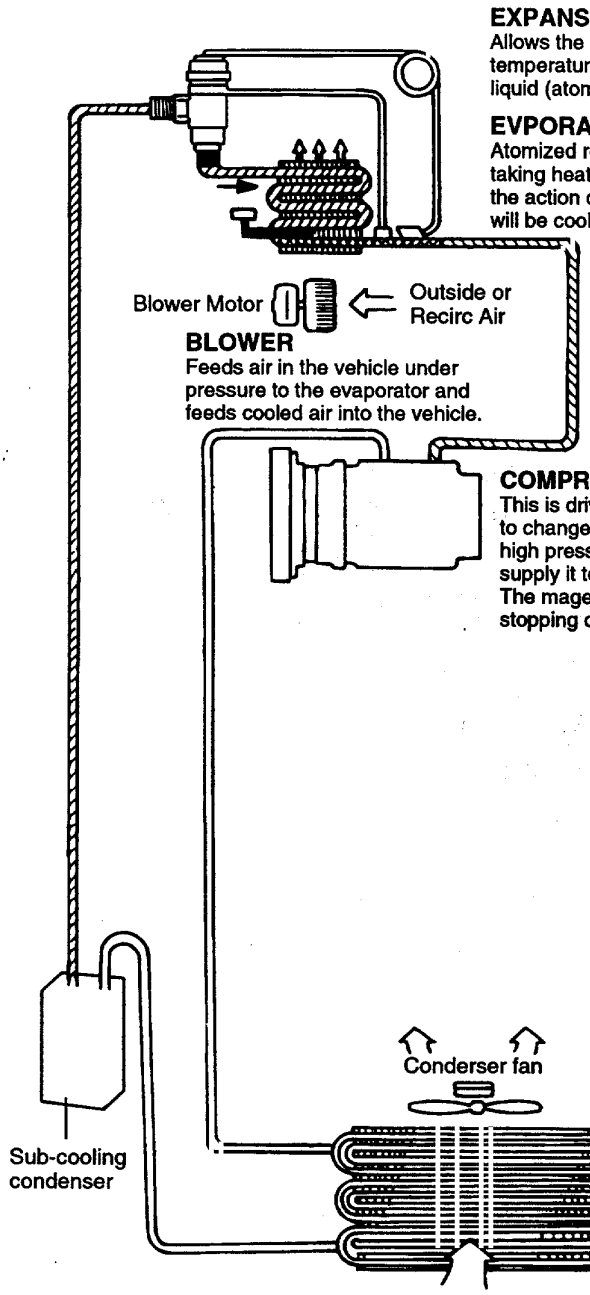
DIAGNOSIS K53E6BBB

GAUGE READINGS	OTHER SYMPTOMS	DIAGNOSIS	CORRECTION
1 LOW SIDE NORMAL HIGH SIDE NORMAL  EQDA022A	• Discharge air : slightly cool. • Thermostatic switch (with thermistor) : Low side gauge doesn't fluctuate with "ON" and "OFF".	Some air and moisture in system.	• Check for leaks. • Discharge refrigerant from system. • Repair leaks as located. • Evacuate the system for at least 30 minutes. • Charge system with refrigerant. • Operate system and check performance.
2 LOW SIDE NORMAL HIGH SIDE NORMAL  EQDA022B	• Discharge air : Becomes warm all the time during hot part of day.	Some air and moisture in system.	• Discharge refrigerant. • Evacuate system with a vacuum pump. • Recharge system to proper capacity. • Operate system and check performance.
3 LOW SIDE NORMAL HIGH SIDE NORMAL  EQDA022C	• Compressor : Cycles on and off too fast.	Defective thermostatic switch.	• Replace thermostatic switch. • Operate system and check performance.
4 LOW SIDE NORMAL HIGH SIDE NORMAL  EQDA022D	• Compressor : Low side pressure builds too high before compressor turns on (cycle "ON" point too high).	Faulty thermostatic switch.	• Replace the thermostatic switch. • Operate system and check performance.

GAUGE READINGS	OTHER SYMPTOMS	DIAGNOSIS	CORRECTION
5  EQDA022E	• Discharge air : Slightly cool.	System slightly low on refrigerant.	• Check for leaks. • Discharge refrigerant. • Repair leaks. • Evacuate system using a vacuum pump. • Charge system with refrigerant. • Operate system and check performance.
6  EQDA022F	• Discharge air : Warm	• System very low on refrigerant. • Possible leak in system.	• Check for leaks. • Discharge refrigerant. • Evaporate system using a vacuum pump. • Charge system with refrigerant. • Operate system and check performance.
7  EQDA022G	• Discharge air : Slightly cool. • Expansion valve : Frost build up.	• Expansion valve stuck. • Screen plugged. • Sensing bulb malfunction.	• Discharge system. • Disconnect inlet line at expansion valve and remove and inspect screen. • Replace screen and reconnect inlet line. • Evacuate system using a vacuum pump. • Charge system with refrigerant.
8  EQDA022H	• Discharge air : Slightly cool. • High side pipe : Cool and also shows moisture or frost.	Restriction in high side of system	• Discharge system. • Evacuate system using a vacuum pump. • Charge system with refrigerant. • Operate system and check performance.

GAUGE READINGS	OTHER SYMPTOMS	DIAGNOSIS	CORRECTION
9 LOW SIDE HIGH SIDE HIGH LOW  EQDA022I	• Compressor : Noisy	Compressor malfunction	• Disassemble compressor. • Inspect compressor. • Check compressor oil level. • Operate system and check performance.
10 LOW SIDE HIGH SIDE HIGH HIGH  EQDA022J	• Discharge air : Warm • High side pipe : Very hot	• Faulty condenser. • Overcharged.	• Check for loose or worn fan belt. • Inspect condenser for clogged air passage. • Check for refrigerant overcharge. • Operate system and check performance.
11 LOW SIDE HIGH SIDE HIGH HIGH  EQDA022K	• Discharge air : Slightly cool.	Large amount of air and moisture.	• Discharge refrigerant from system. • Evacuate system using vacuum pump. • Charge system with refrigerant. • Operate system and check performance.
12 LOW SIDE HIGH SIDE HIGH HIGH  EQDA022L	• Discharge air : Warm • Evaporator : Moisture or frost.	Expansion valve stuck.	• Discharge system. • Replace expansion valve. • Evacuate system using vacuum pump, then recharge system with refrigerant. • Operate system and check performance.

REFRIGERATION CYCLE E88203AD



EXPANSION VALVE
Allows the refrigerant to rapidly expand into low temperature and low pressure and low pressure liquid (atomized)

EVPORATOR
Atomized refrigerant evaporates into gas while taking heat away from the surroundings through the action of the cooling fan. (the surroundings will be cooled).

BLOWER
Feeds air in the vehicle under pressure to the evaporator and feeds cooled air into the vehicle.

COMPRESSOR
This is driven by a V-belt from the engine to change the evaporated refrigerant into high pressure (high temperature) gas and supply it to the condenser.
The magenetic clutch is installed to enable stopping of the compressor.

CONDENSER
This is installed in front of the radiator. Cools high pressure and high temperature refrigerant to its condensation point to return to high pressure liquid with air from the cooling fan and the vehicle speed.

High pressure and high temperature gas

Low pressure and low temperature liquid

High pressure and high temperature liquid

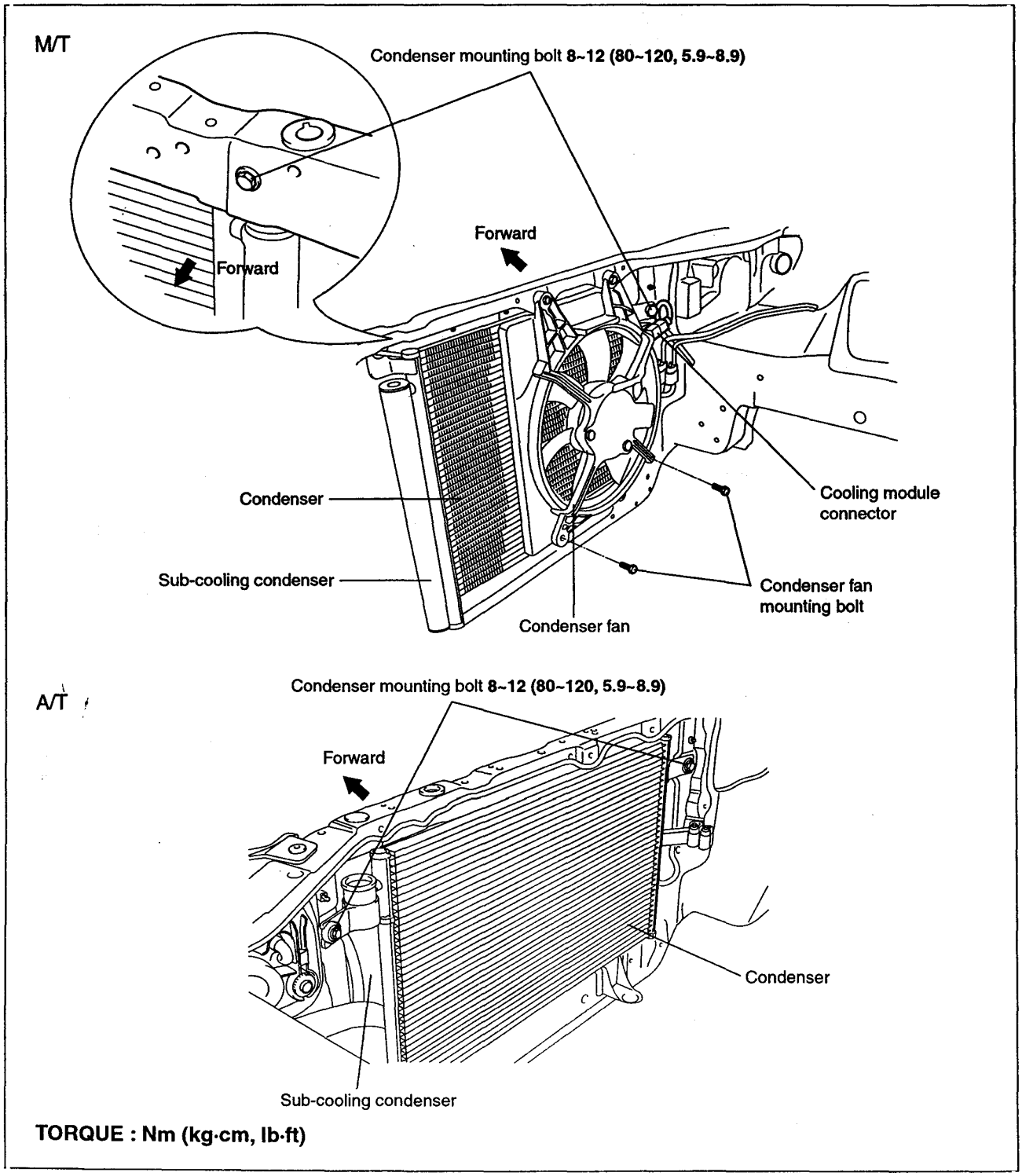
Low pressure and low temperature gas

EQDA020A

A/C COMPRESSOR CONTROLS (MANUAL)

CONDENSER

COMPONENTS E86FF6E0

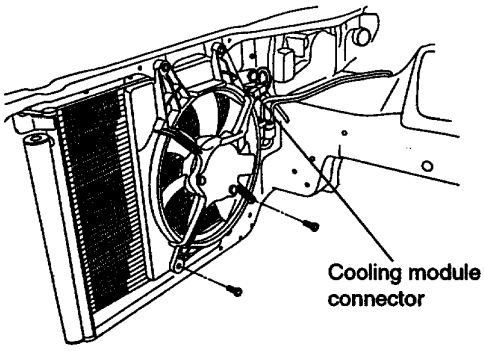


TORQUE : Nm (kg·cm, lb·ft)

EQDD141A

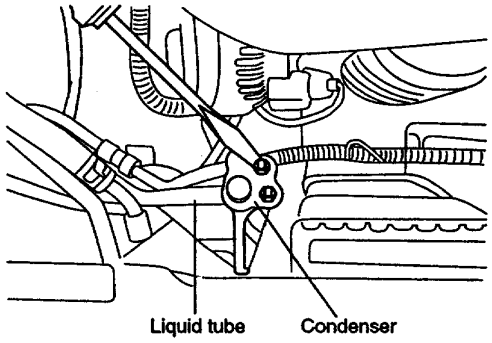
REMOVAL K014DD81

1. Remove the cooling module connector.



EQDD191E

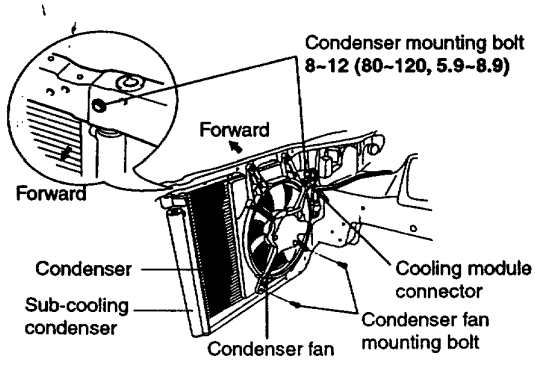
2. Remove the cooling module (condenser fan).
3. Remove the liquid tube nut.



EQPD141D

4. Remove the condenser mounting bolts (2).

Tightening torque : 8~12Nm



EQDD141B

5. Remove the condenser upward by pressing the radiator backward the vehicle.

INSTALLATION K79F4BFE

Installation is the reverse of removal.

INSPECTION KA98B48D

1. Check condenser pin for clogging and damage. If clogged, clean it with water, and blow it with compressed air. If bent, gently stretch it using a screwdriver or pliers.
2. Check the condenser connection area for leakage, and repair or replace if required.

TRIPLE PRESSURE SWITCH

OPERATION K1E2BBFF

The triple switch is a combination of a middle switch as well as conventional low pressure and high pressure switches. The low pressure switch will turn off to stop compressor operation if refrigerant pressure is low. The high pressure switch will turn off to stop compressor operation if refrigerant pressure is too high. The middle switch will it turn on at a medium level pressure to determine the A/C system is overheating. It will cool the A/C system by operating the radiator fan and the condenser fan at high speed.

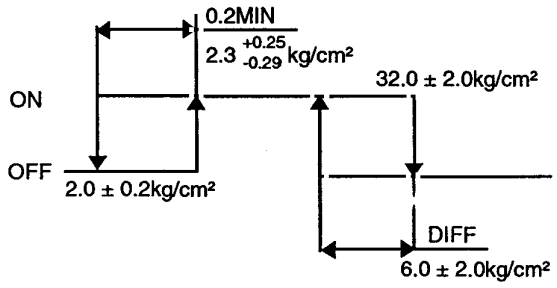
OPERATING CHARACTERISTIC

kg/cm²

Pressure	ON	OFF
High	32.0 ± 2.0	26.0 ± 2.0
Low	2.3 ± 0.25/-0.29	2.0 ± 0.2
Middle	18.0 ± 0.8	14 ± 1.2

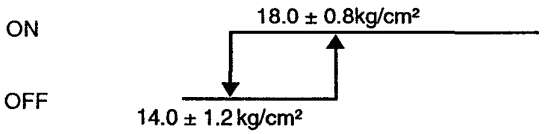
EQPD150A

LOW & HIGH



KQDD236A

MIDDLE

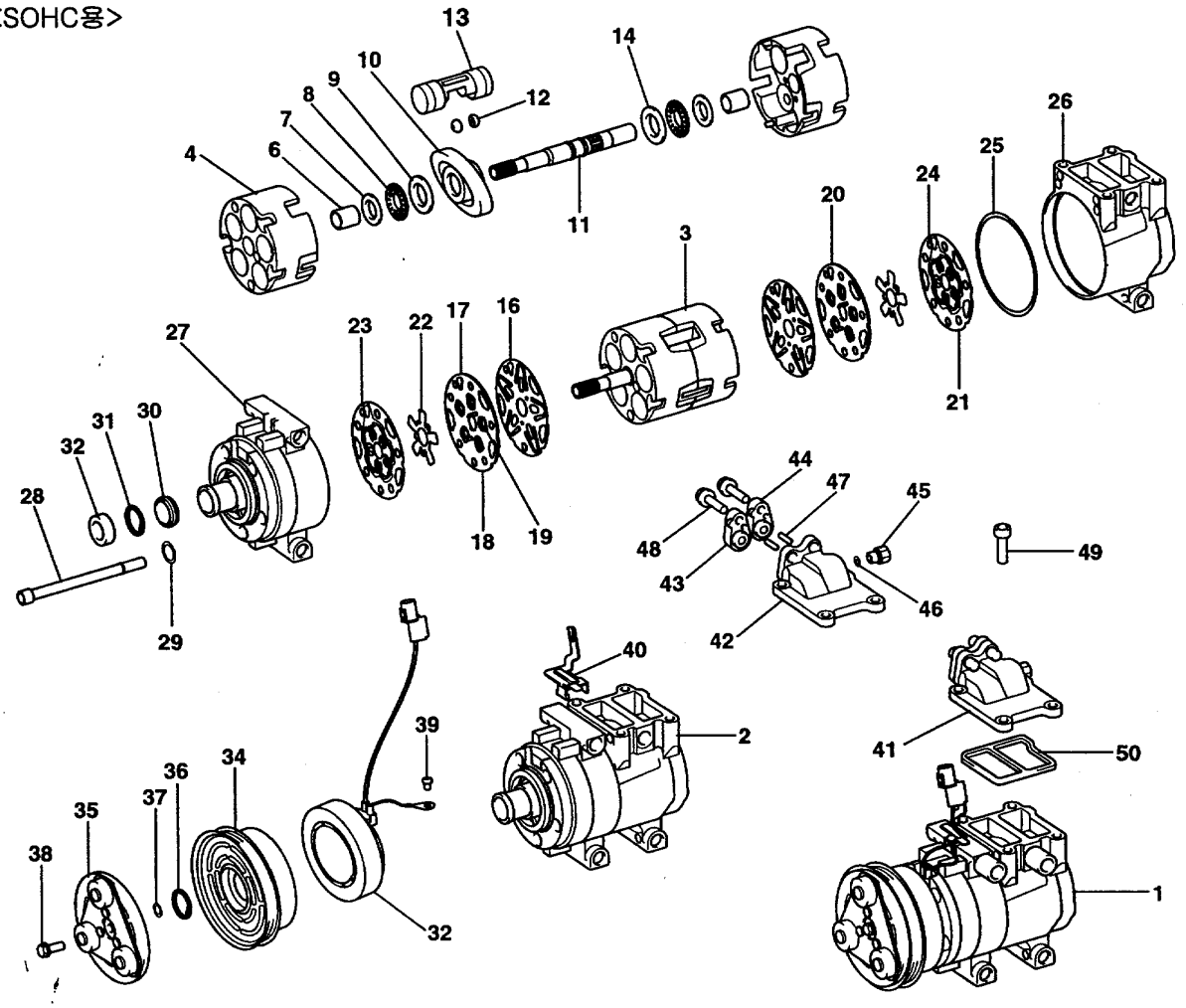


KQDD236B

COMPRESSOR

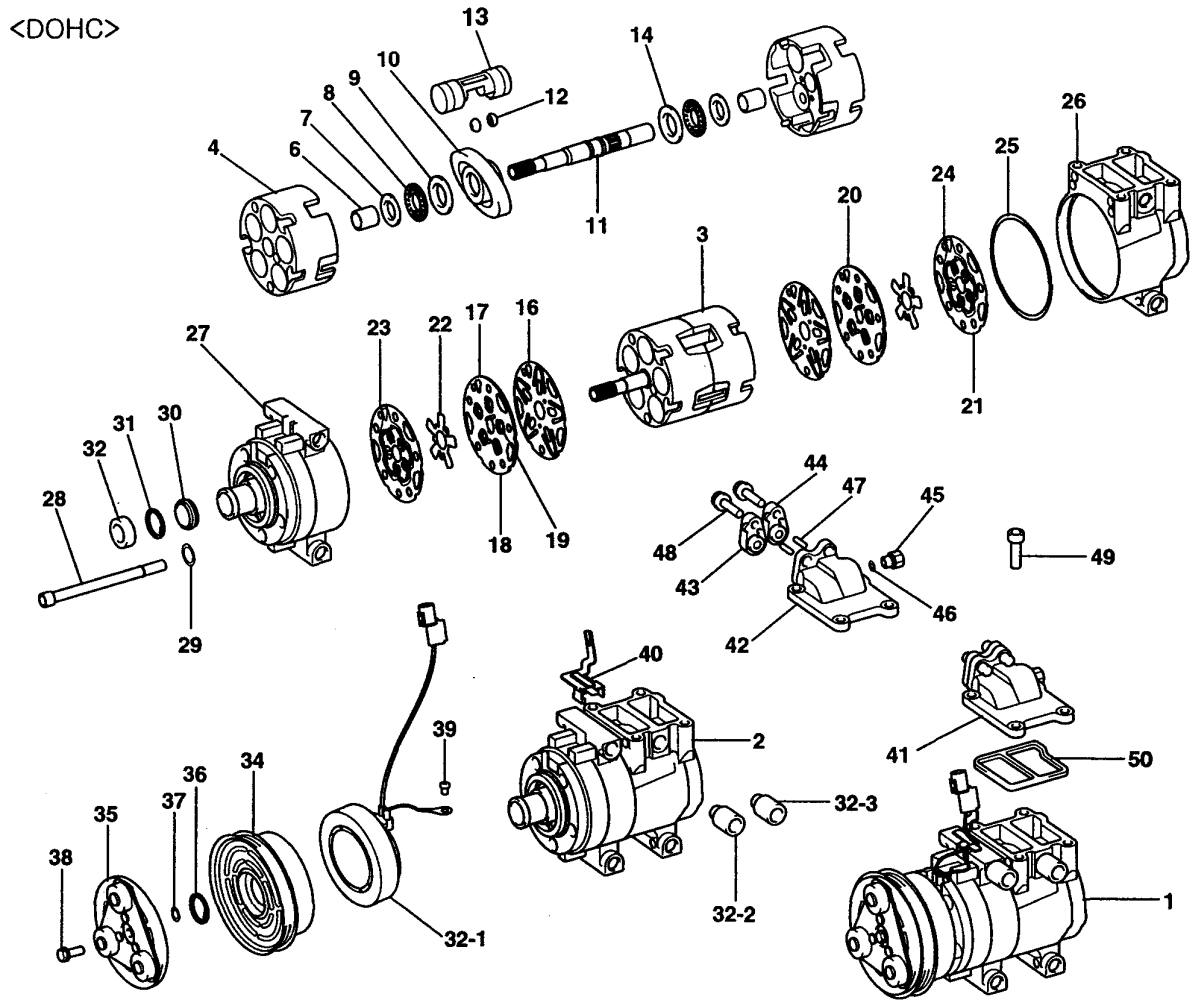
COMPONENTS E7D316C6

<SOHC용>



1. Compressor & clutch assembly
2. Compressor assembly
3. Cylinder & shaft assembly
4. Front cylinder
5. Rear cylinder
6. Bushing
7. Thrust bearing race A
8. Thrust bearing
9. Thrust bearing race L
10. Swash plate
11. Shaft
12. Shoe
13. Piston
14. Thrust bearing race E
15. Pin spring
16. Inlet reed
17. Front plate assembly
18. Front plate
19. Pin
20. Rear plate assembly
21. Rear plate
22. Discharge
23. Front gasket
24. Rear gasket
25. Seal
26. Rear head
27. Front head
28. Bolt
29. Flat washer
30. Shaft seal
31. Ring
32. Seal
33. Field coil
34. Pulley
35. Disc & hub
36. Ring
37. Spacer
38. Bolt
39. Screw
40. Connector bracket
41. Manifold assembly
42. Manifold
43. Suction cap
44. Discharge cap
45. Relief valve
46. O-ring
47. Pin knurling
48. Flange head bolt
49. Bolt wrench
50. Gasket.

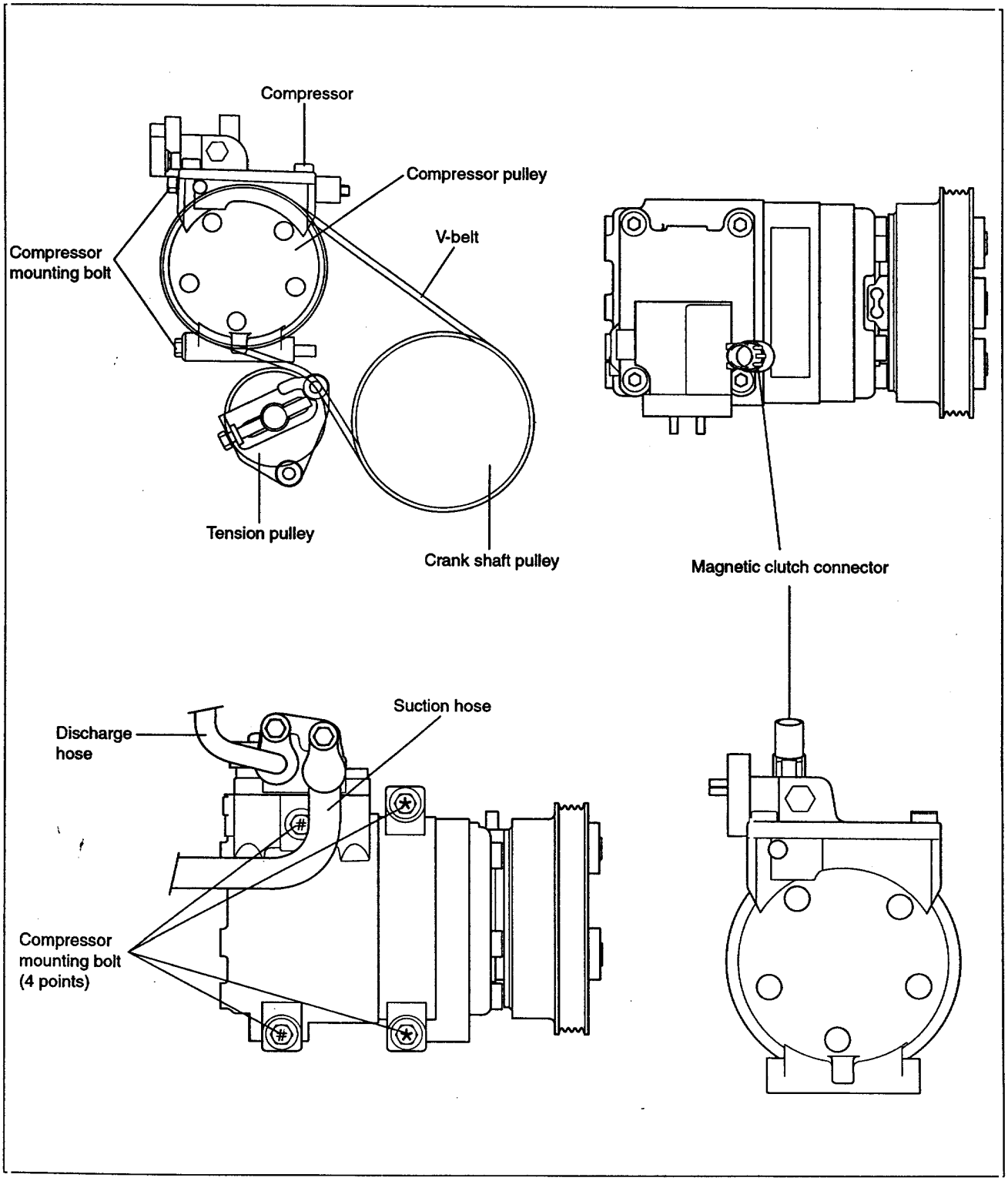
EQDD125B



1. Compressor & clutch assembly
2. Compressor assembly
3. Cylinder & shaft assembly
4. Front cylinder
5. Rear cylinder
6. Bushing
7. Thrust bearing race A
8. Thrust bearing
9. Thrust bearing race L
10. Swash plate
11. Shaft
12. Shoe
13. Piston
14. Thrust bearing race E
15. Pin spring
16. Inlet reed
17. Front plate assembly
18. Front plate
19. Pin
20. Rear plate assembly
21. Rear plate
22. Discharge
23. Front gasket
24. Rear gasket
25. Seal
26. Rear head
27. Front head
28. Bolt
29. Flat washer
30. Shaft seal
31. Ring
32-1 . Seal
32-2 . Mounting spacer
32-3 . Mounting spacer
33. Field coil
34. Pulley
35. Disc & hub
36. Ring
37. Spacer
38. Bolt
39. Screw
40. Connector bracket
41. Manifold assembly
42. Manifold
43. Suction cap
44. Discharge cap
45. Relief valve
46. O-ring
47. Pin knurling
48. Flange head bolt
49.Bolt wrench
50. Gasket.

EQDD125C

COMPRESSOR CONFIGURATION



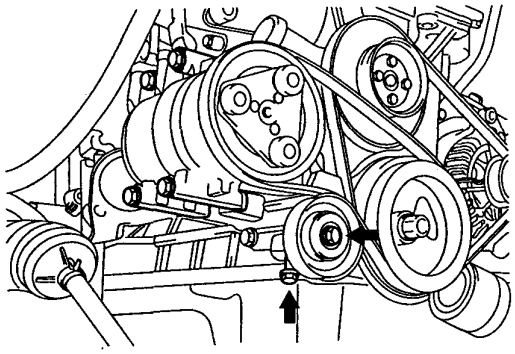
EQDD029A

⚠ ***CAUTION***

' ⋆ ' Marked bolt should be tightened first.

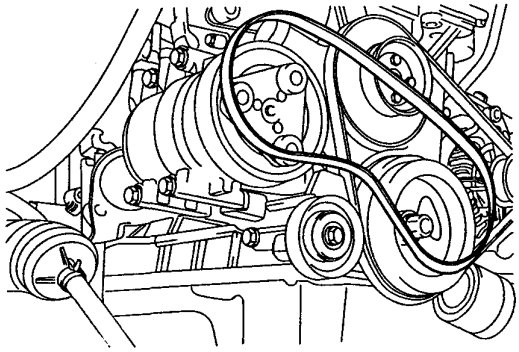
REMOVAL KD3B1FE8

1. Discharge the refrigerant.
2. Remove the tension bolt.



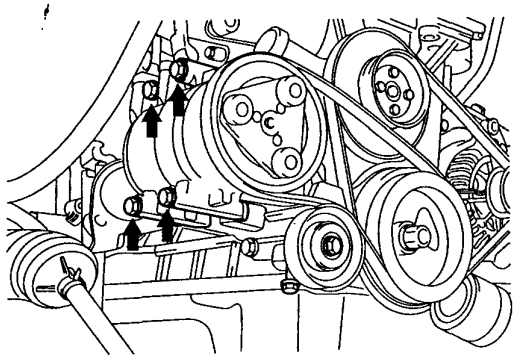
KQDD033A

3. Remove the V-belt.



KQDD029F

4. Remove the suction hose and discharge hose from the compressor.
5. Remove the 4 mounting bolts on the compressor.



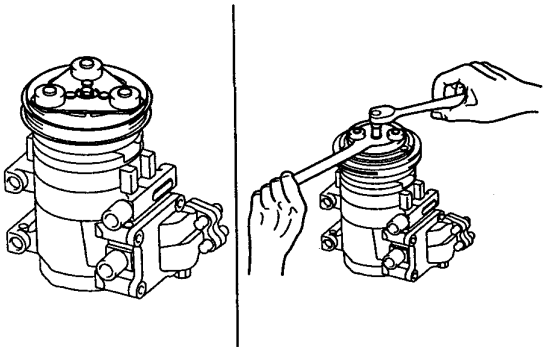
KQDD033B

6. Remove the compressor downwards.

DISASSEMBLY EFA55CAF

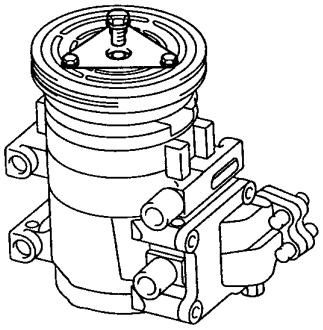
CLUTCH HUB AND PULLEY

1. Remove the clutch hub supporting bolt using a spanner wrench.



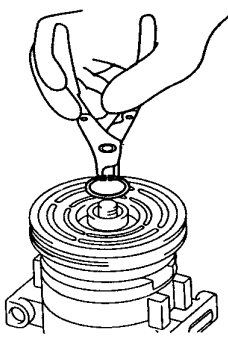
KQDD028A

2. Pull out the clutch hub and shim from the compressor shaft. If it is hard to pull out, insert a 8mm bolt into the shaft hole to remove the hub from the shaft.



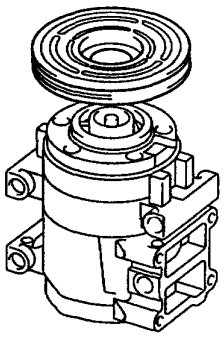
KQPC028C

3. Remove the pulley supporting the snap ring.



KQPC028D

4. Remove the pulley and bearing assembly from the compressor.



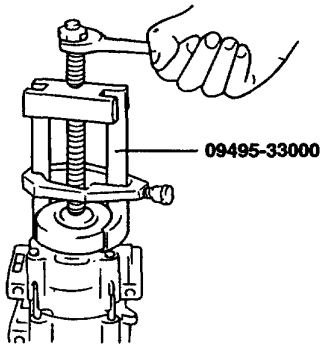
KQPC028E

CLUTCH FIELD COIL

1. Remove the clutch hub and pulley.
2. Install a shaft protection tool at the compressor opening.
3. Install the pulley at the compressor.
   Place the puller screw end at the shaft protectors center concave and the puller projection around the rear side field coil.
4. Turn the puller screw using a wrench and remove the coil.

⚠ ***CAUTION***

Do not use air tools.

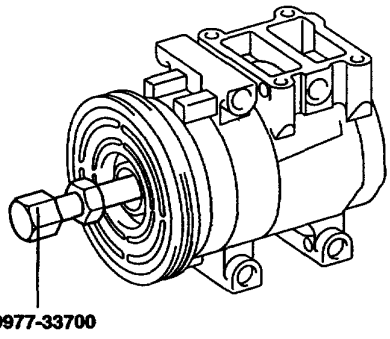


EQHA130B

SHAFT SEAL

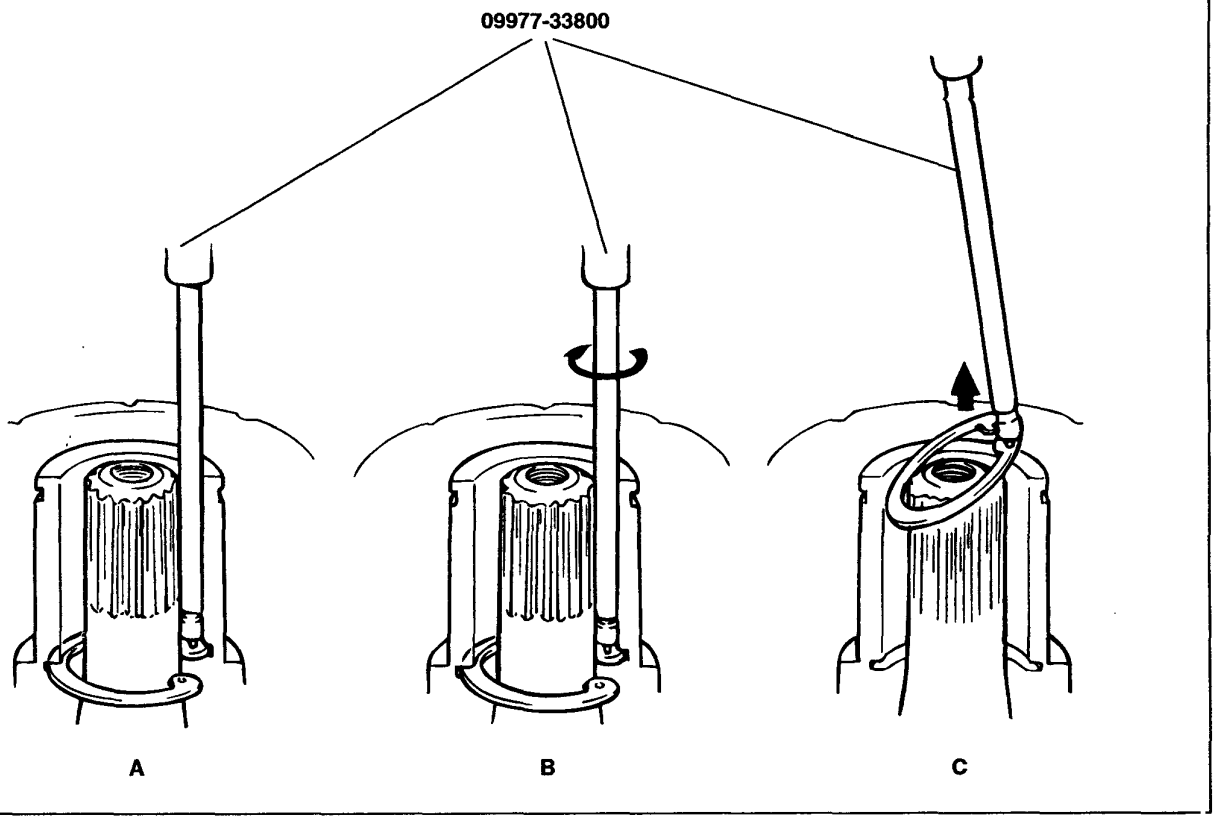
Prior to replacement of the compressor shaft, remove the compressor from the vehicle and discharge the refrigerant.

1. Remove the clutch hub from the compressor.
2. Remove the shaft seal felt from the nose of the compressor with a pick type tool.
3. Blow any debris from inside the compressor nose with low pressure compressed air. Then, clean the inside and outside nose area of the compressor with a lint-free cloth to remove any oil and dirt.
4. Using a snap ring remover, remove the shaft seal support snap ring out of the compressor nose.
   1) Insert tip of the snap ring remover into one of the snap ring eyes (View A).
   2) Rotate the snap ring remover to position the tool tip and snap ring eye closest to the compressor shaft (View B).
   3) Pull the snap ring remover tool up quickly while keeping the tool shaft against the side of the nose opening to remove the snap ring (View C).
5. Position the shaft seal remover tool (09977-33700) over the compressor shaft and push the tool into the nose of the compressor and down against the shaft seal. Engage the end of the tool with the internal diameter of the shaft seal. While holding the hex part of the tool, turn the tool handle clockwise to expand the tool tip inside the seal inner radius. Then, pull the shaft seal from the compressor with the tool



KQPC028L

Removal of shaft seal support snap ring

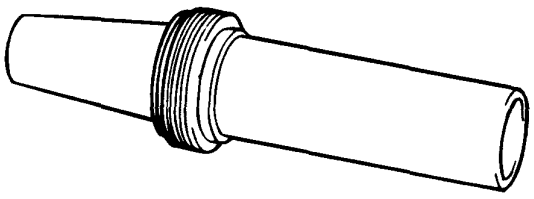


EQPD050A

REASSEMBLY E172F9DF

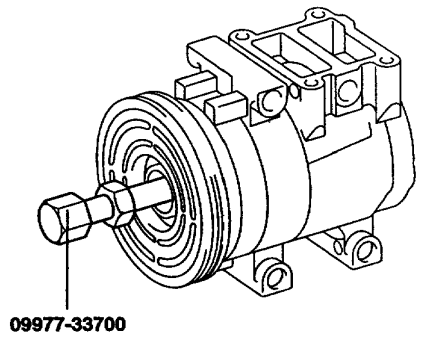
SHAFT SEAL

1. Obtain a new shaft seal kit. Carefully remove the contents from the package and locate the plastic shaft seal protector. Inspect the protector for any burrs or other damage. Do not use the protector if it is damaged. Obtain another shaft seal kit and use the protector from it.
2. Using a clean lint-free cloth, clean the shaft and the seal pocket inside the compressor nose.
3. Dip the shaft seal protector and seal in clean refrigerant oil and position the seal on the protector with the lip of the seal pointing toward the large end of the protector.



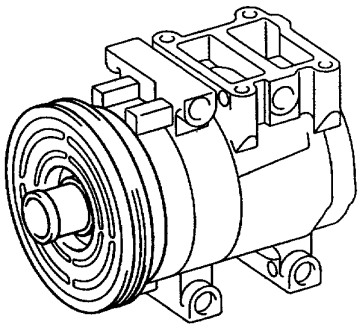
EQDA028M

4. Place the seal protector with shaft seal over the end of the compressor shaft.



KQPC028L

5. Place the shaft seal installer tool over the end of the shaft seal protector. Then, slowly push the shaft seal down the protector until it is seated in the compressor.

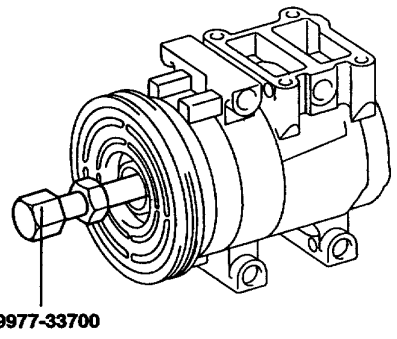


KQPC028O

6. Remove the seal installer and seat protector from the compressor.
7. Place a new seal retaining snap ring into the compressor nose opening and seat the snap ring into the groove with the remover tool.
8. Leak test the shaft seal installation after rotating the shaft about 10 revolutions with the clutch hub.
9. Install a new felt into the compressor nose.
10. Install the clutch hub on the compressor as outlined in this section.

CLUTCH FIELD COIL

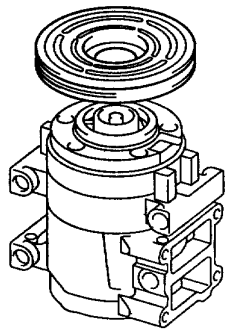
1. Clean the front head coil mounting portion.
2. Place the compressor vertically and put the coil in position of compressor front head.
   Check the electric connector of clutch coil is located in position.
3. Place the coil compression tool in the compressor nose and the center of field coil.
4. Place two 8 inch pullers on the compressor and compression tool. The jaws of puller should deeply hold the front mounting portion of compressor, then the screw should be located in the central position of the compression tool.
5. Using a wrench, tighten the screw so as to securely seat the coil on the compressor front head.
6. Install the clutch pulley and hub on the compressor.



KQPC028L

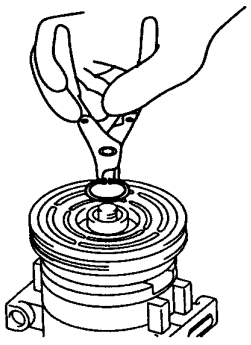
CLUTCH HUB AND PULLEY

1. Clean the pulley bearing surface of the compressor head and remove dirt and rust.
2. Install the pulley and bearing on the compressor.



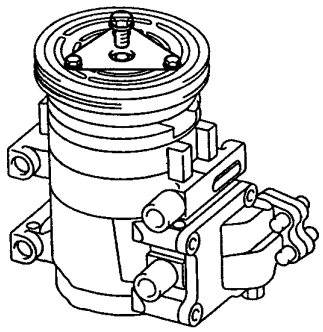
KQPC028E

3. Install the snap ring with the bevelled side facing outward.



KQPC028D

4. Place shim of specified side at the hub spline opening inside and slide the hub onto the compressor shaft end.



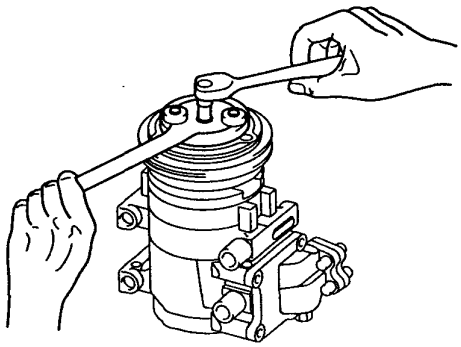
KQPC028C

5. Install a new hub supporting bolt on the compressor shaft end. Tighten the bolt to the specified torque.

Tightening torque : 110~140kg·cm

⚠ ***CAUTION***

Do not use air tools.

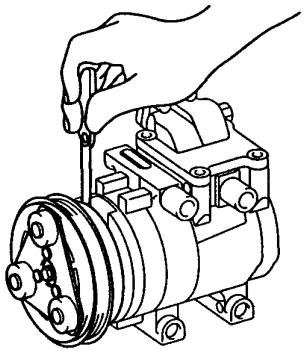


KQDD028B

6. Check clutch air gap between the clutch hub and the pulley contact surface using a filler gauge.

Clutch air gap : 0.05~0.08mm

Check gaps around the pulley at 3 points.

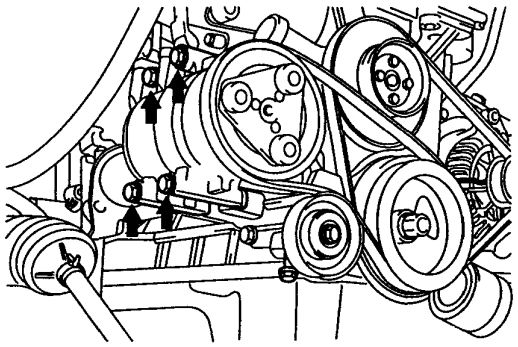


KQDD028G

7. If the clutch air gap is outside the normal range, correct the air gap into the normal range using a shim of the proper size.

INSTALLATION E3204BDA

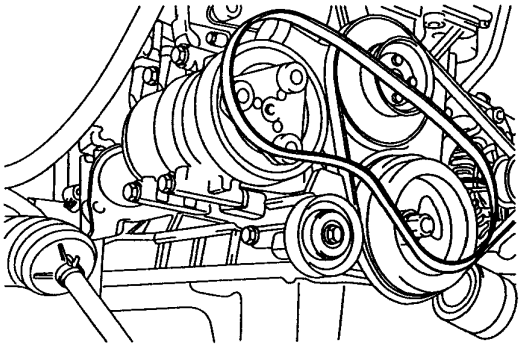
1. Tighten the 4 compressor mounting bolts.



KQDD033B

2. Connect the suction hose and discharge hose to the compressor.

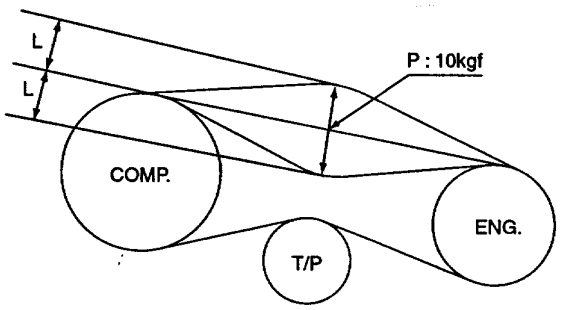
3. Connect the V belt.



KQDD029F

4. Adjust the V belt tension.

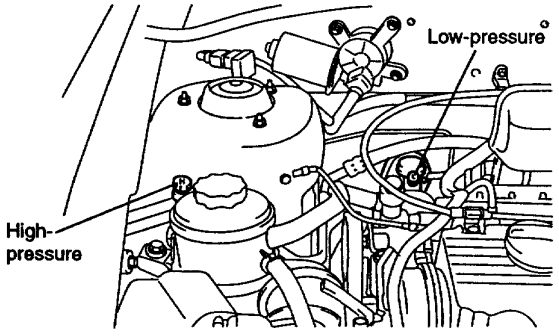
Item	Deflection L (mm)
New one	5~5.5
Used one	6~7
After driving	8



EQDD019B

5. Supply the coolant.

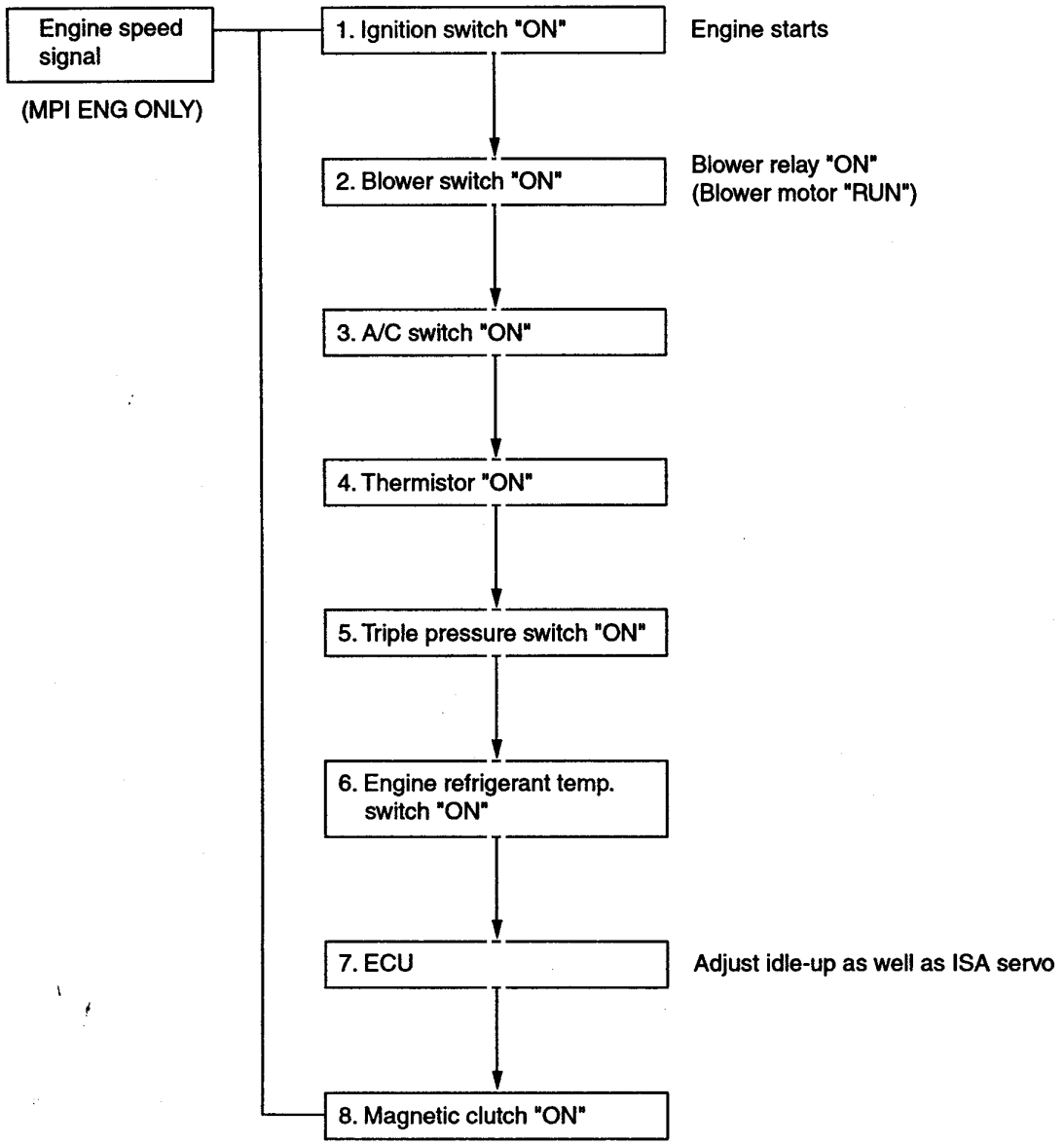
Specified amount : 550 ± 25g



EQDD012A

OPERATION E6ED05FC

MAGNETIC CLUTCH

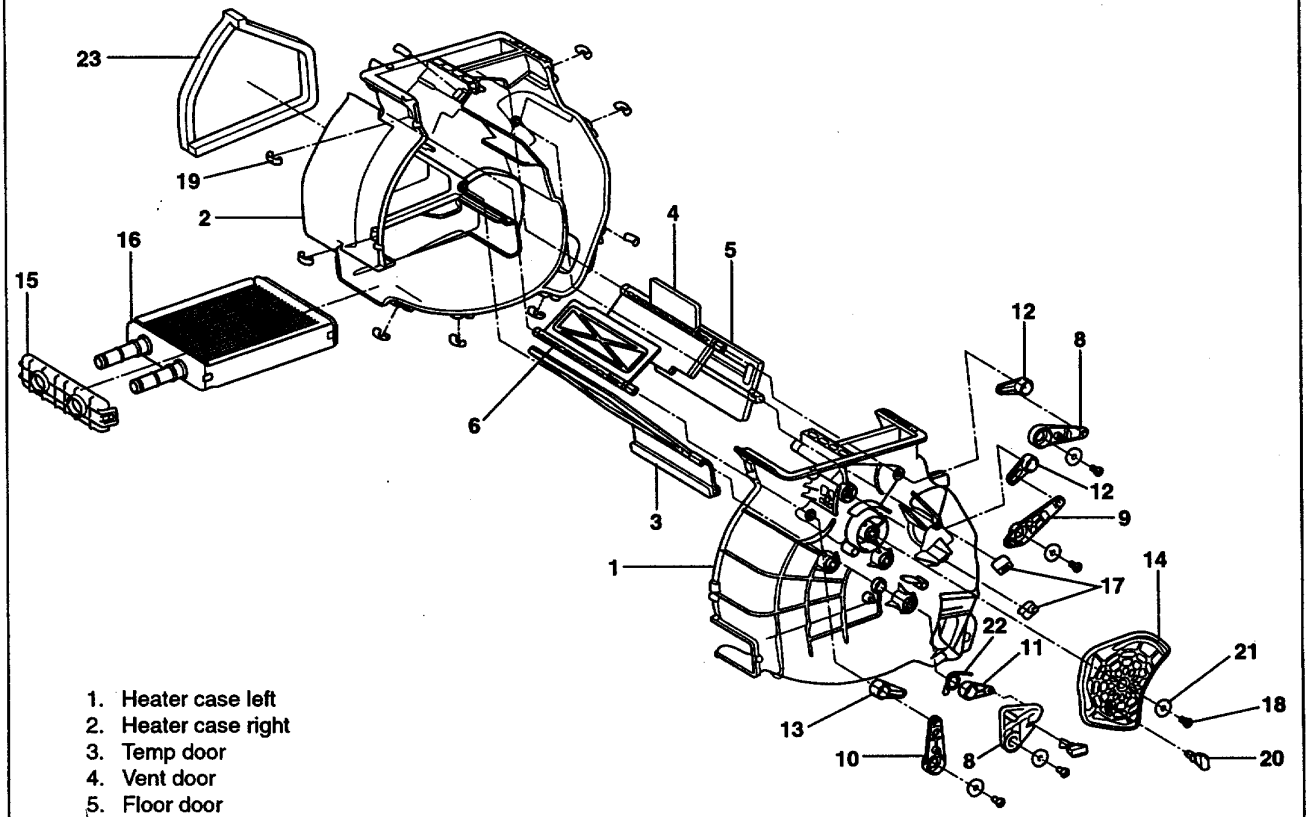


EQDD136A

HEATER

HEATER UNIT

COMPONENTS ECCBA5CF

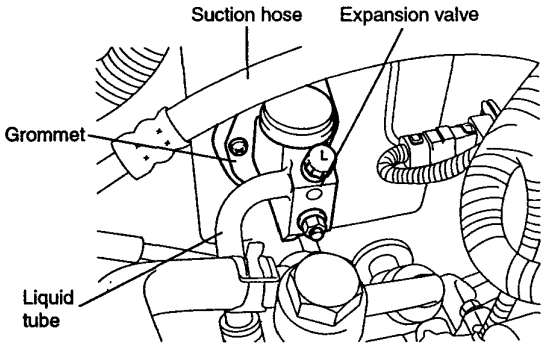


1. Heater case left
2. Heater case right
3. Temp door
4. Vent door
5. Floor door
6. Defrost door
7. Temp door lever
8. Vent door lever
9. Floor door lever
10. Defrost door lever
11. Temp door arm
12. Vent door arm
13. Defrost door arm
14. Mode cam
15. Heater core cover
16. Heater core & seal
17. Control cable clamp
18. Tapping screw
19. Clip
20. Door location key
21. Spring washer
22. Torsion spring
23. Seal

EQDD180J

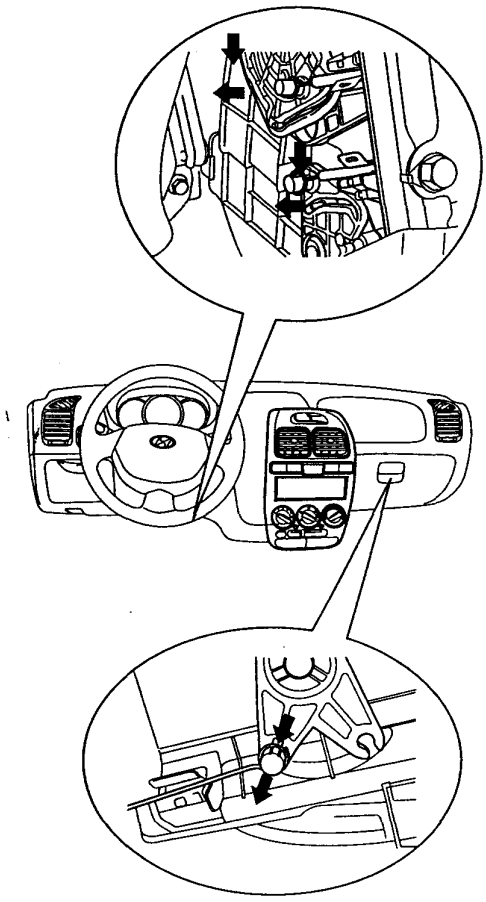
REMOVAL EB9E9BE1

1. Disconnect the (-)negative battery terminal.
2. Drain the coolant of the radiator.
3. Remove the A/C suction hose, liquid tube and grommet.



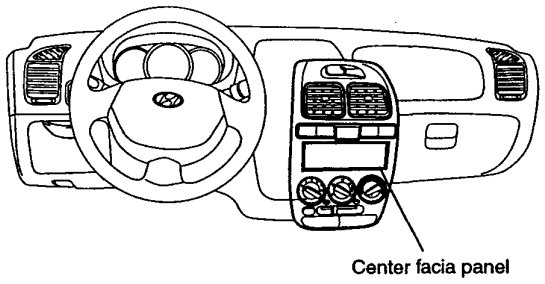
EQDD161A

4. Remove the 2 heater side control cables and one blower side control cable.



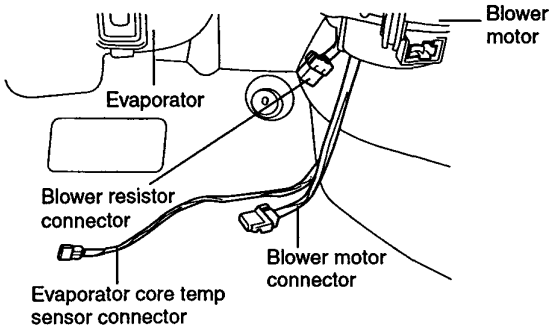
KQDD020B

5. Remove the center facia panel from the lower portion.



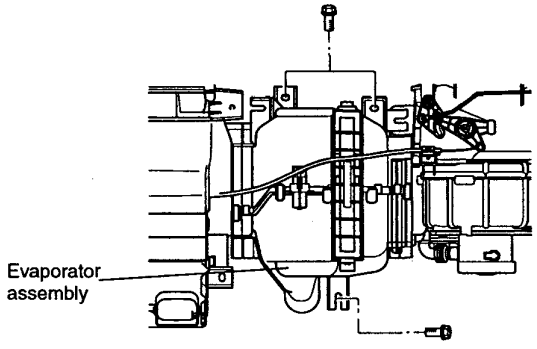
EQDD020C

6. Disconnect the switch connectors and remove the center facia panel.
7. After removing the mounting bolts, remove the main crash pad. (Refter to "CRASH PAD" of BD group)
8. Disconnect the evaporator core temp sensor (thermister), blower resistor connector, and blower motor connector.



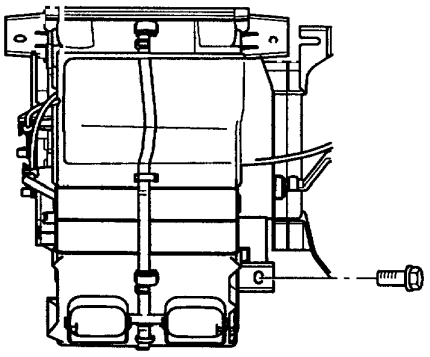
EQPD700A

9. Remove the evaporator unit.



EQPD161B

10. Remove the heater assembly.



KQDD161F

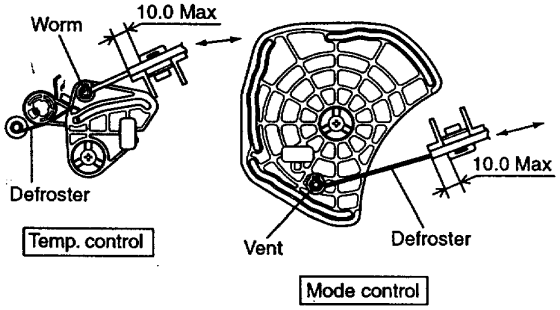
DISASSEMBLY AND REASSEMBLY EAEECF73

Refer to "COMPONENTS" for disassembly and reassembly. When installing and reassembling the temp. control and mode control cable, refer to the following chart.

Condition	Lever load	
	Temp. control cable	Mode control cable
Blower : 12V Mode : ALL	Max 2.0kgf	Max 2.0kgf

INSTALLATION E6CC0075

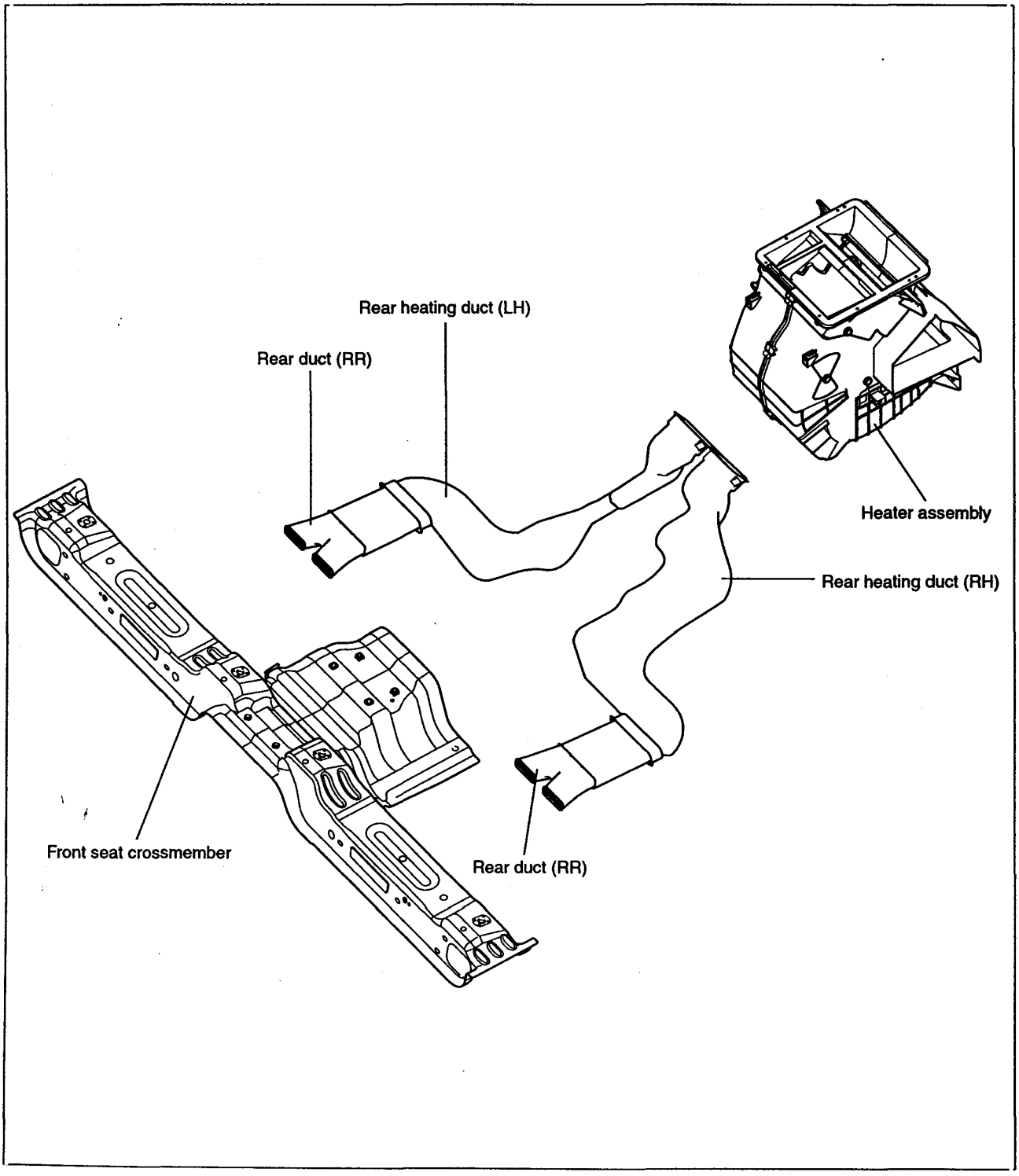
Installation is the reverse of removal. (Prior to installation of temp. control and mode control cables, first install the locating pin.)



EQPD161K

DUCT

COMPONENTS E394FB8F

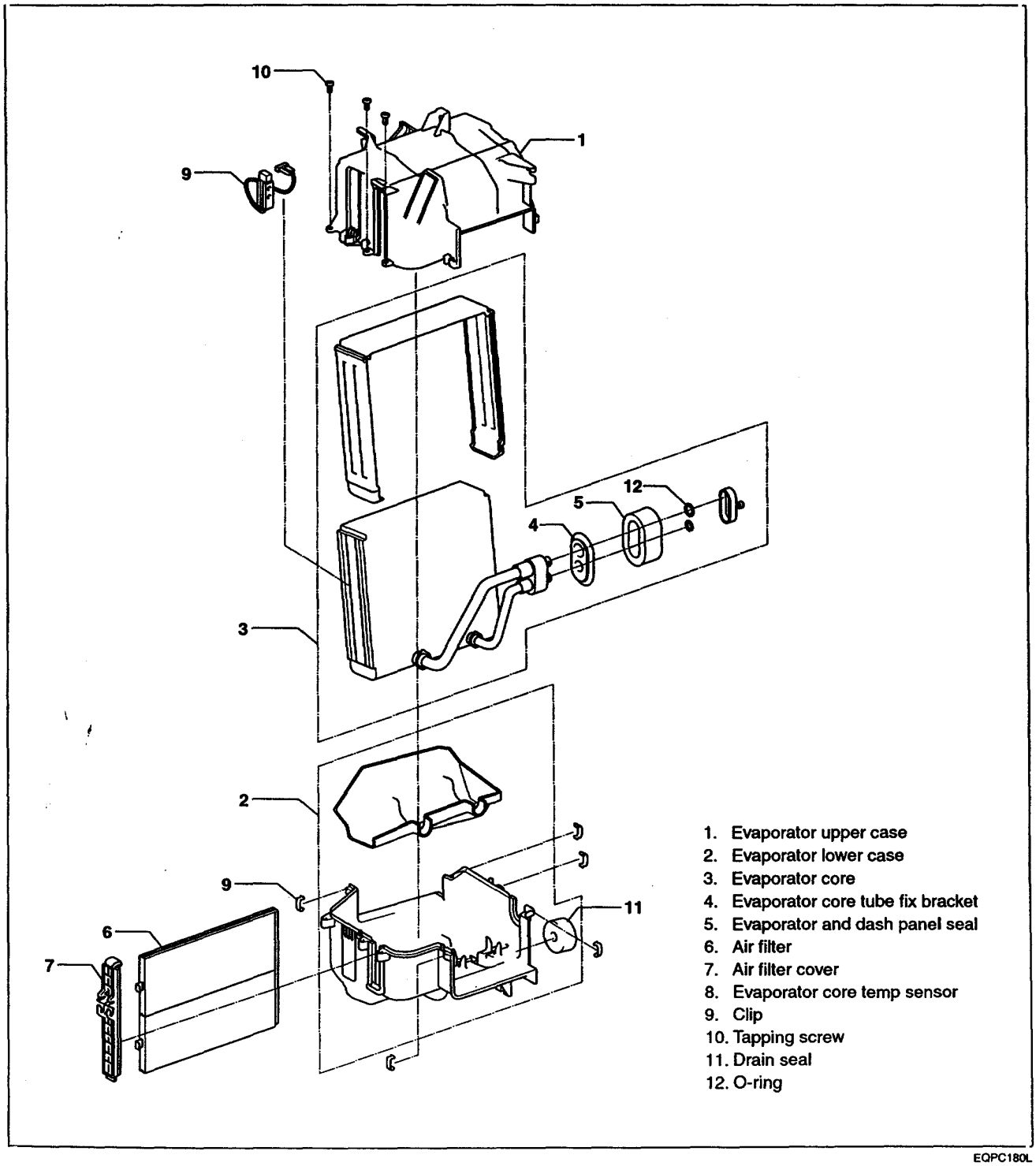


EQDD161O

EVAPORATOR

EVAPORATOR UNIT

COMPONENTS KACAFFBD

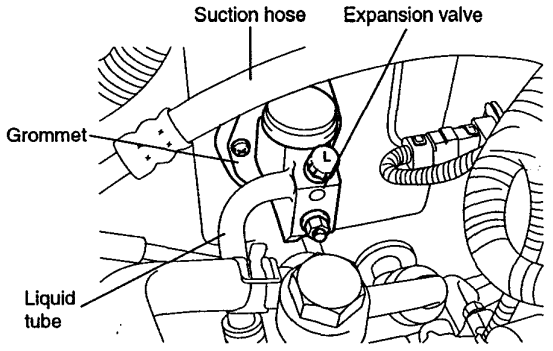


1. Evaporator upper case
2. Evaporator lower case
3. Evaporator core
4. Evaporator core tube fix bracket
5. Evaporator and dash panel seal
6. Air filter
7. Air filter cover
8. Evaporator core temp sensor
9. Clip
10. Tapping screw
11. Drain seal
12. O-ring

EQPC180L

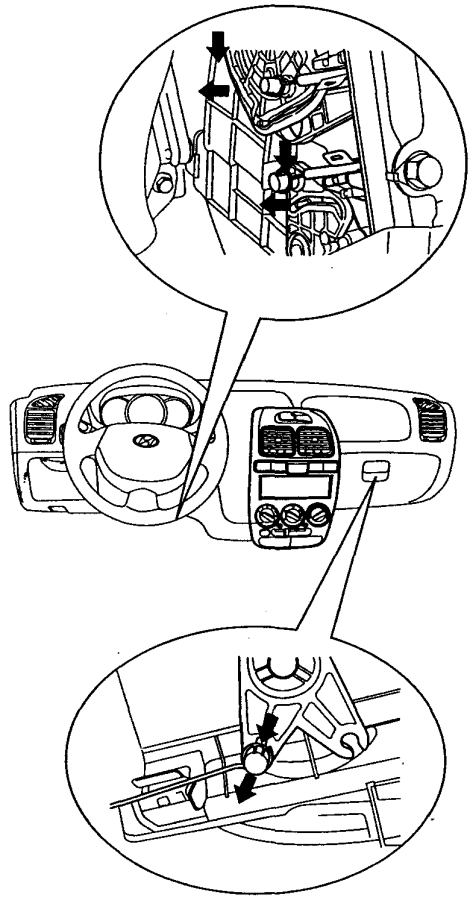
REMOVAL K0DE4BA5

1. Discharge the refrigerant.
2. Remove the air conditioner suction hose, liquid tube and grommet.



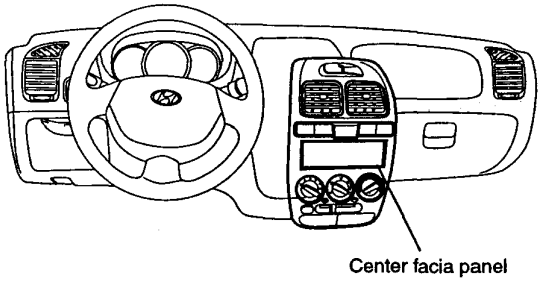
EQDD161A

3. Remove the 2 control cables of heater side and one control cable of blower side.



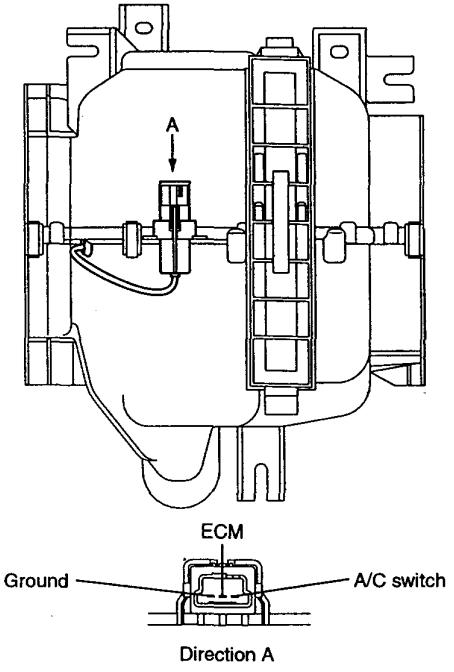
KQDD020B

4. Remove the center facia panel from the lower portion.

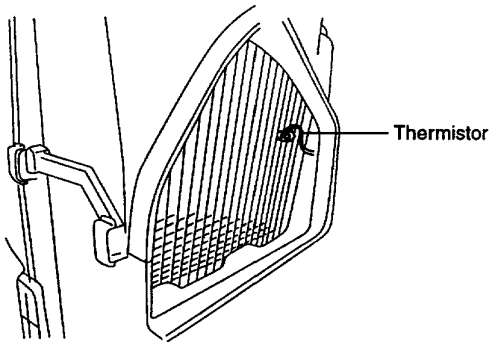


EQDD020C

5. Disconnect the switch connectors and remove the center facia panel.
6. Loosen the mounting bolts on the main crash pad and remove the main crash pad. (Refer to "CRESH PAD" of BD group)
7. Remove the evoporator core temp sensor (thermistor) connector.

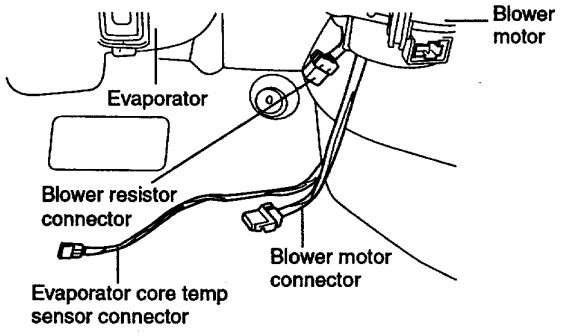


EQPD236B



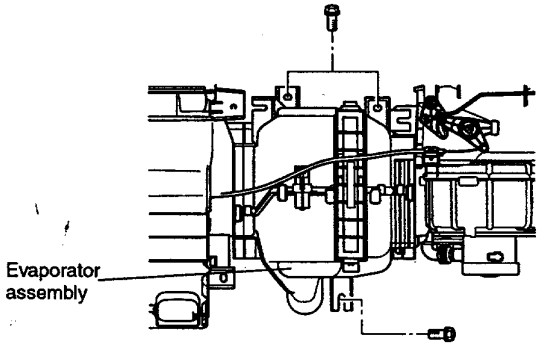
EQPD184G

8. Disconnect the blower resistor and blower motor connector.



EQPD700A

9. Remove the evaporator assembly.



EQPD161B

DISASSEMBLY AND REASSEMBLY KAD9CFFF

Refer to "COMPONENTS".

INSTALLATION KDD50FB6

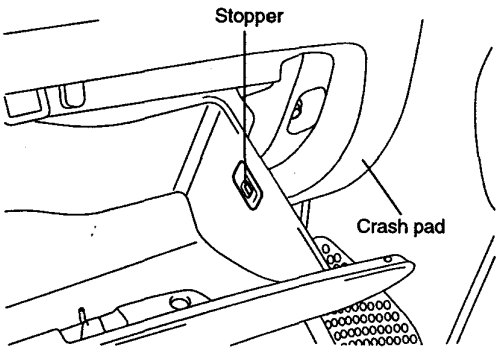
Installation is the reverse of removal.

A/C AIR FILTER

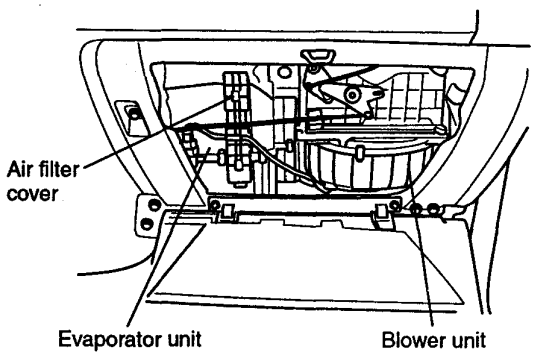
AIR CONDITIONER AIR FILTER KCCFAE7B

REPLACEMENT

1. Open the glove box, remove the glove box stopper in the lower crash pad (assist seat side), and completely lower the glove box.

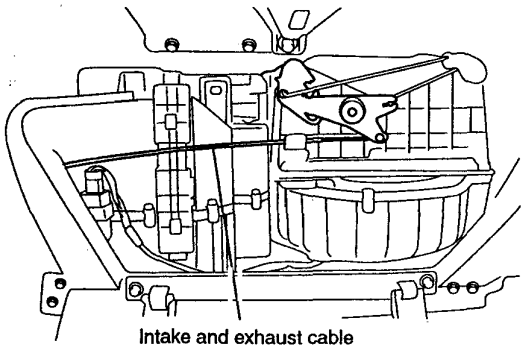


EQDD075A



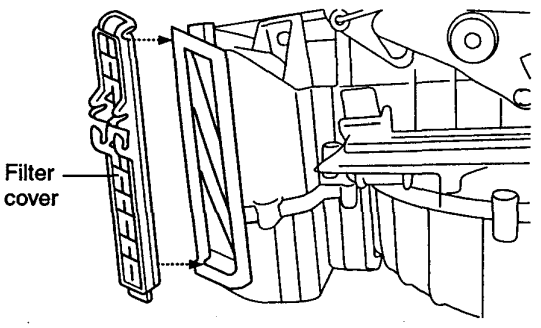
EQDD075B

2. Disconnect the intake and exhaust cable from the blower unit.



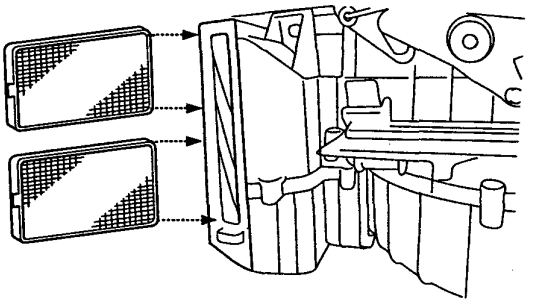
EQDD075C

3. Press the hook on the air conditioner side air filter cover and remove the cover.



EQPD075C

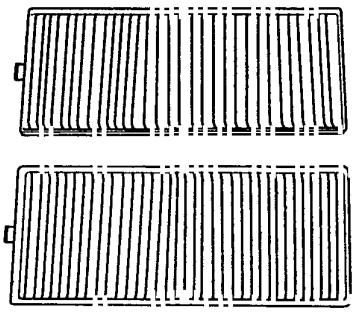
4. Replace the upper/lower air filters.



KQPC075D

NOTE

When removing and installing, don't forget there are 2 air filters in the air conditioner.

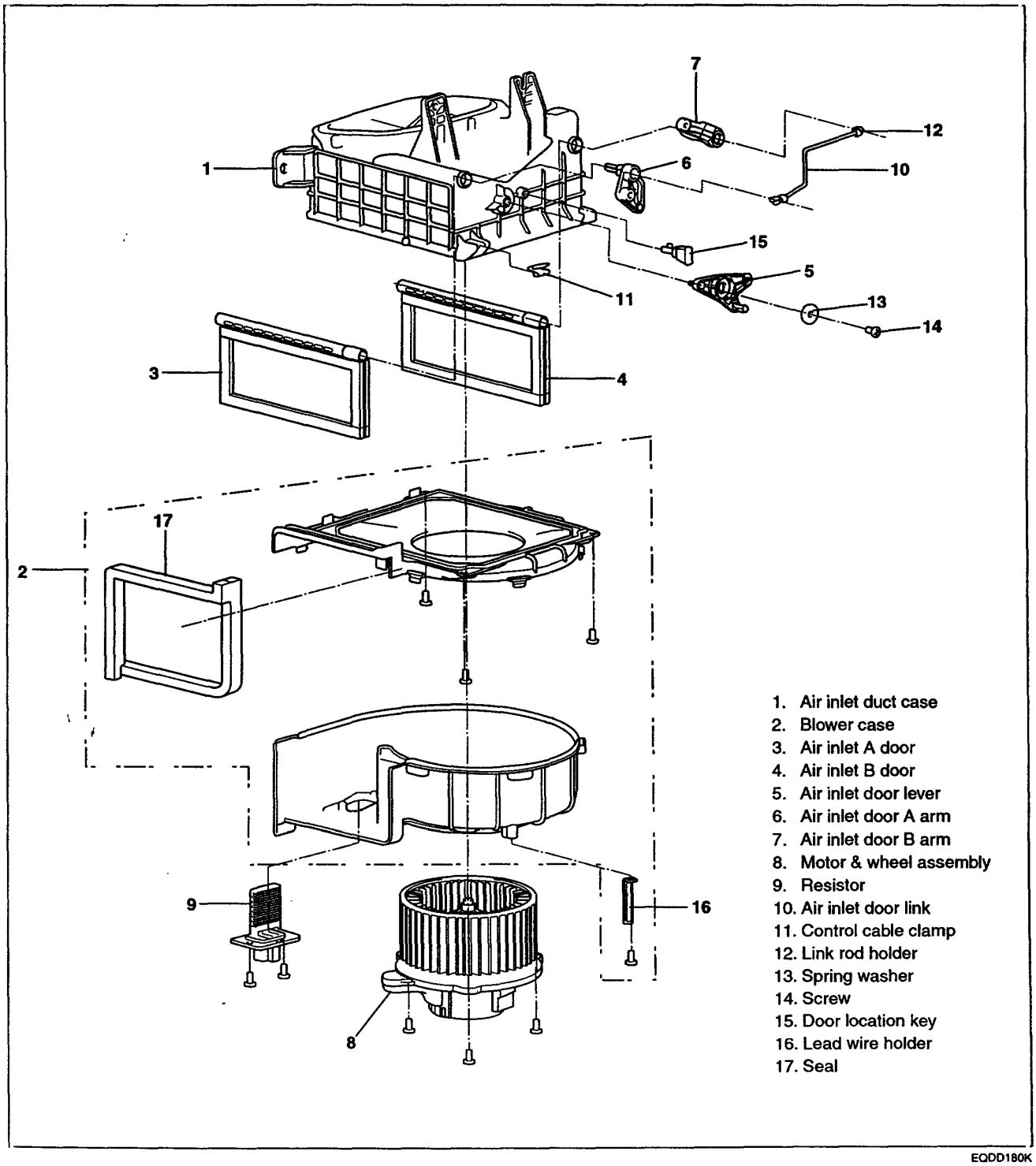


KQPC075E

BLOWER CONTROLS

BLOWER UNIT

COMPONENTS E1E4DB8F

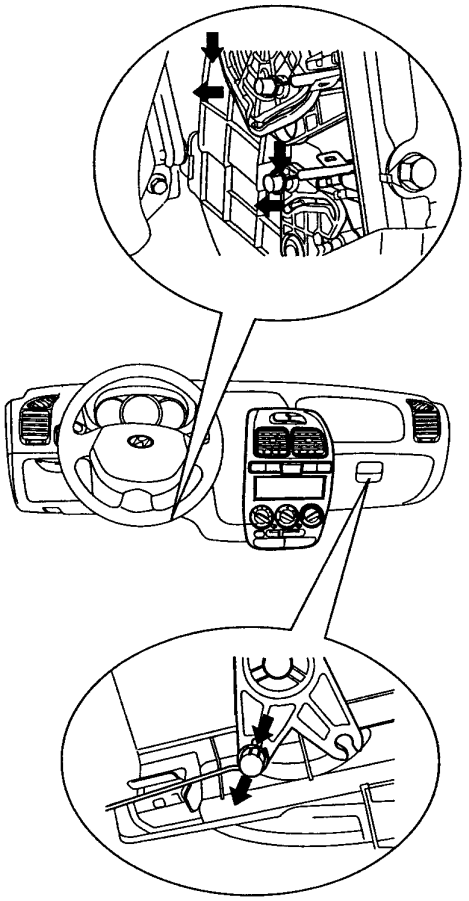


1. Air inlet duct case
2. Blower case
3. Air inlet A door
4. Air inlet B door
5. Air inlet door lever
6. Air inlet door A arm
7. Air inlet door B arm
8. Motor & wheel assembly
9. Resistor
10. Air inlet door link
11. Control cable clamp
12. Link rod holder
13. Spring washer
14. Screw
15. Door location key
16. Lead wire holder
17. Seal

EQDD180K

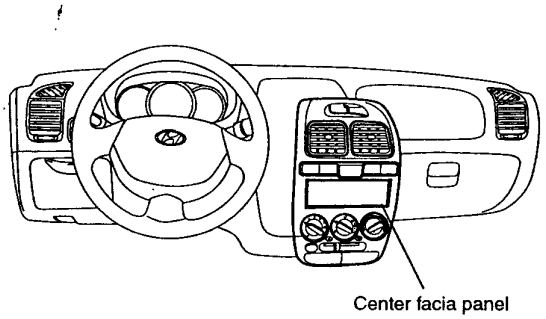
REMOVAL E421EAF2

1. Remove the 2 heater side control cables and one blower side control cable.



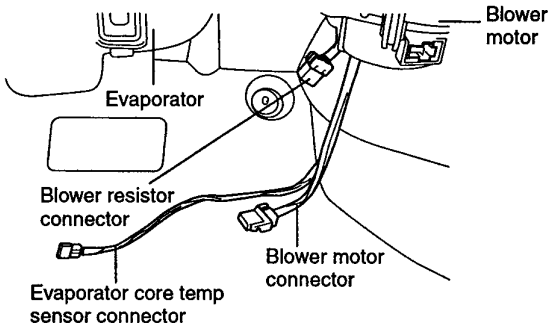
KQDD020B

2. Remove the center facia panel from the lower portion.



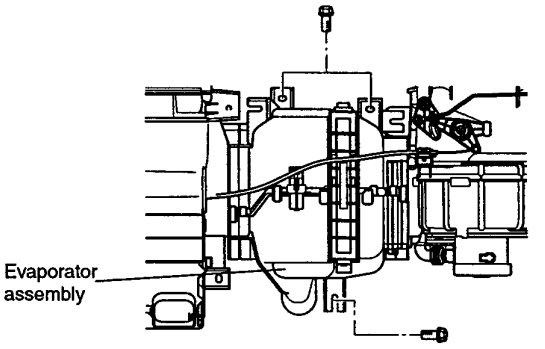
EQDD020C

3. Disconnect the switch connectors and remove the center facia panel.
4. After removing the mounting bolts, remove the main crash pad. (Refer to "CRASH PAD" of BD guoup)
5. Disconnect the evaporator core temp sensor (thermister), blower resistor connector, and motor connector.



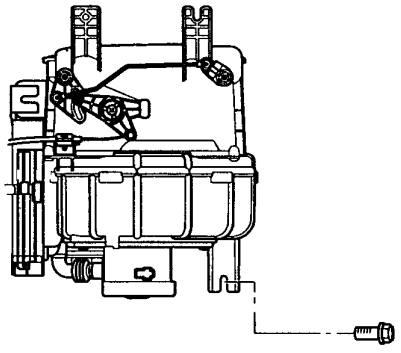
EQPD700A

6. Remove the evaporator unit.



EQPD161B

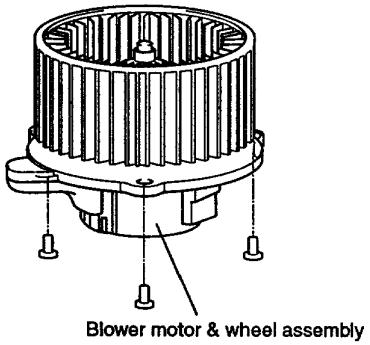
7. Remove the blower unit.



KQDD161D

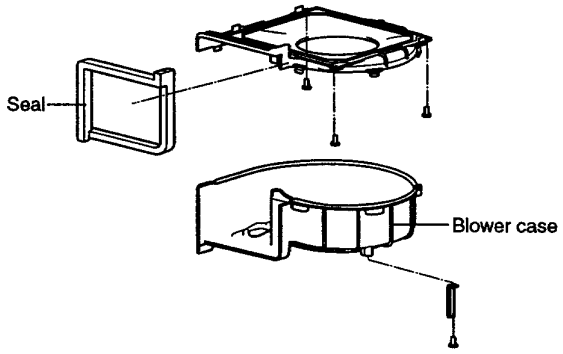
DISASSEMBLY AND REASSEMBLY E7FB351F

1. Loosen the motor mounting screw.



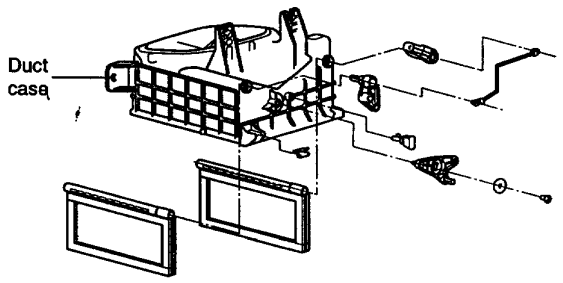
EQPD180O

2. Loosen the duct and blower case mounting screw.



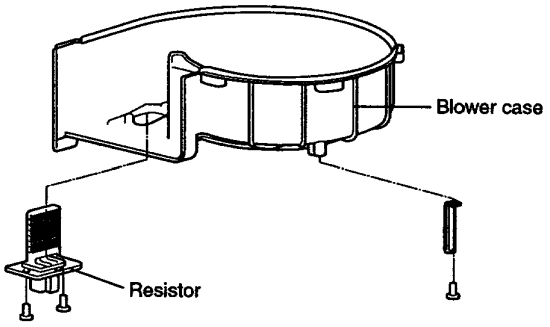
EQPD180L

3. Disconnect the door lever and arm.



EQDD180M

4. Remove the blower resistor.

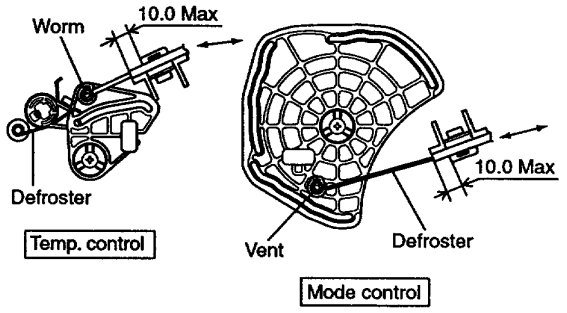


EQPD180N

5. Reassembly is the reverse of disassembly.

INSTALLATION E28BE8A4

Installation is the reverse of removal. (Prior to installation of intake and exhaust cables, install the locating pin)



EQPD161K

BLOWER MOTOR

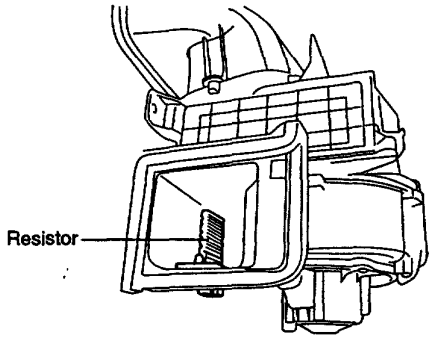
INSPECTION E9DBB316

1. Check the blower motor shaft for bend.
2. Check the packing portion for crack.
3. Check the fan for damage.
4. Check the blower case for damage.
5. Check for the air selection damper operation.
6. Connect the blower motor to the battery and check for smooth operation.
7. Connect the blower motor to the opposite poles of battery and check for reverse operation.

BLOWER RESISTOR

INSPECTION EEB7A0BB

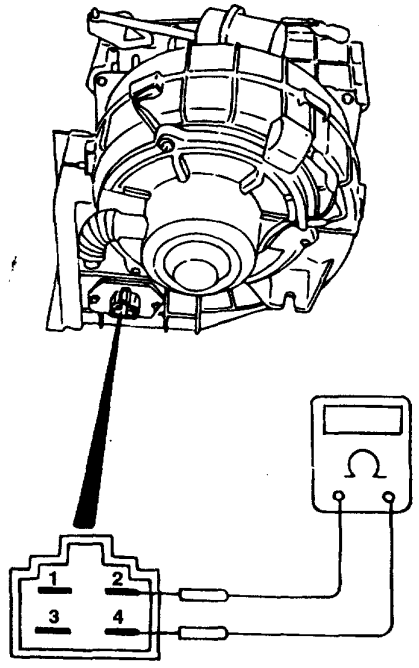
Measure the resistance between terminals and replace the blower resistor if the measured value is not within the specified range.



EQPD181G

Pin / Speed	1 ML	2 MH	3 LO	4 HI	Resistance (Ω)
Continuity	○——		——○		1.3
	○——	——○			0.65
		○——		——○	0.35±5%

EQNB235A

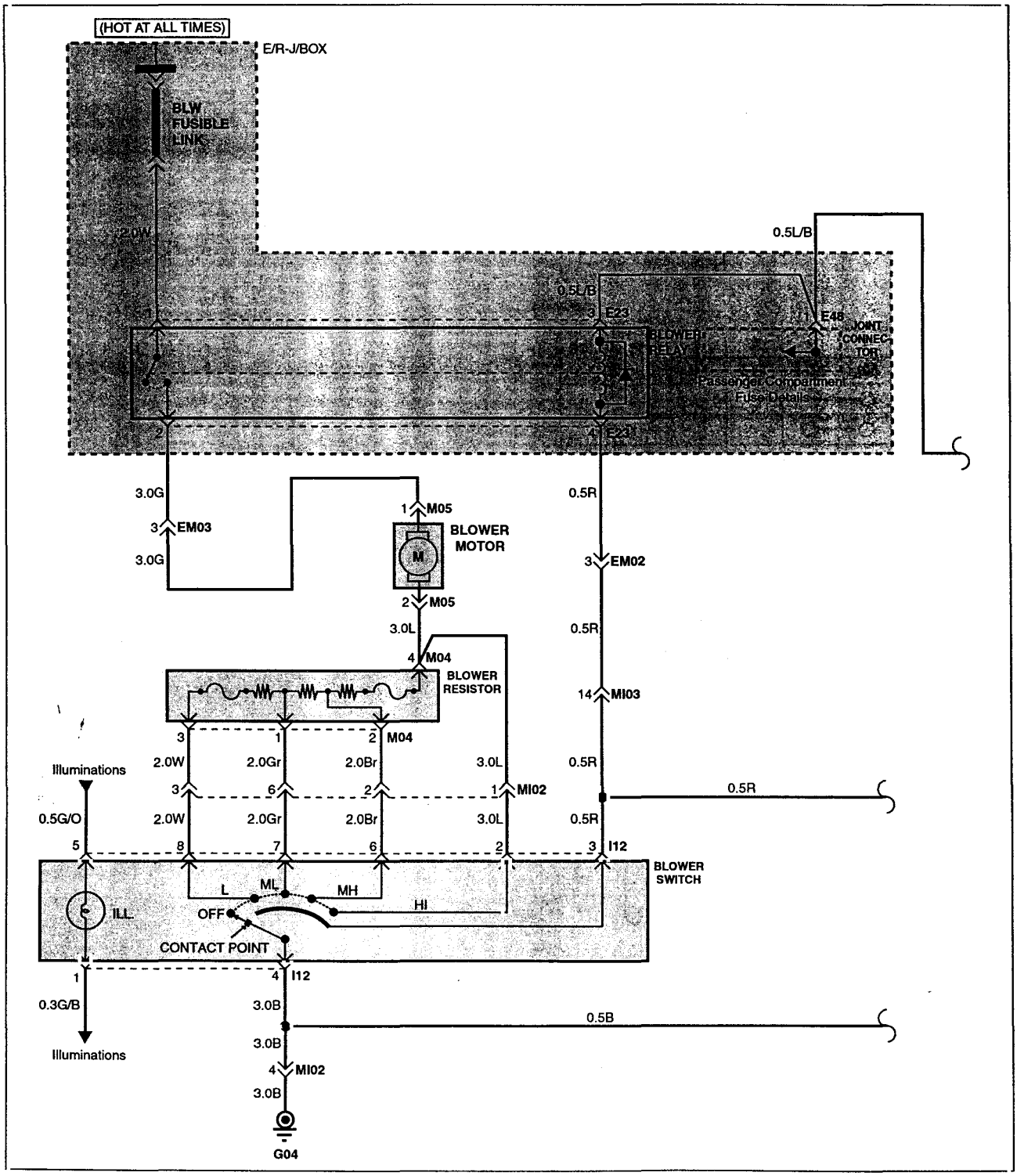


KQNB235B

BLOWER AND A/C CONTROLS (MANUAL)

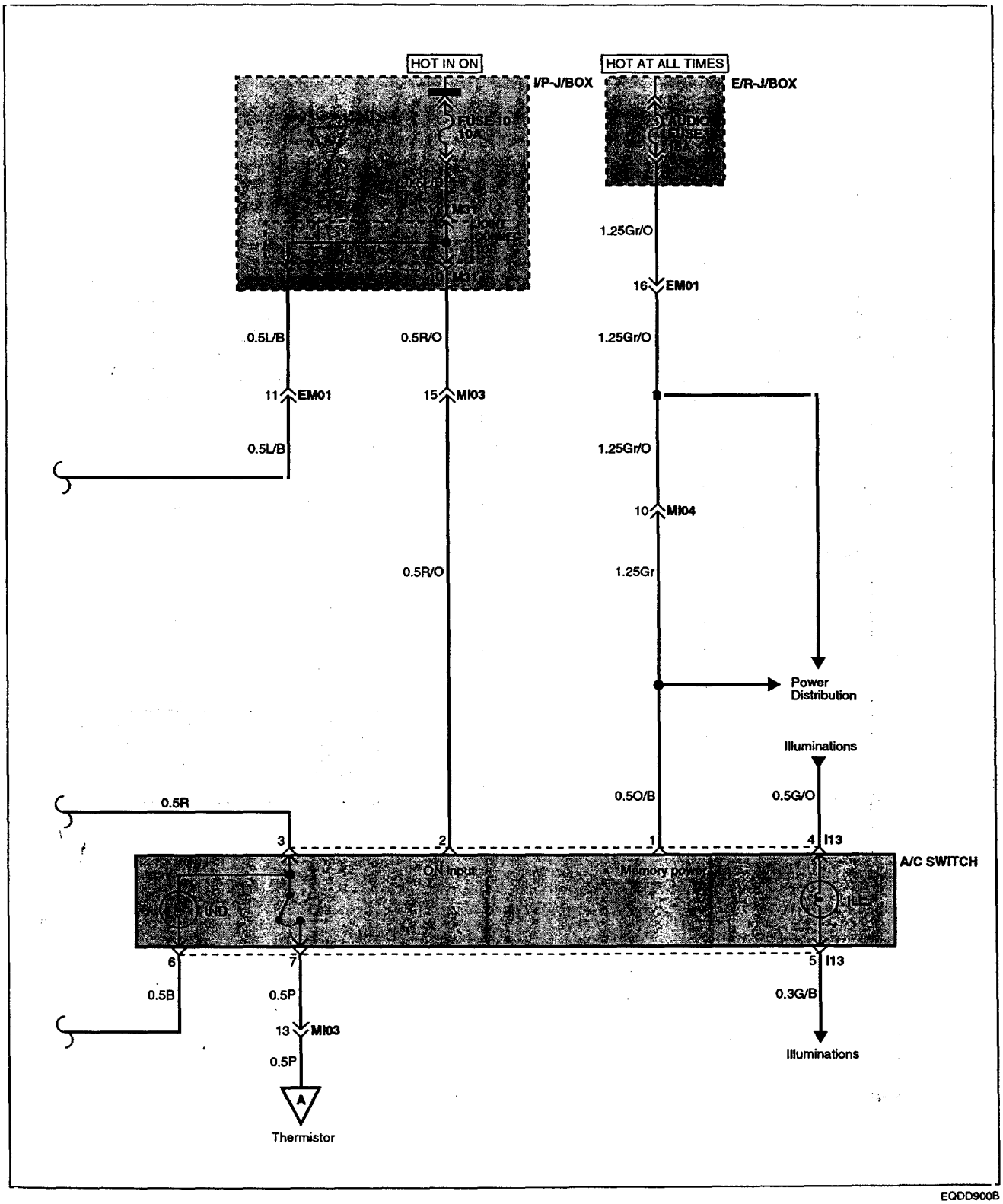
EAD0C82B

SCHEMATIC DIAGRAM (MANUAL) (1)



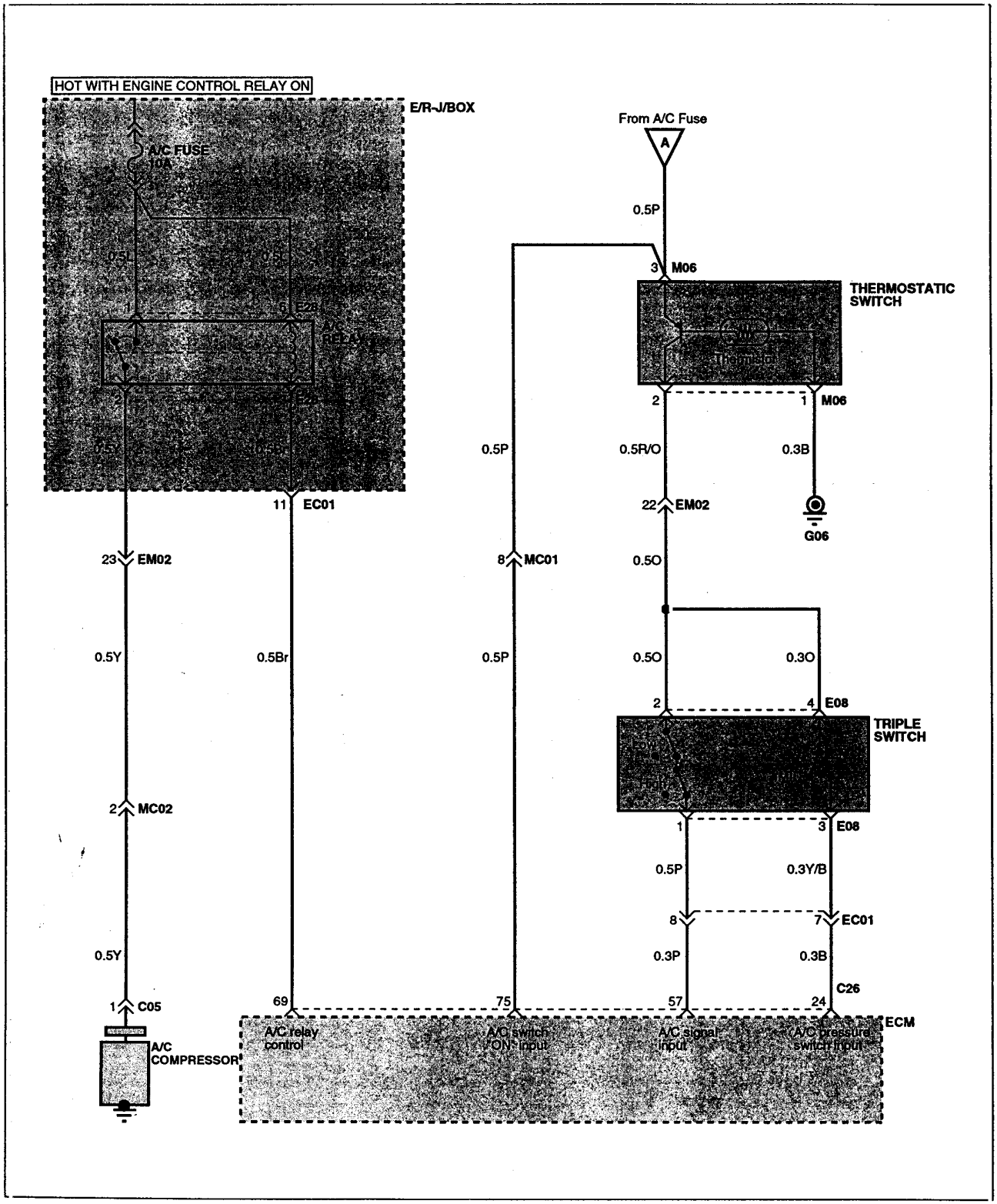
EQDD900A

SCHEMATIC DIAGRAM (MANUAL) (2)



EQDD900B

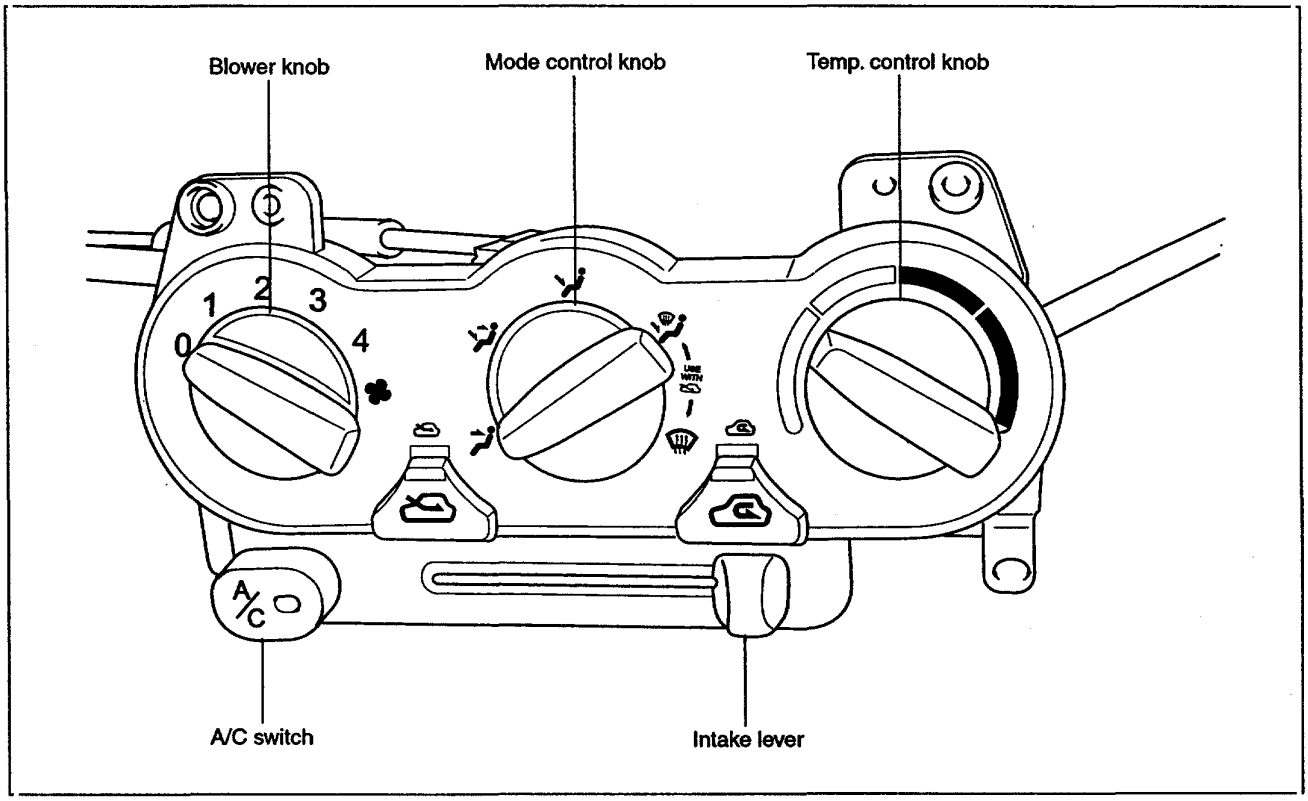
SCHEMATIC DIAGRAM (MANUAL) (3)



EQDD900C

CONTROL PANEL

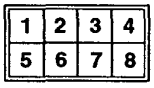
COMPONENTS ED71A5BD



EQDD191D

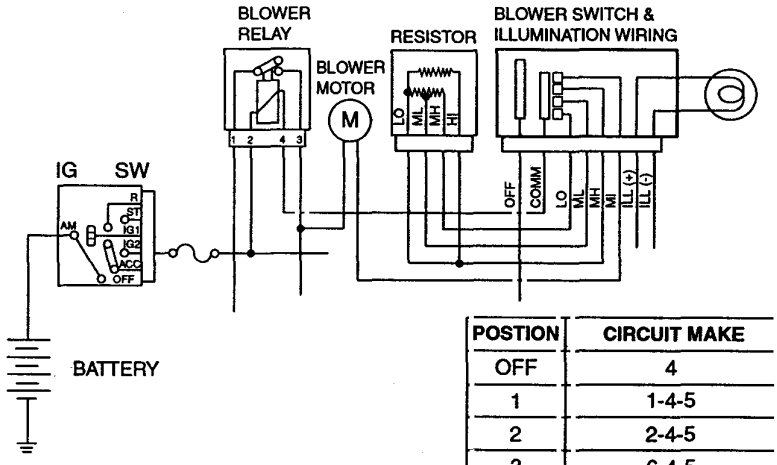
BLOWER SWITCH CONNECTOR & CONNECTION DIAGRAM

CONNECTOR



NO	DESCRIPTION
1	LOW
2	MIDDLE LOW
3	MIDDLE HIGH
4	ILL (+)
5	EARTH
6	COMMON
7	HIGH
8	ILL (-)

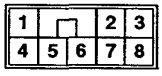
CONNECTION DIAGRAM



POSTION	CIRCUIT MAKE
OFF	4
1	1-4-5
2	2-4-5
3	6-4-5
4	3-4-5

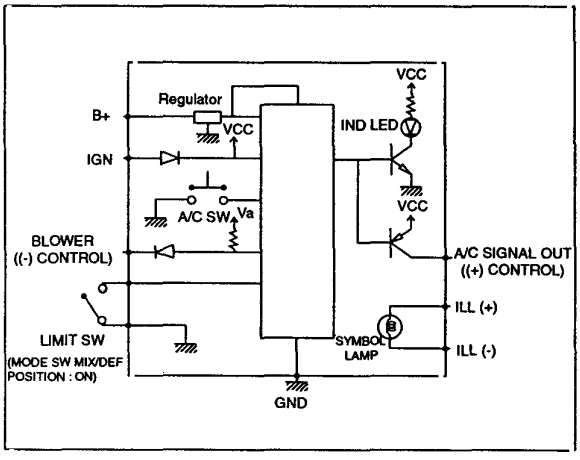
A/C SWITCH & DEFROSTER SWITCH CONNECTOR

CONNECTOR



NO	DESCRIPTION
1	B (+)
2	IGN
3	BLOWER
4	ILL (+)
5	ILL (-)
6	GND
7	A/C SIGNAL OUT
8	-

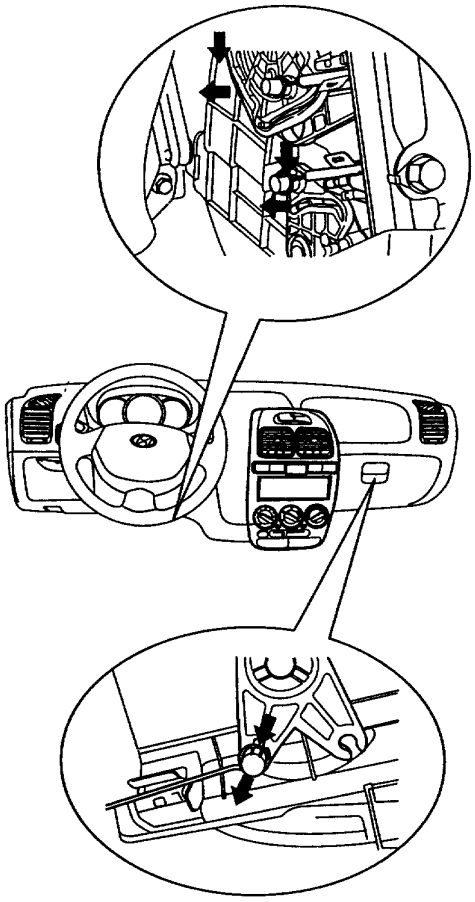
A/C SWITCH DIAGRAM



EQDD086A

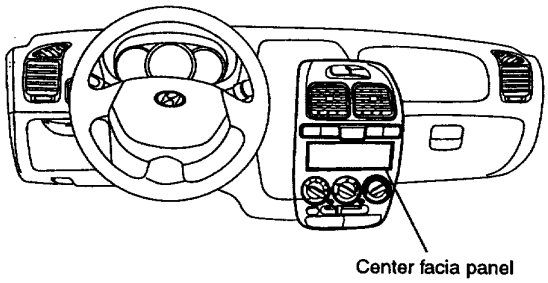
REMOVAL AND INSTALLATION EB6FEBC7

1. Remove the 2 control cables in the heater side and one control cable in the blower side.



KQDD020B

2. Remove the center facia panel from the lower portion.



EQDD020C

3. Disconnect the switch connectors and remove the center facia panel.

4. Installation is the reverse of removal.

DISASSEMBLY AND REASSEMBLY E5ADF040

Refer to "COMPONENTS".

HOW TO USE THIS MANUAL

INTRODUCTION ..... GI -2
SYMBOLS ..... GI -6
TROUBLESHOOTING INSTRUCTIONS GI-10

G

INTRODUCTION E497F9B3

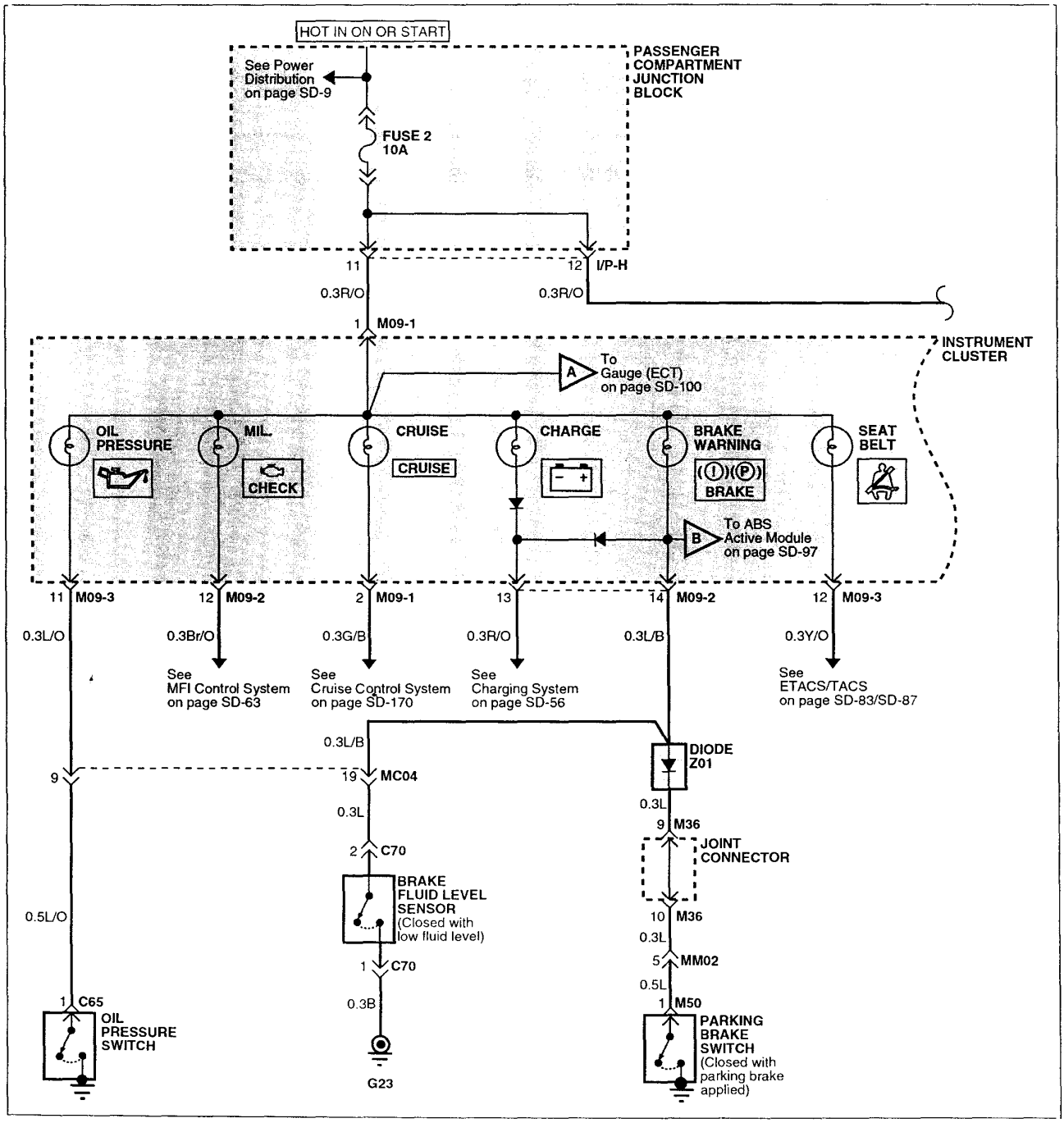
This Manual consists of five major diagnostic sections for electrical problem troubleshooting.

- Schematic diagrams
- Component location indexes
- Component locations
- Connector configurations
- Harness layouts

SCHEMATIC DIAGRAMS

The starting point of each system section is the schematic diagram. These diagrams show how all the components work together, such as electrical current paths from power source to ground(via electrical load), switch connections at each position, and other related circuit functions.

It is important to fully understand how a circuit works prior to troubleshooting and diagnosis.



EGI001A

COMPONENT LOCATION INDEXES

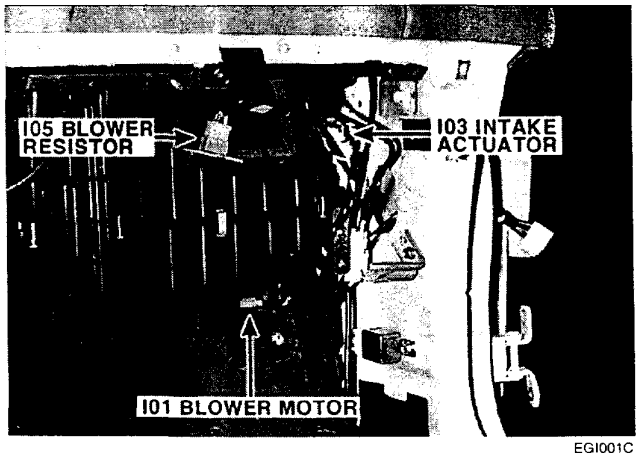
When you want to locate the schematic components on the vehicle, use the Component Location Index which follows each schematic. A Component Location Index lists major components, connectors, grounds, diodes, and their physical location and page reference. Almost all components, connectors or grounds, and diodes shown on a schematic can be pinpointed visuallyby using the Component Location Illustrations.

Components		Location Reference - Page
I12	Digital clock	CL-15
I16-1	Instrument cluster	CL-15
M55	Fuel sender	CL-19
M56	Fuel pump	CL-19
C34	Engine coolant temperature sender	CL-5, CL-8
Connectors		
MI01/MI02/MI03		CL-21
MC02		CL-21
CC02		CL-8
Grounds		
G01		CL-24
G02		CL-24

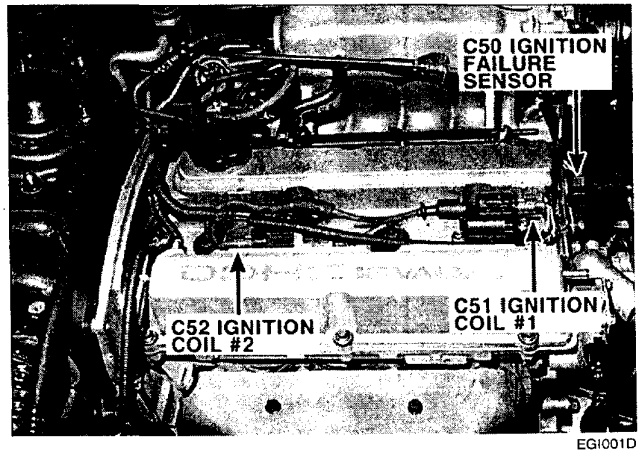
EGI001B

COMPONENT LOCATIONS

Component Locations make it easy to find the schematic components on the vehicle shown in the Component Location Index.



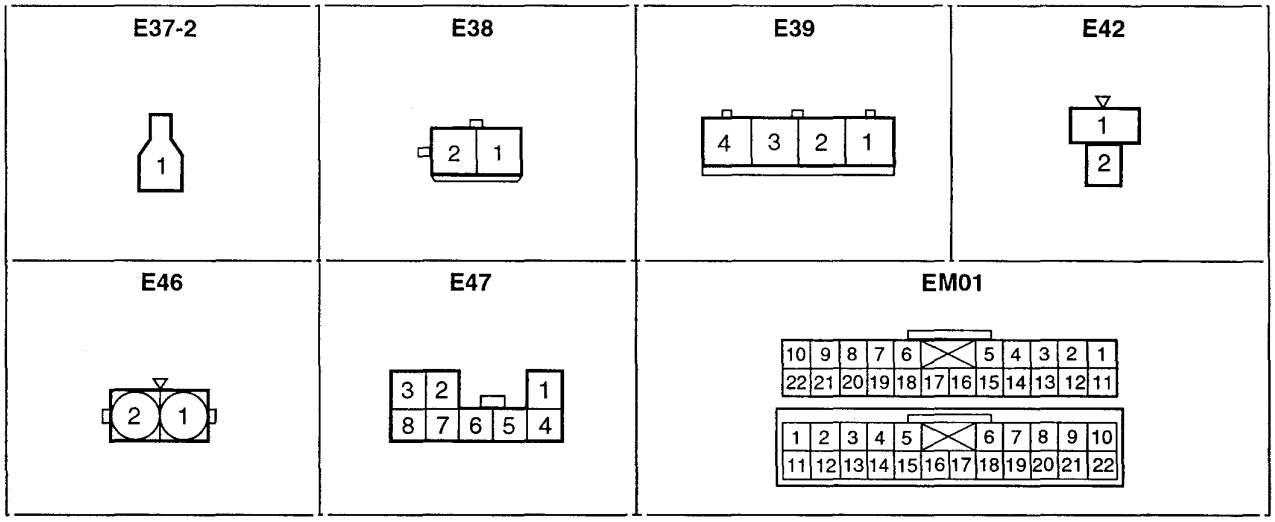
EGI001C



EGI001D

CONNECTOR CONFIGURATIONS

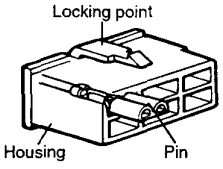
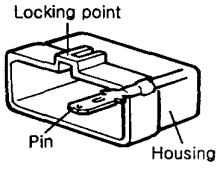
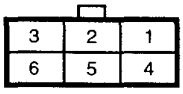
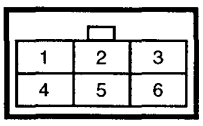
This section shows the cavity or terminal locations in all the multi-pin connectors shown in the schematic diagrams. It will help you to locate check points, together with the wire colors and terminal numbers in the schematic. The configuration drawings show the connector view as seen from a component after the harness connector has been disconnected. When more than one connector is connected to a component, the connectors are all shown together. Both halves of in-line connectors are shown together.



EGI001E

CONNECTOR VIEW AND NUMBERING ORDER

1. CONNECTOR VIEW

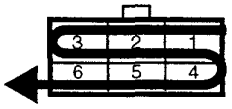
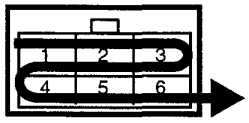
	Female	Male	Remarks
Actual Illustration			It is not the shape of the connector housing, but the connector pin that distinguishes between male or female connectors. When numbering female and male connectors, refer to the numbering order in the following table. Some connectors may not follow this method of numbering order. For individual detailed numbering, refer to the CONNECTOR CONFIGURATIONS.
Illustration in the Shop manual			

EGI001F

NOTE

UNLESS OTHERWISE STATED, ALL CONNECTOR VIEWS ARE FROM THE TERMINAL SIDE OF THE CONNECTOR.

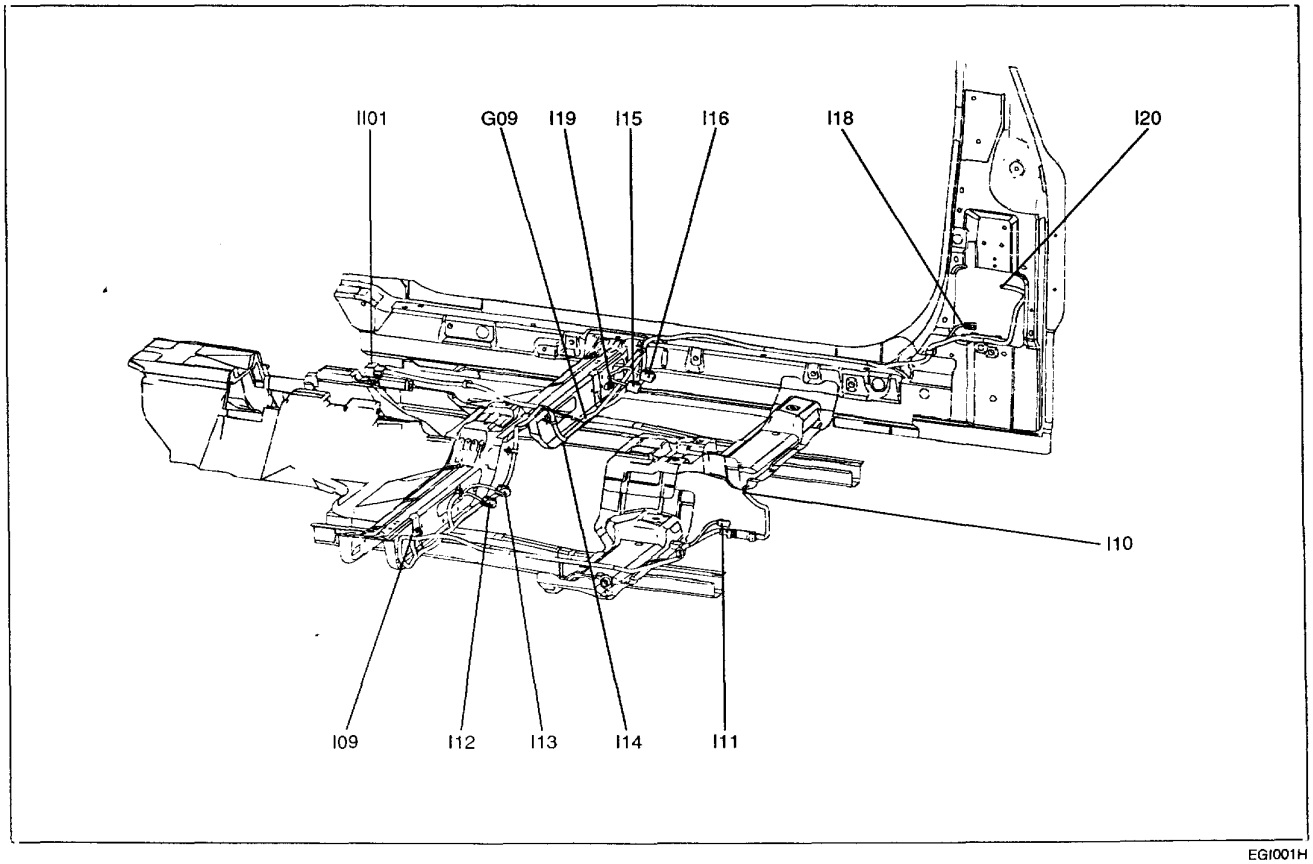
2. NUMBERING ORDER

	Numbering order	Remarks
Female Connector		Numbered in order from upper right to lower left
Male Connector		Numbered in order from upper left to lower right

EGI001G

HARNESS LAYOUTS

Harness layouts show the routing of the major wiring harnesses, the in-line connectors and the splices between the majorharnesses. These layouts will make electrical troubleshooting easier.



EGI001H

SYMBOLS E378DABD

The symbols and abbreviations explained in this section are used throughout the manual.

SYMBOLS IN SCHEMATIC

Components



A solid line means the entire component is shown.



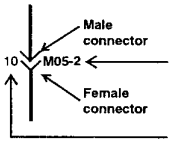
A broken line indicates only part of the component is shown.



The name of the component appears next to its upper right corner.

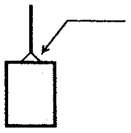
Notes about component function follow its name.

Connectors

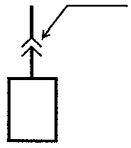


Connector number

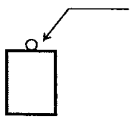
Connector cavity number



This means the connector connects directly to the component.



This indicates the connector connects to a lead (pigtail), wired directly to the component.



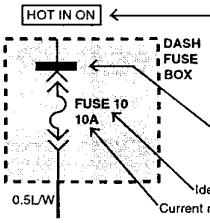
This indicates a screw terminal on the component.

Diode



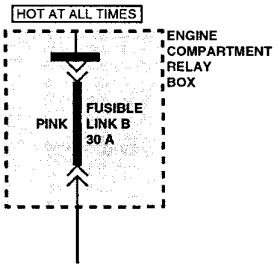
This diode allows current to flow only in the direction of the arrow.

Fuse and Fusible link



This means power is supplied with the ignition on position.

This means the short bar connects to other fuses.



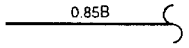
Circuit Breaker



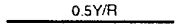
Basically a reusable fuse, a circuit breaker will heat and open if too much current flows through it. Some units automatically reset when cool, others must be manually reset.

EGI002A

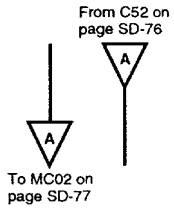
Wires



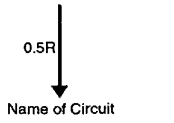
A wavy line means the wire is broken but is to be continued.



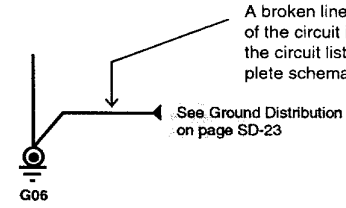
Wire insulation is yellow with a red strip.



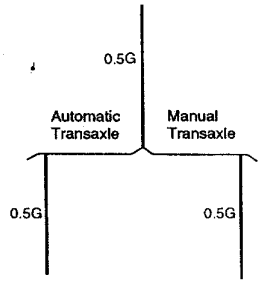
Current path is continued on the same page or another page. The arrow shows the direction of current flow. You should look for the "A" in the marked position.



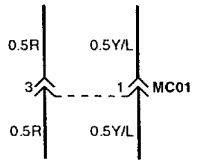
A wire connects to another circuit. The wire is shown again on that circuit which the arrow is pointing.



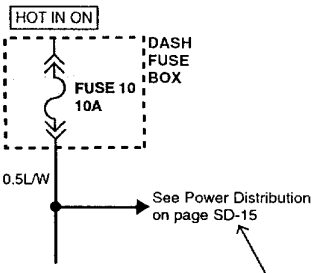
A broken line means only some of the circuit is shown: refer to the circuit listed for the complete schematic.



Wire choices for options or different models are labeled and shown with a "choice" bracket like this.

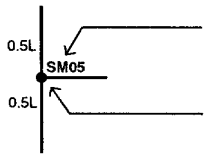


This dashed line means the R(red) and Y/L(yellow/blue) wires are both in connector MC01.



Where separate wires join, only the splice is shown: for details on the additional wiring, refer to the circuit listed.

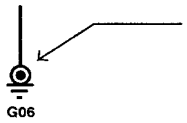
Splices



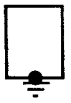
Splice number

Splices are numbered and shown as a dot with circle. The exact location and connection of these splices may vary among vehicles.

Ground - "G"

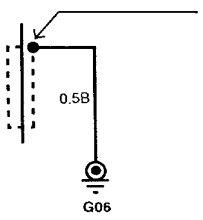


This symbol means the end of the wire is attached to a metal part of the vehicle.



This ground symbol (dot and 3 lines overlapping the component) means the housing of the component is attached to a metal part of the vehicle.

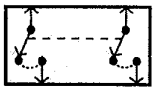
Shield Wire



This represents RFI (Radio Frequency Interference) Shielding around a wire. The shielding is always connected to ground.

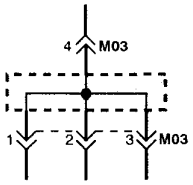
EGI002B

Switches



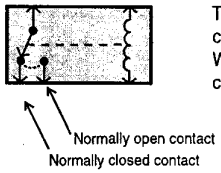
These switches move together: a dashed line shows a mechanical connection between them.

Joint Connectors



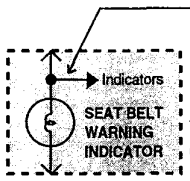
This is a connector showing the joining wires.

Relays



This is a relay shown with no current flowing through its coil. When a current flows through coil, contact will toggle.

Indicator



This indicates seat belt warning indicator continues to other indicators within instrument cluster.

This is an indicator which displays the lighted symbol.

EGI002C

WIRE COLOR ABBREVIATIONS

The following abbreviations are used to identify wire colors in the circuit schematics.

Symbol	Color of wire	Symbol	Color of wire
B	Black	O	Orange
Br	Brown	P	Pink
G	Green	R	Red
Gr	Gray	W	White
L	Blue	Y	Yellow
Lg	Light green		

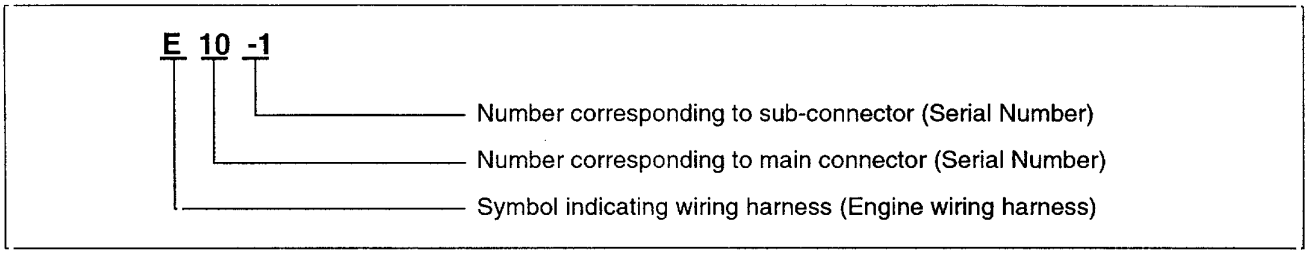
HARNESS CLASSIFICATION

Electrical wiring connectors are classified according to the wiring parts in the Harness Layouts.

Harness name	Location	Symbol
Engine harness	Engine compartment	E
Main, Floor, Roof, Sunroof, Seat warmer ext. harness	Passenger compartment, Floor, Roof	M
Control, Injector harness	Engine compartment	C
Tail gate harness	Tail gate	R
Air bag harness	Under crash pad and Floor	I
Door harness	Door	D

CONNECTOR IDENTIFICATION

A connector identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector. These connector locations can be found in the HARNESS LAYOUTS.
For example :

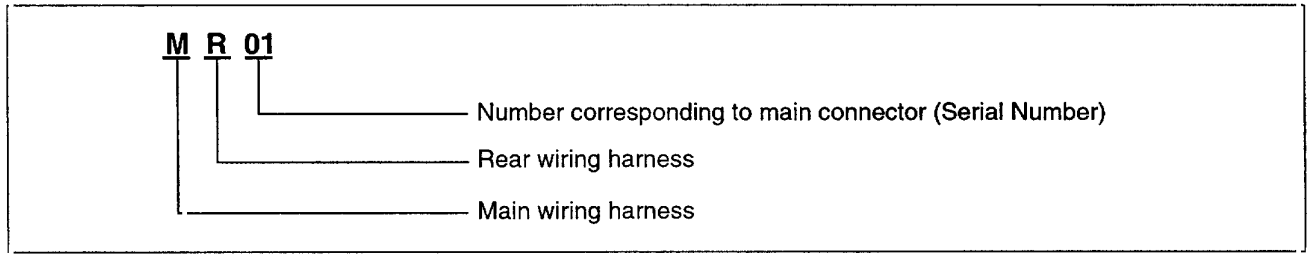


EGI002D

NOTE

Connectors which connect each wiring harness are represented by the following symbols.

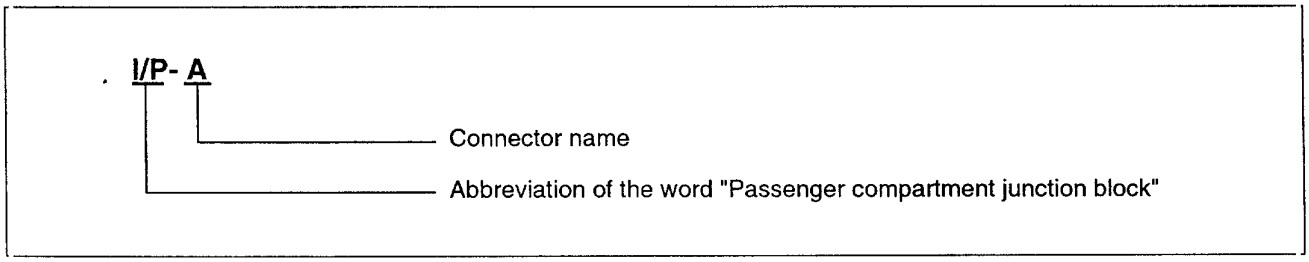
For example :



EGI002E

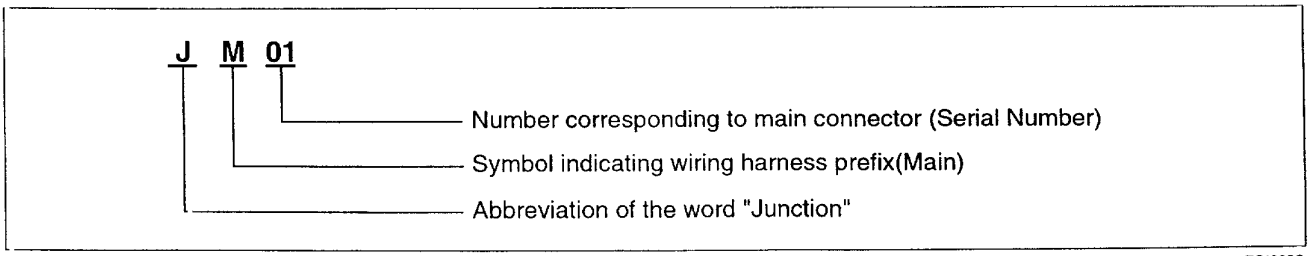
JUNCTION BLOCK IDENTIFICATION

A junction block identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector in the junction block.
For example :



EGI002F

For example :



EGI002G

TROUBLESHOOTING INSTRUCTIONS EF7DB7B5

TROUBLESHOOTING PROCEDURES

The following five-steps troubleshooting procedure is recommended.

1. **Verify the customer's complaints**

   Turn on all the components in the problem circuit to check the accuracy of the customer's complaints. Note the symptoms.Do not begin disassembly or testing until you have narrowed down the probable causes.

2. **Read and analyze the schematic diagram**

   Locate the schematic for the problem circuit. Determine how the circuit is supposed to work by tracing the current pathsfrom the power source through the system components to ground. If you do not understand how the circuit should work, read the circuit operation text. Also check other circuits that share with the problem circuit. The name of circuits that share the same fuse, ground, or switch, for example, are referred to on each diagram. Try to operate any shared circuitsyou did not check in step 1. If the shared circuit works, the shared wiring is okay, and the cause must be within the wiring used only by the problem circuit. If several circuits fail at the same time, the fuse or ground is a likely cause.

3. **Inspect the circuit/ component with the problem isolated**

   Make a circuit test to check the diagnosis you made in step 2. Remember that a logical, simple procedure is the key to efficient troubleshooting. Narrow down the probable causes using the troubleshooting hints and system diagnosis charts. Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.

4. **Repair the problem**

   Once the problem is found, make the necessary repairs.

5. **Make sure the circuit works**

   Repeat the system check to be sure you have repaired the problem. If the problem was a blown fuse, be sure to test all of the circuits on that fuse.

TROUBLESHOOTING EQUIPMENT

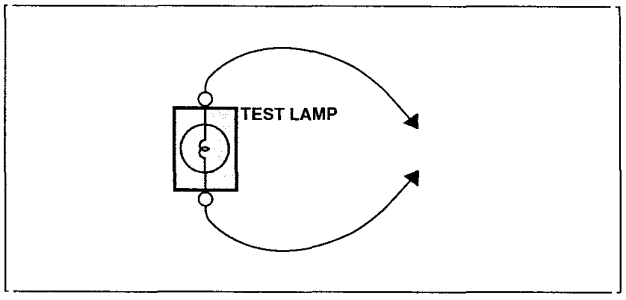
VOLTMETER AND TEST LAMP

Use a test lamp or a voltmeter on circuits without solid-state units and use a test lamp to check for voltage. A test lamp is made up of a 12-volt light bulb with a pair of leads attached. After grounding one lead, touch the other lead to various points along the circuit where voltage should be present. When the bulb goes on, there is voltage at the point being tested.>

CAUTION

A number of circuits include solid-state modules, such as the Engine Control Module(ECM), used with computer command con trol injection. Voltage in these circuits should be tested only with a 10-megaohm or higher impedance digital volt-met er . Never use a test lamp on circuits that contain solid state modules. Damage to the modules may result.

A voltmeter can be used in place of a test lamp. While a test lamp shows whether the voltage is present or not, a voltmeter indicates how much voltage is present.



EGI003A

SELF-POWERED TEST LAMP AND OHMMETER

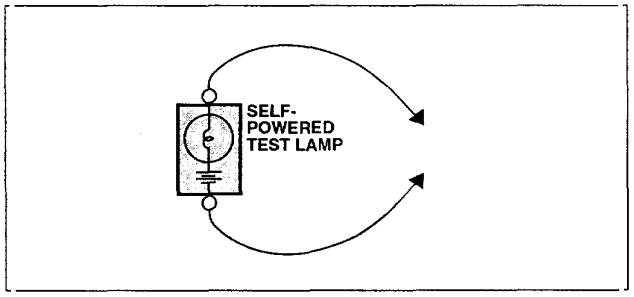
Use a self-powered test lamp or an ohmmeter to check for continuity. The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

CAUTION

Never use a self-powered test lamp on circuits that contain solid state modules. Damage to these modules may result.

An ohmmeter can be used in place of a self-powered test lamp. The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

Circuits which include any solid-state devices should be tested only with a 10-megaohm or higher impedance digital multimeter. When measuring resistance with a digital multimeter, the battery negative terminal should be disconnected. Otherwise, there may incorrect readings. Diodes and solid-state devices in a be circuit can make an ohmmeter give a false reading. To find out if a component is affecting a measurement, take one reading, reverse the leads and take a second reading. If different the solid-state device is affecting the measurement.



EGI003B

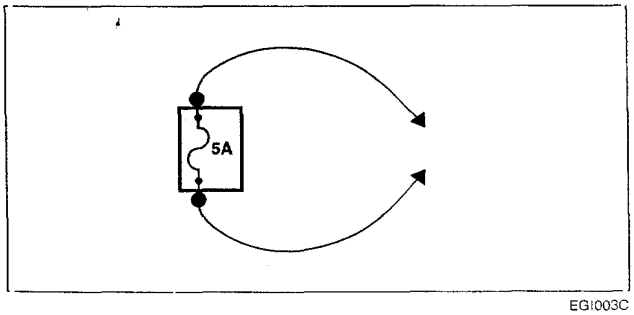
JUMPER WIRE WITH FUSE

Use a jumper wire with a fuse to by-pass an open circuit.

A jumper wire is made up of an in-line fuse holder connected to a set of test leads. This tool is available with small clamp connectors providing adaption to most connectors without damage.

CAUTION

Do not use a fuse with a higher rating than the specified fuse that protects the circuilt being tested. Do not use this tool in any situation to substitute an input or output at the solid-state control module, such as ECM, TCM, etc.



EGI003C

SHORT FINDER

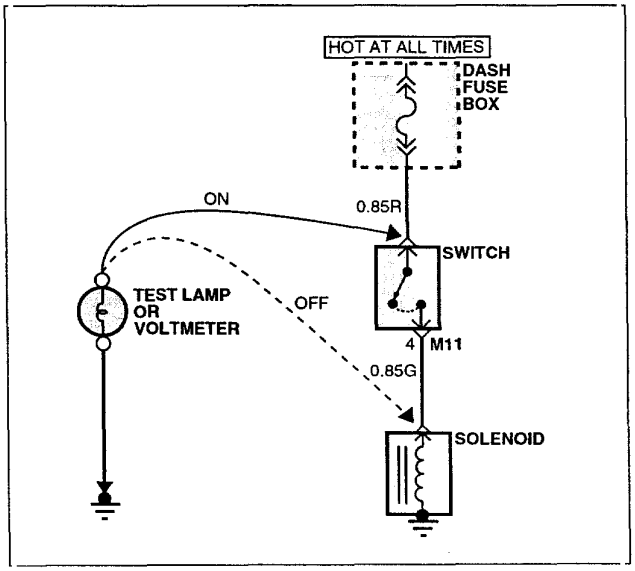
A short finder is available to locate a short to ground. The short finder creates a pulsing magnetic field in the shorted circuit and shows you the location of the short through body trim or sheet metal.

TROUBLESHOOTING TEST

1. TESTING FOR VOLTAGE

This test measures voltage in a circuit. When testing for voltage at a connector, you do not have to separate the two halves of the connector. Instead, probe the connector from the back(backprobe). Always check both sides of the connector because dirt and corrosion between its contact surfaces can cause electrical problems.

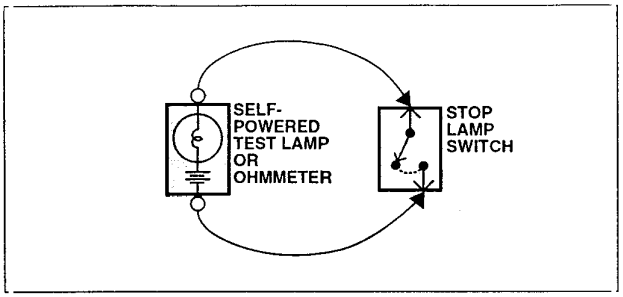
A. Connect one lead of a test lamp or voltmeter to a ground. If you are using a voltmeter, be sure it is the voltmeter's negative test lead you have connected to ground.
B. Connect the other lead of the test lamp or voltmeter to a selected test point(connector or terminal).
C. If the test lamp glows, there is voltage present. If you are using a voltmeter, note the voltage reading. A loss of more than 1 volt from specification indicates a problem.



EGI003D

2. TESTING FOR CONTINUITY

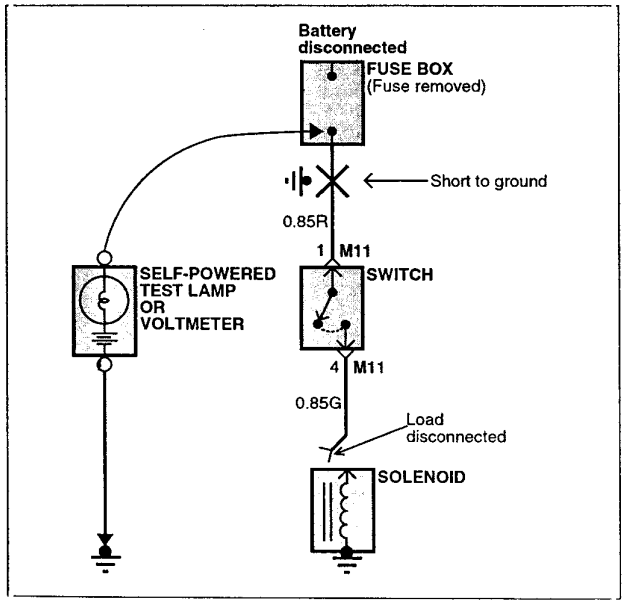
A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or ohmmeter to one end of the part of the circuit you wish to test. If you are using an ohmmeter, hold the leads together and adjust the ohmmeter to read zero ohms.
C. Connect the other lead to the other end.
D. If the self-power test lamp glows, there is continuity. If you are using an ohmmeter, low or zero resistance means good continuity.



EGI003E

3. TESTING FOR SHORT TO GROUND

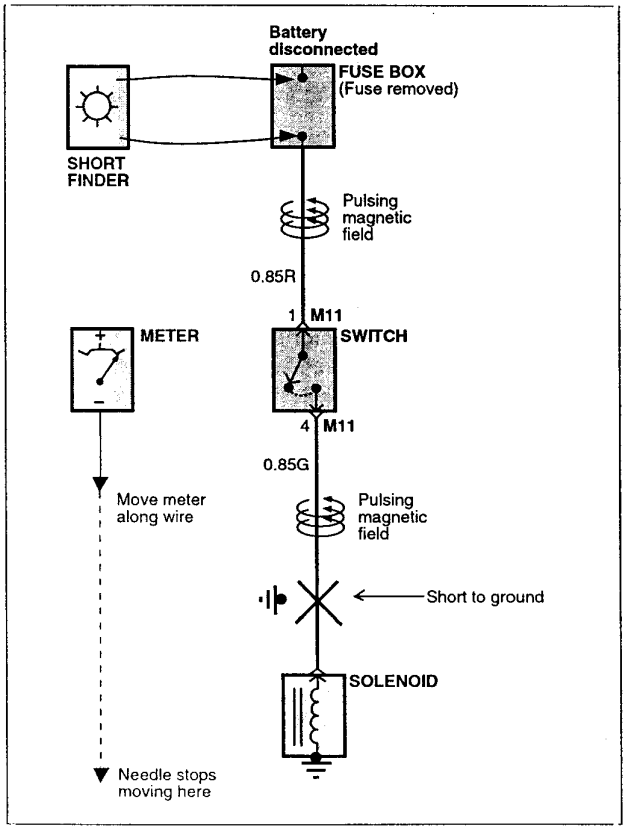
A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or an ohmmeter to the fuse terminal on the load side.
C. Connect the other lead to a ground.
D. Beginning near the fuse block move the harness from side to side. Continue this proceedure(about six inches apart) while watching the self-powered test lamp or ohmmeter.
E. When the self-powered test lamp glows, or ohmmeter registers, there is a short to a ground in the wiring near that point.



EGI003F

4. TESTING FOR A SHORT WITH A SHORT FINDER

A. Remove the blown fuse. Leave the battery connected.
B. Connect the short finder across the fuse terminals.
C. Close all switches in series in the circuit that is being testing.
D. Turn on the short circuit locator. It sends pulses of current to the short. This creates a pulsing magnetic field around the wiring between the fuse box and the short.
E. Beginning at the fuse box, slowly move the short finder along the circuit wiring. The meter will show current pulses through sheet metal and body trim. As long as the meter is between the fuse and the short, the needle will move with each current pulse. Once the meter is moved past the point of the short, the needle will stop moving. Check around this area to locate the cause of the short circuit.



EGI003G

Body (Interior and Exterior)

GENERAL
- SPECIFICATIONS ..... BD - 2
- SPECIAL TOOLS ..... BD - 4
- TROUBLESHOOTING ..... BD - 6

EXTERIOR
- HOOD
  - REMOVAL AND INSTALLATION ..... BD - 7
  - ADJUSTMENT ..... BD - 8
- TRUNK LID
  - COMPONENTS ..... BD - 9
  - REMOVAL AND INSTALLATION ..... BD -10
  - ADJUSTMENT ..... BD -11
- TAIL GATE
  - COMPONENTS ..... BD -12
  - REMOVAL AND INSTALLATION ..... BD -13
  - ADJUSTMENT ..... BD -15
- FRONT DOOR
  - COMPONENTS ..... BD -16
  - REMOVAL AND INSTALLATION ..... BD -17
  - ADJUSTMENT ..... BD -19
- REAR DOOR
  - COMPONENTS ..... BD -20
  - REMOVAL AND INSTALLATION ..... BD -21
  - ADJUSTMENT ..... BD -24
- BODY SIDE MOLDINGS
  - REMOVAL AND INSTALLATION ..... BD -25
- SUN ROOF
  - COMPONENTS ..... BD -29
  - REMOVAL AND INSTALLATION ..... BD -30
- OUTSIDE REAR VIEW MIRROR
  - COMPONENTS ..... BD -32
  - REMOVAL AND INSTALLATION ..... BD -33

INTERIOR
- CONSOLE
  - COMPONENTS ..... BD -34
  - REMOVAL AND INSTALLATION ..... BD -35
- CRASH PAD
  - COMPONENTS ..... BD -36
  - REMOVAL AND INSTALLATION ..... BD -37
- INTERIOR TRIM
  - COMPONENTS ..... BD -40
  - REMOVAL AND INSTALLATION ..... BD -41
- WINDSHIELD GLASS
  - COMPONENTS ..... BD -46
  - REMOVAL ..... BD -47
  - INSTALLATION ..... BD -48
- TAILGATE GLASS
  - COMPONENTS ..... BD -51
  - REMOVAL ..... BD -52
  - INSTALLATION ..... BD -52
- QUARTER FIXED GLASS
  - COMPONENTS ..... BD -55
  - REMOVAL ..... BD -56
  - INSTALLATION ..... BD -56

BUMPER
- FRONT BUMPER
  - COMPONENTS ..... BD -58
  - REMOVAL AND INSTALLATION ..... BD -59
- REAR BUMPER
  - COMPONENTS ..... BD -60
  - REMOVAL AND INSTALLATION ..... BD -61

SEAT
- FRONT SEAT
  - COMPONENTS ..... BD -63
  - REMOVAL AND INSTALLATION ..... BD -64
- REAR SEAT
  - COMPONENTS ..... BD -65
  - REMOVAL AND INSTALLATION ..... BD -66
- FRONT SEAT BELT
  - PECAUTIONS ..... BD -67
  - REMOVAL AND INSTALLATION ..... BD -68
- REAR SEAT BELT
  - REMOVAL AND INSTALLATION ..... BD -69

GENERAL

SPECIFICATIONS E8DDC73C

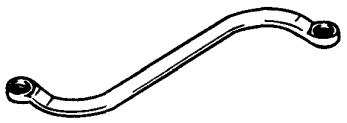
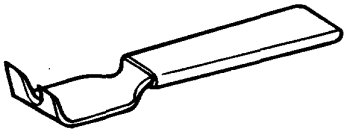
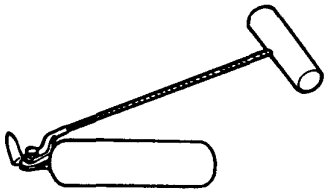
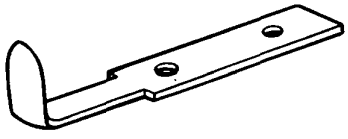
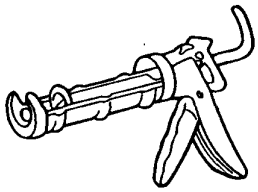
Items	Specifications
Hood	
Type	Rear hinged, front opening type (open stay rod type)
Front door	
Construction	Front hinged, full door construction
Regulator system	Wire drum type
Locking system	Pin-fork system
Rear door	
Construction	Front hinged, full door construction
Regulator system	Wire drum type
Locking system	Pin-fork system
Trunk lid	
Type	Torsion bar type
Tailgate	
Type	Inner hinged, gas lifter type
Glass thickness mm (in.)	
Windshield glass	5.0 (0.20)
Front door glass	3.2 (0.13)
Rear door glass	3.2 (0.13)
Fixed glass	3.5 (0.14)
Tailgate glass	3.5 (0.14)
Seat belts	3 point type with E.L.R.

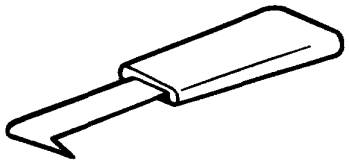
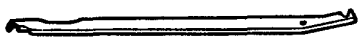
E.L.R. : Emergency Locking Retractor

TIGHTENING TORQUE

	Nm	kg·cm	lb·ft
Door			
Door hinge to body	35 ~ 42	350 ~ 420	25 ~ 31
Door hinge to door	22 ~ 27	220 ~ 270	16 ~ 19.5
Door striker mounting bolt	17 ~ 22	170 ~ 220	12 ~ 16
Trunk lid			
Trunk lid hinge to body	7 ~ 9	70 ~ 90	5 ~ 7
Trunk lid hinge to trunk lid	7 ~ 9	70 ~ 90	5 ~ 7
Tailgate			
Tailgate hinge to body	7 ~ 9	70 ~ 90	5 ~ 7
Tailgate hinge to tailgate	7 ~ 9	70 ~ 90	5 ~ 7
Tailgate latch mounting bolt	7 ~ 11	70 ~ 110	5 ~ 8
Tailgate striker mounting bolt	9 ~ 14	90 ~ 140	7 ~ 10
Hood			
Hood hinge to body	22 ~ 27	220 ~ 270	16 ~ 19.5
Hood hinge to hood	22 ~ 27	220 ~ 270	16 ~ 19.5
Hood latch to body	7 ~ 11	70 ~ 110	5 ~ 8
Seat			
Front seat to floor bolt	35 ~ 55	350 ~ 550	25 ~ 40
Rear seat back center bracket bolt	17 ~ 26	170 ~ 260	12 ~ 19
Rear seat back lower side bracket bolt	17 ~ 26	170 ~ 260	12 ~ 19
Rear seat cushion mounting bolt	17 ~ 26	170 ~ 260	12 ~ 19
Seat belt			
Front seat belt retractor mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Front seat belt upper anchor mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Front seat belt sliding bar mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Front seat belt height adjuster mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Rear seat belt retractor mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Rear seat belt upper anchor mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Front seat belt buckle mounting bolt	40 ~ 55	400 ~ 550	30 ~ 40
Sunroof			
Sunroof lid panel mounting nut	7 ~ 9	70 ~ 90	5 ~ 7
Sunroof assembly mounting bolt	7 ~ 11	70 ~ 110	5 ~ 8

SPECIAL TOOLS K4AACB1D

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench	 ESA9010F	Adjustment, removal, and installation of the door hinge
09800-21000 Ornament remover	 ESA9010G	Trim removal
09853-31000 Headliner clip remover	 ESA9010H	Removal of the headliner clip
09861-31100 Sealant cut-out tool	 ESA9010I	Cutting the sealant of the windshield (use with 09861-31200)
09861-31200 Sealant cutting blade	 ESA9010J	Cutting the sealant of the windshield (use with 09861-31100)
09861-31300 Sealant gun	 ESA9010K	Application of the sealant to the windshield

Tool (Number and name)	Illustration	Use
09861-31400 Glass holder	 ESA9010L	Removal and installation of the windshield
09861-31000 Windshield moulding remove	 ESA9010M	Removal of the windshield moulding
09681–22000 Torsion bar wrench	 ESDA010I	Removal and installation of the torsion bar in the luggage compartment

TROUBLESHOOTING E1E56875

Trouble symptom	Probable cause	Remedy
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defective or cracked clip	Check tube installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps in body work	Retighten adjust or replace
Wind noise around door	Foreign particles lodged in guide rail	Adjust fit of door
	Improperly installed weatherstrip or setting of weatherstrip	Repair or replace
	Improperly closed door	Adjust
	Improperly fitting door	Adjust
	Improper clearance between door glass and division channel	Adjust
	Deformed door	Repair or replace
Door glass fails to operate up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield and rear window	Defective seal	Fill with sealant
	Defective flange	Correct
Wind noise around door	Weatherstrip not holding firmly	Adjust fit of door
	Improperly installed weatherstrip	Repair or replace
	Improperly closed door	Adjust
	Improperly fit door	Adjust
	Improper clearance between door glass and division channel	Adjust
	Deformed door	Repair or replace

EXTERIOR

HOOD

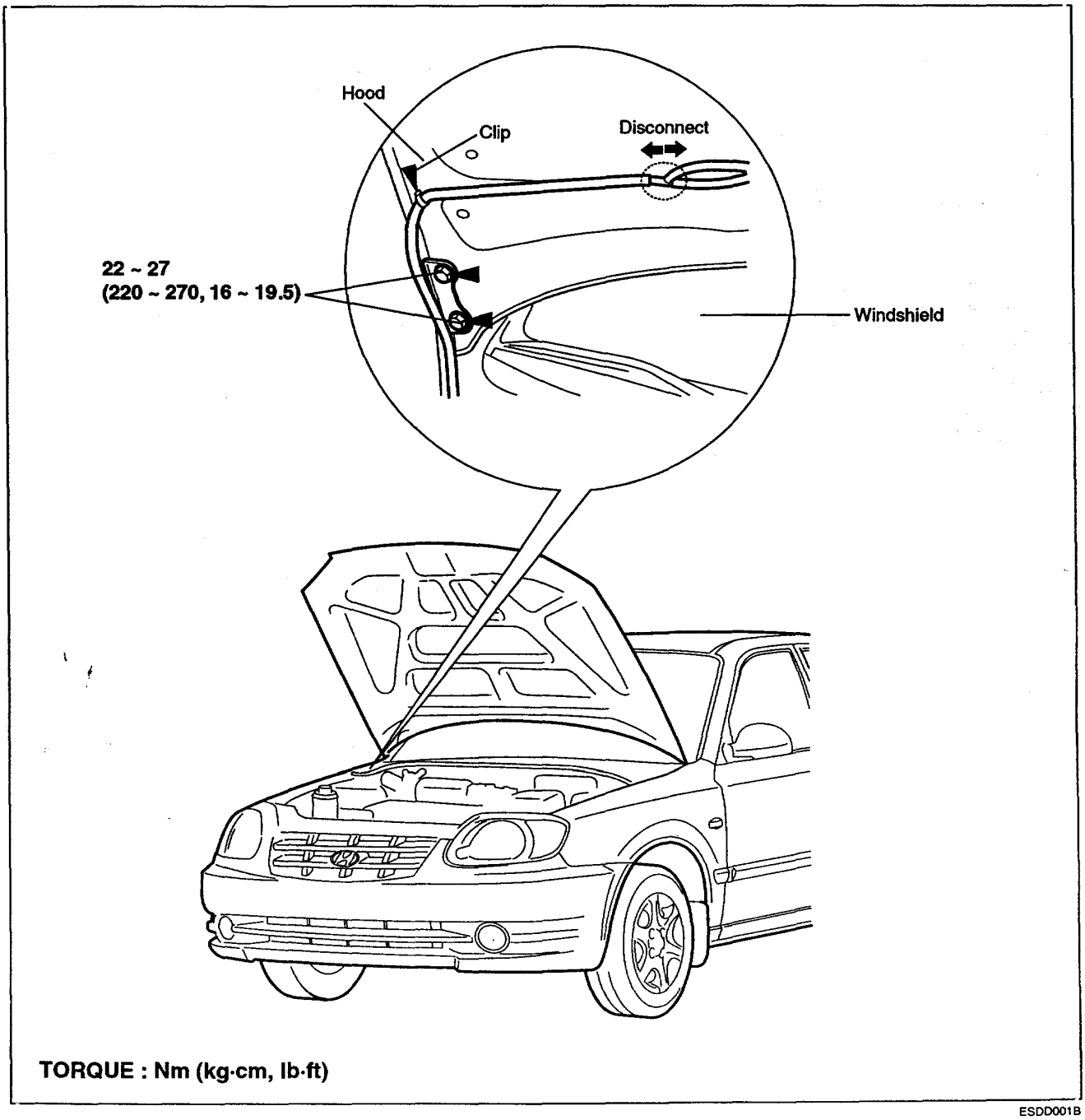
REMOVAL AND INSTALLATION E0A20DFF

HOOD

1. Disconnect the windshield washer nozzle connecting tube and clip.
2. After loosening the hood hinge mounting bolts(4EA), remove the hood.
3. Installation is the reverse of removal.

⚠ ***CAUTION***

When removing and installing the hood, an assistant is necessary.

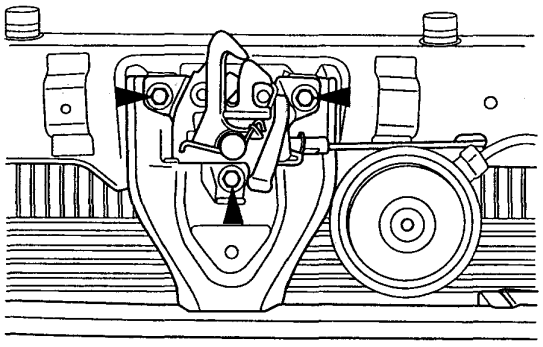


TORQUE : Nm (kg·cm, lb·ft)

ESDD001B

HOOD LATCH

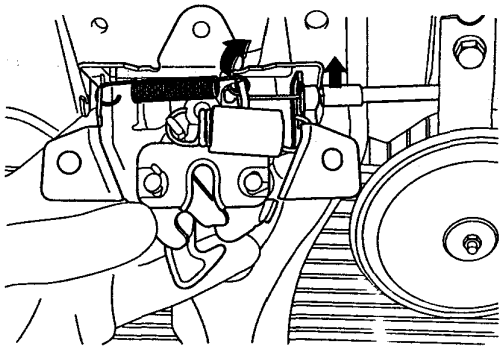
1. Remove the hood latch mounting bolts(3EA).



KSPD015C

TORQUE : 7 ~ 11 Nm (70 ~ 110 kg·cm, 5 ~ 8 lb·ft)

2. After disconnecting the hood latch and the hood latch cable, remove the hood latch.



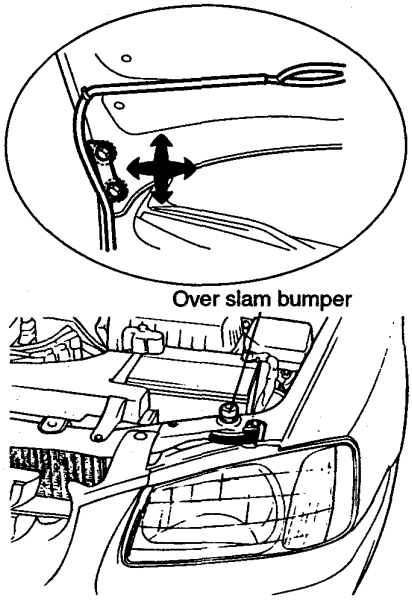
KSPD025D

3. Installation is the reverse of removal.

ADJUSTMENT EE2D3DEF

HOOD

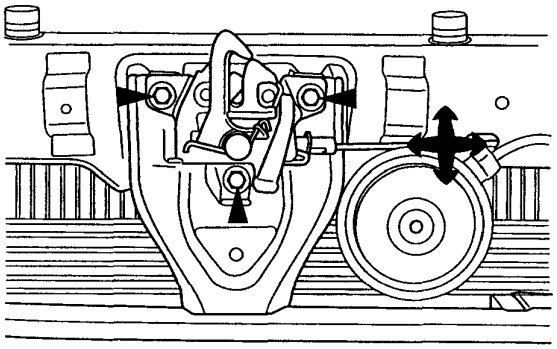
1. After loosening the hood hinge mounting bolt, adjust the hood by moving it up or down, or right or left.
2. Adjust the hood height by turning the hood over slam bumper.



ESDD001A

HOOD LATCH

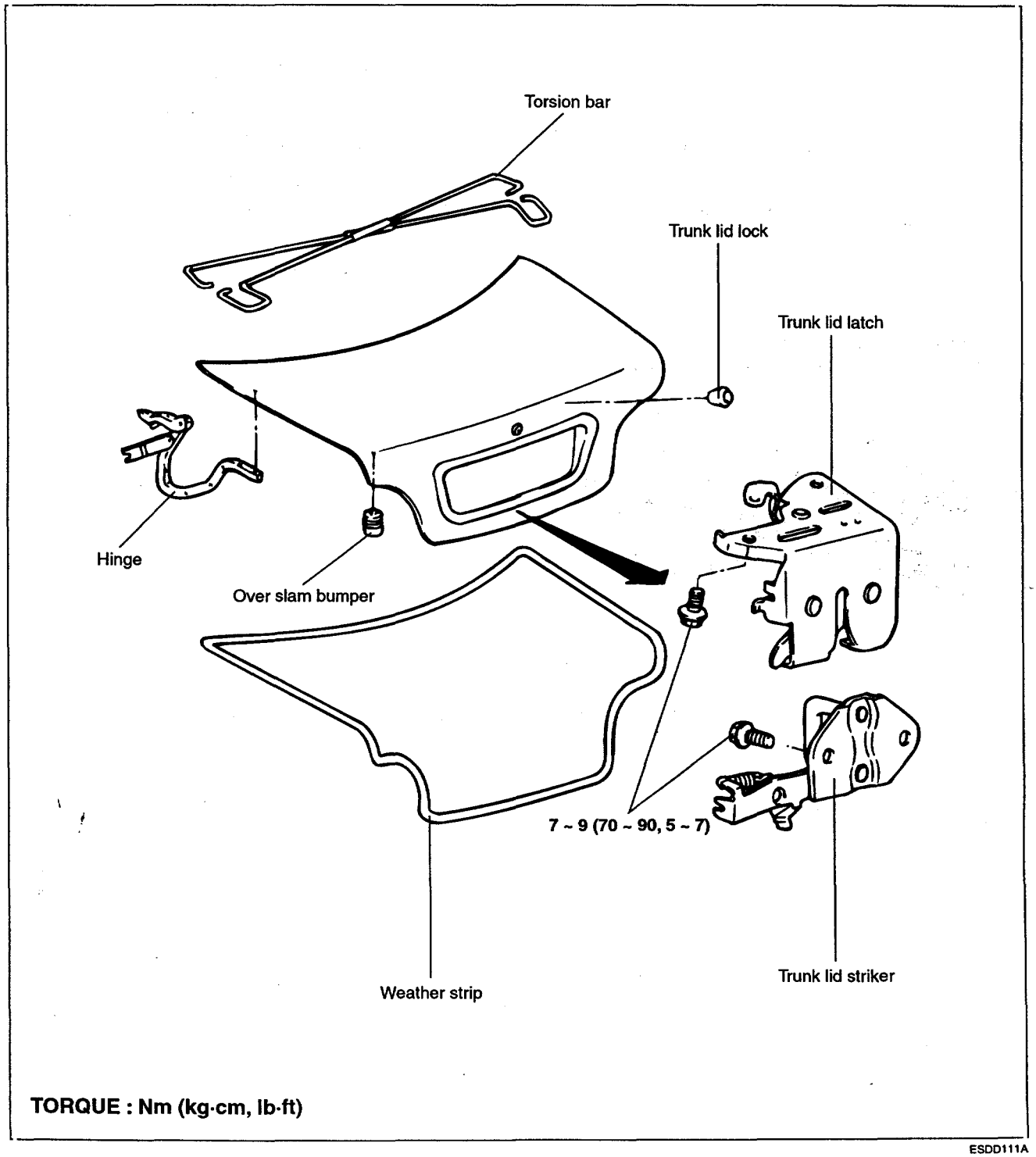
1. Loosen the hood latch mounting bolt lightly.
2. Adjust the hood latch by moving it up or down, or right or left.



KSPD016A

TRUNK LID

COMPONENTS EE8BB84F

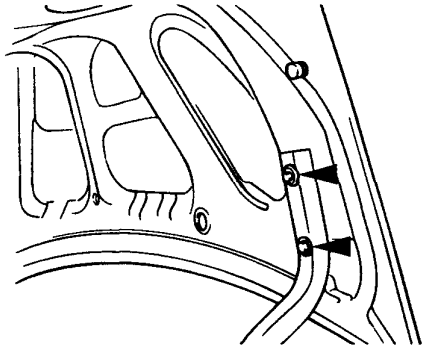


TORQUE : Nm (kg·cm, lb·ft)

ESDD111A

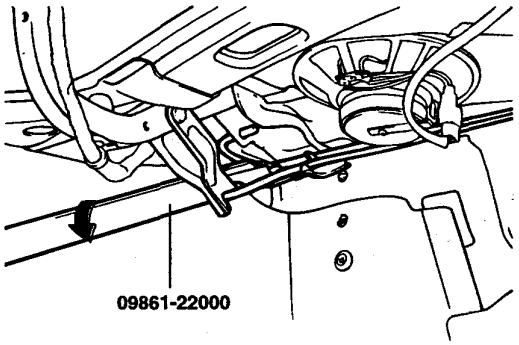
REMOVAL AND INSTALLATION E58EDF3E

1. Remove the trunk lid hinge mounting bolts and remove trunk lid.

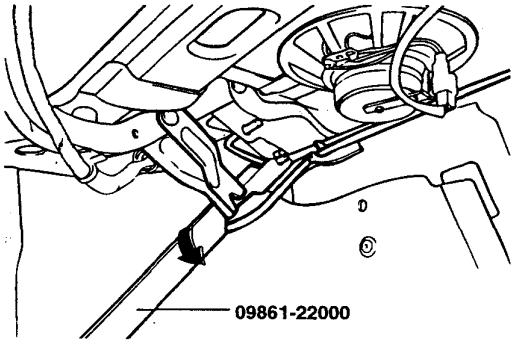


KSDC100H

2. Remove the torsion bar by using the torsion bar wrench (09861-22000) as shown in the illustration.

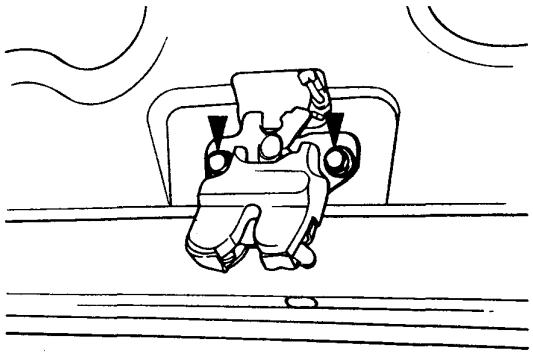


ESDA035B



ESDA035C

3. Remove the trunk lid latch and trunk lid lock.

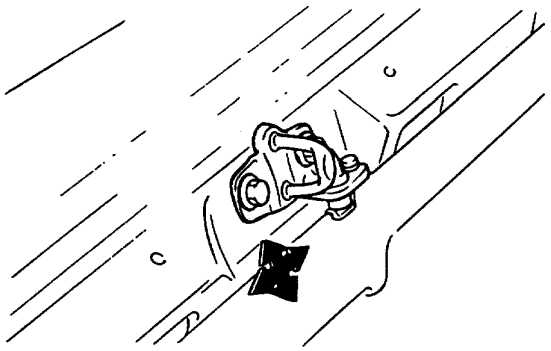


KSDC100I

4. Installation is the reverse of removal.

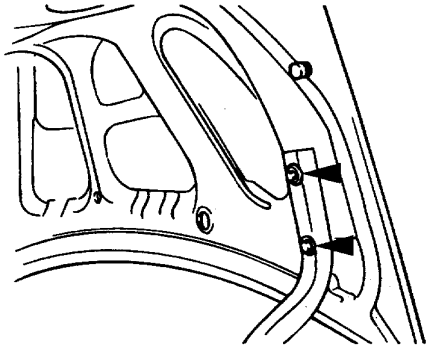
ADJUSTMENT E03CD99D

1. Adjust the striker up or down, and right or left until the trunk lid is flush with the rear edge of the body.



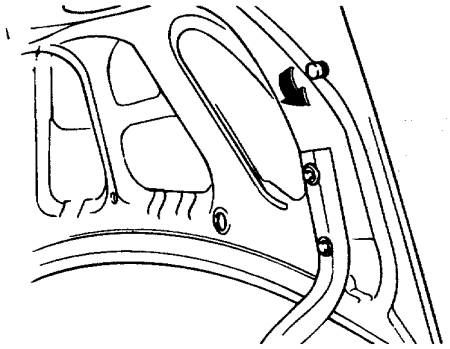
ESDA045B

2. Adjust the trunk hinges up or down, and right or left until the gap is flush between the lid and body.



KSDC100H

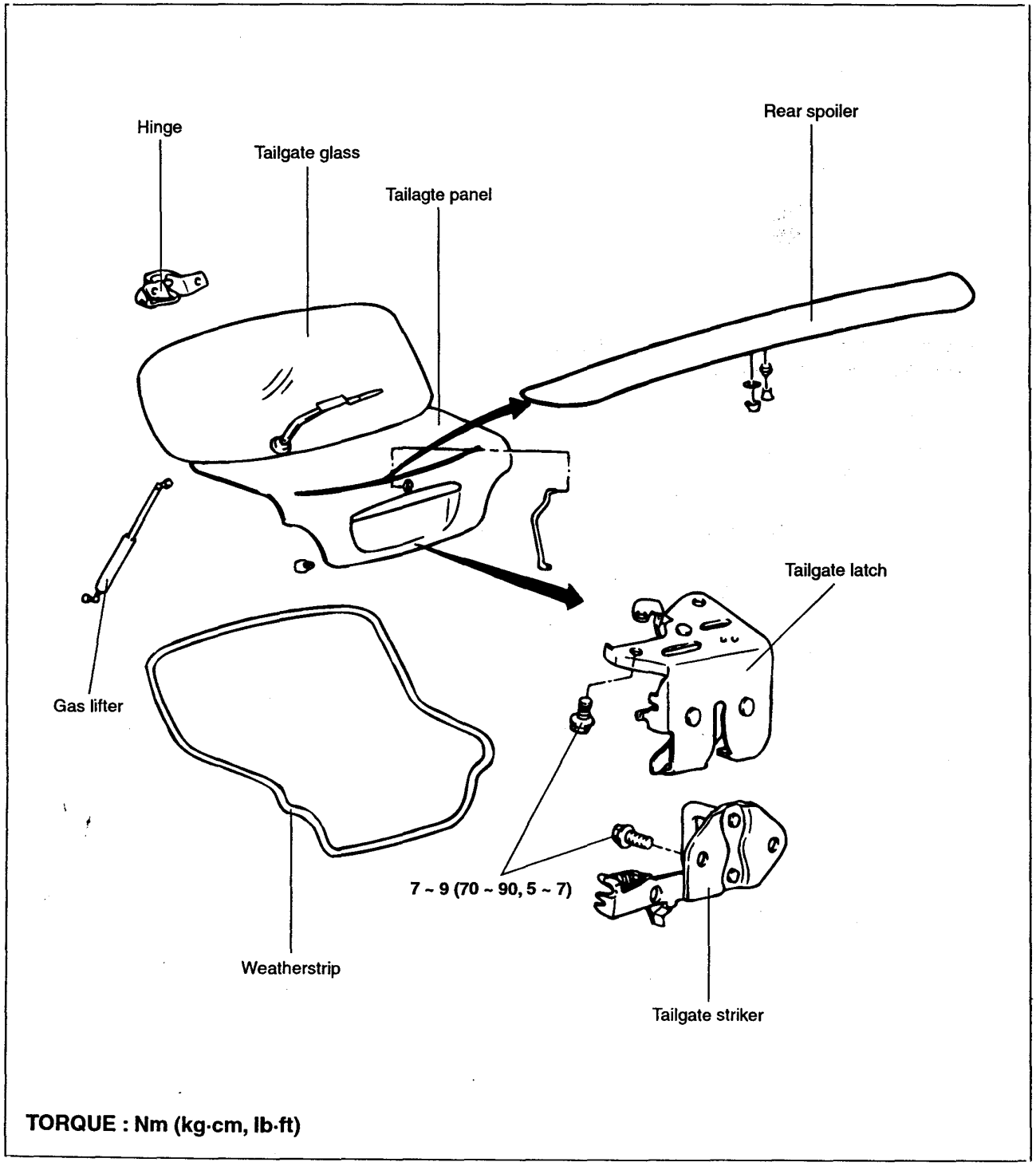
3. Turn the lid bumpers either clockwise or counterwise to adjust the height of the trunk lid.



ESDA045A

TAIL GATE

COMPONENTS EE27C77A



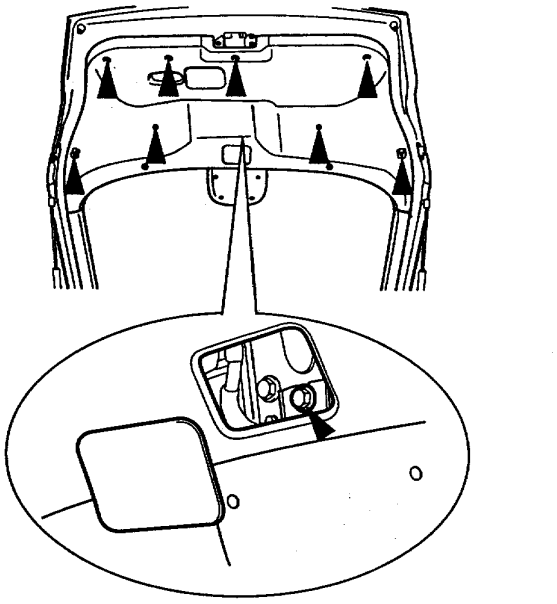
TORQUE : Nm (kg·cm, lb·ft)

ESDD100A

REMOVAL AND INSTALLATION EB290DEF

TAILGATE TRIM

1. Remove the tailgate trim mounting screws(8EA).
2. Remove the tailgate trim mounting bolt.

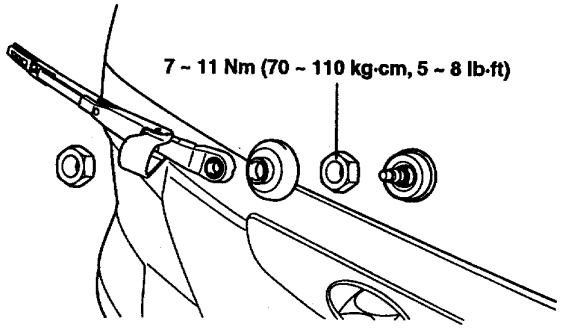


KSDC003A

3. Installation is the reverse of removal.

REAR WIPER ASSEMBLY

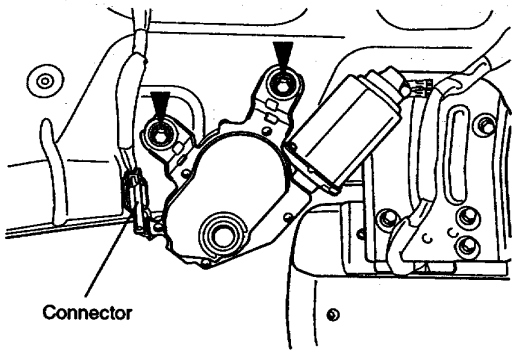
1. Remove the tailgate trim.
2. Remove the rear wiper.



ESPD035F

3. After loosening the rear wiper motor mounting bolts(2EA), remove the rear wiper motor.

TORQUE : 4 ~ 7 Nm (40 ~ 70 kg·cm, 3 ~ 5 lb·ft)

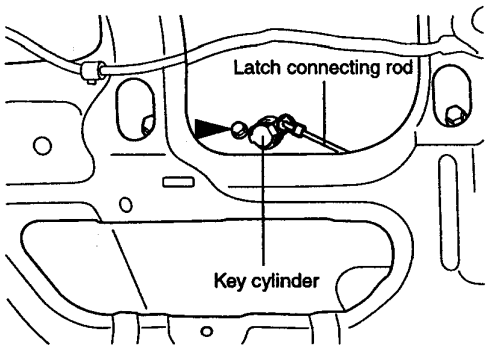


ESDD003C

4. Installation is the reverse of removal.

KEY CYLINDER

1. Remove the tailgate trim. ("See Page BD-13")
2. Disconnect the latch connecting rod, loosen the mounting bolt, and then remove the key cylinder.

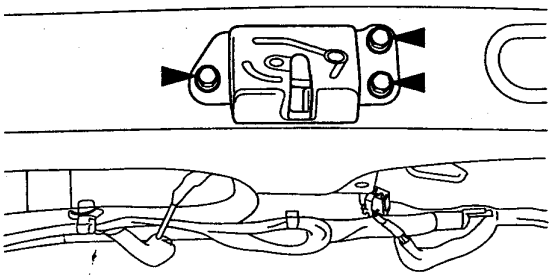


ESDD003D

3. Installation is the reverse of removal.

LATCH

1. Remove the tailgate trim. ("See Page BD-13")
2. Disconnect the key cylinder and latch connecting rod.
3. After loosening the latch mounting bolt(3EA), remove the latch.

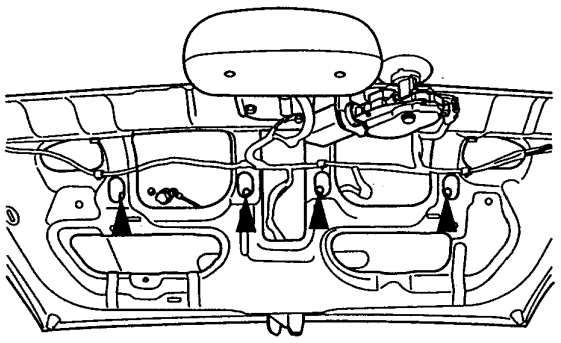


KSPD035M

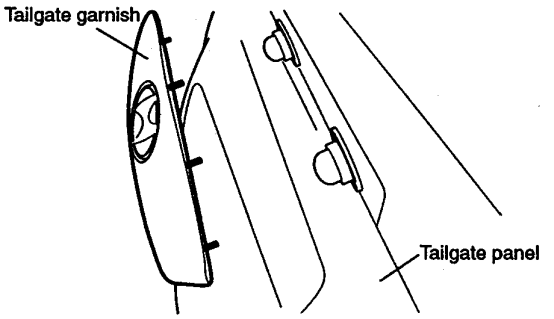
4. Installation is the reverse of removal.

TAILGATE GARNISH

1. Remove the tailgate trim. ("See Page BD-13")
2. Loosen the tailgate garnish mounting nut (4EA), and remove the tailgate garnish.

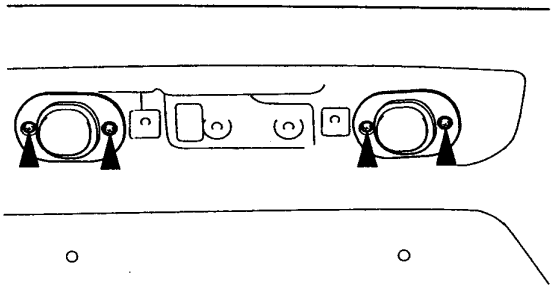


KSDC003E



ESDD003H

3. Loosen the license plate lamp mounting screws (4EA), and remove the license plate lamp.

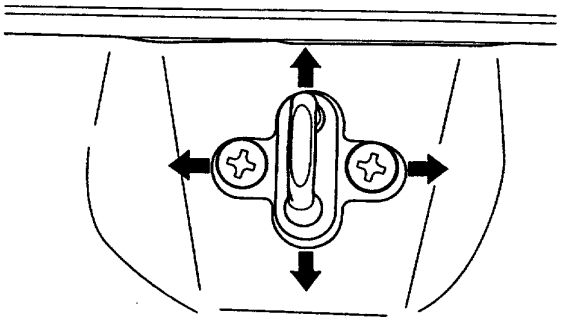


KSPD035S

4. Installation is the reverse of removal.

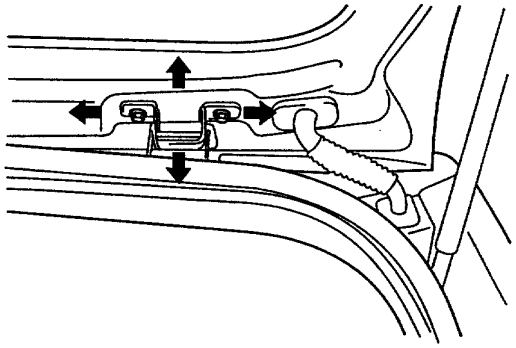
ADJUSTMENT EDBD83E3

1. Align the tailgate and body by moving the striker up or down, or left or right.



KSPD040A

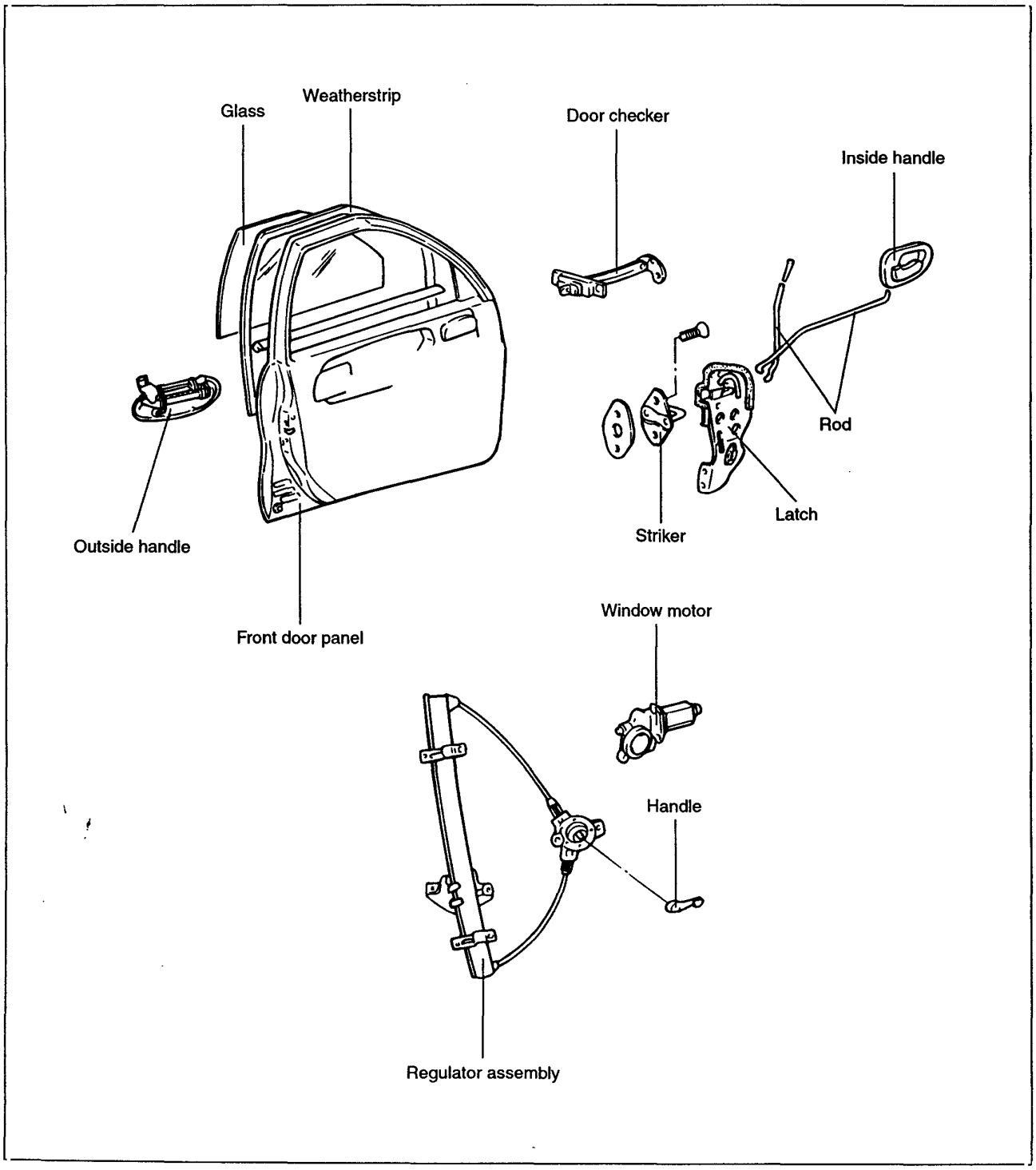
2. Align the cap between the tailgate and the body by moving the tailgate hinge.



KSPD040B

FRONT DOOR

COMPONENTS E471EFE3



ESDD150A

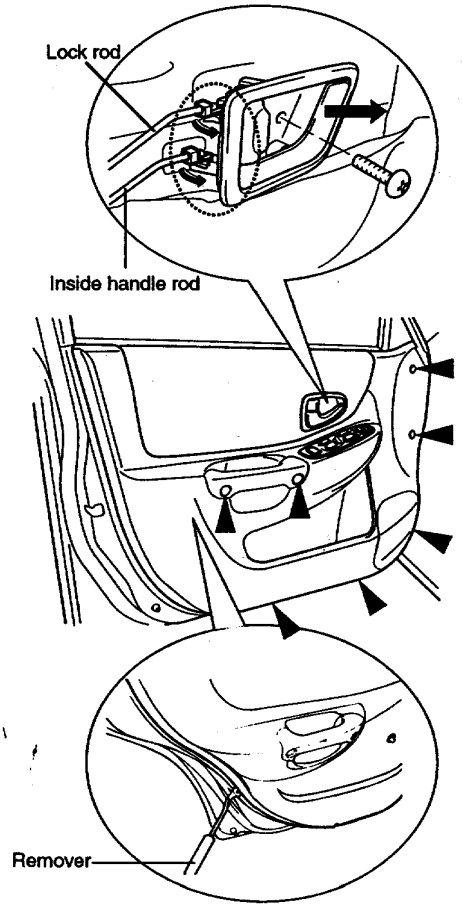
REMOVAL AND INSTALLATION KA7F029C

FRONT DOOR TRIM

1. Remove the inside handle mounting screw.
2. Loosen the door trim mounting screws(7EA), remove the trim using a trim remover, and then disconnect the power window switch connector.

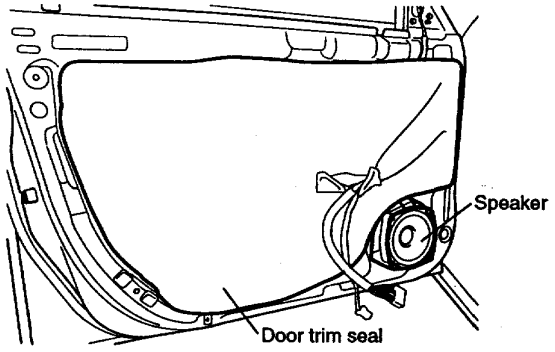
NOTE

When using a trim remover, wrap it with a piece of cloth so as not to damage the painted surface.



ESDD003F

3. Remove the door trim seal, speaker, and connector.



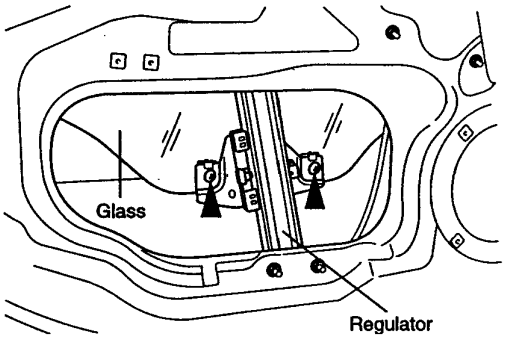
ESDD003G

4. Installation is the reverse of removal.

GLASS AND REGULATOR

1. Remove the door trim, door trim seal, speaker.("See Page BD-17")
2. Carefully move the glass by the power window switch until the 2 mounting bolts appear, then remove them.

TORQUE : 8 ~ 12 Nm (80 ~ 120 kg·cm, 6 ~ 9 lb·ft)

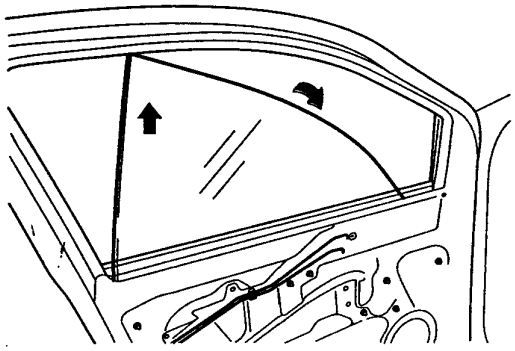


ESPD050E

3. Separate the glass from the glass run and carefully pull the glass out through the window slot.

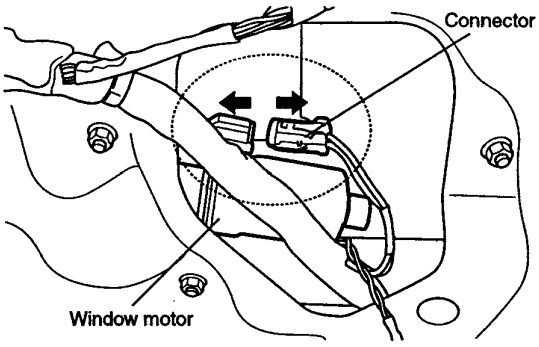
⚠ ***CAUTION***

Take care not to drop the glass and scratch the glass surface.



KSPD050F

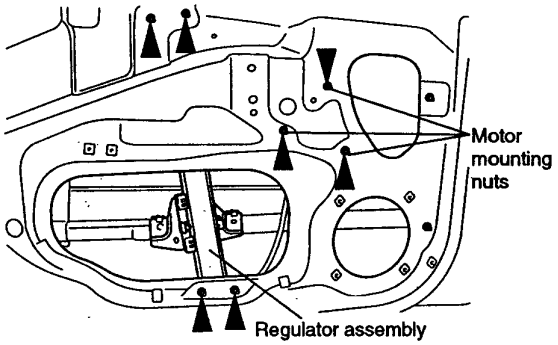
4. Disconnect the power window motor connector.



ESPD051A

5. Loosen the regulator mounting nuts(4EA) and power window motor mounting nuts(3EA), then remove the regulator assembly.

TORQUE : 4 ~ 6 Nm (40 ~ 60 kg·cm, 3 ~ 4 lb·ft)



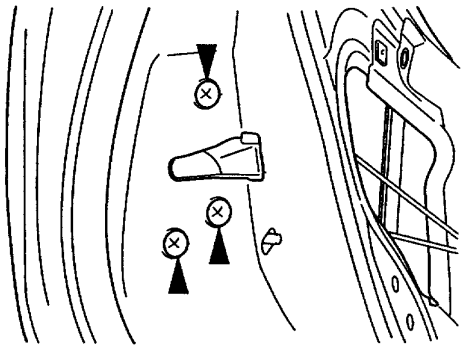
ESPD050G

6. After loosening the front channel mounting nuts(2EA), remove the front channel.
7. Installation is the reverse of removal.

LATCH AND OUTSIDE HANDLE

1. Remove the front door trim, door trim seal, speaker.("See Page BD-17")
2. Remove the glass and regulator. ("See Page BD-18")
3. Loosen the latch mounting screws(3EA).

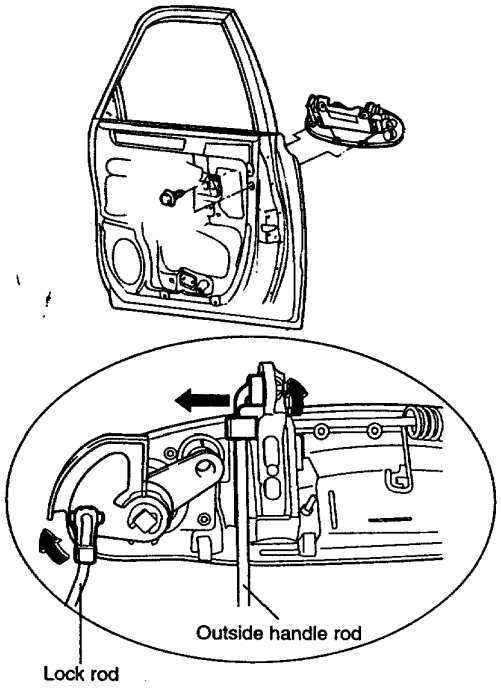
TORQUE : 8 ~ 11 Nm (80 ~ 110 kg·cm,6 ~ 8 lb·ft)



KSDC004H

4. Loosen the outside handle mounting bolts(2EA), disconnect the rod, and remove the outside handle.

TORQUE : 8 ~ 11 Nm (80 ~ 110 kg·cm,6 ~ 8 lb·ft)



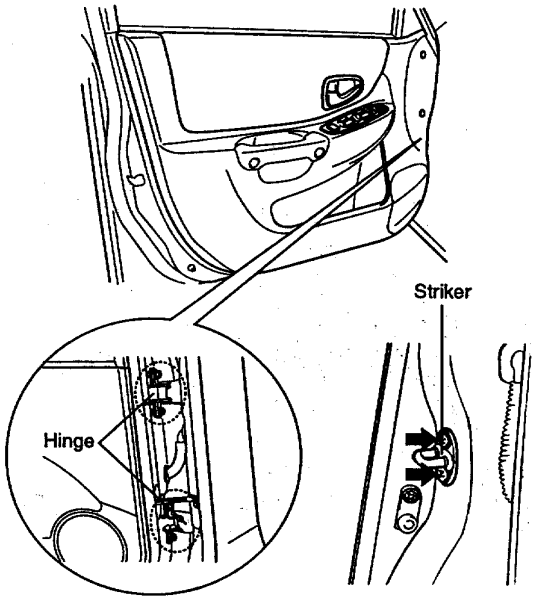
ESDD114A

5. Installation is the reverse of removal.

ADJUSTMENT EBD3DCE9

DOOR

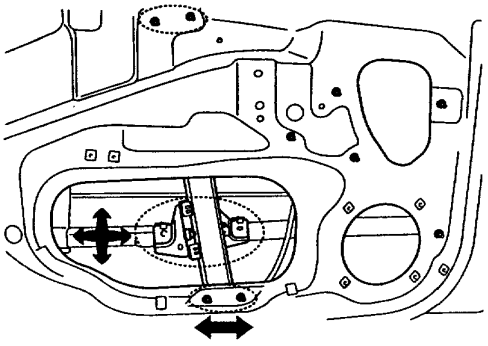
1. After loosening the door hinge mounting bolt lightly, adjust the door by moving it up or down, or right or left.
2. After loosening the door striker mounting screw lightly, adjust the striker by moving it up or down, or right or left.



ESDD113A

GLASS

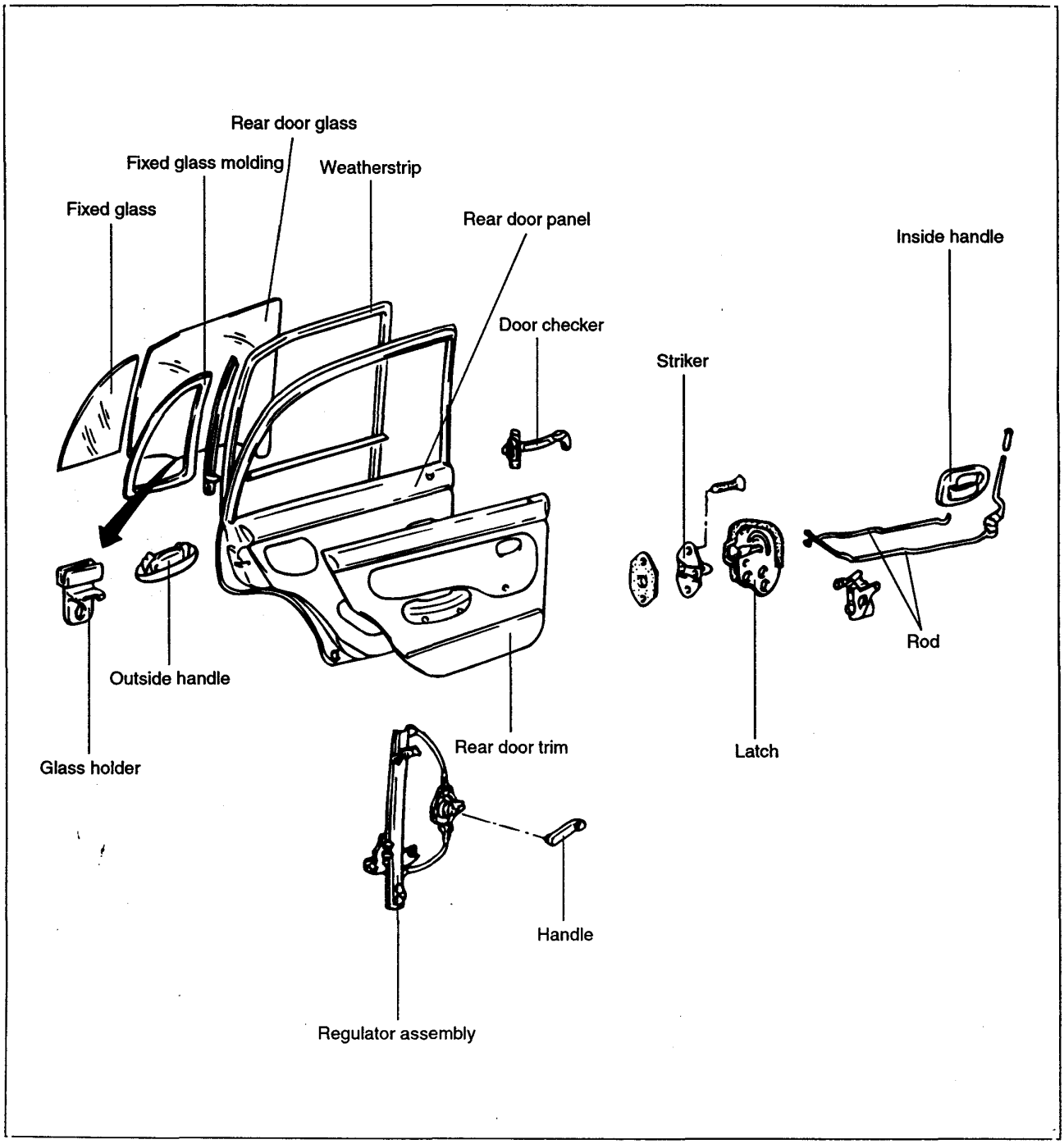
1. After loosening the glass mounting bolt, adjust the glass by moving it up or down.
2. After loosening the regulator mounting bolt, adjust the regulator and glass by moving the regulator up or down, or right or left.



KSPD055B

REAR DOOR

COMPONENTS EC387FCD



ESDD200A

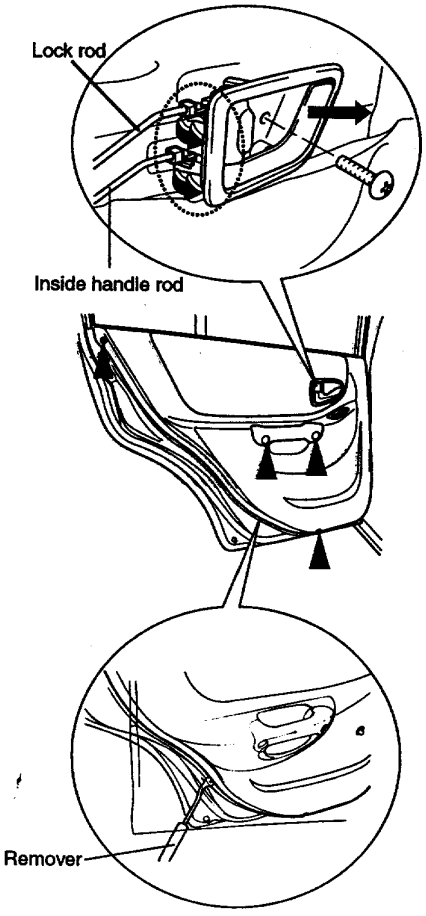
REMOVAL AND INSTALLATION EDFA317A

REAR DOOR TRIM

1. Remove the inside handle mounting screw.
2. Loosen the door trim mounting screws(4EA) and remove the rear door trim using a trim remover.

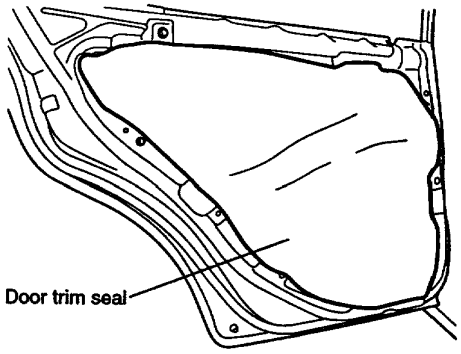
NOTE

When using a trim remover, wrap it with a piece of cloth so as not to damage the painted surface.



ESDD004A

3. Remove the door trim seal.

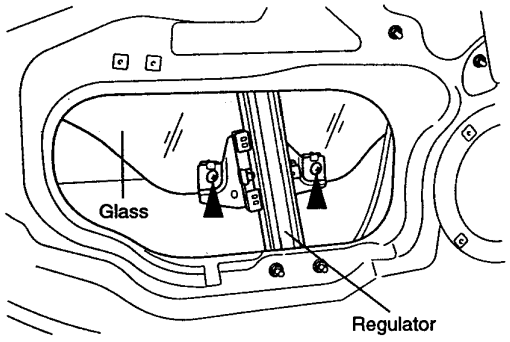


ESDD004B

4. Installation is the reverse of removal.

GLASS AND REGULATOR

1. Remove the rear door trim, door trim seal.("See Page BD-21")
2. Carefully move the glass by the power window switch until the 2 mounting bolts appear, then remove them.

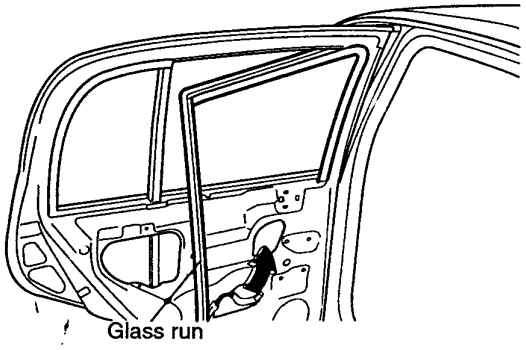


ESPD050E

3. Remove 6 regulator assembly mounting nuts, and remove the regulator assembly.

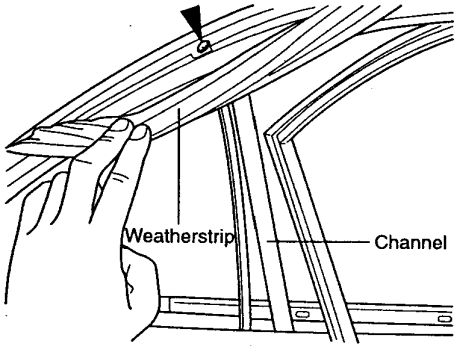
TORQUE : 8 ~ 12 Nm (80 ~ 120 kg·cm,6 ~ 9 lb·ft)

4. Remove the glass run from the channel.



ESPD065H

5. After loosening the screw attaching the upper channel, remove the channel.

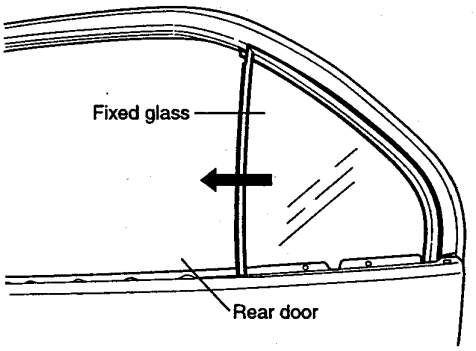


ESDD004E

6. Installation is the reverse of removal.

FIXED GLASS

1. Remove the rear door trim.("See Page BD-21")
2. Remove the glass and regulator.("See Page BD-22")
3. Remove the channel.
   Remove the fixed glass by pulling it as shown in the illustration.

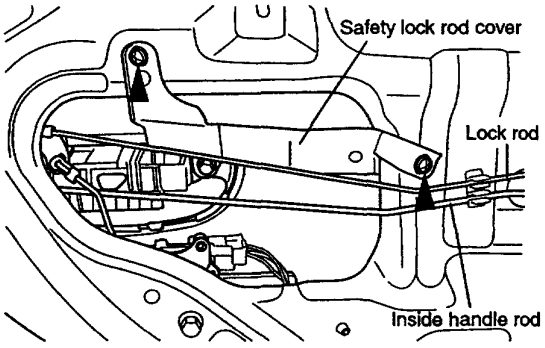


ESDD004F

4. Installation is the reverse of removal.

LATCH AND OUTSIDE HANDLE

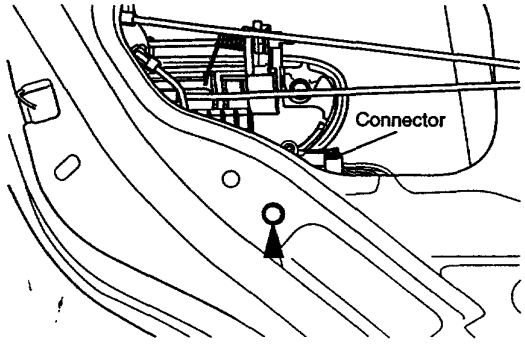
1. Remove the rear door trim, door trim seal.("See Page BD-21)
2. Remove the glass and regulator.("See Page BD-22")
3. After loosening the safety lock rod cover mounting screws(2EA), remove the safety lock rod cover using a remover.



ESDD004C

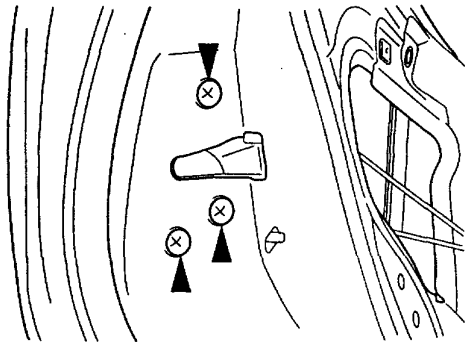
4. Disconnect the actuator connector and loosen the latch mounting screws(3EA).

TORQUE : 8 ~ 11 Nm (80 ~ 110 kg·cm,6 ~ 8 lb·ft)



ESDD004J

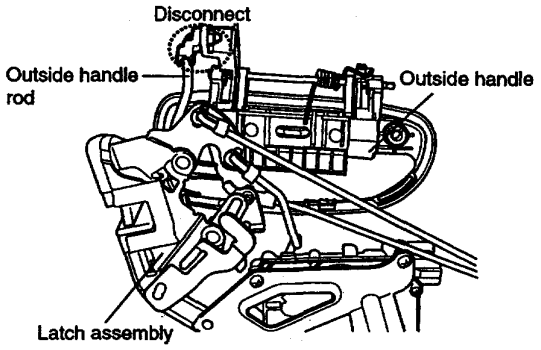
5. Loosen the latch mounting screws.



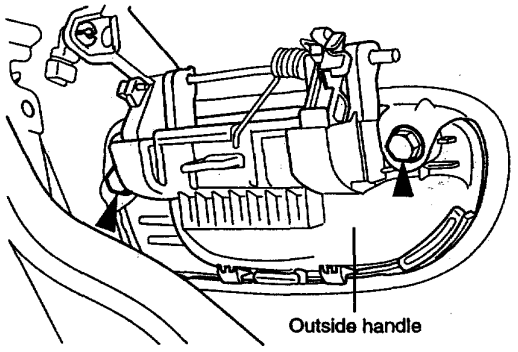
KSDC004H

6. Loosen the outside handle mounting bolts(2EA), disconnect the rod, and then remove the latch and outside handle.

TORQUE : 8 ~ 12 Nm (80 ~ 120 kg·cm,6 ~ 9 lb·ft)



ESDD004D



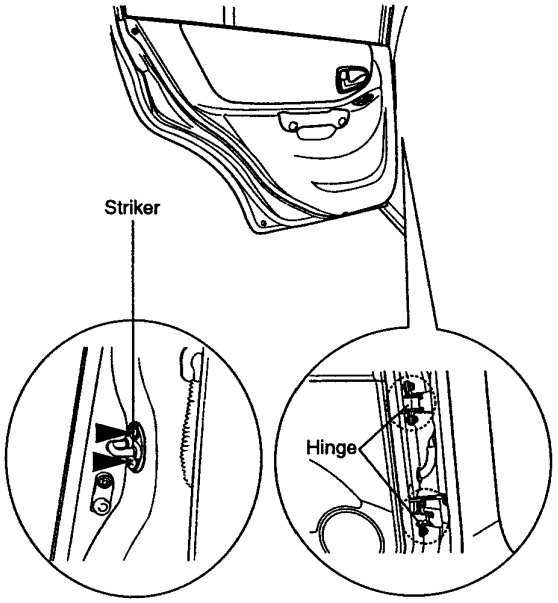
ESDD004G

7. Installation is the reverse of removal.

ADJUSTMENT K836EA81

DOOR

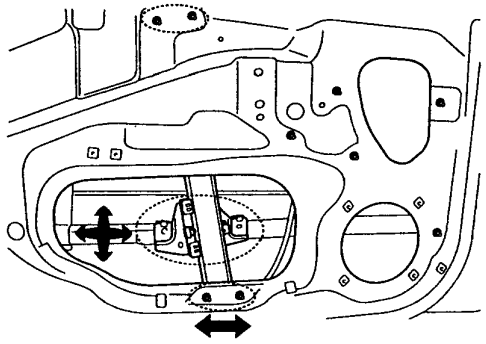
1. After loosening the door hinge mounting bolt lightly, adjust the door by moving it up or down, or left or right.
2. After loosening the door striker mounting screw lightly, adjust the striker by moving it up or down, or left or right.



ESDD004N

GLASS

1. After loosening the glass mounting bolt, adjust the glass by moving it up or down.
2. After loosening the regulator mounting bolt, adjust the regulator and glass by moving the regulator up or down, or right or left.



KSPD055B

BODY SIDE MOLDINGS

REMOVAL AND INSTALLATION KB7FC4B5

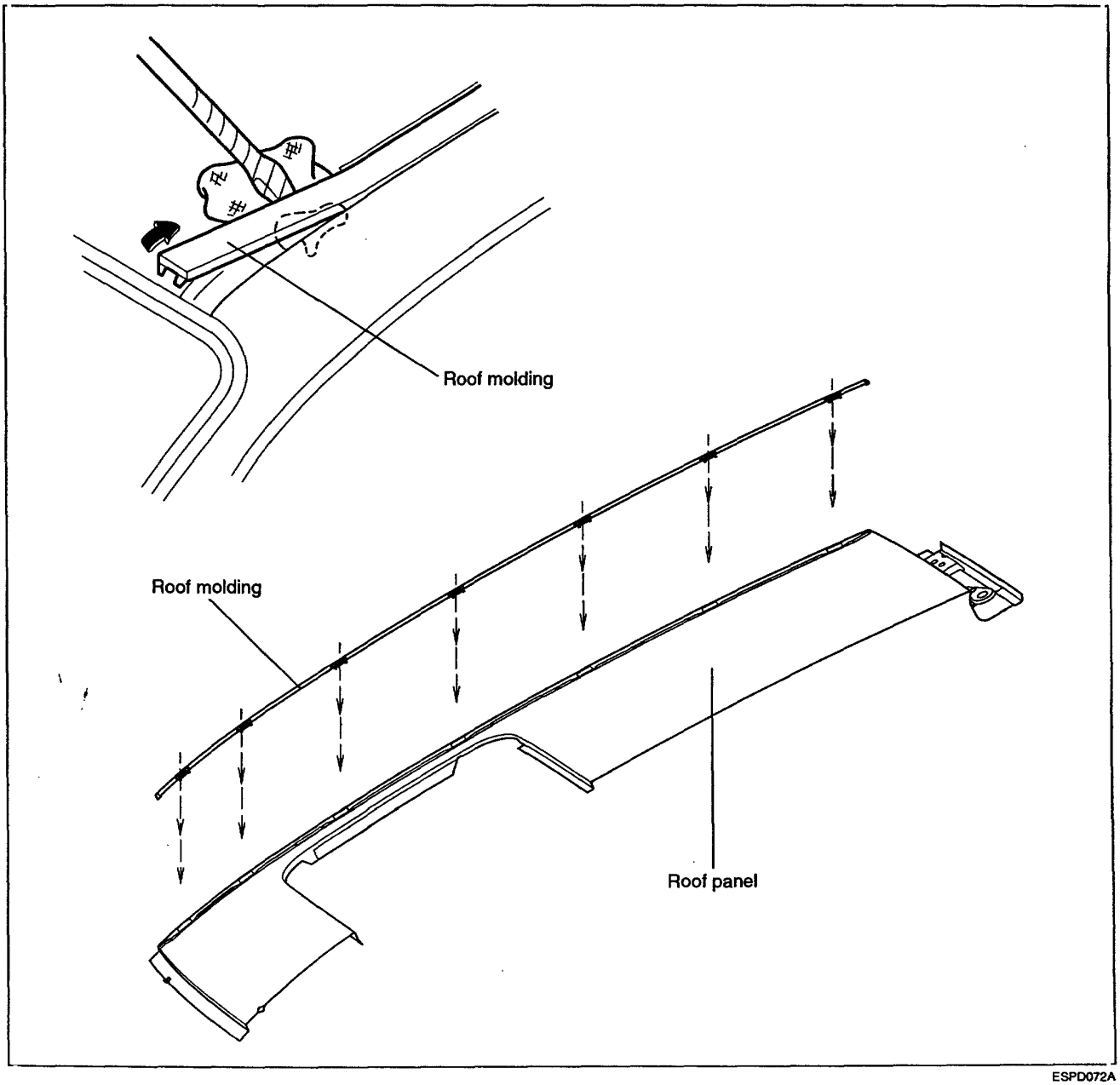
ROOF MOLDING

⚠ ***CAUTION***

- ***Wear gloves to protect hands from injury.***
- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***

NOTE

- *Take care not to scratch the body.*
- *Remove the windshield molding from the front portion.*
- *Take care not to damage the windshield molding.*
- *Do not reuse the damaged roof molding.*



ESPD072A

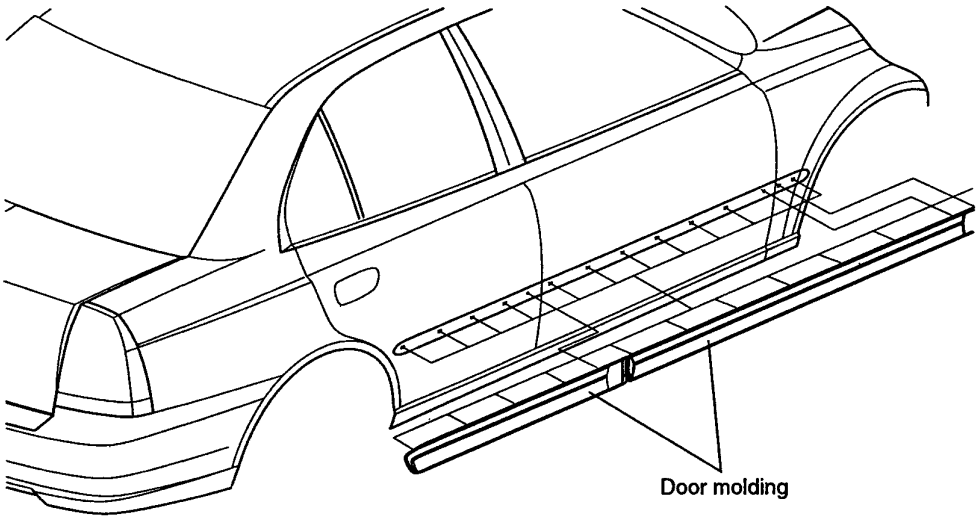
DOOR MOLDING

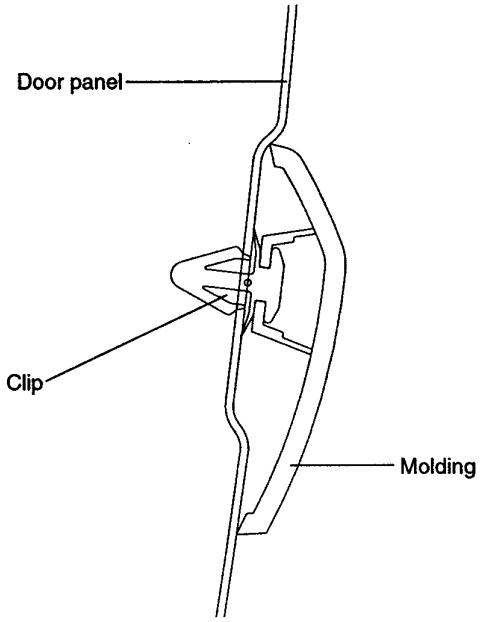
CAUTION

- ***Wear gloves to protect hands from injury.***
- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***

NOTE

- *Take care not to scratch the body*
- *Do not reuse the damaged roof molding.*





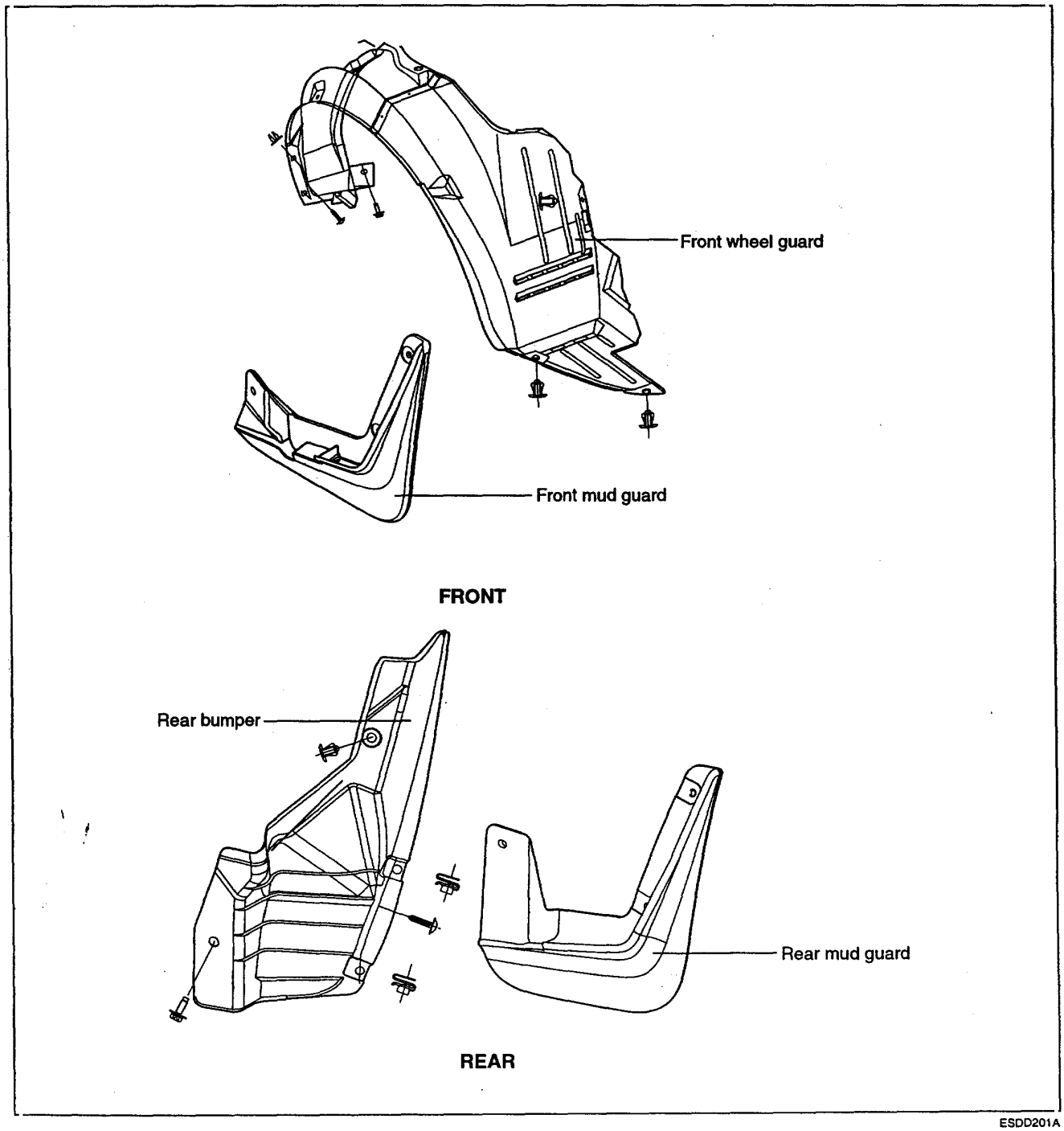
ESDD004L

MUD GUARD AND WHEEL GUARD

After loosening the mud guard and wheel guard mounting screw, remove the mud guard and wheel guard.

NOTE

- *Wear gloves to protect hands from injury.*
- *Do not reuse the damaged clip.*



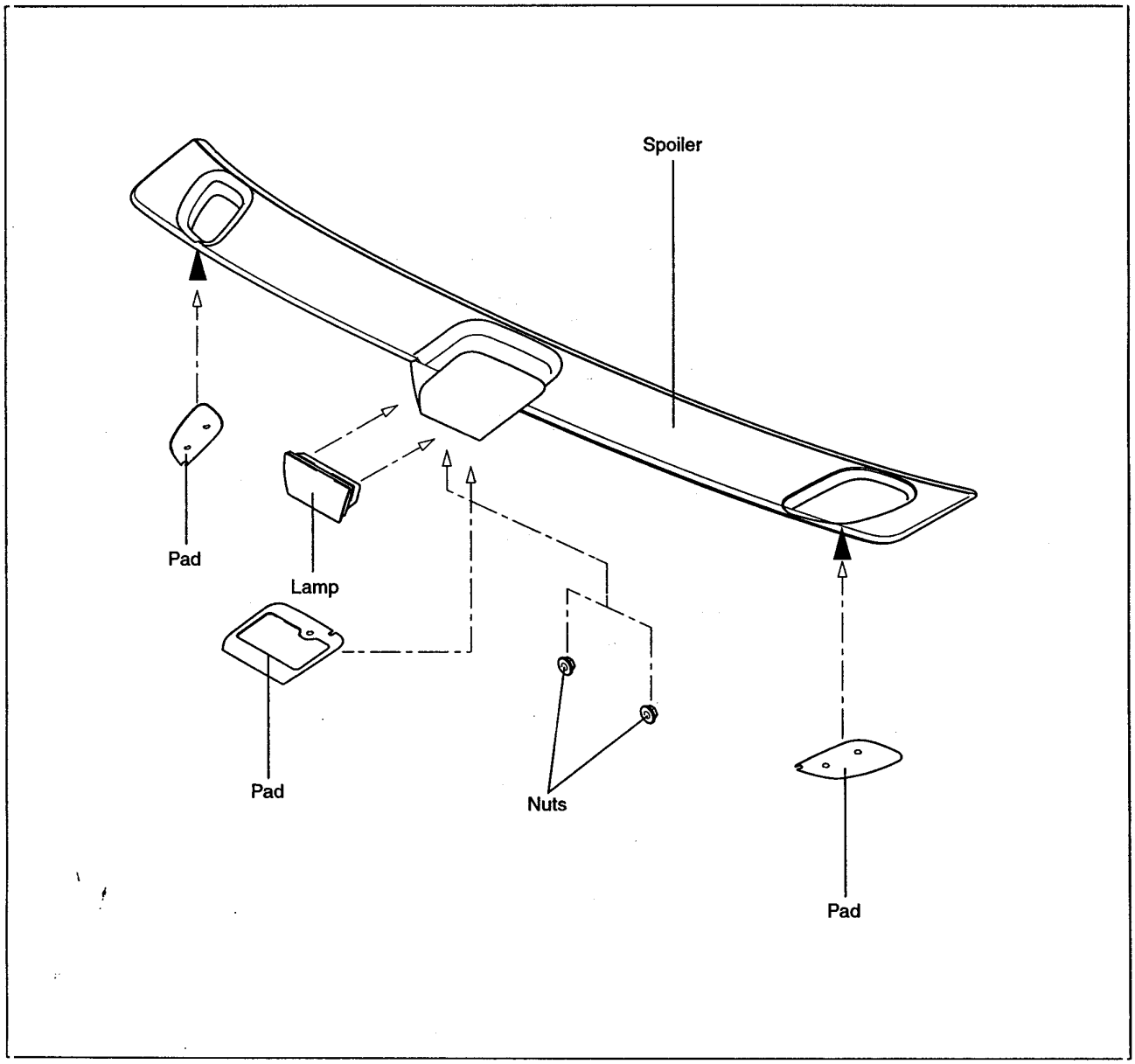
ESDD201A

SPOILER

After loosening the spoiler mounting screw(2EA), remove the spoiler.

NOTE

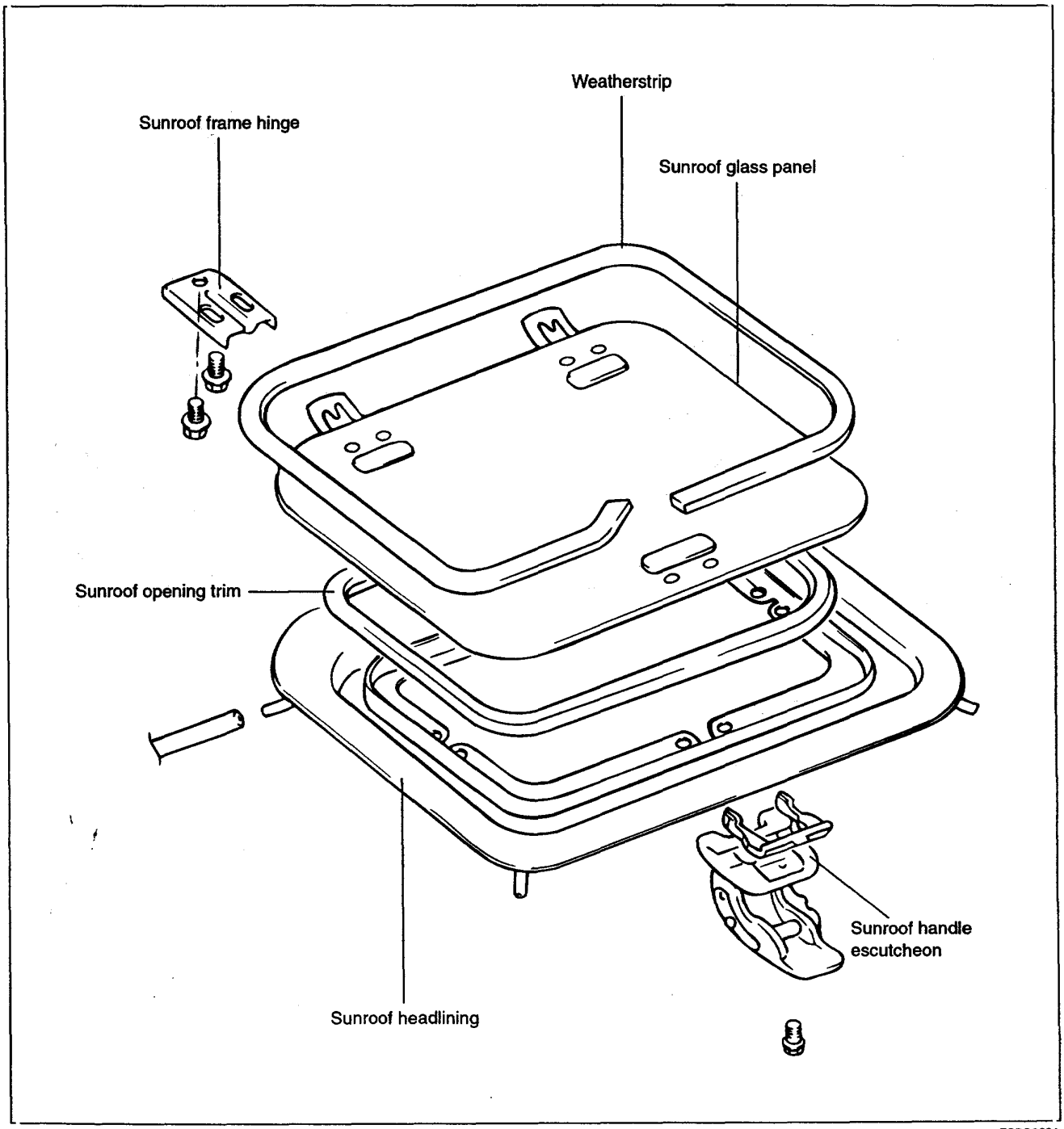
- *Wear gloves to protect hands from injury.*
- *Take care not to damage the body.*



ESDD201C

SUN ROOF

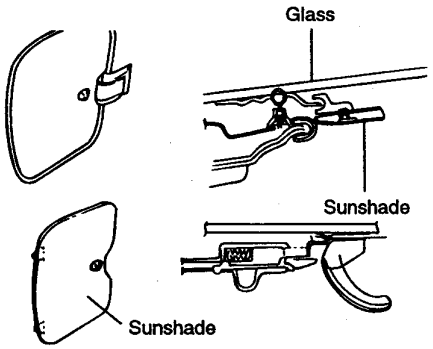
COMPONENTS E6DE4DF5



ESDD202A

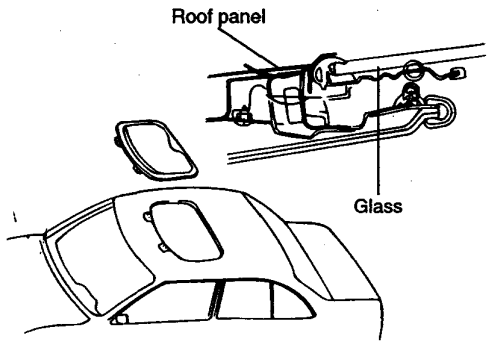
REMOVAL AND INSTALLATION EE24BA5F

1. To remove the sunroof, first remove the following parts :
   1) Overhead console lamp assembly
   2) Sunvisor and inside rear view mirror
   3) Front pillar trim
   4) Roof assist handle
2. Remove the sunshade assembly from the sunroof glass.



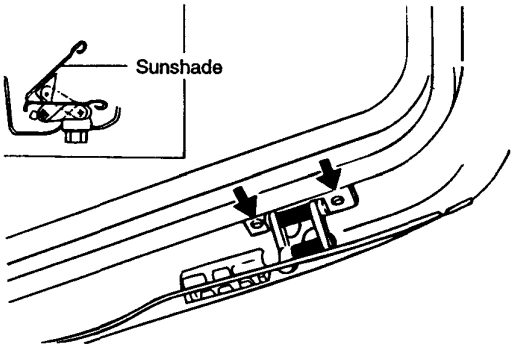
ESDA125A

3. Remove the sunroof glass assembly from the frame hinge.



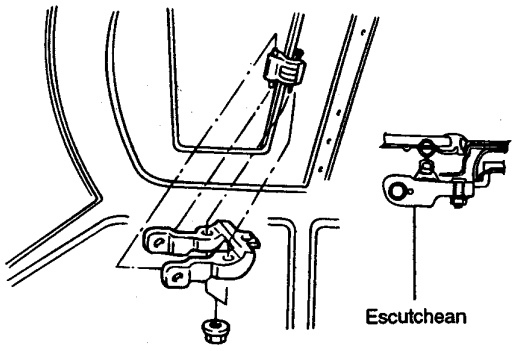
ESDA125B

4. Remove the sunroof deflector.



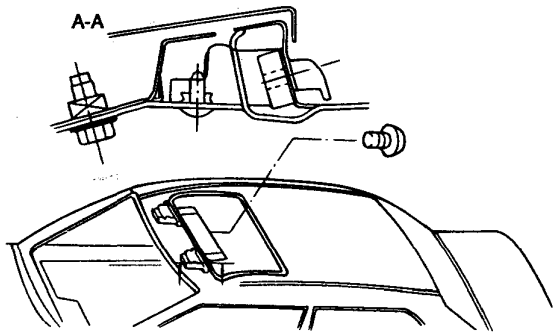
ESDA125C

5. Remove the sunroof handle escutcheon and the sunroof handle base plate.



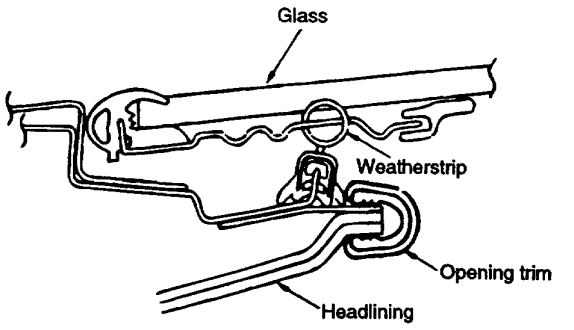
ESDA125D

6. Remove the sunroof frame hinge.



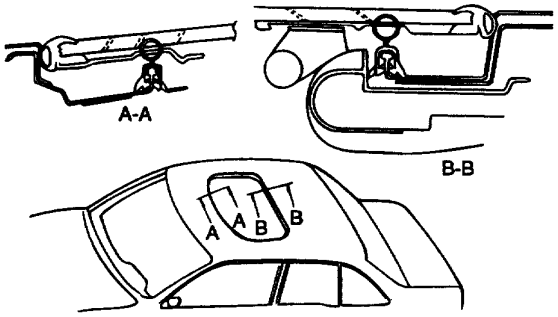
ESDA125E

7. Installation is the reverse of removal.



ESDA125F

8. When installing the sunroof opening trim, make sure that there is no gap between the trim and the headlining.

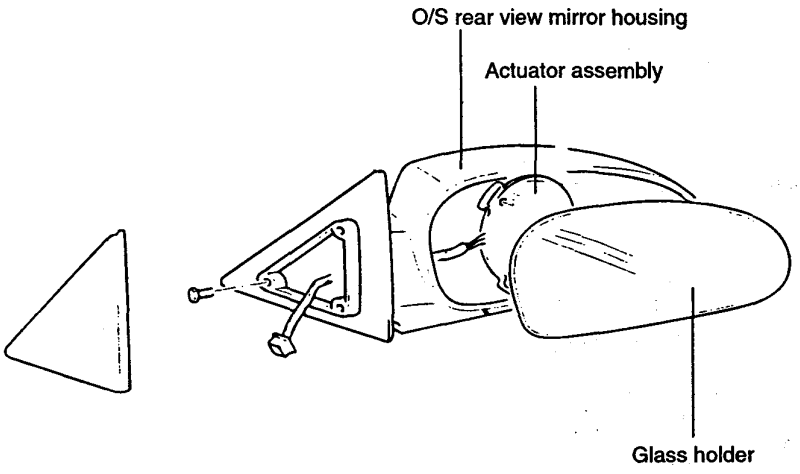


ESDA125G

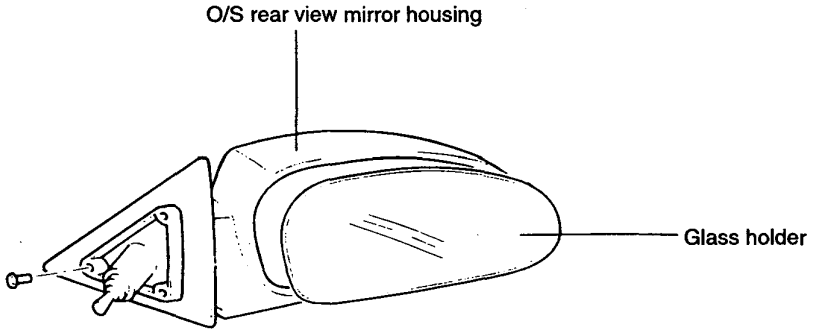
OUTSIDE REAR VIEW MIRROR

COMPONENTS E620D1C4

[ELECTRIC REMOTE CONTROL TYPE]



[MANUAL REMOTE CONTROL TYPE]



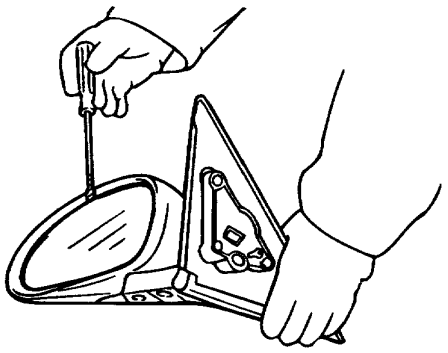
ESDA135A

REMOVAL AND INSTALLATION E65BC2CE

⚠ ***CAUTION***

Wear gloves to remove and install the mirror holder.

1. Insert flat tip (-) screwdriver between the outside rearview mirror holder and mirror assembly.

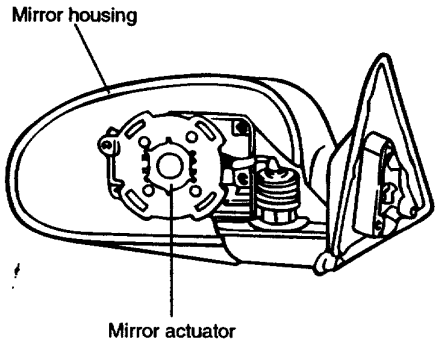


ESDA140A

⚠ ***CAUTION***

When prying with a flat tip screwdriver, wrap it with a shop towel to prevent damage.

2. Remove the outside rearview mirror actuator from outside rearview mirror housing.



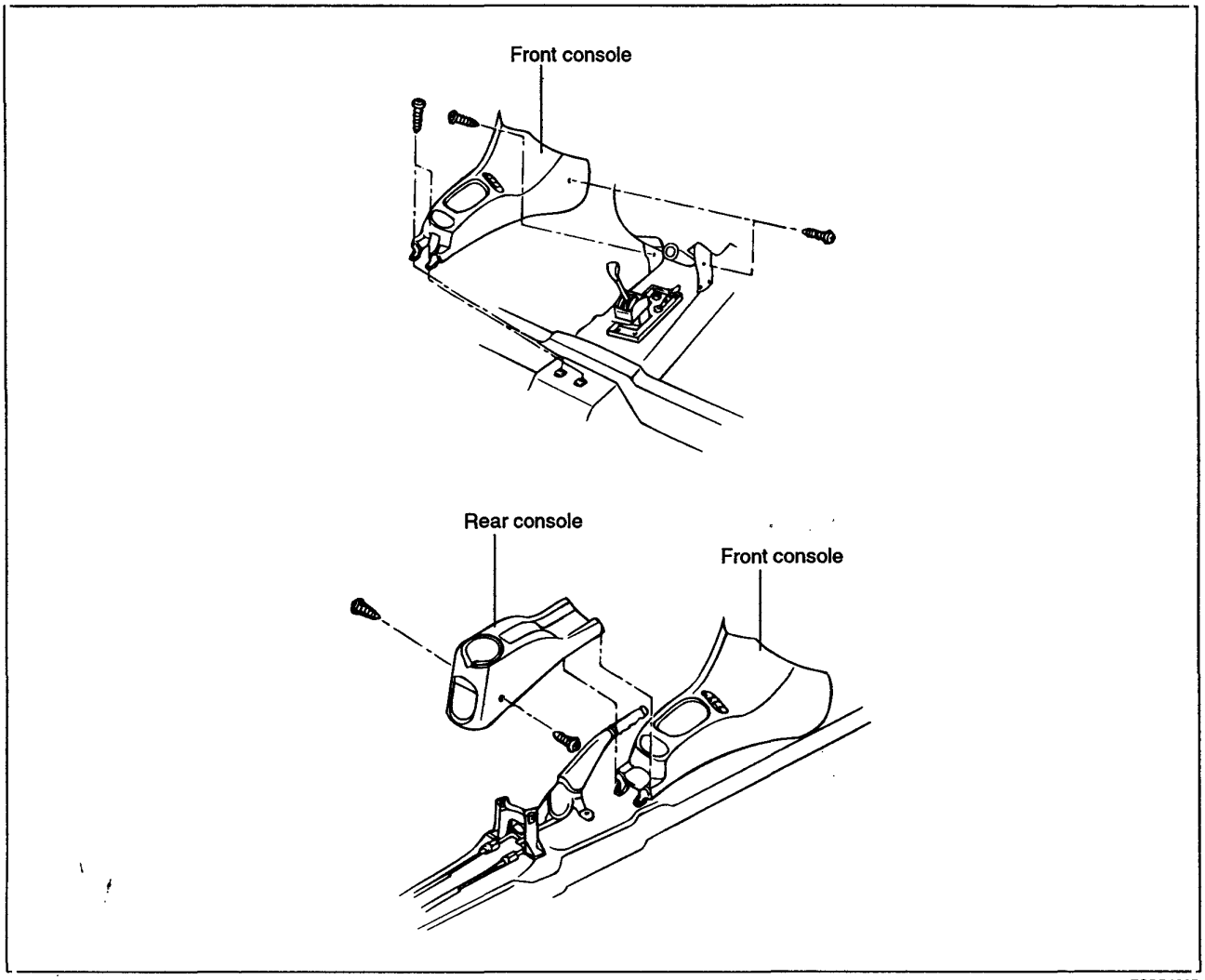
ESDD100K

3. Installation is the reverse of removal.

INTERIOR

CONSOLE

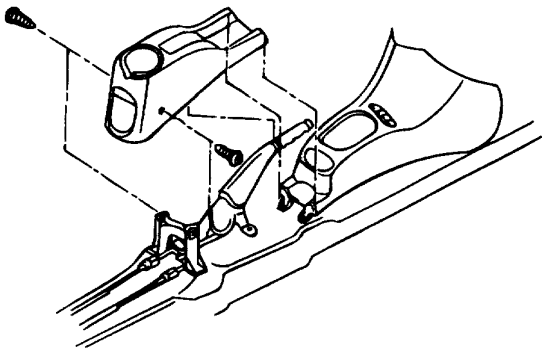
COMPONENTS E010B75F



ESDD150B

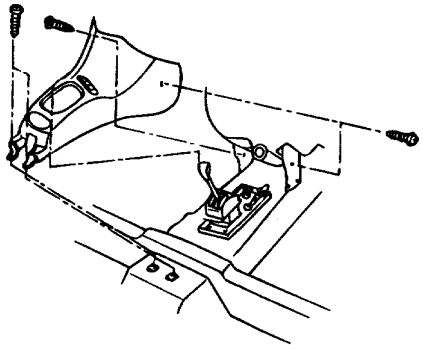
REMOVAL AND INSTALLATION E95FECA2

1. Remove the rear console mounting screws, and then pull out the rear console.



ESDA150A

2. Remove the transaxle control lever.
3. Remove the front console assembly and then disconnect the connectors.

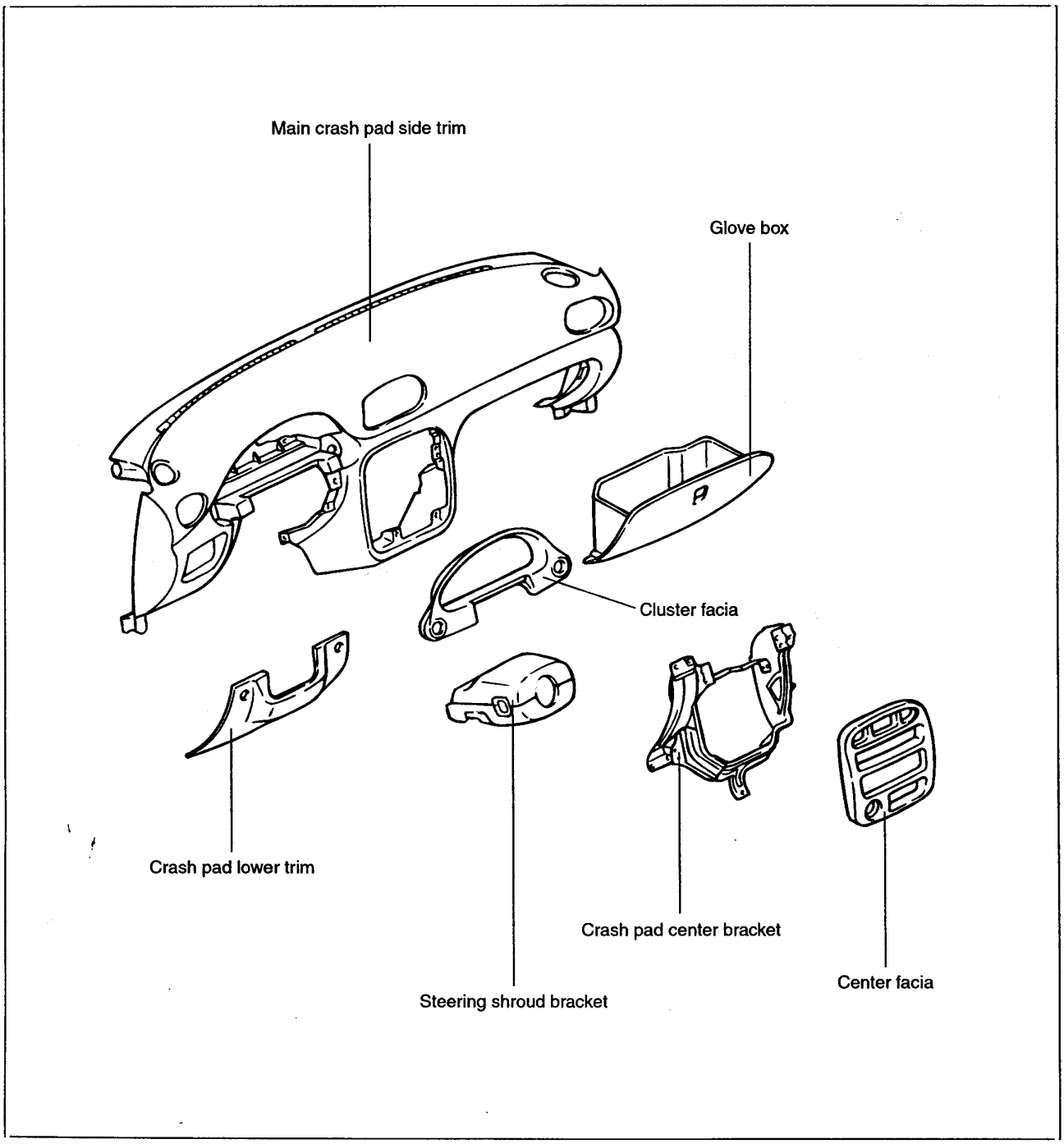


ESDA150B

4. Installation is the reverse of removal.

CRASH PAD

COMPONENTS EF67DEA0



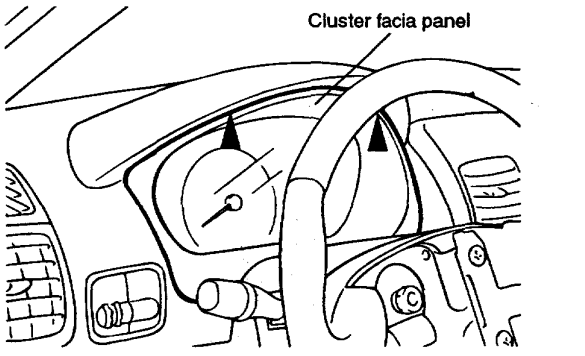
REMOVAL AND INSTALLATION KE820C44

INSTRUMENT CLUSTER REMOVAL AND INSTALLATION

CAUTION

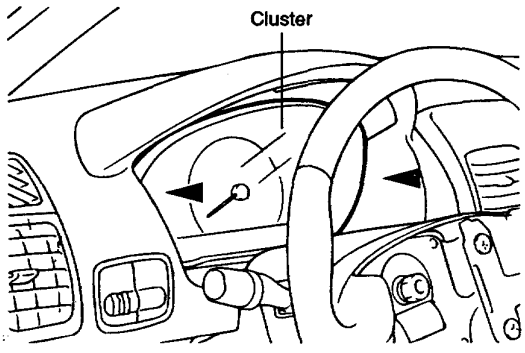
- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***
- ***Wear gloves to protect hands from injury.***

1. Lower the steering column.
2. After loosening the mounting screw, remove the cluster facia panel using a screwdriver.



ESDD008C

3. After loosening the cluster mounting screws, take out the cluster from the housing.



ESDD006D

4. Installation is the reverse of removal.

CRASH PAD LOWER PANEL REMOVAL AND INSTALLATION

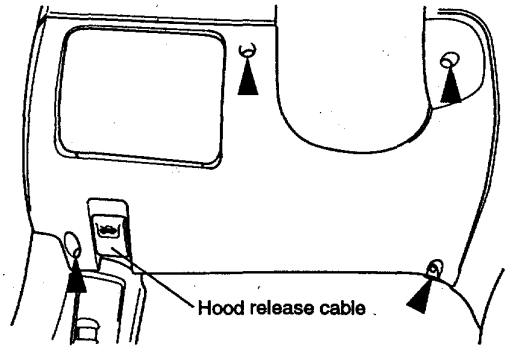
CAUTION

- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***
- ***Wear gloves to protect hands from injury.***

NOTE

Take care not to scratch the crash pad.

1. Raise the steering column.
2. Loosen the 4 mounting. Disconnect the self-diagnosis connector and hood release cable and remove the crash pad lower panel.



ESDD113S

3. Installation is the reverse of removal.

GLOVE BOX REMOVAL AND INSTALLATION

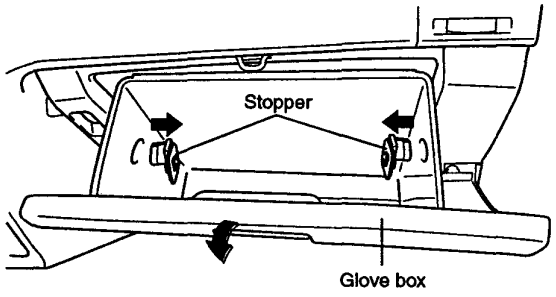
CAUTION

- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***
- ***Wear gloves to protect hands from injury.***

NOTE

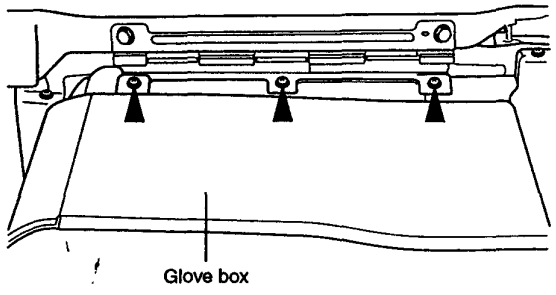
Take care not to scratch the crash pad.

1. Remove the glove box stopper.



ESPD150G

2. After loosening the glove box mounting screws(3EA), remove the glove box.



ESDD113C

3. Installation is the reverse of removal.

CENTER FACIA PANEL REMOVAL AND INSTALLATION

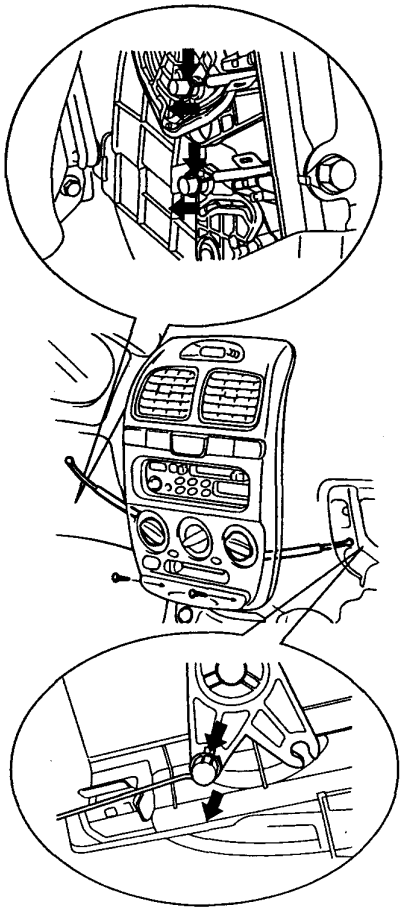
CAUTION

- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***
- ***Wear gloves to protect hands from injury.***

NOTE

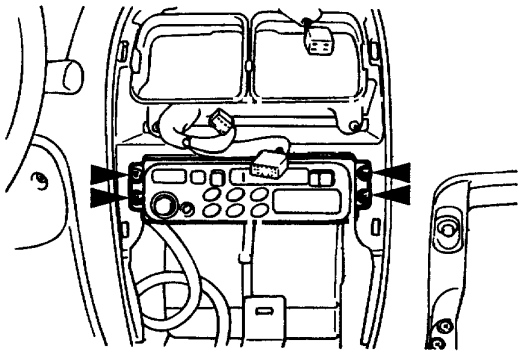
Take care not to scratch the crash pad.

1. Remove the glove box.
2. Remove the crash pad lower panel. ("See Page BD-37")
3. Disconnect the intake control mode, mode control, and air mix control cable. Remove the center facia panel from the lower portion with a trim remover.



KSDC113E

4. Loosen the 4 mounting screws and remove the audio assembly.



KSDC008E

5. Installation is the reverse of removal.

MAIN CRASH PAD

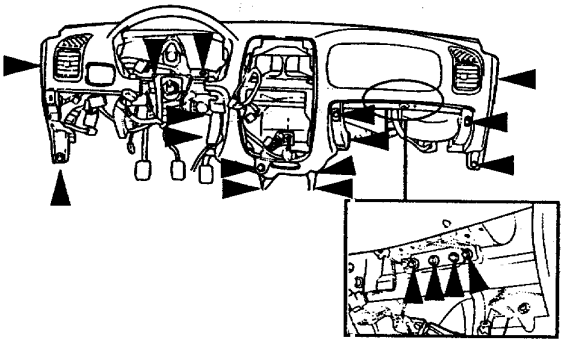
CAUTION

- ***When using a screwdriver or equivalent, wrap it with protective tape to prevent damage.***
- ***Wear gloves to protect hands from injury.***

NOTE

Take care not to scratch the crash pad.

1. Remove the steering wheel and airbag module.
2. Remove the glove box. ("See Page BD-38")
3. Remove the crash pad lower panel. ("See Page BD-37")
4. Remove the center facia panel.("See Page BD-38")
5. Remove the audio assembly.
6. Remove the crash pad side trim.
7. Disconnect the antenna connecting connector.
8. After loosening the main crash pad mounting bolts, remove the main crash.
9. Installation is the reverse of removal.

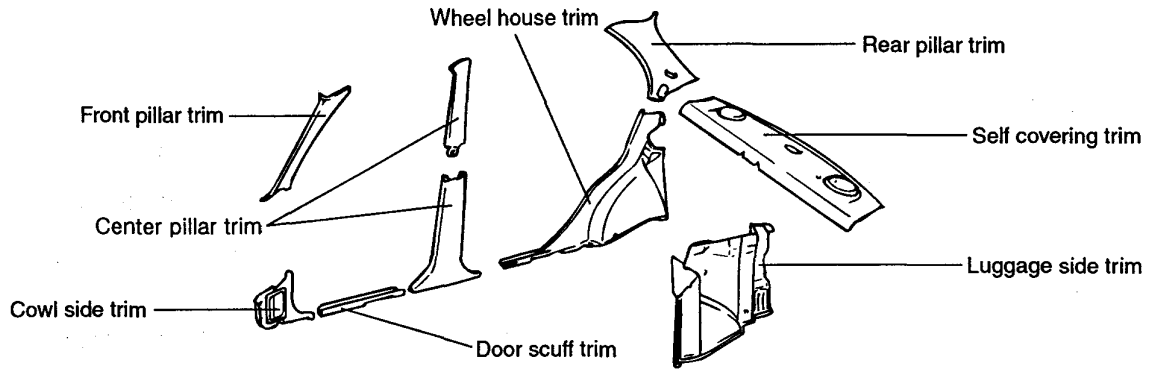


KSDC117A

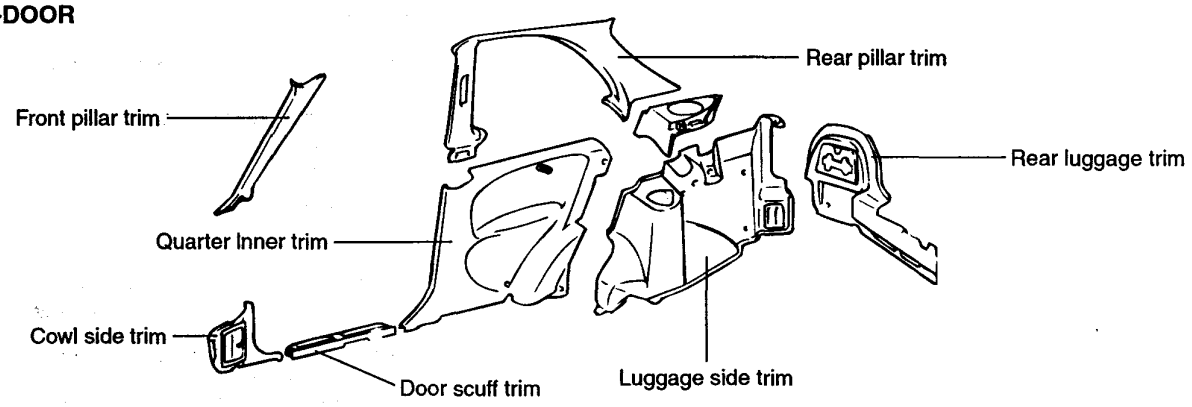
INTERIOR TRIM

COMPONENTS EA66F852

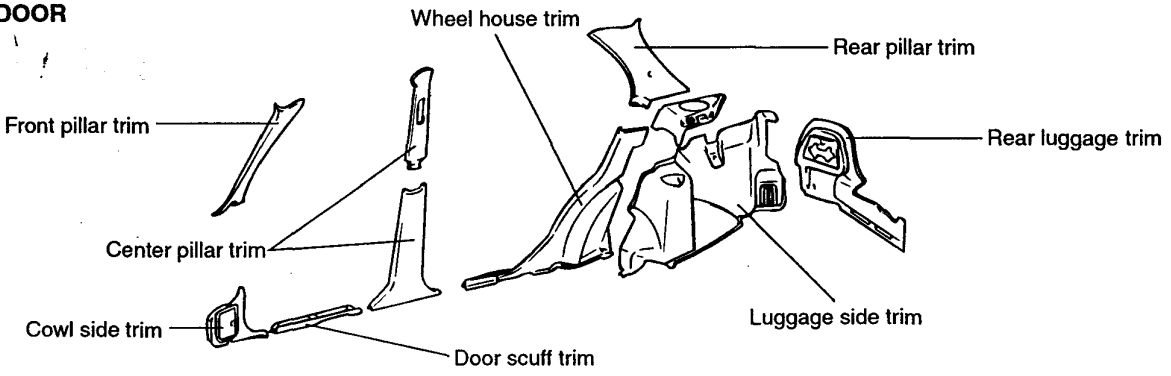
4-DOOR



3-DOOR



5-DOOR



ESDD204A

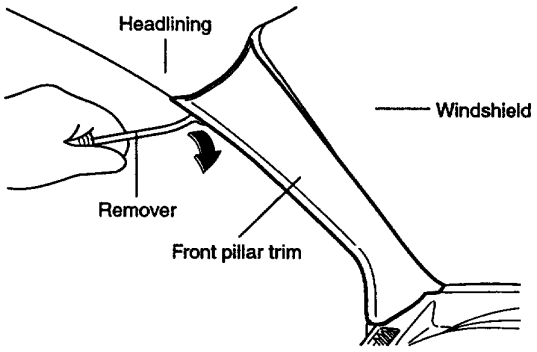
REMOVAL AND INSTALLATION KA066A3A

NOTE

Prior to removing the trims, remove the outside weatherstrip.

FRONT PILLAR TRIM

Remove the front pillar trim using a trim remover.

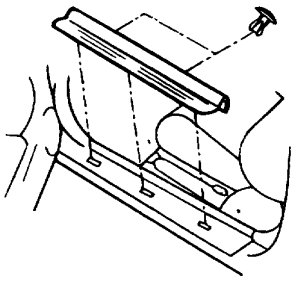


ESPD170C

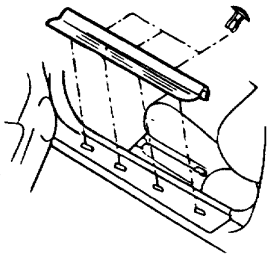
FRONT DOOR SCUFF TRIM

1. After disengaging the trim mounting clips, remove the front door scuff trim.

4/5-DOOR



3-DOOR

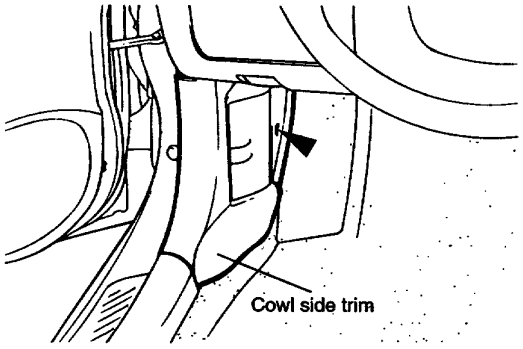


ESDD205A

2. Installation is the reverse of removal.

COWL SIDE TRIM

1. Remove the front door scuff trim.
2. After disengaging the cowl side trim mounting clip, remove the cowl side trim.

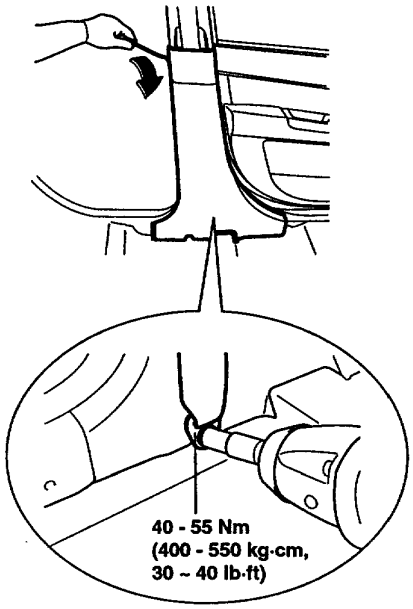


ESDD100L

3. Installation is the reverse of removal.

CENTER PILLAR LOWER TRIM

1. Remove the front door scuff trim.
2. After removing the front seat belt lower anchor bolt and clip, remove the center pillar lower trim.

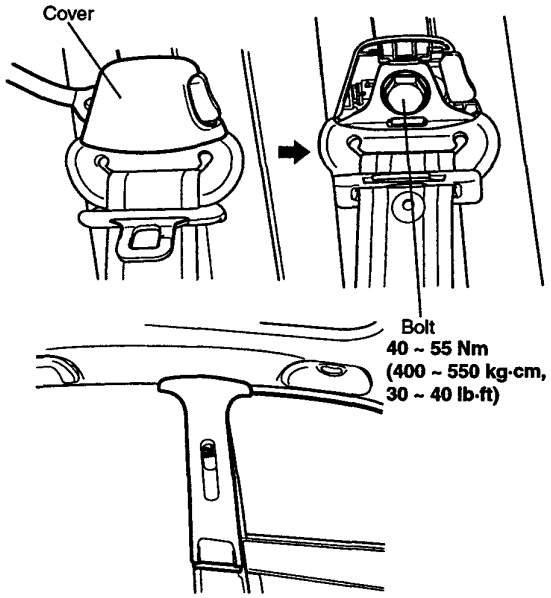


KSPD170F

3. Installation is the reverse of removal.

CENTER PILLAR UPPER TRIM

1. Remove the front door scuff trim. ("See Page BD-41")
2. Remove the center pillar lower trim. ("See Page BD-41")
3. Remove the front seat belt upper anchor cover, loosen the anchor mounting bolt, and remove the center pillar upper trim.

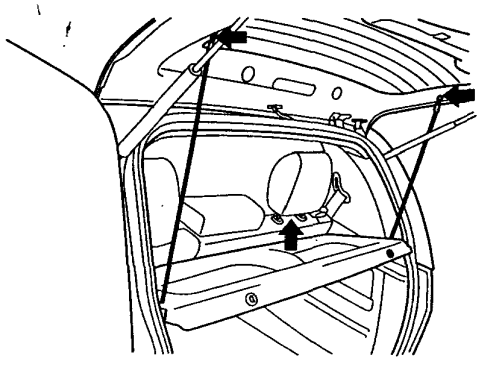


ESPD170G

4. Installation is the reverse of removal.

COVERING SELF TRIM

1. Detach the mounting wire, remove the covering self trim by pulling it upward.

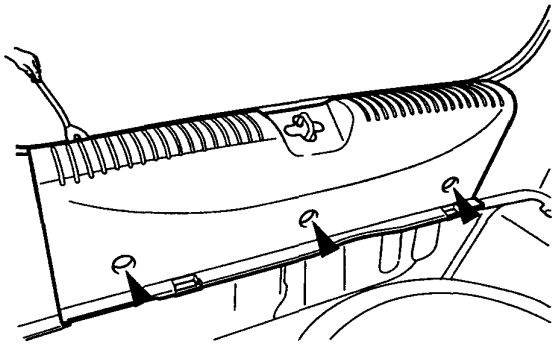


KSPD170H

2. Installation is the reverse of removal.

REAR TRANSVERSE TRIM

1. Remove the covering self trim.
2. Remove the luggage cover mat.
3. After loosening the transverse trim mounting screws(3EA), remove the transverse trim.

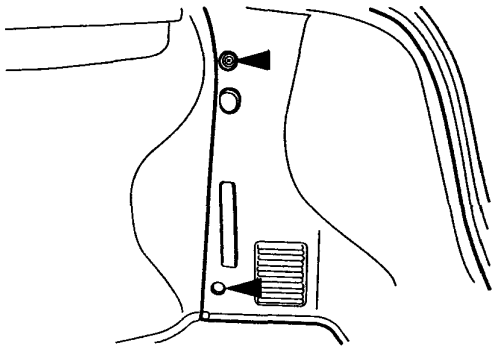


KSPD170I

4. Installation is the reverse of removal.

LUGGAGE REAR TRIM

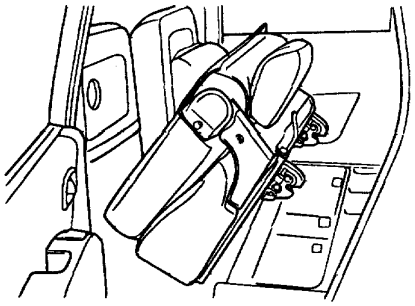
1. Remove the rear transverse trim.
2. After loosening the luggage rear trim mounting screws(2EA), remove the luggage rear trim.



KSDC221C

LUGGAGE SIDE TRIM

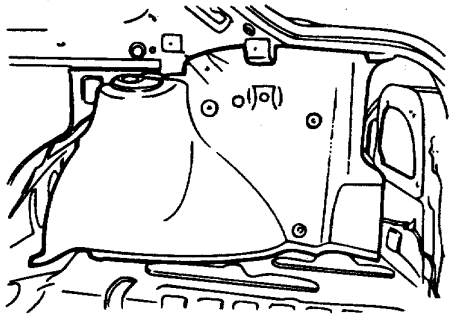
1. Raise the rear seat.



KSNB011D

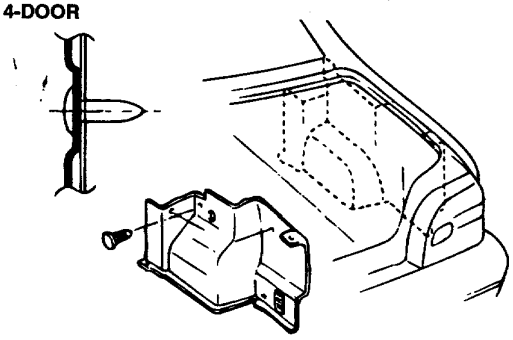
2. Remove the luggage cover mat.
3. Remove the rear transverse trim.
4. Remove the wheel house trim.
5. Remove the screws, clips and then luggage side trim.

3/5-DOOR



ESDD116B

4-DOOR



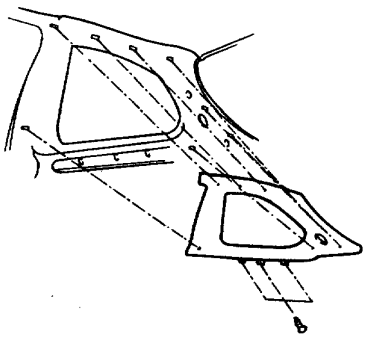
ESDD116A

6. Installation is the reverse of removal.

REAR PILLAR TRIM

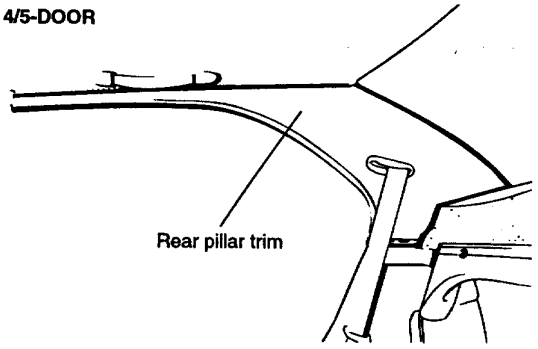
1. Remove the rear pillar trim using a trim remover.

3-DOOR



ESDD205B

4/5-DOOR

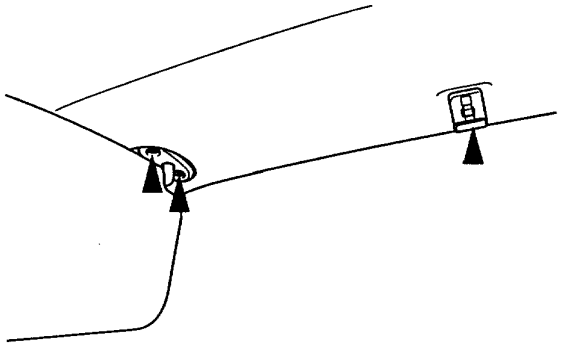


ESDD116C

2. Installation is the reverse of removal.

SUNVISOR

1. Loosen the sunvisor mounting screws(2EA) and holder mounting screw, then remove the sunvisor and holder.

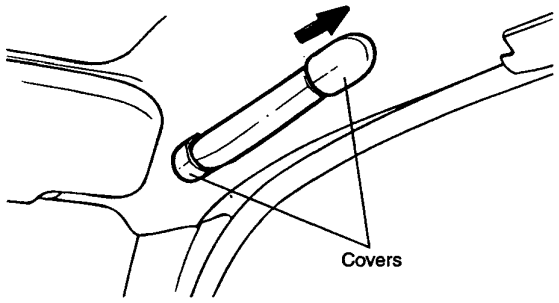


KSPD170N

2. Installation is the reverse of removal.

GRAB HANDLE

1. Peel both grab handle covers, loosen the 2 mounting bolts, and remove the grab handle.

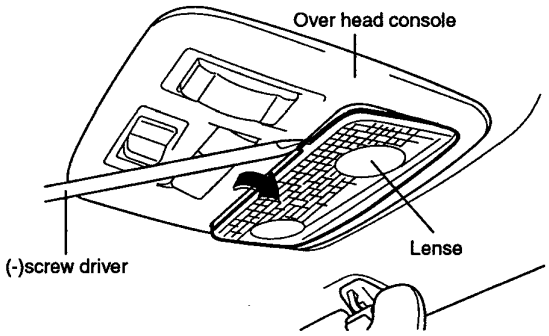


ESDD175C

2. Installation is the reverse of removal.

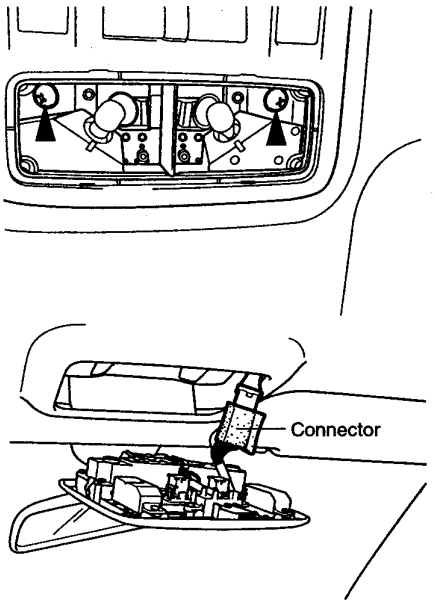
OVERHEAD CONSOLE

1. Remove the ceiling light cover.



ESPD170P

2. Loosen the 2 mounting screws, disconnect the connector, and then remove the overhead console.



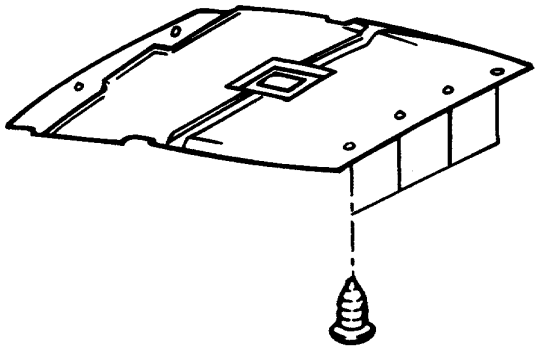
ESPD170R

3. Installation is the reverse of removal.

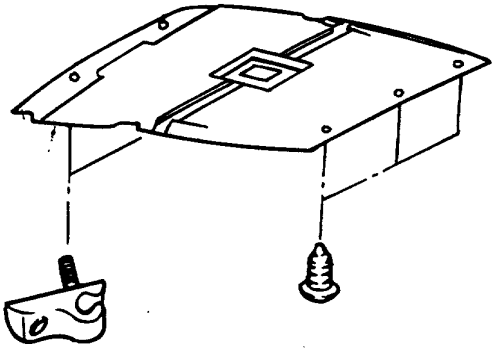
HEAD LINING

1. Prior to removing the headlining, remove the following items.
   - Front seat
   - Rear seat
   - Overhead console
   - Front pillar trim
   - Front door scuff trim
   - Rear door scuff trim
   - Front seat belt
   - Center pillar lower, upper trim
   - Rear seat belt lower anchor
   - Transverse trim
   - Rear center seat belt anchor
   - Luggage side trim
   - Rear pillar trim
   - Sunvisor and Grab handles

2. After detaching the headlining mounting clips, remove the headlining.



KSDC116F

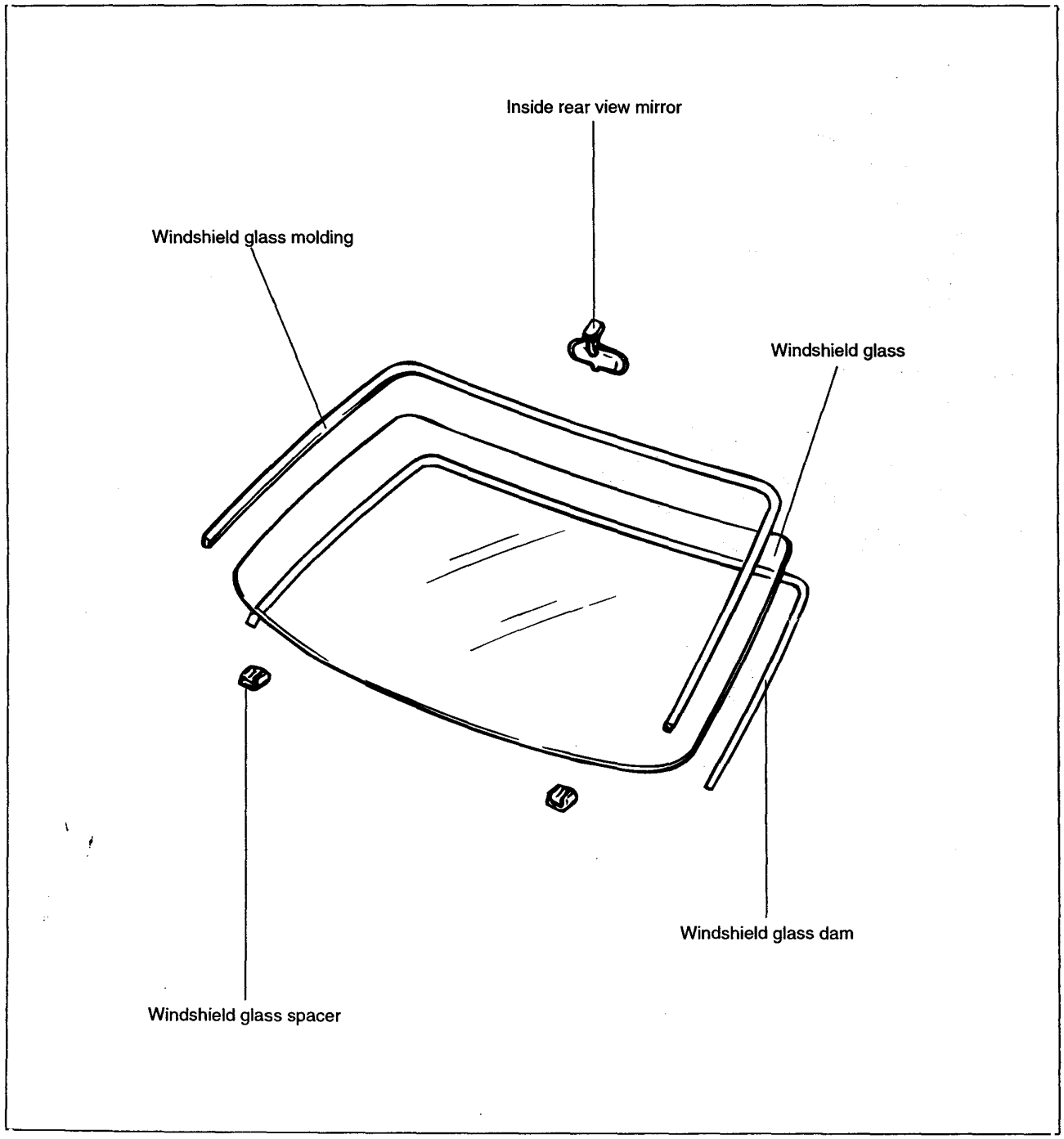


KSDC116G

3. Installation is the reverse of removal.

WINDSHIELD GLASS

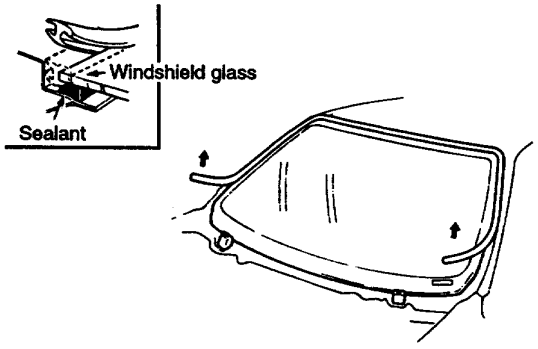
COMPONENTS E0625B7C



ESDD203E

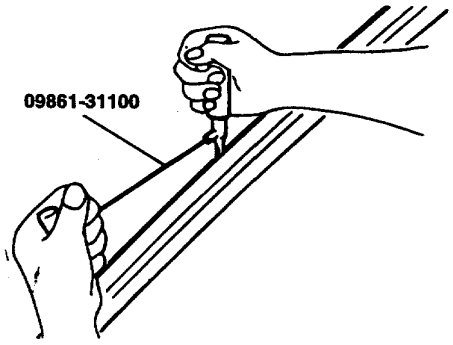
REMOVAL E4DCBFF4

1. To remove the windshield, first remove the following parts :
   1) Front pillar trims
   2) Inside rear view mirror
   3) Wiper arms
   4) Weatherstrip and cowl top cover
   5) Windshield glass molding



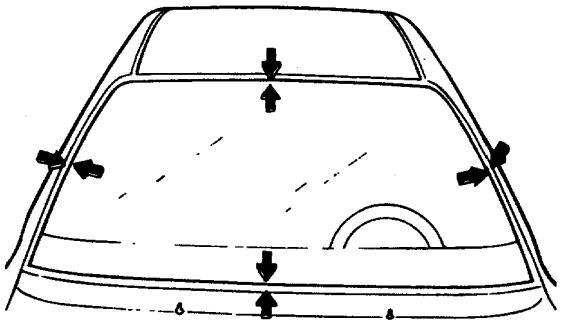
ESNB090A

2. Use the special tool (09861-31100) to cut through the sealant.



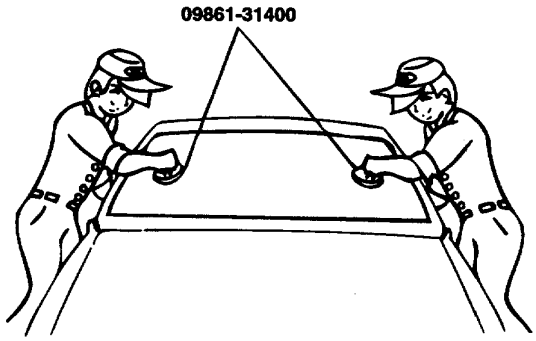
ESDA230B

3. Make mating marks on the glass and body if the glass is to be reinstalled.



KSHA125A

4. Take out the windshield glass with the special tool (09861-31400).



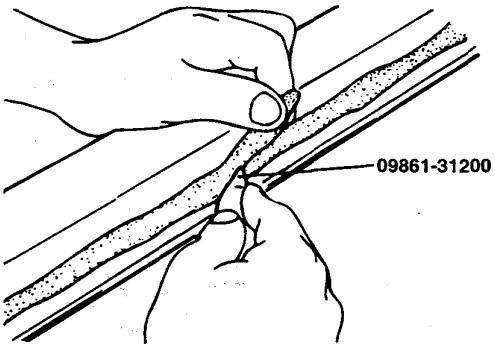
ESDA230D

INSTALLATION E963EDFF

1. Using a cutter knife or the special tool (09861-31200), scrape the old sealant smoothly to a thickness of about 2 mm (0.08 in.) on the bonding surface around the entire windshield flange.

⚠ ***CAUTION***

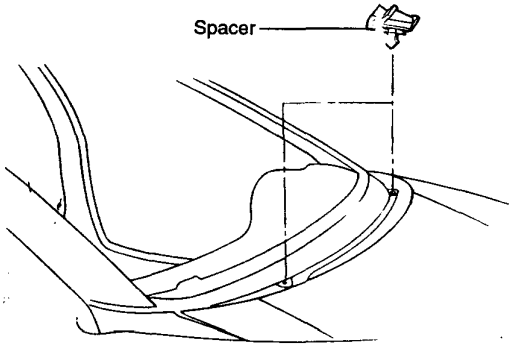
Be careful not to remove more adhesive than necessary, and also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with touch-up paint.



ESDA235B

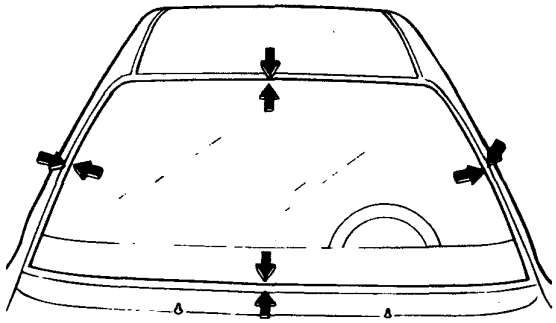
2. Clean the body bonding surface with a sponge dampened in alcohol or wax and grease remover.

3. Install the spacer in the windshield aperture.



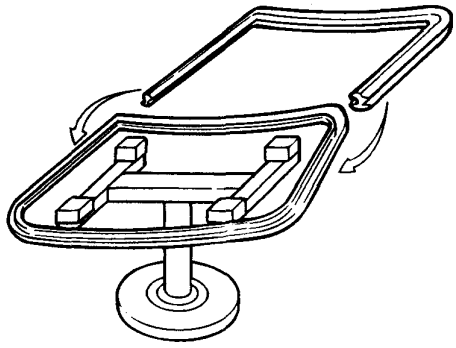
ESNB090B

4. Center a new windshield glass in the opening. Mark the location by marking lines across the glass and body with a grease pencil at the four points as shown.



KSHA125A

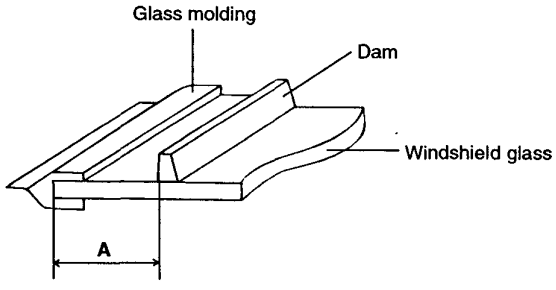
5. Install the windshield glass molding without any gaps.



KSHA130B

6. Glue the rubber dam to the inside surface of the windshield glass around the entire edge as shown, to contain the sealant during installation.

Part	"A"	Remarks
Upper	13.5 mm	Glass molding sub
Side	13.5 mm	
Lower	27 mm	

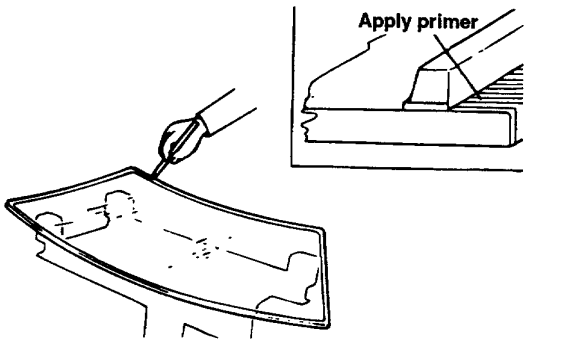


ESHA050E

7. Apply a light coat of glass primer to the outside of the dam.

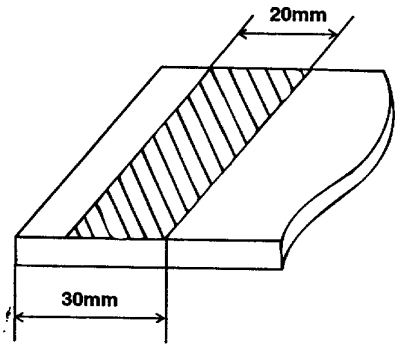
NOTE

1. *Never touch the surface applied primer with your hand.*
   If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
2. *Do not apply body primer to the glass.*
3. *Keep water, dust, and abrasive materials away from the surface applied primer.*



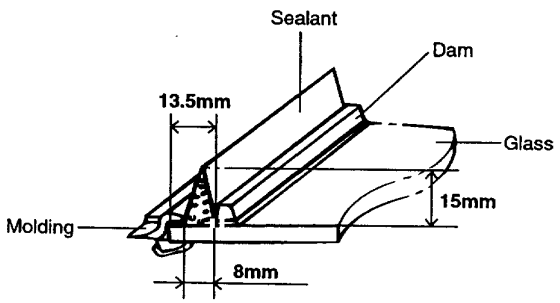
ESDA235E

8. Apply a primer to the lower glass as shown.



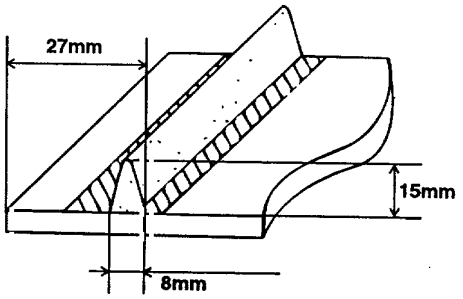
ESHA050F

9. Apply a sealant around the edge of the glass.



UPPER AND SIDE

ESDD008F



LOWER

ESDD008G

NOTE

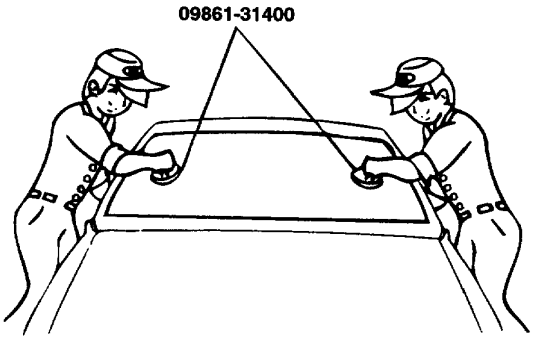
Apply the adhesive within 5 minutes after applying the primer to the glass.

10. Apply a light coat of body primer to the original sealant remaining around the window opening flange. The glass should be installed within 5 minutes after you apply the primer.



ESDA235F

11. Using suction cups or the special tool (09861-31400), lower the glass over the opening, align it with the marks made in step 4 and set it down on the sealant.

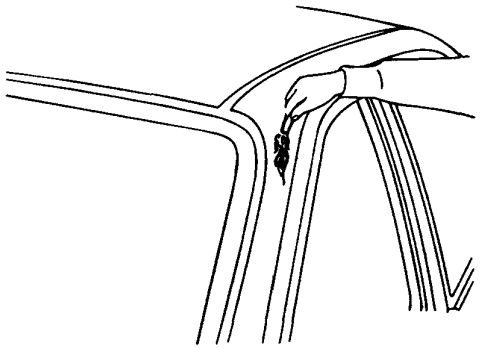


ESDA230D

12. Scrape or wipe excess adhesive off with a putty knife or gauze. Fill all cavities around the windshield glass.

13. Perform a water-leak test for the windshield. Use a cold water spray, being careful not to direct a powerful stream of water on the new adhesive material. Allow water to spill over the edges of the glass.

14. If there are leaks, dry the affected area, then apply sealant.



ESDA235G

15. Install the removed parts.

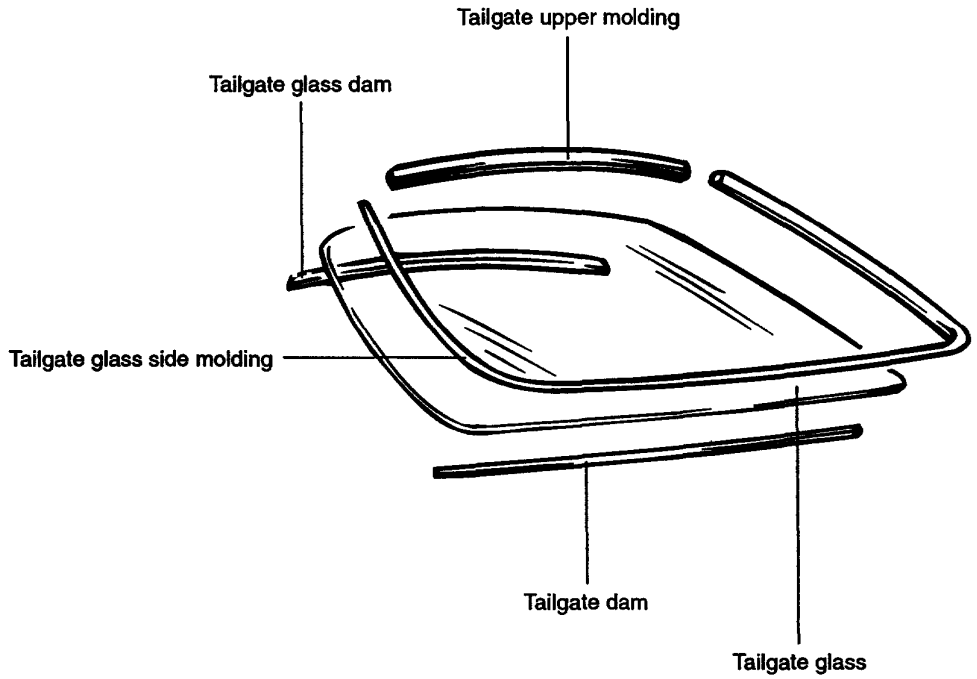
⚠ ***CAUTION***

1. ***Keep the windshield dry for the first hour after installation.***
2. ***Let the car stand for at least four hours after windshield installation. If the car has to be used winthin the first 8 hours, it must be driven slowly.***
3. ***Take care not to slam the doors with all the windows rolled up.***
4. ***Take care not to twist the vehicle excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads).***

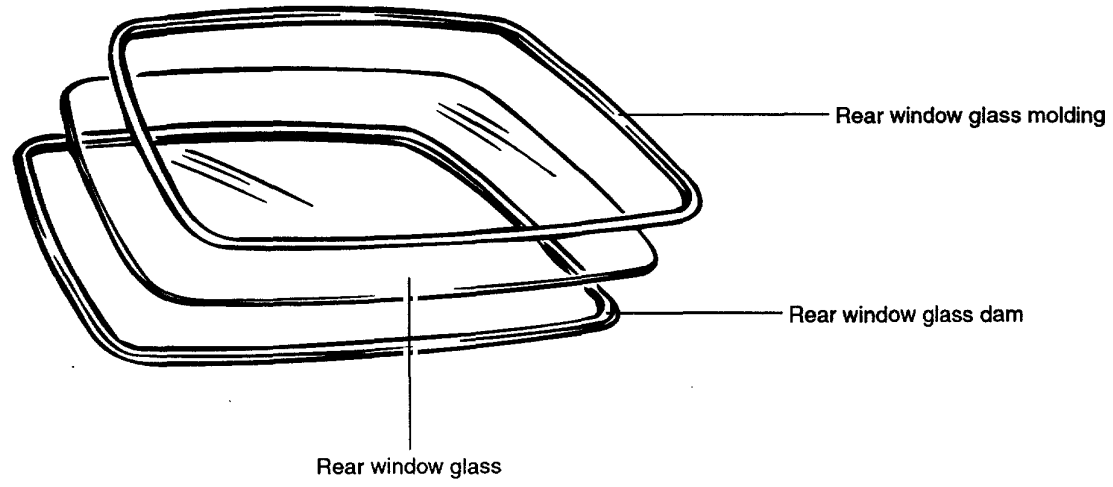
TAILGATE GLASS

COMPONENTS EB2DE9A6

3/5-DOOR



4-DOOR

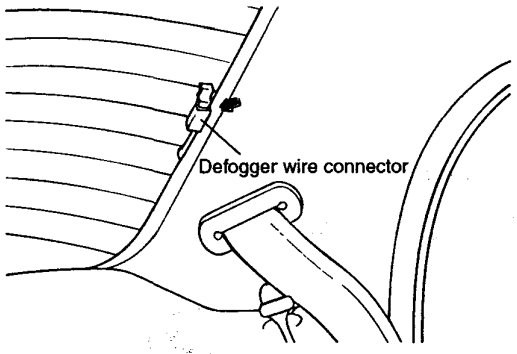


ESDD212A

REMOVAL EFF092FD

1. To remove the tailgate glass, first remove the following parts :

   1) Rear window defogger wire connector.

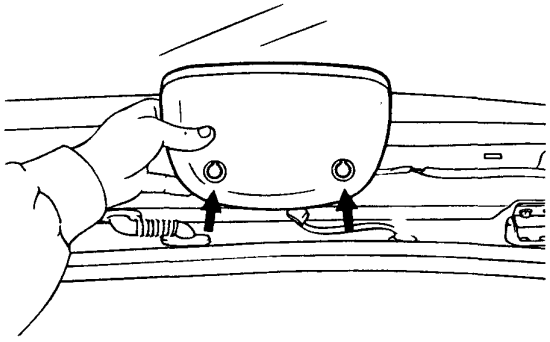


ESDD100S

   2) Tailgate trims.

   3) Rear wiper and wiper motor.

   4) High mounted stop lamp.



ESJA040N

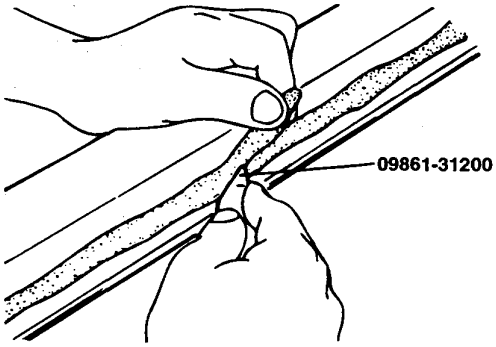
2. Remove the tailgate glass in the same manner as the windshield glass.

INSTALLATION EAD9F0F3

1. Using a cutter knife or the special tool (09861-31200), scrape the old sealant smoothly to a thickness of about 2 mm (0.08 in.) on the bonding surface around the entire tailgate glass.

⚠ ***CAUTION***

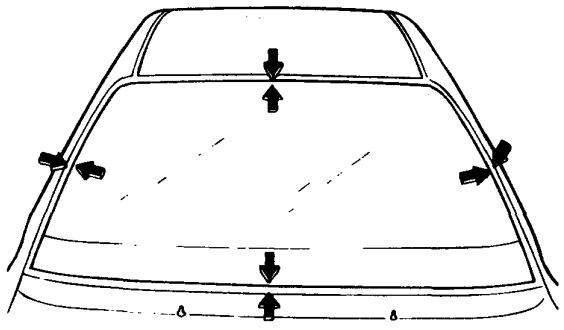
Be careful not to remove more adhesive than necessary, and also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with touch-up paint.



ESDA235B

2. Clean the body bonding surface with a sponge dampened in alcohol or wax and grease remover.

3. Center a new tailgate glass in the opening. Mark the location by marking lines across the glass and body with a grease pencil at the four points as shown.



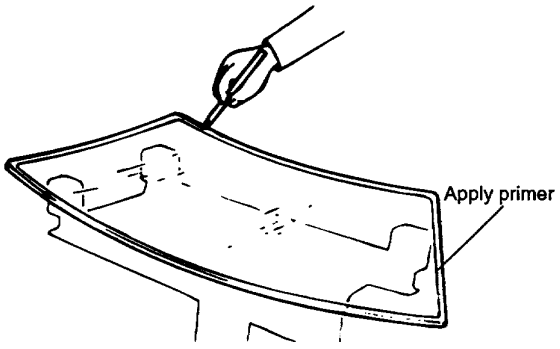
ESHA150B

4. Install the tailgate glass molding without any gaps.

5. Apply a light coat of glass primer around the tailgate glass.

NOTE

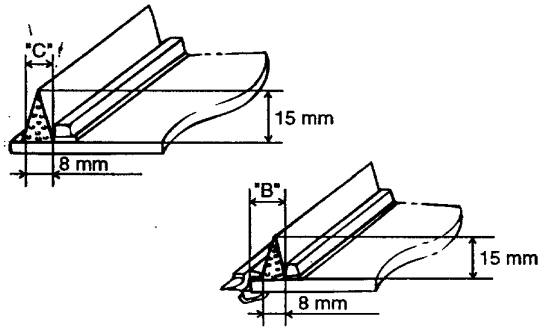
1. *Never touch the surface applied primer with your hands.*
   If you do, the adhesive may not bond to the glass properly, causing a leak after the tailgate glass has been installed.
2. *Do not apply body primer to the glass.*
3. *Keep water, dust, and abrasive materials away from the surface applied primer.*



ESNB110A

6. Apply a sealant around the edge of the glass.

Part	"B" (4DR)		"C" (3/5DR)	
Upper	13.5 mm	Glass molding sub	23 mm	-
Side	13.5 mm			
Lower	13.5 mm		24 mm	-



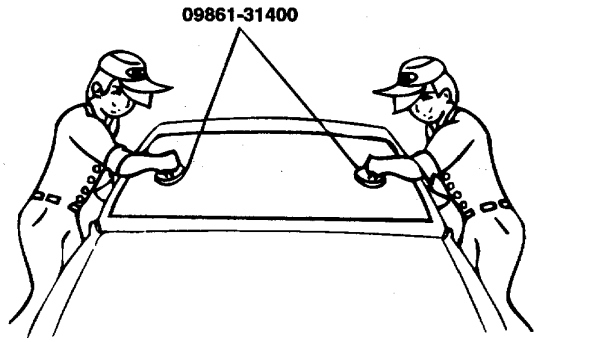
ESDA250A

NOTE

Apply the adhesive within 5 minutes after applying the primer to the glass.

7. Apply a light coat of body primer to the original sealant remaining around the window opening flange. The glass should be installed within 5 minutes after you apply the primer.

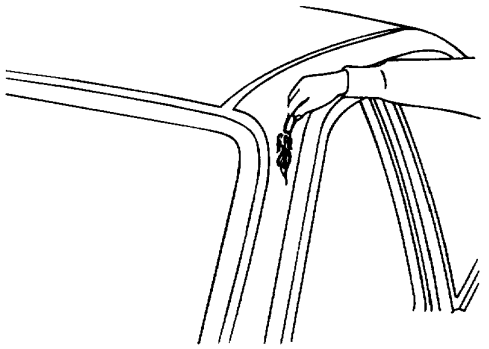
8. Use suction cups or the special tool (09861-31400), lower the glass over the opening, align it with the marks made in step 3 and set it down on the sealant.



ESDA230D

9. Scrape or wipe excess adhesive off with putty knife or gauze. Fill all cavities around the tailgate glass.

10. Perform a water-leak test for the tailgate glass. Use a cold water spray, being careful not to direct a powerful stream of water on the new adhesive material. Allow water to spill over the edges of the glass.



ESDA235G

11. If there are leaks, dry the affected area, then apply sealant.

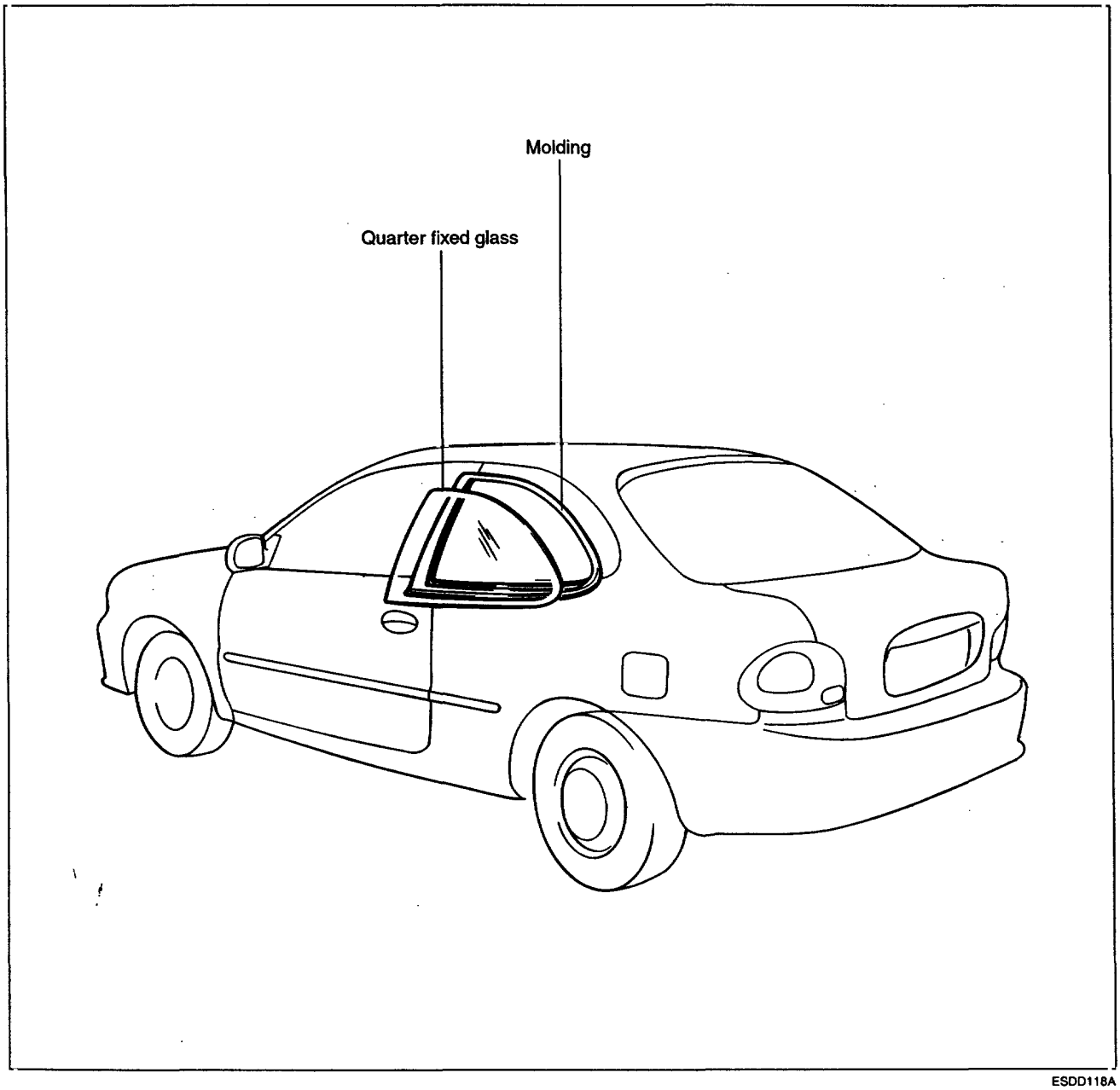
12. Install the removed parts.

⚠ ***CAUTION***

1. ***Keep the tailgate glass dry for the first hour after installation.***
2. ***Let the car stand for at least four hours after tailgate glass installation. If the car has to be used winthin the first 8 hours, it must be driven slowly.***
3. ***Take care not to slam the doors with all the windows rolled up.***
4. ***Take care not to twist the vehicle excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads).***

QUARTER GLASS

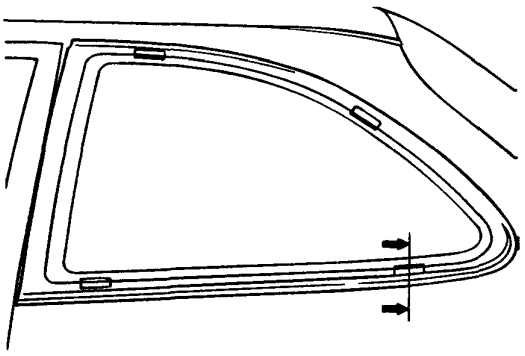
COMPONENTS EC99979D



ESDD118A

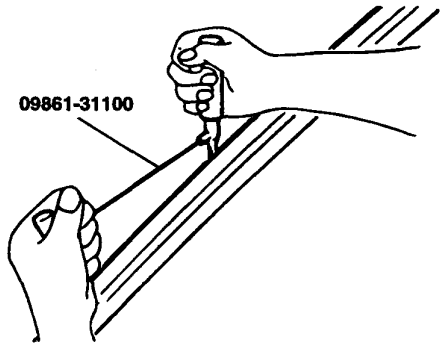
REMOVAL E6D119B1

1. Remove the center pillar upper trim and the quarter inner trim then, loosen the glass moulding installing nuts.



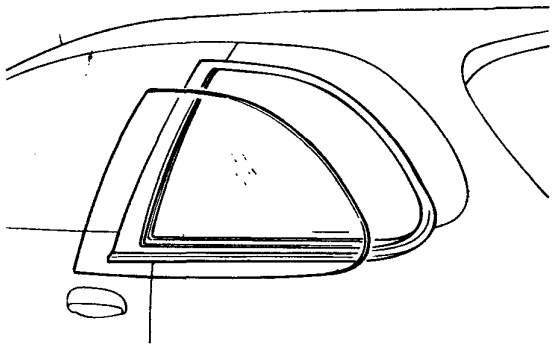
KSDC118B

2. After removing the quarter fixed glass moulding, cut the sealant using the special tool.



ESDA230B

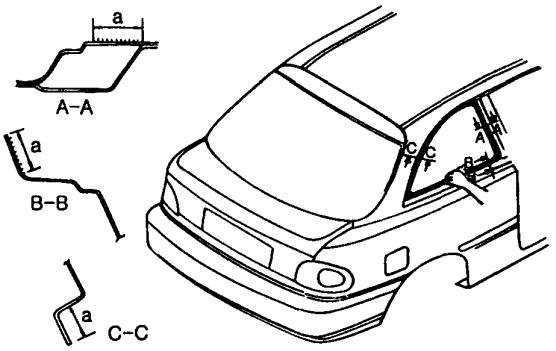
3. Remove the quarter fixed glass.



KSDC118C

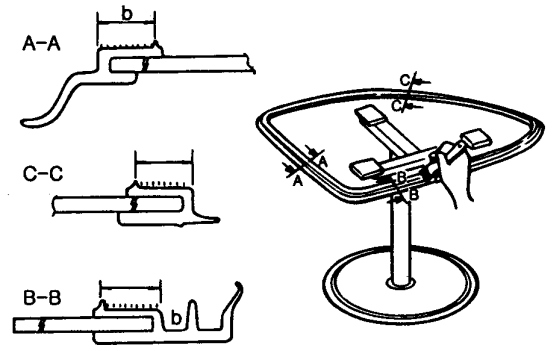
INSTALLATION EDB7C93D

1. Clean the quarter fixed glass moulding assembly with gause.



KSDC118D

2. Apply a primer to the glass and the glass moulding assembly.

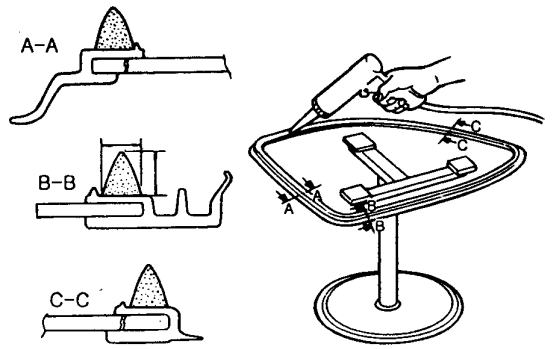


KSDC118E

3. Apply the sealant to the entire circumference of the glass.

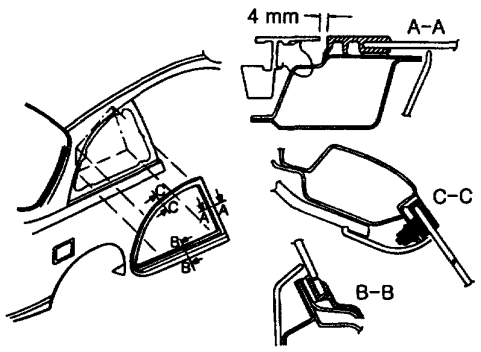
NOTE

Install the glass to the body within five minutes.



KSDC118F

4. To install the quarter fixed glass, tighten the glass moulding installing nuts. After setting it to the quarter fixed glass hole.

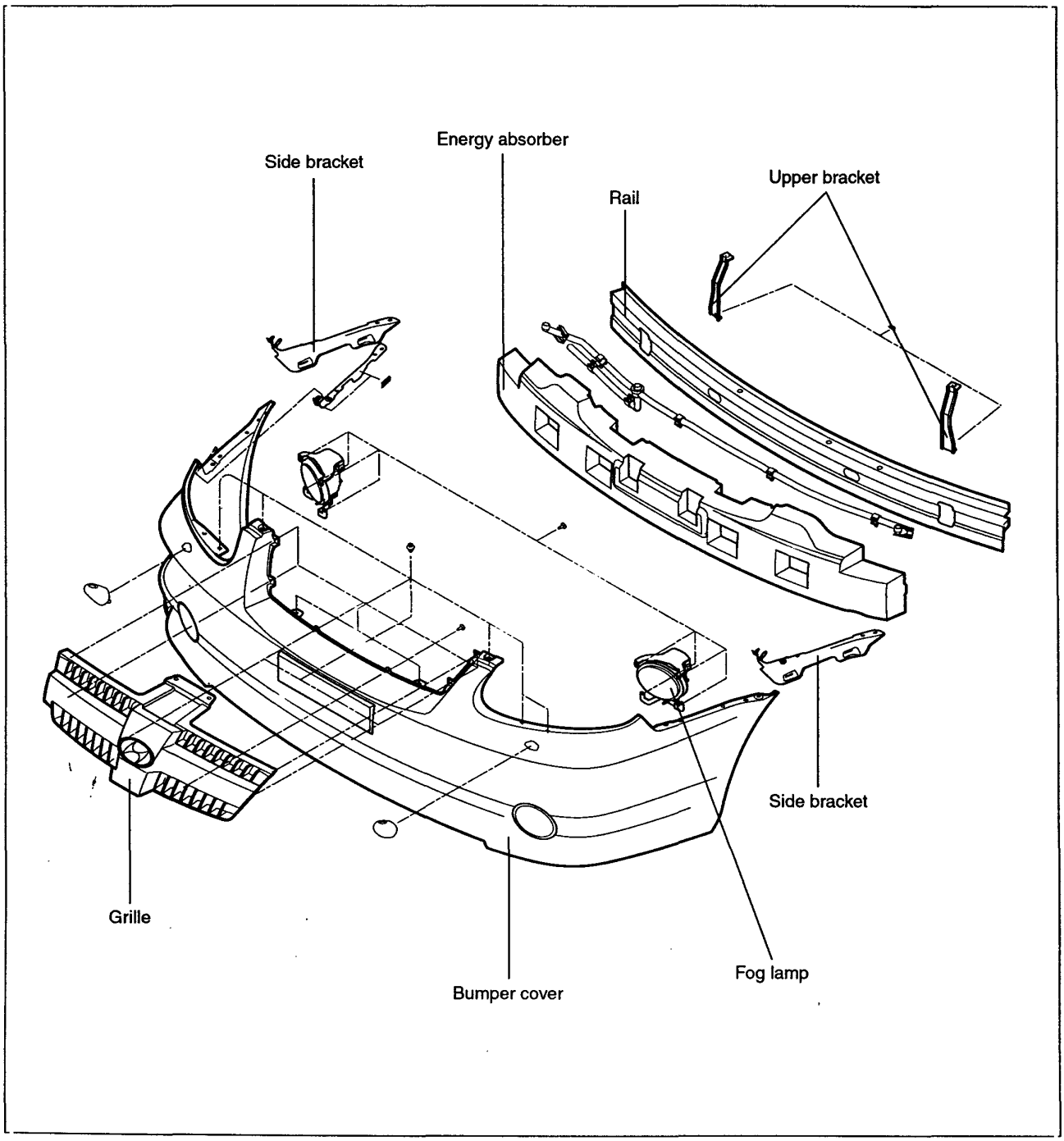


KSDC118G

BUMPER

FRONT BUMPER

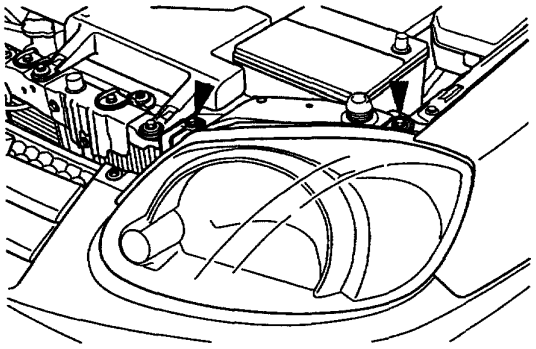
COMPONENTS E60DA9EB



ESDD210A

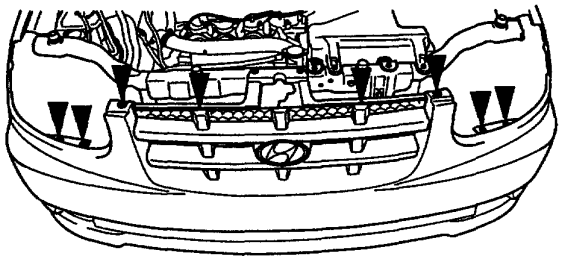
REMOVAL AND INSTALLATION E328A0DF

1. Loosen the 2 head lamp, disconnect all connectors, and remove the head lamp.



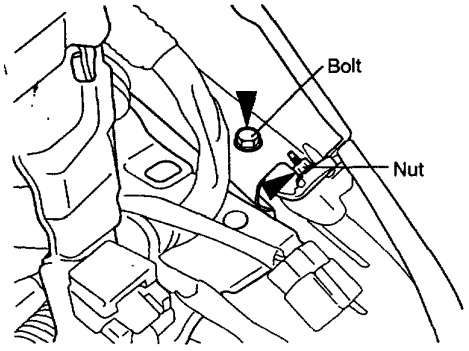
KSDC211A

2. Remove the 6 mounting clips on the upper bumper and 2 clips in the inner bumper.



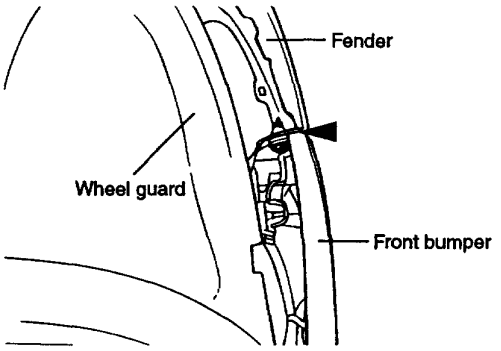
KSDC211B

3. Remove the mounting bolt and nut in the bumper side.

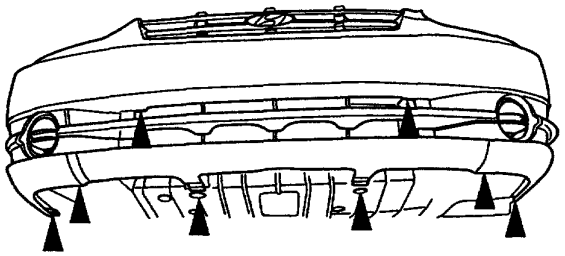


ESDD211C

4. Raise the vehicle, remove the clip and screw from the lower member, and remove the bumper cover.

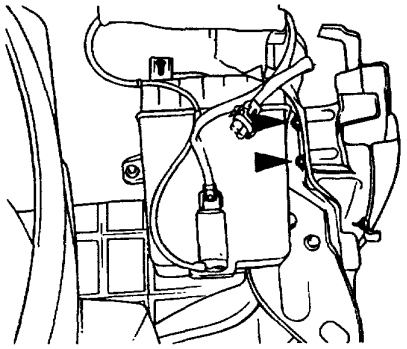


ESDD211H



KSDC211D

5. Remove the bumper stay.

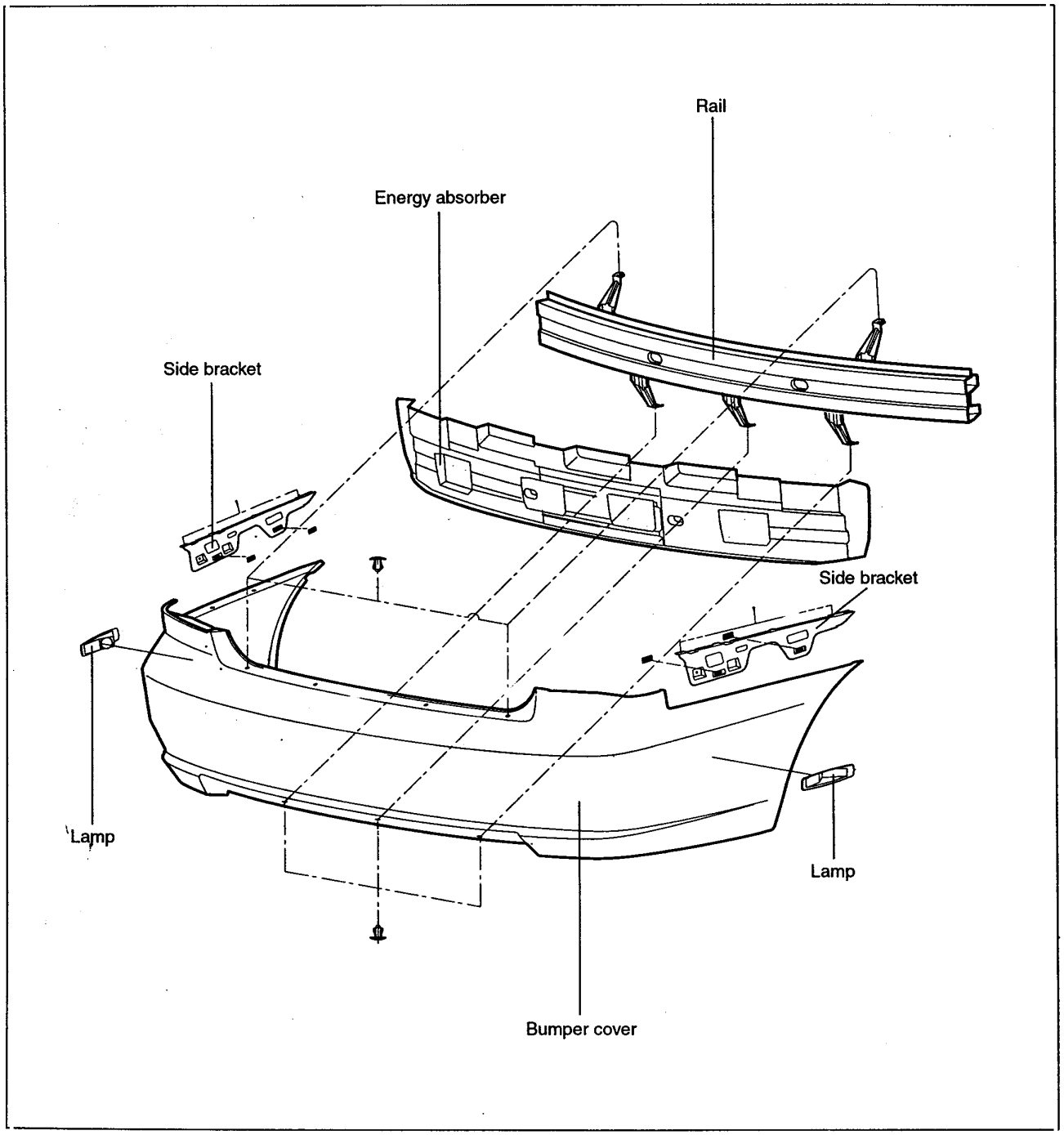


KSDC211I

6. Installation is the reverse of removal.

REAR BUMPER

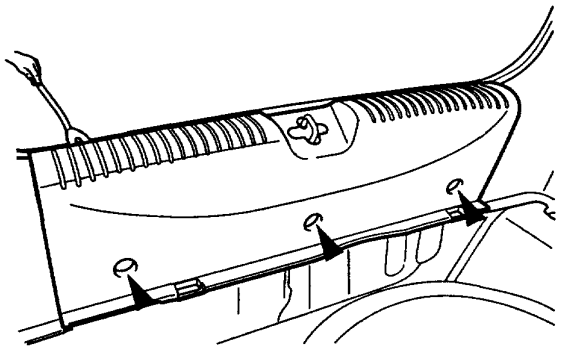
COMPONENTS ED32D132



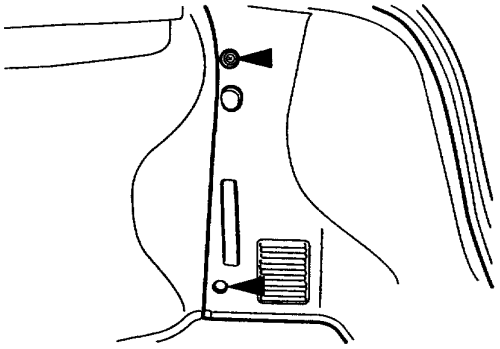
ESDD220A

REMOVAL AND INSTALLATION EDE0F784

1. Remove the transverse trim and luggage rear trim.

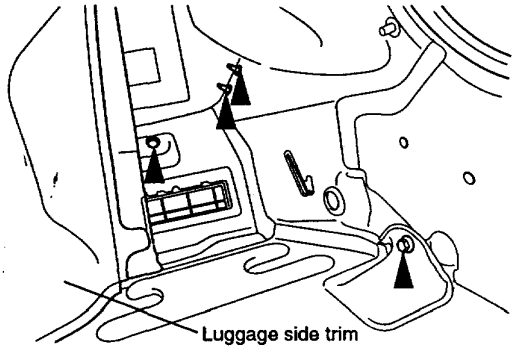


KSPD170I



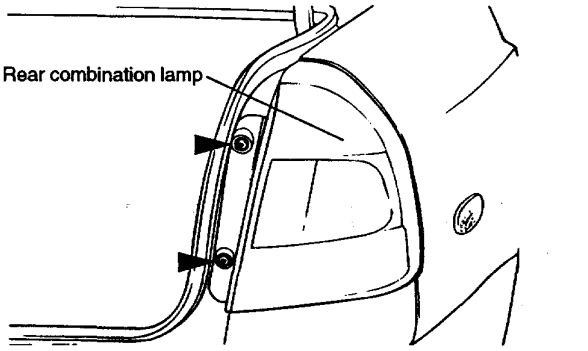
KSDC221C

2. Loosen the 2 mounting bolts and 2 nuts from the luggage rear trim inner rear bumper cover.



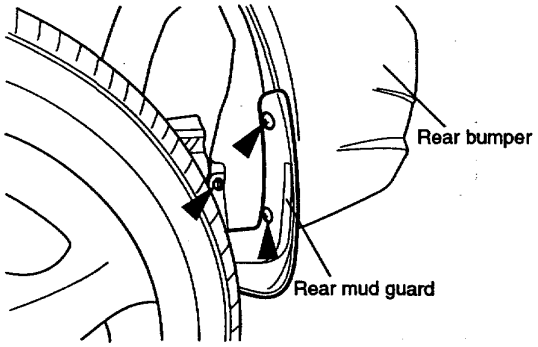
ESDD221E

3. Remove the rear combination lamp.

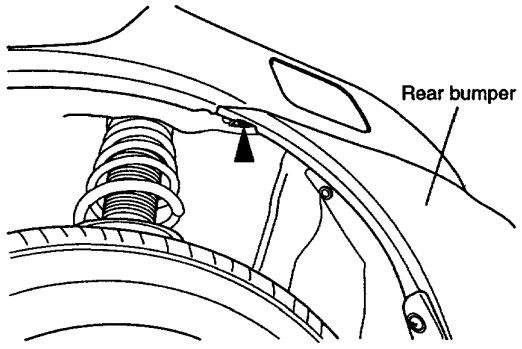


ESDD100M

4. Loosen the 3 mounting screws on the mud guard, remove the mud guard, and loosen the rear wheel house inner mounting screw.

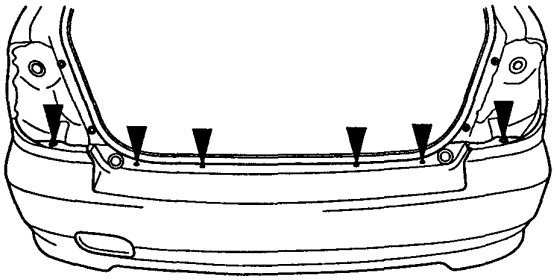


ESDD221B



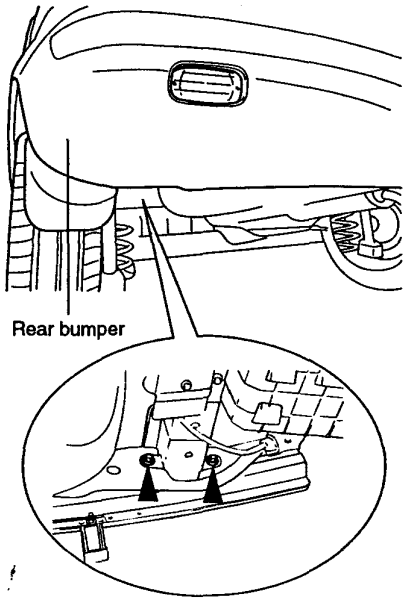
ESDD221G

5. Loosen the 6 mounting screw on the upper rear bumper cover.



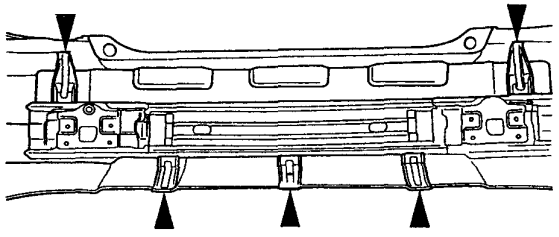
KSDC221A

6. After loosening the rear bumper cover inner rail mounting bolts (Left : 2, Right : 2), remove the rear bumper assembly.



ESDD221H

7. After loosening 5 mounting screw on the rear bumper cover, disconnect the cover from the rail.



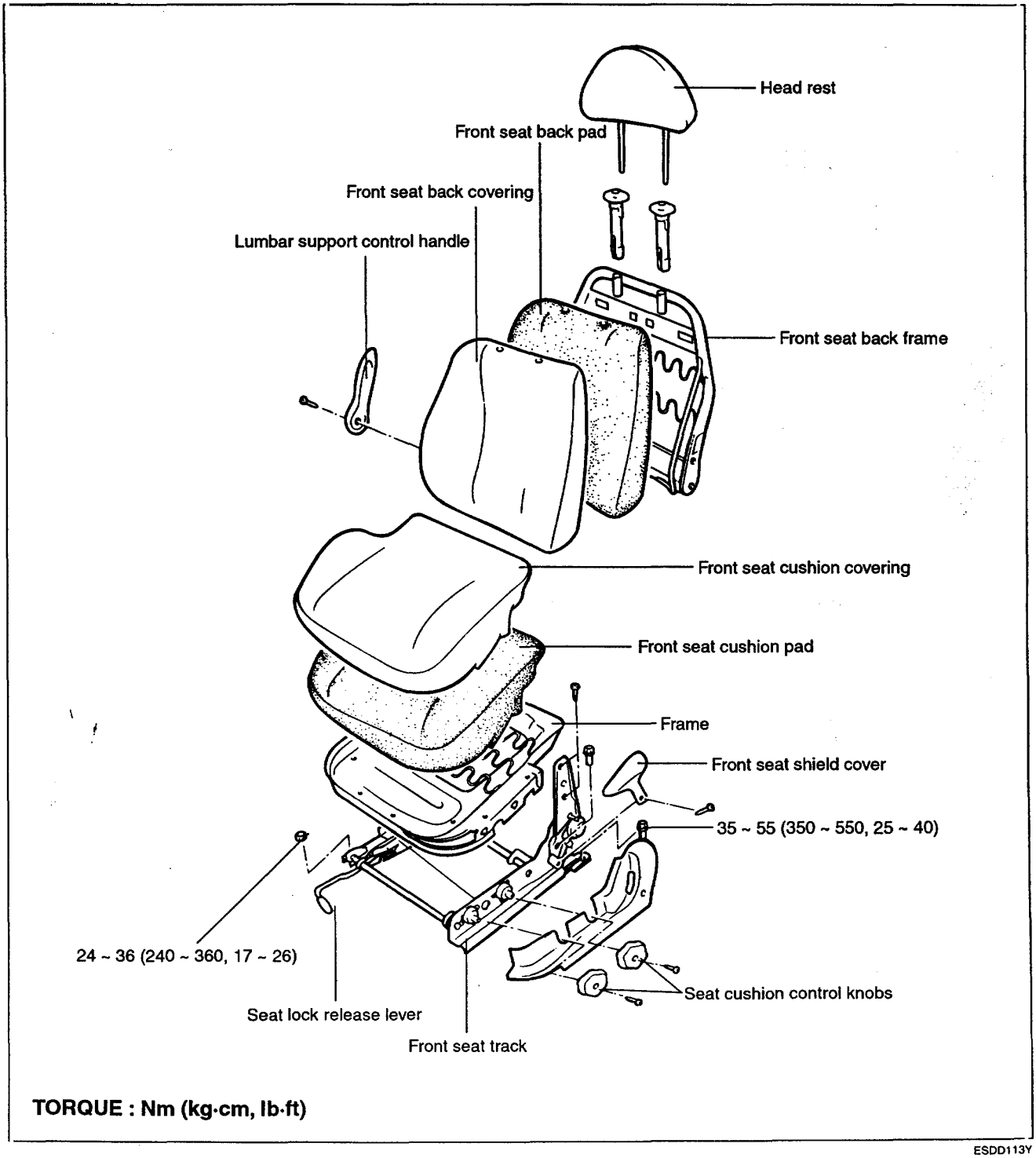
KSDC221D

8. Installation is the reverse of removal.

SEAT

FRONT SEAT

COMPONENTS E1D449E2



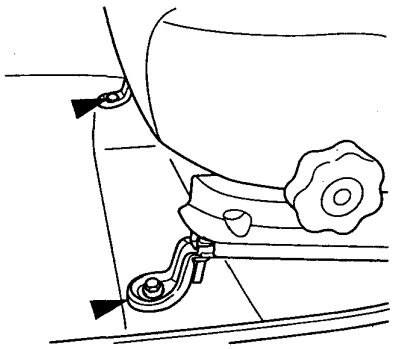
TORQUE : Nm (kg·cm, lb·ft)

ESDD113Y

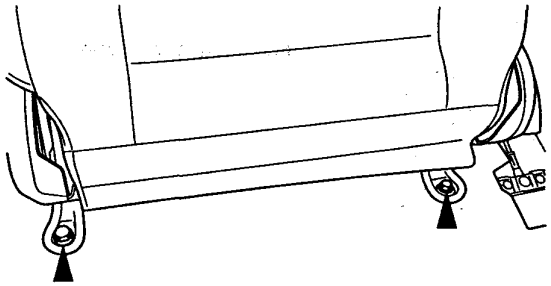
REMOVAL AND INSTALLATION E6A4B893

1. Loosen 4 mounting bolts on the front seat.

TORQUE : 35 ~ 55 Nm (350 ~ 550 kg·cm,25 ~ 40 lb·ft)

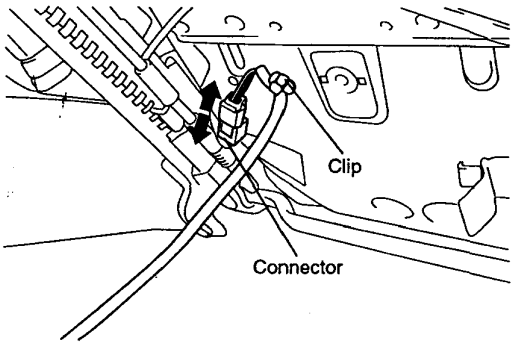


KSPD290A



KSPD290B

2. Disconnect the airbag connector and remove the front seat.

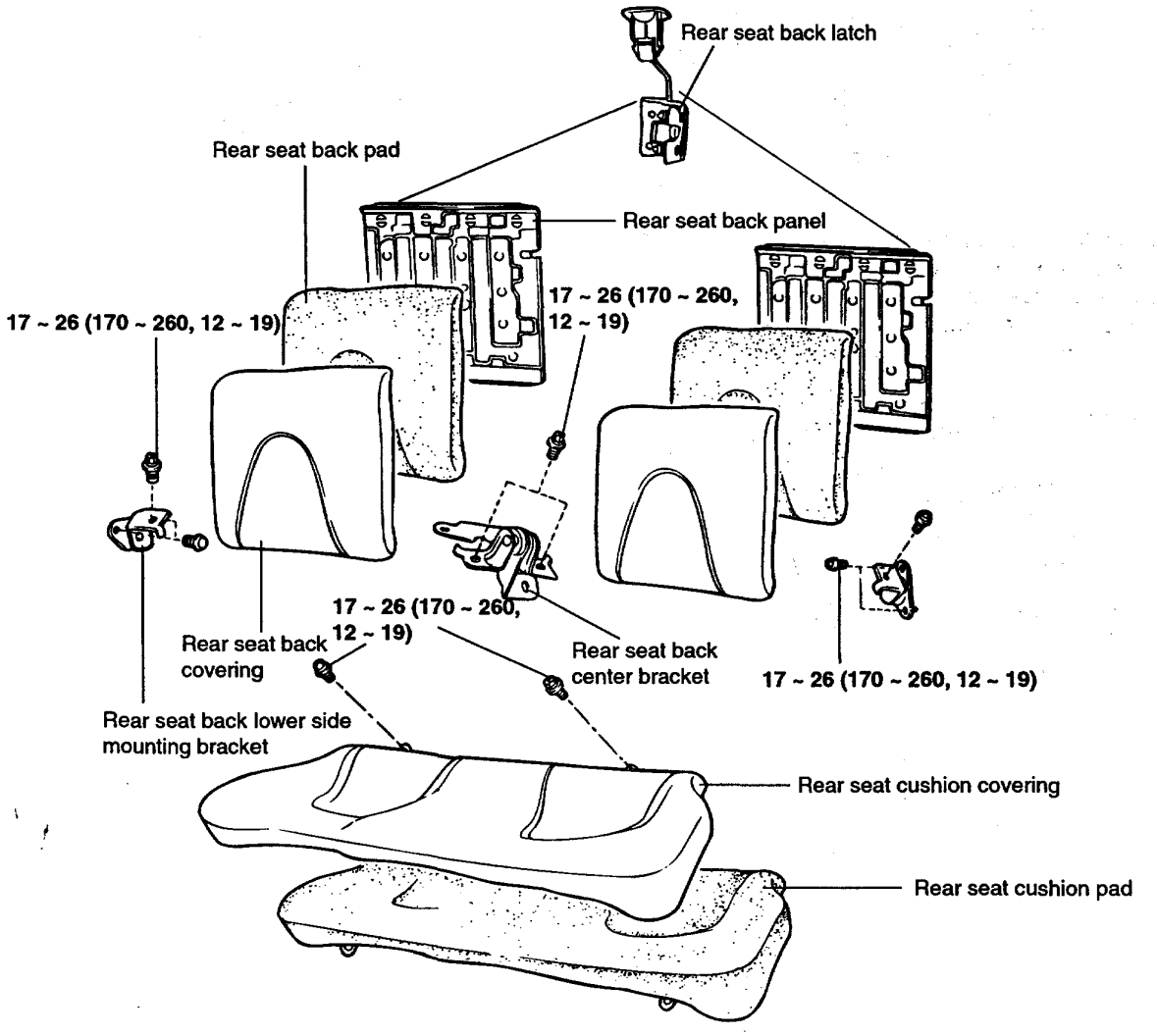


ESPD290C

3. Installation is the reverse of removal.

REAR SEAT

COMPONENTS E17A71DC

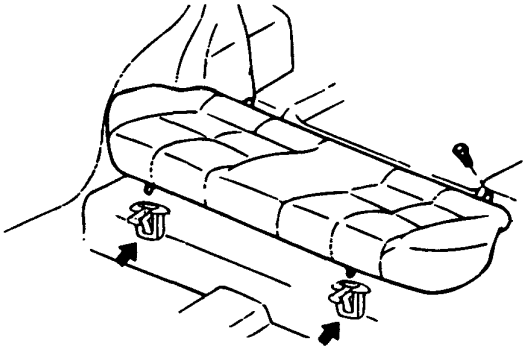


TORQUE : Nm (kg·cm, lb·ft)

ESDD113T

REMOVAL AND INSTALLATION E50E0D26

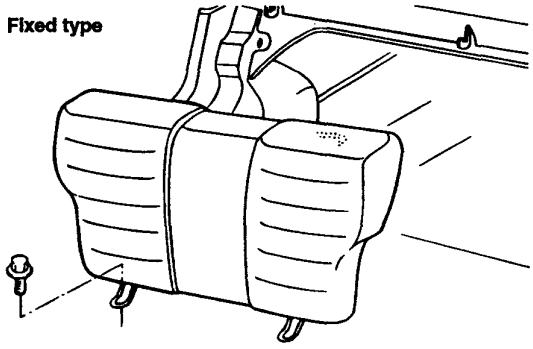
1. Loosen the rear seat cushion mounting bolts and remove the rear seat cushion.



ESDA320A

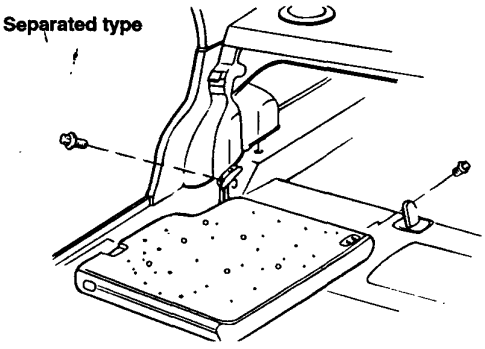
2. Loosen the rear seat mounting bolts and then remove the seat back (fixed type).
   Recline the rear split back forward and then loosen the mounting bracket.
   Remove the seat back (Separated type).

Fixed type



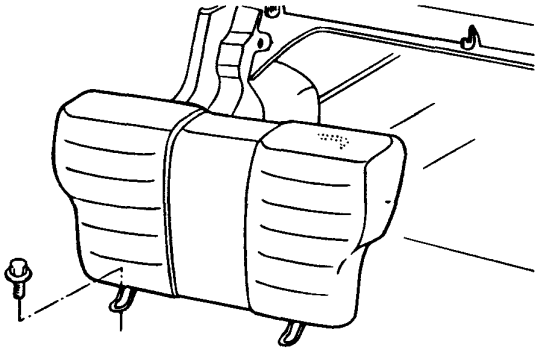
ESDA320B

Separated type



ESDA320C

3. Installation is the reverse of removal. When installing the rear seat back, tighten the mounting bracket after inserting the hook on the bracket.



ESDA320D

FRONT SEAT BELT

PECAUTIONS E633AEAF

PRECAUTIONS FOR MECHANICAL PRETENSIONER SEAT BELT HANDLING

1. Do not reuse the pretensioner seat belt. It is available just one time.
2. Do not grab the WEBB'G when carrying out the pretensioner seat belt. It can damage the parts as well as injury hands seriously by unexpected deployment.
3. Do not disassemble or repair the pretensioner seat belt.
4. After assembling the mounting bolt temporarily, insert the WEBB'G over 500mm to the retractor. (It can be deployed during installation).
5. After installation, when the WEBB'G is drawn out over 2000mm(from the low anchor plate center to the retractor center), a little impact can cause deployment.
6. Do not install the pretensioner at over 40cm higher.
7. When the number of pretensioner is more than one, do not carry them by hand.

PRECAUTIONS FOR ELECTRICAL PRETENSIONER SEAT BELT HANDLING

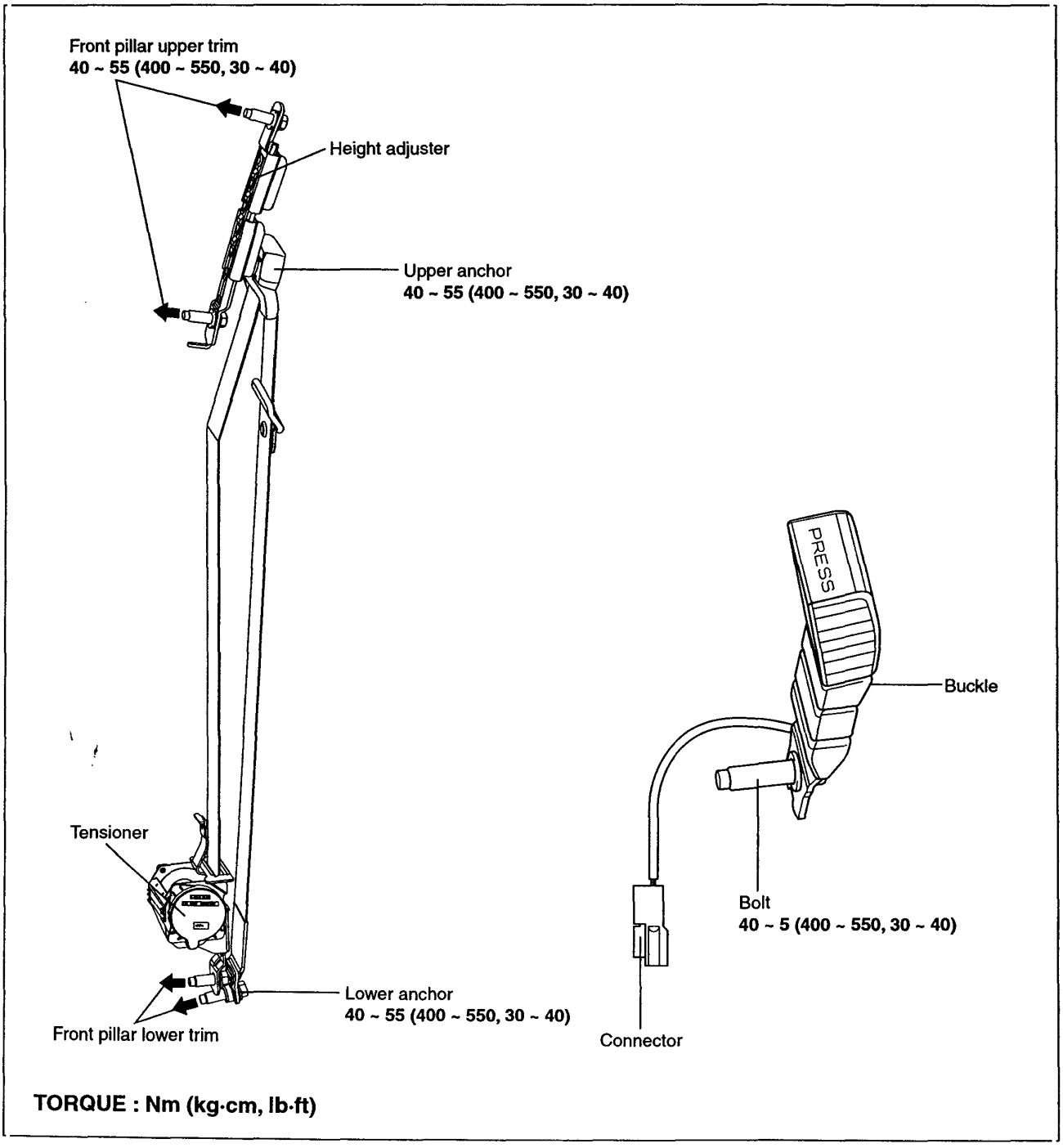
1. Do not reuse the pretensioner seat belt. It is available just one time.
2. Do not grab the WEBB'G when carrying out the pretensioner seat belt. It can damage the parts as well as injury hands seriously by unexpected deployment.
3. Do not disassemble or repair the pretensioner seat belt.
4. After securely installing the pretensioner, connect the battery.
5. Removal procedure for the prtensioner
   - Check that the power is turned off and the ignition key is at "STOP".
   - Disconnect the (-) negative battery terminal.
   - Wait about one minute.
   - After disconnecting the gas generator, loosen the mounting bolt and disconnect the pretensioner.
6. Installation is the reverse of removal.

REMOVAL AND INSTALLATION E4CD4AB9

NOTE

When using a screwdriver or a trim remover, wrap it with protective tape to prevent damage.

1. First, remove the following items.
   - Front door scuff trim
   - Rear door scuff trim
   - Center pillar lower trim
   - Center pillar upper trim
2. Remove the front seat belt.
3. Installation is the reverse of removal.



TORQUE : Nm (kg·cm, lb·ft)

ESPD310A

REAR SEAT BELT

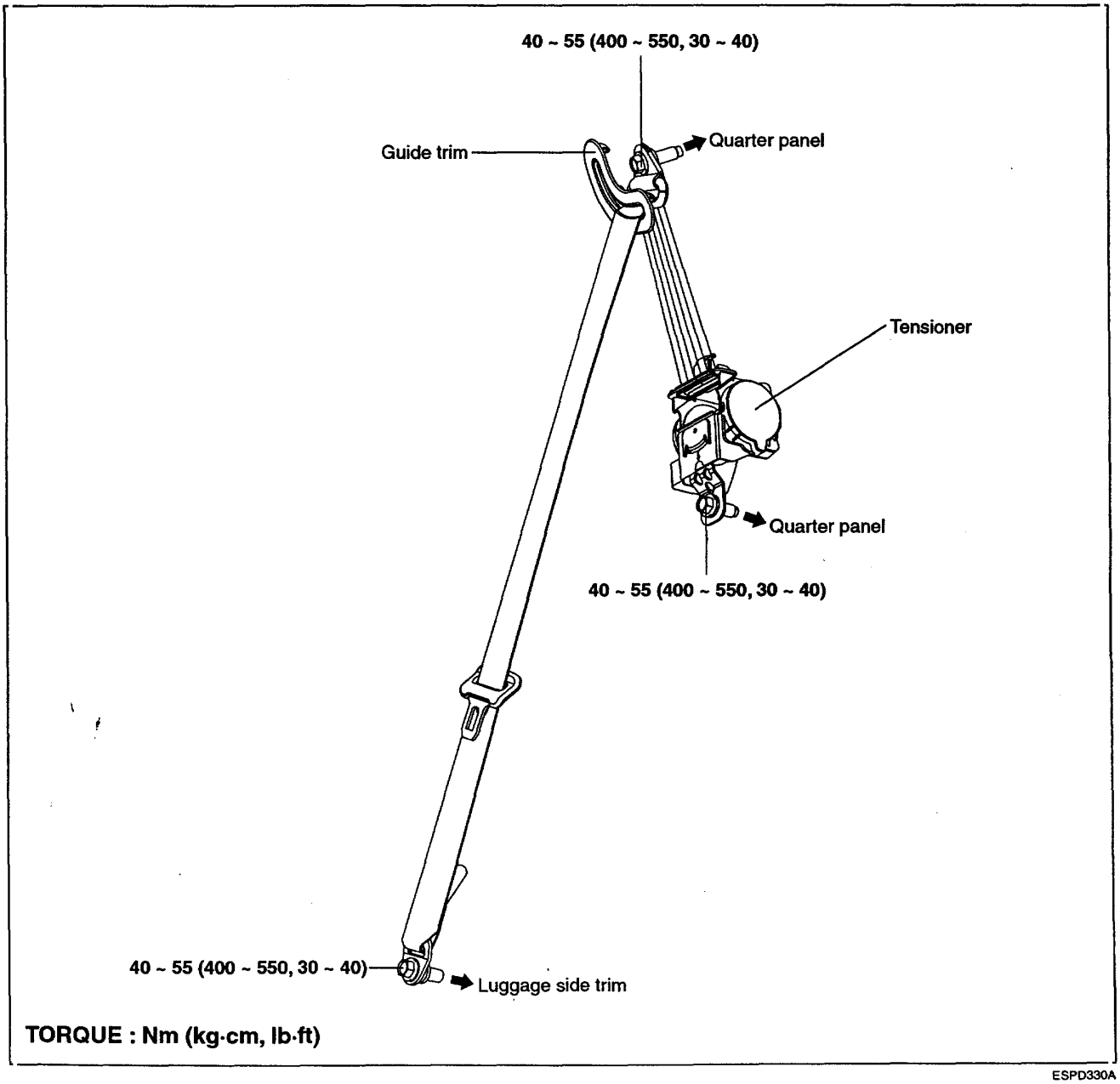
REMOVAL AND INSTALLATION E7A1E302

REAR SEAT BELT

NOTE

When using a screwdriver or a trim remover, wrap it with protective tape to prevent damage.

1. First, remove the following items.
   - Transverse trim
   - Luggage side trim
   - Rear pillar trim
2. Remove the rear seat belt.
3. Installation is the reverse of removal.



TORQUE : Nm (kg·cm, lb·ft)

ESPD330A

Restraints

GENERAL
- GENERAL ..... RT - 2
- SPECIAL TOOLS ..... RT - 7

SRSCM (SUPPLEMENTAL RESTRAINTS SYSTEM CONTROL MODULE)
- SRSCM ..... RT - 8
- SYSTEM COMPONENT AND LAYOUT ..... RT -10
- REMOVAL ..... RT -12
- SRSCM CONNECTOR ..... RT -13

AIR BAG MODULE (DRIVE SIDE) AND CLOCK SPRING
- COMPONENTS ..... RT -17
- REMOVAL ..... RT -18
- INSPECTION ..... RT -19

AIR BAG MODULE (PASSENGER SIDE)
- AIR BAG MODULE (PASSENGER)
  - REMOVAL ..... RT -21
- PRETENSIONER SEAT BELT
  - FUNCTION OF PRETENSIONER ..... RT -22
  - REMOVAL ..... RT -24

AIR BAG MODULE (SIDE AIR BAG)
- AIR BAG MODULE (SIDE AIR BAG)
  - REMOVAL ..... RT -26
- SATELLITE SENSOR
  - SATELLITE SENSOR ..... RT -27
  - REMOVAL ..... RT -27

TROUBLESHOOTING
- DIAGNOSIS WITH SCAN TOOL ..... RT -28
- DIAGNOSTIC TROUBLESHOOTING FLOW .. RT -29
- INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODE ..... RT -31
- CIRCUIT INSPECTION ..... RT -35

AIR BAG MODULE DISPOSAL
- FIELD DEPLOYMENT PROCEDURES ..... RT -92

GENERAL

GENERAL K30ECAA5

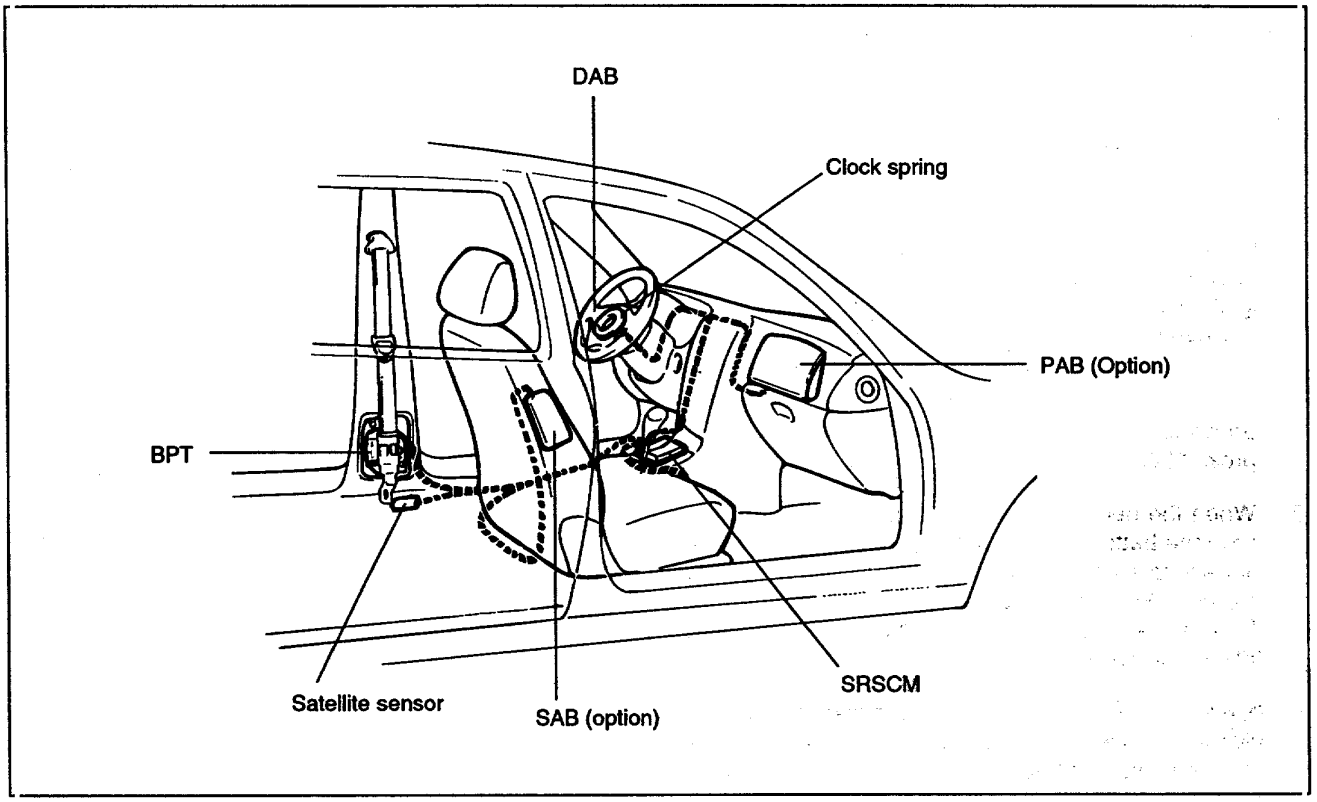
The Supplemental Restraint System (SRS AIRBAG) is designed to supplement the seat belts to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger and side airbag as well as the belt pretensioner in certain frontal or side collisions.

The SRS (Airbag) consists of : a driver airbag module located in the center of the steering wheel, which contains a folded cushion and an inflator unit ; a passenger airbag module located in the passenger side crash pad which contains a folded cushion together with an inflator unit ; side airbag modules located in the driver and passenger seat which contain folded cushions and inflator units; SRSCM located on the floor center console core which monitors the system,; an accelerometer which senses vehicle deceleration,; a spring interconnection (clock spring) located within the steering column; system wiring and wiring connectors; and a knee bolster located under the steering column. The impact sensing function of the SRSCM is carried out by the electronic accelerometer that continuously measures the vehicle's acceleration and delivers a corresponding signal through an amplifying and filtering circuit to the microprocessor. Deployment of the airbag is designed to occur in frontal or near-frontal side impacts of moderate to severe force.

Only authorized service personnel should work on or around SRS components. Those service personnel should read this manual carefully before doing any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the airbag) or the driver (by rendering the SRS inoperative).

INFLATOR MODULE (DAB, PAB, SAB)

DAB (Driver airbag), PAB (Passenger airbag) module, DSAB (Driver side airbag), PSAB (Passenger side airbag) all consist of an inflator and cushion. The initiator (a gas generator igniting device) is part the inflator. When the vehicle is in a frontal or side crash of sufficient force to close the sensor of the SRSCM, current flows through the deployment loop. This current ignites the material and inflates the airbag.



ERA9002A

1. When removing the airbag module or handling a new airbag module, it should be placed with the pad top surface facing up. In this case, the twin-lock type connector lock lever should be in the locked state and care should be taken to place it so the connecter will not be damaged. Do not store a steering wheel pad on top of another one. (Storing the pad with its metallic surface up may lead to a serious accident if the airbag should inflate accidentally.)
2. Never measure the resistance of the airbag squib. (This may cause the airbag to deploy, which is very dangerous.)
3. Store the airbag module where the ambient temperature remains below 93°C (200°F), without high humidity and away from electrical noise.
4. During electric welding, disconnect the airbag under the steering column near the MULTI-FUNCTION SWITCH connector before starting work.

CUSTOMER CAUTIONS

Failure to carry out service operations in the correct sequence could cause the airbag system to unexpectedly deploy during servicing, possibly leading to serious injury.

Further, if a mistake is made in servicing the airbag system, it is possible that the airbag may fail to operate when required.

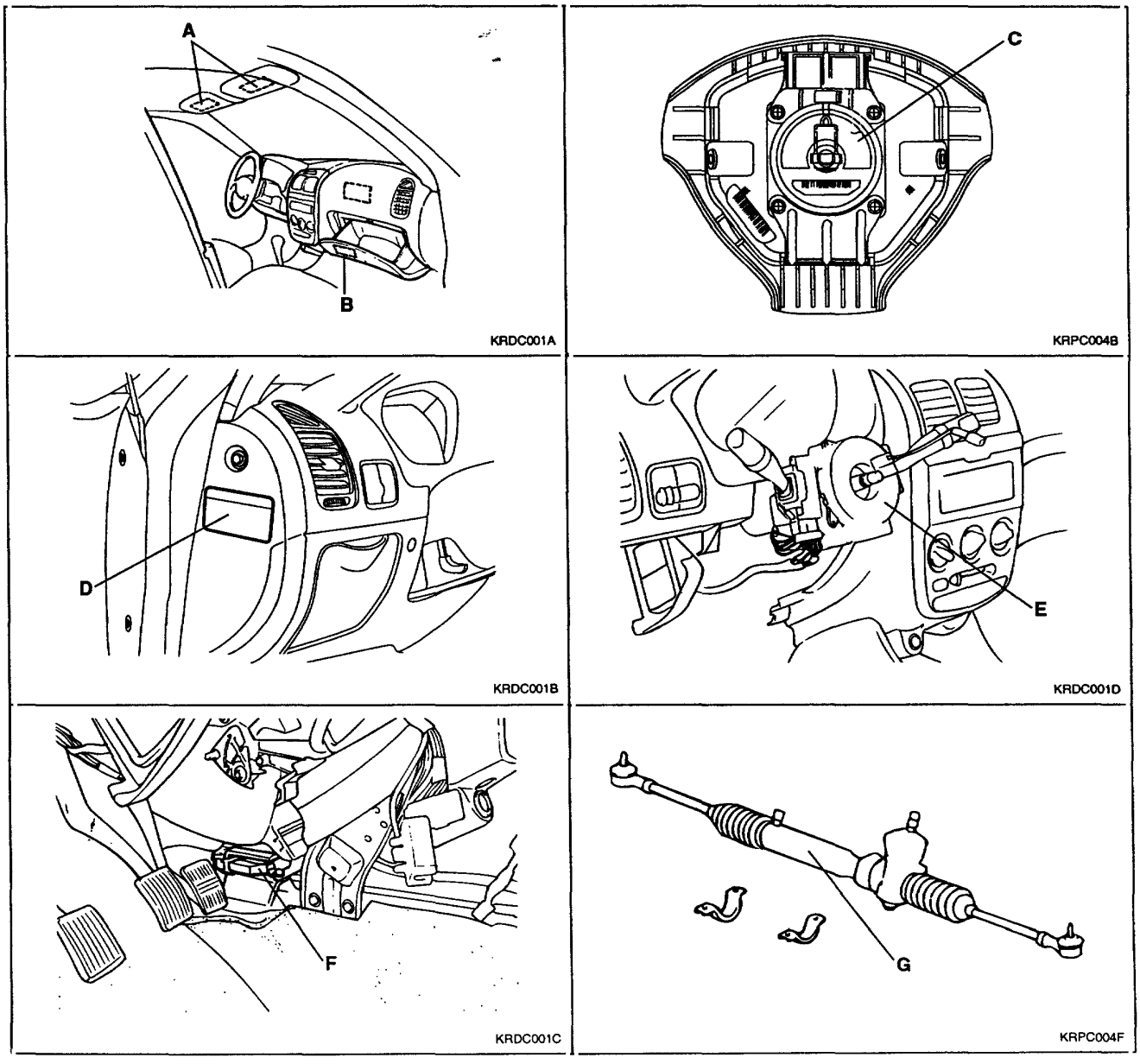
Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following items carefully.

1. Be sure to proceed with airbag related service only after approx. 30 seconds or longer from the time the ignition switch is turned to the LOCK position and the negative (-) battery cable is disconnected from the battery. The airbag system is equipped with a back-up power source to assure the deployment of airbags when the battery cable is disconneted during an accident. The back-up power is available for approx. 150ms.
2. When the negative (-) battery cable is disconnected from the battery, the clock and audio system's memory will be wiped out. So before starting work, make a record of the contents of the audio system's memory. When the work is finished, reset the audio system and adjust the clock.
3. Symptoms of malfunction of the airbag system are difficult to detect, so the diagnostic codes become the most important source of information when troubleshooting.
4. When troubleshooting the airbag system, always inspect the diagnostic codes before disconnecting the battery.
5. Never use airbag parts from another vehicle. When replacing parts, replace them with new parts.
6. Never attempt to disassemble and repair the airbag modules (DAB, PAB, SAB, BPT), clock spring and wiring in order to reuse them.
7. If any component of the SRS has been dropped, or if there are cracks, dents or other defects in the case, bracket or connector, replace them with new ones.
8. After work on the airbag system is completed, perform an SRS SRI check. The airbag indicator lamp can be triggered by faults in other circuit in some cases. Therefore if the airbag indicator lamp goes on, be sure to erase the DTC codes using the Hi-Scan Pro just after repairing or replacing the troubled parts, including the fuse.
9. Especially when carring out body welding, never fail to disconnect the battery's negative (-) terminal.

WARNING/CAUTION LABELS

A number of caution labels relating to the SRS are found in the vehicle, as shown in the following illustration. Follow label instructions when servicing the SRS.

If labels are dirty or damaged, replace them with new ones.



A. DAB + PAB
CAUTION
TO AVOID SERIOUS INJURY :

- For maximum safety protection in all types of crashes, you must always wear your safety belt.
- Do not install rearward-facing child seats in any front passenger seat position.
- Do not sit or lean unnecessarily close to the airbag.
- Do not place any objects over the airbag or between the airbag and yourself.
- See the owner's manual for further information and explanation.

B. SUPPLEMENTAL RESTRAINT SYSTEM (AIRBAG) INFORMATION

The airbag is a supplemental restraint system (SRS). You must always wear the seat belts. The airbag system condition is normal if the "SRS" lamp in the cluster flashes approximately 6 times after the ignition key is turned on and then goes out.
If any of the following conditions occur, the system must be serviced :

1. "SRS" lamp does not light when key is turned on.
2. "SRS" lamp stays lit or flashes continuously.
3. The airbag has inflated.

The airbag system must be inspected by an authorized dealer ten years after the vehicle manufacture date shown on the certification label located at the left front door opening area.

C. WARNING :

Contents are poisonous and extremely flammable. Do not probe with electrical devices or otherwise tamper with item in any way. Servicing of this unit to be performed only by authorized personnel.

D. WARNING

This car is equipped with a side airbag for each front seat.

- Do not use any accessory seat covers.
- Use of other seat covers could reduce the effect of the system.
- Do not install any accessories on the side or near the side airbag.
- Do not use excessive force on the side of the seat.
- For further information, see owner's manual.

E. CAUTION : SRS clock spring

This is not a repairable part. Do not disassemble or tamper with. If defective, replace entire unit as per service manual instructions.
To re-center, rotate clockwise until tight. Then rotate in opposite direction approximately 3 turns and align →←.
Failure to follow instructions may render SRS system inoperative possibly resulting in serious driver injury.

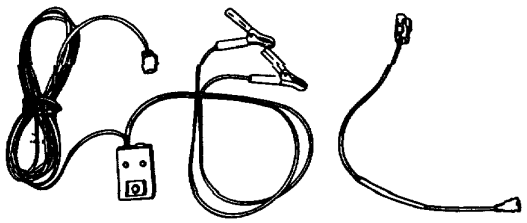
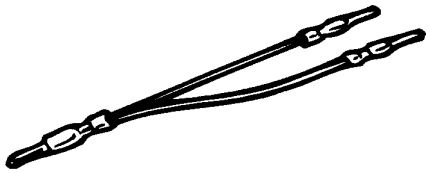
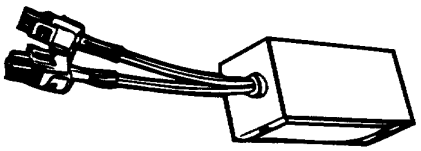
F. CAUTION : AIRBAG ESPS UNIT

Detach connector before unmounting. Assemble strictly according to manual instructions.

G. CAUTION : SRS

Before removal of steering gearbox, read service manual, center the front wheels and remove the ignition key. Failure to do so may damage SRS clock spring and render SRS system inoperative,possibly resulting in serious driver injury.

SPECIAL TOOLS K14B5C7D

Tool (Number and name)	Illustration	Use
0957A-34100A Deployment tool	 ERHA010A	Airbag deployment adapter PAB, SAB : 0957A-38100 DAB, BPT : 0957A-38500 PAB (DUAL STAGE) : 0957A-25000
0957A-38000 Diagnosis checker	 ERHA010B	Wring harness checker for each module
0957A-38200 Dummy	 ERHA010C	Simulator to check the resistance of each wiring harnes Dummy adapter PAB, SAB : 0957A-38300 DAB, BPT : 0957A-38400 PAB (DUAL STAGE) : 0957A-25100

* DAB : Driver Airbag

* PAB : Passenger Airbag

* SAB : Side Airbag

* BPT : Belt Pretensioner

SRSCM (SUPPLEMENTAL RESTRAINTS SYSTEM CONTROL MODULE)

SRSCM K94ACD8D

The SRS airbag system has sophisticated electrical and electronic components. Therefore the airbag operating components should be handled very carefully.

SRSCM (Supplement Restraint System Control Module)

The SRSCM will deploy the airbag modules by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC converter in the power supply includes a step-up and a step-down converter, which provides the firing voltage for four firing circuits and the internal operating voltage. If the internal operating voltage falls below a defined threshold, a reset is executed.

2. Arming sensor/safing sensor : The arming/safing sensor built in to the airbag firing circuit has the function of arming the airbag circuit under all required deployment conditions and maintaining the airbag firing circuits unarmed under normal driving conditions. The safing sensor is a dual-contact electromechanical switch that closes if it experiences a deceleration exceeding a specified threshold.

3. Back-up power : The SRSCM reserves an energy reserve to provide deployment energy for a short period when the vehicle voltage is low or if lost in a vehicle frontal crash.

4. Malfunction detection : The SRSCM continuously mohitors SRS operating status while the ignition key is turned on and detects possible malfunctions in the system. The malfunction can be displayed in the form of a diagnostic trouble codes using the Hi-Scan Pro.

5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the instrument cluster to warn the vehicle driver.
   The MIL indicator is the key item in notifying the driver of SRS faults. It verifies lamp and SRSCM operation by flashing 6 times when the ignition switch is first turned on.

6. Malfunction recording : Once a fault occurs in the system, the SRSCM records the fault in memory in the form of a DTC, which can only be erased by the Hi-Scan Pro.

7. Data link connector : SRSCM memory stored is linked through this connector located underneath the driver side crash pad to an external output device such as the Hi-Scan Pro.

8. What if only BPT's deploy.

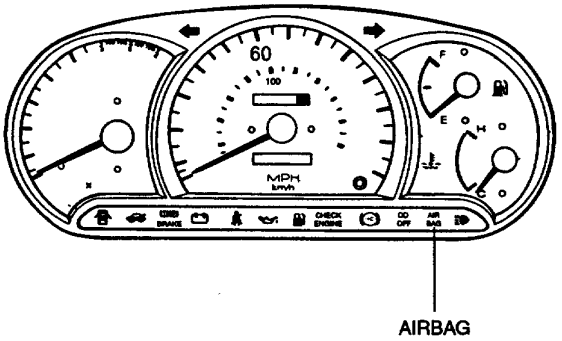
9. Crash output
   The crash output is used to unlock the doors in case of a crash. The crash output is : 0-200 μA in OFF mode and 200mA in ON mode. During the unlock command, the switch is closed for 200 mS.

SRS HARNESS

The SRS harness is wrapped in a yellow tube to be discriminated from other system harnesses. A shorting bar is included inside the wiring connectors of DAB, PAB, SAB and BPT inflator side. The shorting bar shorts the current flow the DAB, PAB, SAB and BPT module circuits when the connectors are disconnected. The circuits to the inflator module are shorted in this way to help prevent unwanted deployment of the airbag when servicing the airbag module.

SRSCM INDEPENDENT LAMP ACTIVATION

The SRS malfunction indicator lamp (MIL) is located in the cluster givinginformation of SRS operating conditions by control signals from the SRSCM.



ERDA009D

There are certain fault conditions in which the SRSCM (SRS Control Module) cannot function and thus cannot control the operation of the lamp. In these cases, the lamp is directly activated by appropriate circuitry that operates independently of the SRSCM, as follow :

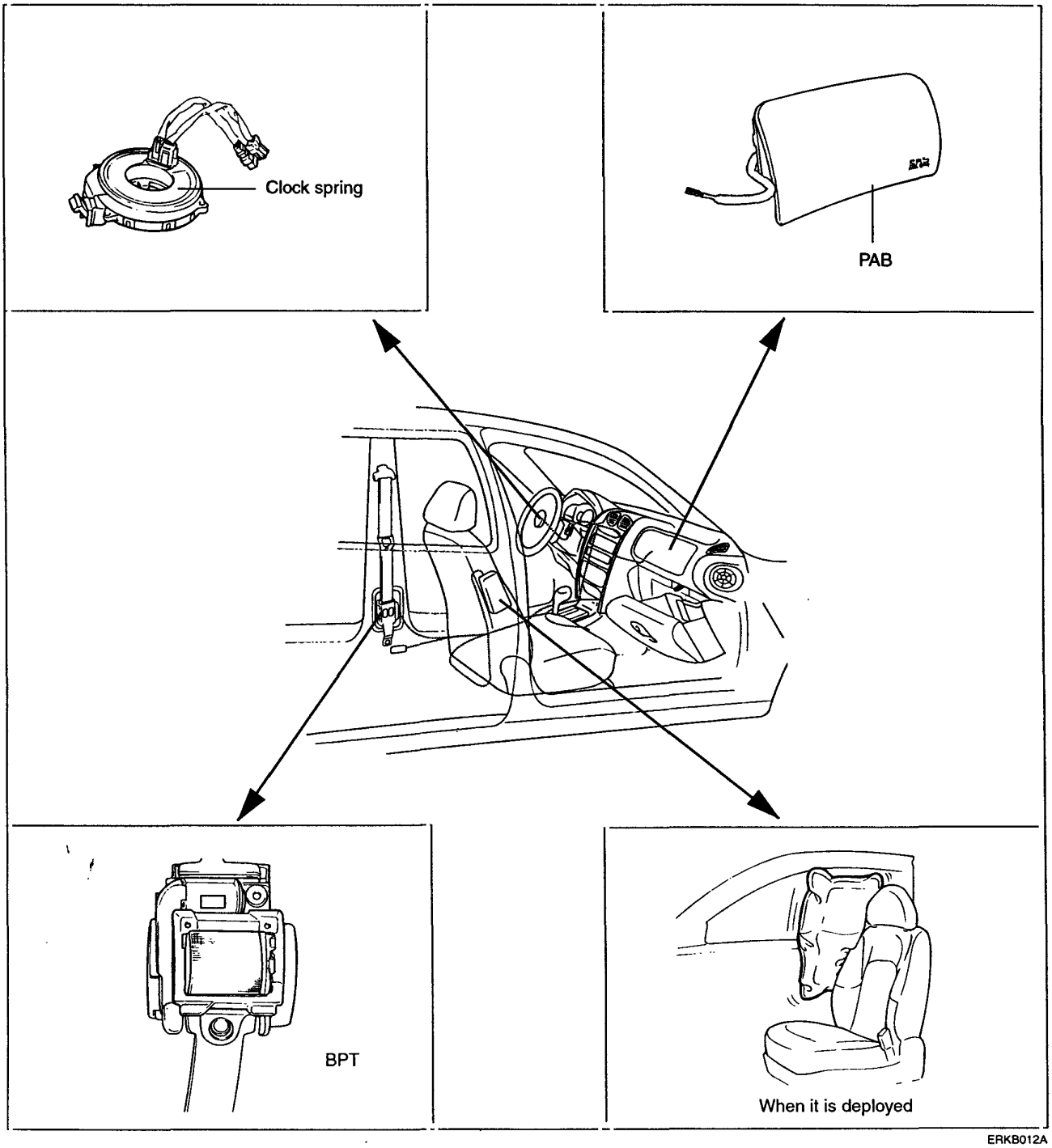
1. Loss of ignition voltage supply to the SRSCM : lamp turned on continuously.
2. Loss of internal operating voltage : lamp turned on continuously.
3. SRSCM not connected : lamp turned on through shorting bar in wiring harness connector.

MIL OPERATING METHOD

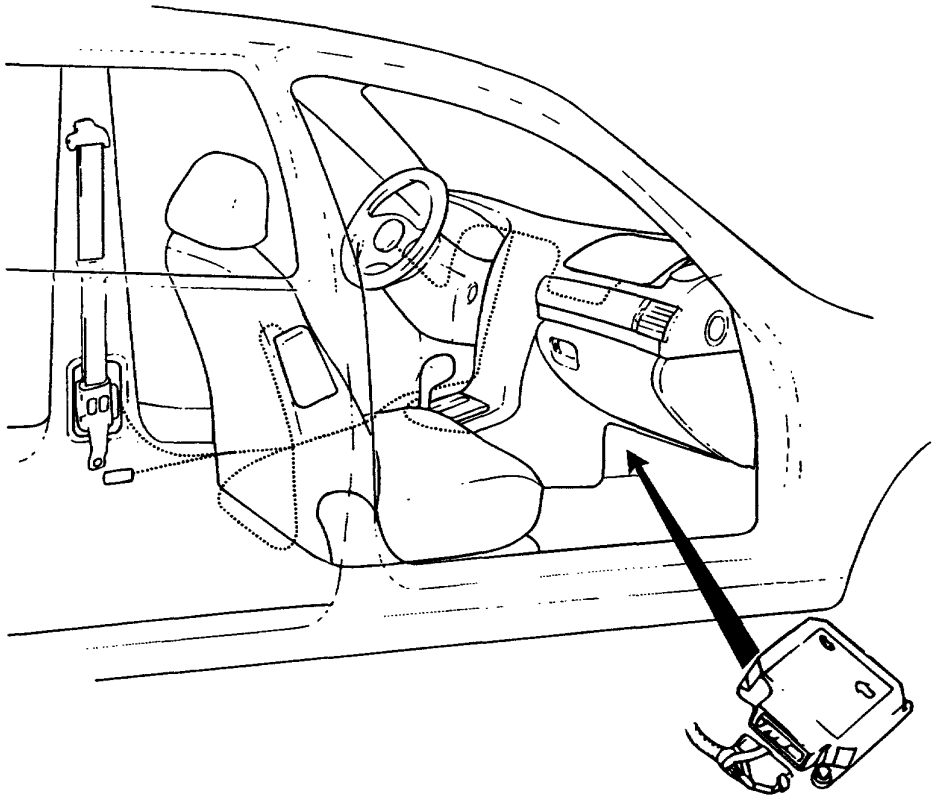
	Operating situation	Operating method
RUNNING	o Return to normal from temporary fault	ON → OFF
	o Total faults frequency ≥ 5 o Active fault	Turn it on continuously
STARTING	o Normal	Blink 6 times
	o Total faults frequency ≤ 4	On to off after 6 seconds
	o Total faults frequency ≥ 5 o Active fault	1second 6seconds

ERPD008A

SYSTEM COMPONENT AND LAYOUT KC77F8E3



SRSCM (SRS CONTROL MODULE)



SRSCM

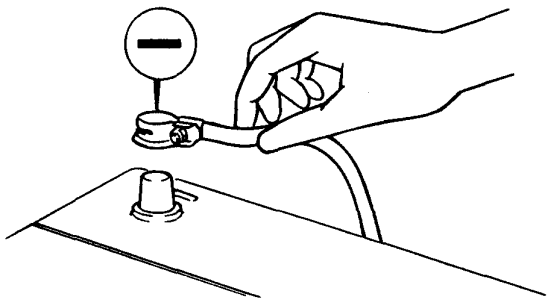
KRDC030A

REMOVAL KF3EF45E

1. Disconnect the negative battery cable and keep secure from battery.

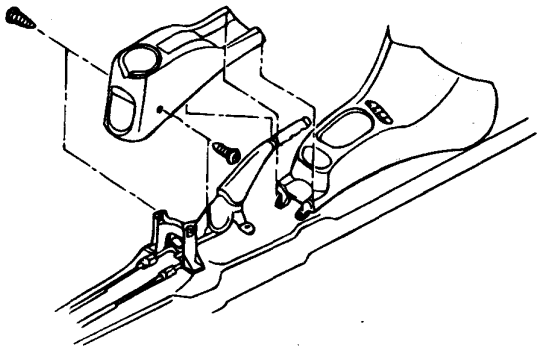
   ⚠ ***CAUTION***

   Wait at least 30 seconds after disconnecting the battery cable before doing any further work.

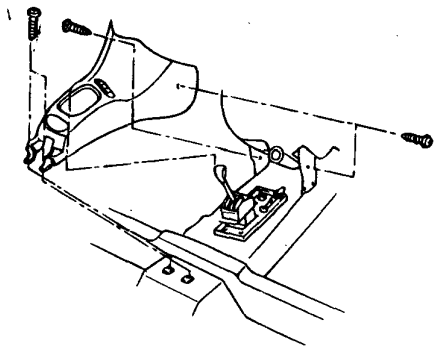


EADA011A

2. Remove the center console mounting bolts (10mm).

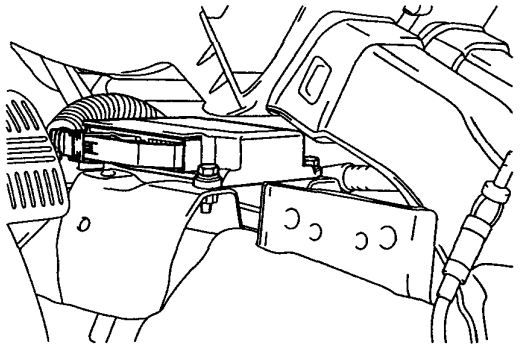


ESDA150A



ESDA150B

3. Remove the center console.
4. Disconnect the SRSCM connector.
5. Remove the SRSCM (10mm).



KRDC003B

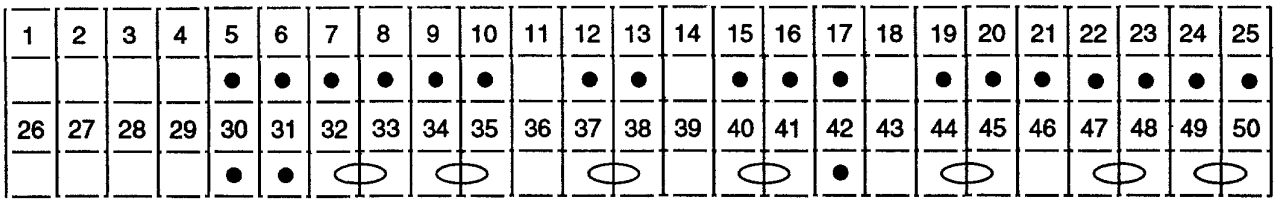
📖 ***NOTE***

- *Do not damage the SRSCM terminals or connectors.*
- *Do not disassemble the SRSCM ; It has no serviceable parts.*
- *Store the SRSCM in a clean, dry area.*
- *Do not use any SRSCM which has been subjected to water or shows sign of being dropped or impro perly handled, such as dents, cracks or deformation.*

6. After installing the SRSCM, confirm proper system operation : Turn the ignition switch ON ; the SRS indicatior light should come on for about six seconds and then go off.

SRSCM CONNECTOR K93AAF4F

DAB+PAB+SAB+BPT (SRE-LC)



⬭ : Shorting bar

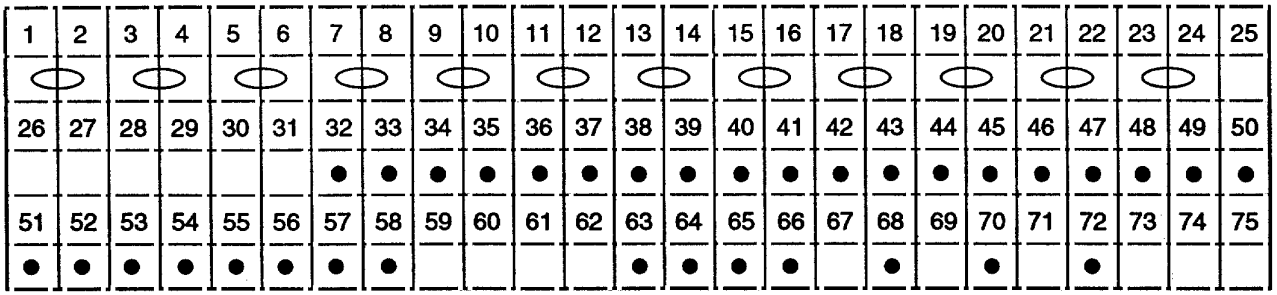
ERDC010A

CONNECTOR

PIN NO.	FUNCTION	INPUT/OUTPUT
1	-	-
2	-	-
3	-	-
4	-	Output
5	Passenger satellite sensor, High	Output
6	Driver satellite sensor, High	Output
7	Driver belt pretensioner, Low	Output
8	Driver belt pretensioner, High	Output
9	Passenger belt pretensioner, High	Output
10	Passenger belt pretensioner, Low	Output
11	-	-
12	Passenger airbag, Low	Output
13	Passenger airbag, High	Output
14	-	-
15	Driver airbag, Low	Output
16	Driver airbag, High	Output
17	K-diagnostic line	Input/output
18	-	-
19	Warning lamp	Output
20	GND	Input
21	Battery supply	Input
22	Driver side airbag, High	Output
23	Driver side airbag, Low	Output
24	Passenger side airbag, LOW	Output
25	Passenger side airbag, High	Output
26	-	-
27	-	-
28	-	-

PIN NO.	FUNCTION	INPUT/OUTPUT
29	-	-
30	Passenger satellite sensor, Low	Output
31	Driver satellite sensor, Low	Output
32-33	Shorting bar	-
34-35	Shorting bar	-
36	-	-
37-38	Shorting bar	-
39	-	-
40-41	Shorting bar	-
42	Crash output	Output
43	-	-
44-45	Shorting bar	-
46	-	-
47-48	Shorting bar	-
49-50	Shorting bar	-

DAB+PAB+SAB+BPT (DUAL-STAGE AIRBAG)



⬭ : Shorting bar

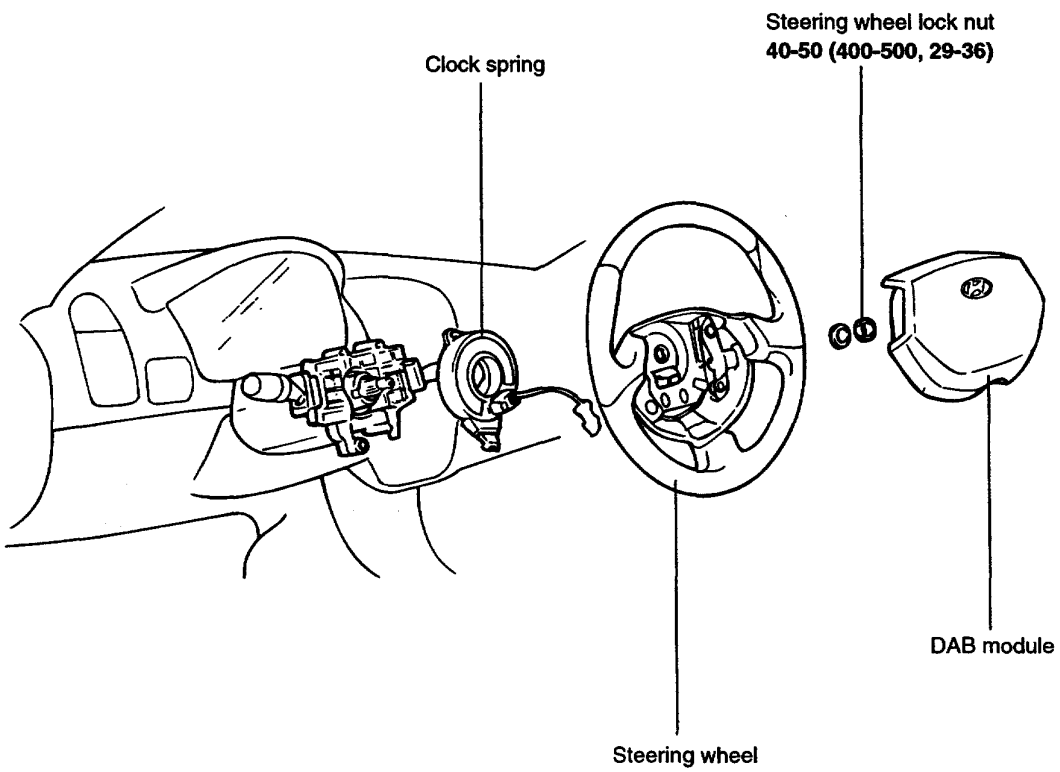
ERDC010B

PIN NO.	FUNCTION	INPUT/OUTPUT
1-24	Shorting bar	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	Passenger airbag stage 2, Low	Output
33	Passenger airbag stage 2, High	Output
34	Driver airbag stage 2, High	Output
35	Driver airbag stage 2, Low	Output
36	Passenger side airbag, Low	Output
37	Passenger side airbag, High	Output
38	Driver side airbag, High	Output
39	Driver side airbag, Low	Output
40	Passenger belt pretensioner, Low	Output
41	Passenger belt pretensioner, High	Output
42	Driver belt pretensioner, High	Output
43	Driver belt pretensioner, Low	Output
44	Passenger airbag, Low	Output
45	Passenger airbag, High	Output
46	Driver airbag, High	Output
47	Driver airbag, LOW	Output
48	Ground	Input
49	Warning lamp	Output
50	Battery supply	Input
51	Driver electronic frontal sensor, Low	Input/output

PIN NO.	FUNCTION	INPUT/OUTPUT
52	Driver electronic frontal sensor, High	Input/output
53	Passenger electronic frontal sensor, High	Input/output
54	Passenger electronic frontal sensor, Low	Input/output
55	Driver satellite sensor, Low	Input/output
56	Driver satellite sensor, High	Input/output
57	Passenger satellite sensor, High	Input/output
58	Passenger satellite sensor, Low	Input/output
59-62	-	-
63	Passenger seat track sensor	Intput
64	Passenger seat buckle switch	Intput
65	Driver seat buckle switch	Intput
66	Driver seat track sensor	Intput
67	-	-
68	Enhanced crash output	Output
69	-	-
70	Crash output	Output
71	-	-
72	K-diagnostic line	Input/output
73-75	-	-

AIR BAG MODULE (DRIVE SIDE) AND CLOCK SPRING

COMPONENTS K1FBD4D6



TORQUE : Nm (kg·m, lb·t)

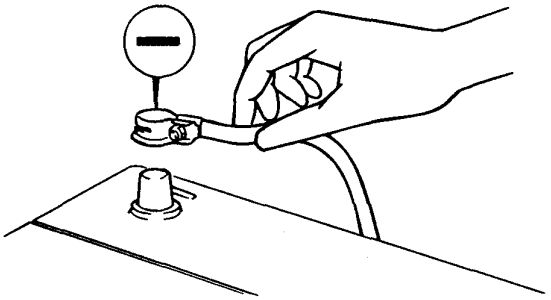
ERDA005A

REMOVAL KBE99BBA

1. Disconnect the negative battery cable and keep secure from battery.

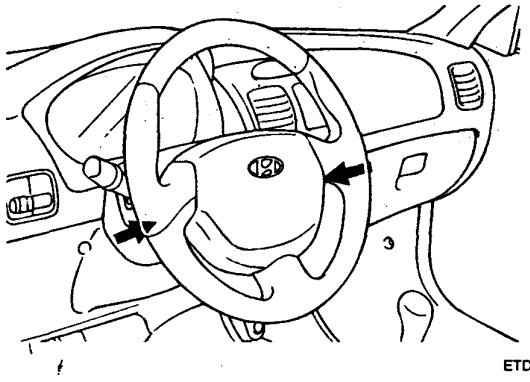
⊗ WARNING

Wait at least 30 seconds after disconnecting the battery cable before doing any further work.



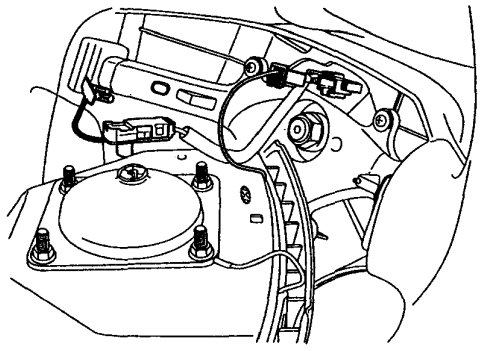
EADA011A

2. Remove the side protect cover of steering wheel and airbag module mounting bolts using a hexagonal wrench.



ETDA035D

3. Disconnect the drive airbag module connector.



KRPC017B

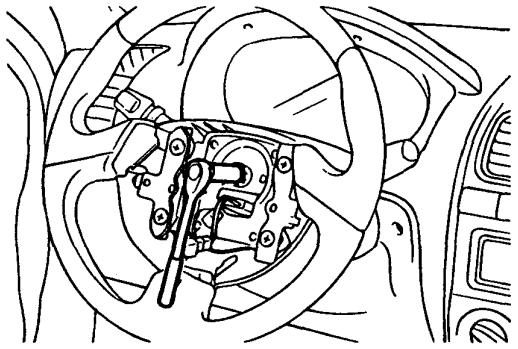
⊗ WARNING

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

4. Remove the steering wheel using SST (09561-11002).

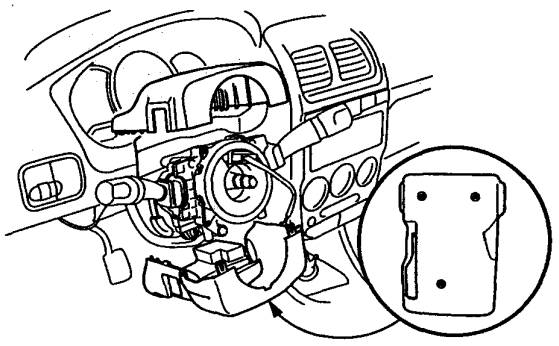
⚠ CAUTION

Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.



ERDA006D

5. Remove the steering column upper shroud and lower shroud.

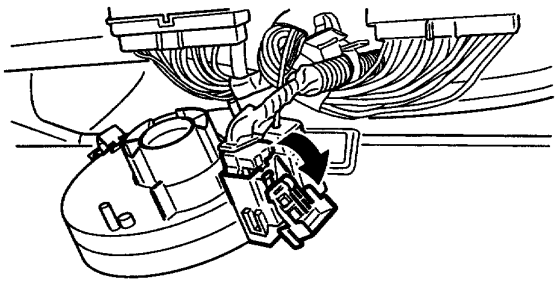


KRDC004B

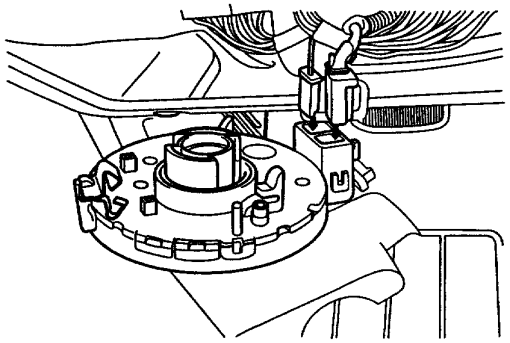
6. When disconnecting the connector of the clock spring from the airbag module, pull the airbag's lock toward the outer side to spread it open.

⚠ ***CAUTION***

When disconnecting the airbag module-clock spring connector, take care not to apply excessive force to it.



KRPC020E



KRPC020G

INSPECTION KF7D13F7

AIRBAG MODULE

If any improper parts are found during the following inspection, replace the airbag module with a new one.

Dispose the old one according to the specified procedure.

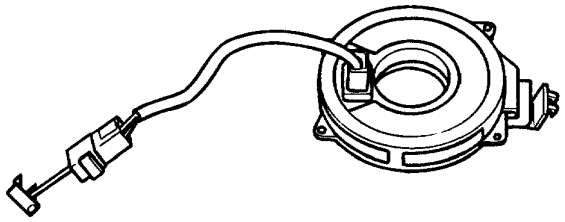
⊗ **WARNING**

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.
5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

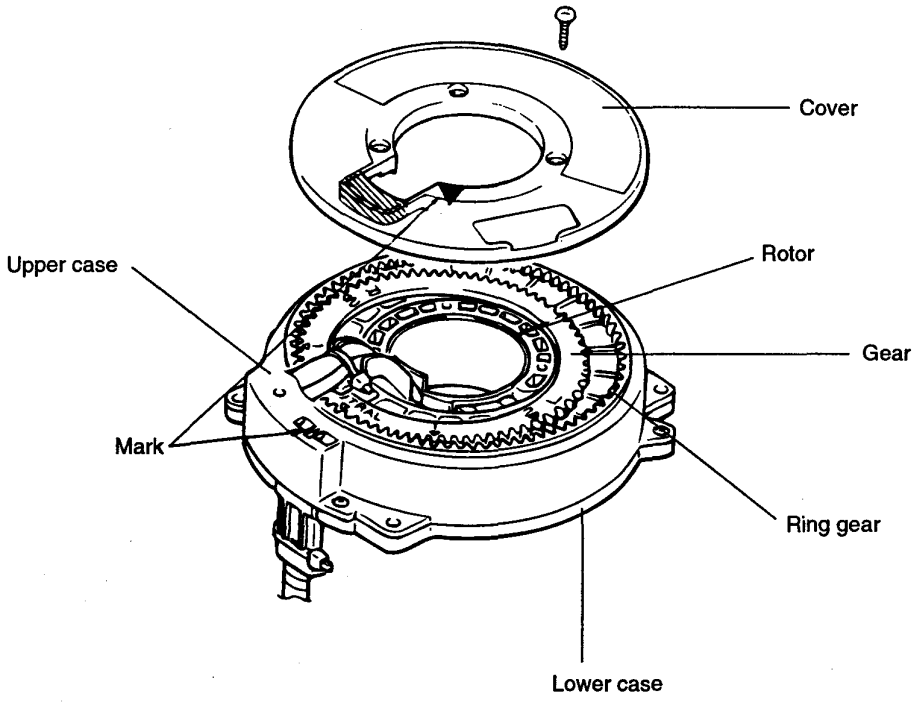
CLOCK SPRING

The clock spring (coil spring) consists of two current carrying coils. It is attached between the steering column and the steering wheel. It allows rotation of the steering wheel while maintaining continuous contact of the deployment loop through the inflator module.



ERJA010E

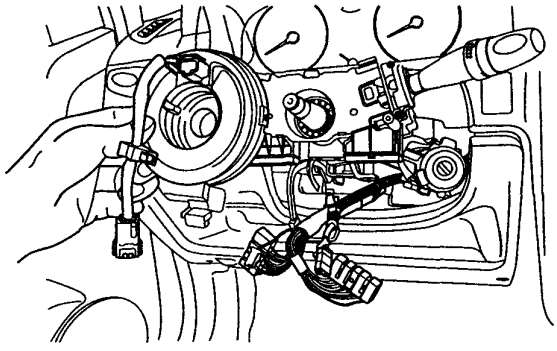
The steering wheel must be fitted correctly to the steering column with the clock spring at the neutral position, otherwise cable disconnection and other troubles may result.



When the rotor is rotated clockwise

ERLB002C

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.



KPPD009A

AIR BAG MODULE (PASSENGER SIDE)

AIR BAG MODULE (PASSENGER)

REMOVAL KEDF0D8E

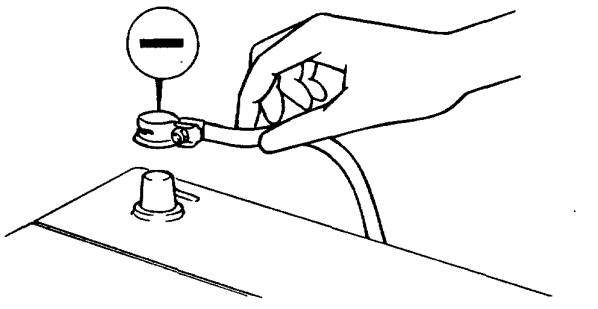
⊗ WARNING

1. **Never attempt to disassemble or repair the airbag module.**
2. **Do not drop the airbag module or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust are detected.**
3. **The airbag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.**
4. **Do not expose the airbag module to temperature over 93°C (200°F)**
5. **An undeployed airbag module should only be disposed in accordance with the procedures.**
6. **Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.**
7. **Whenever the PAB is deployed it should be replaced with a new one assembled with an extension wire. The squib is melt down if the PAB is deployed making the extension wire useless.**

1. Disconnect the battery negative (-) terminal cable.

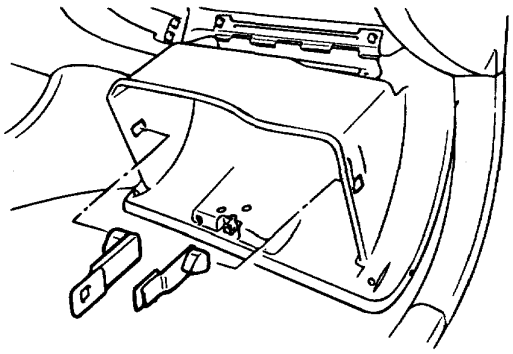
⚠ ***CAUTION***

Wait at least 30 seconds.



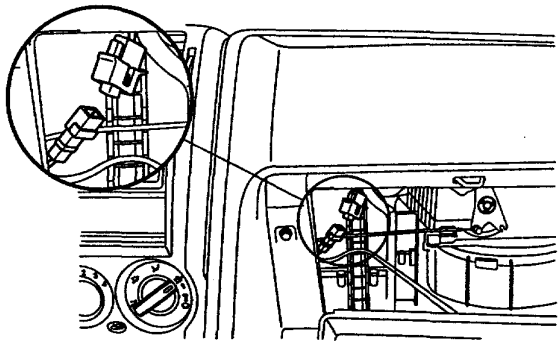
EADA011A

2. Remove the glove box.



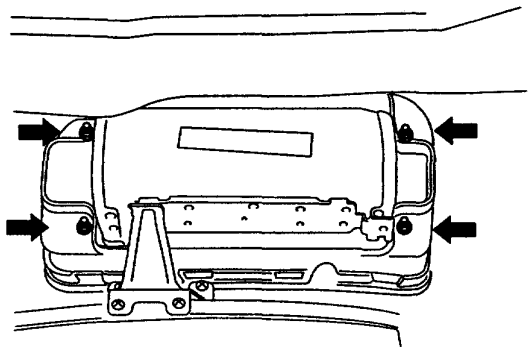
ETDA015B

3. Disconnect the PAB module connector.

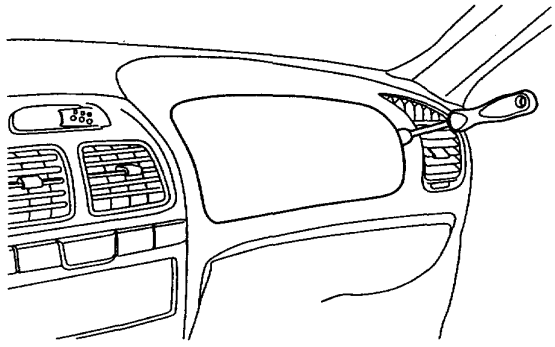


ERPD010C

4. Remove the crash pad assembly and then undo the PAB module. (Refer to the BD section)



KRDC005C



KRDC005D

PRETENSIONER SEAT BELT

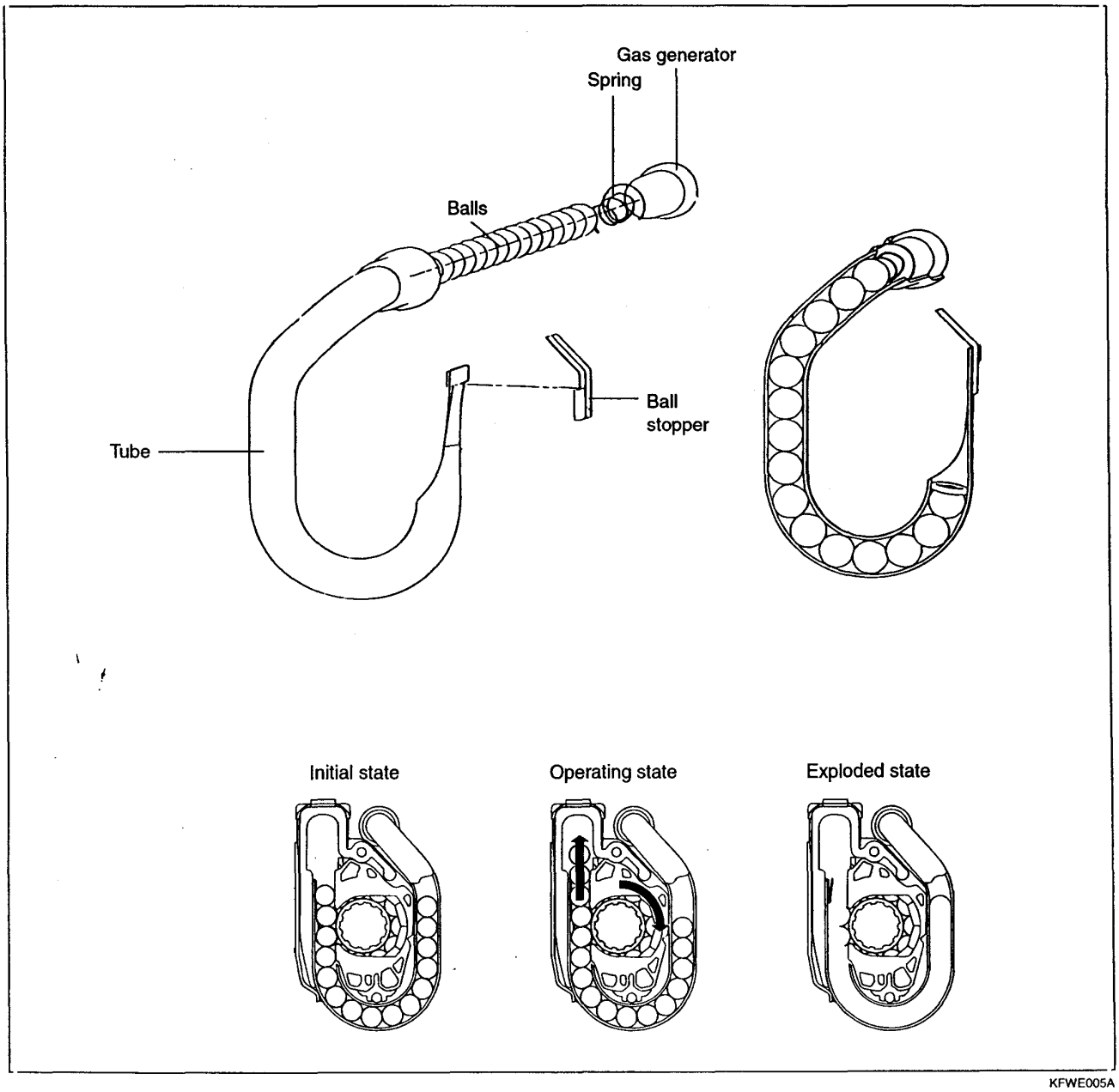
FUNCTION OF PRETENSIONER KF7F2AAD

When a vehicle crashes with a certain degree of frontal impact, the gas generator will ignited an electrical firing signal from the SRSCM (Supplemental Restraint System Control Module).

Gas from the gas generator causes movement of the piston in the manifold case (cylinder), which operates the rack gear.

The rack gear, rotates a piston gear and a pinion rotates the planet gears.

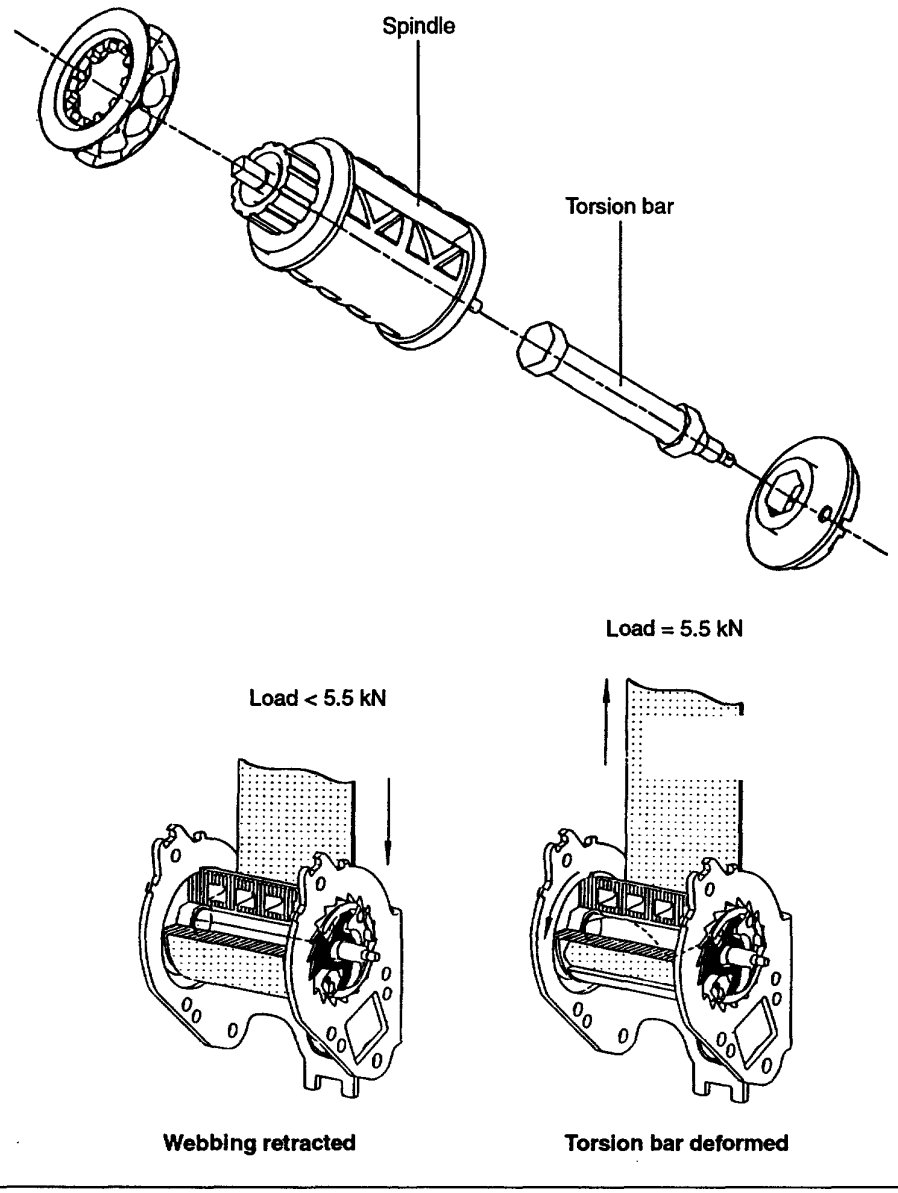
Finally, the webbing is retracted by the rotation of the spool. Therefore, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupant by retracting the seat belt webbing. This prevents the occupant from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.



KFWE005A

LOAD LIMITER

The load limiter is designed to relieve the impact force to an occupant chest's of the seat belt webbing when the occupant is restrained by the seat belt during a crash. If the crash force reaches a certain value, the torsion bar in the pretensioned seat belt will deform and cause the webbing to extracted from the seat belt, thus, relieving the impact force.



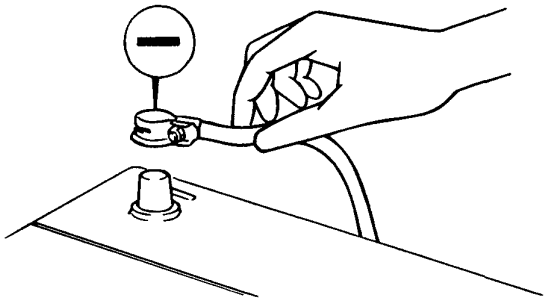
KFWE006A

REMOVAL K7F4BDA2

1. Disconnect the battery negative (-) terminal.

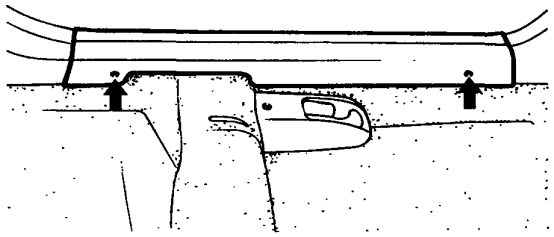
⊗ WARNING

Wait at least 30 seconds.



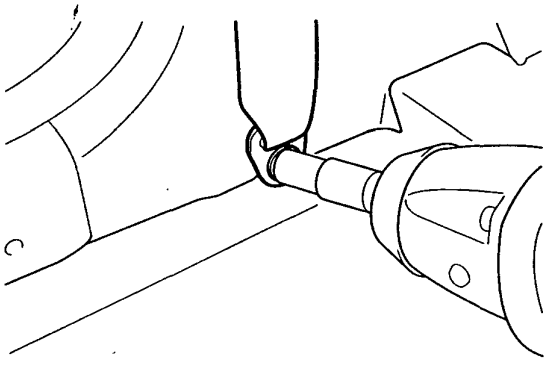
EADA011A

2. Remove the door scuff trim.



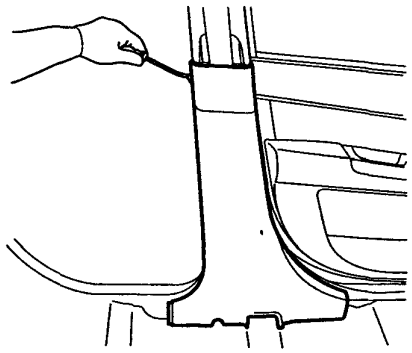
ESKA045B

3. Remove the lower anchor plate cover and lower anchor plate.



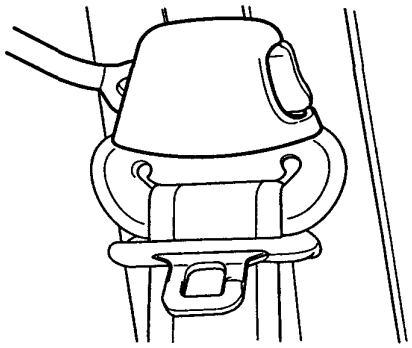
KRPC025G

4. Remove the center pillar lower trim.

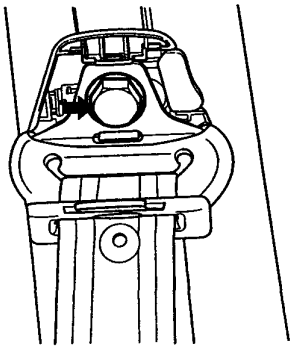


KRPC025D

5. Remove the upper anchor plate cover and upper anchor plate.

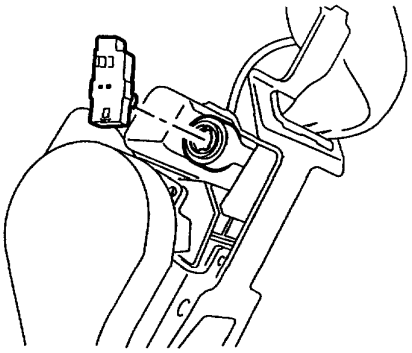


KRPC025E



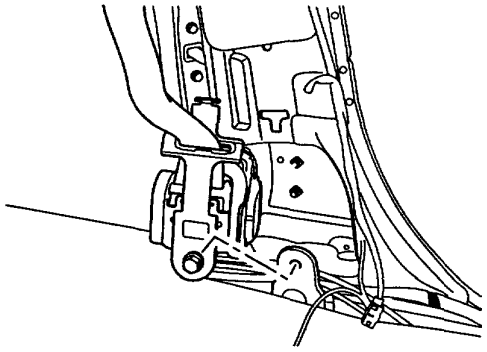
KRPC025F

6. Disconnect the belt pretensioner connector.



KRDC006C

7. Remove the front seat belt.



KRDC006B

WARNING

1. **Never attempt to disassemble or repair the BPT.**
2. **Do not drop the BPT or allow contact with water, grease, oil.**
   Replace it if a dent, crack, deformation or rust are detected.
3. **Do not place anything on the BPT.**
4. **Do not expose the BPT to temperature over 93°C(200°F).**
5. **BPT functions one time only. Be sure to replace the BPT after it is deployed.**
6. **Be sure to wear gloves and safety goggles when handling the deployed BPT.**

AIR BAG MODULE (SIDE AIR BAG)

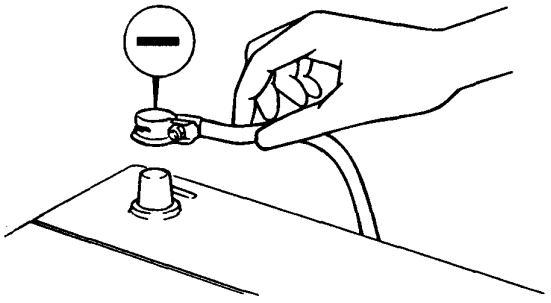
AIR BAG MODULE (SIDE AIR BAG)

REMOVAL E56D5ED0

1. Disconnect the battery negative (-) terminal cable.

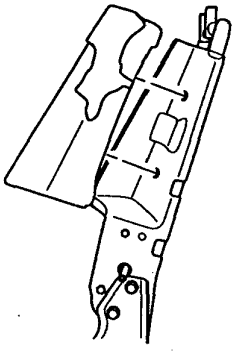
⚠ ***CAUTION***

Wait at least 30 seconds.



EADA011A

2. Disconnect the side airbag harness 2p connector.
3. Remove the seat assembly and seat-back cover.
4. Remove the two mounting nuts and the side airbag.



KRDC006D

⊗ WARNING

1. **Never attempt to disassemble or repair the airbag module.**
2. **Do not drop the airbag module or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust are detected.**
3. **The airbag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.**
4. **Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.**

SATELLITE SENSOR

SATELLITE SENSOR EBFCDA3D

The release system for the side airbag consists of a SRSCM installed in the middle of the vehicle and two satellites - one on the left-hand side and one on the right. Only the SRSCM is capable of deploying the airbags or the seat-belt pretensioners systems in the vehicle. In the dialog between the SRSCM and the satellite, it is the SRSCM that makes the deployment decision.

The SRSCM is supported with the side airbag function by two satellites, which act as intelligent acceleration sensors and as such back up the central airbag controller. Both the satellites continuously report the system status on the left and right-hand sides of the vehicle to the SRSCM.

It monitors the acceleration sensor continuously. The test results are reported to the SRSCM by means of periodic status signals.

⊗ WARNING

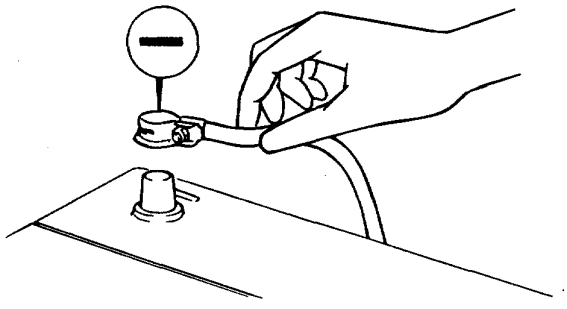
When the ignition is ON, never cause a sudden shock around the installation area of the satellite sensor by a hammer, etc. Otherwise it could cause the airbag system to unexpectedly deploy during servicing.

REMOVAL E70F0F9D

1. Disconnect the negative battery cable and keep secure from battery.

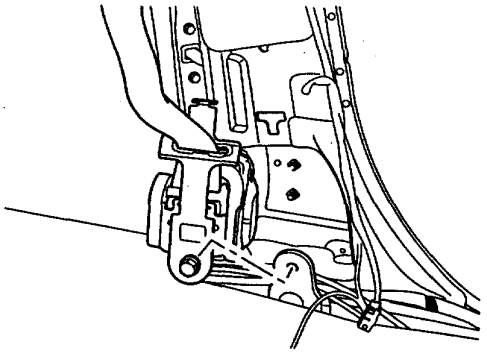
⚠ CAUTION

Wait at least 30 seconds after disconnecting the battery cable before doing any further work.



EADA011A

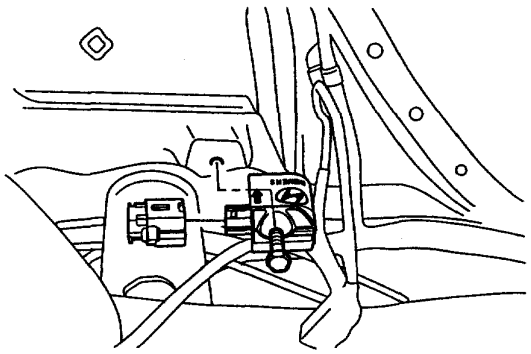
2. Remove the door scuff trim.
3. Remove the lower anchor plate.
4. Remove the center pillar lower trim.
5. Remove the seat belt assembly.



KRDC006B

6. Disconnect the satellite sensor connector and remove the satellite sensor.

TORQUE : 8 ~ 10 Nm (80 ~ 100 kg·cm, 6 ~ 7.4 lb·ft)



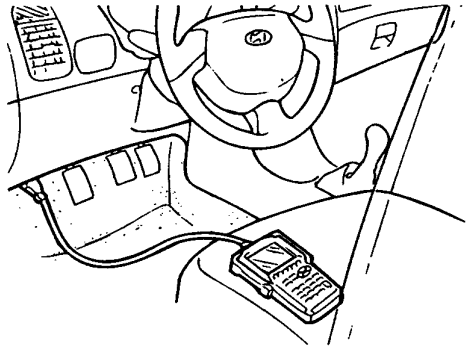
KRDC002B

TROUBLESHOOTING

DIAGNOSIS WITH SCAN TOOL K21FC0A3

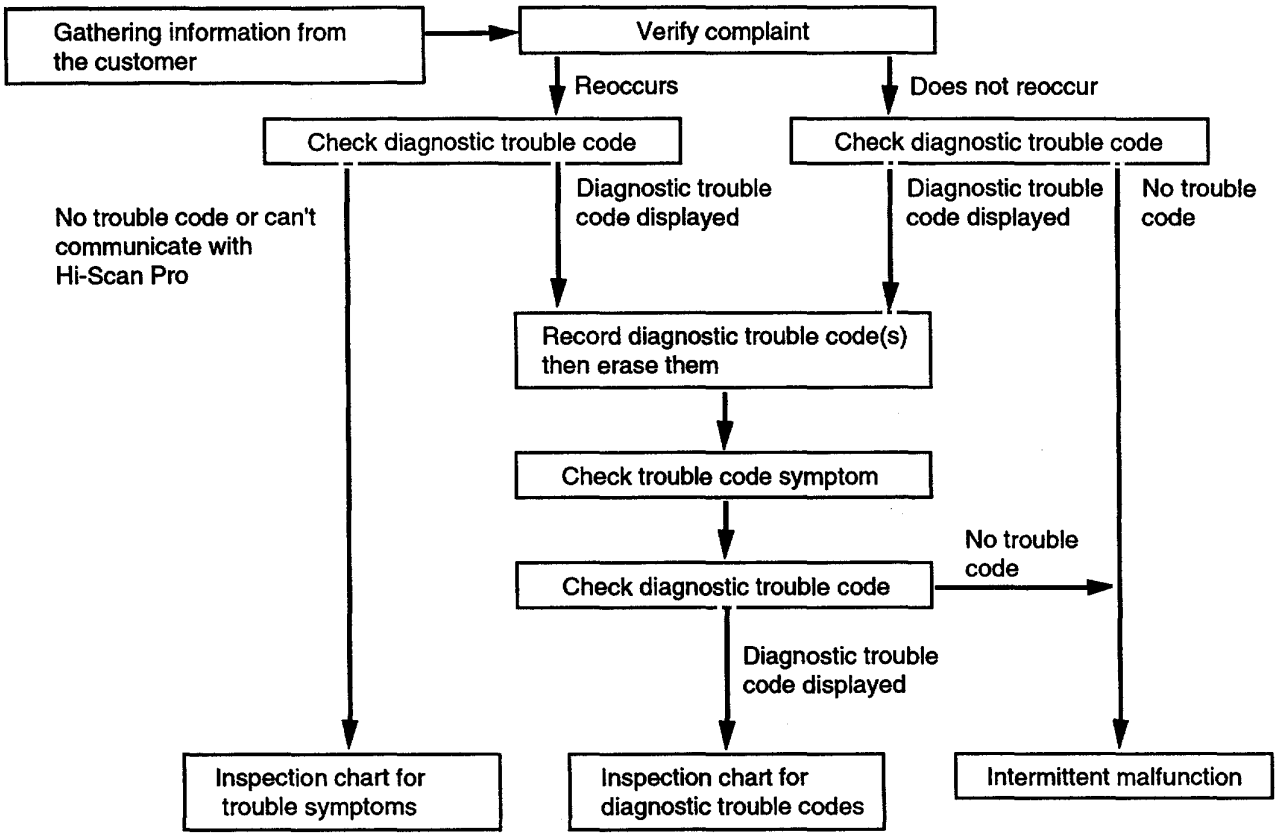
CHECK PROCEDURES

1. Connect the Hi-Scan Pro DLC to the vehicle's data link connector located underneath the dash panel.
2. Turn the ignition key to the "ON" position and turn the Hi-Scan Pro ON.
3. Perform the SRS diagnosis according to the vehicle model configuration.
4. If a fault code is assured, then replace the component. Never attempt to repair the component.
5. If the Hi-Scan Pro finds that a component of the system is faulty, there is a possibility that the fault is not in the component, but in SRS wiring or connector.



ERDA010A

DIAGNOSTIC TROUBLESHOOTING FLOW K95060FF



ERA9035A

AIRBAG SQUIB RESISTANCE LIMITS (SRE-LC)

DAB

R ≤ 1.06Ω	Resistance too low	Fault definitely detected
1.8Ω ≤ R ≤ 3.4Ω	Resistance within tolerance	Definitely no fault detected
R ≥ 6.7Ω	Resistance too high	Fault definitely detected
1.06Ω < R < 1.8Ω 3.4Ω < R < 6.7Ω	Tolerance band	Fault may or may not be detected

PAB, SAB, BPT

R ≤ 0.4Ω	Resistance too low	Fault definitely detected
1.6Ω ≤ R ≤ 2.8Ω	Resistance within tolerance	Definitely no fault detected
R ≥ 5.4Ω	Resistance too high	Fault definitely detected
0.4Ω < R < 1.6Ω 2.8Ω < R < 5.4Ω	Tolerance band	Fault may or may not be detected

SRE-SMART : DUAL STAGE AIRBAG

DAB, DAB (2ND STAGE)

R ≤ 0.9Ω	Resistance too low	Fault definitely detected
1.6Ω ≤ R ≤ 4.1Ω	Resistance within tolerance	Definitely no fault detected
R ≥ 6.0Ω	Resistance too high	Fault definitely detected
1.9Ω < R < 1.6Ω 4.1Ω < R < 6.0Ω	Tolerance band	Fault may or may not be detected

PAB, SAB, PAB(2ND STAGE)

R ≤ 1.0Ω	Resistance too low	Fault definitely detected
1.8Ω ≤ R ≤ 2.8Ω	Resistance within tolerance	Definitely no fault detected
R ≥ 4.2Ω	Resistance too high	Fault definitely detected
1.0Ω < R < 1.8Ω 2.8Ω < R < 4.2Ω	Tolerance band	Fault may or may not be detected

BPT

R ≤ 0.9Ω	Resistance too low	Fault definitely detected
1.8Ω ≤ R ≤ 3.1Ω	Resistance within tolerance	Definitely no fault detected
R ≥ 4.7Ω	Resistance too high	Fault definitely detected
0.9Ω < R < 1.8Ω 3.1Ω < R < 4.7Ω	Tolerance band	Fault may or may not be detected

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODE KF648B42

OPTIONS : DAB + PAB + SAB + BPT (SRE-LC)

DTC No.	Fault description
B1111	Battery voltage too high
B1112	Battery voltage too low
B1346	Driver airbag (DAB), Resistance too high
B1347	Driver airbag (DAB), Resistance too low
B1348	Driver airbag (DAB), Short to ground
B1349	Driver airbag (DAB), Short to Battery
B1352	Passenger airbag (PAB), Resistance too high
B1353	Passenger airbag (PAB), Resistance too low
B1354	Passenger airbag (PAB), Short to ground
B1355	Passenger airbag (PAB), Short to Battery
B1361	Driver seat belt pretensioner (DBPT), Resistance too high
B1362	Driver seat belt pretensioner (DBPT), Resistance too low
B1363	Driver seat belt pretensioner (DBPT), Short to ground
B1364	Driver seat belt pretensioner (DBPT), Short Battery
B1367	Passenger seat belt pretensioner (PBPT), Resistance too high
B1368	Passenger seat belt pretensioner (PBPT), Resistance too low
B1369	Passenger seat belt pretensioner (PBPT), Short to ground
B1370	Passenger seat belt pretensioner (PBPT), Short to Battery
B1378	Driver side airbag (DSAB), Resistance too High
B1379	Driver side airbag (DSAB), Resistance too Low
B1380	Driver side airbag (DSAB), Short to ground
B1381	Driver side airbag (DSAB), Short to Battery
B1382	Passenger side airbag (PSAB), Resistance too high
B1383	Passenger side airbag (PSAB), Resistance too low
B1384	Passenger side airbag (PSAB), Short to ground
B1385	Passenger side airbag (PSAB), Short to Battery
B1400	Satellite left side sensor defect
B1401	Satellite left side short to ground
B1402	Satellie left side short to battery
B1403	Satellite right side sensor defect
B1404	Satellite right side short to ground
B1405	Satellite right side short to battery
B1620	Internal failure
B1650	Crash recorded (Frontal repace SRE-HMC)
B1661	Parameter configuration missing/incorrect
B2500	Warning lamp failure

NOTE

- *The DAB is located in the steering wheel.*
- *The PAB is located in the crash pad.*
- *The DSAB is located in the left side of driver's seat.*
- *The PSAB is located in the right side of passenger's seat.*

OPTIONS : DAB+PAB+SAB+BPT (DUAL STAGE AIRBAG)

DTC No.	Fault description
B1101	Battery voltage too high
B1102	Battery voltage too low
B1103	Communication voltage too low
B1326	Driver side electronic frontal sensor short to ground
B1327	Driver side electronic frontal sensor short to battery
B1328	Driver side electronic frontal sesnor defect
B1329	Driver side electronic frontal sesnor communication error
B1330	Driver side electronic frontal sesnor wrong ID
B1331	Passenger side eelectronic frontal sesnor short to ground
B1332	Passenger side electronic frontal sesnor short to battery
B1333	Passenger side electronic frontal sesnor defect
B1334	Passenger side electronic frontal sesnor communication error
B1335	Passenger side electronic frontal sesnor wrong ID
B1346	Driver airbag (DAB), Resistance too high
B1347	Driver airbag (DAB), Resistance too low
B1348	Driver airbag (DAB), Short to ground
B1349	Driver airbag (DAB), Short to Battery
B1352	Passenger airbag (PAB), Resistance too high
B1353	Passenger airbag (PAB), Resistance too low
B1354	Passenger airbag (PAB), Short to ground
B1355	Passenger airbag (PAB), Short to Battery
B1361	Driver seat belt pretensioner (DBPT), Resistance too high
B1362	Driver seat belt pretensioner (DBPT), Resistance too low
B1363	Driver seat belt pretensioner (DBPT), Short to ground
B1364	Driver seat belt pretensioner (DBPT), Short Battery
B1367	Passenger seat belt pretensioner (PBPT), Resistance too high
B1368	Passenger seat belt pretensioner (PBPT), Resistance too low
B1369	Passenger seat belt pretensioner (PBPT), Short to ground
B1370	Passenger seat belt pretensioner (PBPT), Short to Battery
B1378	Driver side airbag (DSAB), Resistance too High
B1379	Driver side airbag (DSAB), Resistance too Low
B1380	Driver side airbag (DSAB), Short to ground
B1381	Driver side airbag (DSAB), Short to Battery
B1382	Passenger side airbag (PSAB), Resistance too high
B1383	Passenger side airbag (PSAB), Resistance too low
B1384	Passenger side airbag (PSAB), Short to ground
B1385	Passenger side airbag (PSAB), Short to Battery
B1387	Driver seat-track position sensor short to ground

DTC No.	Fault description
B1388	Driver seat-track position sensor short to battery
B1389	Driver seat-track position sensor defect
B1390	Passenger seat-track position sensor short to ground
B1391	Passenger seat-track position sensor short to battery
B1392	Passenger seat-track position sensor defect
B1395	Firing loop interconnection fault
B1400	Satellite left side sensor defect
B1401	Satellite left side short to ground
B1402	Satellite left side short to battery
B1403	Satellite right side sensor defect
B1404	Satellite right side short to ground
B1405	Satellite right side short to battery
B1409	Satellite left side communication error
B1410	Satellite right side communication error
B1414	Satellite sensor left side wrong ID
B1415	Satellite sensor right side wrong ID
B1481	2nd stage driver airbag, Resistance too high
B1482	2nd stage driver airbag, Resistance too low
B1483	2nd stage driver airbag, Short to ground
B1484	2nd stage driver airbag, Short to battery
B1485	2nd stage passenger airbag, Resistance too high
B1486	2nd stage passenger airbag, Resistance too low
B1487	2nd stage passenger airbag, Short to ground
B1488	2nd stage passenger airbag, Short to battery
B1511	Driver seat buckle switch short to battery
B1512	Driver seat buckle switch short to ground
B1513	Passenger seat buckle switch short to battery
B1514	Passenger seat buckle switch short to ground
B1515	Driver seat buckle switch defect
B1516	Passenger seat buckle switch defect
B1620	Internal failure
B1650	Crash recorded (Frontal-Replace SRE-SMART)
B1651	Crash recorded driver side airbag (Side Airbag-Replace SRE-SMART)
B1652	Crash recorded passenger side airbag (Side Airbag-Replace SRE-SMART)
B1657	Crash recorded-belt pretensioner only
B1670	2nd stage crash recorded (Frontal Airbag-Replace SRE-SMART)
B2500	Warning lamp failure
B2502	Passenger deactivation lamp failure

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K1D68DD2

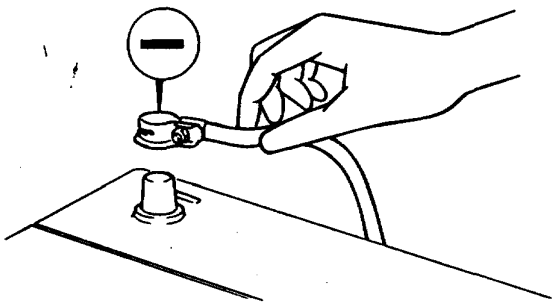
DTC	B1101 Battery voltage too high B1102 Battery voltage too low B1103 Communication voltage too low

CIRCUIT DESCRIPTION

The SRS is equipped with a voltage-increase or decrease circuit (DC-DC converter) in the SRSCM in case the source voltage goes down or up. When the battery voltage is down or up the voltage-increase or decrease circuit (DC-DC converter) function will increase or decrease the voltage of the SRS to normal voltage. The diagnosis system malfunction display for this circuit is different to other circuits. When the SRS warning lamp remains lit up and the DTC is a B1101 or B1102 code, battery voltage too high or low is indicated. When voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the SRSCM connector.

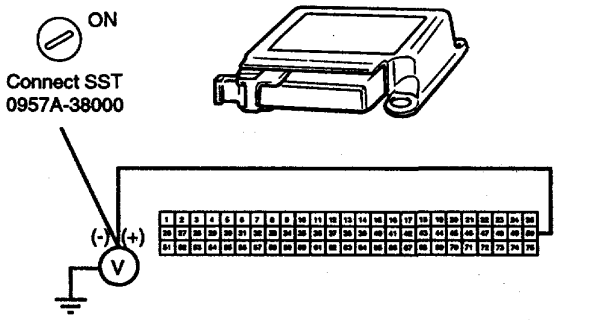


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check source voltage.
   1) Connect the negative (-) terminal cable to the battery.
   2) Turn the ignition switch ON.



ERDD100B

[CHECK]

Measure voltage between the battery supply terminal 50 of the SRS connector and body ground.

LIMIT : 10-16.5V

NG → Check the harness between the battery and the SRSCM. Check the battery and charging system

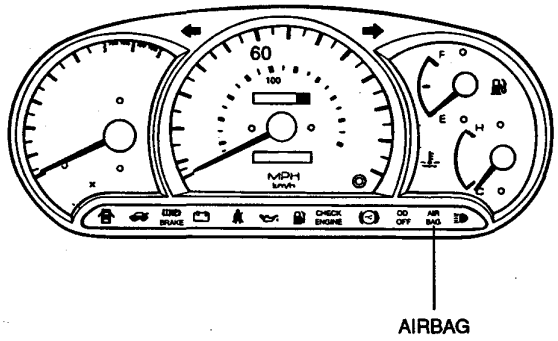
OK ↓

ERJB040A

3. Does the SRS warning light turn off ?

[PREPARATION]

1) Turn the ignition switch to LOCK.
2) Connect the DAB module.
3) Connect the PAB connector, left and right side airbag, belt pretensioner and satellite connectors.
4) Connect the SRSCM connector.
5) Turn the ignition switch ON.



ERDA009D

[CHECK]

Check that the SRS warning light goes off.

NG → Check for DTCs. If a DTC is output, perform troubleshooting for the DTC. If B1101 or B1102 is output, replace the SRSCM.

OK ↓

From the results of the above inspection, the malfunctioning part can now be considered normal.

ERPD040B

CIRCUIT INSPECTION (SRE-LC) KF2CA5C0

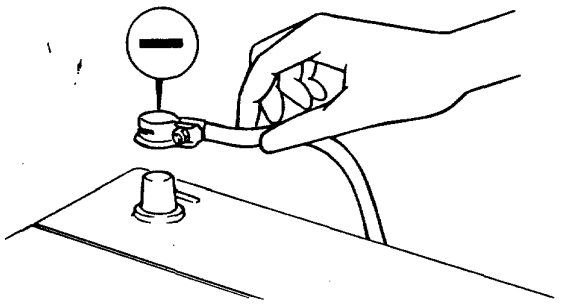
DTC	B1111 Battery voltage too high B1112 Battery voltage too low

CIRCUIT DESCRIPTION

The SRS is equipped with a voltage-increase or decrease circuit (DC-DC converter) in the SRSCM in case the source voltage goes down or up. When the battery voltage is down or up the voltage-increase or decrease circuit (DC-DC converter) function will increase or decrease the voltage of the SRS to normal voltage. The diagnosis system malfunction display for this circuit is different to other circuits. When the SRS warning lamp remains lit up and the DTC is a B1111 or B1112 code, battery voltage too high or low is indicated. When voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the SRSCM connector.

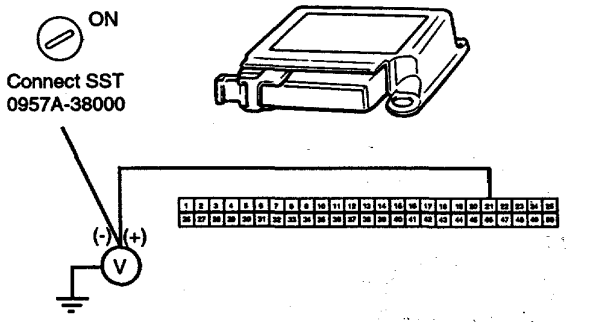


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check source voltage.
   1) Connect the negative (-) terminal cable to the battery.
   2) Turn the ignition switch ON.



ERDC020A

[CHECK]

Measure voltage between the battery supply terminal 21(SRE-LC) of the SRS connector and body ground.

LIMIT : 9-16V

NG ➔ Check the harness between the battery and the SRSCM. Check the battery and charging system

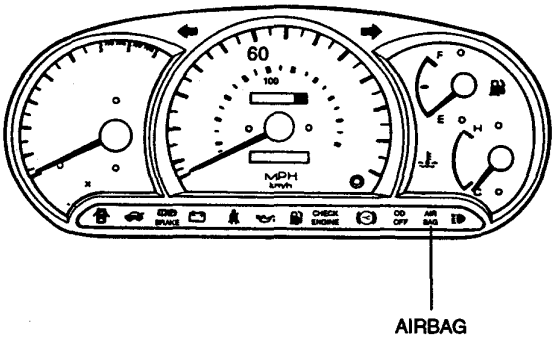
OK ↓

ERJB040A

3. Does the SRS warning light turn off ?

[PREPARATION]

1) Turn the ignition switch to LOCK.
2) Connect the DAB module.
3) Connect the PAB connector, left and right side airbag, belt pretensioner and satellite connectors.
4) Connect the SRSCM connector.
5) Turn the ignition switch ON.



ERDA009D

[CHECK]

Check that the SRS warning light goes off.

NG ➔ Check for DTCs. If a DTC is output, perform troubleshooting for the DTC. If B1111 or B1112 is output, replace the SRSCM.

OK ⬇

From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDA040B

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K7ACBBB7

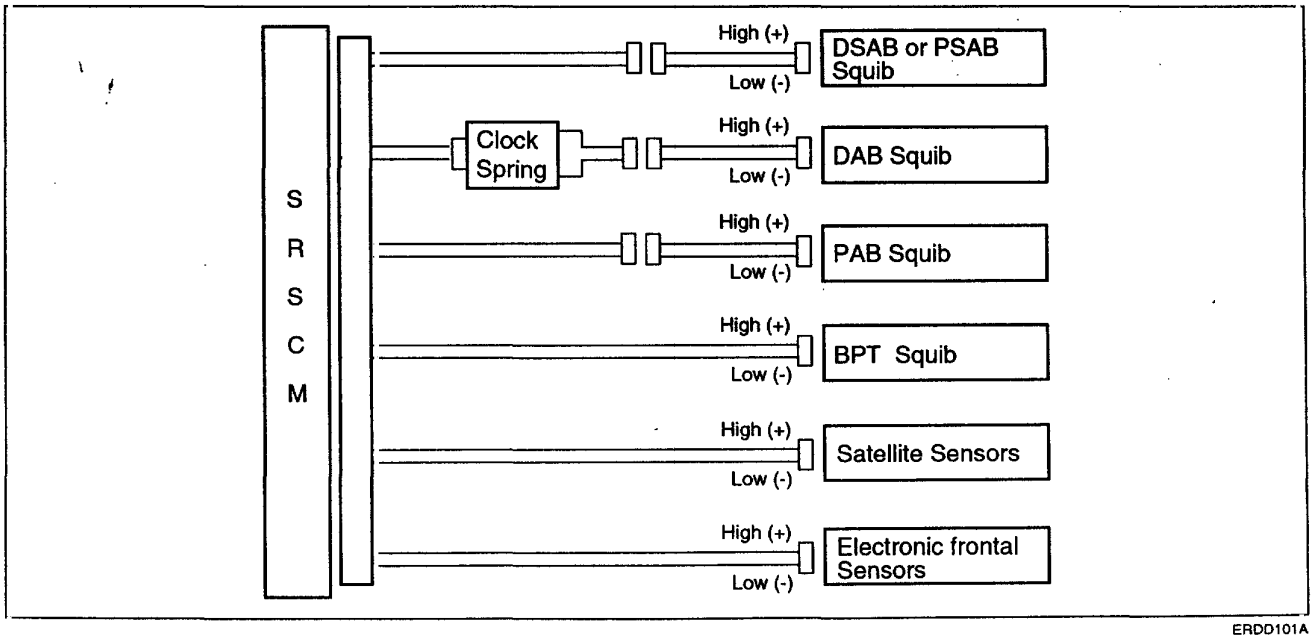
DTC	B1326 Driver side electronic frontal sensor short to ground B1331 Passenger side electronic frontal sensor short to ground B1348 DAB Short to ground B1354 PAB Short to ground B1363 DBPT Short to ground B1369 PBPT Short to ground B1380 DSAB Short to ground B1384 PSAB Short to ground B1401 Satellite sensor left side short to ground B1404 Satellite sensor right side short to ground B1483 2nd stage DAB short to ground B1487 2nd stage PAB short to ground

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB, SAB, BPT, and satellite sensors. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTCs are recorded when a short to ground is detected in the squib circuit.

DTC Detecting Condition	Trouble Area	
• Short circuit in squib wire harness (to ground) • Squib malfunction • Clock spring malfunction • SRSCM malfunction	• DAB squib • PAB squib • DSAB squib • PSAB squib • BPT squib • Satellite sensor • Clock spring • SRSCM • Wire harness	• 2nd stage DAB squib • 2nd stage PAB squib • Electronic frontal sensor

WIRING DIAGRAM



ERDD101A

INSPECTION PROCEDURE

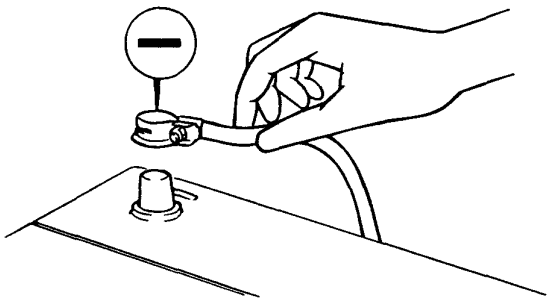
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.

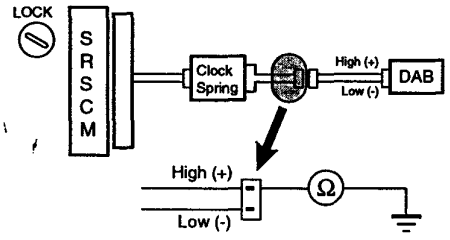


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the DAB squib circuit.



ERA9011B

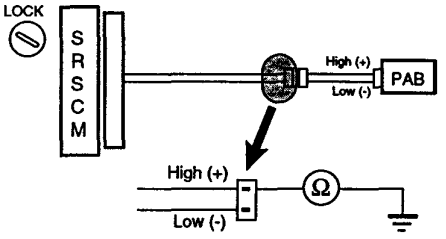
[CHECK]
For the connector (on the clock spring side) between the clock spring and the DAB, measure the resistance between the DAB high and body ground.
Resistance : ∞

NG ➔ Go to step "15"

OK
↓
Go to step "9"

ERDD101B

3. Check the PAB squib circuit.



ERA9011C

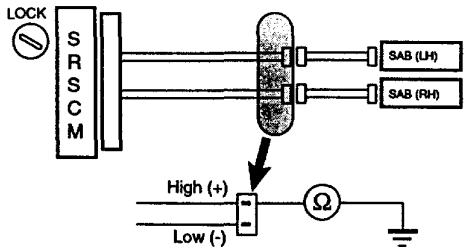
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the PAB, measure the resistance between the PAB high and body ground.
Resistance : ∞

NG ➔ Repair or replace the harness or the connector between the SRSCM and the PAB.

OK
↓
Go to step "10"

ERDD101C

4. Check the PSAB and DSAB squib circuit.



ERA9011D

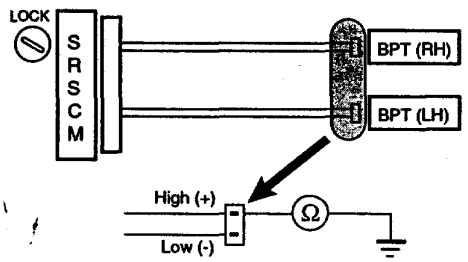
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the SAB, measure the resistance between the SAB high and body ground.
Resistance : ∞

NG → Repair or replace the harness between the SRSCM and the SAB.

OK ↓
Go to step "11"

ERDD101D

5. Check the BPT squib circuit.



ERA9011E

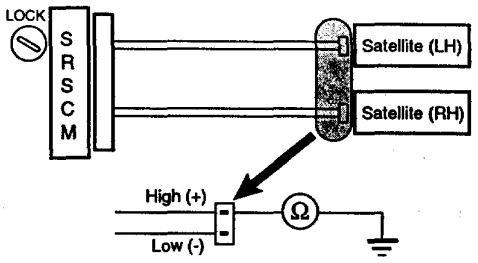
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the BPT, measure the resistance between the BPT high and body ground.
Resistance : ∞

NG → Repair or replace the harness between the SRSCM and the BPT.

OK ↓
Go to step "12"

ERDD101E

6. Check the Satellite sensor circuit.



ERA9011F

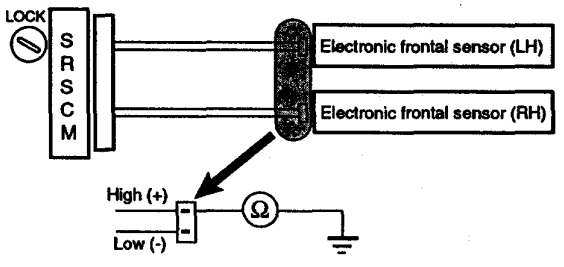
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the Satellite sensor, measure the resistance between the Satellite high and body ground.
Resistance : ∞

NG → Repair or replace the harness between the SRSCM and the Satellite sensor.

OK ↓
Go to step "13"

ERDD101F

7. Check the electronic frontal sensor circuit.



ERDD101G

[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the Electronic frontal sensor, measure the resistance between the Electronic frontal sensor high and body ground.
Resistance : ∞

NG → Repair or replace the harness between the SRSCM and the Electronic frontal sensor.

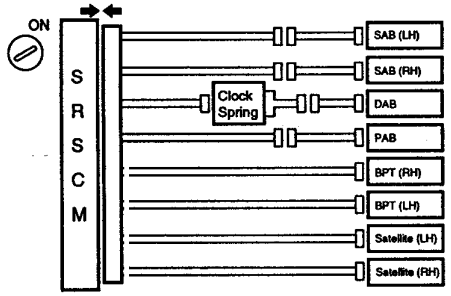
OK ↓
Go to step "14"

ERDD101H

8. Check the SRSCM.

[PREPARATION]

1. Connect the connector to the SRSCM.
2. Using a service wire, connect the DAB high and the DAB low to the clock spring side connector between the clock spring and the DAB.
3. Using a service wire, connect the PAB high and low on the SRSCM side of the connector between the SRSCM and the PAB.
4. Connect the SAB and the BPT by the same method.
5. Connect the negative (-) terminal cable to the battery, and wait least 30 seconds.



ERA9011G

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these ones may be output at this time, but they are not relevantto this check.

NG ➔ Replace the SRSCM.

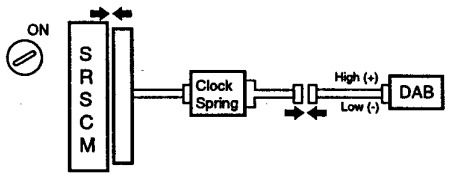
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041F

9. Check the DAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the DAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011U

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-scan, check the DTC.
   There is no DTC.

NG ➔ Replace the DAB.

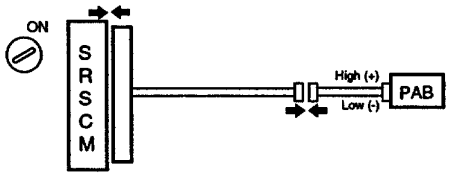
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041G

10. Check the PAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the PAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011V

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the PAB.

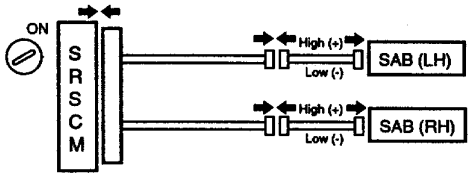
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041H

11. Check the SAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the SAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011W

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the SAB.

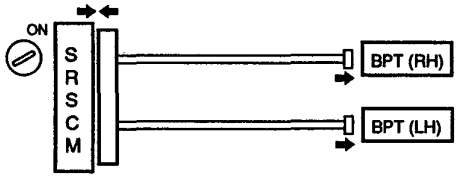
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041I

12. Check the BPT squib.

[PREPARATION]

1. Turn the ignition swich to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the BPT connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011X

[CHECK]

1. Turn the ignition switch to ON, and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the BPT.

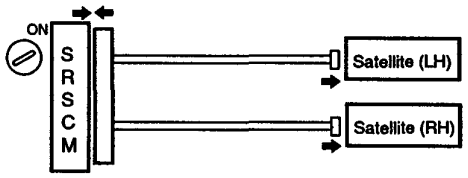
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041J

13. Check the Satellite sensors.

[PREPARATION]

1. Turn ignition switch to LOCK.
2. Disconnect negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the Satellite sensor connector.
4. Connect the negative (-) terminal cable from the battery, and wait at least 30 seconds.



ERA9011Y

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the Satellite sensor.

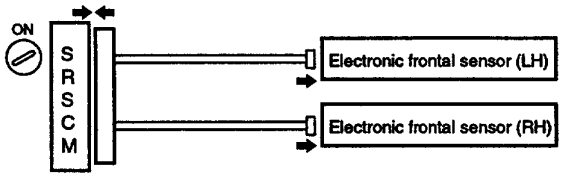
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041K

14. Check the electronic frontal sensors.

[PREPARAION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the electronic frontal sensor connector.
4. Commect the negative (-) terminal cable from the battery, and wait at least 30 seconds.



ERDD101I

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is noDTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the Electronic frontal sensor.

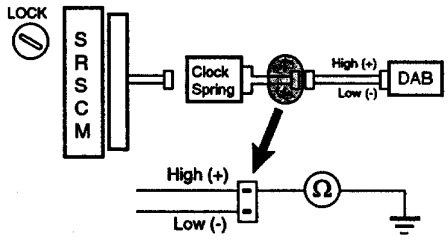
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD101J

15. Check the clock spring circuit.

[PREPARAION]

Disconnect the connector between the SRSCM and the clock spring.



ERKB010B

[CHECK]
Measure the resistance between the DAB high on the clock spring side of the connector between the clock spring and the DAB and body ground.
Resistance : ∞

NG ➔ Replace the clock spring.

OK
↓
Repair or replace the harness or the connector between the SRSCM and the clock spring.

ERDA027R

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K874A970

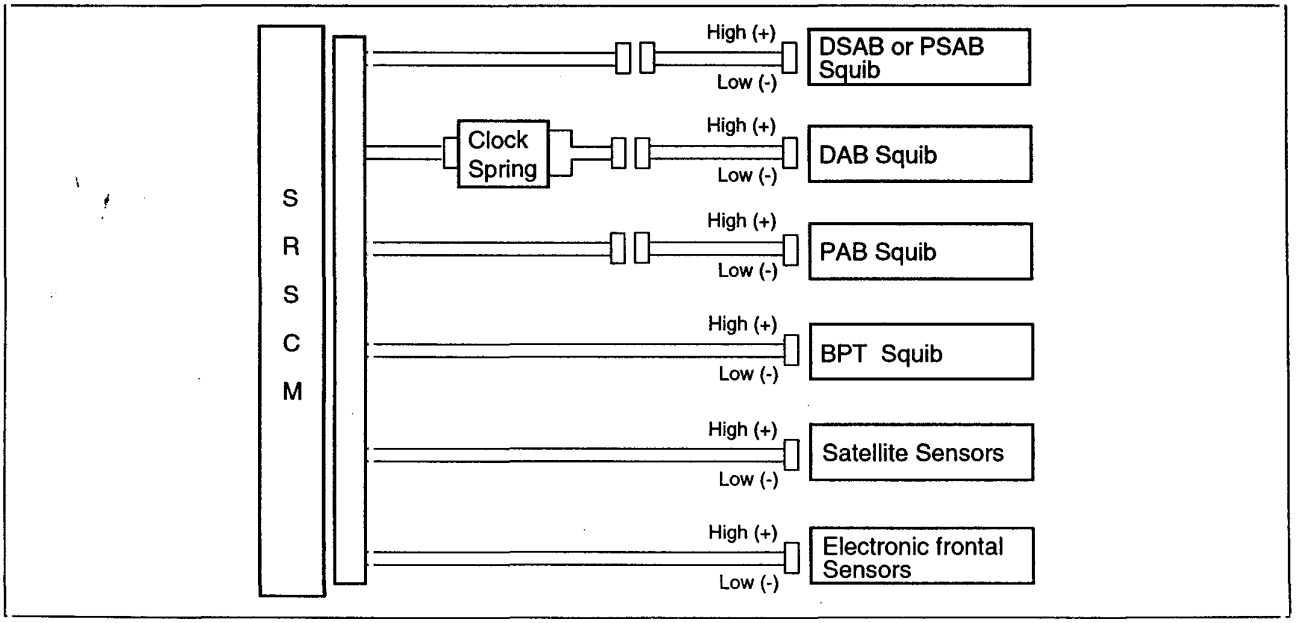
DTC	B1327 Driver side electronic frontal sensor short to battery B1332 Passenger side electronic frontal sensor short to battery B1349 DAB Short to battery B1355 PAB Short to battery B1364 BPT (Driver) Short to battery B1370 BPT (Passenger) Short to battery B1381 SAB (Driver) short to battery B1385 SAB (Passenger) short to battery B1402 Satellite left side short to battery B1405 Satellite right side short to battery B1484 2nd stage DAB shrot to battery B1488 2nd stage PAB short to battery

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB, SAB, BPT and satellite sensor. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTCs are recorded when a B+ short is detected in the squib circuit.

DTC Detecting Condition	Trouble Area	
• Short circuit in squib wire harness (to B+) • Squib malfunction • Spiral cable malfunction • SRSCM malfunction	• DAB squib • PAB squib • DSAB or PSAB squib • BPT squib • Satellite sensor • Wire harness	• 2nd stage DAB squib • 2nd stage PAB squib • Electronic frontal sensor

WIRING DIAGRAM



ERDD101A

INSPECTION PROCEDURE

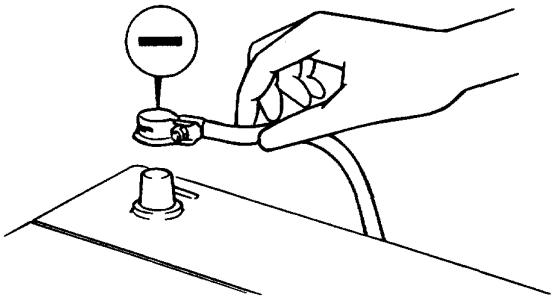
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.

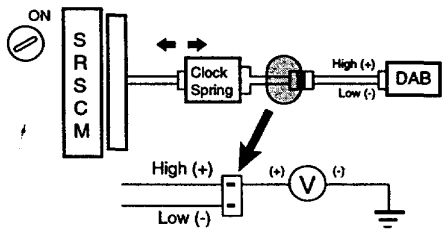


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the DAB squib circuit.



ERA9011O

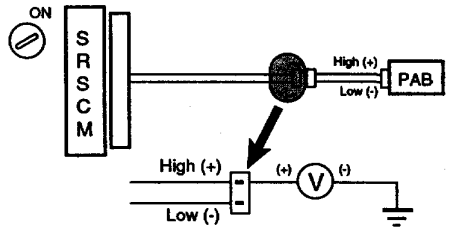
[CHECK]
For the connector (on the clock spring side) between the clock spring and the DAB, measure the voltage between the DAB high and body ground.
Voltage : 0 V

NG ➔ Go to step "15"

OK
↓
Go to step "9"

ERDD101B

3. Check the PAB squib circuit.



ERA9011P

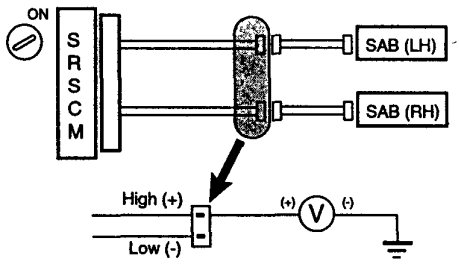
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the PAB, measure the voltage between the PAB high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness or the connector between the SRSCM and the PAB.

OK
↓
Go to step "10"

ERDD101C

4. Check the SAB squib circuit.



ERA9011Q

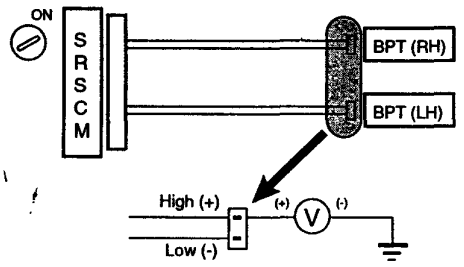
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the SAB, measure the voltage between the SAB high and body ground.
Voltage : 0 V

NG → Repair or replace the harness between the SRSCM and the SAB.

OK
↓
Go to step "11"

ERDD101D

5. Check the BPT squib circuit.



ERA9011R

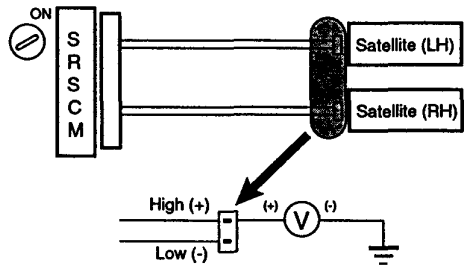
[CHECK]
For the connector between the SRSCM and the BPT, measure the voltage between the BPT high and body ground.
Voltage : 0 V

NG → Repair or replace the harness between the SRSCM and the BPT.

OK
↓
Go to step "12"

ERDD101E

6. Check the Satellite sensor circuit.



ERA9011S

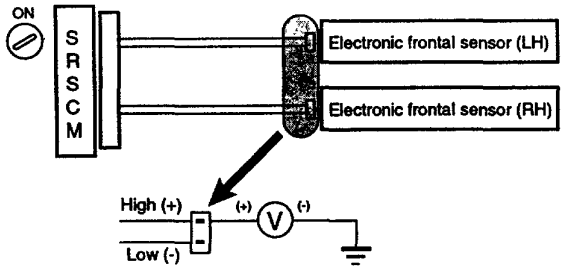
[CHECK]
For the connector between the SRSCM and the Satellite sensor, measure the voltage between the Satellite sensor high and body ground.
Voltage : 0 V

NG → Repair or replace the harness between the SRSCM and the Satellite sensor.

OK
↓
Go to step "13"

ERDD101F

7. Check the electronic frontal sensor circuit.



ERDD102B

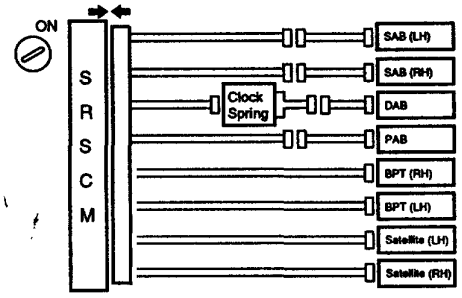
[CHECK]
For the connector between the SRSCM and the electronic frontal sensor, measure the voltage between the electronic frontal sensor high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the Electronic frontal sensor.

OK
↓
Go to step "14"

ERDD101H

8. Check the SRSCM.



ERA9011G

[PREPARATION]

1. Connect the connector to the SRSCM.
2. Using a service wire, connect the DAB high and low on the clock spring side of the connector between the clock spring and the DAB.
3. Using a service wire, connect the PAB high and low on the SRSCM side of the connector between the SRSCM and the PAB.
4. Using a service wire, connect the SAB high and low on the SRSCM side connector between the SRSCM and the SAB.
5. Using a service wire, connect the BPT high and low on the SRSCM side connector between the SRSCM and the BPT.
6. Using a service wire, connect the satellite high and low on the SRSCM side connector between the SRSCM and the satellite sensor.
7. Connect negative (-) battery cable to the battery, and wait at least 30 seconds.

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the SRSCM.

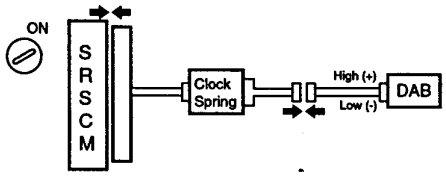
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041F

9. Check the DAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the DAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011U

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the DAB.

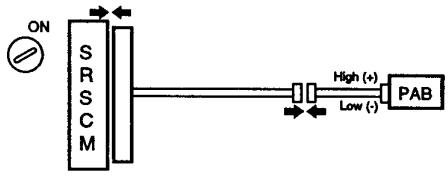
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041G

10. Check the PAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the PAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011V

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the PAB.

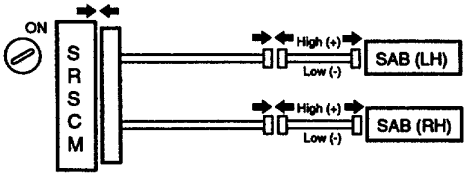
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041H

11. Check the SAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the SAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011W

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG ➔ Replace the SAB.

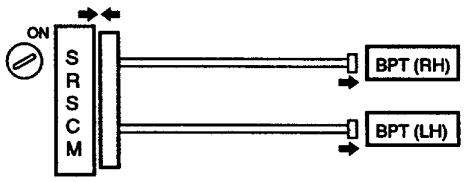
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041I

12. Check the BPT squib.

[PREPARATION]

1. Turn the ignition swich to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the BPT connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011X

[CHECK]

1. Turn the ignition switch to ON, and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the BPT.

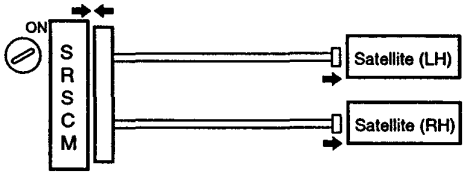
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041J

13. Check the Satellite sensors.

[PREPARATION]

1. Turn ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the Satellite sensor connector.
4. Connect the negative (-) terminal cable from the battery, and wait at least 30 seconds.



ERA9011Y

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with Hi-scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the Satellite sensor.

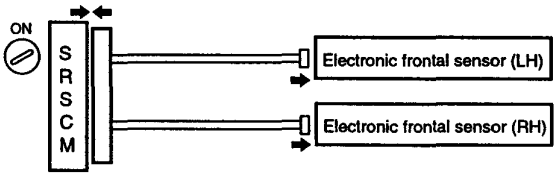
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041K

14. Check the electronic frontal sensors.

[PREPARAION]

1. Turn ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the Electronic frontal sensor connector
4. Connect the negative (-) terminal cable from the battery, and wait at least 30 seconds.



ERDD101I

[CHECK]

- Turn the ignition switch to ON, and wait at least 30 seconds.
- Clear the malfunction code stored in memory with Hi-scan.
- Turn the ignition switch to LOCK, and wait at least 30 seconds.
- Turn the ignition switch to ON, and wait at least 30 seconds.
- Using the Hi-Scan Pro, check for DTCs.
  There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure

NG ➔ Replace the Electronic frontal sensor.

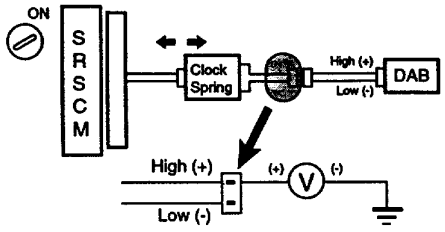
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD101J

15. Check the clock spring.

[PREPARAION]

1. Turn the ignition switch to LOCK.
2. Disconnect the connector between the SRSCM and the clock spring.



ERA9011O

[CHECK]
Turn the ignition switch to ON, and measure voltage between the DAB high and body ground.
Voltage : 0 V

NG ➔ Replace the clock spring.

OK
↓
Repair or replace the harness or the connector between the SRSCM and the clock spring.

ERDA027R

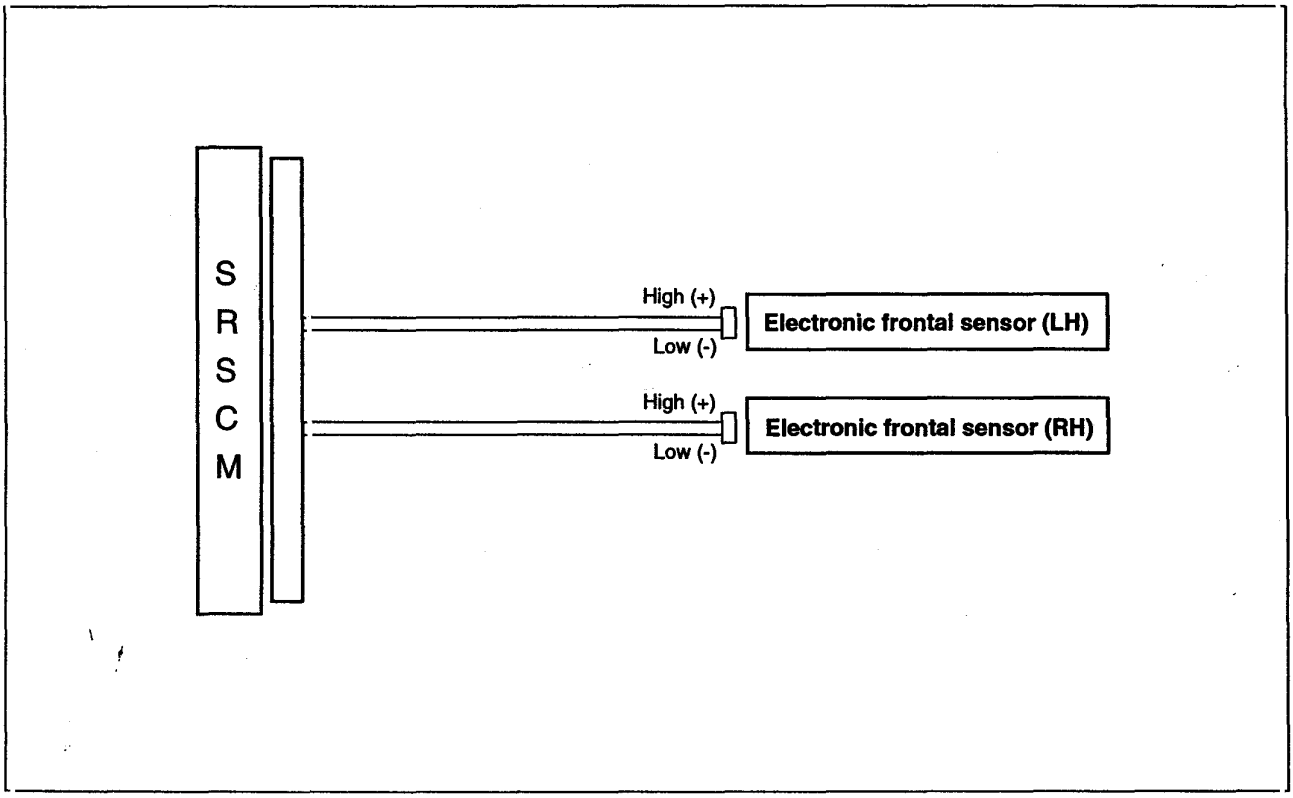
CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K0BD246A

DTC	B1328 Electronic frontal sensor left side defect B1329 Electronic frontal sensor left communication error B1330 Electronic frontal sensor left side wrong ID B1333 Electronic frontal sensor right side defect B1334 Electronic frontal sensor right communication error B1335 Electronic frontal sensor right side wrong ID

CIRCUIT DESCRIPTION

The release system for the airbag consists of the SRSCM and two Electronic frontal sensor - one on the left - hand side and one on the right. The above DTCs are recorded when the defect or communication error of a Electronic frontal sensor is detected in the Electronic frontal circuit.

WIRING DIAGRAM



ERDD104A

INSPECTION PROCEDURE

1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

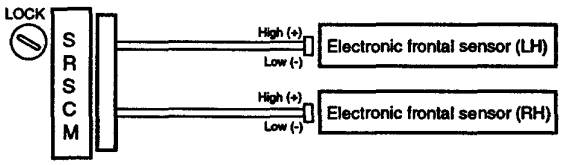
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the connector of theSRSCM.

   ⚠ ***CAUTION***

   Place the DAB with the front surface facing upward.

2. Check the Electronic frontal sensor circuits (Communication error).



ERDD104B

[PREPARATION]
Check sensor continuity between sensor SRSCM connector and both electronic frontal sensor connector's high (+) and low (-) sides.
OK : Continuity

NG ➔ Repair or replace the harness between the SRSCM and the Electronic frontal sensor.

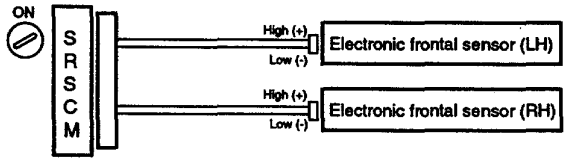
OK ↓

ERDD104D

3. Check the Electronic frontal sensor (Defect).

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the electronic frontal sensor connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERDD104C

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory of the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the Electronic frontal sensor.

OK ↓

From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD104E

CIRCUIT INSPECTION (SRE-LC) K65B3E0B

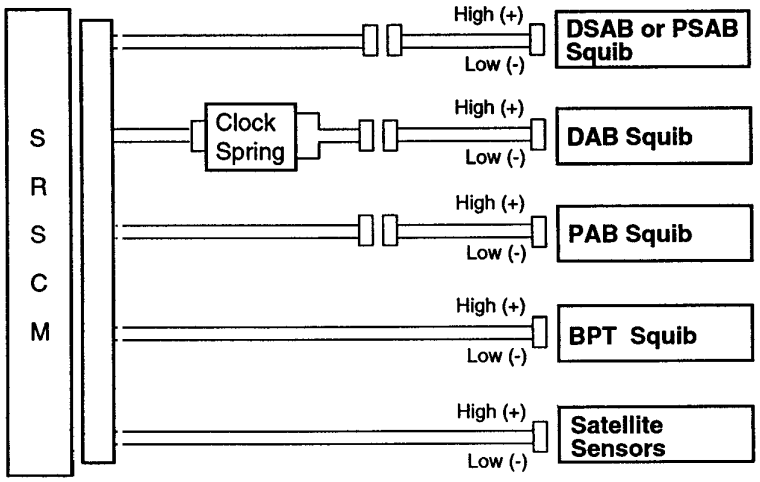
DTC	B1348 DAB Short to ground B1354 PAB Short to ground B1363 DBPT Short to ground B1369 PBPT Short to ground B1380 DSAB Short to ground B1384 PSAB Short to ground B1401 Satellite sensor left side short to ground B1404 Satellite sensor right side short to ground

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB, SAB, BPT, and satellite sensors. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTCs are recorded when a short to ground is detected in the squib circuit.

DTC Detecting Condition	Trouble Area
• Short circuit in squib wire harness (to ground) • Squib malfunction • Clock spring malfunction • SRSCM malfunction	• DAB squib • PAB squib • DSAB squib • PSAB squib • BPT squib • Satellite sensor • Clock spring • SRSCM • Wire harness

WIRING DIAGRAM



ERA9011A

INSPECTION PROCEDURE

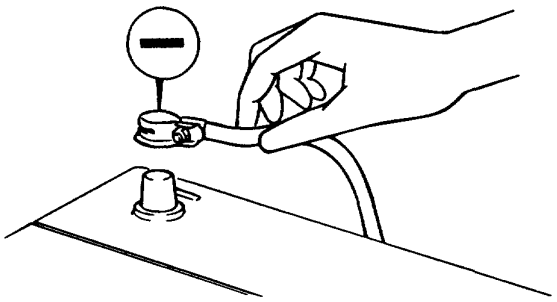
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.

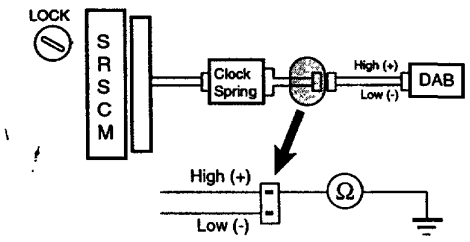


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the DAB squib circuit.



ERA9011B

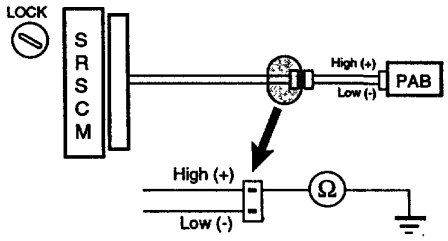
[CHECK]
For the connector (on the clock spring side) between the clock spring and the DAB, measure the resistance between the DAB high and body ground.
Resistance : ∞

NG ➔ Go to step "13"

OK
⬇
Go to step "8"

ERFB014A

3. Check the PAB squib circuit.



ERA9011C

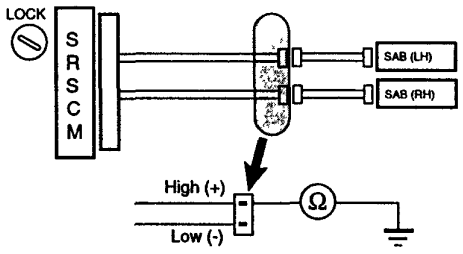
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the PAB, measure the resistance between the PAB high and body ground.
Resistance : ∞

NG ➔ Repair or replace the harness or the connector between the SRSCM and the PAB.

OK
⬇
Go to step "9"

ERFB014B

4. Check the PSAB and DSAB squib circuit.



ERA9011D

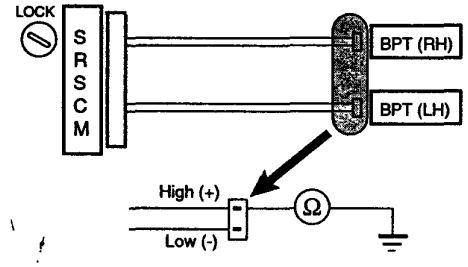
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the SAB, measure the resistance between the SAB high and body ground.
Resistance : ∞

NG ➔ Repair or replace the harness between the SRSCM and the SAB.

OK
↓
Go to step "10"

ERFB014C

5. Check the BPT squib circuit.



ERA9011E

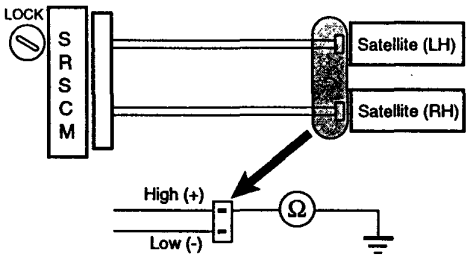
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the BPT, measure the resistance between the BPT high and body ground.
Resistance : ∞

NG ➔ Repair or replace the harness between the SRSCM and the BPT.

OK
↓
Go to step "11"

ERFB014D

6. Check the Satellite sensor circuit.



ERA9011F

[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the Satellite sensor, measure the resistance between the Satellite high and body ground.
Resistance : ∞

NG ➔ Repair or replace the harness between the SRSCM and the Satellite sensor.

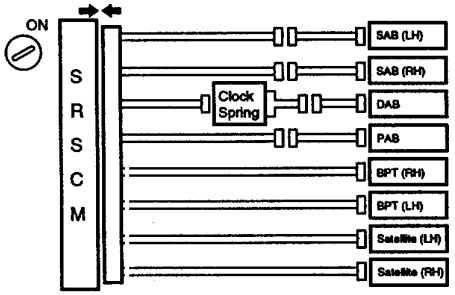
OK
↓
Go to step "12"

ERJB041E

7. Check the SRSCM.

[PREPARATION]

1. Connect the connector to the SRSCM.
2. Using a service wire, connect the DAB high and the DAB low to the clock spring side connector between the clock spring and the DAB.
3. Using a service wire, connect the PAB high and low on the SRSCM side of the connector between the SRSCM and the PAB.
4. Connect the SAB and the BPT by the same method.
5. Connect the negative (-) terminal cable to the battery, and wait least 30 seconds.



ERA9011G

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these ones may be output at this time, but they are not relevantto this check.

NG ➔ Replace the SRSCM.

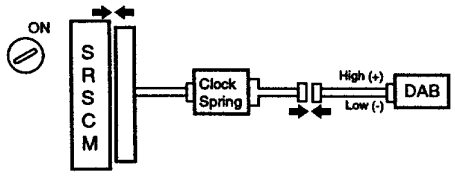
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041F

8. Check the DAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the DAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011U

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-scan, check the DTC.
   There is no DTC.

NG ➔ Replace the DAB.

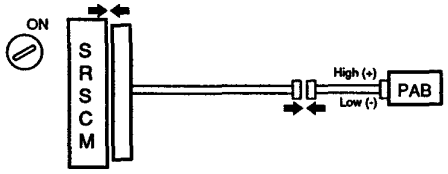
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041G

9. Check the PAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the PAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011V

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the PAB.

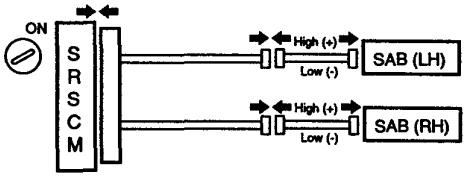
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041H

10. Check the SAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the SAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011W

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the SAB.

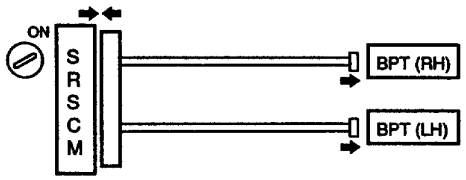
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041I

11. Check the BPT squib.

[PREPARATION]

1. Turn the ignition swich to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the BPT connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011X

[CHECK]

1. Turn the ignition switch to ON, and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the BPT.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041J

12. Check the Satellite sensors.

[PREPARATION]

1. Turn ignition switch to LOCK.
2. Disconnect negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the Satellite sensor connector.
4. Connect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the Satellite sensor.

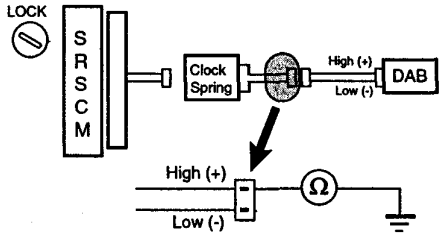
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041K

13. Check the clock spring circuit.

[PREPARAION]

Disconnect the connector between the SRSCM and the clock spring.



ERKB010B

[CHECK]
Measure the resistance between the DAB high on the clock spring side of the connector between the clock spring and the DAB and body ground.
Resistance : ∞

NG ➔ Replace the clock spring.

OK
↓
Repair or replace the harness or the connector between the SRSCM and the clock spring.

ERDA027R

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K7933EDD

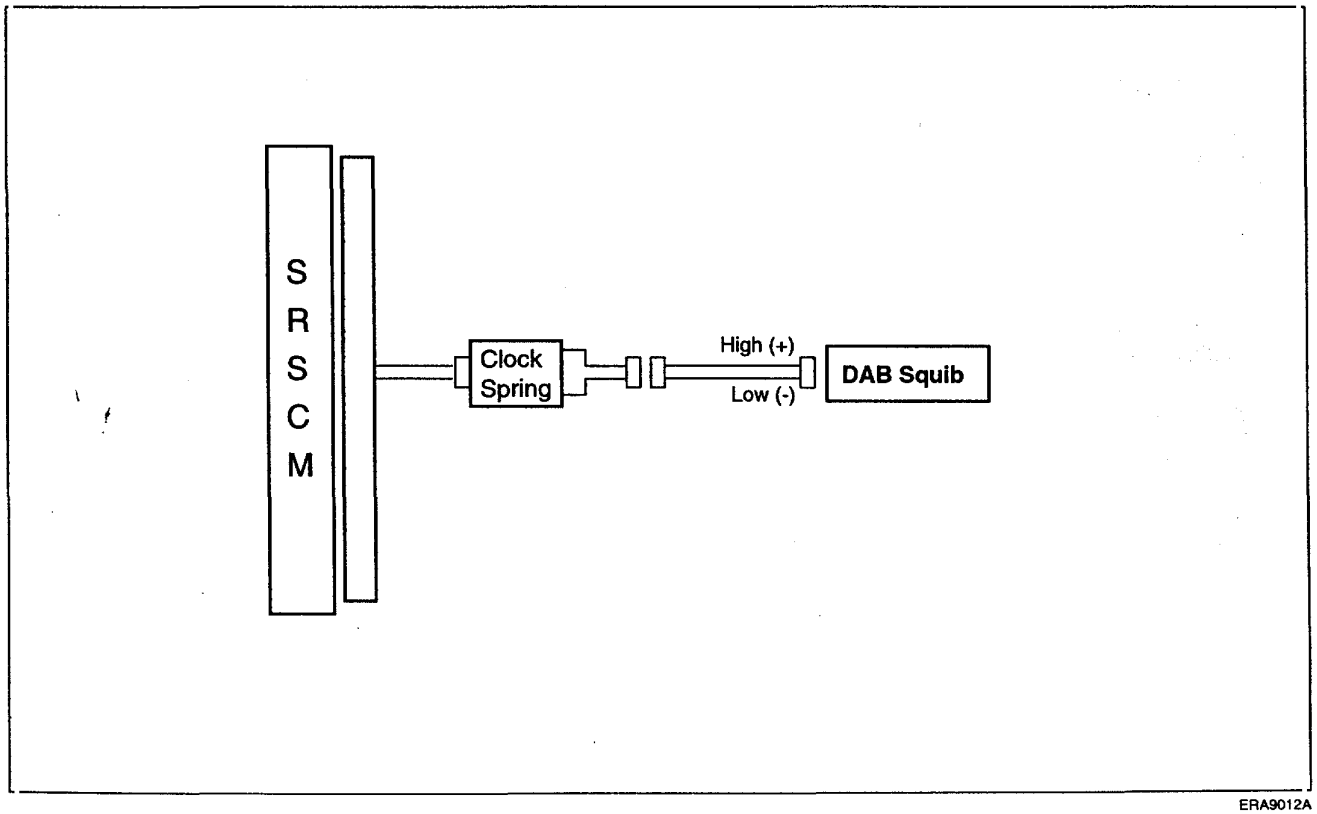
DTC	B1346 DAB resistance too high (R ≥ 6.0Ω) B1347 DAB resistance too low (R ≤ 0.9Ω) B1481 2nd stage DAB resistance too high (R ≥ 6.0Ω) B1482 2nd stage DAB resistance too low (R ≤ 0.9Ω)

CIRCUIT DESCRIPTION

The DAB squib circuit consists of the SRSCM, the clock spring, the DAB. It causes the airbag to deploy when the airbag deployment conditions are satisfied. The above DTCs are recorded when the DAB circuit is open or the DAB resistance too high or low is detected in the DAB squib circuit.

DTC Detecting Condition	Trouble Area
• Too high or low resistane between DAB high (+) wiring harness and DAB low (-) wiring harness of squib. • DAB malfunction • Clock spring malfunction • SRSCM malfunction	• DAB squib • Clock spring • SRSCM • Wire harness • 2nd stage DAB squib

WIRING DIAGRAM



ERA9012A

INSPECTION PROCEDURE

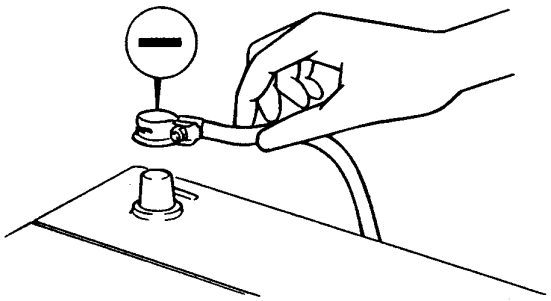
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.



EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

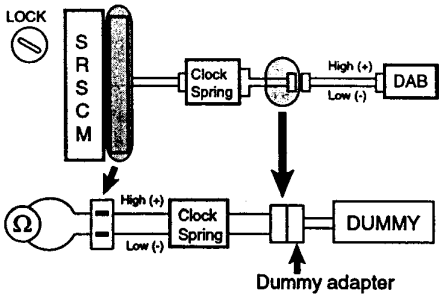
2. Check the DAB resistance.
   [PREPARATION]
   Release the airbag activation prevention mechanism on SRSCM side of airbag squib side. Connect the dummy (0957A-38200) and dummy adapter (0957A-38400) to the clock spring side connector.

⊗ WARNING

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester.

NOTE

Before checking the resistance, you have to insert the shorting bar insert plastic that is attached to the diagnosis checker into the SRSCM connector.



ERKB010C

[CHECK]
Measure the resistance between the DAB high (+) and low (-).
1.6Ω ≤ R ≤ 4.1Ω

NG ➔ Go to step "4"

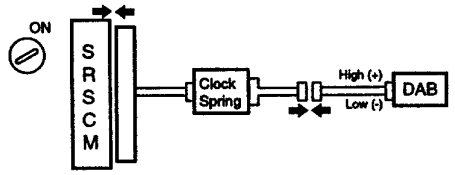
OK

ERJB043A

3. Check the DAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the DAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011U

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the DAB.

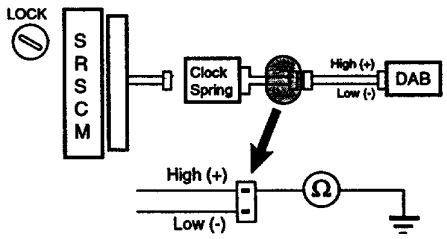
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041G

4. Check the clock spring.
[PREPARAION]
Disconnect the connector between the SRSCM clock spring, and connect the dummy connector (0957A-38200) and dummy adapter (0957A-38400) to the clock spring side connector.

⊗ WARNING

Before checking the resistance, you have to insert the shorting bar insert plastic that is attached to the diagnosis checker into the SRSCM connector.



ERKB010D

[CHECK]
Measure the resistance between the DAB high (+) and low (-).
1.6Ω ≤ R ≤ 4.1Ω

NG ➔ Replace the clock spring.

OK
↓
Repair or replace the harness or the connector between the SRSCM and the clock spring.

ERDA027R

CIRCUIT INSPECTION (SRE-LC) K5A4A7E0

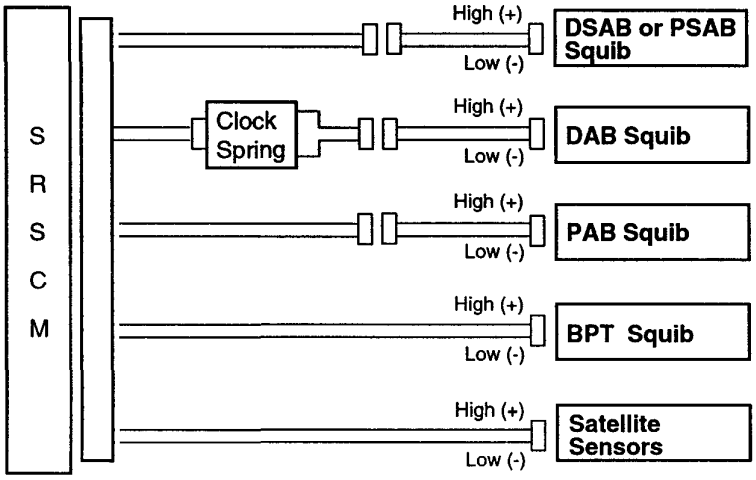
DTC	B1349 DAB Short to battery B1355 PAB Short to battery B1364 BPT (Driver) Short to battery B1370 BPT (Passenger) Short to battery B1381 SAB (Driver) short to battery B1385 SAB (Passenger) short to battery B1402 Satellite left side short to battery B1405 Satellite right side short to battery

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB, SAB, BPT and satellite sensor. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTCs are recorded when a B+ short is detected in the squib circuit.

DTC Detecting Condition	Trouble Area
• Short circuit in squib wire harness (to B+) • Squib malfunction • Spiral cable malfunction • SRSCM malfunction	• DAB squib • PAB squib • DSAB or PSAB squib • BPT squib • Satellite sensor • Wire harness

WIRING DIAGRAM



ERA9011A

INSPECTION PROCEDURE

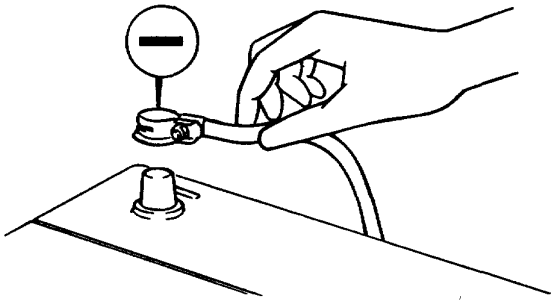
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.

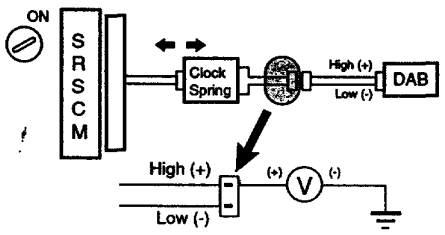


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the DAB squib circuit.



ERA9011O

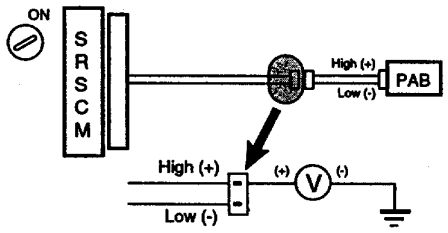
[CHECK]
For the connector (on the clock spring side) between the clock spring and the DAB, measure the voltage between the DAB high and body ground.
Voltage : 0 V

NG ➔ Go to step "13"

OK
↓
Go to step "8"

ERFB014A

3. Check the PAB squib circuit.



ERA9011P

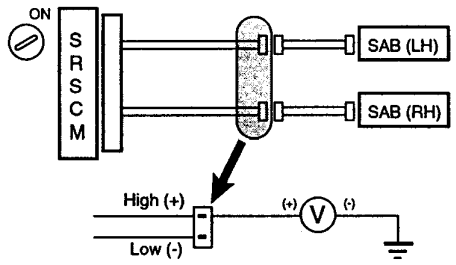
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the PAB, measure the voltage between the PAB high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the PAB.

OK
↓
Go to step "9"

ERFB015A

4. Check the SAB squib circuit.



ERA9011Q

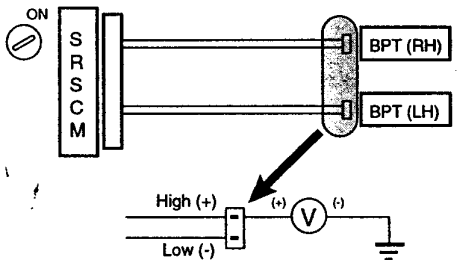
[CHECK]
For the connector (on the SRSCM side) between the SRSCM and the SAB, measure the voltage between the SAB high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the SAB.

OK ↓
Go to step "10"

ERFB014C

5. Check the BPT squib circuit.



ERA9011R

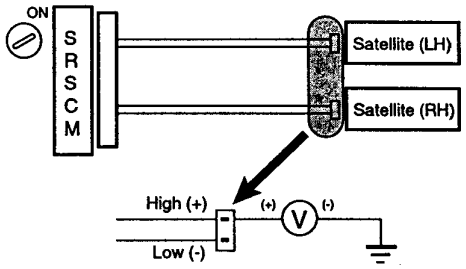
[CHECK]
For the connector between the SRSCM and the BPT, measure the voltage between the BPT high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the BPT.

OK ↓
Go to step "11"

ERFB014D

6. Check the Satellite sensor circuit.



ERA9011S

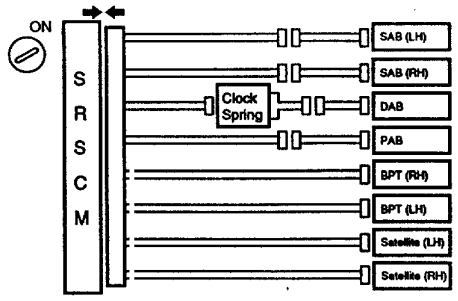
[CHECK]
For the connector between the SRSCM and the Satellite sensor, measure the voltage between the Satellite sensor high and body ground.
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the Satellite sensor.

OK ↓
Go to step "12"

ERJB041E

7. Check the SRSCM.



ERA9011G

[PREPARATION]

1. Connect the connector to the SRSCM.
2. Using a service wire, connect the DAB high and low on the clock spring side of the connector between the clock spring and the DAB.
3. Using a service wire, connect the PAB high and low on the SRSCM side of the connector between the SRSCM and the PAB.
4. Using a service wire, connect the SAB high and low on the SRSCM side connector between the SRSCM and the SAB.
5. Using a service wire, connect the BPT high and low on the SRSCM side connector between the SRSCM and the BPT.
6. Using a service wire, connect the satellite high and low on the SRSCM side connector between the SRSCM and the satellite sensor.
7. Connect negative (-) battery cable to the battery, and wait at least 30 seconds.

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the SRSCM.

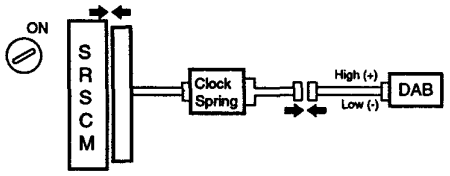
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041F

8. Check the DAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the DAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011U

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the DAB.

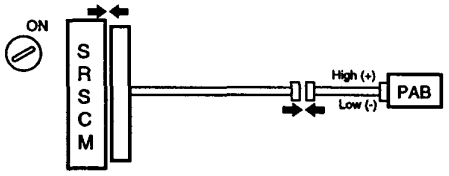
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041G

9. Check the PAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the PAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011V

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   DTC is not output.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the PAB.

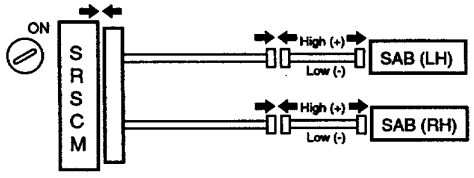
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041H

10. Check the SAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the SAB connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011W

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch ON, and wait for 30 seconds.
5. Using the Hi-Sacn Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG ➔ Replace the SAB.

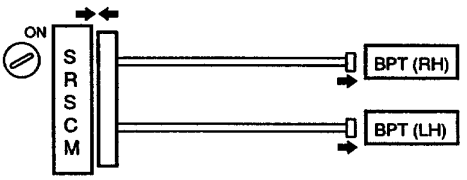
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041I

11. Check the BPT squib.

[PREPARATION]

1. Turn the ignition swich to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the the BPT connector.
4. Connect the negative (-) terminal cable from the battery, and wait for 30 seconds.



ERA9011X

[CHECK]

1. Turn the ignition switch to ON, and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the BPT.

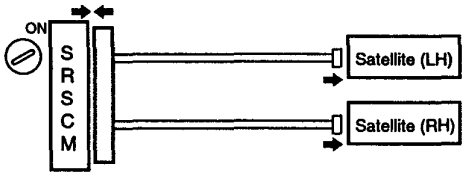
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041J

12. Check the Satellite sensors.

[PREPARATION]

1. Turn ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
3. Connect the Satellite sensor connector.
4. Connect the negative (-) terminal cable from the battery, and wait at least 30 seconds.



ERA9011Y

[CHECK]

1. Turn the ignition switch to ON, and wait at least 30 seconds.
2. Clear the malfunction code stored in memory with Hi-scan Pro.
3. Turn the ignition switch to LOCK, and wait at least 30 seconds.
4. Turn the ignition switch to ON, and wait at least 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the Satellite sensor.

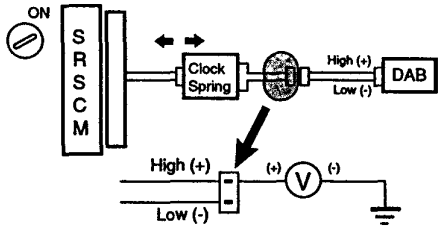
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041K

13. Check the clock spring.

[PREPARAION]

1. Turn the ignition switch to LOCK.
2. Disconnect the connector between the SRSCM and the clock spring.



ERA9011O

[CHECK]
Turn the ignition switch to ON, and measure voltage between the DAB high and body ground.
Voltage : 0 V

NG ➔ Replace the clock spring.

OK
↓
Repair or replace the harness or the connector between the SRSCM and the clock spring.

ERDA027R

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K5AC7E40

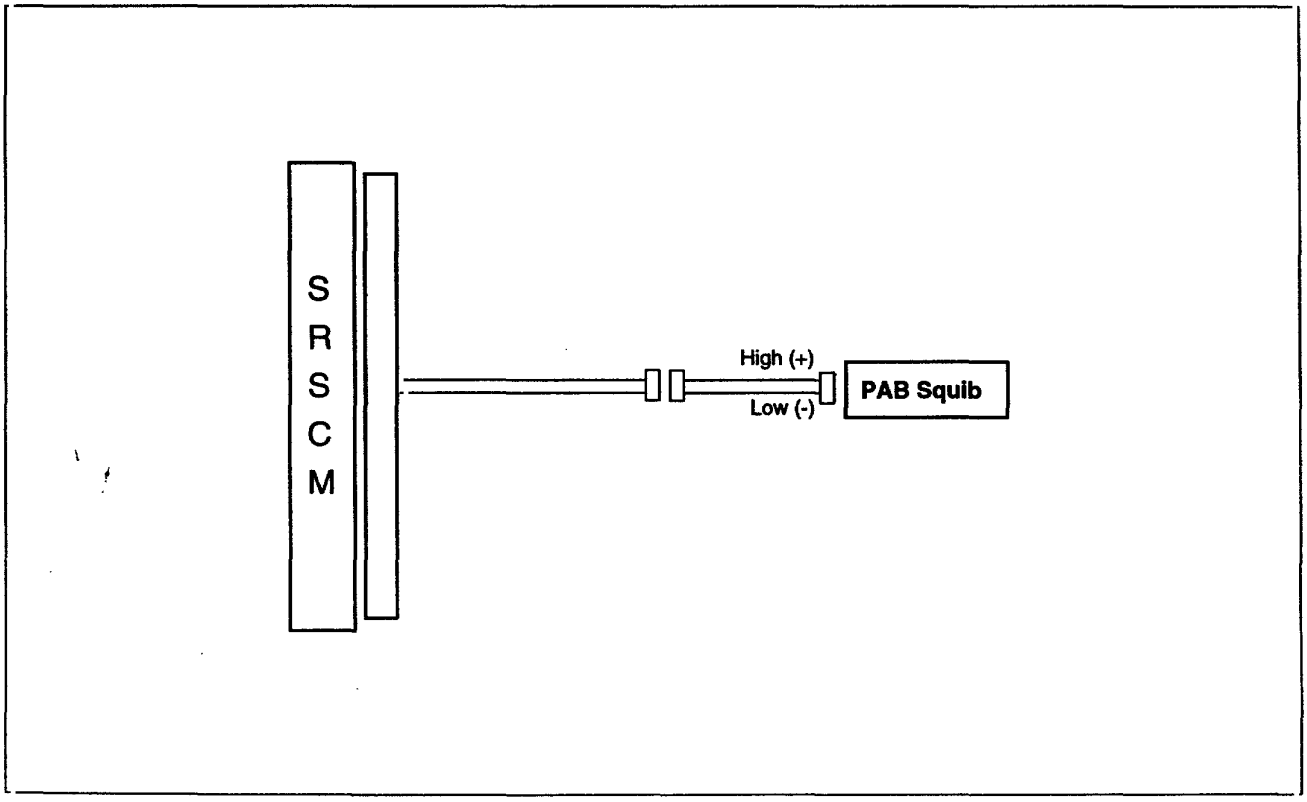
DTC	B1352 PAB resistance too high (R ≥ 4.2Ω) B1353 PAB resistance too low (R ≤ 1.0Ω) B1485 2nd stage PAB resistance too high (R ≥ 4.2Ω) B1486 2nd stage PAB resistance too low (R ≤ 1.0Ω)

CIRCUIT DESCRIPTION

The PAB squib circuit consists of the SRSCM and PAB. It causes the airbag to deploy when the airbag deployment conditions are satisfied. The above DTCs are recorded when the PAB circuit is open or the PAB resistance too high orlow is detected in the PAB squib circuit.

DTC Detecting Condition	Trouble Area
• Too high or low resistane between PAB high (+) wiring harness and PAB low (-) wiring harness of squib. • PAB malfunction • SRSCM malfunction	• PAB squib • SRSCM • Wire harness • 2nd stage PAB squib

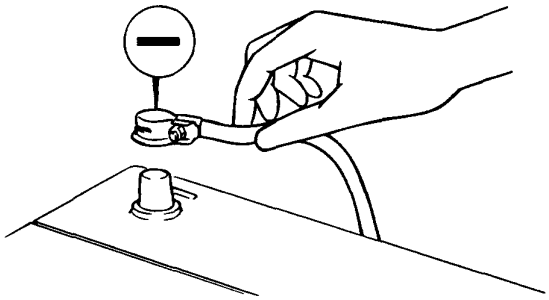
WIRING DIAGRAM



ERA9012E

INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the SRSCM connector.



EADA011A

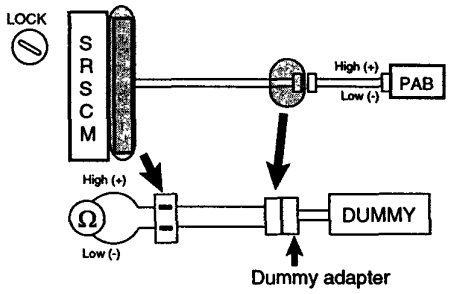
WARNING

Place the DAB with the front surface facing upward.

2. Check the PAB resistance.
   [PREPARATION]
   Release the airbag activation prevention mechanism on the SRSCM side of the airbag squib side. Connect the dummy (0957A-38200) and dummy adapter (0957A-25100) to PAB connector of the SRSCM connector side.

WARNING

Before checking the resistance, you have to insert the shorting bar insert plastic that is attached to the diagnosis checker into the SRSCM connector.



ERKB010E

[CHECK]
Measure the resistance between the PAB high (+) and the PAB low (-).
1.8Ω ≤ R ≤ 2.8Ω

NG → Repair or replace the harness between the SRSCM and the PAB.

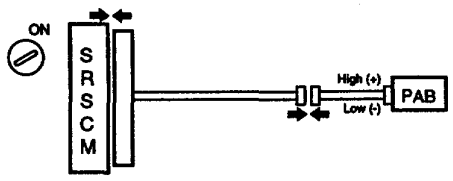
OK ↓

ERJB044A

3. Check the PAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the PAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9011V

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the PAB.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041H

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) KDFECBCC

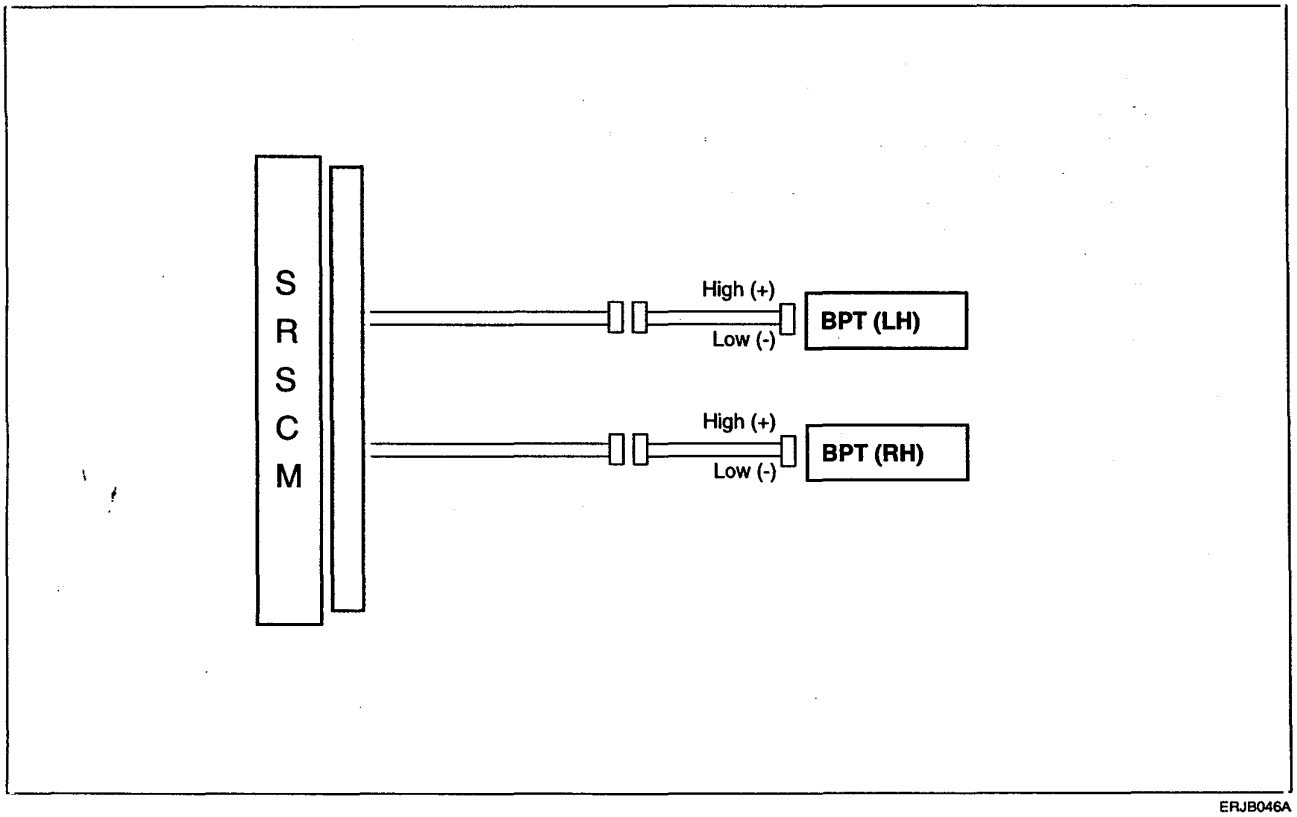
DTC	B1361 DBPT Resistance too high (R ≥ 4.7Ω) B1362 DBPT Resistance too low (R ≤ 0.9Ω) B1367 PBPT Resistance too high (R ≥ 4.7Ω) B1368 PBPT Resistance too low (R ≤ 0.9Ω)

CIRCUIT DESCRIPTION

The BPT squib circuit consists of the SRSCM and BPT. It causes the airbag to deploy when the airbag deployment conditions are satisfied. The above DTCs are recorded when the BPT circuit is open or the BPT resistance too high or low is detected in the BPT squib circuit.

DTC Detecting Condition	Trouble Area
• Too high or low resistane between BPT high (+) wiring harness and BPT low (-) wiring harness of squib. • BPT malfunction • SRSCM malfunction	• BPT squib • SRSCM • Wire harness

WIRING DIAGRAM



ERJB046A

INSPECTION PROCEDURE

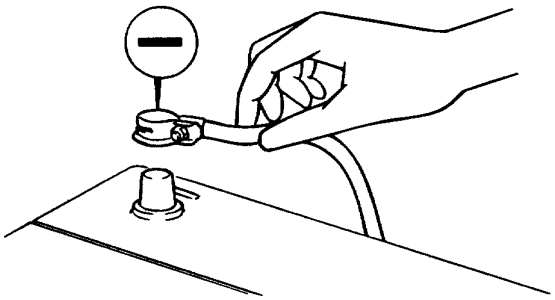
1. Preparation

   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.

   2) Remove the DAB module.

   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.

   4) Disconnect the SRSCM connector.



EADA011A

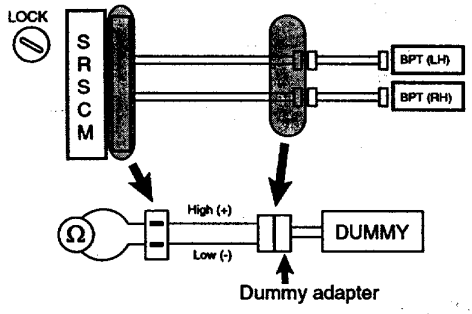
⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the BPT resistance.
   [PREPARATION]
   Release the airbag activation prevention mechanism on the SRSCM side of the airbag squib side. Connect the dummy (0957A-38200) and dummy adapter (0957A-38400) to the BPT connector of the SRSCM connector side.

NOTE

Before checking the resistance, you have to insert the shorting bar insert plastic that is attached to the diagnosis checker into the SRSCM connector.



ERJB046D

[CHECK]
Measure the resistance between the BPT high (+) and the BPT low (-).
1.8Ω ≤ R ≤ 3.1Ω

NG ➔ Repair or replace the harness between the SRSCM and the BPT.

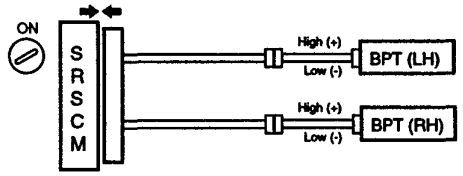
OK ↓

ERJB046B

3. Check the BPT squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the BPT connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERJB046C

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the BPT.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041J

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) KD605008

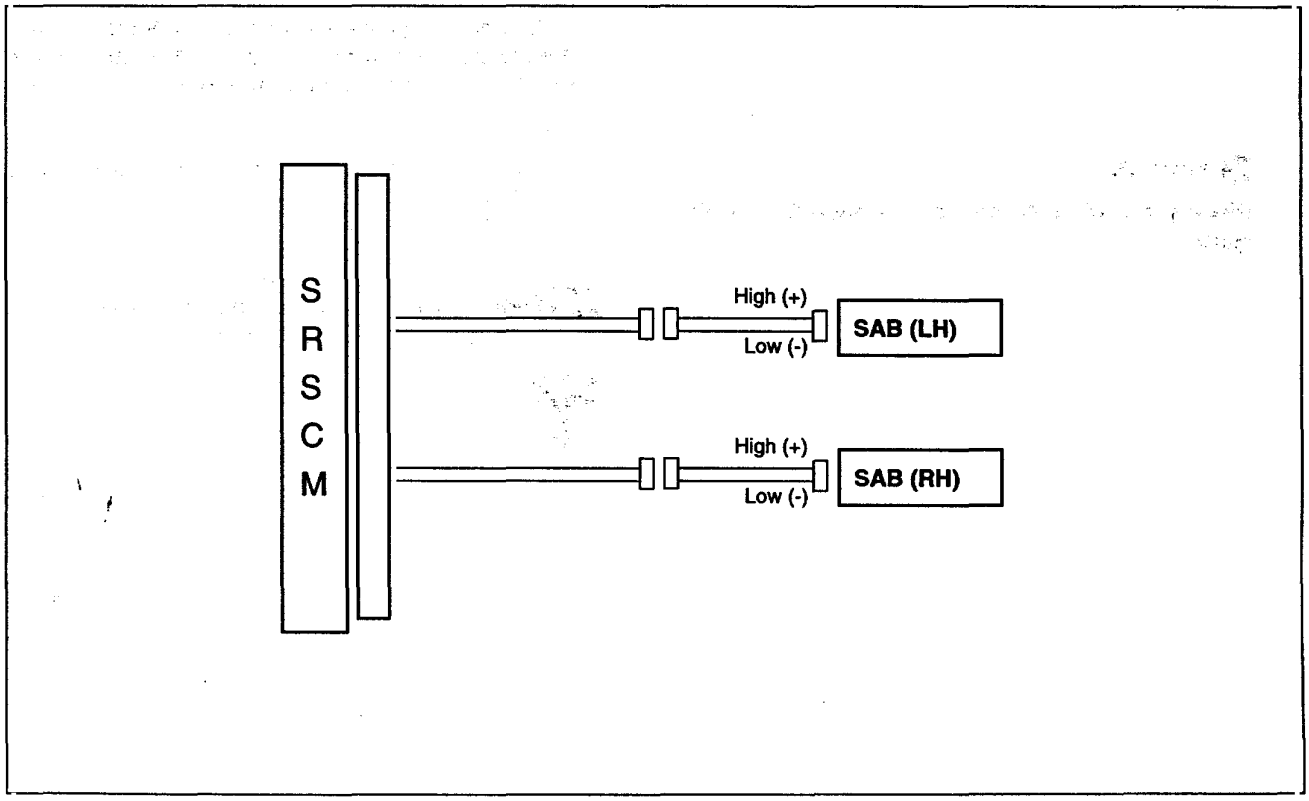
DTC	B1378 DSAB Resistance too high (R ≥ 4.2Ω) B1379 DSAB Resistance too low (R ≤ 1.0Ω) B1382 PSAB Resistance too high (R ≥ 4.2Ω) B1383 PSAB Resistance too low (R ≤ 1.0Ω)

CIRCUIT DESCRIPTION

The SAB squib circuit consists of the SRSCM and SAB. It causes the airbag to deploy when the airbag deployment conditions are satisfied. The above DTCs are recorded when the SAB circuit is open or the SAB resistance too high or low is detected in the SAB squib circuit.

DTC Detecting Condition	Trouble Area
• Too high or low resistane between SAB high (+) wiring harness and SAB low (-) wiring harness of squib. • SAB malfunction • SRSCM malfunction	• SAB squib • SRSCM • Wire harness

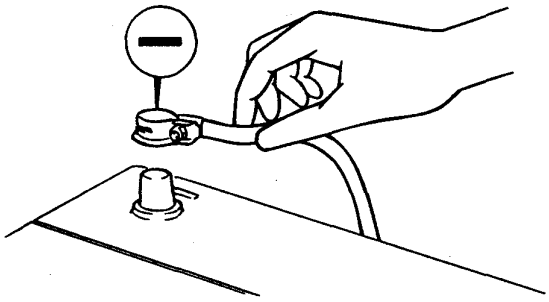
WIRING DIAGRAM



ERJB045B

INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the SRSCM connector.

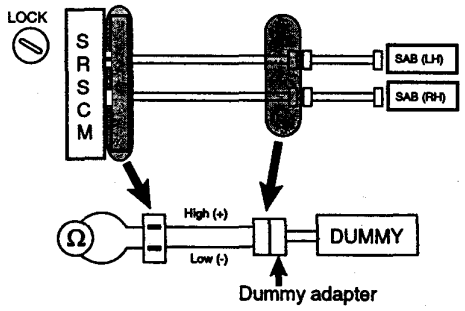


EADA011A

⊗ WARNING

Place the DAB with the front surface facing upward.

2. Check the SAB resistance.
   [PREPARATION]
   Release the airbag activation prevention mechanism on the SRSCM side of the airbag squib side. Connect the dummy (0957A-38200) and dummy adapter (0957A-38300) to the SAB connector of the SRSCM connector side.



ERKB020A

⊗ WARNING

Before checking the resistance, you have to insert the shorting bar insert plastic that is attached to the diagnosis checker into the SRSCM connector.

[CHECK]
Measure the resistance between the SAB high (+) and the SAB low (-).
1.8Ω ≤ R ≤ 2.8Ω

NG → Repair or replace the harness between the SRSCM and the SAB.

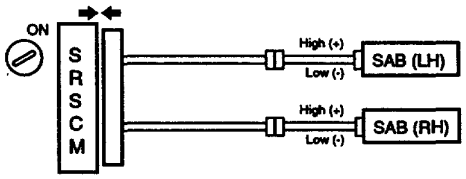
OK ↓

ERJB045A

3. Check the SAB squib.

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the SAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9012K

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using Hi-Scan Pro, check the DTC.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this procedure.

NG ➔ Replace the SAB.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB0411

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K9CBEFD9

DTC	B1387 Driver seat track position sensor short to GND B1388 Driver seat track position sensor short to Battery B1389 Driver seat track position sensor defect B1390 Passenger seat track position sensor short to GND B1391 Passenger seat track position sensor short to Battery B1392 Passenger seat track position sensor defect

CIRCUIT DESCRIPTION

This system detects driver seat and passenger seat position and determines the airbag deployment condition. (If the seat position is within 5 clicks at the seat track forward, low pressure deployment is determined. Otherwise, high or low pressure depleyment depending on the condition.)

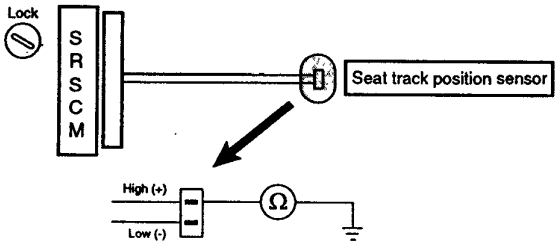
INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the connector of theSRSCM.

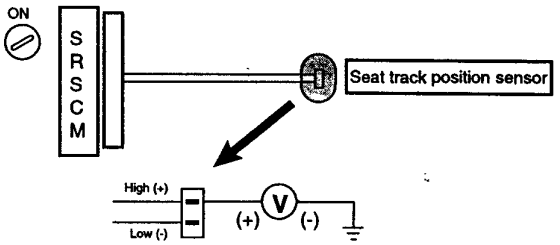
   ⚠ ***CAUTION***

   Place the DAB with the front surface facing upward.

2. Check seat track position sensor circuit (Short to GND/Battery).



ERDD105B



ERDD105C

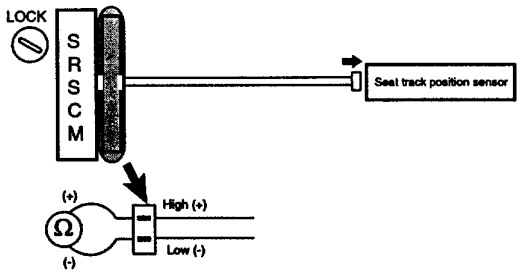
[CHECK]
Measure the voltage and resistance of the seat track position sensor high and body ground between the SRSCM connector and the seat track position sesnor connector.
Resistance : ∞
Voltage : 0 V

NG → Repair or replace the harness between the SRSCM and the seat track position sensor.

OK ↓

ERDD105D

3. Check the seat track position sensor.



ERDD105S

[CHECK]
Check the resistance.
SWITCH OPEN : R = 900Ω ± 10% (Backward : over 5 clicks)
SWITCH CLOSED : R = 300Ω ± 10% (Forward : within 5 clicks)

NG ➔ Replace the Seat track position sensor.

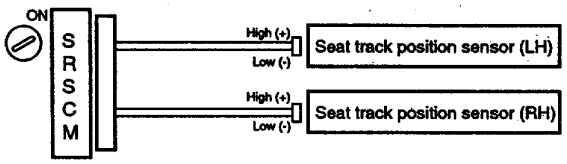
OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD105F

4. Check the seat track position sensor. (Defect)

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the seat track position sensor connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERDD105E

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory of the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

]HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the Seat track position sensor.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD105F

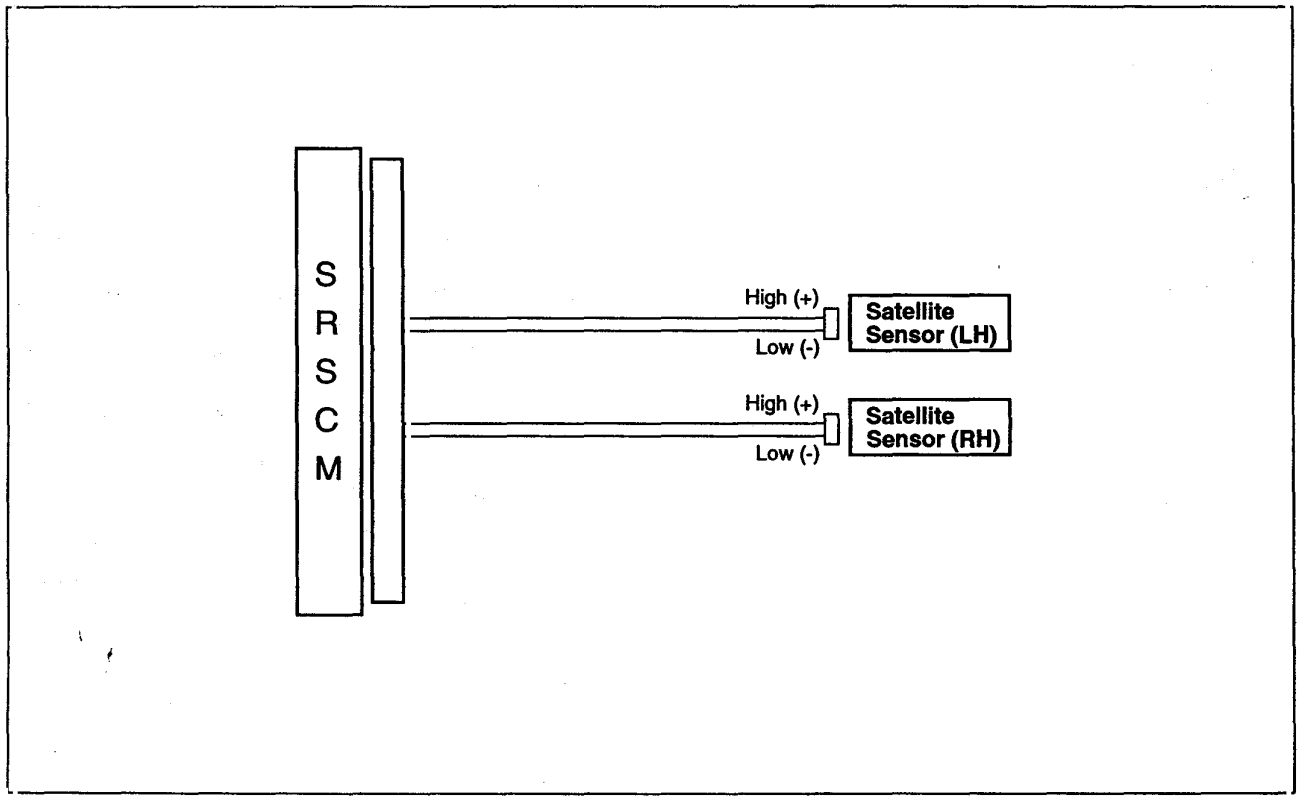
CIRCUIT INSPECTION (DUAL STAGE AIRBAG) KF83909B

DTC	B1400 Satellite sensor left side defect B1403 Satellite sensor right side defect B1409 Satellite sensor left communication error B1410 Satellite sensor right communication error B1414 Satellite sensor left side wrong ID B1415 Satellite sensor right side wrong ID

CIRCUIT DESCRIPTION

The release system for the airbag consists of the SRSCM and two satellite sensor - one on the left - hand side and one on the right. The above DTCs are recorded when the defect or communication error of a satellite sensor is detected in the satellite circuit.

WIRING DIAGRAM



ERA9012L

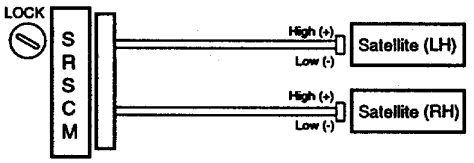
INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the SRSCM connector.

⚠ ***CAUTION***

Place the DAB with the front surface facing upward.

2. Check sensor Satellite circuits (Communication error).



ERA9012M

[PREPARATION]
Check sensor continuity between sensor SRSCM connector and both satellite connector's high (+) and low (-) sides.
OK : Continuity

NG ➔ Repair or replace the harness between the SRSCM and the Satellite sensor.

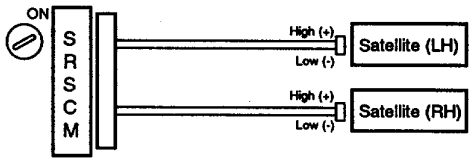
OK
↓

ERJB047A

3. Check the Satellite sensor (Defect).

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the satellite connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERA9012N

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory of the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the Satellite sensor.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERJB041K

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) KE3B840C

DTC	B1511 Driver seat buckle switch open/short to Battery B1512 Driver seat buckle switch short to GND B1513 Passenger seat buckle swithch open/short to Battery B1514 Passenger seat buckle swithch short to GND B1515 Driver seat buckle switch defect B1516 Passenger seat buckle switch defect

CIRCUIT DESCRIPTION

This system decides whether the seat position of the driver or passenger are locked and then prevent the belt pretensioner from deploying on crash.

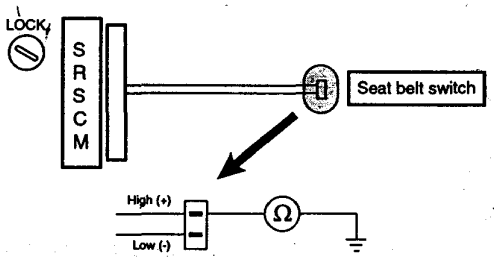
INSPECTION PROCEDURE

1. Preparation
   1) Disconnect the negative (-) terminal cable from the battery, and wait at least 30 seconds.
   2) Remove the DAB module.
   3) Disconnect the connectors of the PAB, left and right side airbags, belt pretensioners and satellite sensors.
   4) Disconnect the connector of theSRSCM.

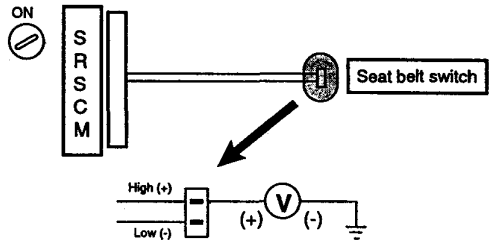
   ⚠ ***CAUTION***

   Place the DAB with the front surface facing upward.

2. Check buckle switch sensor circuit (Short to GND/Battery).



ERKB030B



ERKB030C

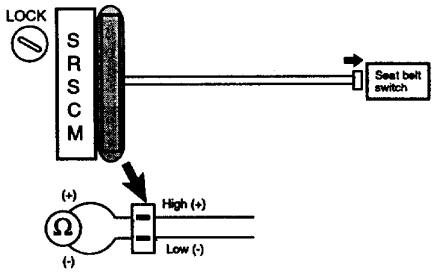
[CHECK]
Measure the voltage and resistance of the seat track position sensor high and body ground between the SRSCM connector and the seat track position sesnor connector.
Resistance : ∞
Voltage : 0 V

NG ➔ Repair or replace the harness between the SRSCM and the seat belt swtich.

OK ↓

ERKB049B

3. Check the seat belt switch.



ERKB030D

[CHECK]
Check the resistance with the switch on and off.
SWITCH OPEN : R = 4KΩ ± 10% (Belted)
SWITCH OPEN : R = 1KΩ ± 10% (Unbelted)

NG ➔ Replace the seat belt switch

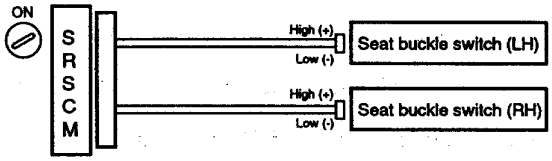
OK
↓
From the results of the above inspection the malfunctioning part can now be considered normal.

ERKB049C

4. Check the seat buckle switch (Defect).

[PREPARATION]

1. Turn the ignition switch to LOCK.
2. Disconnect the negative (-) terminal cable from the battery, and wait for 30 seconds.
3. Connect the seat buckle switch connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.



ERDD103B

[CHECK]

1. Turn the ignition switch to ON, and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory of the Hi-Scan Pro.
3. Turn the ignition switch to LOCK, and wait for 30 seconds.
4. Turn the ignition switch to ON, and wait for 30 seconds.
5. Using the Hi-Scan Pro, check for DTCs.
   There is no DTC.

[HINT]
Codes other than these may be output at this time, but they are not relevant to this check.

NG ➔ Replace the Seat buckle switch.

OK
↓
From the results of the above inspection, the malfunctioning part can now be considered normal.

ERDD103C

CIRCUIT INSPECTION (SRE-LC) K9F6B0C8

DTC	B1620 Internal fault B1650 Crash recorded (Frontal-Replace SRSCM) B1661 Parameter configuration missing/incorrect

CIRCUIT DESCRIPTION

SRSCM MALFUNCTION

The SRSCM monitors the following :

1. Condition of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integrity. (detection of faulty closure)
4. Plausibility of the accelerometer signal.
5. Operation of the SRSCM components.

The timely completion of all tests is monitored by a separate hardware watchdog. During normal operation, the watchdog is triggered periodically by the SRSCM. If the SRSCM fails to trigger the watchdog, the watchdog will reset the SRSCMand activate the SRI (Service Reminder Indicator). The SRSCM must be replaced once the above fault codes are confirmed.

CIRCUIT INSPECTION (DUAL STAGE AIRBAG) K7512515

DTC	B1395 Firing loop interconnection fault B1620 Internal fault B1650 Crash recorded (Frontal airbag) B1651 Crash recorded (Driver side airbag) B1652 Crash recorded (Passenger side airbag) B1657 Crash recorded (Belt pretensioner only) B1670 2nd stage crash recorded (Frontal airbag)

CIRCUIT DESCRIPTION

SRSCM MALFUNCTION

The SRSCM monitors the following :

1. Condition of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integrity. (detection of faulty closure)
4. Plausibility of the accelerometer signal.
5. Operation of the SRSCM components.

The timely completion of all tests is monitored by a separate hardware watchdog. During normal operation, the watchdog is triggered periodically by the SRSCM. If the SRSCM fails to trigger the watchdog, the watchdog will reset the SRSCMand activate the SRI (Service Reminder Indicator). The SRSCM must be replaced once the above fault codes are confirmed.

For B1657 five times reusablility is possible.

CIRCUIT INSPECTION (SRE-LC) K85F0B63

DTC	B2500 Warning lamp failure

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRI flashes for approx. 6 seconds after the ignition switch is turned ON, and then turns off automatically. If there is a malfunction in the airbag system, the SRI lights up to inform the driver of the abnormality. The SRSCM shall measure the voltage at the airbag SRI (Malfunction Indicator Lamp) output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

INSPECTION PROCEDURE

1. Check the fuse.

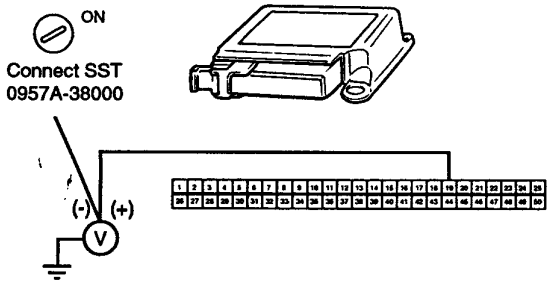
   [PREPARATION]

   1. Remove fuse airbag fuse and airbag warning lamp fuse from the junction block.
   2. Inspect the state of the fuses.
   3. Replace if necessary.

2. Check the SRS warning lamp circuit.

   [PREPARATION]

   1. Connect the negative (-) terminal cable to the battery.
   2. Turn the ignition switch to ON.



ERDD049A

[CHECK]

1. Measure voltage at the harness side connector of the SRSCM.
   Voltage : 9-16 V

NG → Check the SRS warning light bulb/repair the SRS warning light circuit.

OK ↓

ERDA032A

2. Check the SRS SRI (Service Reminder Indicator).
   OK : SRS SRI ON

NG → If no fault is found in wiring or connector, replace the SRSCM.

OK ↓

From the results of the above inspection, the part can now be considered to be normal.

ERDA032B

CIRCUIT INSPECTION (DUAL STAGE AIRBAG)

DTC	B2500 Warning lamp failure B2502 Passenger deactivation lamp failure

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRI flashes for approx. 6 seconds after the ignition switch is turned ON, and then turns off automatically. If there is a malfunction in the airbag system, the SRI lights up to inform the driver of the abnormality. The SRSCM shall measure the voltage at the airbag SRI (Malfunction Indicator Lamp) output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

INSPECTION PROCEDURE

1. Check the fuse.

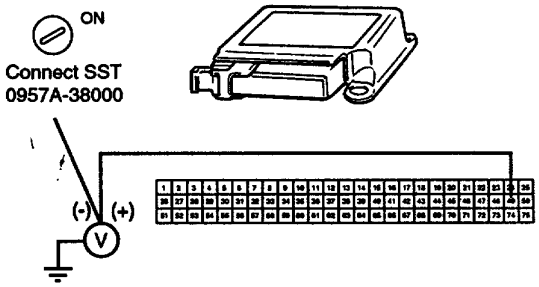
   [PREPARATION]

   1. Remove fuse airbag fuse and airbag warning lamp fuse from the junction block.
   2. Inspect the state of the fuses.
   3. Replace if necessary.

2. Check the SRS warning lamp circuit.

   [PREPARATION]

   1. Connect the negative (-) terminal cable to the battery.
   2. Turn the ignition switch to ON.



ERDD106B

[CHECK]

1. Measure voltage at the harness side connector of the SRSCM.
   Voltage : 10-16.5 V

NG ➔ Check the SRS warning light bulb/repair the SRS warning light circuit.

OK ↓

ERDA032A

2. Check the SRS SRI (Service Reminder Indicator).
   OK : SRS SRI ON

NG ➔ If no fault is found in wiring or connector, replace the SRSCM.

OK ↓

From the results of the above inspection, the part can now be considered to be normal.

ERDA032B

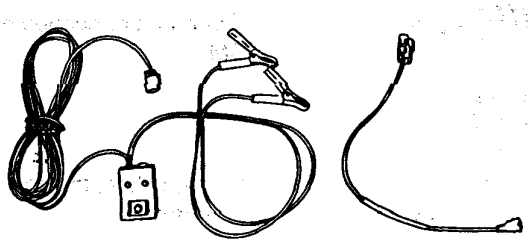
AIR BAG MODULE DISPOSAL

FIELD DEPLOYMENT PROCEDURES K478AA08

⊗ WARNING

When handling the deployed airbag be careful that not the dust enters your eyes and always wear gloves to avoid direct contact with the dust.

AIRBAG REMOTE DEPLOYMENT DEVICES

Tool, Number, Name	Use
Deployment tool (0957A-34100A) SRS DEPLOYMENT ADAPTER HARNESS DAB, BPT : 0957A-38500 PAB, SAB : 0957A-38100 PAB (DUAL STAGE) : 0957A-25000  ERDA034A	Deployment inside the vehicle (if the vehicle will no longer be driven)

AIRBAG MODULE DISPOSAL PROCEDURES

Before disposing of a vehicle equipped with an airbag, or prior to disposing of the airbag module, be sure to first follow the procedures described below to deploy the airbag.

DISPOSAL PLAN

Take the following disposal steps.

CASE		DISPOSAL PLAN
Abnormal problems in airbag module		Deploy and discard
Car scrapping	DAB, PAB, BPT, SAB	Deploy the airbag module with the SST
Crash (Deployed)		Discard

UNDEPLOYED AIRBAG MODULE DISPOSAL

⚠ *CAUTION*

1. ***If the vehicle is to be scrapped, junked, or otherwise disposed of, deploy the airbag inside the vehicle.***
2. ***Since there is a loud noise when the airbag is deployed, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.***
3. ***Since a large amount of smoke is produced when the airbag is deployed, select a well-ventilated site. Moreover, never attempt the test near a fire or smoke sensor.***

DEPLOYMENT INSIDE THE VEHICLE

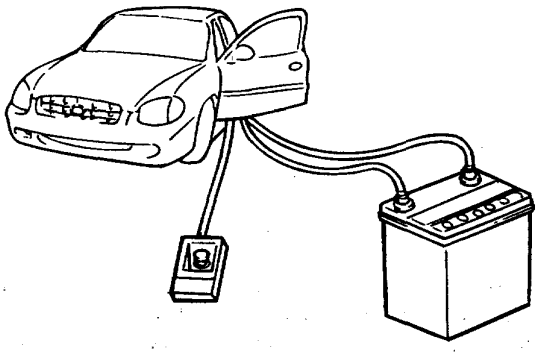
when vehicle will no longer be driven

1. Open all windows and doors of the vehicle. Move the vehicle to an isolated spot.
2. Disconnect the negative (-) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

⊗ **WARNING**

Wait at least 30 seconds after disconnecting the battery cable before doing any further work.

3. Remove the center crash pad side cover.
4. Remove Airbag SRSCM connector.
5. Connect deployment tool to the connector of each module.
6. At location as far away from the vehicle as possible, press the push button (removed from the vehicle) to deploy the airbag.



ERA9009B

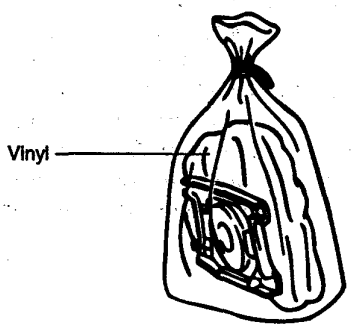
⊗ **WARNING**

1. **Before deploying the airbag in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.**
2. **The inflator will be quite hot immediately following the deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it. Although not poisonous, do not inhale gas from airbag deployment. See Deployed Airbag Module Disposal Procedures for post-deployment handling instructions.**
3. **If the airbag fails to deploy when the procedures above are followed, do not go near the module. Contact your local distributor.**

DEPLOYED AIRBAG MODULE DISPOSAL PROCEDURES

After deployment, the airbag module should be disposed of in the same manner as any other scrap part, except that the following points should be carefully noted during disposal.

1. The inflator will be quite hot immediately following deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it.
2. Do not put water or oil on the airbag after deployment.
3. There may be adhered to the deployed airbag module, material that could irritate the eyes and/or skin, so wear gloves and safety glasses when handling a deployed airbag module. If despite these precautions, the material does get into your eyes or on your skin, immediately rinse the affected area with a large amount of clean water. If any irritation develops, seek medical attention.
4. Tightly seal the airbag module in a strong vinyl bag for disposal.

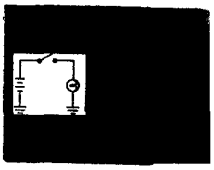


ERA9009C

5. Be sure to always wash your hands after completing this operation.

SCHEMATIC DIAGRAMS

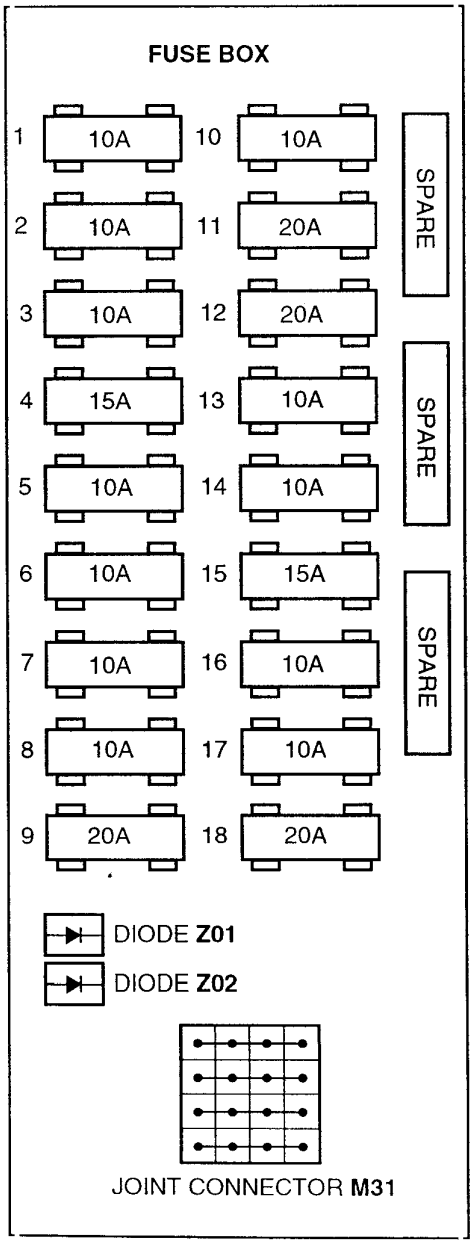
ACOUSTIC WARNING SYSTEM SD-84
AIR BAG SYSTEM (SRS) SD-152
ANTI-LOCK BRAKE SYSTEM (ABS) SD-66
AUDIO SD-110
AUTOMATIC TRANSAXLE CONTROL SYSTEM SD-60
BACK-UP & STOP LAMPS SD-138
BLOWER & A/C CONTROLS SD-158
CHARGING SYSTEM SD-34
CIGARETTE LIGHTER & DIGITAL CLOCK SD-72
COOLING SYSTEM SD-36
COURTESY LAMPS SD-142
DASH FUSE BOX DETAILS SD-14
DATA LINK DETAILS SD-24
DAYTIME RUNNING LIGHTS SD-118
ETACS (ELECTRONIC TIME & ALARM CONTROL SYSTEM) SD-74
FRONT FOG & REAR FOG LAMPS SD-130
FUEL FILTER HEATING SYSTEM (DIESEL) SD-58
FUSE & RELAY INFORMATION SD-2
GROUND DISTRIBUTION SD-18
HEAD LAMP LEVELING DEVICE SD-124
HEAD LAMP WASHER SD-122
HEAD LAMPS SD-116
HORNS SD-114
ILLUMINATIONS SD-146
IMMOBILIZER CONTROL SYSTEM SD-70
INDICATORS & GAUGES SD-86
MFI CONTROL SYSTEM (EXCEPT DIESEL) SD-40
MFI CONTROL SYSTEM (DIESEL) SD-48
MFI CONTROL SYSTEM (CARBURETOR) SD-56
POWER DISTRIBUTION SD-6
POWER DOOR LOCKS SD-92
POWER OUTSIDE MIRRORS SD-96
POWER WINDOWS SD-106
REAR WINDOW & OUTSIDE MIRROR DEFOGGERS SD-98
SEAT BELT WARNING & CHIME (WITHOUT ETACS) SD-102
SEAT WARMER SD-104
SHIFT & KEY LOCK SYSTEM SD-64
STARTING SYSTEM SD-30
TAIL, PARKING & LICENSE LAMPS SD-134
TURN & HAZARD LAMPS SD-126
VEHICLE SPEED SENSOR SD-28
WIPER & WASHER SD-78



FUSE & RELAY INFORMATIONS EEE0856C

DASH FUSE BOX

LAYOUT

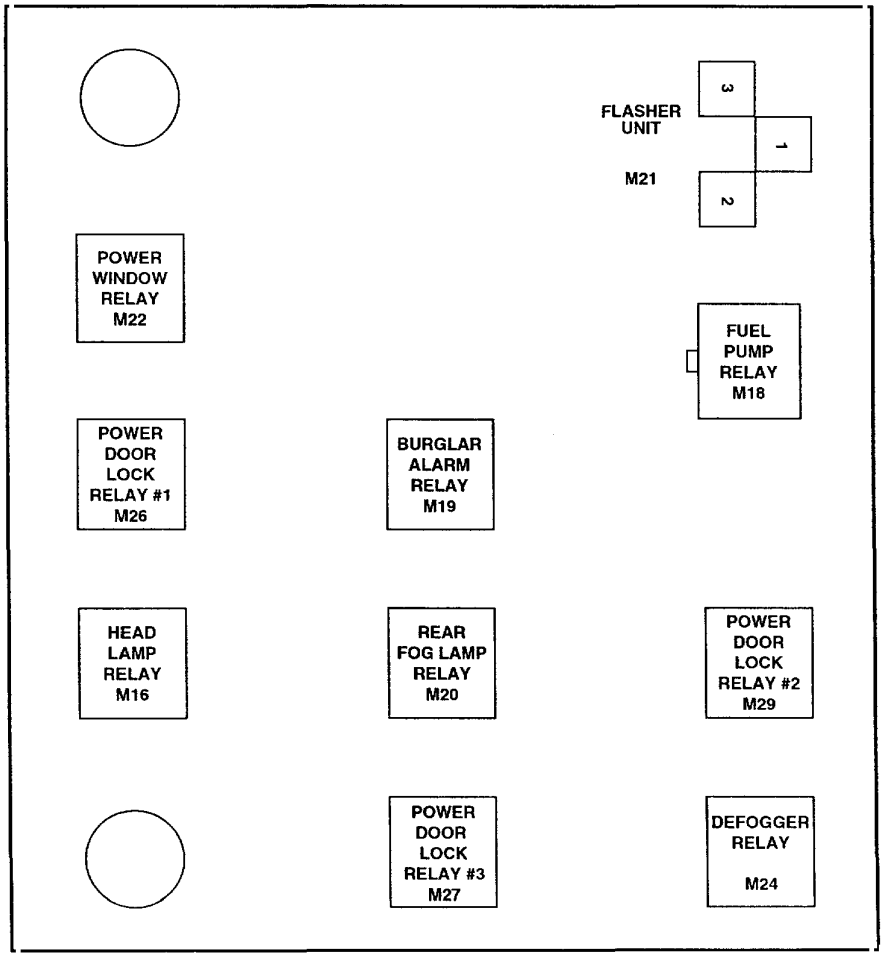


CIRCUIT

FUSE	AMPERAGES	Related Circuit
1	10A	Hazard warning, Back-up lamp switch, Transaxle range switch, A/T shift & key lock control module
2	10A	ETACM, Pre-Excitation resistor, Instrument cluster, Seat belt timer
3	10A	Instrument cluster
4	15A	Air bag
5	10A	ECM, A/T shift lever, Transaxle range switch, Mass air flow sensor, Vehicle speed sensor, Water sensor
6	10A	Power door lock
7	10A	Hazard warning, ETACM
8	10A	Stop lamp, A/T shift lever, A/T key interlock solenoid
9	20A	Rear window defogger
10	10A	Head lamp, Power window, Head lamp leveling, Head lamp washer, ETACM, Front fog lamp, Blower control, Rear intermittent washer, Fuel filter relay
11	20A	Front wiper & washer
12	20A	Seat warmer
13	10A	ABS control, ABS bleeding
14	10A	Digital clock, Audio, A/T shift & key lock control module
15	15A	Cigarette lighter
16	10A	Power outside mirror
17	10A	Rear window & outside mirror defogger
18	20A	Rear wiper

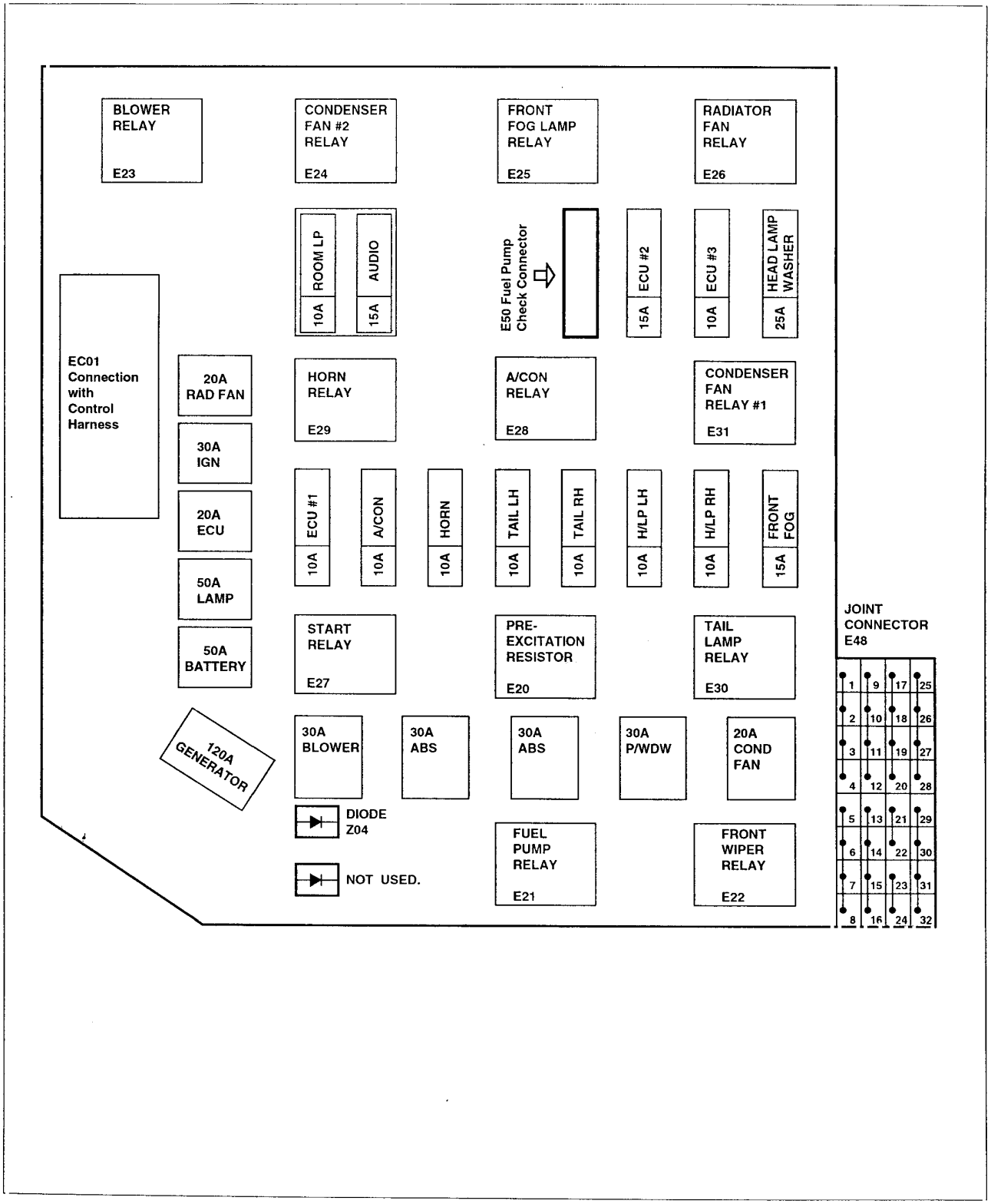
E2DD001A

PASSENGER COMPARTMENT RELAY BOX



E2DD001B

ENGINE COMPARTMENT RELAY & FUSE BOX



E2DD001C

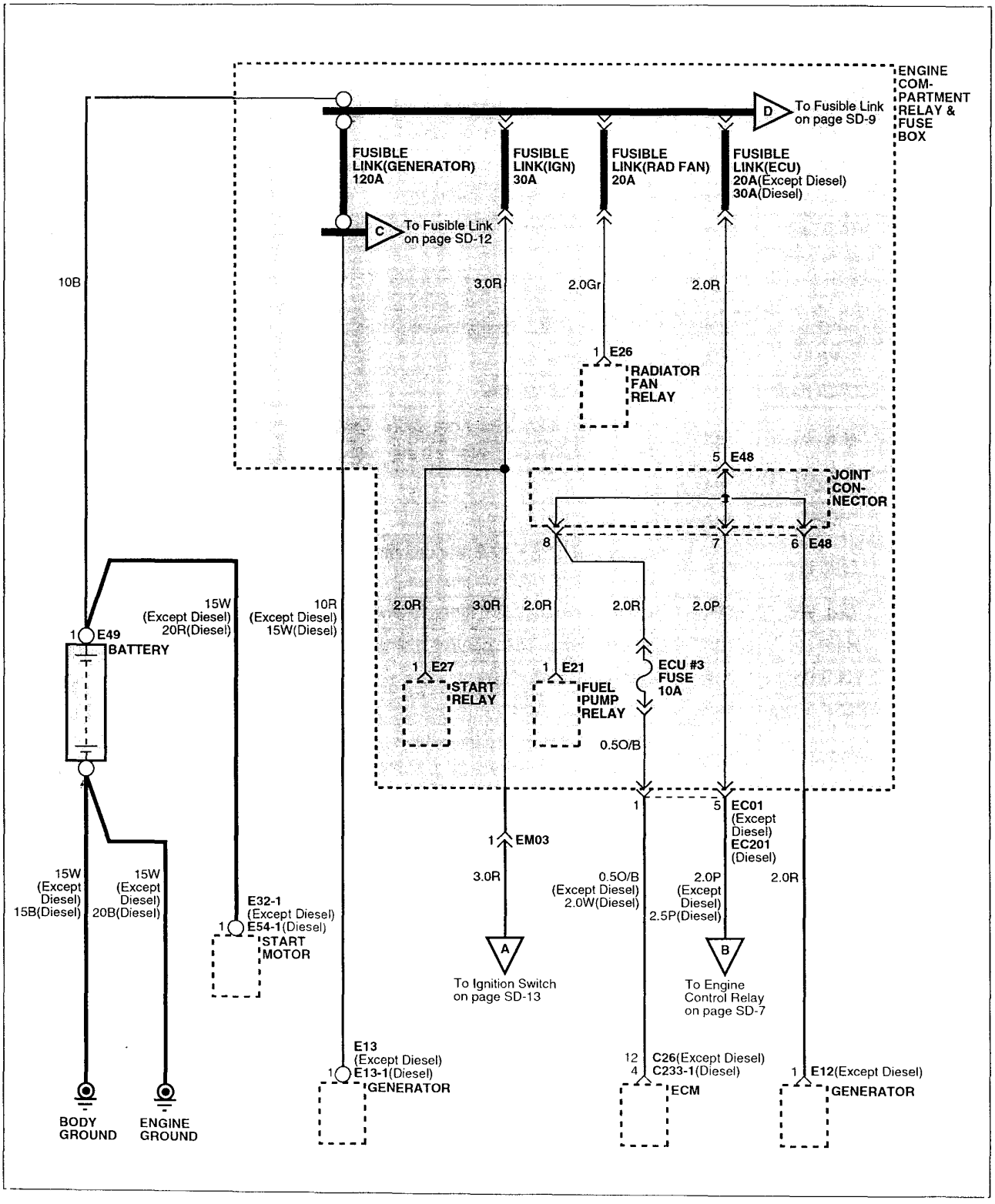
CIRCUIT

DESCRIPTION		(A)	RELATED CIRCUIT
FUSIBLE LINK	GENERATOR	120A	Charging (Generator)
	BATTERY	50A	Fuse 6,7,8,9, Horn fuse, Room lamp fuse
	LAMP	50A	Head lamp fuse, Front fog lamp fuse, Tail lamp relay, H/LP washer fuse
	ECU	20A/30A	Engine control relay, Generator, Fuel pump relay, ECU #3 fuse
	IGN	30A	Ignition power source, Start relay
	RAD FAN	20A	Radiator fan control
	BLOWER	30A	Blower control
	ABS	30A	ABS control, ABS bleeding connector
	ABS	30A	ABS control, ABS bleeding connector
	P/WDW	30A	Power window
	COND FAN	20A	Condenser fan control
FUSE	ECU #1	10A	Radiator fan, Condenser fan, ECM, Oxygen sensor, Purge control valve, SMATRA, Glow plug relay, Heater relay, Stop lamp switch
	A/CON	10A	A/C relay
	HORN	10A	Horn relay
	TAIL LH	10A	Illumination lamps, Left rear combination lamp, license lamp, DRL control, Position lamp, H/LP washer relay
	TAIL RH	10A	Right rear combination lamp, License lamp, Position lamp
	H/LP LH	10A	Left head lamp, DRL control, Instrument cluster
	H/LP RH	10A	Right head lamp
	FRONT FOG	15A	Front fog lamp relay
	ROOM LP	10A	Instrument cluster, Courtesy lamp, Trunk room lamp, ETACM, DLC, Door warning, Multipurpose check connector
	AUDIO	15A	Audio, Digital clock, Power antenna, A/C switch, Rear fog lamp switch
	ECU #2	15A	Idle speed actuator, ECM, Camshaft position sensor, EGR actuator, Throttle plate actuator
	ECU #3	10A	ECM
	H/L WASHER	25A	Head lamp washer motor
F/PUMP CHK (E50)			Fuel pump relay, Fuel pump motor

E2DD001D

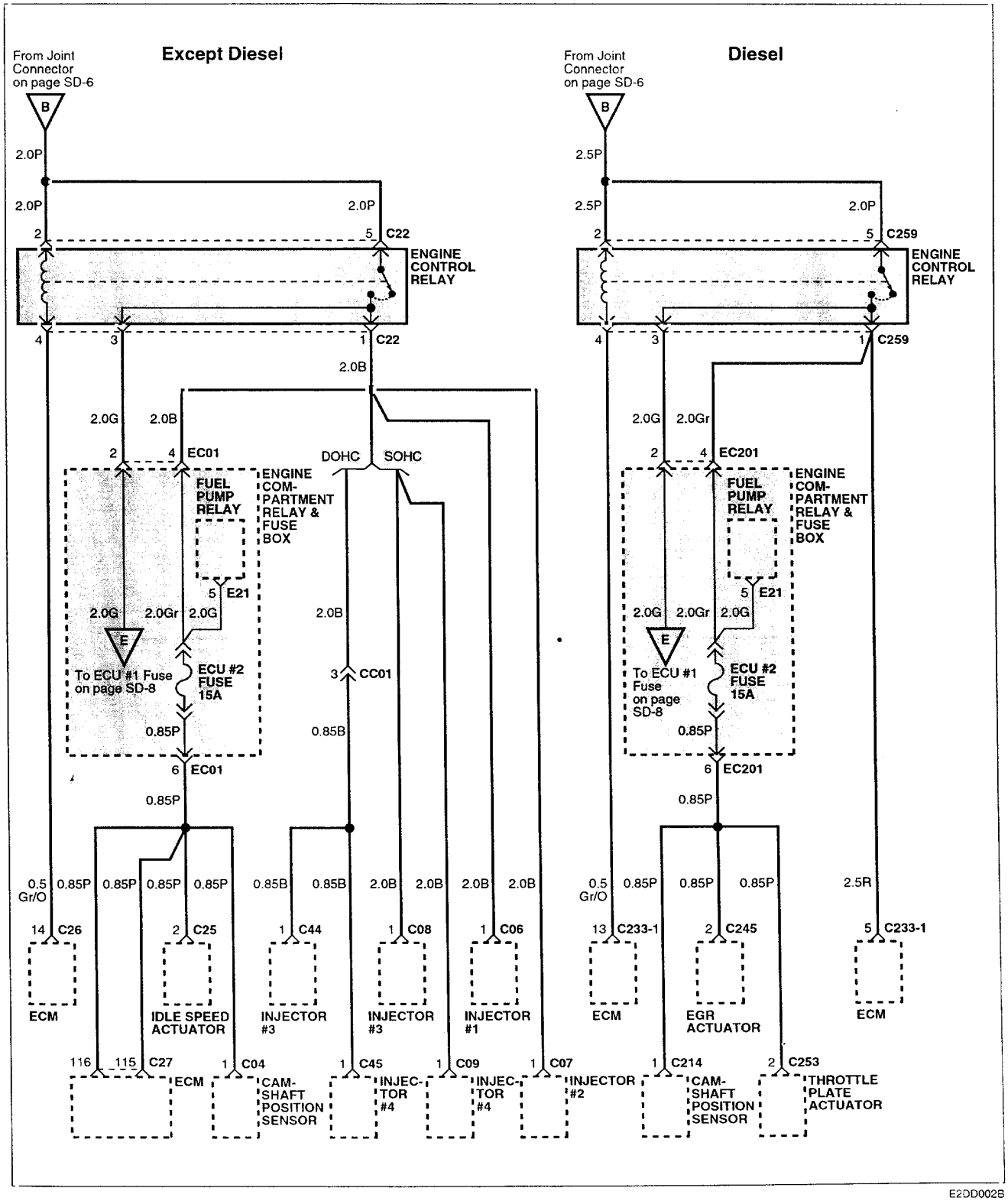
POWER DISTRIBUTION E4C95FD7

POWER DISTRIBUTION (1)



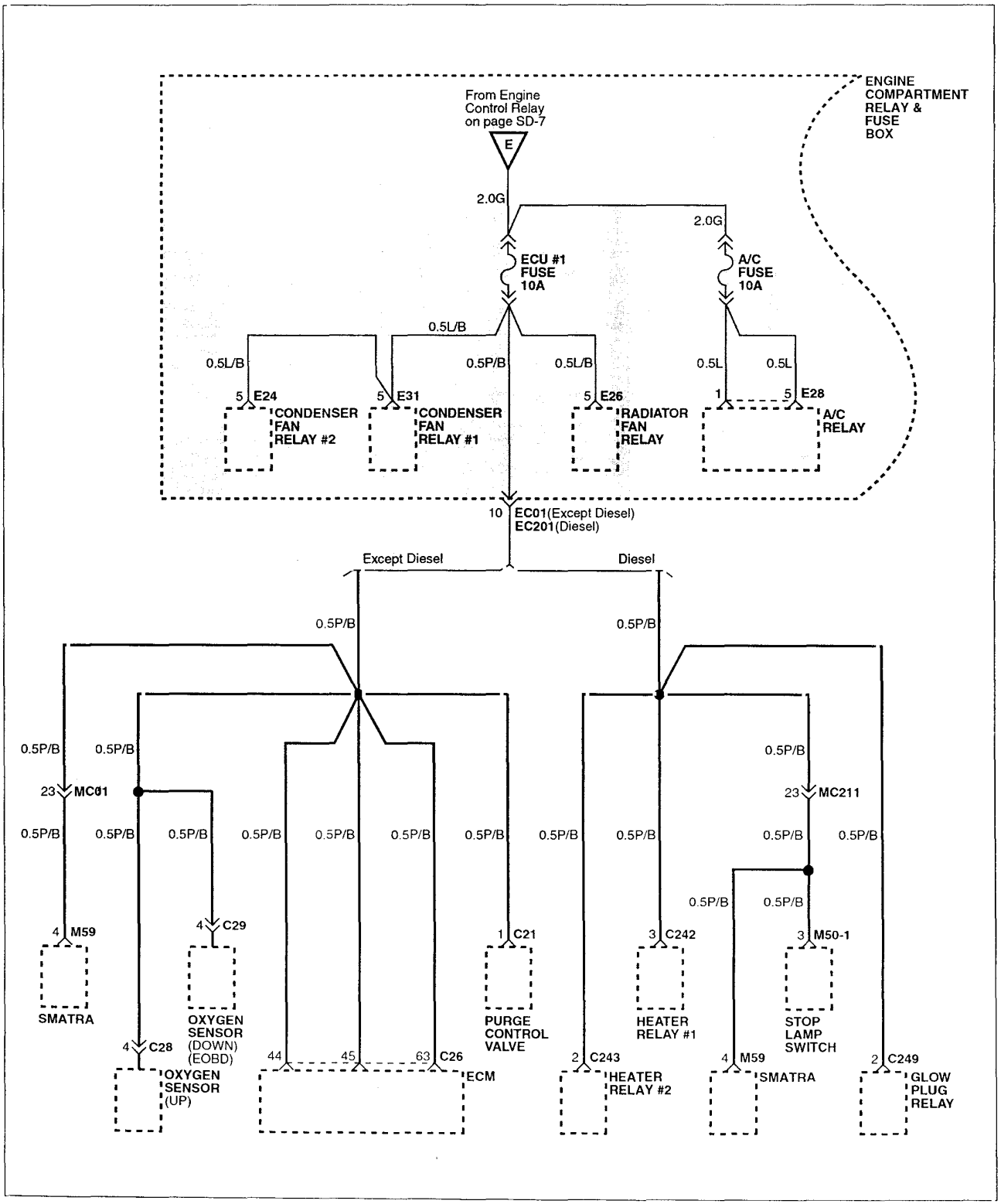
E2DD002A

POWER DISTRIBUTION (2)



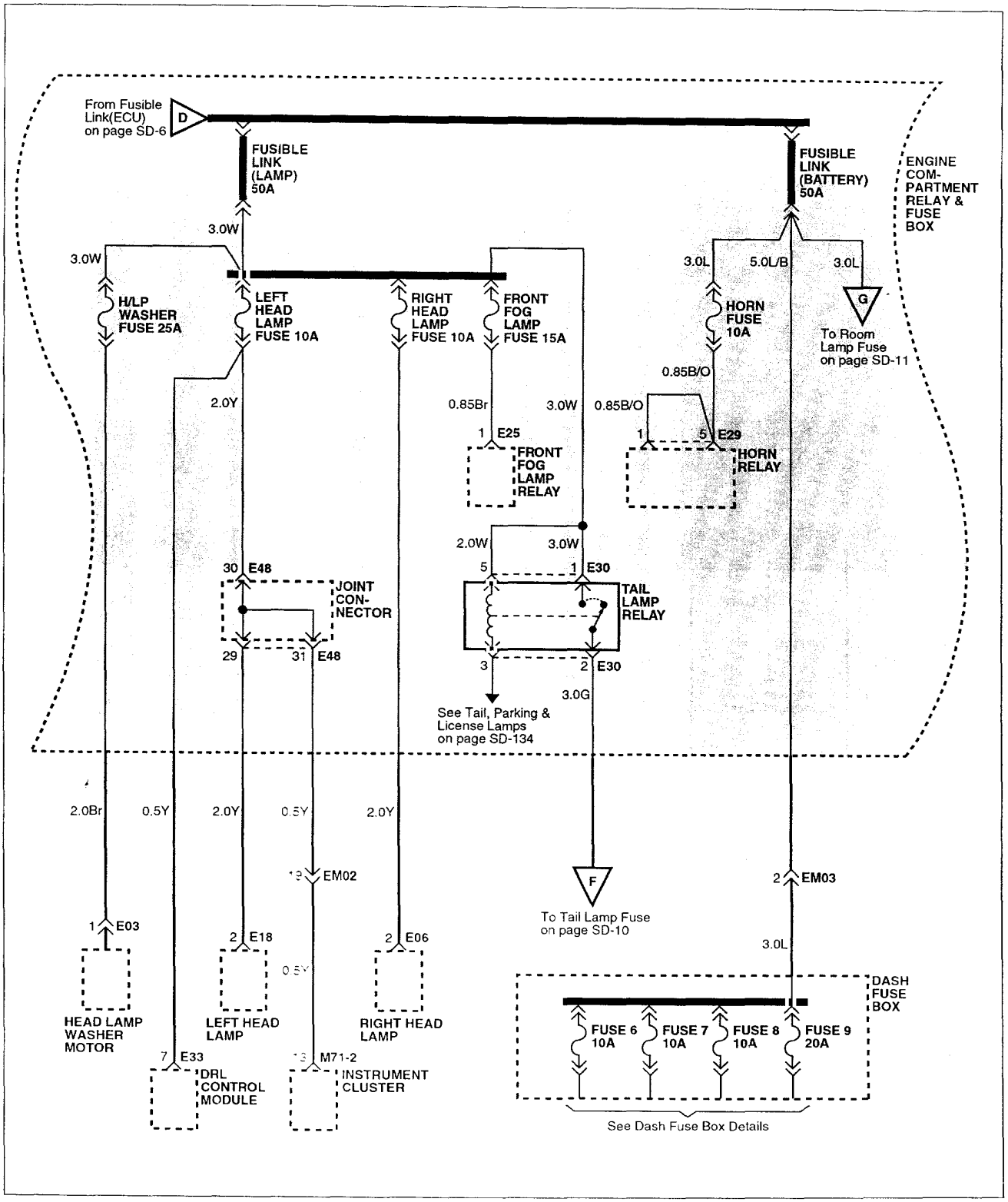
E2DD002B

POWER DISTRIBUTION (3)



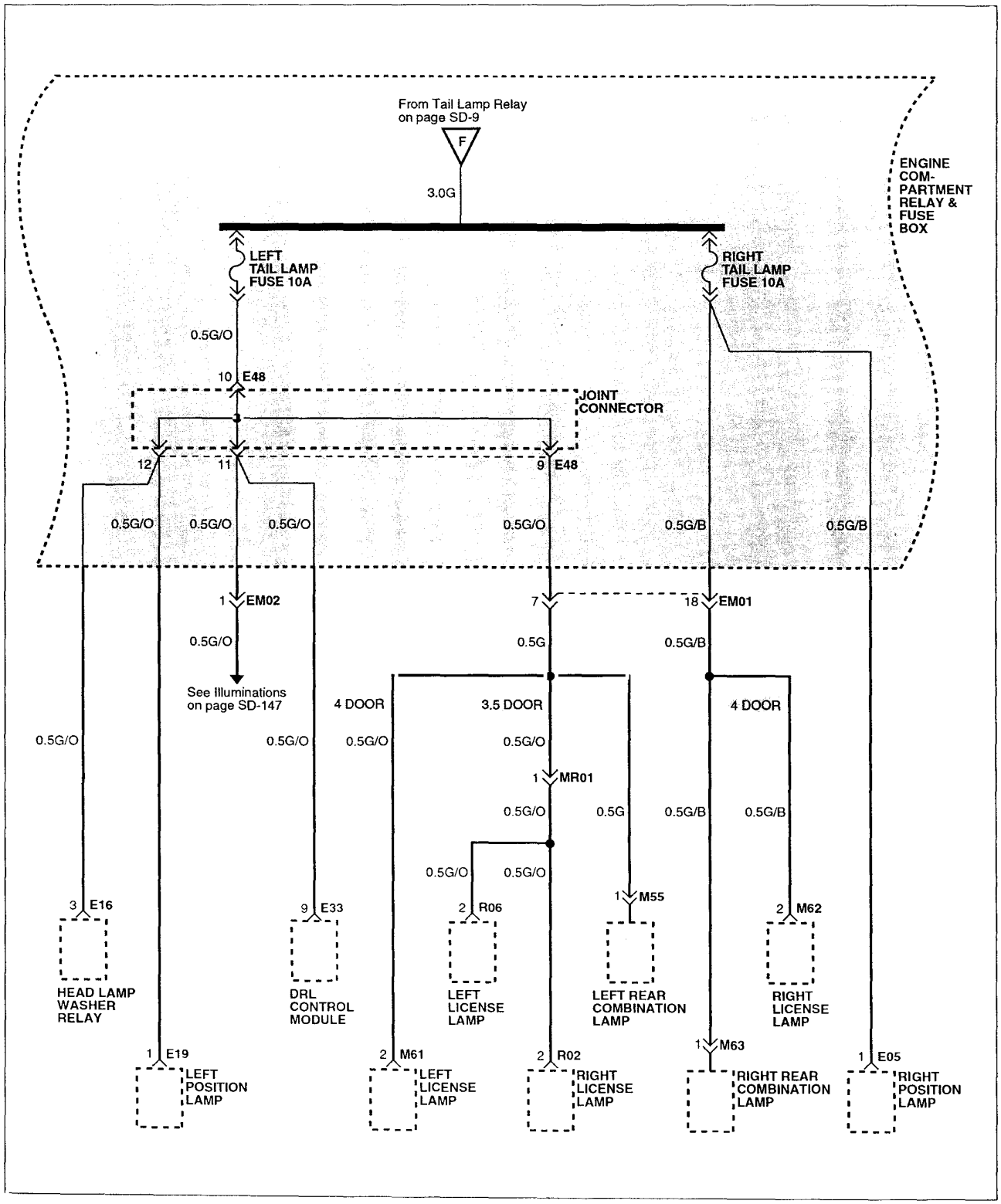
E2DD002C

POWER DISTRIBUTION (4)



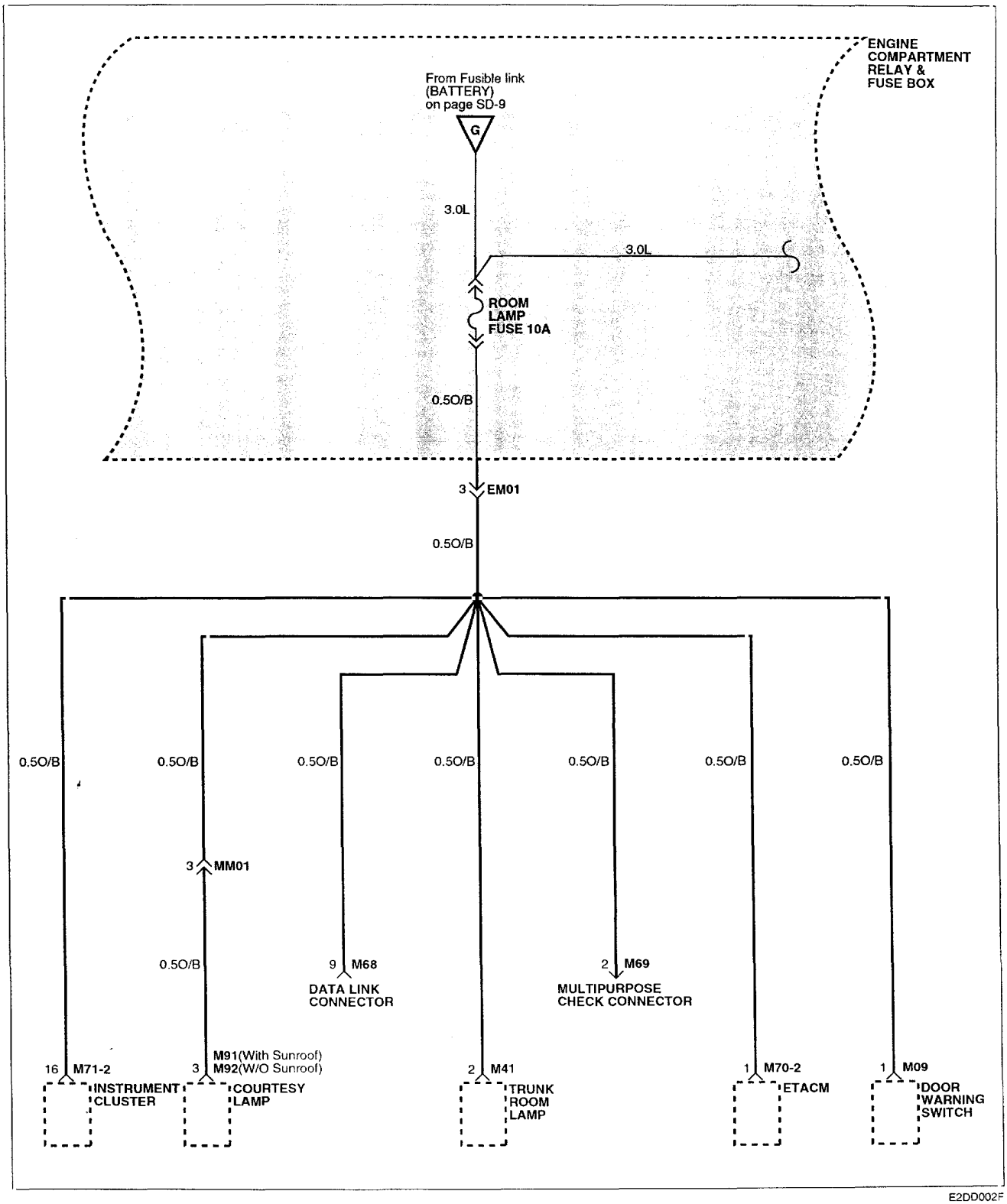
E2DD002D

POWER DISTRIBUTION (5)

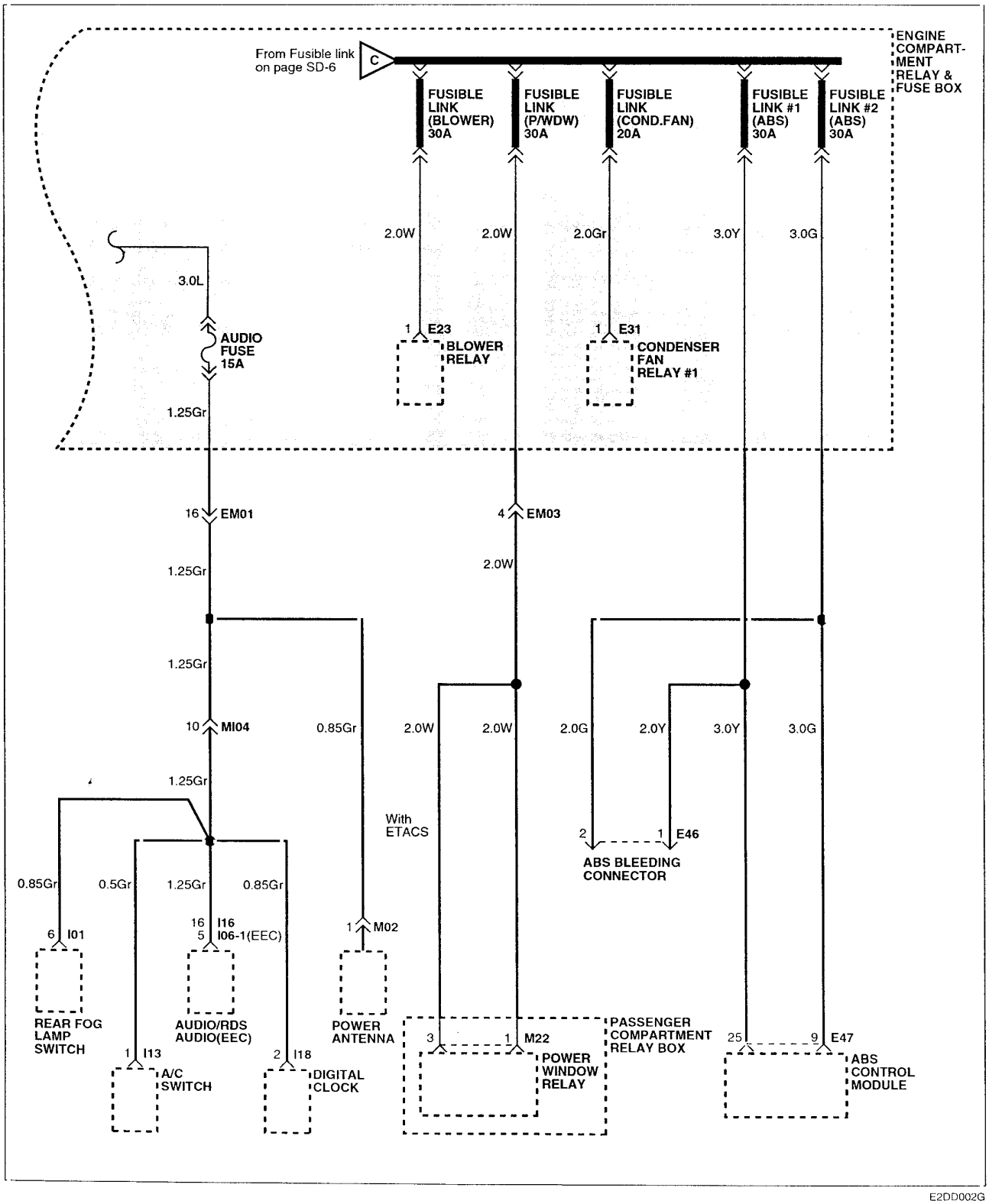


E2DD002E

POWER DISTRIBUTION (6)

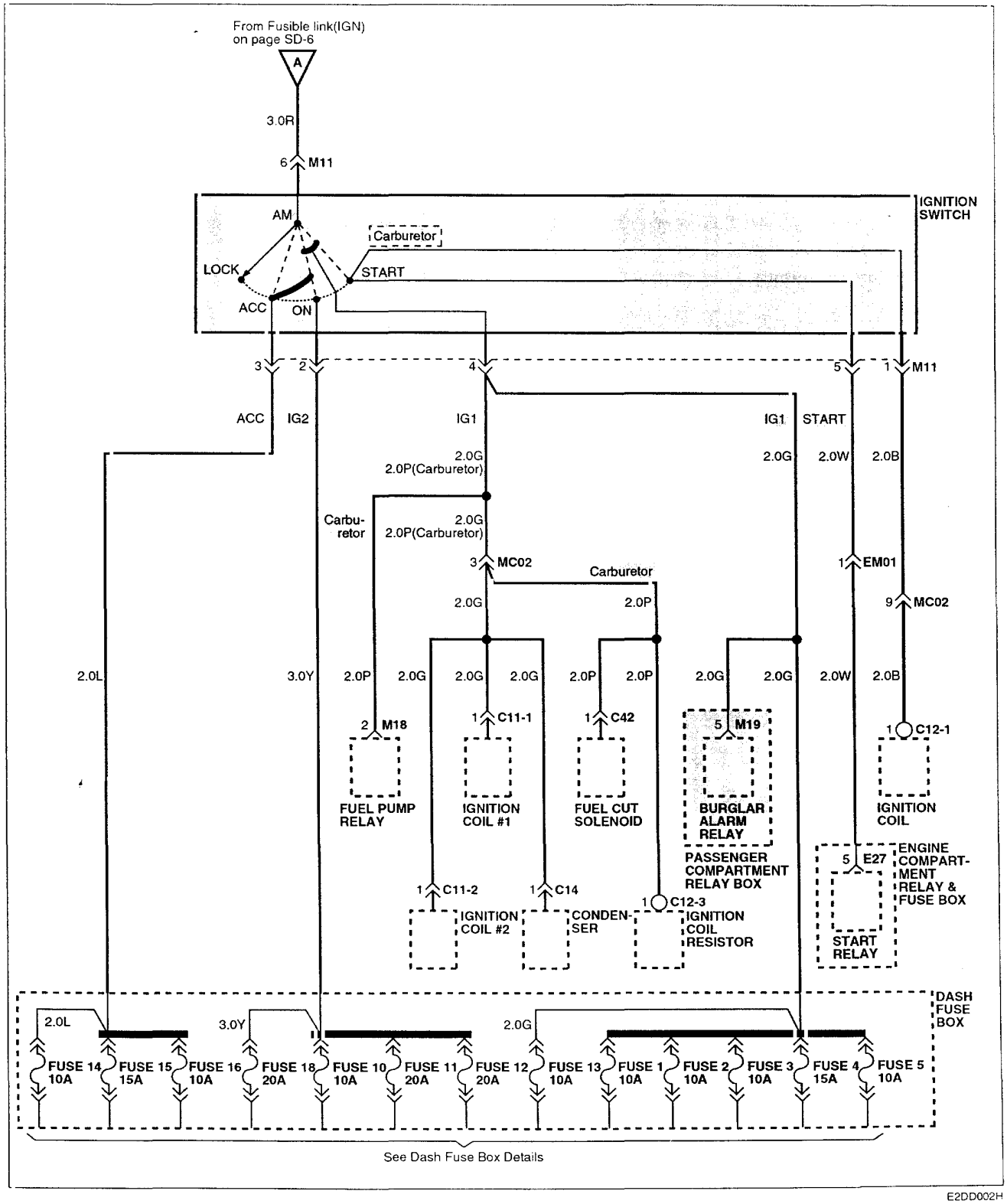


POWER DISTRIBUTION (7)



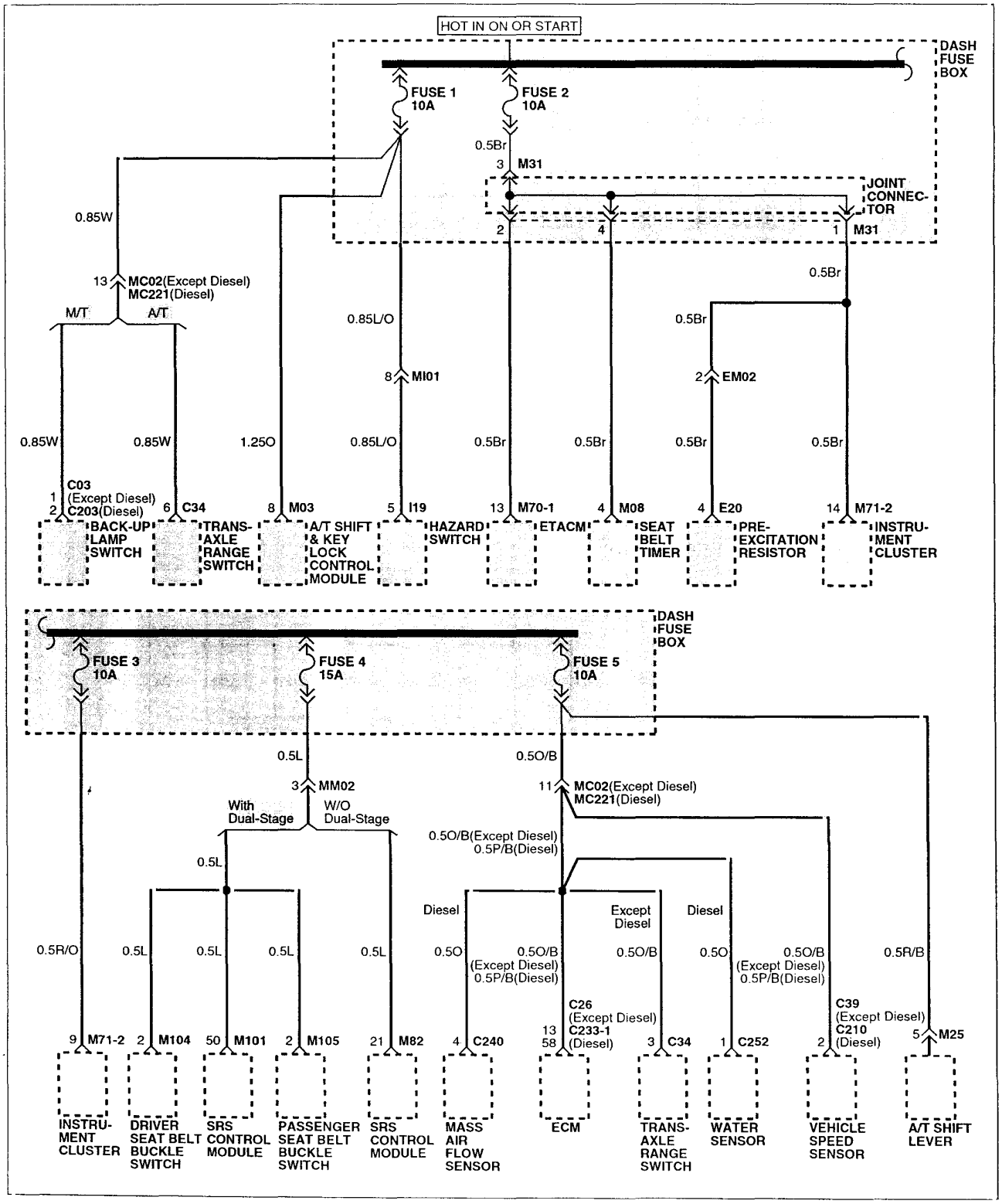
E2DD002G

POWER DISTRIBUTION (8)



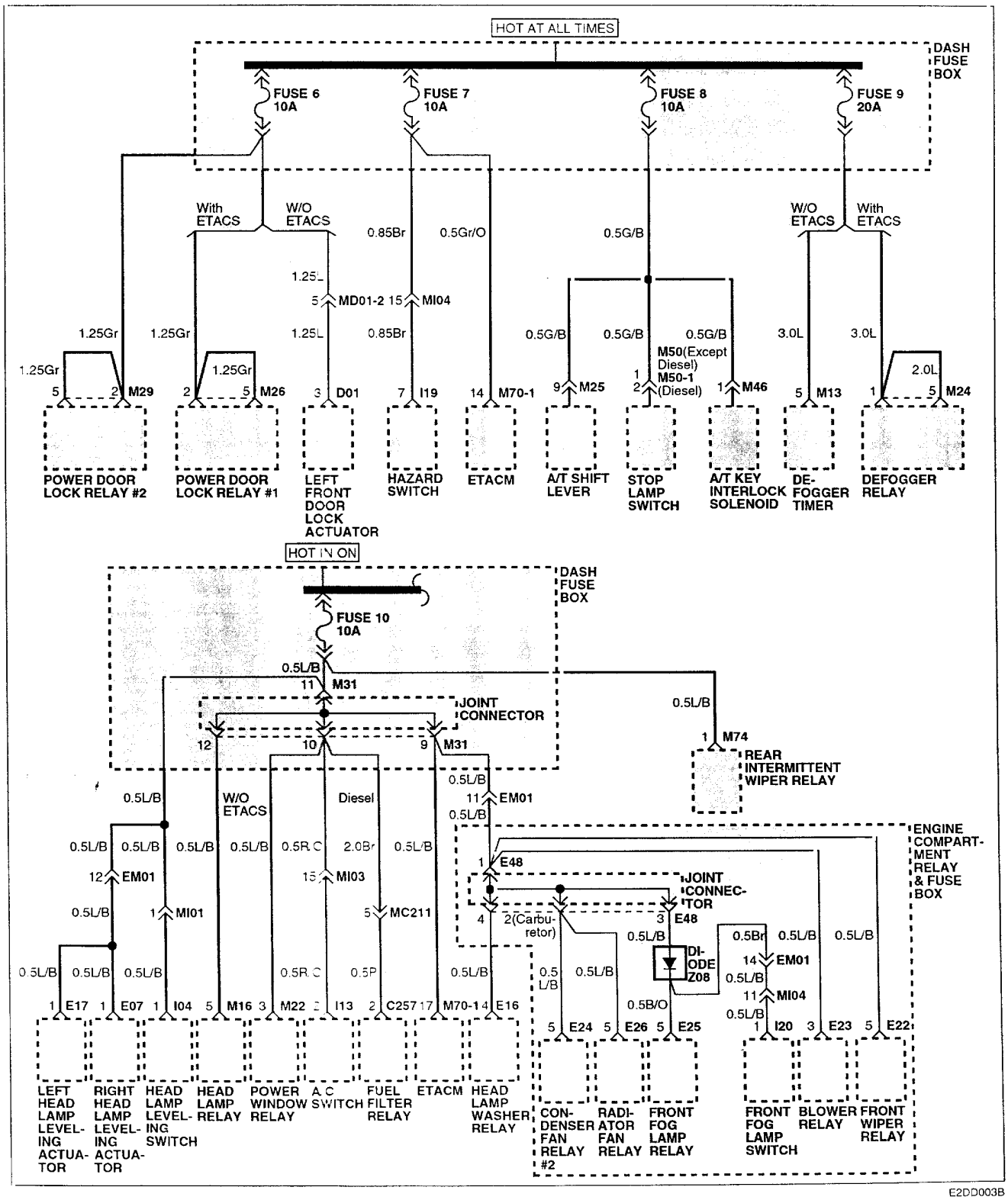
DASH FUSE BOX DETAILS E4495042

DASH FUSE BOX DETAILS (1)



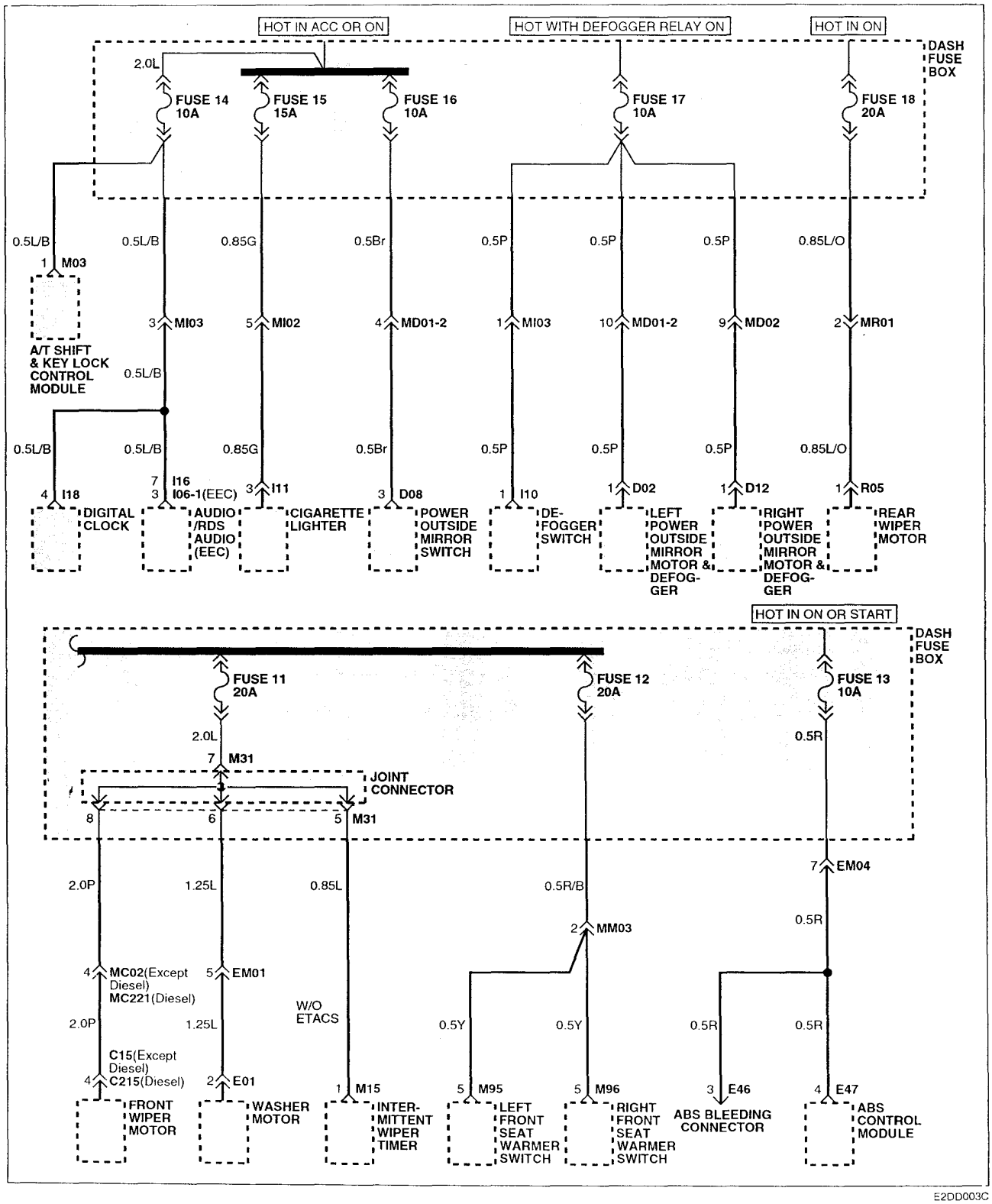
E2DD003A

DASH FUSE BOX DETAILS (2)



E2DD003B

DASH FUSE BOX DETAILS (3)



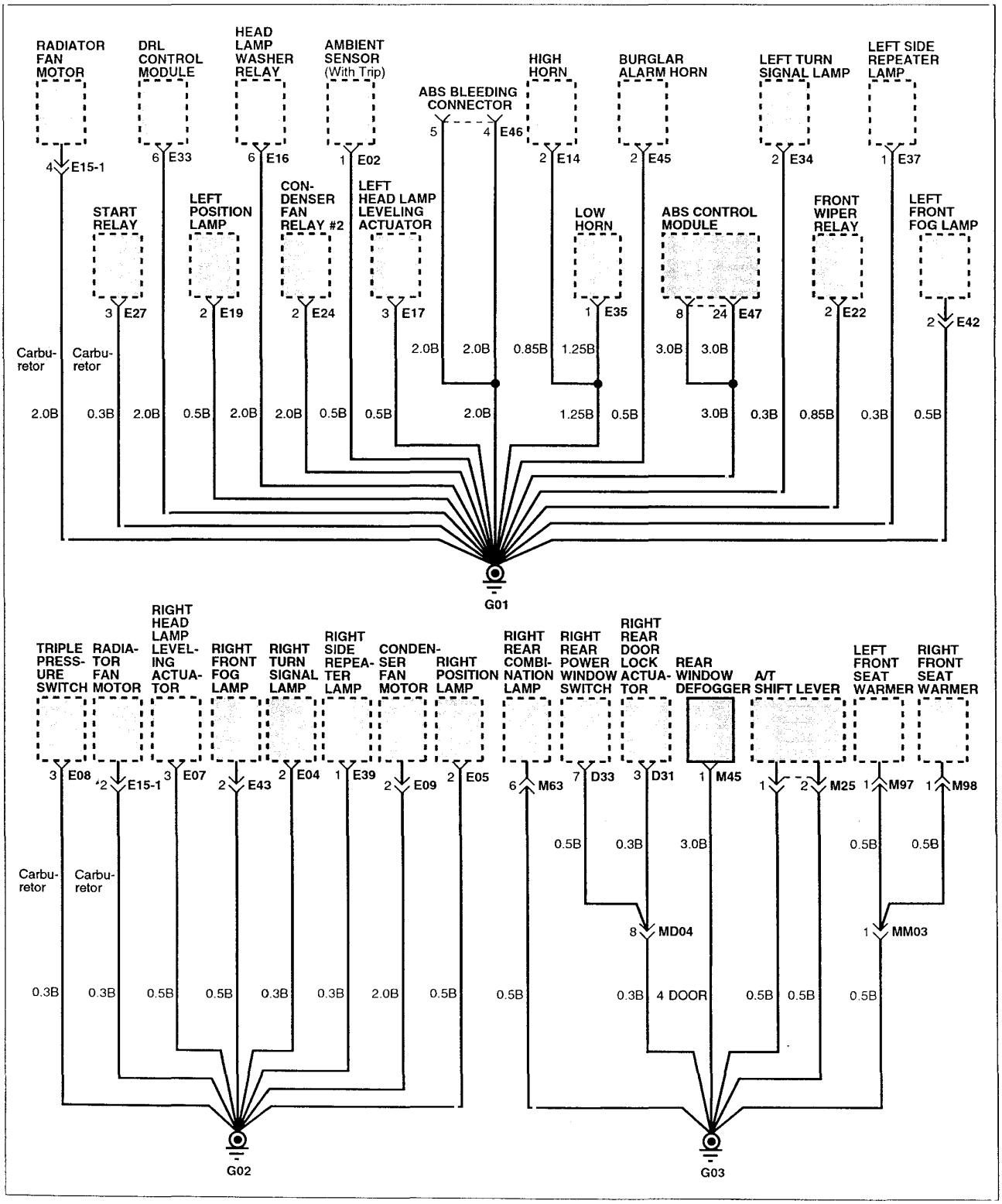
E2DD003C

MEMO

MEMO

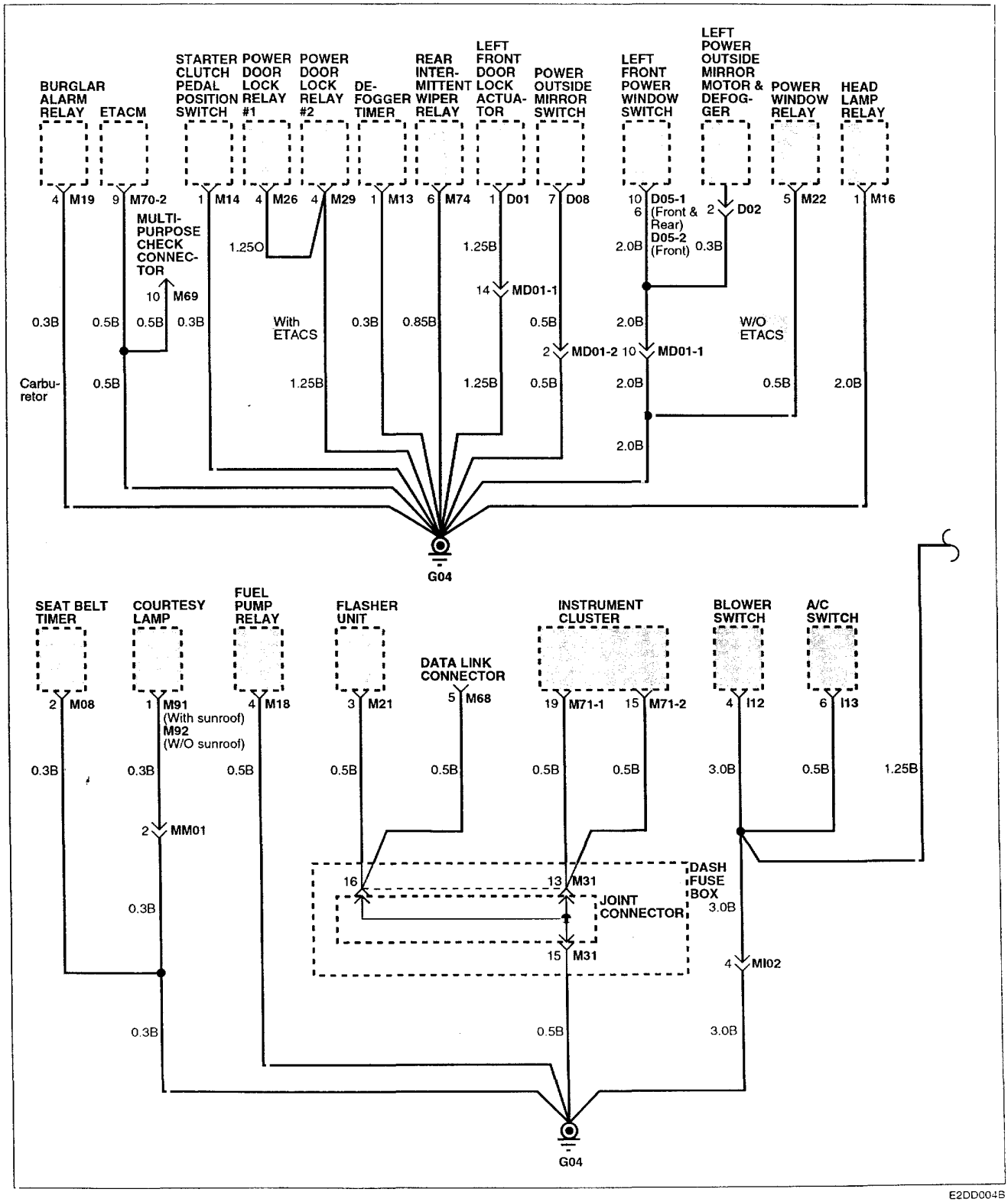
GROUND DISTRIBUTION E48DC1CC

GROUND DISTRIBUTION (1)



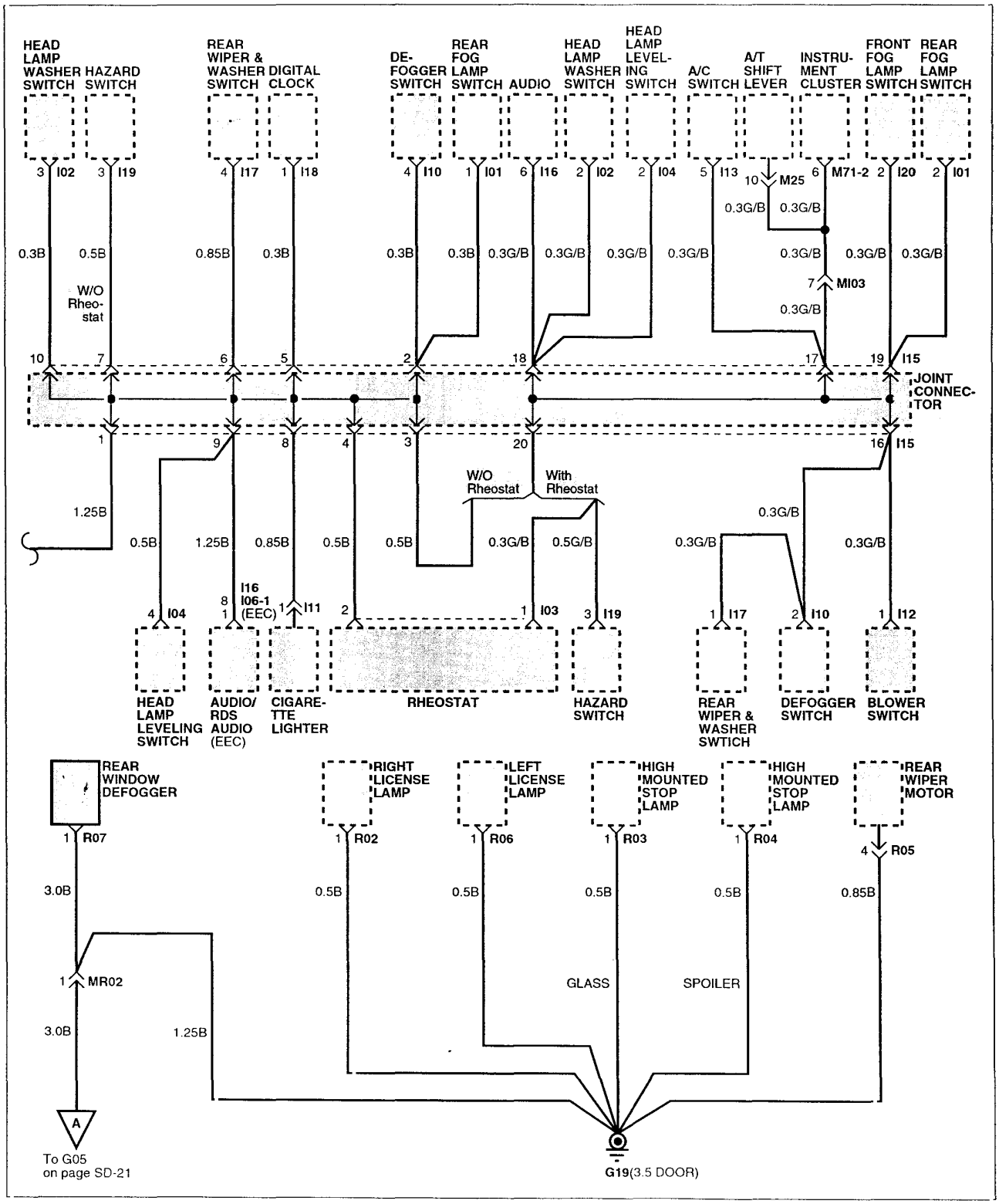
E2DD004A

GROUND DISTRIBUTION (2)



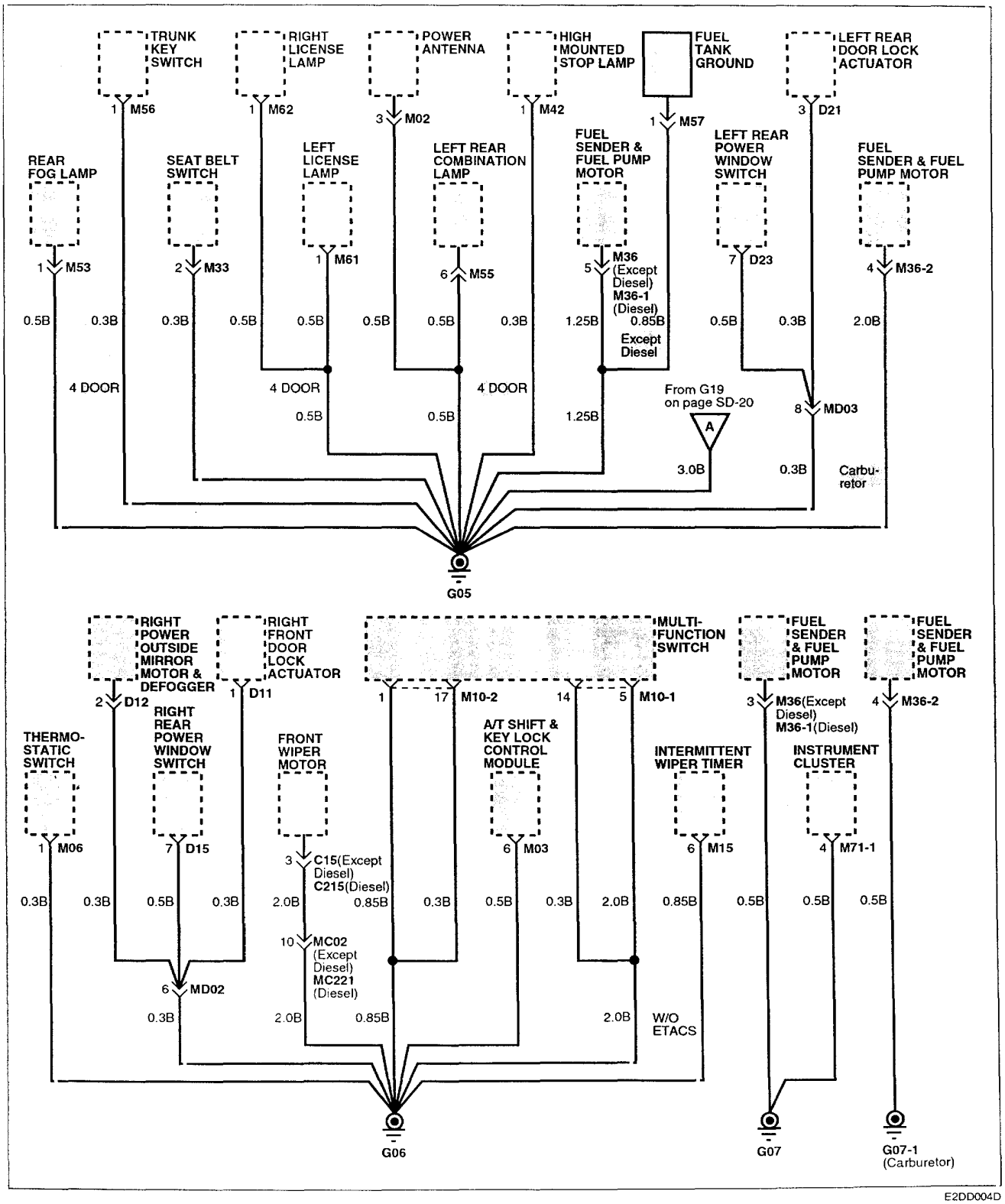
E2DD004B

GROUND DISTRIBUTION (3)



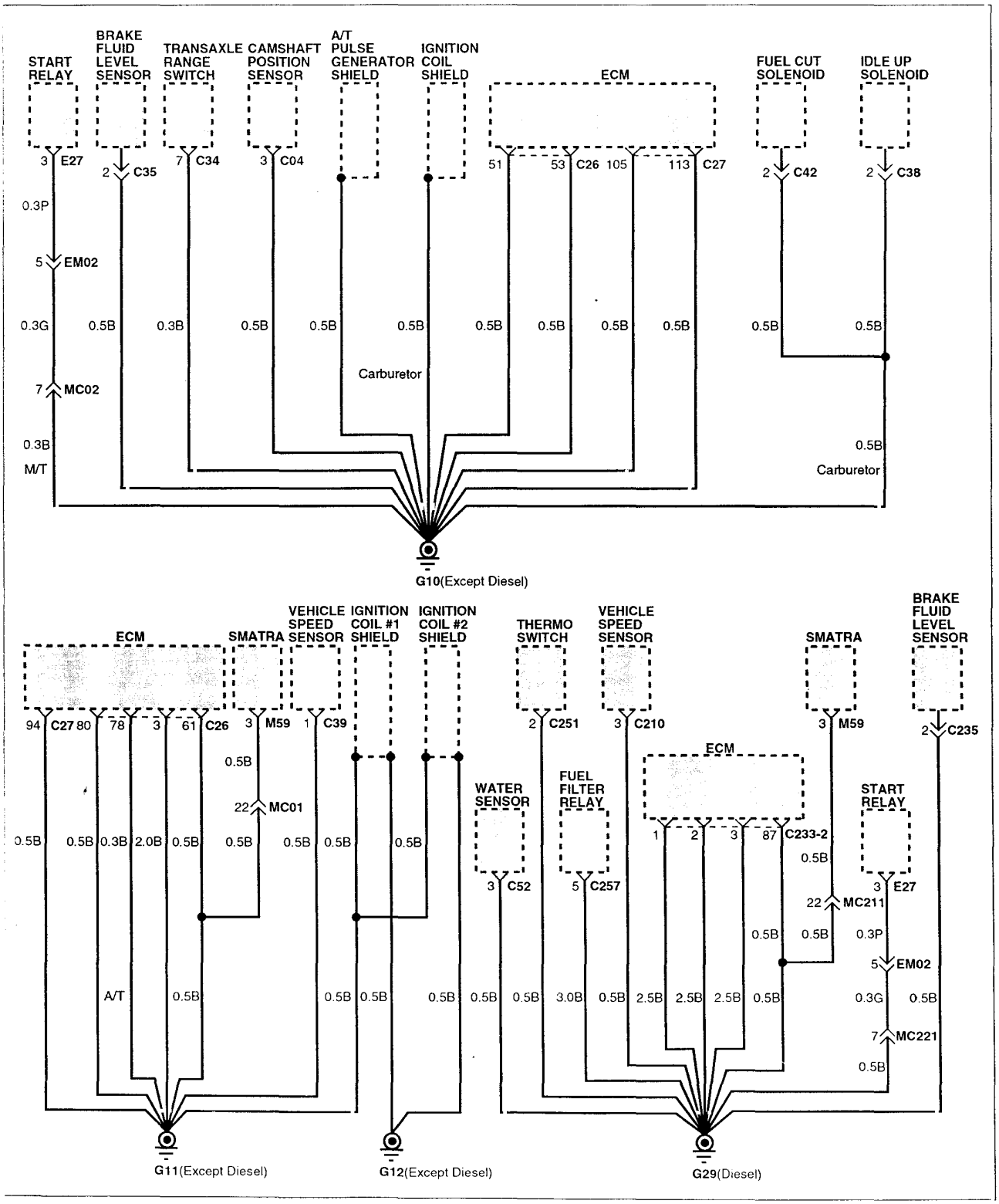
E2DD004C

GROUND DISTRIBUTION (4)



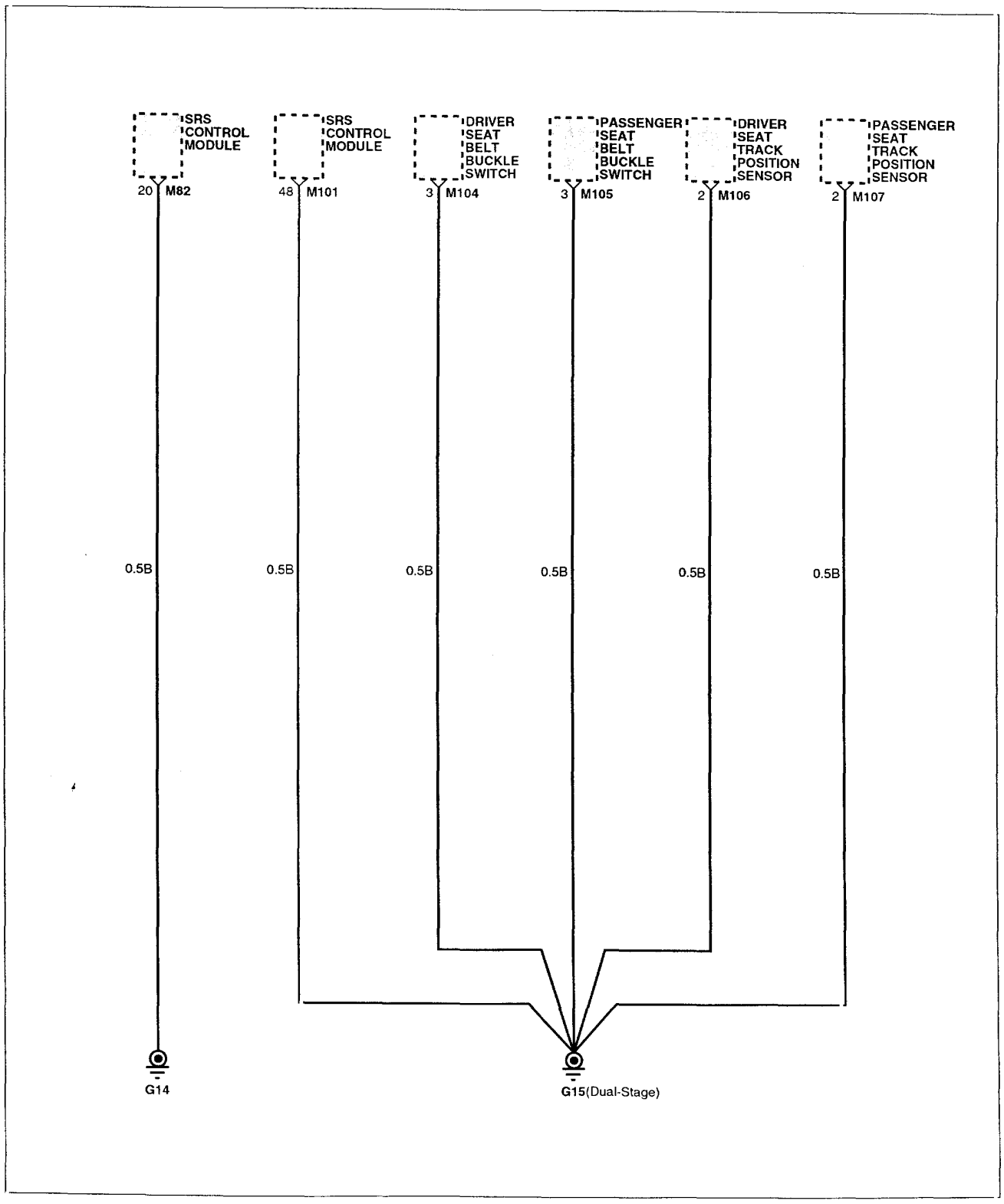
E2DD004D

GROUND DISTRIBUTION (5)



E2DD004E

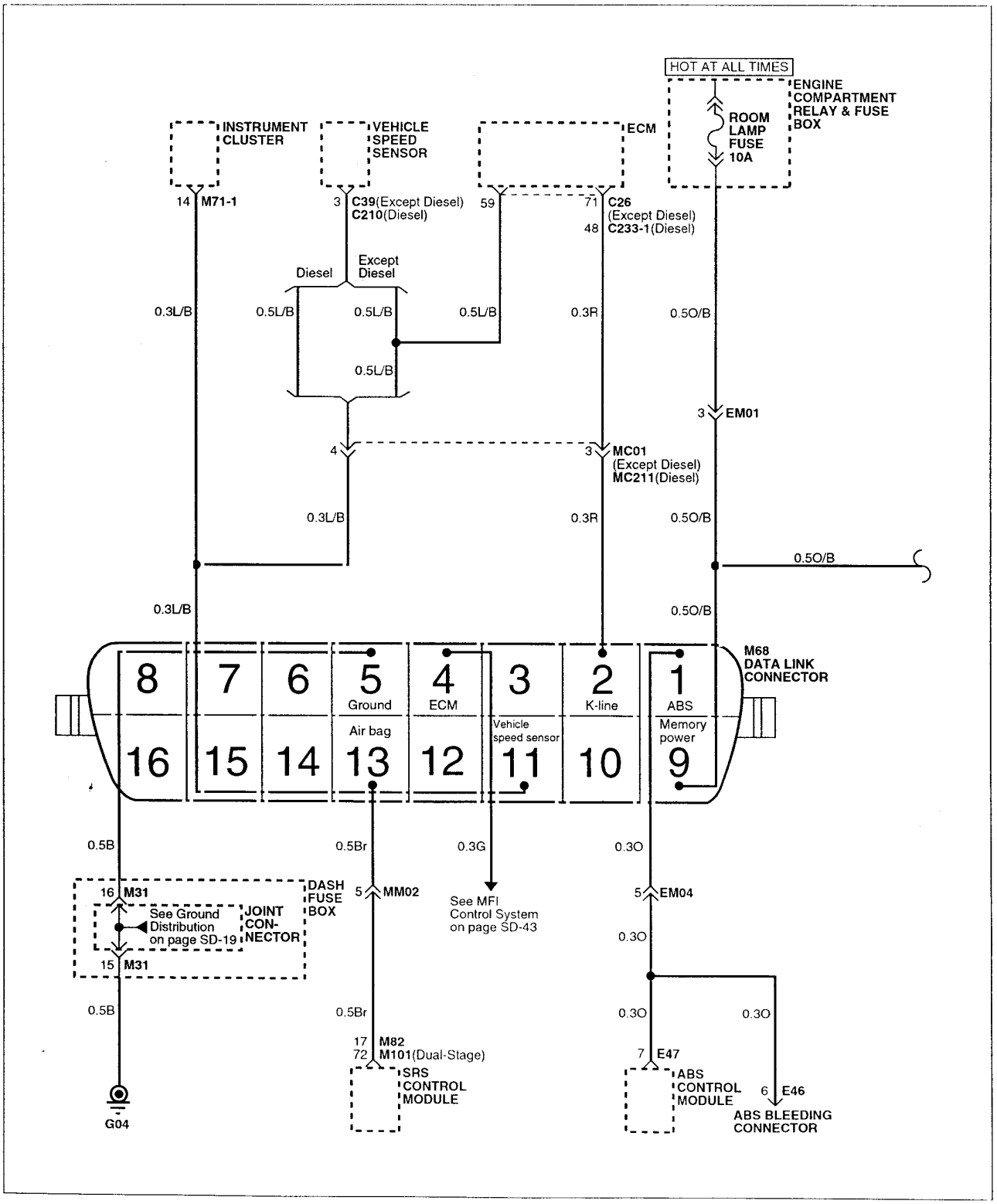
GROUND DISTRIBUTION (6)



E2DD004F

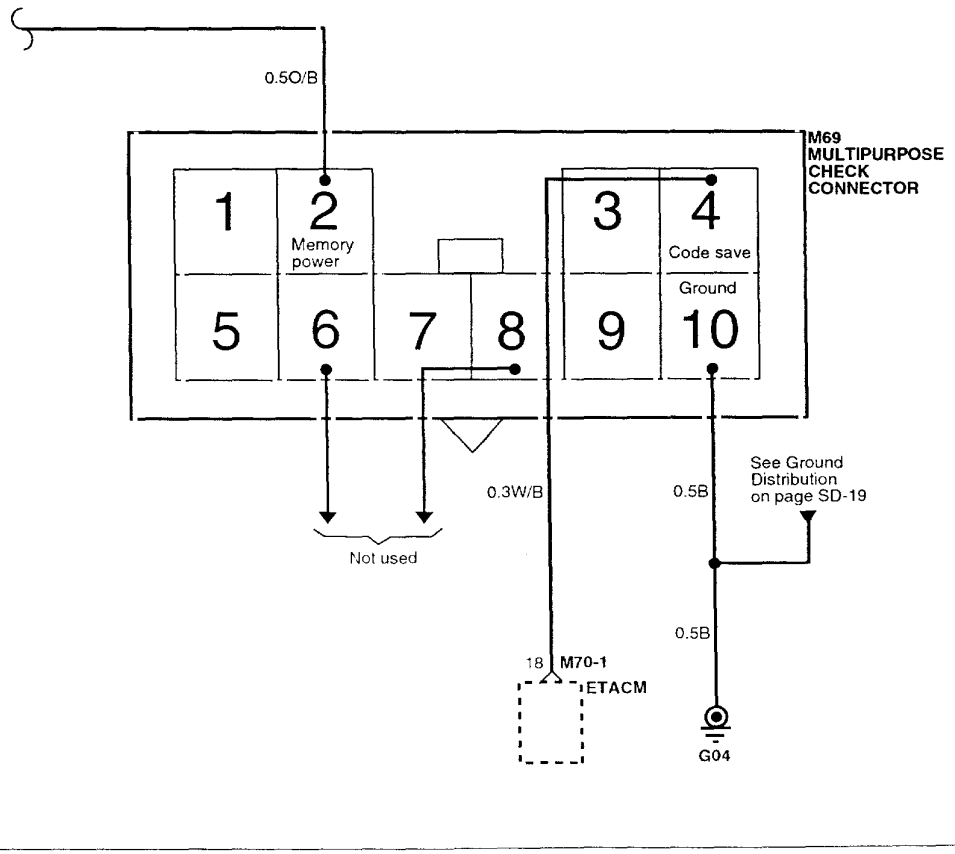
DATA LINK DETAILS E8AD31CE

DATA LINK DETAILS (1)



E2DD005A

DATA LINK DETAILS (2)



E2DD005B

COMPONENT LOCATION INDEX

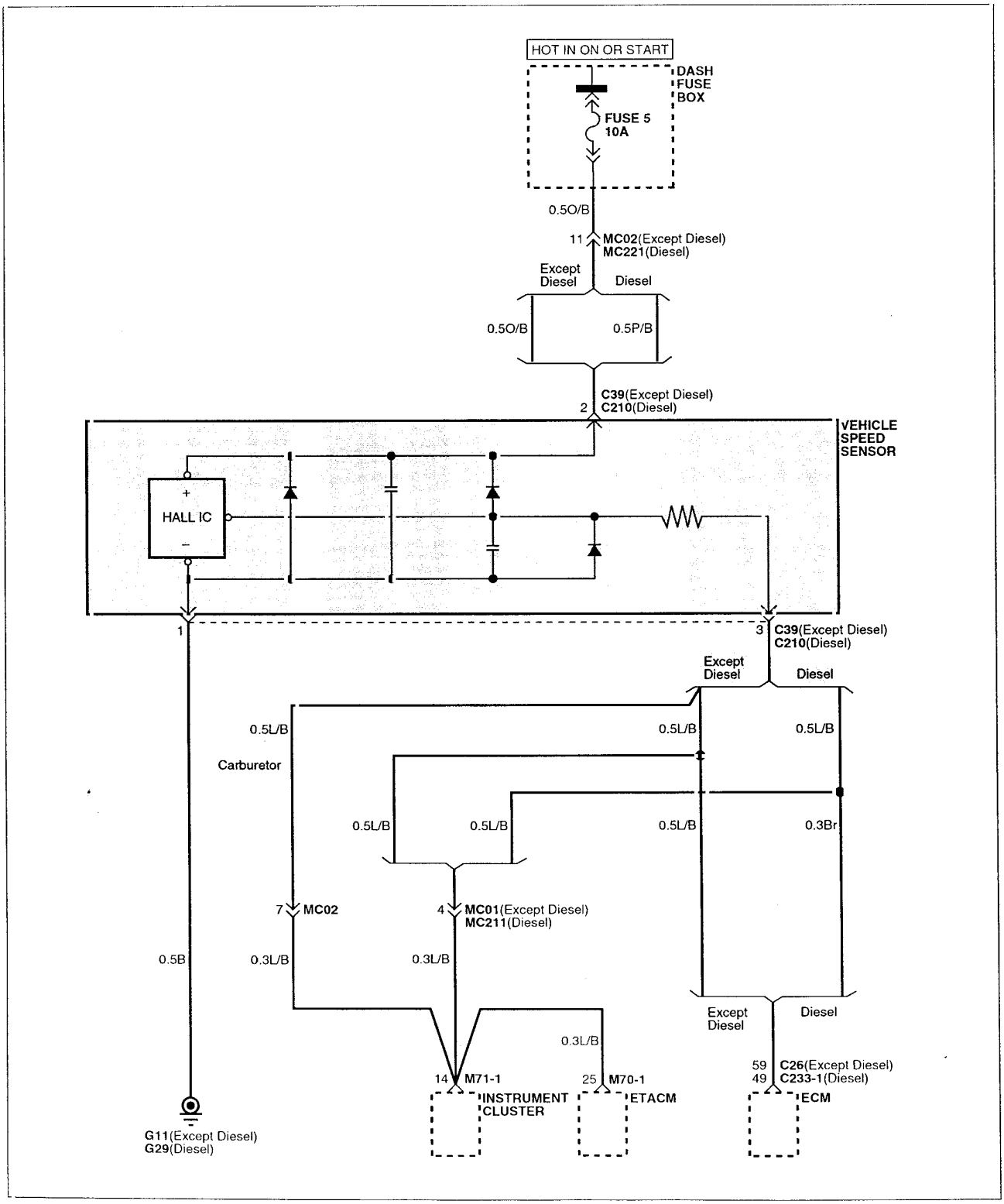
Components		Location reference - page
C26	ECM (Except Diesel)	CL-20
C39	Vehicle speed sensor (Except Diesel)	CL-22
C210	Vehicle speed sensor (Diesel)	CL-23
C233-1	ECM (Diesel)	CL-24
E46	ABS bleeding connector	CL-15
E47	ABS control module	CL-15
M31	Joint connector	CL-3
M68	Data link connector	CL-7
M69	Multipurpose check connector	CL-7
M70-1	ETACM	CL-7
M71-1	Instrument cluster	CL-8
M82	SRS control module	CL-8
Connectors		
EM01		CL-16
EM04		CL-16
MM02		CL-11
Grounds		
G04		CL-28

MEMO

MEMO

VEHICLE SPEED SENSOR EB3A176D

VEHICLE SPEED SENSOR (1)



E2DD006A

COMPONENT LOCATION INDEX

Components		Location reference - page
C26	ECM (Except Diesel)	CL-20
C39	Vehicle speed sensor (Except Diesel)	CL-22
C210	Vehicle speed sensor (Diesel)	CL-23
C233-1	ECM (Diesel)	CL-24
M70-1	ETACM	CL-7
M71-1	Instrument cluster	CL-8
Connectors		
MC01		CL-10
MC02		CL-10
MC211		CL-10
Grounds		
G29		CL-29

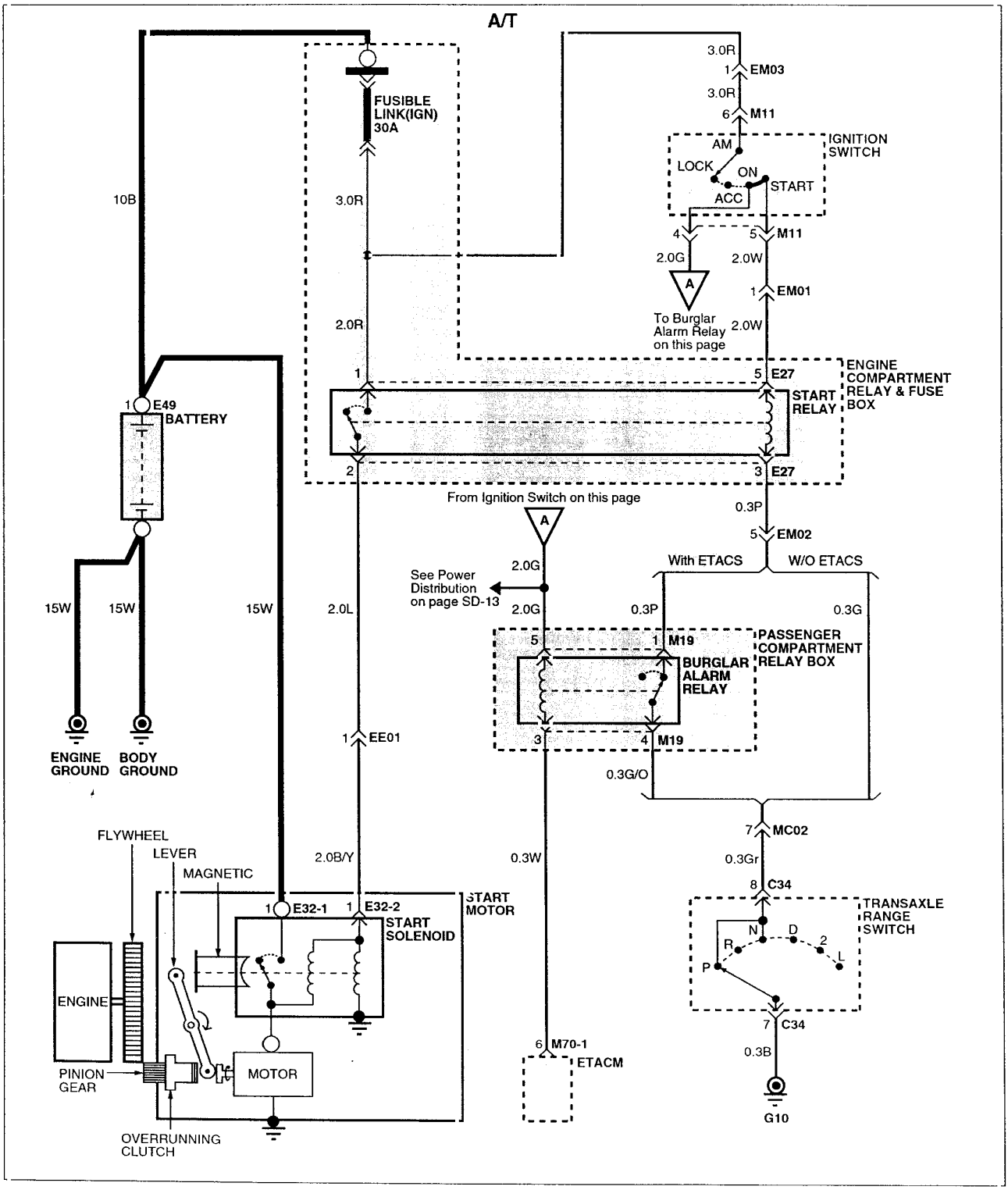
Circuit Description

The vehicle speed sensor, located on the speedometer driven gear in the transaxle, generates pulse signals that indicate the vehicle's speed and provides signals to the control modules to calcaulate the vehicle speed.

The vehicle speed sensor (VSS) intermittently grounds the circuits. The number of pulses per minute increase/decrease with the speed of the car.

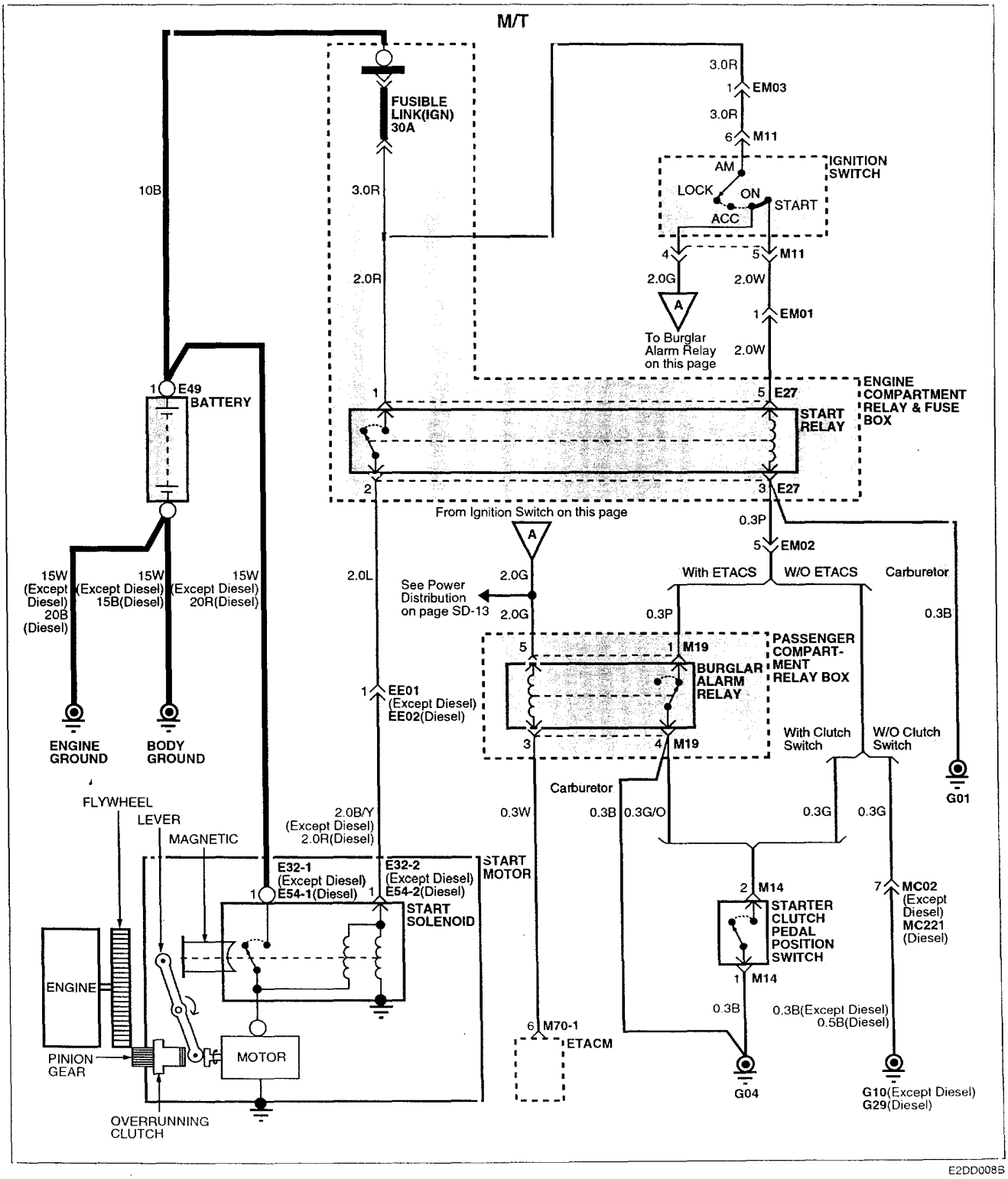
STARTING SYSTEM E529BB29

STARTING SYSTEM (1)



E2DD008A

STARTING SYSTEM (2)



E2DD008B

COMPONENT LOCATION INDEX

Components		Location reference - page
C34	Transaxle range switch (A/T)	CL-21
E27	Start relay	CL-14
E32-1	Start motor (Except Diesel)	CL-14
E32-2	Start solenoid (Except Diesel)	CL-14
E54-1	Start motor (Diesel)	CL-16
E54-2	Start solenoid (Diesel)	CL-16
M11	Ignition switch	CL-2
M14	Start clutch pedal position switch (M/T)	CL-3
M19	Burglar alarm relay	CL-3
M70-1	ETACM	CL-7
Connectors		
EE01		CL-16
EE02		CL-16
EM01		CL-16
EM02		CL-16
EM03		CL-16
MC02		CL-10
MC221		CL-10
Grounds		
G01		CL-28
G04		CL-28
G10		CL-29
G29		CL-29

Circuit Description

A/T

Battery voltage is applied at all times from the positive battery terminal to the ignition switch and the normally open start relay contacts. When the ignition switch is turned to START, transaxle range switch is in the P/N position and the burglar alarm relay contact closed (controlled by ETACM), battery voltage is applied to the start relay coils. The start relay coils energize, the start relay contacts close, and battery voltage is applied to the start motor. The motor engages to start the engine.

M/T

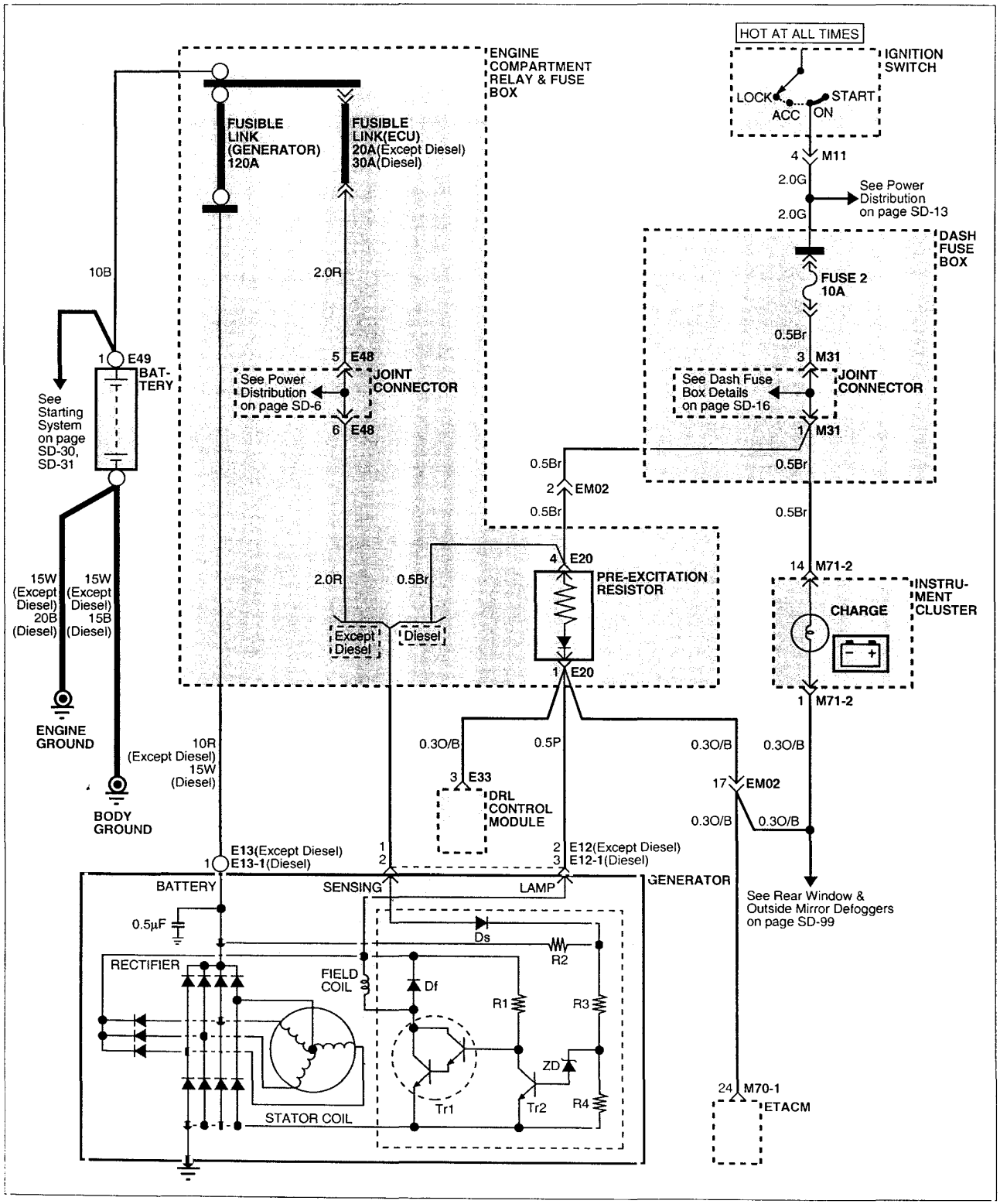
Battery voltage is applied at all times from the positive battery terminal to the ignition switch and the normally open start relay contacts. When the ignition switch is turned to START, the starter clutch pedal position switch is closed, and the burglar alarm relay contact closed (controlled by ETACM), battery voltage is applied to the start relay coils. The start relay coils energize, the start relay contacts close, and battery voltage is applied to the start motor. The motor engages to start the engine.

MEMO

MEMO

CHARGING SYSTEM E4CB8AC1

CHARGING SYSTEM (1)



E2DD007A

COMPONENT LOCATION INDEX

Components		Location reference - page
E12	Generator (L, S) (Except Diesel)	CL-12
E12-1	Generator (L, S) (Diesel)	CL-13
E13	Generator (B+) (Except Diesel)	CL-13
E13-1	Generator (B+) (Diesel)	CL-13
E20	Pre-excitation resistor	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
E49	Battery terminal	CL-16
M11	Ignition switch	CL-2
M31	Joint connector	CL-3
M70-1	ETACM	CL-7
M71-2	Instrument cluster	CL-8
Connectors		
EM02		CL-16

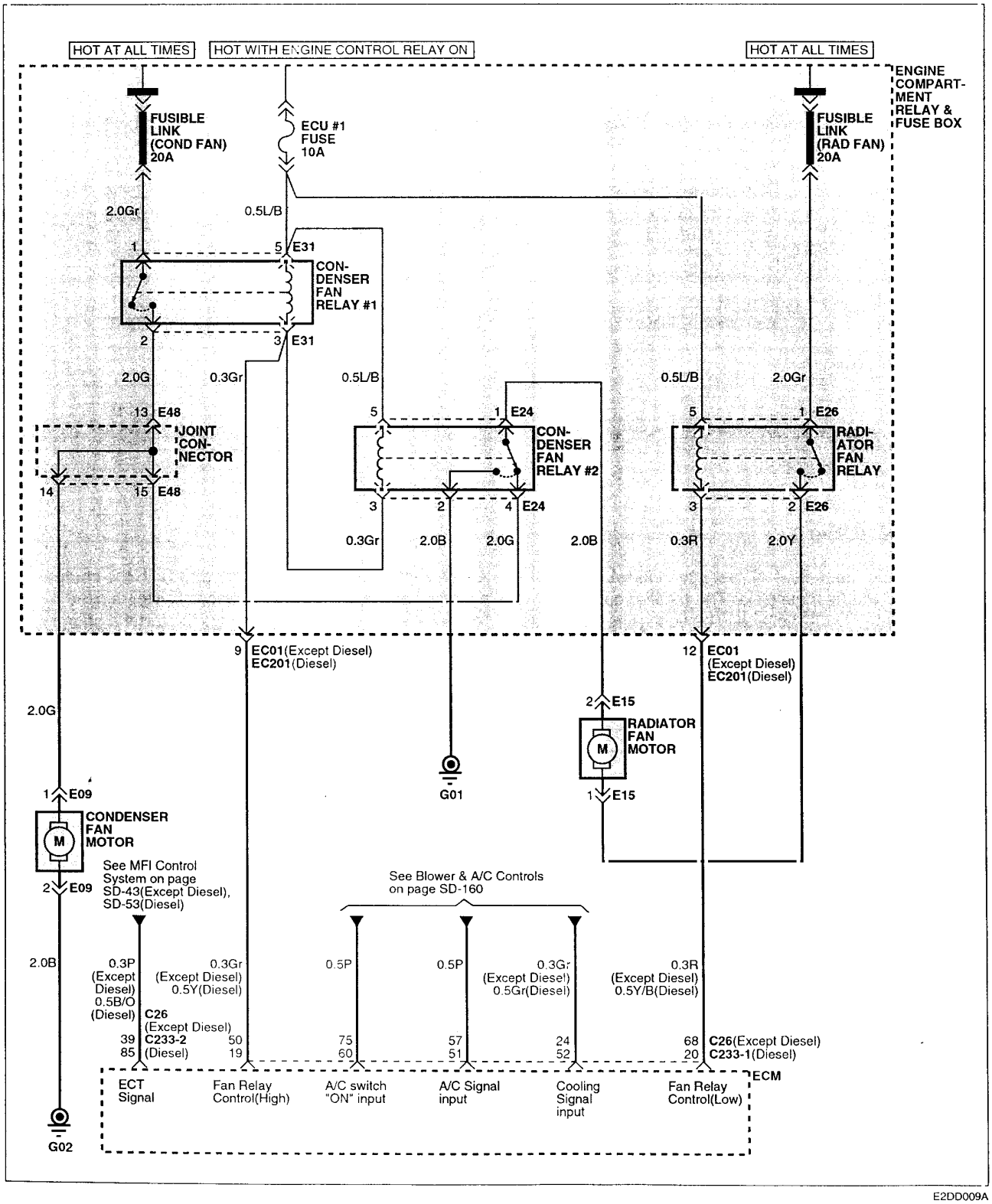
Circuit Description

The generator generates AC voltage in its windings by a belt driven by theengine. The rectifier converts this AC voltage to DC voltage. The voltage regulator, a component which is included in the generator frame, has a primary function of controlling the generator's output to meet electrical system requirements. The regulator also controls the charge warning lamp. Fuse 2 supplies battery voltage to the charge warning indicator. With the engine is not running and the ignition switch in ON, terminal L of the regulator is grounded internally and the indicator lights up.

A small amount of current provided by both the charge warning lamp and the pre-excitation resistor is used to "excite" the magnetic field windings to start the charging process. With the engine running and the generator charging, terminal L voltage rises and the indicator goes out. If the generator fails to charge, terminal L remains below battery voltage and the indicator remains lights.

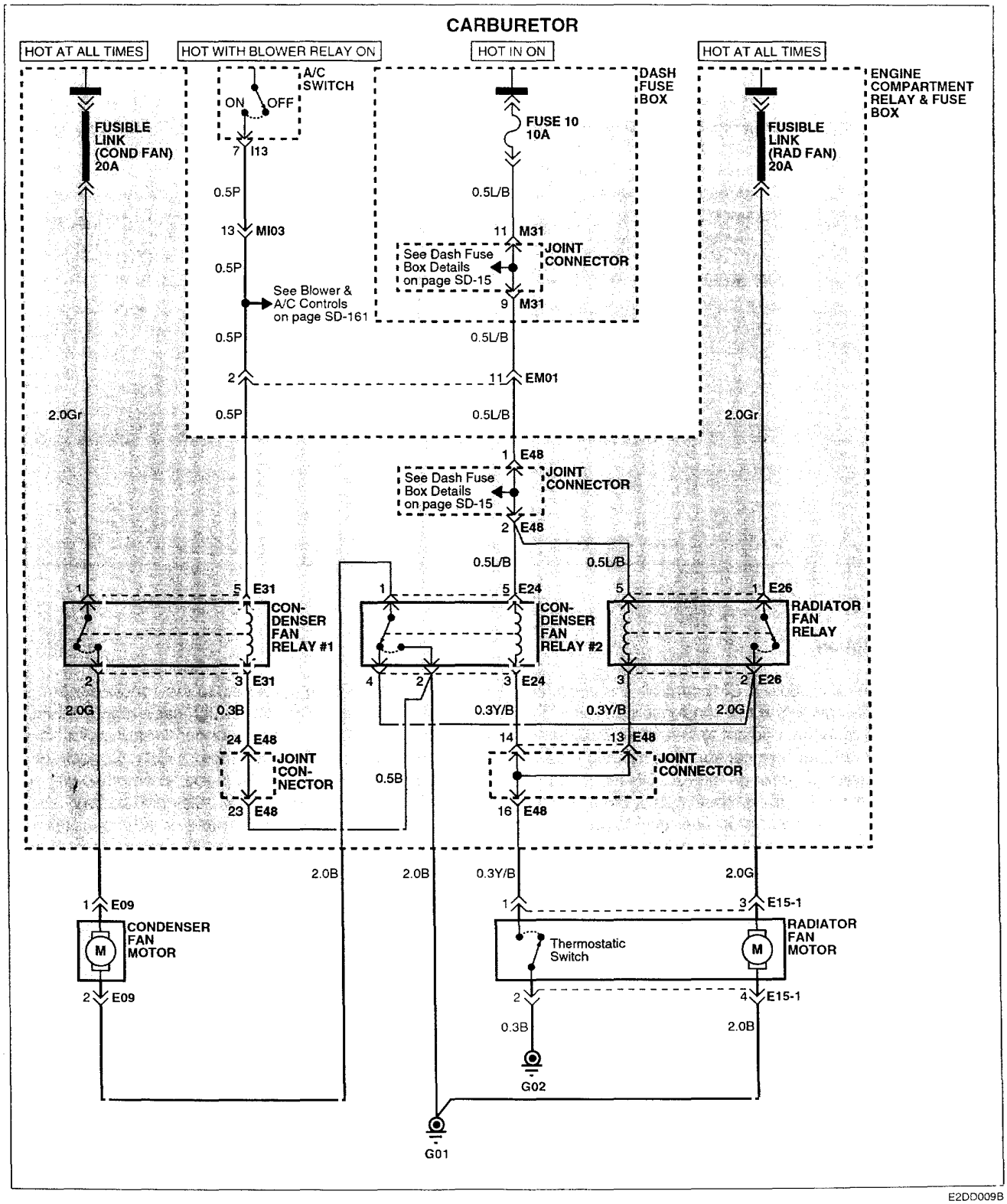
COOLING SYSTEM ED8AE79C

COOLING SYSTEM (1)



E2DD009A

COOLING SYSTEM (2)



E2DD009B

COMPONENT LOCATION INDEX

Components		Location reference - page
C26	ECM	CL-20
C233-1	ECM (Diesel)	CL-24
E09	Condenser fan motor	CL-12
E15	Radiator fan motor	CL-13
E15-1	Radiator fan motor (Carburetor)	CL-13
E24	Condenser fan relay #2	CL-14
E26	Radiator fan relay	CL-14
E31	Condenser fan relay #1	CL-14
E48	Joint connector	CL-16
I13	A/C switch	CL-17
M31	Joint connector	CL-3
Connectors		
EC01		CL-16
MI03		CL-11
Grounds		
G01		CL-28
G02		CL-28

Circuit Description

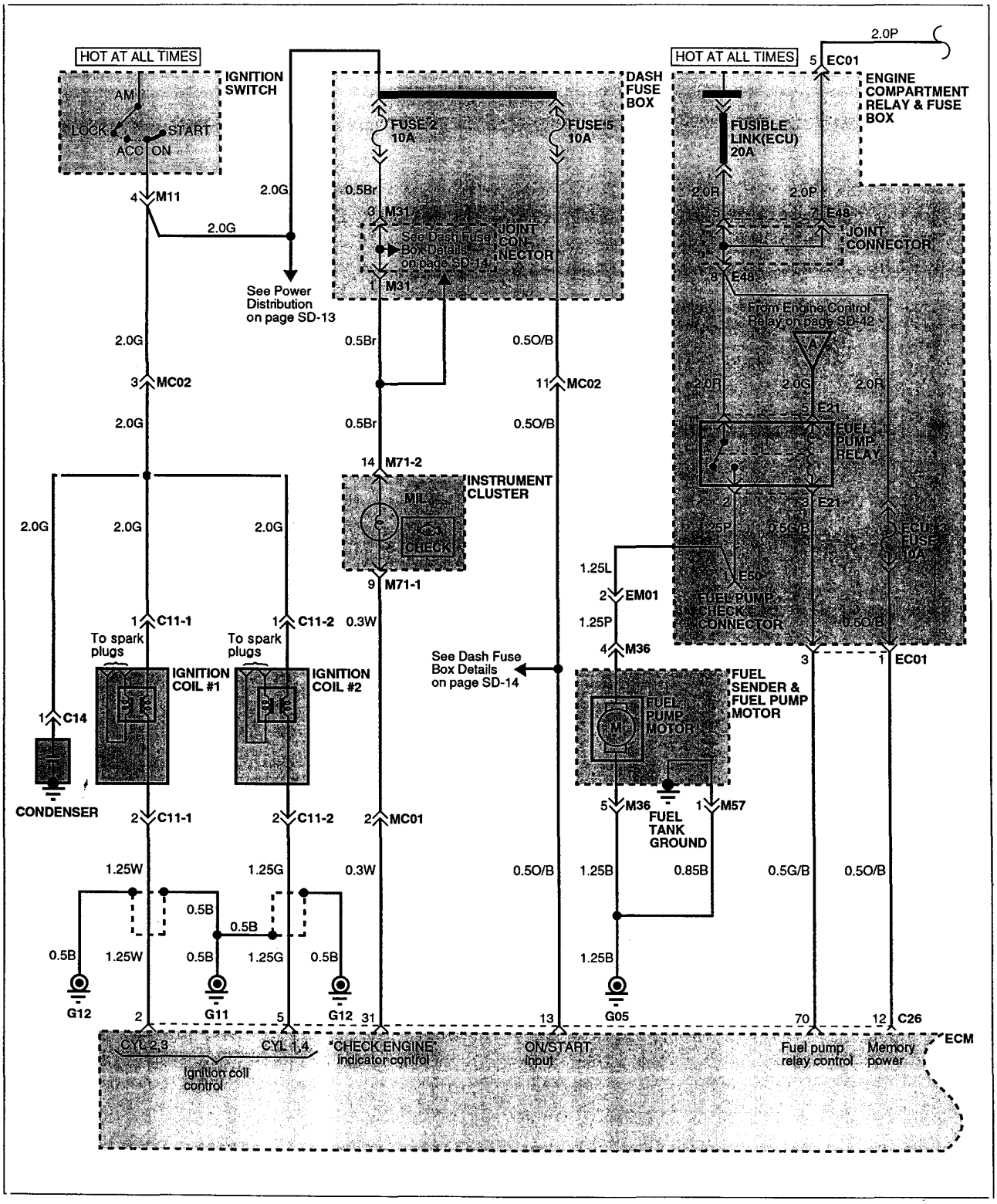
The engine control module (ECM) controls the operation of the radiator fan relay and the condenser fan relay. The control module monitors coolant temperature through the engine coolant temperature sensor. The module also monitors A/C operation through the A/C ON input and A/C pressure switch input . Using these inputs, the module will ground the coil of the appropriate relay to provide fan operation. In high speed mode, the module will ground the coil of the condenser fan relay and radiator fan relay. Battery voltage will then provided to the condenser fan motor and radiator fan motor through each relay contact. The radiator fan motor and the condenser fan motor have their own ground (Radiator fan motor : G01, Condenser fan motor : G02). In low speed mode, the module will ground the coil of the radiator fan relay and battery voltage will then supplied to the radiator fan motor and condenser fan motor. In this case, the radiator fan motor and condenser fan motor have a common ground (G02).

MEMO

MEMO

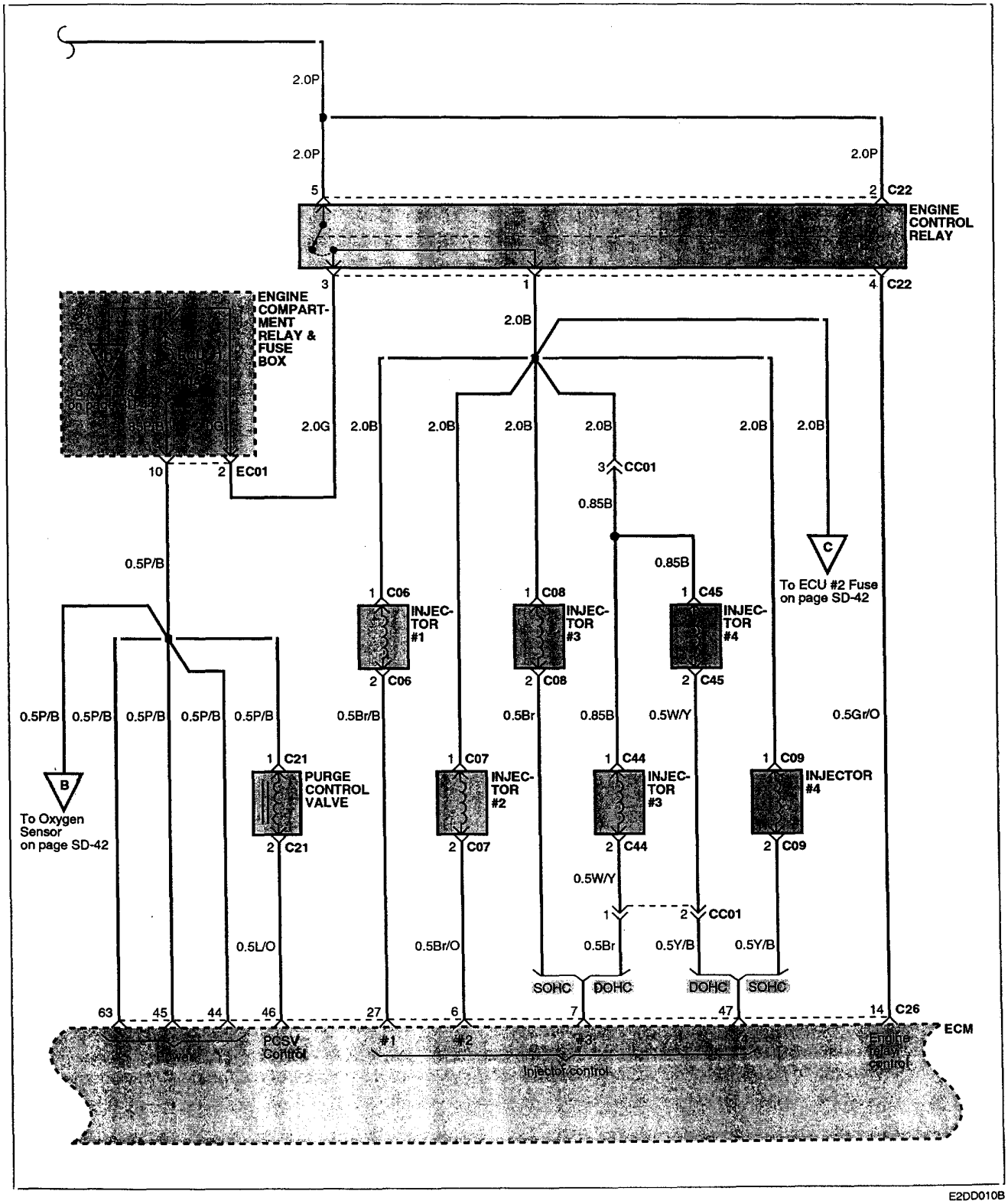
MFI CONTROL SYSTEM (EXCEPT DIESEL) E11B7CE0

MFI CONTROL SYSTEM (EXCEPT DIESEL) (1)



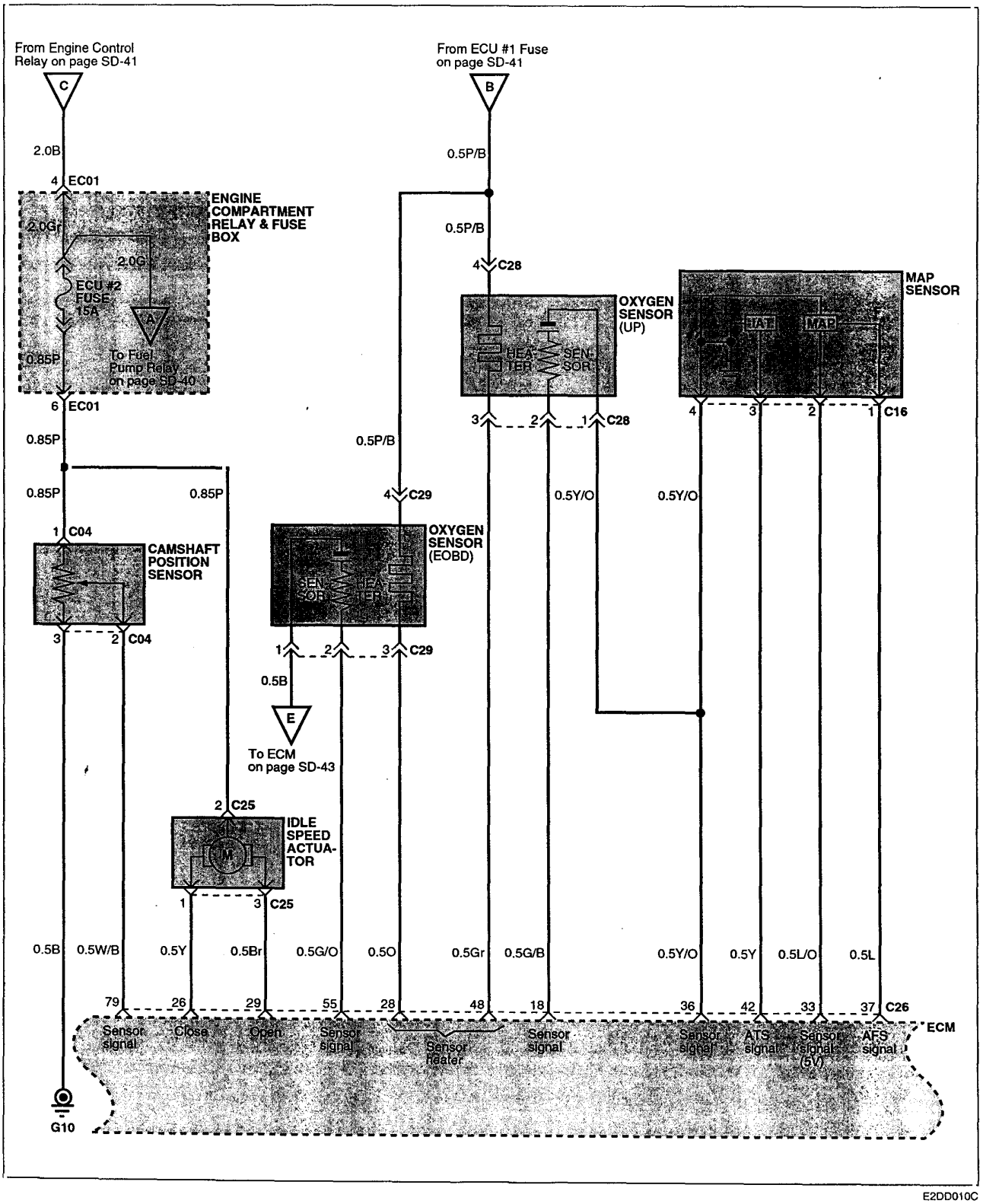
E2DD010A

MFI CONTROL SYSTEM (EXCEPT DIESEL) (2)



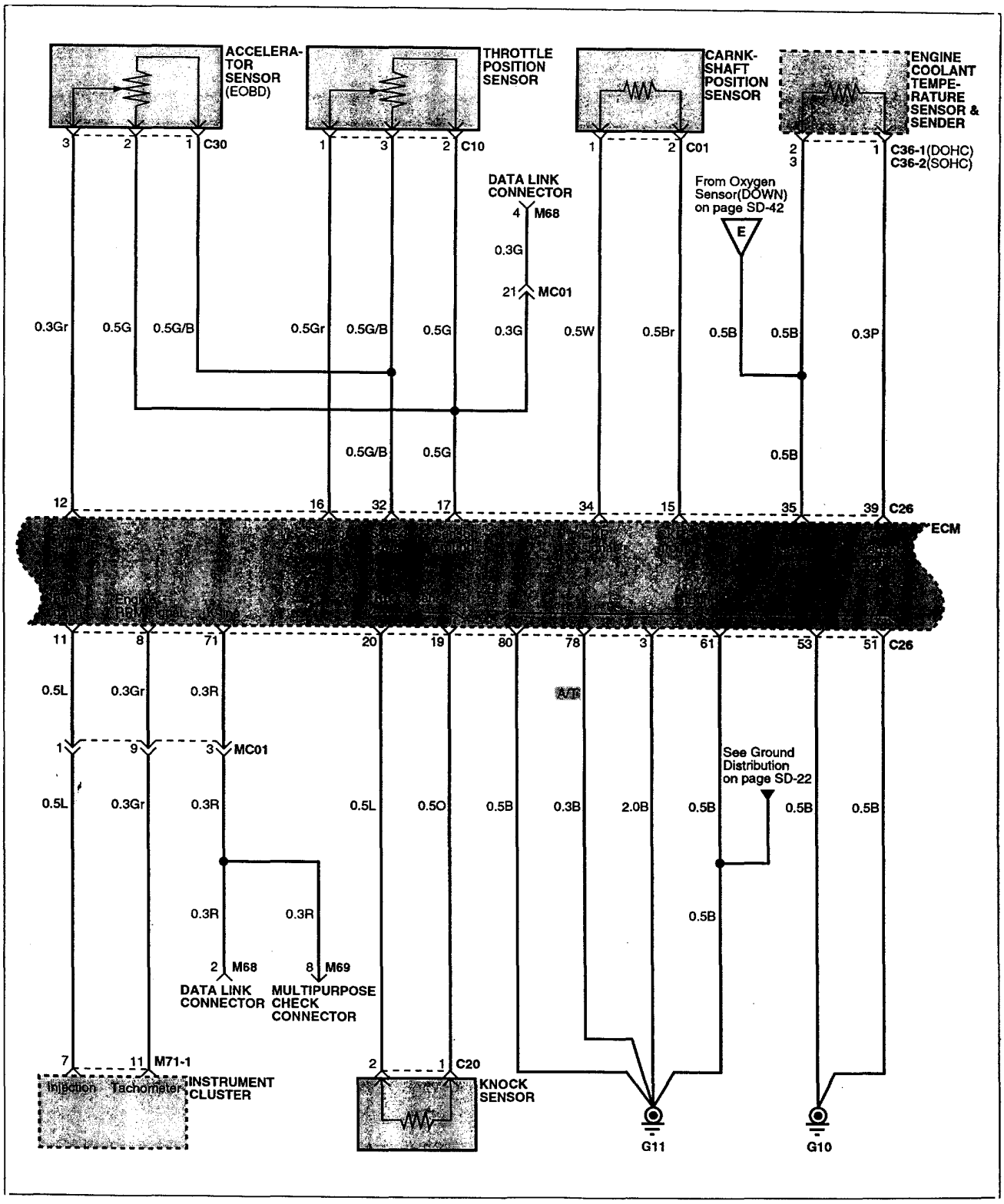
E2DD010B

MFI CONTROL SYSTEM (EXCEPT DIESEL) (3)

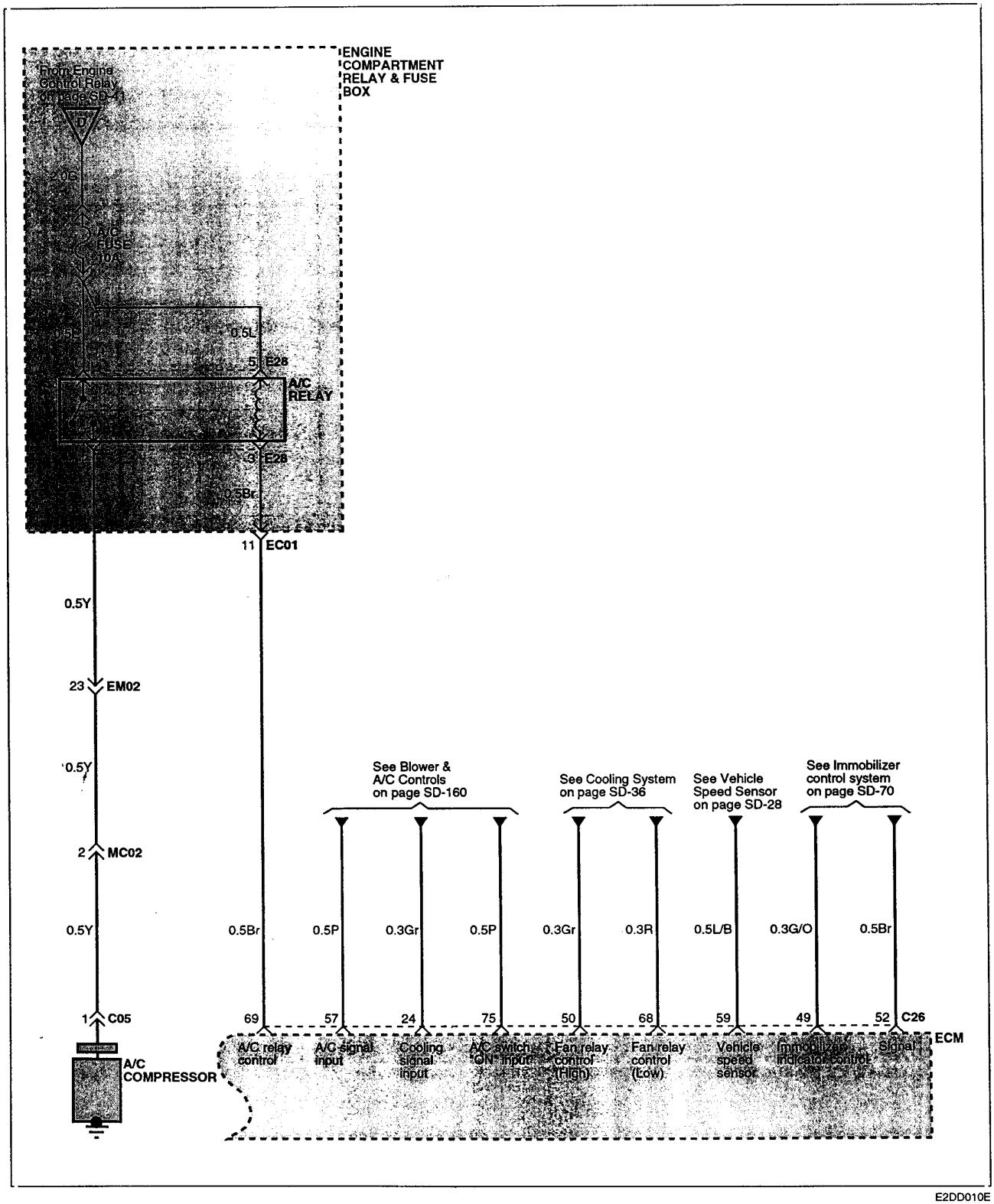


E2DD010C

MFI CONTROL SYSTEM (EXCEPT DIESEL) (4)



MFI CONTROL SYSTEM (EXCEPT DIESEL) (5)



E2DD010E

COMPONENT LOCATION INDEX (1)

Components		Location reference - page
C01	Crankshaft position sensor	CL-18
C04	Camshaft position sensor	CL-18
C05	A/C compressor	CL-18
C06	Injector #1	CL-18
C07	Injector #2	CL-18
C08	Injector #3	CL-18
C09	Injector #4	CL-18
C10	Throttle position sensor	CL-19
C11-1	Ignition coil #1	CL-19
C11-2	Ignition coil #2	CL-19
C14	Condenser	CL-19
C16	MAP sensor	CL-19
C20	Knock sensor	CL-20
C21	Purge control valve	CL-20
C22	Engine control relay	CL-20
C25	Idle speed actuator	CL-20
C26	Engine control module	CL-20
C28	Oxygen sensor (Up)	CL-20
C29	Oxygen sensor (Down)	CL-21
C30	Acceleration sensor	CL-21
C36-1	Engine coolant temperature sensor & sender (DOHC)	CL-21
C36-2	Engine coolant temperature sensor & sender (SOHC)	CL-21
C44	Injector #3	CL-22
C45	Injector #4	CL-22
E21	Fuel pump relay	CL-14
E48	Joint connector	CL-16
M11	Ignition switch	CL-2
M31	Joint connector	CL-3
M36	Fuel sender & Fuel pump motor	CL-4
M57	Fuel tank ground	CL-6
M68	Data link connector	CL-7
M69	Multipurpose check connector	CL-7
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8

COMPONENT LOCATION INDEX (2)

Connectors	Location reference - page
CC01	CL-25
EC01	CL-16
EM01	CL-16
EM02	CL-16
MC01	CL-10
MC02	CL-10
Grounds	
G05	CL-28
G10	CL-29
G11	CL-29
G12	CL-29

Circuit Description

The Multiport Fuel Injection (MFI) control system is an electronic fuel metering system with fuel injectors near the inlet ports of each cylinder. The amount of fuel injection is determined by the ECM. The emission control system includes oxygen sensors and catalystic converters (unleaded fuel only).

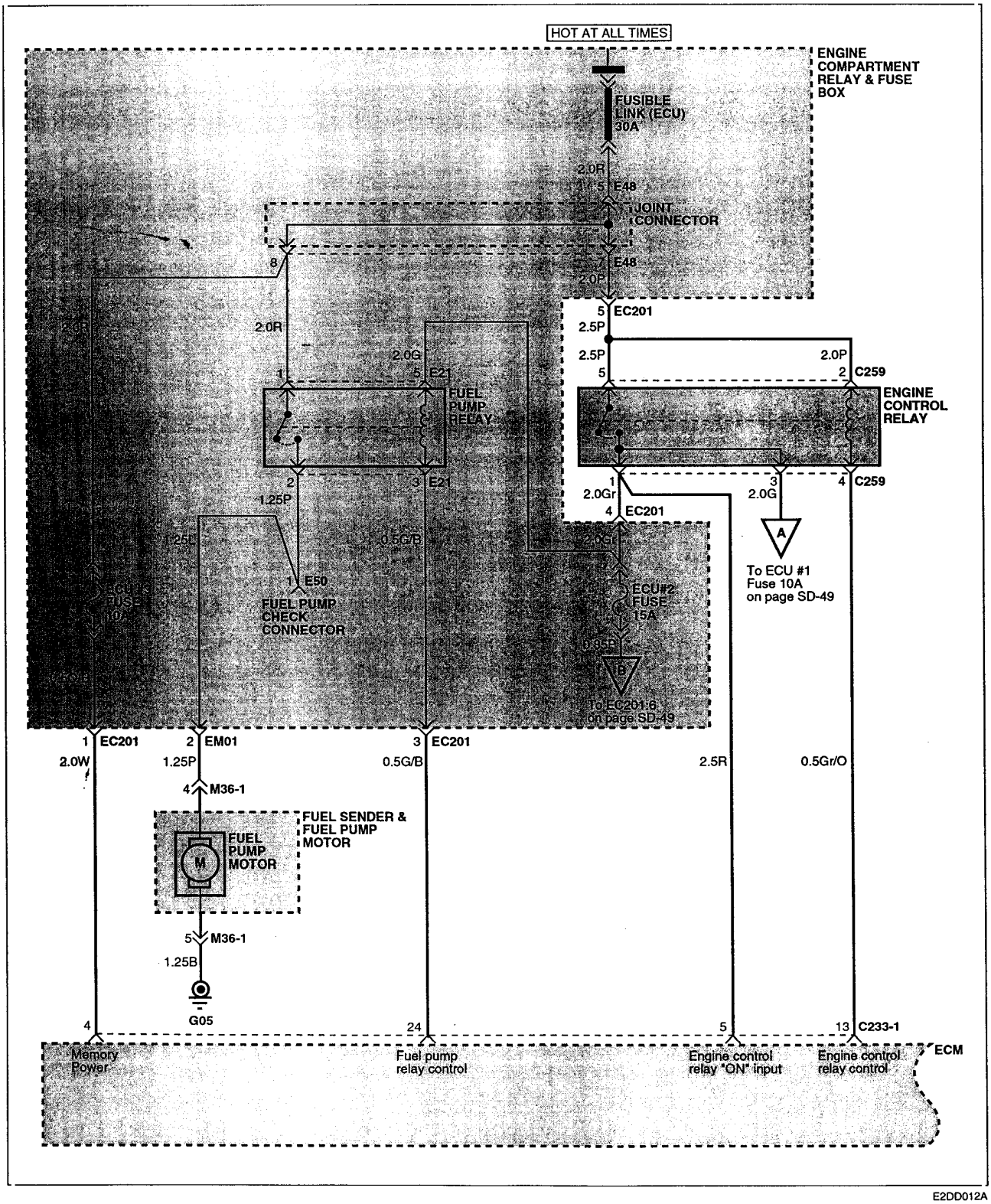
The MFI's three major functions are air-fuel mixture, idle speed control and ignition timing control. Refer to the shop manual, section FL for details.

MEMO

MEMO

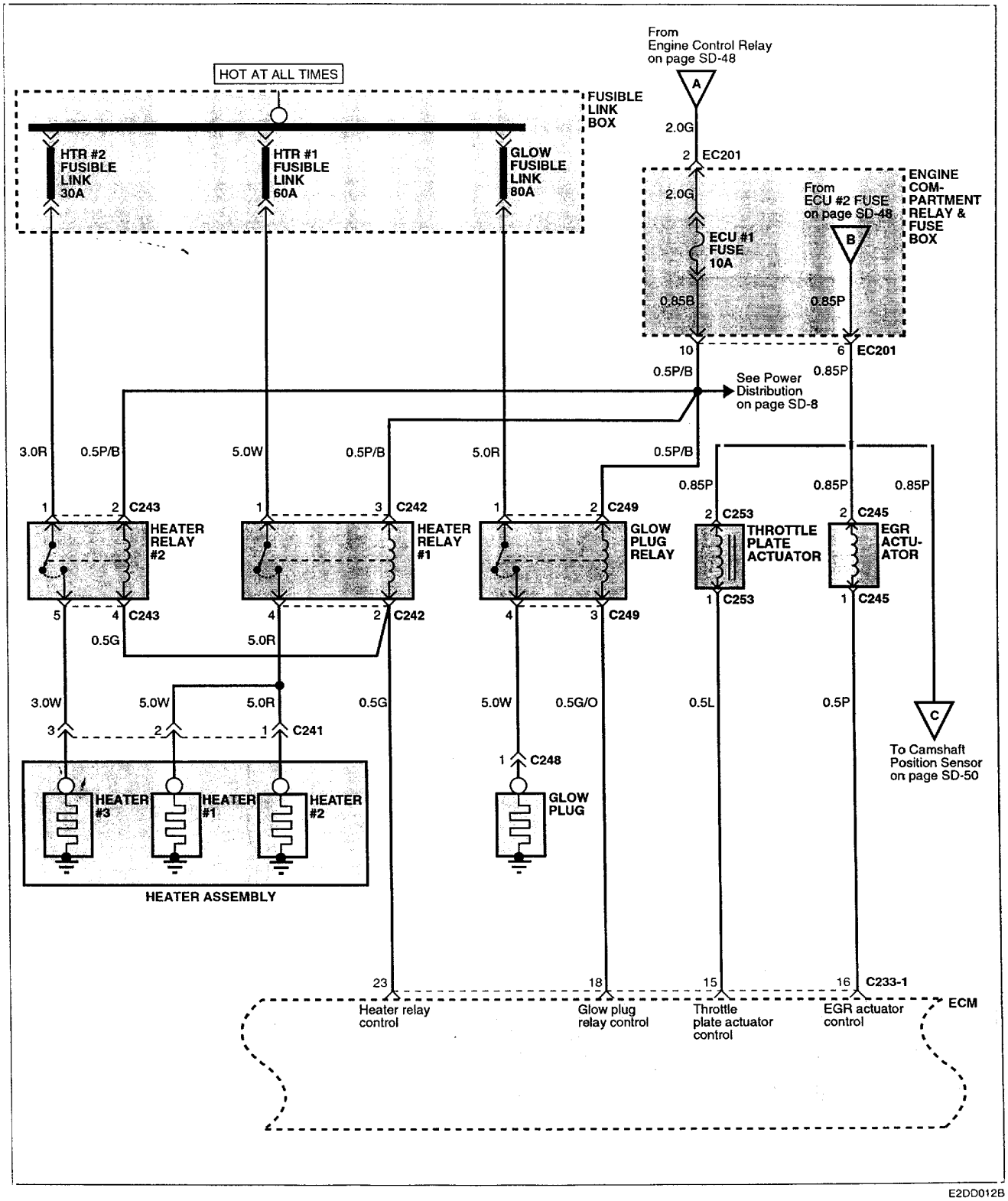
MFI CONTROL SYSTEM (DIESEL) E1F1E5E9

MFI CONTROL SYSTEM (DIESEL) (1)

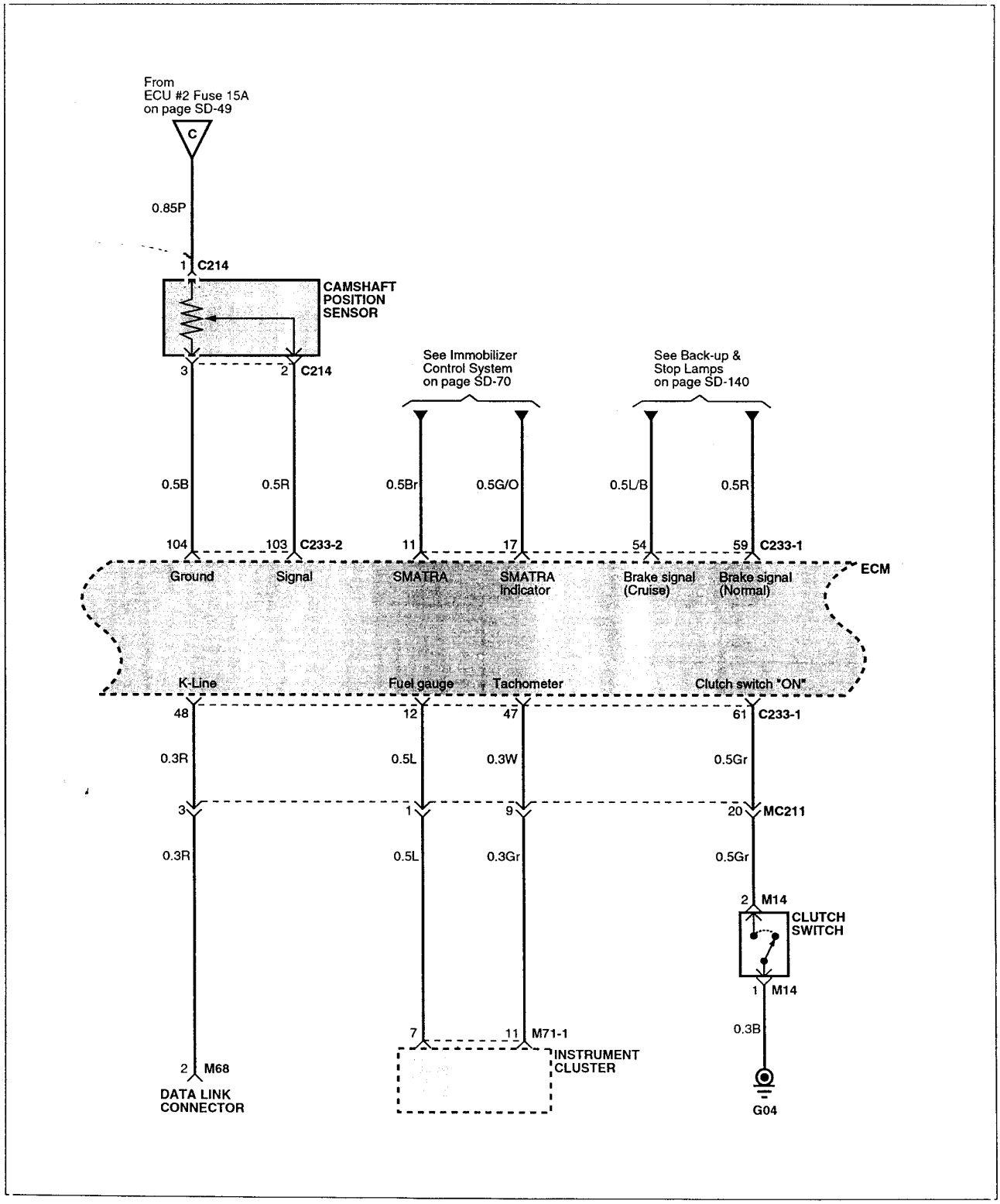


E2DD012A

MFI CONTROL SYSTEM (DIESEL) (2)

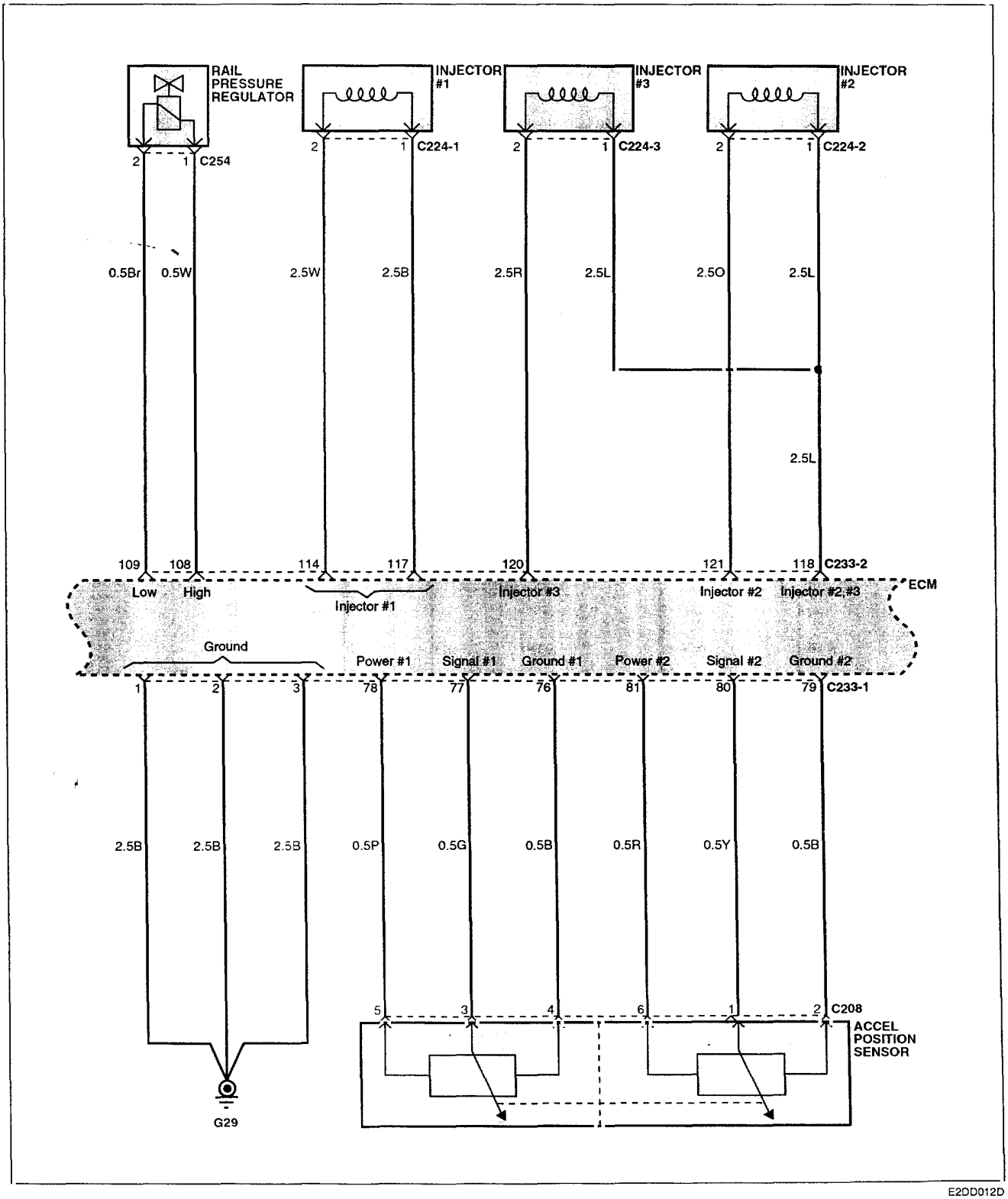


MFI CONTROL SYSTEM (DIESEL) (3)



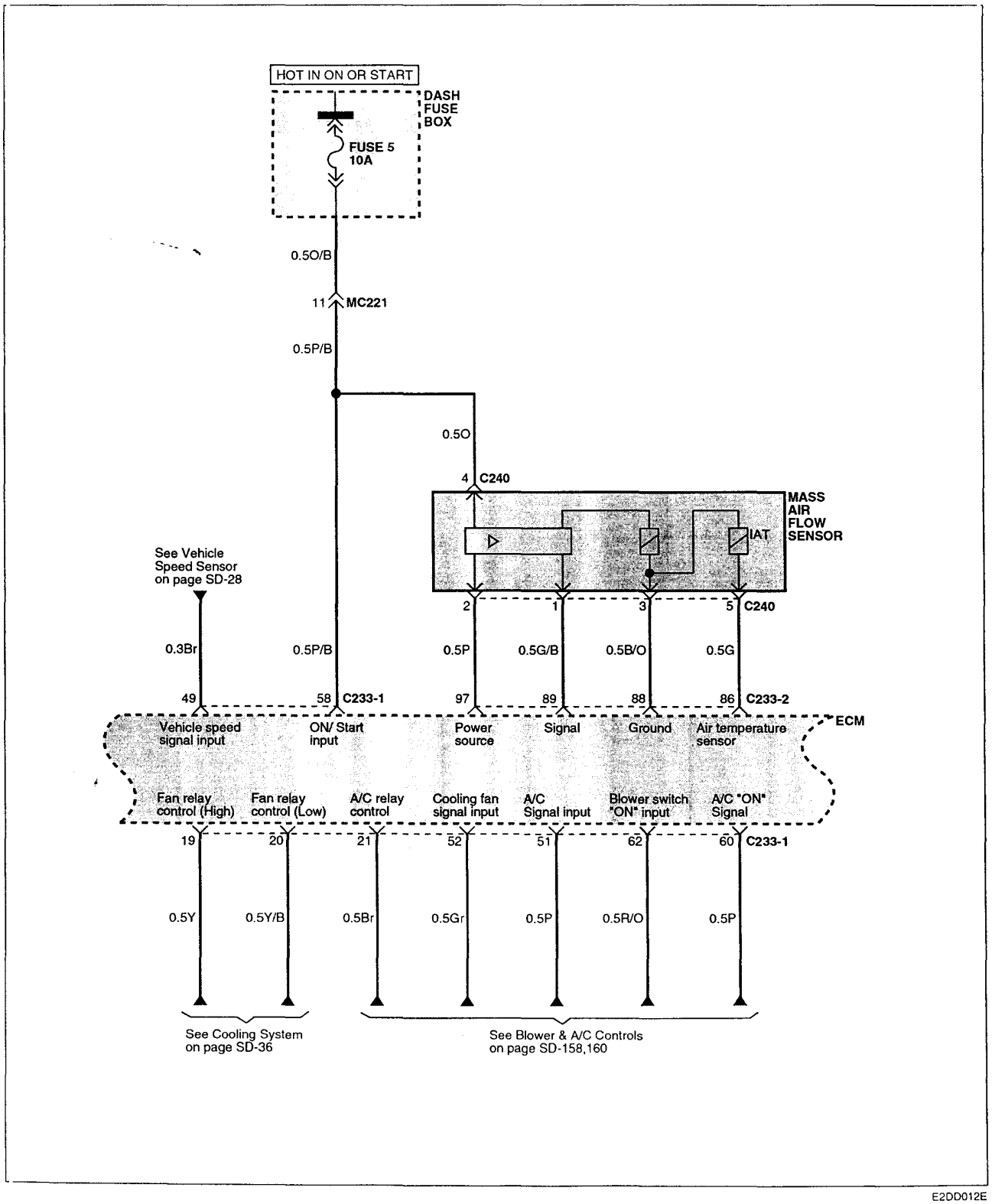
E2DD012C

MFI CONTROL SYSTEM (DIESEL) (4)



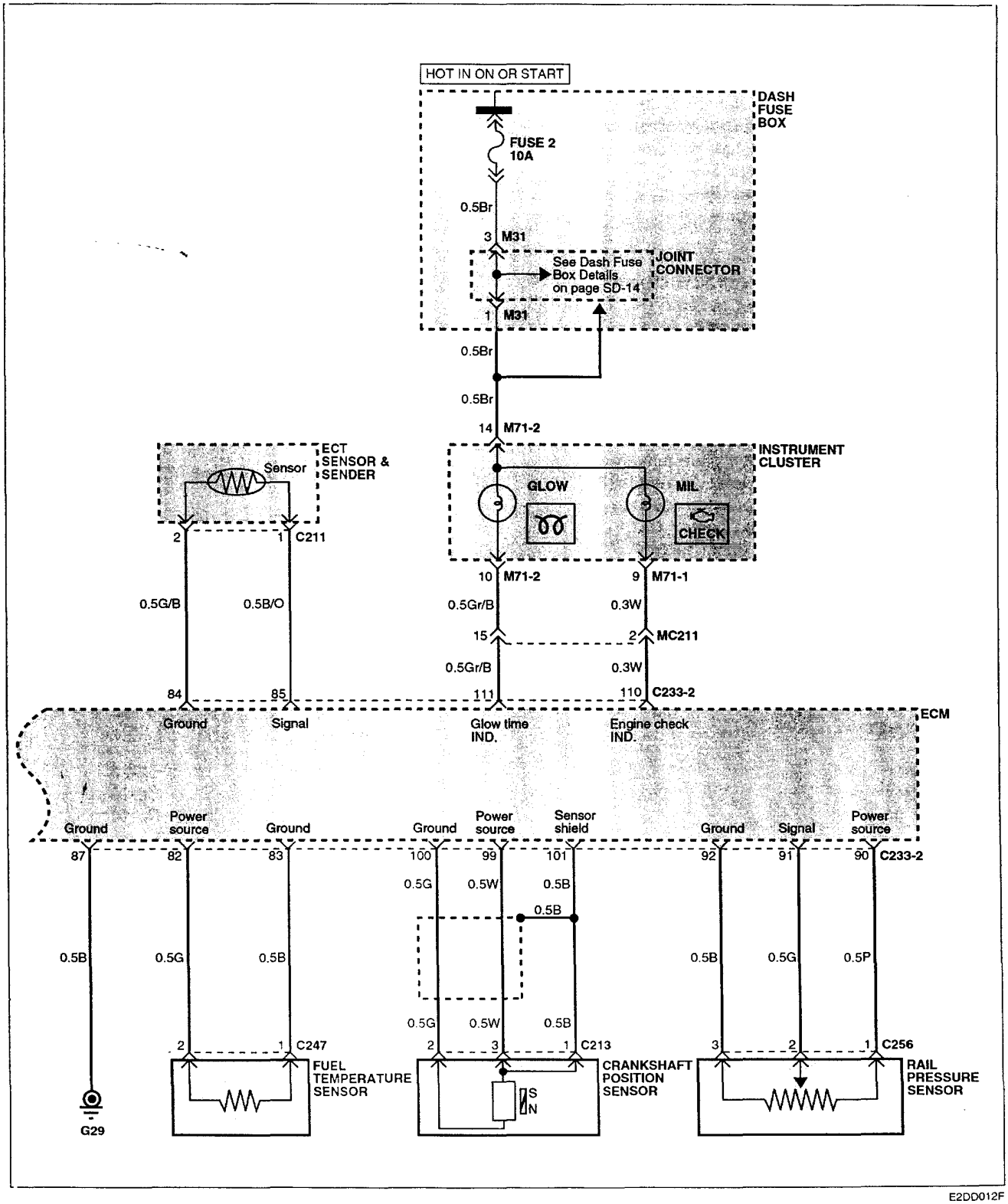
E2DD012D

MFI CONTROL SYSTEM (DIESEL) (5)



E2DD012E

MFI CONTROL SYSTEM (DIESEL) (6)



E2DD012F

COMPONENT LOCATION INDEX (1)

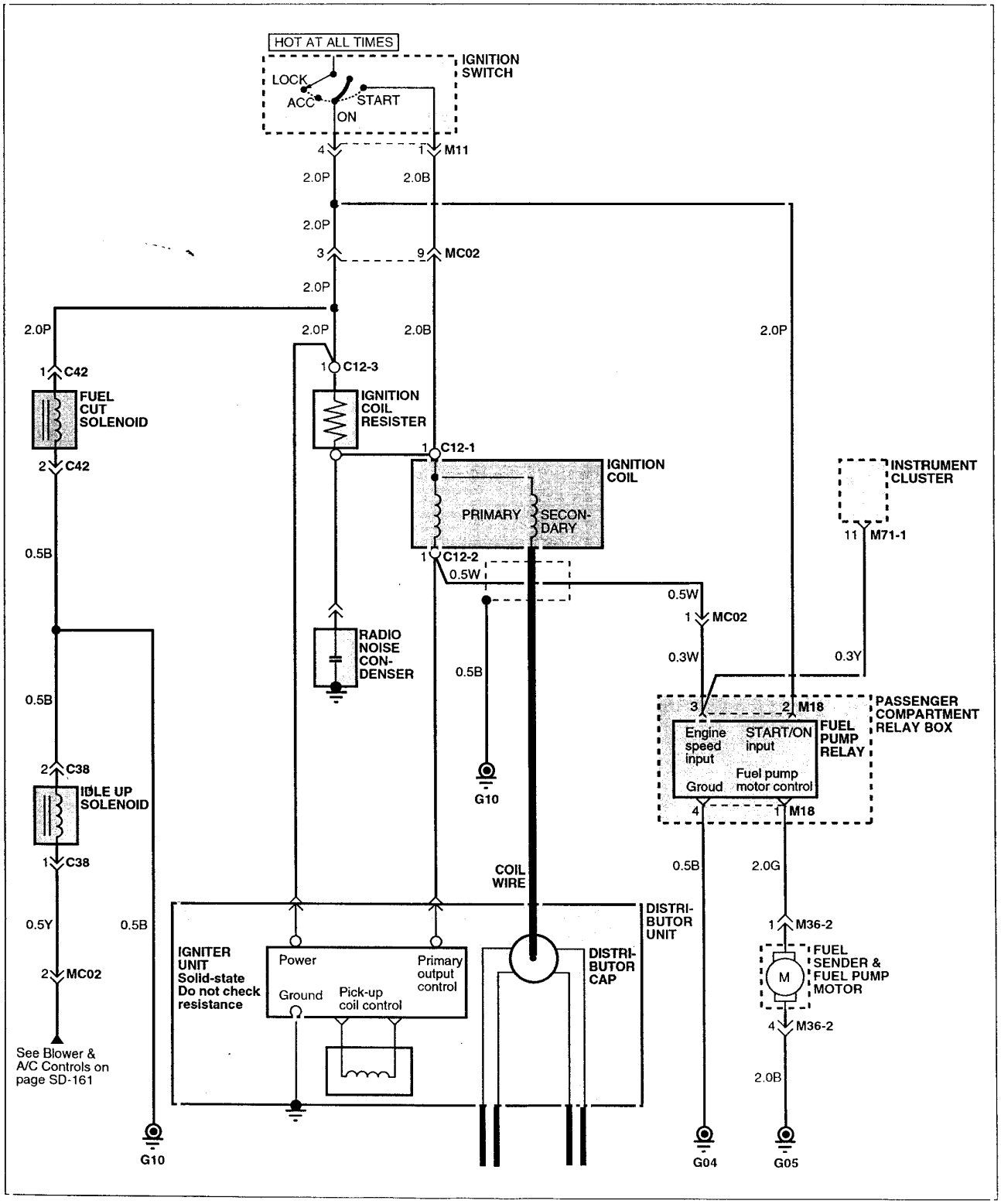
Components		Location reference - page
C208	Accel position sensor	CL-23
C211	ECT sensor & sender	CL-23
C213	Crankshaft position sensor	CL-23
C214	Camshaft position sensor	CL-23
C224-1	Injector #1	CL-23
C224-2	Injector #2	CL-23
C224-3	Injector #3	CL-23
C233-1	ECM	CL-24
C233-2	ECM	CL-24
C240	Mass air flow sensor	CL-24
C241	Heater assembly	CL-24
C242	Heater relay #1	CL-24
C243	Heater relay #2	CL-24
C245	EGR actuator	CL-24
C247	Fuel temperature sensor	CL-24
C248	Glow plug	CL-24
C249	Glow plug relay	CL-25
C253	Throttle plate actuator	CL-25
C254	Rail pressure regulator	CL-25
C256	Rail pressure sensor	CL-25
C259	Engine control relay	CL-25
E21	Fuel pump relay	CL-14
E48	Joint connector	CL-16
M14	Starter clutch pedal position switch (M/T)	CL-3
M36-1	Fuel sender & Fuel pump motor	CL-4
M68	Data link connector	CL-7
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EM01		CL-16
MC211		CL-10
MC221		CL-10
Grounds		
G04		CL-28
G05		CL-28
G29		CL-29

MEMO

MEMO

MFI CONTROL SYSTEM (CARBURETOR) EAEE4EAE

MFI CONTROL SYSTEM (CARBURETOR) (1)



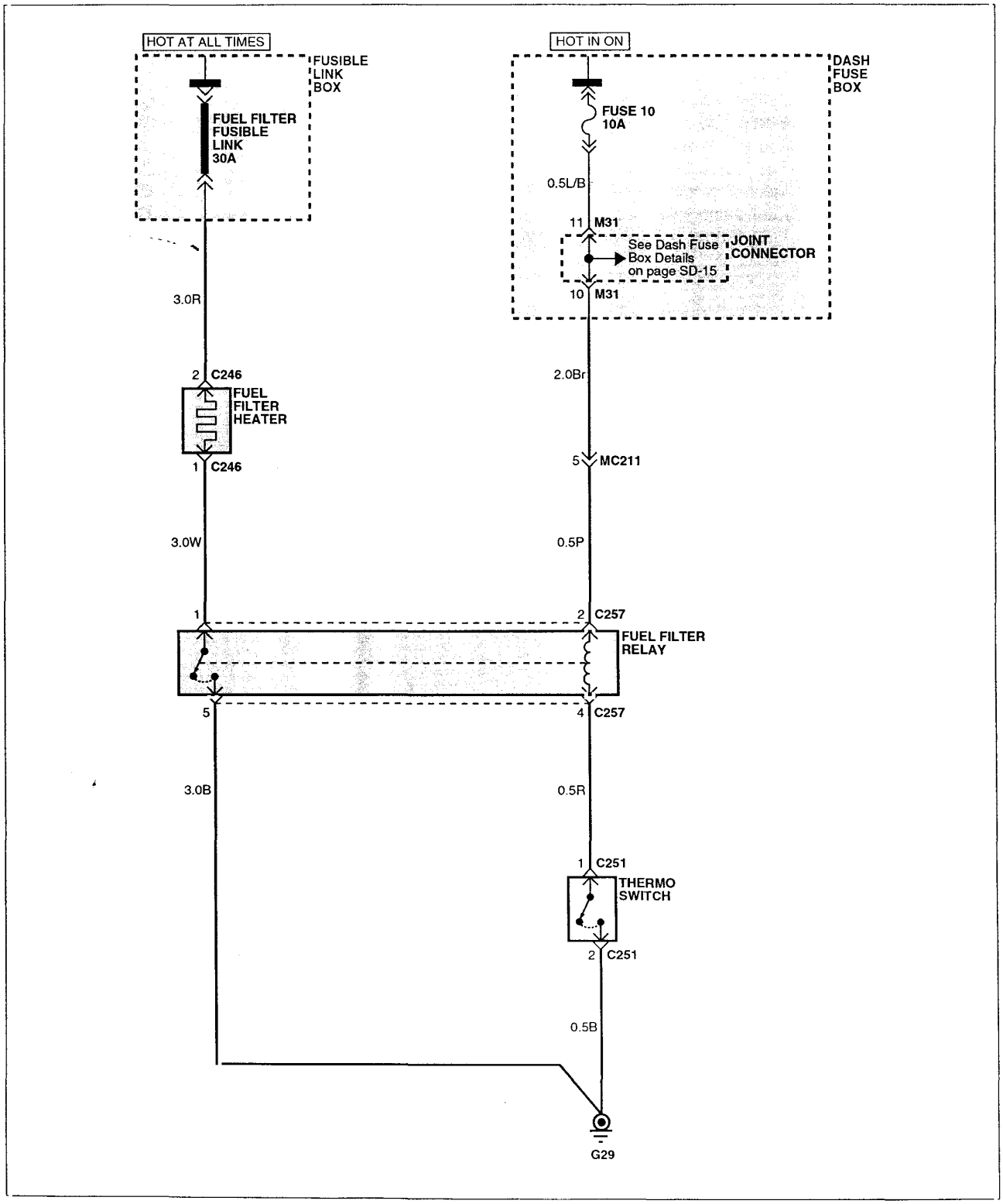
E2DD013A

COMPONENT LOCATION INDEX

Components		Location reference - page
C12-1	Ignition coil	CL-19
C12-2	Ignition coil	CL-19
C12-3	Ignition coil	CL-19
C38	Idle up solenoid	CL-22
C42	Fuel cut solenoid	CL-22
M11	Ignition switch	CL-2
M18	Fuel pump relay	CL-3
M36-2	Fuel sender & Fuel pump motor	CL-4
M71-1	Instrument cluster	CL-8
Connectors		
MC02		CL-10
Grounds		
G04		CL-28
G05		CL-28
G10		CL-29

FUEL FILTER HEATING SYSTEM (DIESEL) EEB6A92C

FUEL FILTER HEATING SYSTEM (DIESEL) (1)



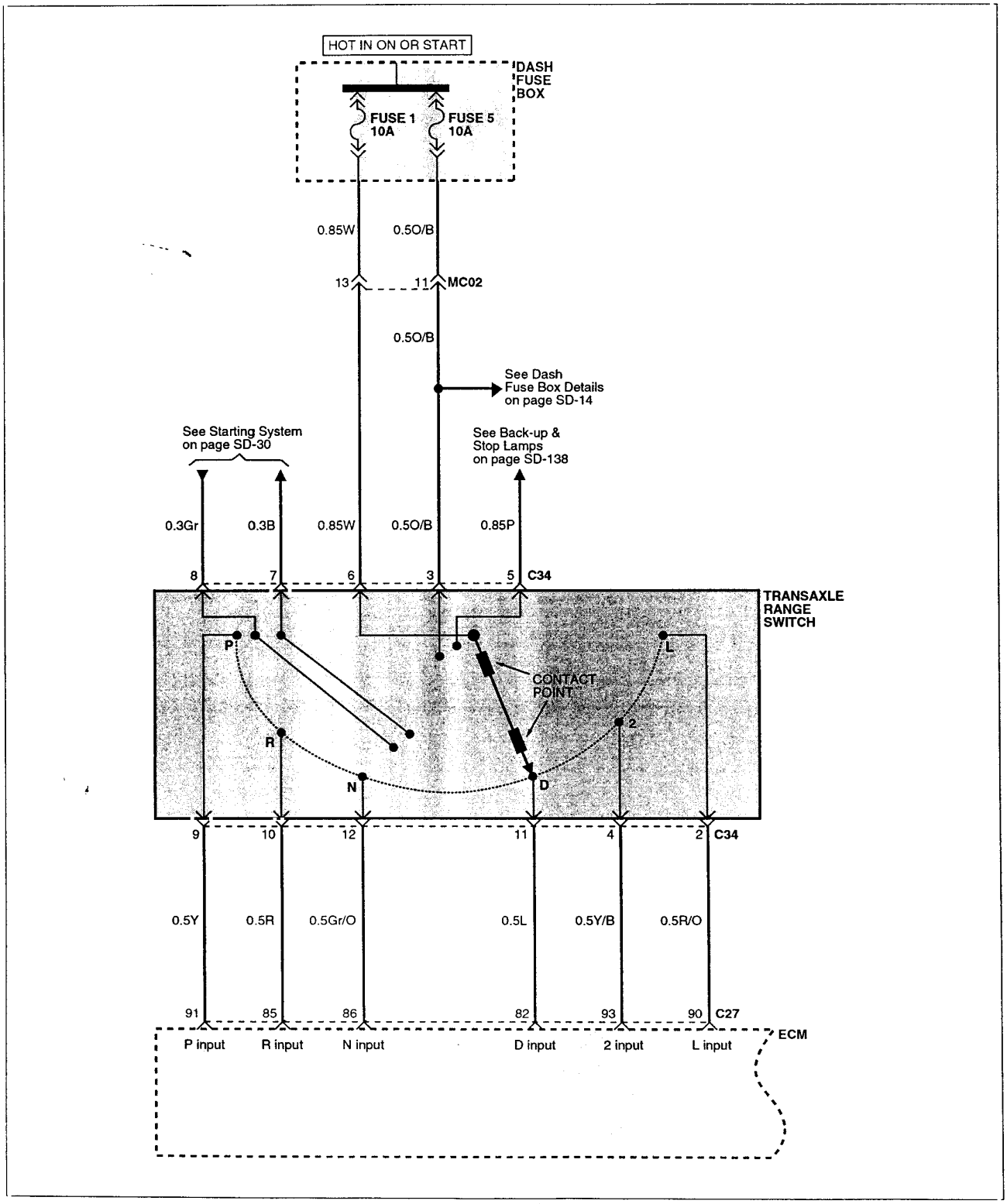
E2DD043A

COMPONENT LOCATION INDEX

Components		Location reference - page
C246	Fuel filter heater	CL-24
C251	Thermo switch	CL-25
C257	Fuel filter relay	CL-25
M31	Joint connector	CL-3
Connectors		
MC211		CL-10
Grounds		
G29		CL-29

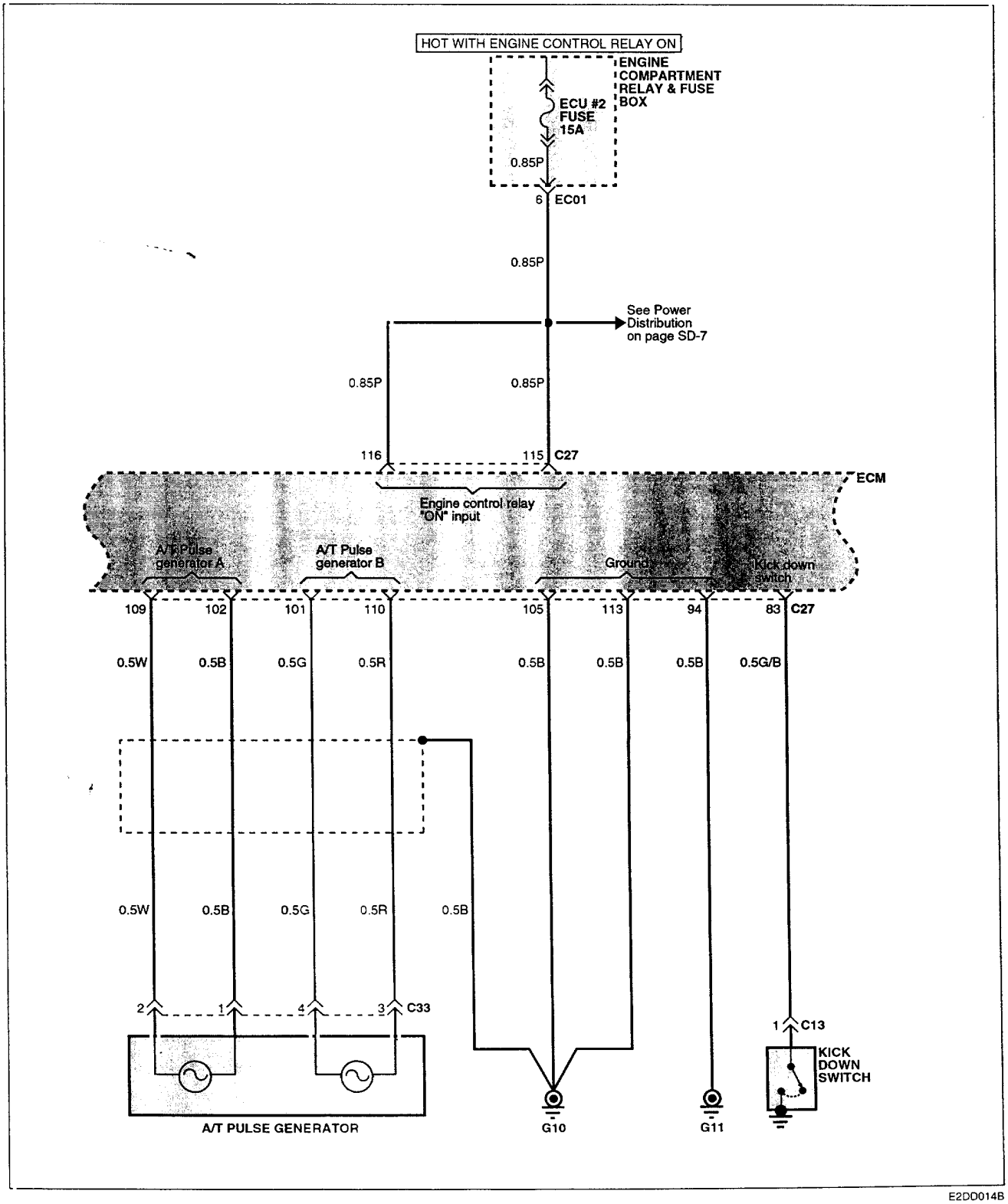
AUTOMATIC TRANSAXLE CONTROL SYSTEM EA0C105A

AUTOMATIC TRANSAXLE CONTROL SYSTEM (1)



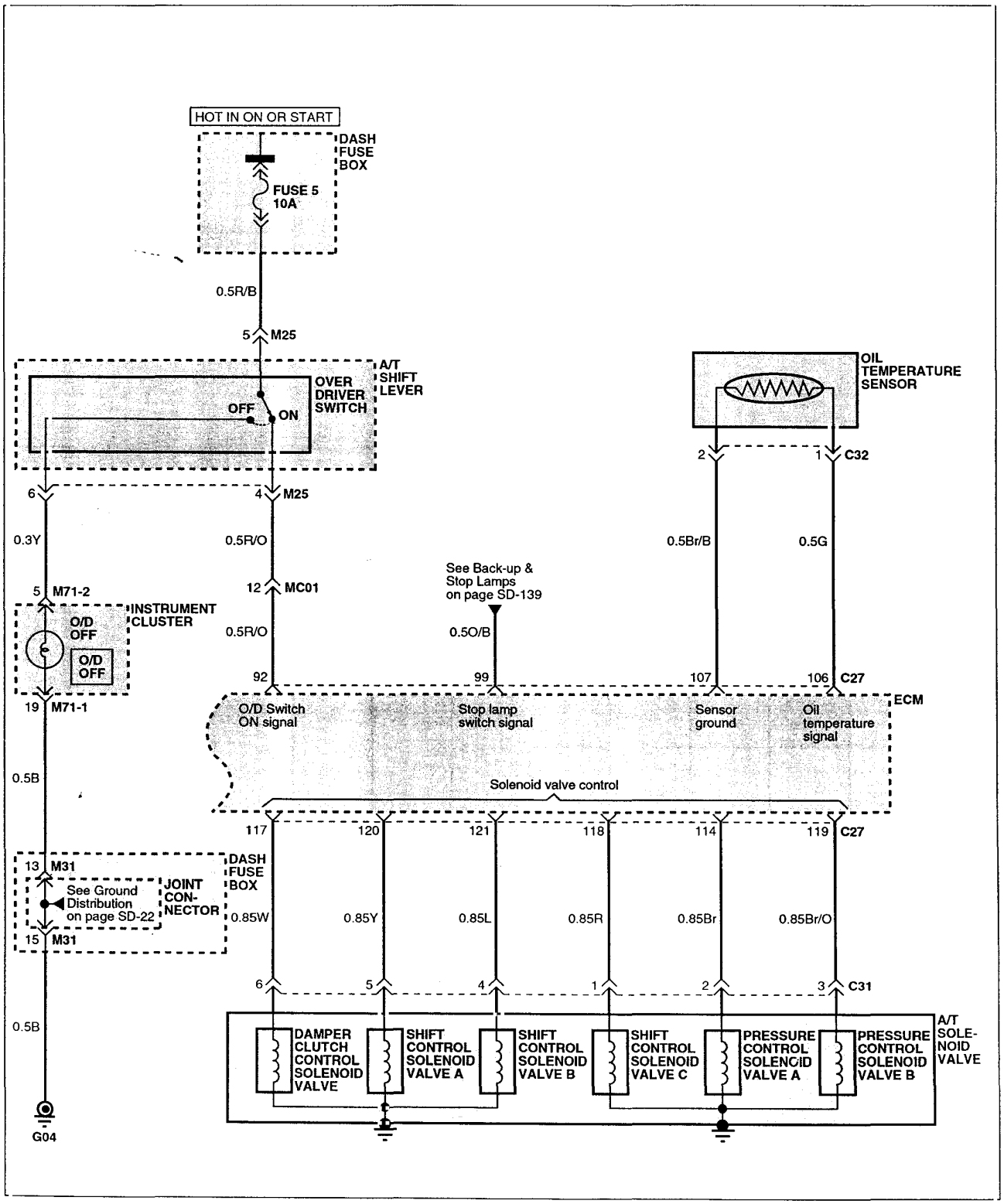
E2DD014A

AUTOMATIC TRANSAXLE CONTROL SYSTEM (2)



E2DD014B

AUTOMATIC TRANSAXLE CONTROL SYSTEM (3)



E2DD014C

COMPONENT LOCATION INDEX

Components		Location reference - page
C13	Kick down switch	CL-19
C27	ECM	CL-20
C31	A/T solenoid valve	CL-21
C32	Oil temperature sensor	CL-21
C33	A/T pulse generator	CL-21
C34	Transaxle range switch	CL-21
M25	A/T shift lever	CL-3
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EC01		CL-16
MC01		CL-10
MC02		CL-10
Grounds		
G04		CL-28
G10		CL-29
G11		CL-29

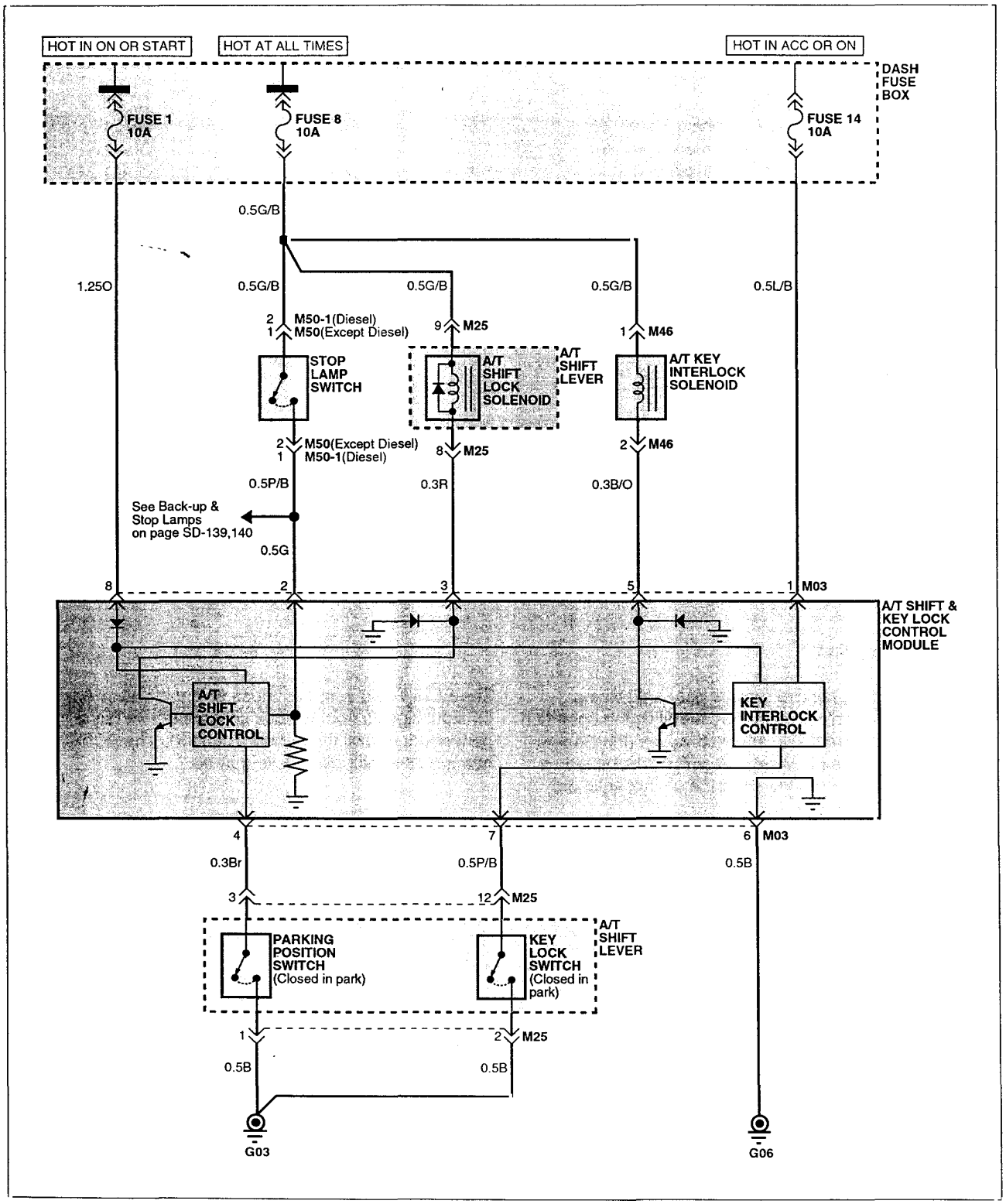
Circuit Description

The ECM(TCM) provides precise gear shift timing and torque converter lock up by controlling the operation of the automatic transaxle solenoid valves (the Damper clutch control solenoid valve, the shift control solenoid valve A, B and C , and the pressure control solenoid valve A and B).

The ECM(TCM) operates these solenoid valves based on input signals from various sensors (for instance, pulse generators and oil temperature sensor). The ECM(TCM) has a built-in self diagnostic feature.

SHIFT & KEY LOCK SYSTEM E25BEDCC

SHIFT & KEY LOCK SYSTEM (1)



E2DD011A

COMPONENT LOCATION INDEX

Components		Location reference - page
M03	A/T shift & key lock control module	CL-2
M25	A/T shift lever	CL-3
M46	A/T key interlock solenoid	CL-5
M50	Stop lamp switch	CL-5
Grounds		
G03		CL-28
G06		CL-28

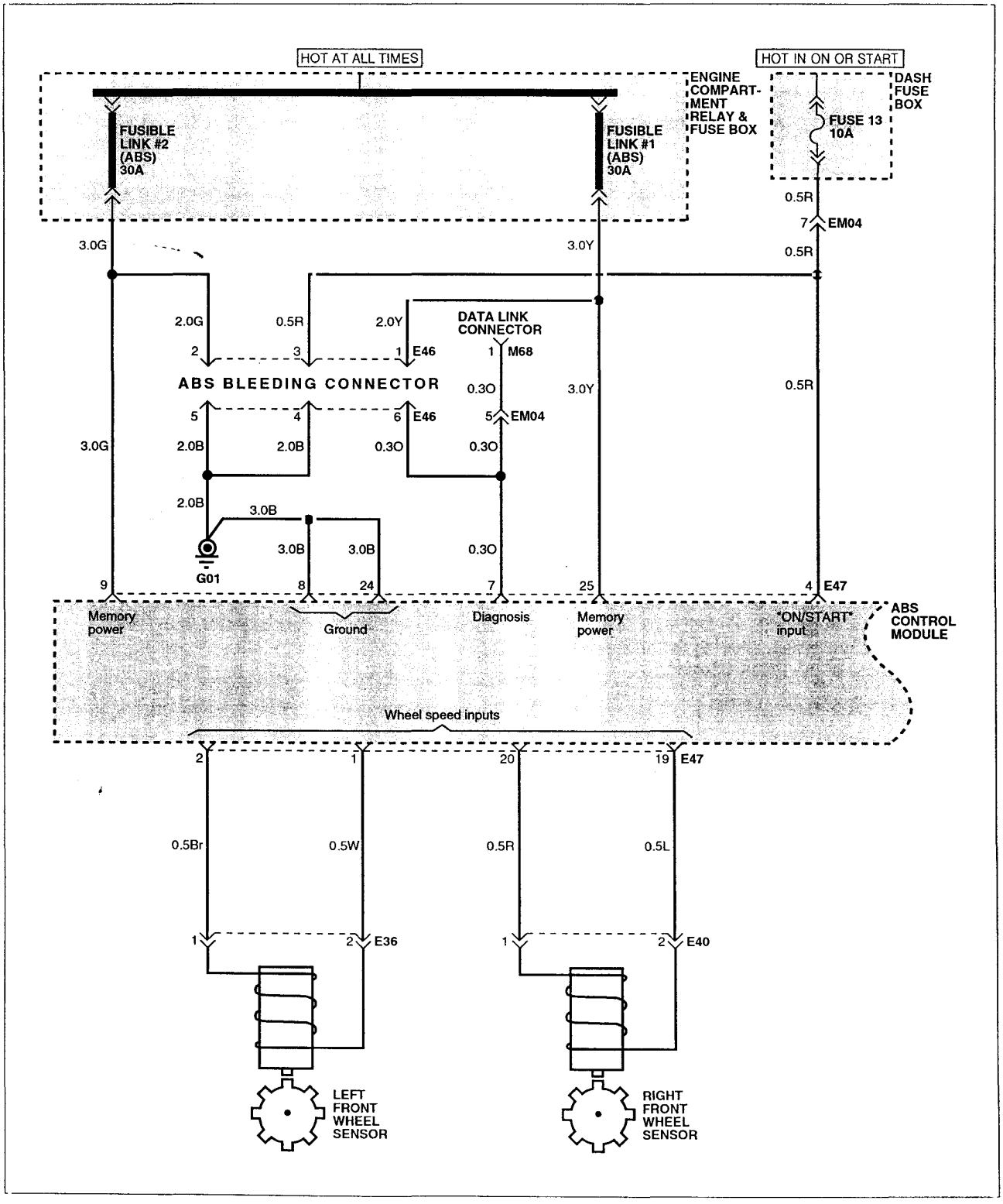
Circuit Description

The transaxle interlock system performs two functions; it allows the ignition key to be removed only with the transaxle in PARK, and allows the transaxle to be released from PARK with only the brake pedal depressed. The transaxle and key lock control module receives voltage from fuse 14 with the ignition switch in ACC or ON, and from fuse 1 in ON or START. With the ignition switch in ON, the park position switch closed and the brake pedal switch depressed, the transaxle and key lock control module grounds the shift lock solenoid. The solenoid is energized, allowing the gear selector to be moved out of the PARK position.

When the ignition switch is in ON or ACC and the gear selector is moved to PARK , the key lock switch is closed and the transaxle and key lock control module de-energizes the key lock solenoid. This allows the ignition key to be removed. In case the shift lock solenoid does not energize and release the gear selector when the brake pedal is depressed, a button beneath the console can be accessed by removing the plug at the top of the console and inserting a thin instrument to manually release the gear selector from PARK.

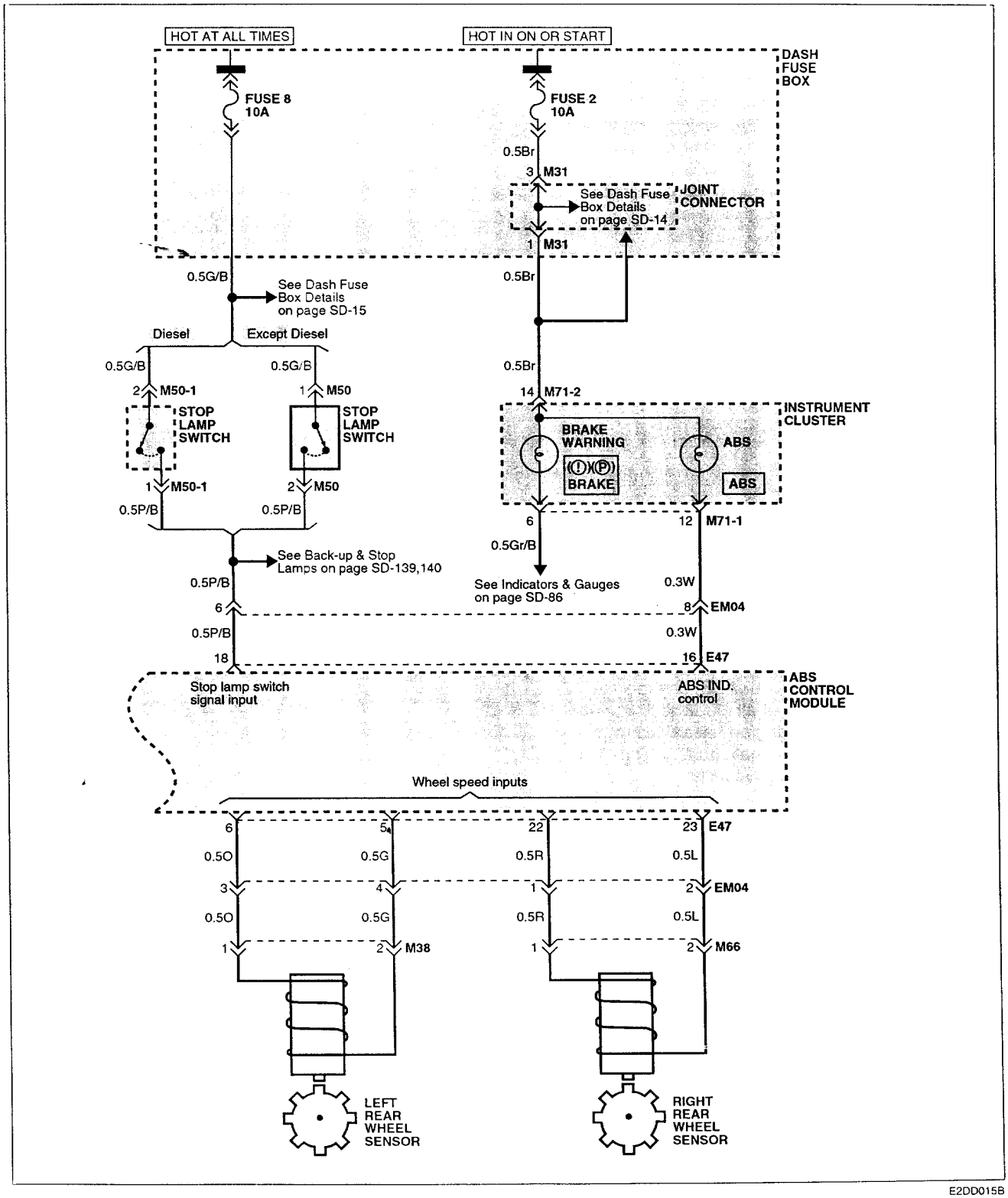
ANTI-LOCK BRAKE SYSTEM (ABS) EE39ECBA

ANTI-LOCK BRAKE SYSTEM (ABS) (1)



E2DD015A

ANTI-LOCK BRAKE SYSTEM (ABS) (2)



E2DD015B

COMPONENT LOCATION INDEX

Components		Location reference - page
E36	Left front wheel sensor	CL-14
E40	Right front wheel sensor	CL-15
E46	ABS bleeding connector	CL-15
E47	ABS control module	CL-15
M31	Joint connector	CL-3
M38	Left rear wheel sensor	CL-4
M50	Stop lamp switch	CL-5
M50-1	Stop lamp switch (Diesel)	CL-5
M66	Right rear wheel sensor	CL-7
M68	Data link connector	CL-7
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EM04		CL-16
Grounds		
G01		CL-28

Circuit Description

ABS

The Anti-Lock Brake System (ABS) controls the hydraulic brake pressure of all four wheels during sudden braking and braking on hazardous road surfaces, preventing the wheels from locking. The ABS proyides the following benefits:

(1) Enables steering around obstacles with a greater degree of certainty during panic braking.

(2) Enables stopping during panic braking while allowing stability and control, even on curves.

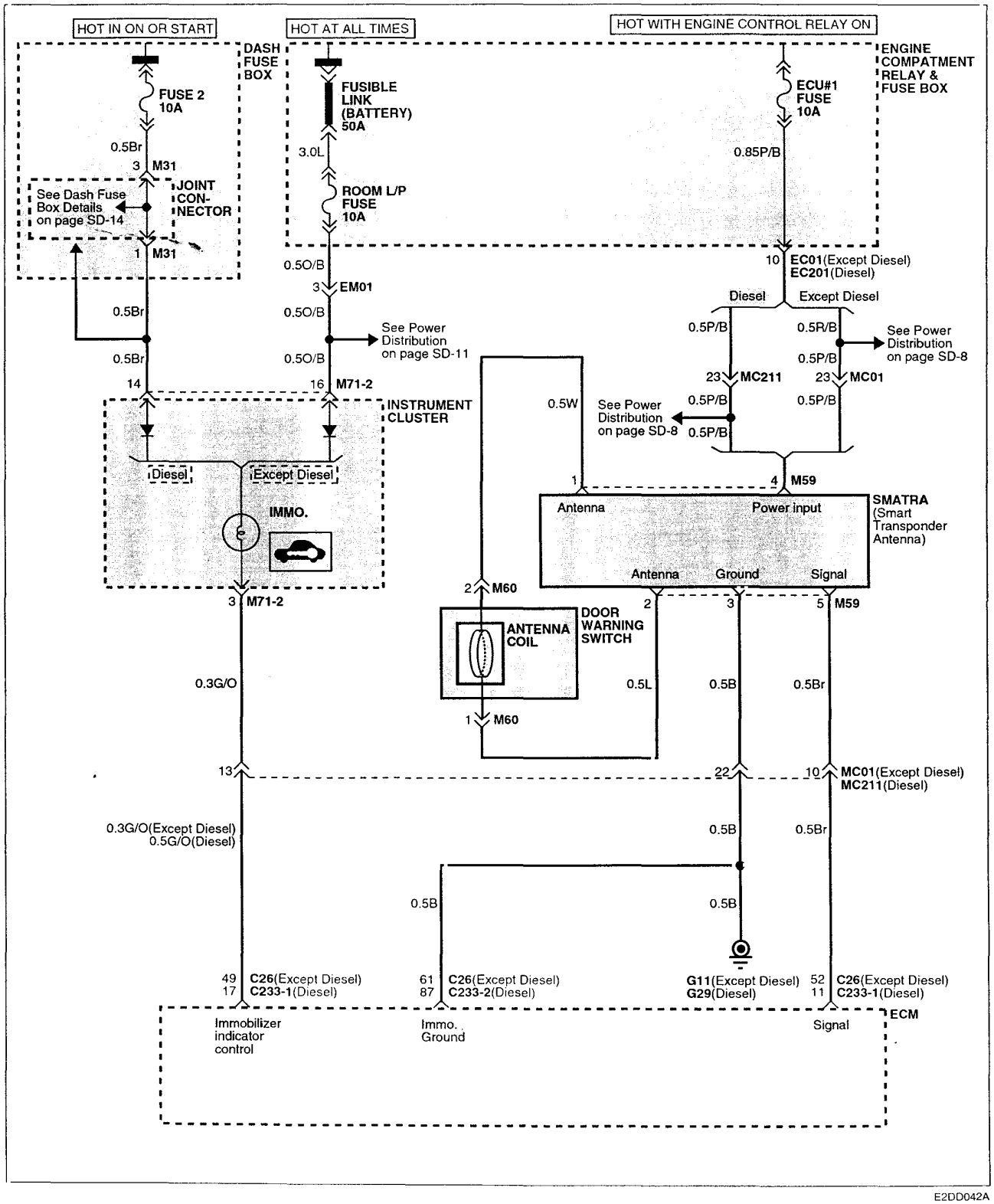
In case a malfunction occurs in the anti-lock brake system, the system will operate as a normal brake (fail safe mode). A diagnosis function and fail-safe system have been included for serviceability.

MEMO

MEMO

IMMOBILIZER CONTROL SYSTEM E2EF5E83

IMMOBILIZER CONTROL SYSTEM (1)



E2DD042A

COMPONENT LOCATION INDEX

Components		Location reference - page
C26	ECM (Except Diesel)	CL-20
C233-1	ECM (Diesel)	CL-24
C233-2	ECM (Diesel)	CL-24
M31	Joint connector	CL-3
M59	SMATRA	CL-6
M60	Door warning switch	CL-6
M71-2	Instrument cluster	CL-8
Connectors		
EC01		CL-16
EM01		CL-16
MC01		CL-10
MC211		CL-10
Grounds		
G11		CL-29
G29		CL-29

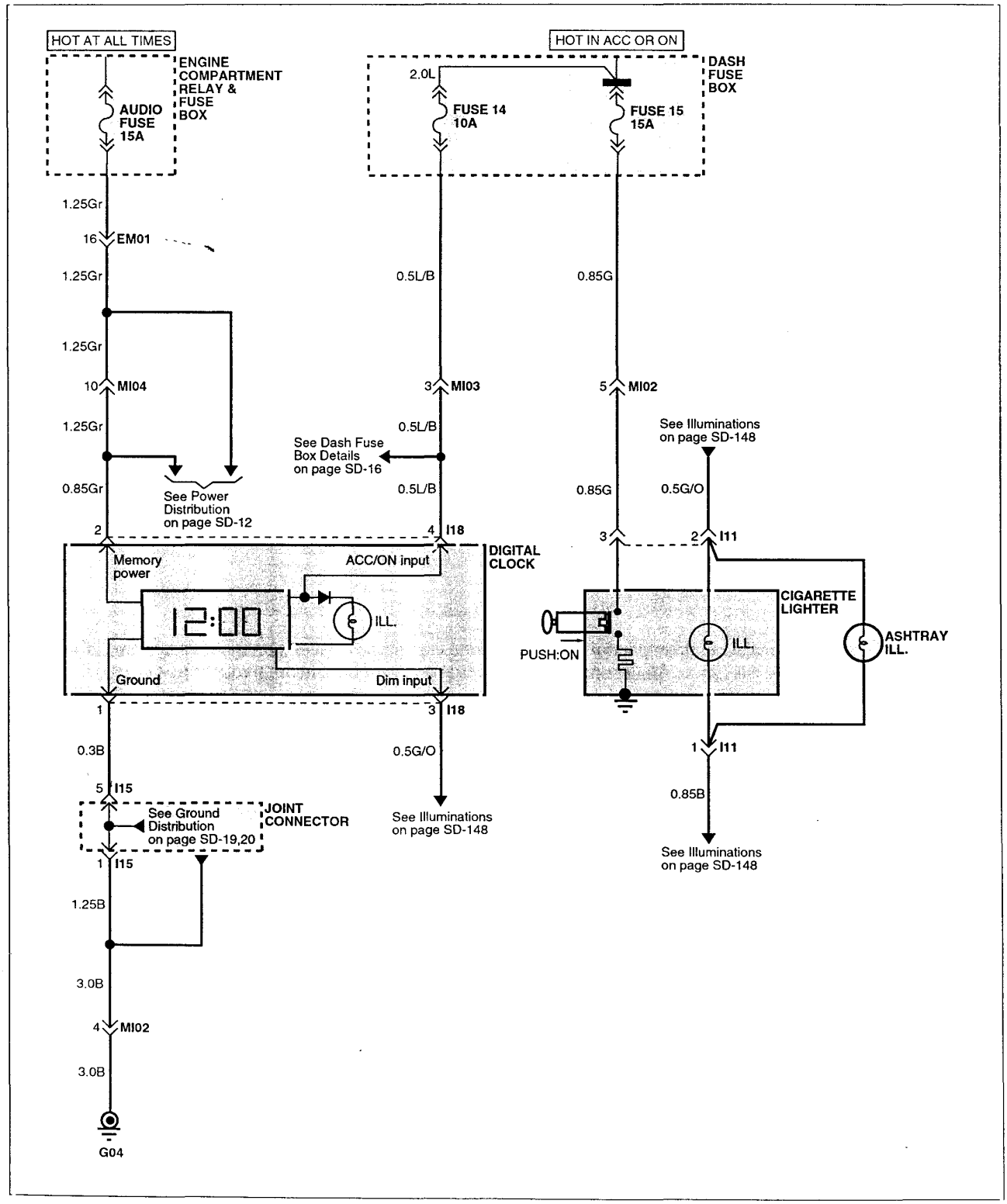
Circuit Description

The immobilizer system consist of a transponder inside the key head and the SMATRA (Smart Transponder Antenna) unit. The SMATRA unit contains an integrated inductive antenna and electronics around the lock assembly. The SMATRA communicates to a control unit via a dedicated communication line.

Since the vehicle engine management system isn able to control engine mobilization (throught fuel injection control), it is the most suitable unit to control the SMATRA.

CIGARETTE LIGHTER & DIGITAL CLOCK EEF4166B

CIGARETTE LIGHTER & DIGITAL CLOCK (1)



E2DD016A

COMPONENT LOCATION INDEX

Components		Location reference - page
I11	Cigarette lighter	CL-17
I15	Joint connector	CL-17
I16	Audio	CL-17
I18	Digital clock	CL-17
Connectors		
EM01		CL-16
EM02		CL-16
MI02		CL-11
MI04		CL-11
Grounds		
G04		CL-28

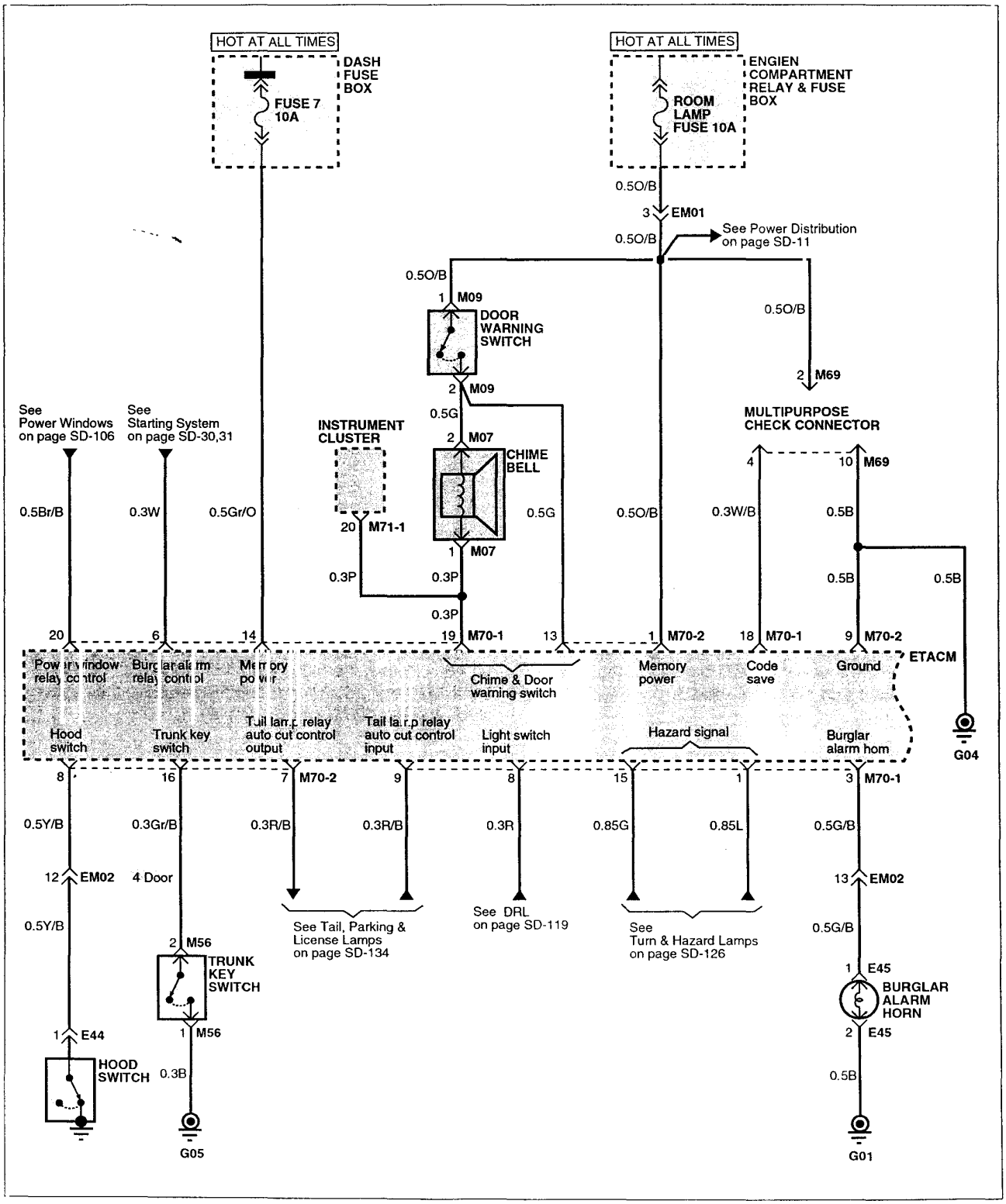
Circuit Description

CIGARETTE LIGHTER
With the ignition switch in ACC or ON, battery voltage is applied from fuse 15 to the cigarette lighter. When you depress (push) the lighter, the lighter element completes the circuit to ground. When the element becomes sufficiently heated, it is spring-released and the circuit opens.

DIGITAL CLOCK
Battery voltage is applied at all times to the digital clock from audio fuse to provide clock memory. With the ignition switch in ACC or ON, battery voltage is applied to the clock through fuse 14. The digital clock lights up and displays the time. With the light switch in PARK or HEAD, the light switch provides ground to the digital clock and the digital clock's display will dim.

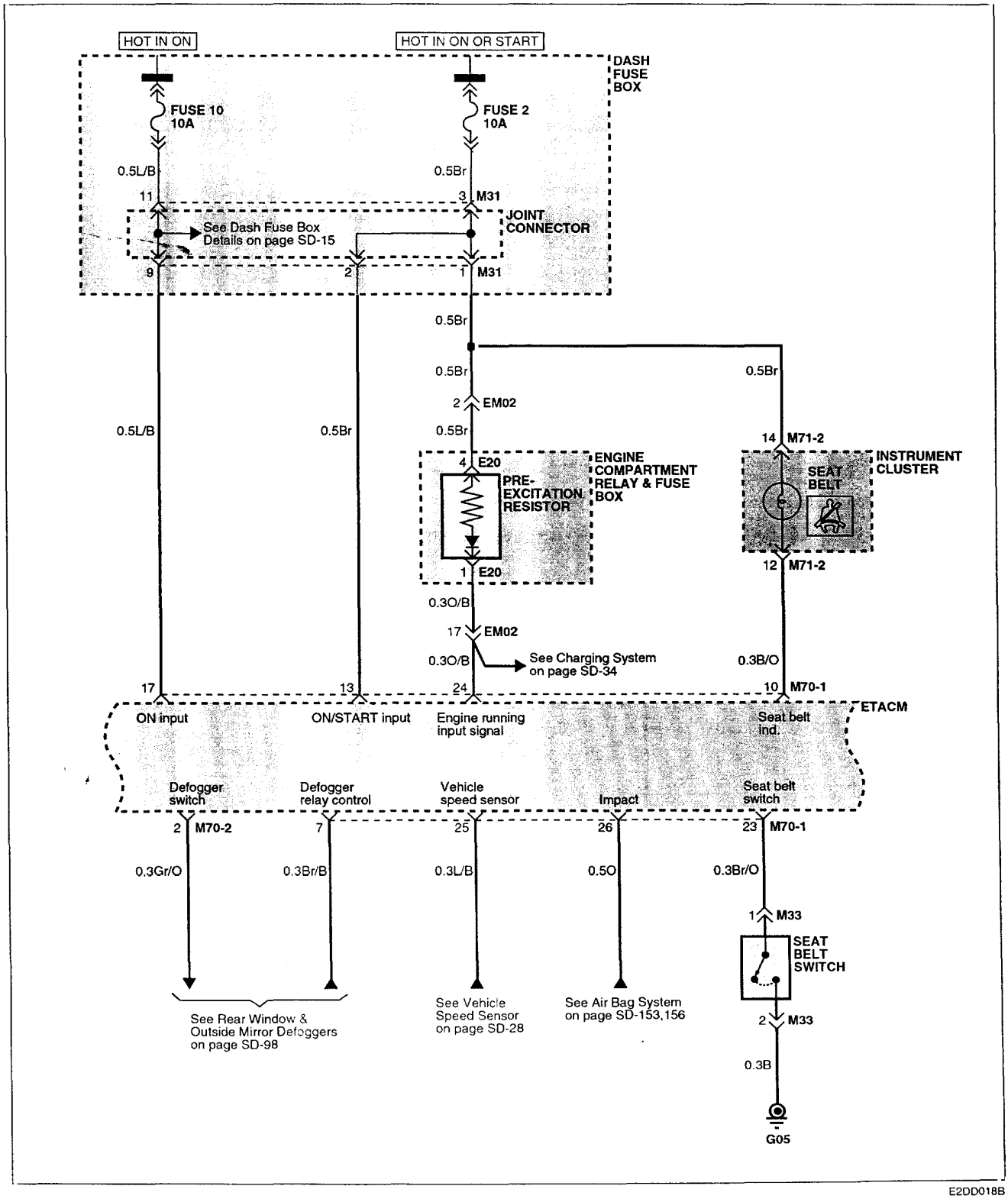
ETACS EA94AF22

ETACS (1)



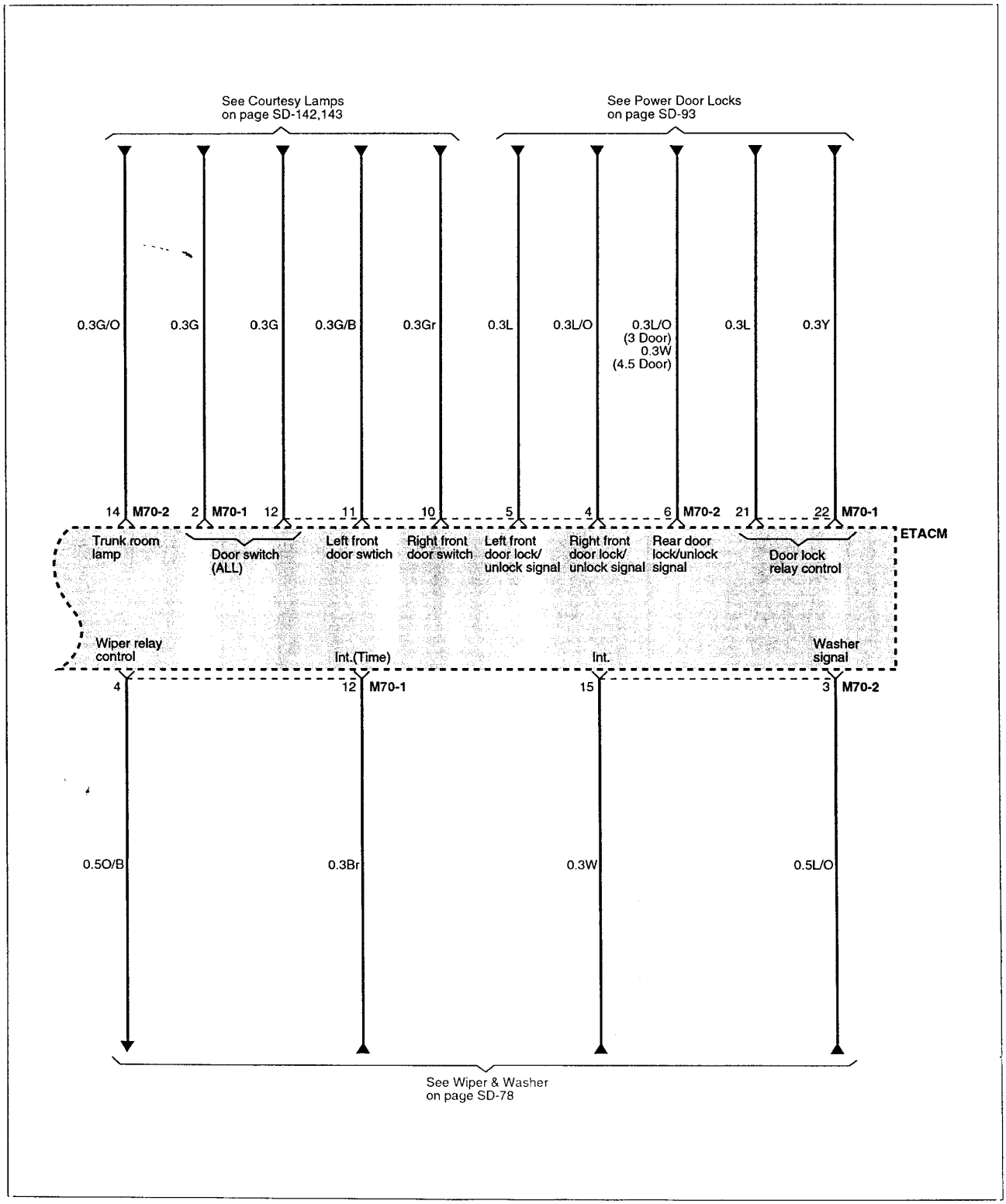
E2DD018A

ETACS (2)



E2DD018B

ETACS (3)



E2DD018C

COMPONENT LOCATION INDEX

Components		Location reference - page
E20	Pre-excitation resistor	CL-14
E44	Hood switch	CL-15
E45	Burglar alarm horn	CL-15
M07	Chime bell	CL-2
M09	Door warning switch	CL-2
M31	Joint connector	CL-3
M33	Seat belt switch	CL-4
M56	Trunk key switch (4Door)	CL-6
M69	Multipurpose check connector	CL-7
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
M71-2	Instrument cluster	CL-8
Connectors		
EM01		CL-16
EM02		CL-16
Grounds		
G01		CL-28
G04		CL-28
G05		CL-28

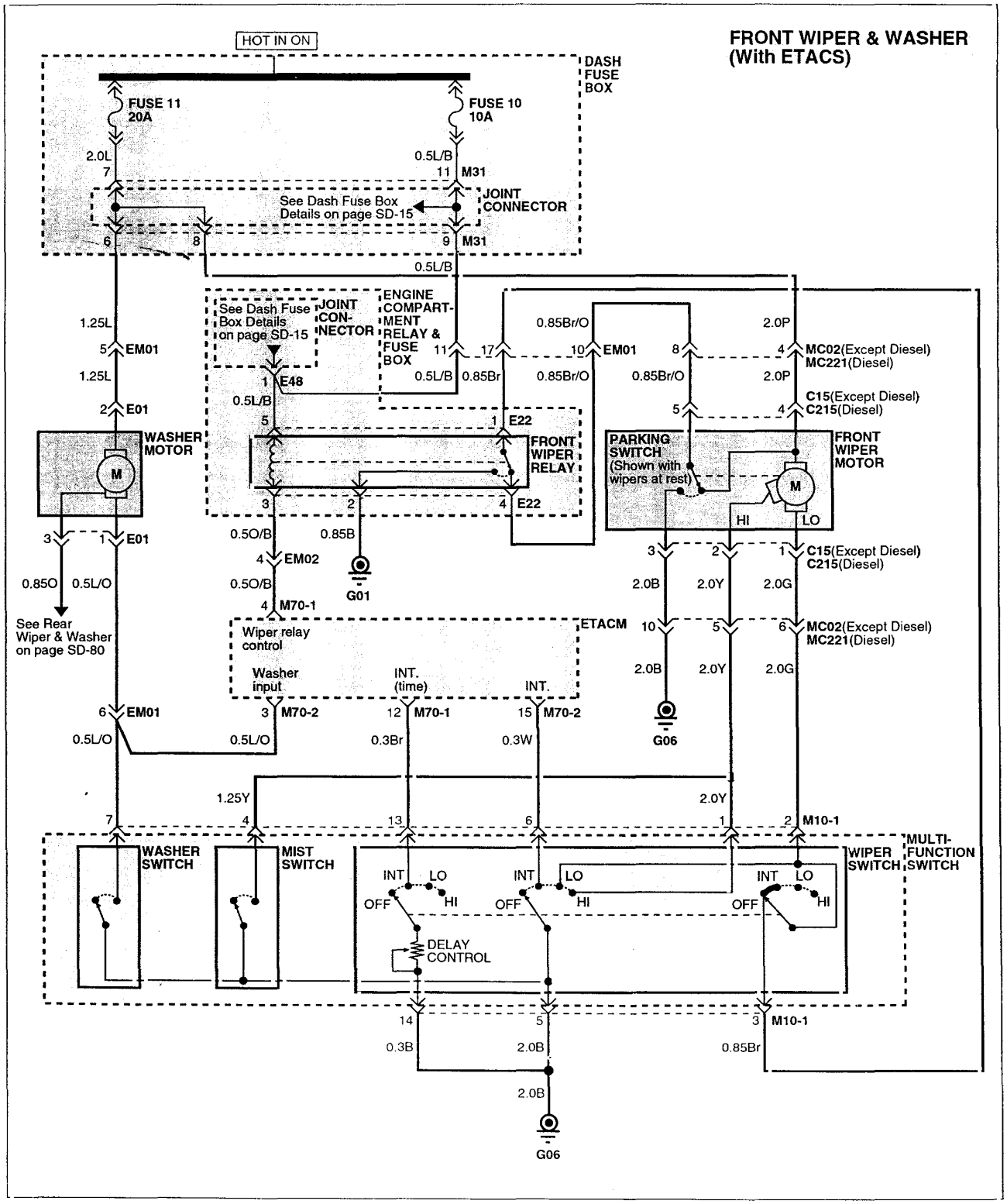
Circuit Description

The electronic time and alarm control module (ETACM) operates the front wiper, the front washer, chime bell, rear window defogger and so on. Fuse 2 supplies battery voltage to the module when the ignition is in ON or START.

Fuse 10 supplies battery voltage to the module whenever the key is in ON. For details on the use of the various inputs and outputs, refer to the Shop Manual, section BE details.

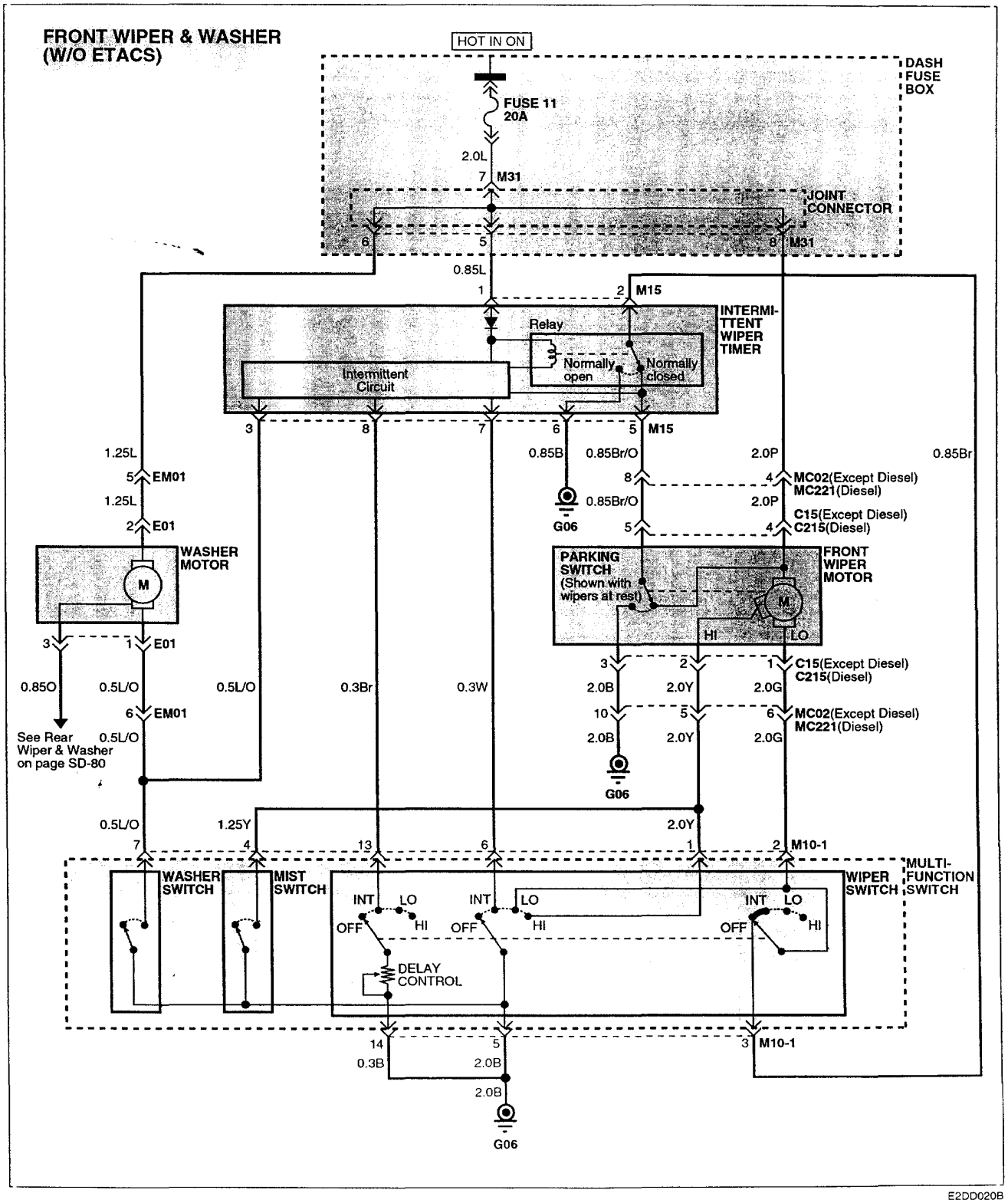
WIPER & WASHER EF3C8810

WIPER & WASHER (1)



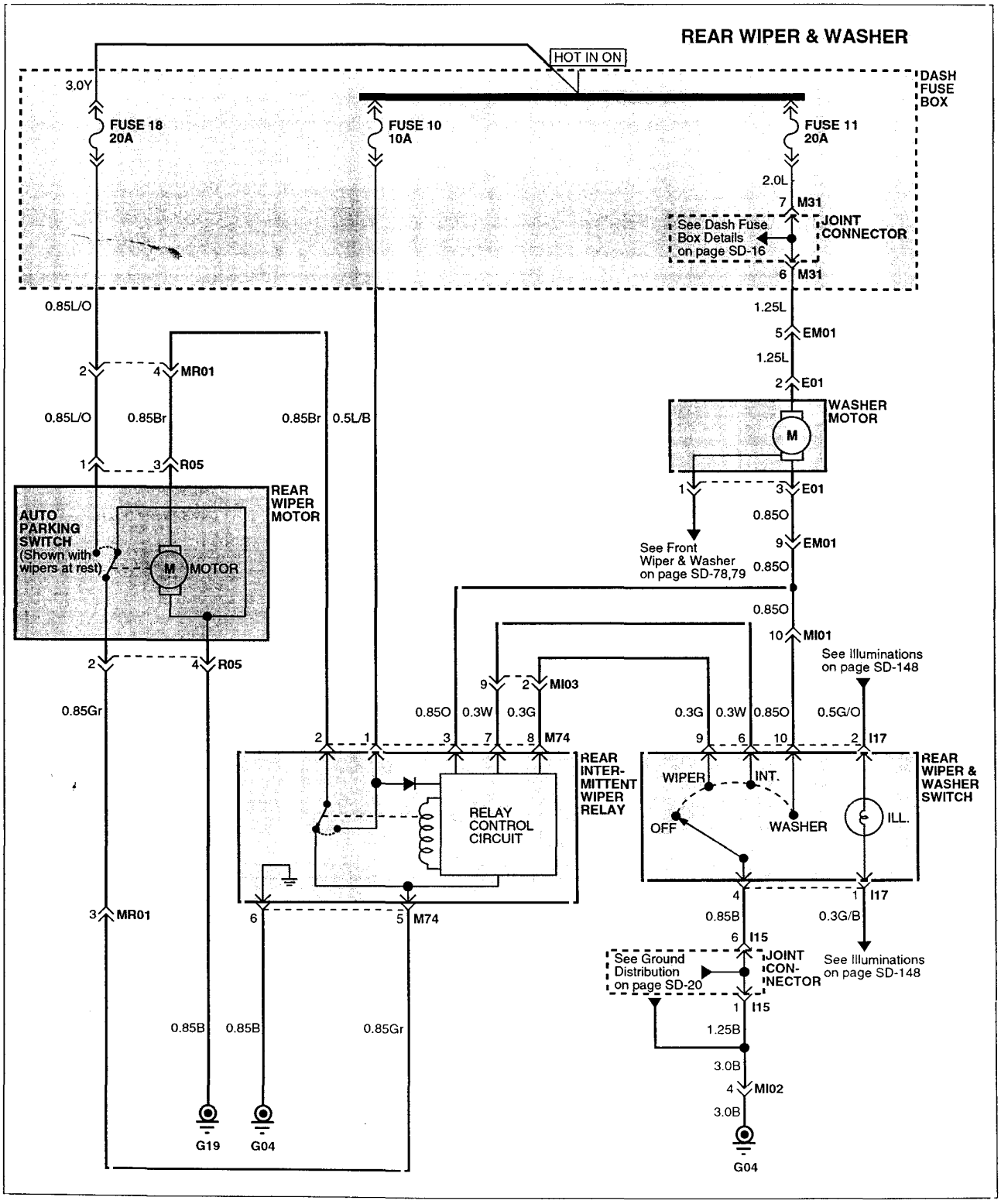
E2DD020A

WIPER & WASHER (2)



E2DD020B

WIPER & WASHER (3)



E2DD020C

COMPONENT LOCATION INDEX

Components		Location reference - page
C15	Front wiper motor (Except Diesel)	CL-19
C215	Front wiper motor (Diesel)	CL-23
E01	Washer motor	CL-12
E22	Front wiper relay	CL-14
E48	Joint connector	CL-16
I15	Joint connector	CL-17
I17	Rear wiper & washer switch	CL-17
M10-1	Multifunction switch	CL-2
M15	Intermittent wiper timer	CL-3
M31	Joint connector	CL-3
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
M74	Rear intermittent wiper relay	CL-8
R05	Rear wiper motor	CL-27
Connectors		
EM01		CL-16
EM02		CL-16
MC02		CL-10
MC221		CL-10
MI01		CL-11
MI02		CL-11
MI03		CL-11
MR01		CL-11
Grounds		
G01		CL-28
G04		CL-28
G06		CL-28
G19		CL-29

Circuit Description

FRONT WIPER & WASHER

All functions of the front wiper/washer circuit are controlled by the position of the front wiper and washer switches. The wiper switch has 4 positions : OFF, INT, LO and HI.

Wiper Operation

I. Low and High Position

The front wiper motor has separate brushes for low and high speed operation. When the wiper switch is in LO or HI position, one of two brushes is connected to ground through the wiper switch in the multifunction switch.

II. INT Position

When the wiper switch is turned to INT, the intermittent input of the ETACS is grounded and this will provide ground to the low speed brush of the front wiper motor long enough to move the wipers out of the park position. The remainder of the wipers' sweep is controlled by the park circuit. The cycle repeats as long as the wiper switch is in INT. The pause interval between sweeps is determined by the solid-state timer in the ETACM. The timer is reset at the end of each sweep when the park switch returns to the at-rest position.

III. OFF position

When the wiper switch is turned OFF and the wipers are not at rest (out of PARK), the low speed brush of the front wiper motor is grounded through the wiper switch, and the park switch of the front wiper motor.

Washer operation

The front wiper motor operates as long as the washer switch is pressed. The WASH input to the ETACM is grounded when the washer switch is operated. And this will then provide ground to the low speed brushes of the front wiper motor.

REAR WIPER & WASHER

All functions of the rear wiper/washer circuit are controlled by the position of the rear wiper & washer switch and the rear intermittent wiper relay (has it own internal control circuit and controls the relay contracts). The rear window wiper and washer are turned on by depressing the button. Washer fluid is sprayed on the glass as long as the button is depressed.

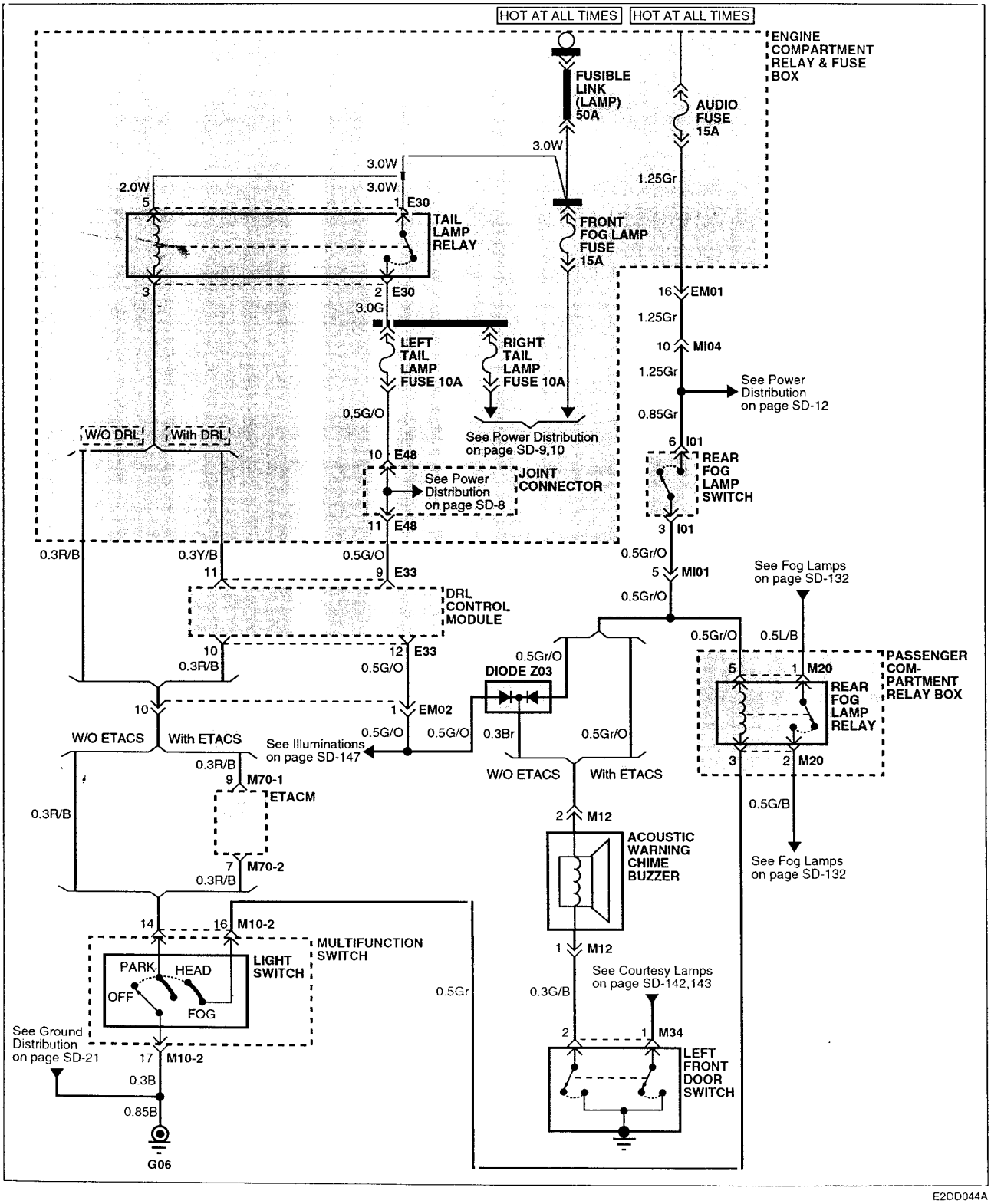
1. When the "wiper" switch is depressed, the rear window wiper starts to operate continuously.
2. When the "washer" switch is depressed, the rear window wiper wipes the window several times after the washer fluid sprays onto the rear window.

MEMO

MEMO

ACOUSTIC WARNING SYSTEM E646C25E

ACOUSTIC WARNING SYSTEM (1)



COMPONENT LOCATION INDEX

Components		Location reference - page
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
I01	Rear fog lamp switch	CL-17
M10-2	Multifunction switch	CL-2
M12	Acoustic warning chime buzzer	CL-2
M20	Rear fog lamp relay	CL-3
M34	Left front door switch	CL-4
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
Connectors		
EM01		CL-16
EM02		CL-16
MI01		CL-11
MI04		CL-11
Grounds		
G06		CL-28
Diode		
Z03		CL-30

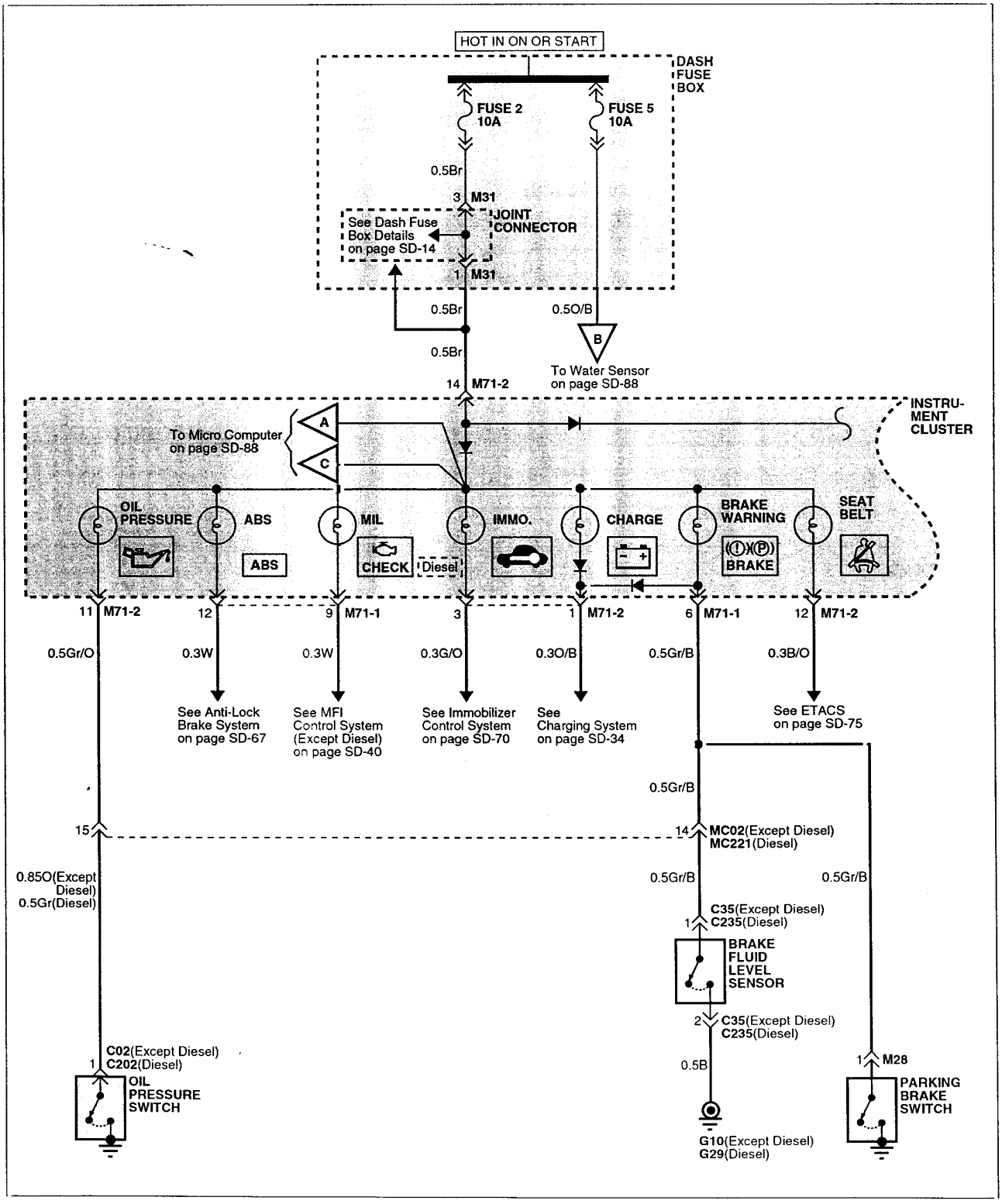
Circuit Description

1. With the light switch in PARK or HEAD position, battery voltage is supplied to the acoustic warning chime buzzer through left tail lamp fuse and diode.
The acoustic warning buzzer sounds when the left front door switch is closed (door opened).

2. With the light switch in HEAD or FOG position and rear fog lamp switch is in ON position, battery voltage is applied to the acoustic warning buzzer and then the buzzer sounds.

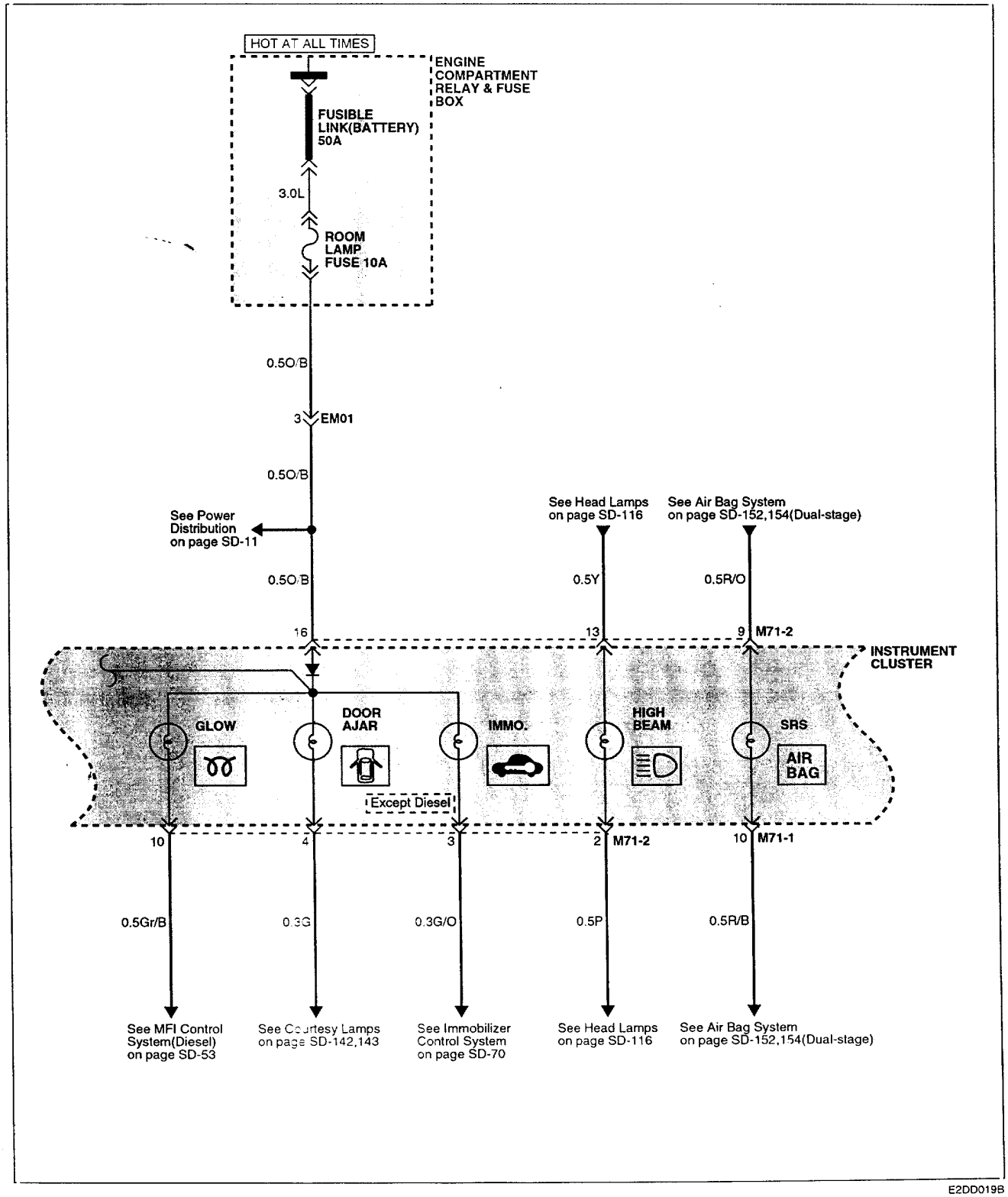
INDICATORS & GAUGES E792A447

INDICATORS & GAUGES (1)



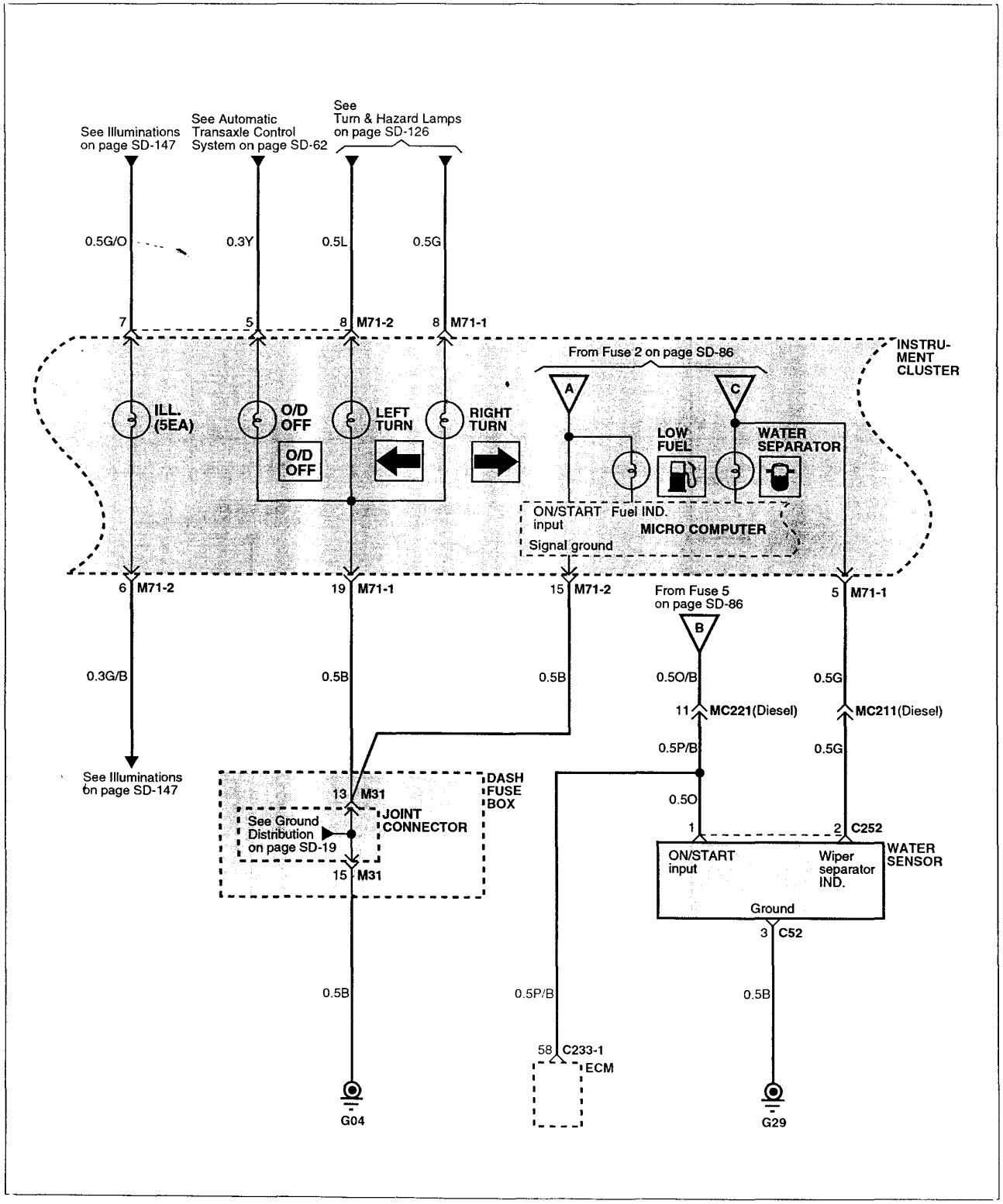
E2DD019A

INDICATORS & GAUGES (2)



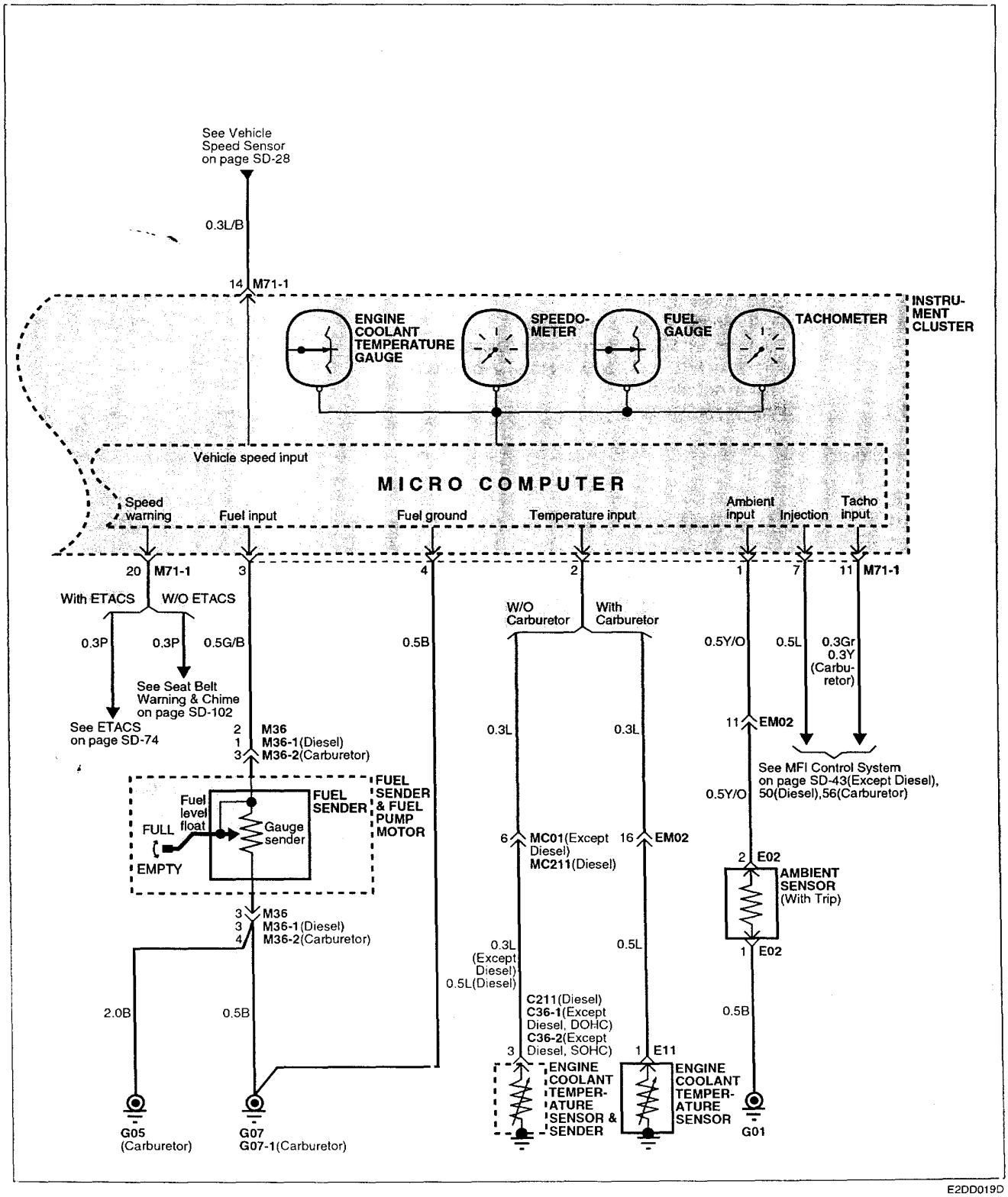
E2DD019B

INDICATORS & GAUGES (3)



E2DD019C

INDICATORS & GAUGES (4)



E2DD019D

COMPONENT LOCATION INDEX

Components		Location reference - page
C02	Oil pressure switch	CL-18
C35	Brake fluid level sensor	CL-21
C36-1	Engine coolant temperature sensor & sender (DOHC)	CL-21
C36-2	Engine coolant temperature sensor & sender (SOHC)	CL-21
C202	Oil pressure switch (Diesel)	CL-22
C211	ECT sensor & sender (Diesel)	CL-23
C233-1	ECM (Diesel)	CL-24
C235	Brake oil level sensor (Diesel)	CL-24
C252	Water sensor (Diesel)	CL-25
M28	Parking brake switch	CL-3
M31	Joint connector	CL-3
M36	Fuel sender & fuel pump motor	CL-4
M36-1	Fuel sender & fuel pump motor (Diesel)	CL-4
M36-2	Fuel sender & fuel pump motor (Carburetor)	CL-4
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EM02		CL-16
MC01		CL-10
MC02		CL-10
MC211		CL-10
MC221		CL-10
Grounds		
G01		CL-28
G04		CL-28
G05		CL-28
G07		CL-29
G10		CL-29
G29		CL-29

Circuit Description

Speedometer
With the ignition switch in ON and START, the speedometer drive circuits receive pulse from the vehicle speed sensor (VSS). The pulse rate increases as the car accelerates. The frequency and duration of these input pulses are measured and displayed by the speedometer.

Tachometer
The tachometer displays engine speed in rpm. Voltage pulses are taken from the ignition system and sent to the tachometer. The tachometer responds to the frequency of the voltage pulses, which vary according to engine speed. The ECM processes these pulses into a signal that causes the gauge's is needle to move.

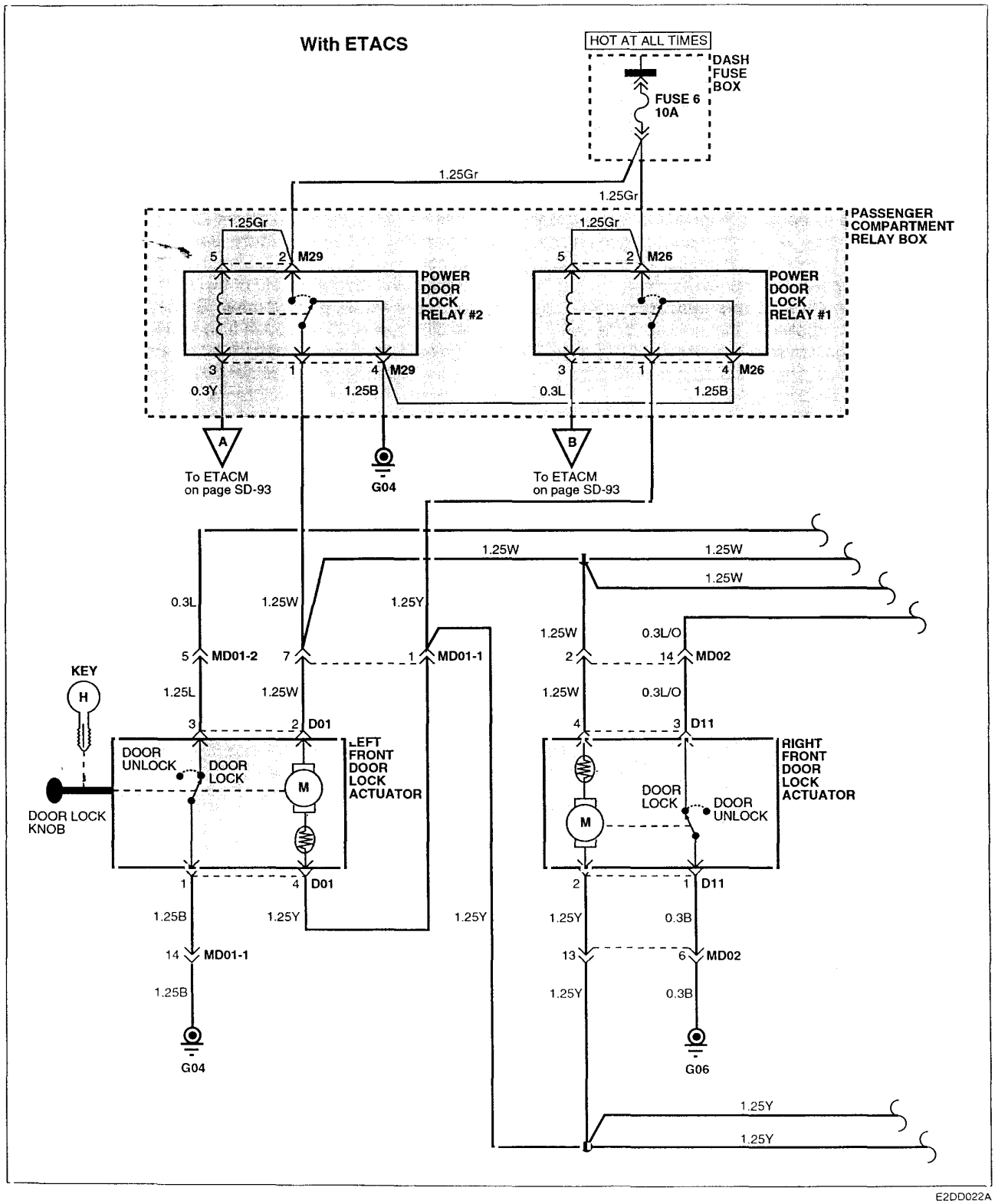
Check Engine & Oil Pressure Indicator
Battery voltage is applied to the indicator bulb from fuse 2 with the ignition switch in ON or START. The ground of the check engine indicator is controlled by the engine control module.
The control module will light the indicator when the engine is not running or when it detects a problem. When the oil pressure is low, the oil pressure switch closes, providing a ground for the oil pressure indicator bulb.

Fuel Gauge & Indicator
The pointer of the fuel gauge moves by the magnetic field of two coils. The coils are at right angles to each other. Battery voltage is applied to the coils through fuse 2, generating a magnetic field. The magnetic field, controlled by the fuel gauge sender, causes the gauge's needle to move. As the resistance in the sender varies, current through the gauge coils change. When the fuel level is below the thermistor, the resistance of the thermistor varies, providing a ground for the low fuel indicator bulb.

Engine Coolant Temperature Gauge
The pointer of the engine coolant temperature gauge moves by the magnetic field of two coils. The coils are at right angles to each other. Battery voltage is applied to the coils through fuse 2, generating a magnetic field. The magnetic field, controlled by the engine coolant temperature sender, causes the gauge's needle to move. As the resistance in the sender varies, current through the gauge coils change.

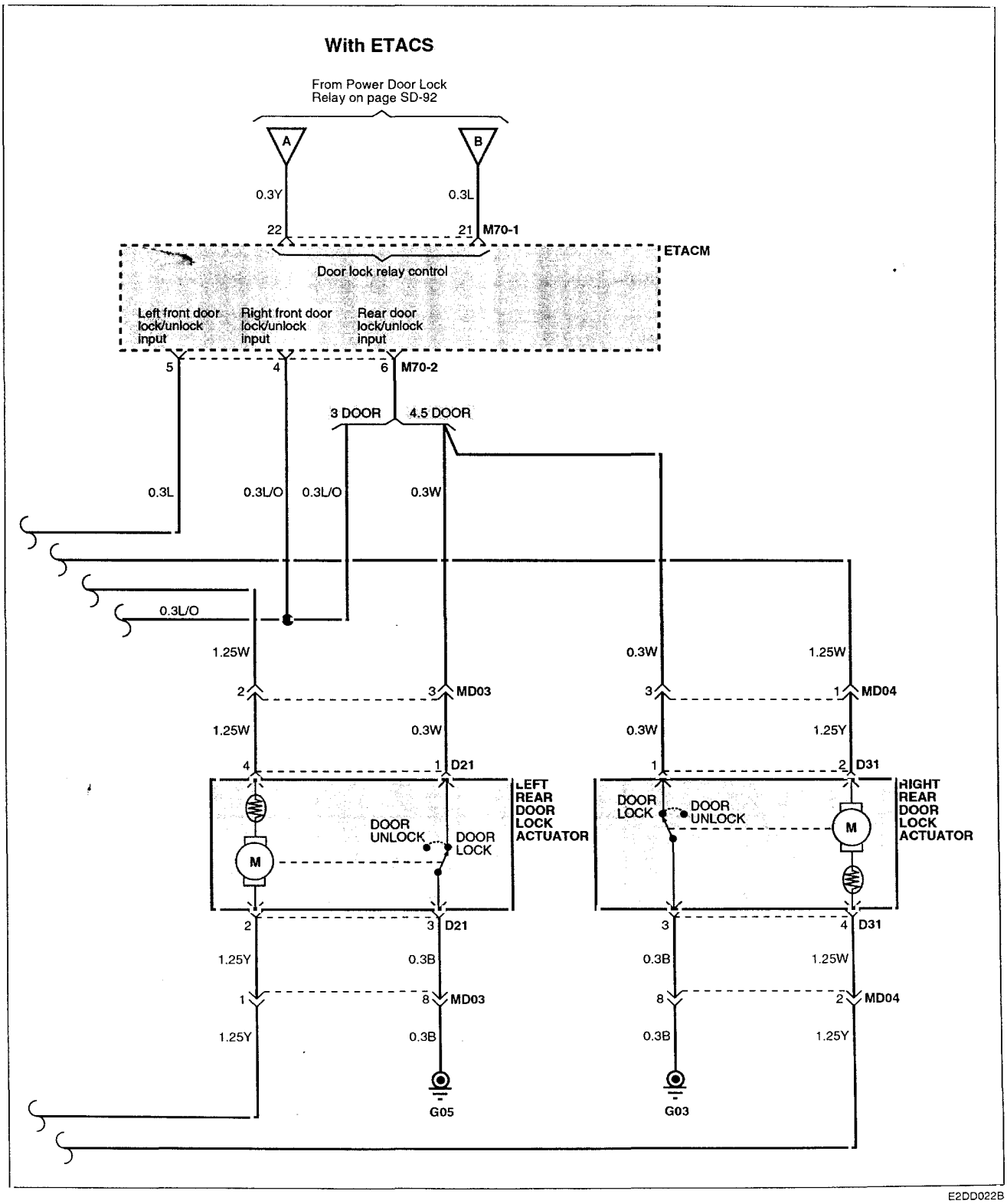
POWER DOOR LOCKS E4846D62

POWER DOOR LOCKS (1)



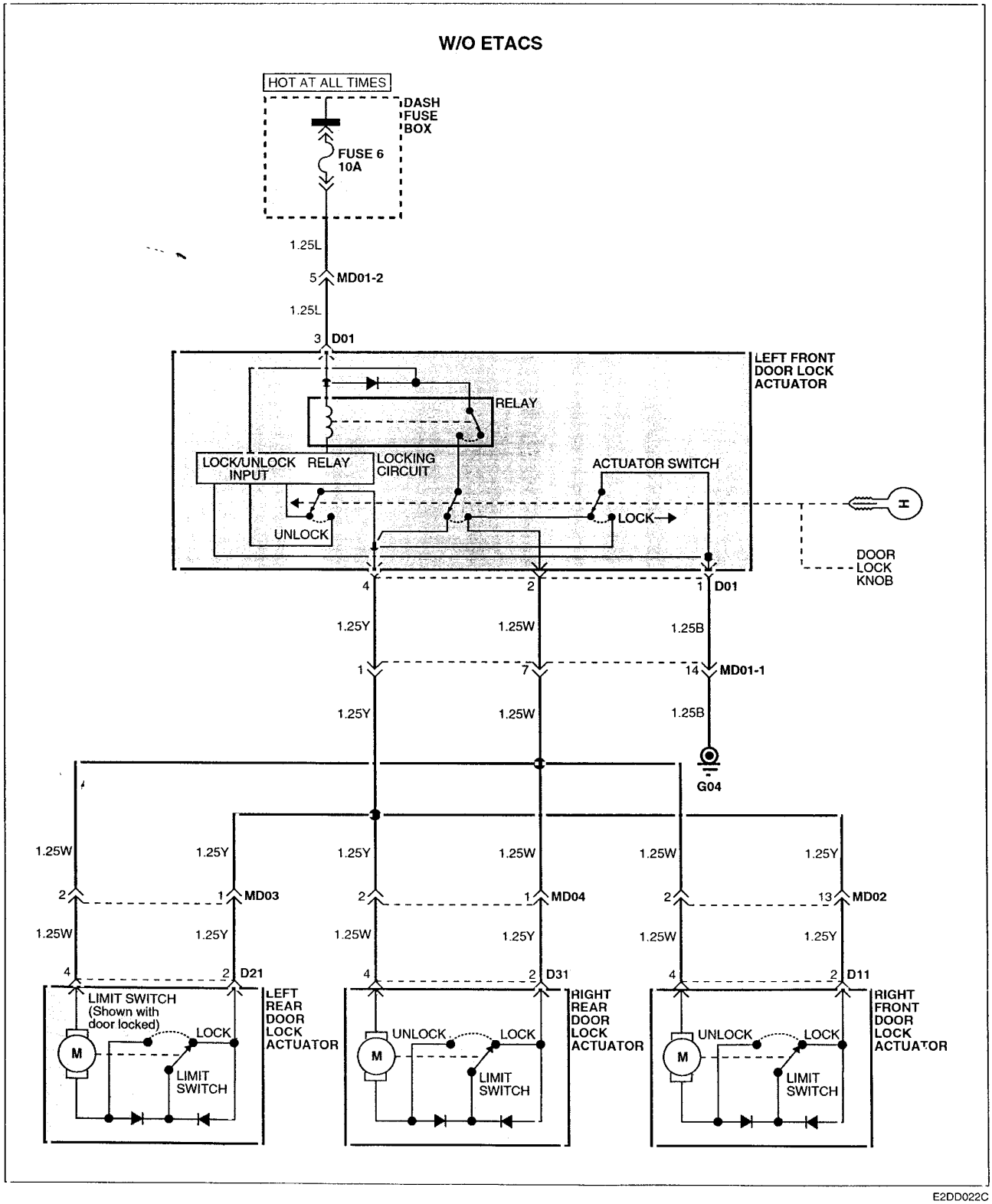
E2DD022A

POWER DOOR LOCKS (2)



E2DD022B

POWER DOOR LOCKS (3)



E2DD022C

COMPONENT LOCATION INDEX

Components		Location reference - page
D01	Left front door lock actuator	CL-26
D11	Right front door lock actuator	CL-26
D21	Left rear door lock actuator	CL-26
D31	Right rear door lock actuator	CL-26
M26	Power door lock relay #1	CL-3
M29	Power door lock relay #2	CL-3
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
Connectors		
MD01-1		CL-10
MD01-2		CL-10
MD02		CL-10
MD03		CL-11
MD04		CL-11
Grounds		
G03		CL-28
G04		CL-28
G05		CL-28
G06		CL-28

Circuit Description

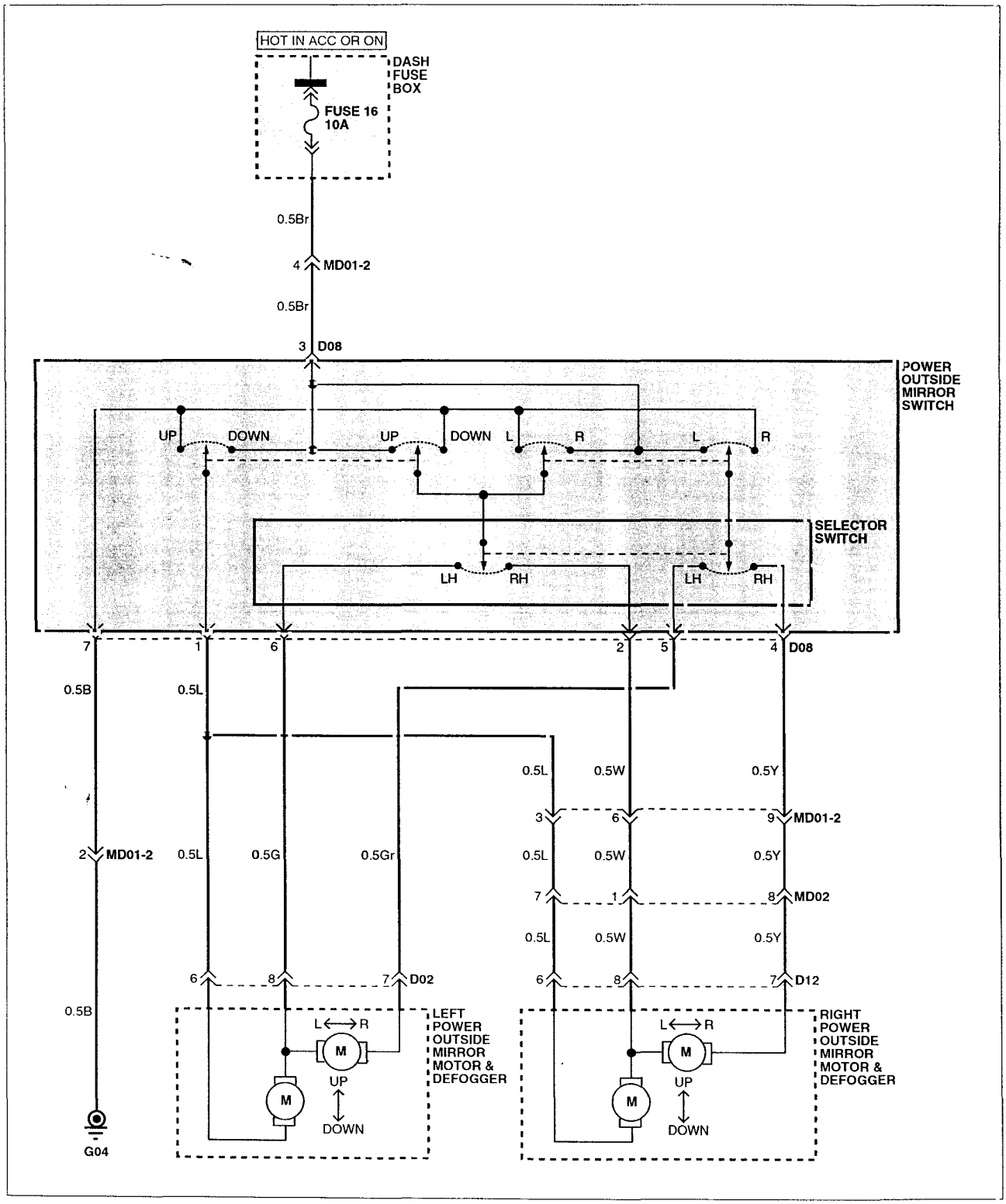
With ETACS

Battery voltage is supplied to the power door lock relay #1, #2, #3 at all times from fuse 6. There is a metal rod that links the left door lock switch and the left door locking actuator. When the left door lock switch is pushed to lock, the metal rod then pushes the actuator switches inside the door lock actuator to the lock position.

The ETACM receives the lock input, controls the two door lock relay coils and then battery voltage is supplied to the door lock actuators through fuse 6 and the two door lock relay contacts. The solid state circuit will de-energize the relay coil when the limit switches in the door lock a actuators move to the unlock position. The door locks work similarly when the left door lock switch is pushed to unlock, except that the electrical current goes through each motor in the opposite direction.

POWER OUTSIDE MIRRORS EFD297C6

POWER OUTSIDE MIRRORS (1)



E2DD024A

COMPONENT LOCATION INDEX

Components		Location reference - page
D02	Left power outside mirror motor & defogger	CL-26
D08	Power outside mirror switch	CL-26
D12	Right power outside mirror motor & defogger	CL-26
Connectors		
MD01-2		CL-10
MD02		CL-10
Grounds		
G04		CL-28

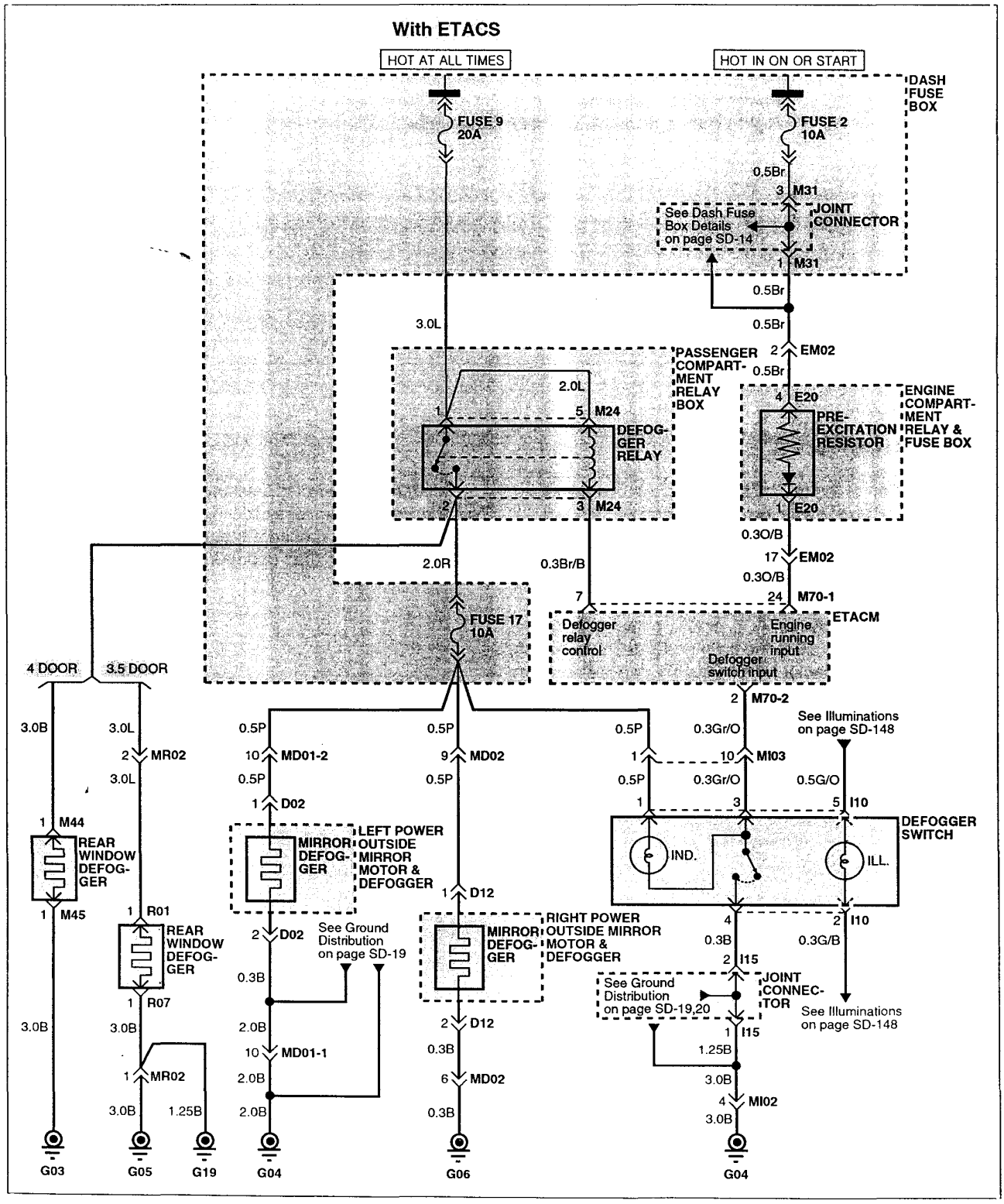
Circuit Description

The operation of the two outside mirrors is controlled by the power door mirror switch. Each mirror has two reversible motors, one motor moves the mirror up and down, the other motor moves the mirror left and right. The master selector switch in power door mirror control switch directs battery voltage to the right or left outside mirror. With the ignition switch in ACC or ON, battery voltage is applied from fuse 16 to the power outside mirror switch. With the master selector switch in LEFT and the up/down switch in UP, battery voltage is applied to the up contacts of the up/down switch and to the left power mirror up/down motor. Ground is provided to the up contacts of the up/down switch and the left power mirror up/down motor and the,mirror goes up. In the DOWN position, battery voltage and ground are applied to the opposite sides of the motor.

The left/right switch works similarly to the up/down switch. With the master selector switch in the RIGHT position, battery voltage and ground are applied to the right power mirror motors which then operate in a similar way.

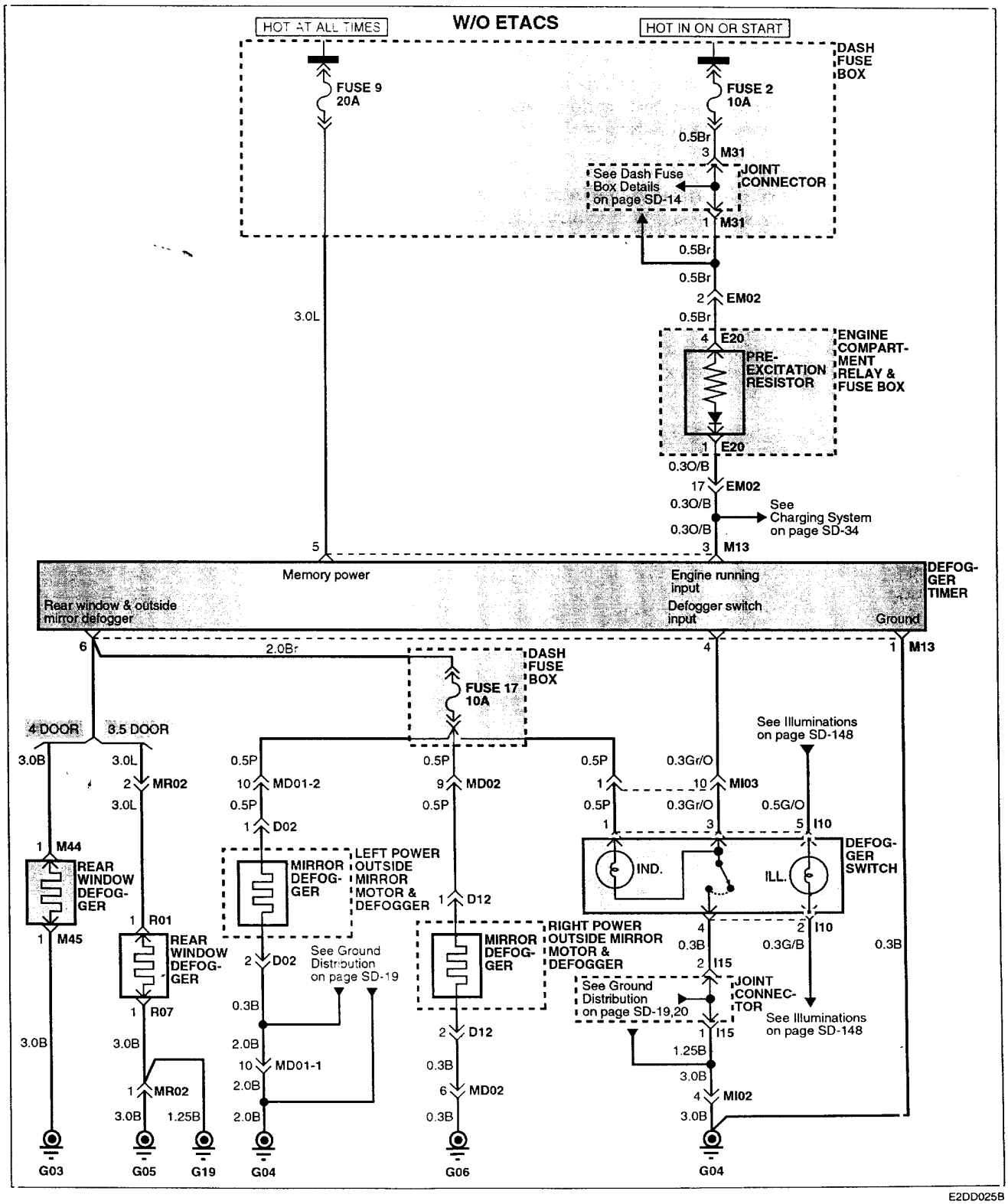
REAR WINDOW & OUTSIDE MIRROR DEFOGGERS E37F2EEB

REAR WINDOW & OUTSIDE MIRROR DEFOGGERS (1)



E2DD025A

REAR WINDOW & OUTSIDE MIRROR DEFOGGERS (2)



E2DD025B

COMPONENT LOCATION INDEX

Components		Location reference - page
D02	Left power outside mirror motor & Defogger	CL-26
D12	Right power outside mirror motor & Defogger	CL-26
E20	Pre-excitation resistor	CL-14
I10	Defogger switch	CL-17
I15	Joint connector	CL-17
M13	Defogger timer (W/O ETACS)	CL-3
M24	Defogger relay (With ETACS)	CL-3
M31	Joint connector	CL-3
M44	Rear window defogger (+) (4 Door)	CL-5
M45	Rear window defogger (-) (4 Door)	CL-5
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
R01	Rear window defogger (+)	CL-27
R07	Rear window defogger (-)	CL-27
Connectors		
EM02		CL-16
MD01-1		CL-10
MD01-2		CL-10
MD02		CL-10
MI02		CL-11
MI03		CL-11
MR02		CL-11
Grounds		
G03		CL-28
G04		CL-28
G05		CL-28
G06		CL-28
G19		CL-29

Circuit Description

W/O ETACS
Battery voltage is supplied to the rear window defogger timer at all times from fuse 9. When the engine is running, battery voltage is also supplied from the generator to the solid state controller. Depressing the rear defogger switch (when the engine is running) momentarily grounds the on/off input terminal of the timer and the solid state controller turns on the rear window defogger, Left/Right power outside mirror defogger and the rear defogger indicator. The solid state controller will turn the rear defogger off after approximately 20 minutes. Depressing the rear defogger switch when the rear defogger is on causes the timer to turn the rear defogger off.

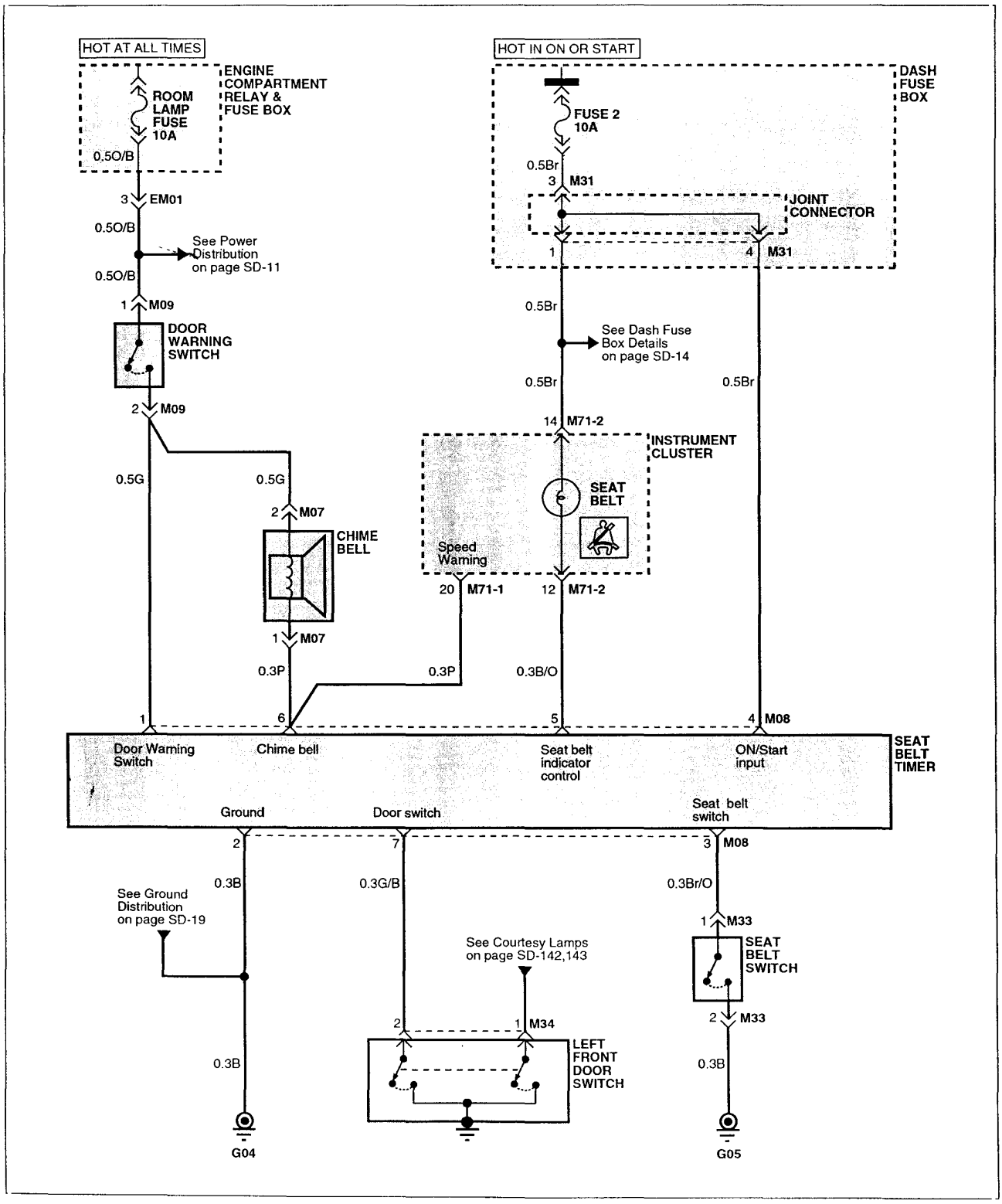
With ETACS
Battery voltage is supplied to the defogger relay coils and contacts at all times from fuse 9 and battery voltage is also supplied from the generator to the ETACM when the engine is running. The rear defogger switch on (depressing) signal is provided to the ETACM and then ETACM provide ground to the defogger relay coil. Fuse 9 supply battery voltage to the rear window defogger and Left/Right power outside mirror defogger through defogger relay contacts.
The ETACM will turn the rear defogger off after approximately 20 minutes. Depressing the rear defogger switch when the rear defogger is on causes the ETACM to turn the rear defogger off.

MEMO

MEMO

SEAT BELT WARNING & CHIME (WITHOUT ETACS) EBDFC65E

SEAT BELT WARNING & CHIME (WITHOUT ETACS) (1)



E2DD046A

COMPONENT LOCATION INDEX

Components		Location reference - page
M07	Chime bell	CL-2
M08	Seat belt timer	CL-2
M09	Door warning switch	CL-2
M31	Joint connector	CL-3
M33	Seat belt switch	CL-4
M34	Left front door switch	CL-4
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EM01		CL-16
Grounds		
G04		CL-28

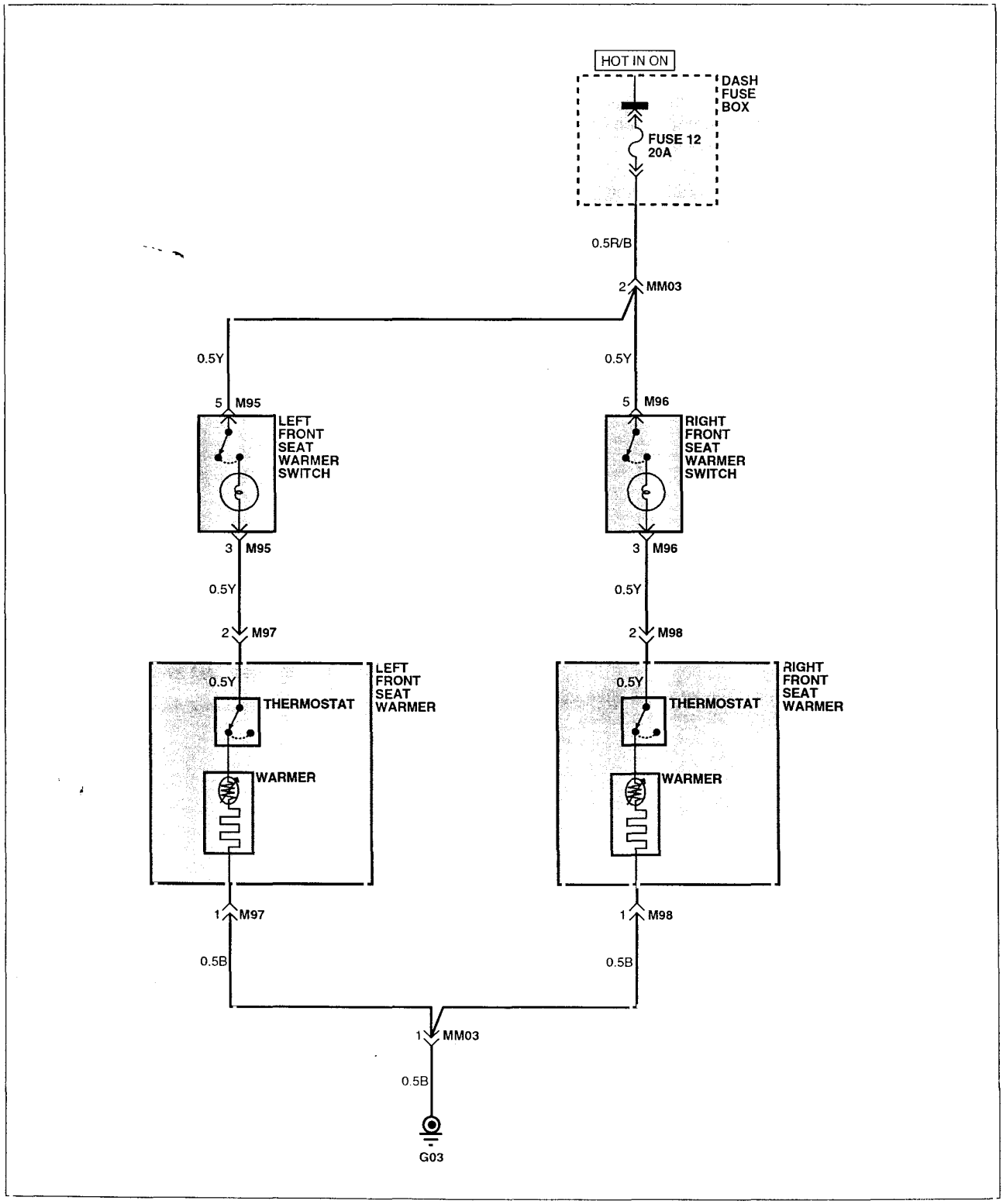
Circuit Description

Key Remain Warning
When the left front door is open and the key in the ignition key hole, battery voltage is supplied to the seat belt timer and chime bell through door warning switch and room lamp fuse.
According to the above signals the seat belt timer controls the chime ground terminal and the chime sounds.

Seat Belt Warning
Battery voltage is supplied from fuse 2 the seat belt timer and the fasten belt indicator with the ignition in ON or START. The seat belt timer grounds the chime and the indicator as dictated by the seat belt switch.

SEAT WARMER EA7BBE03

SEAT WARMER (1)



E2DD039A

COMPONENT LOCATION INDEX

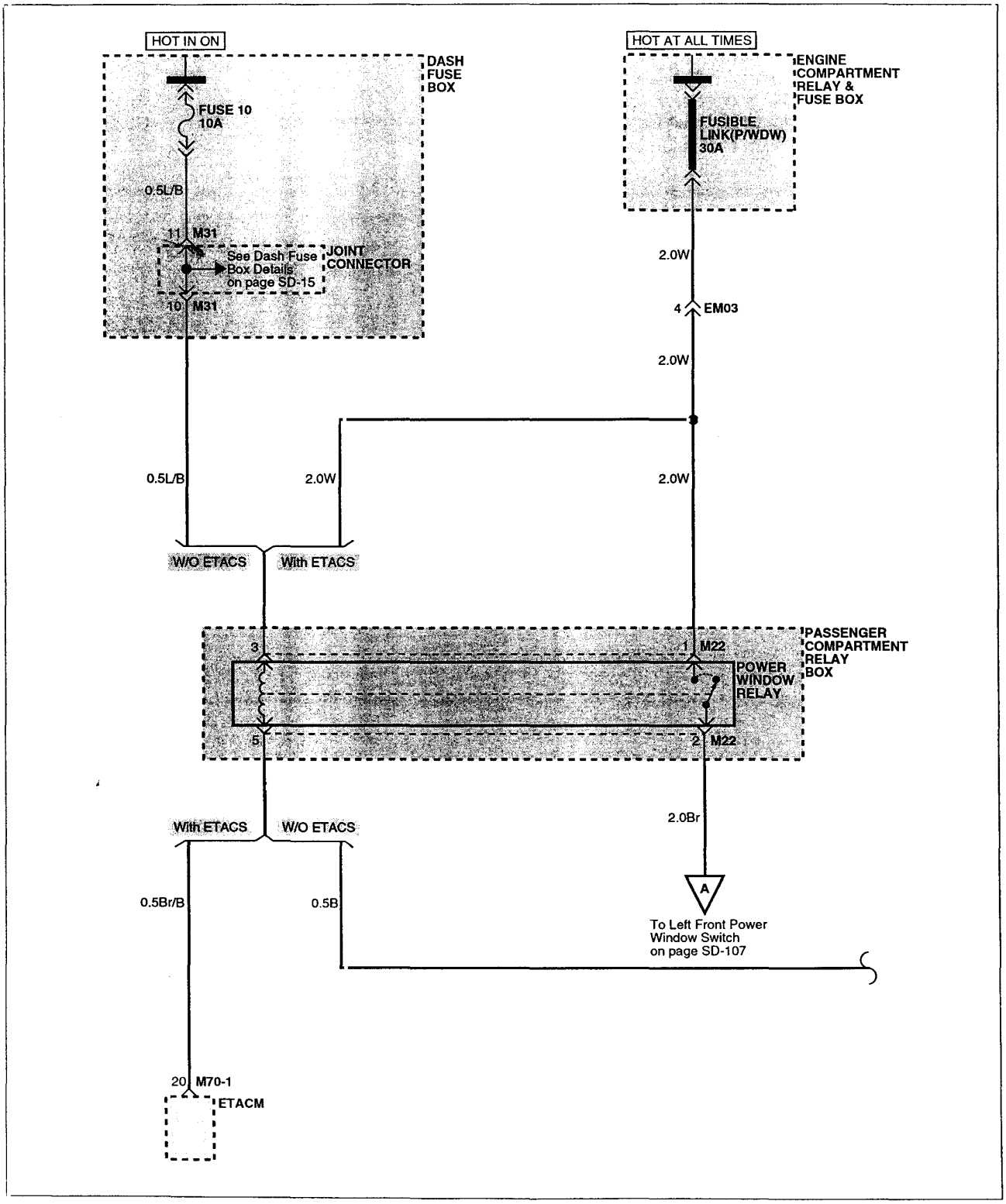
Components		Location reference - page
M95	Left front seat warmer	CL-9
M96	Right front seat warmer	CL-9
M97	Left front seat warmer switch	CL-9
M98	Right front seat warmer switch	CL-9
Connectors		
MM03		CL-11
Grounds		
G03		CL-28

Circuit Description

Fuse 12 supplies battery voltage to the Left/Right front seat warmer switch when the ignition switch is in ON for left/right seat warmer operation.
When each seat warmer switch is pushed, battery voltage supplied to the seat warmer and grounded at G03.

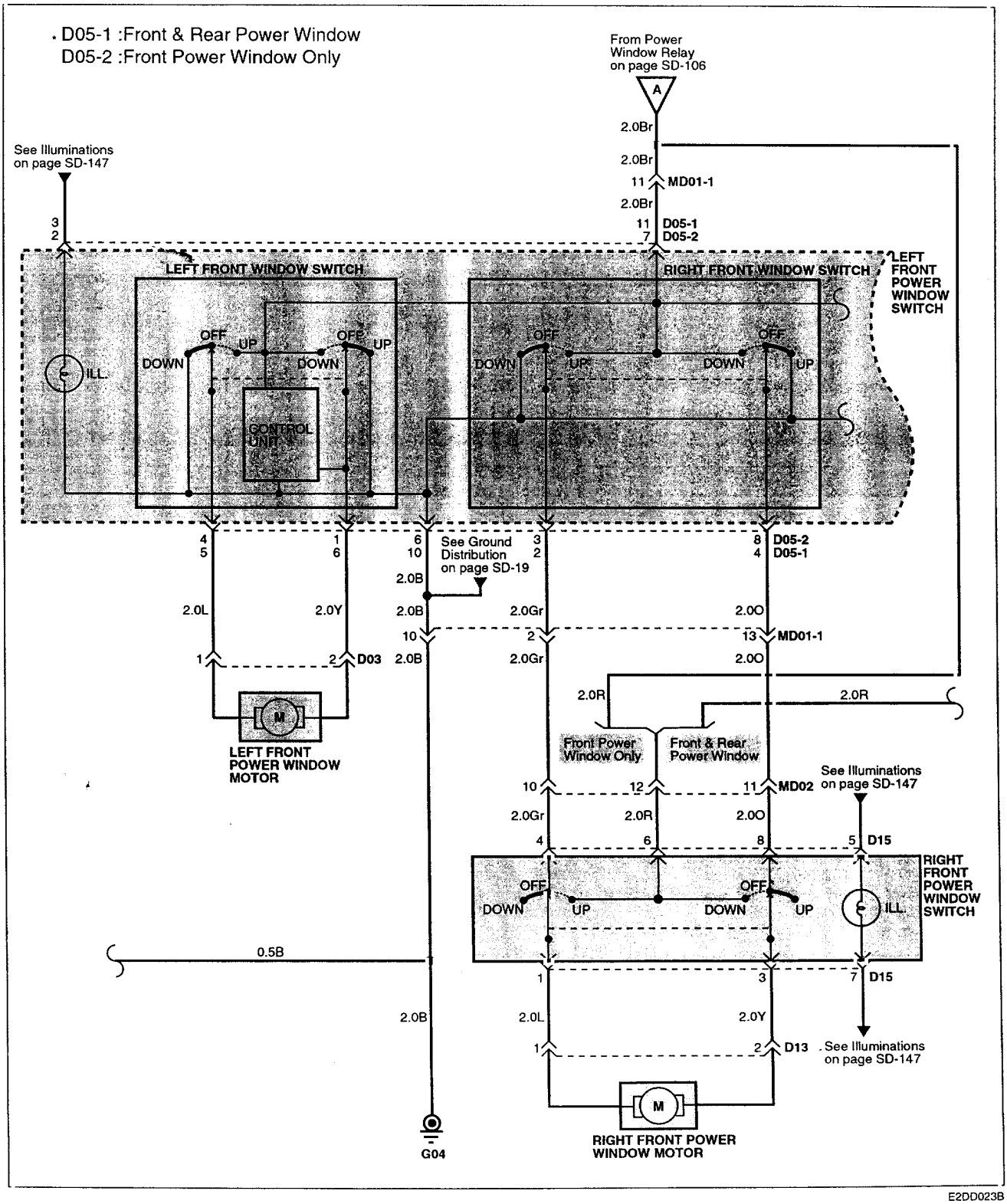
POWER WINDOWS EBE496DA

POWER WINDOWS (1)



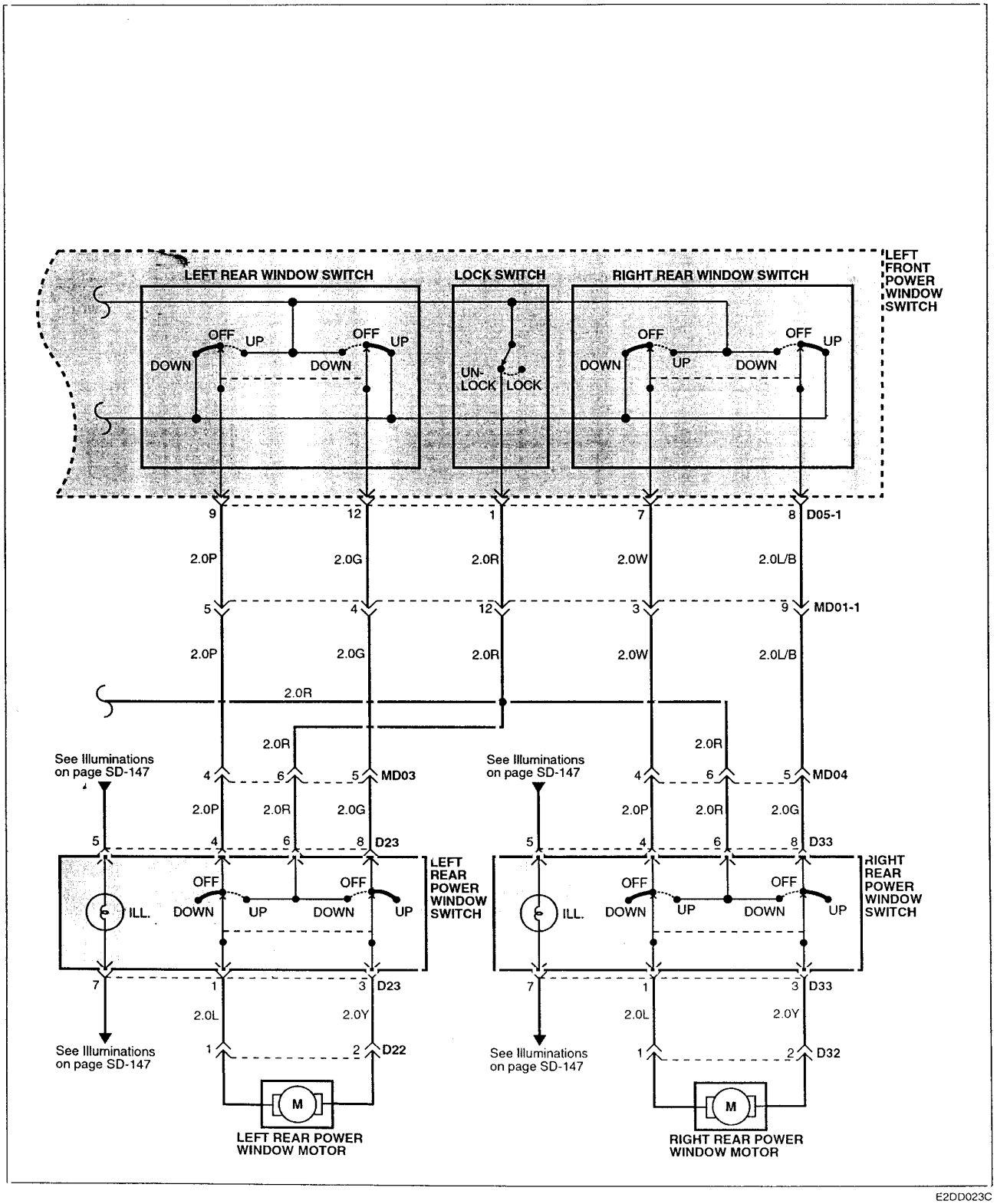
E2DD023A

POWER WINDOWS (2)



E2DD023B

POWER WINDOWS (3)



E2DD023C

COMPONENT LOCATION INDEX

Components		Location reference - page
D03	Left front power window motor	CL-26
D05-1	Left front power window switch	CL-26
D05-2	Left front power window switch	CL-26
D13	Right front power window motor	CL-26
D15	Right front power window switch	CL-26
D22	Left rear power window motor	CL-26
D23	Left rear power window switch	CL-26
D32	Right rear power window motor	CL-26
D33	Right rear power window switch	CL-26
M22	Power window relay	CL-3
M31	Joint connector	CL-3
M70-1	ETACM	CL-7
Connectors		
EM03		CL-16
MD01-1		CL-10
MD02		CL-10
MD03		CL-11
MD04		CL-11
Grounds		
G04		CL-28

Circuit Description

A permanent magnetic motor operates each of the power windows. Each motor raises or lowers the glass when voltage is supplied to it. The direction the motor turns depends on the polarity of the supply voltage.
The power window main switch controls all the power window motors. Each window switch controls only one of the power window motors. If the lock switch in the power outside mirror switch is depressed, the rear power windows and the right front power window cannot be controlled by their own window switches, however, they can still be controlled by the power window main switch.

Power Window Main Switch Operation

Battery voltage is applied at all times to both the coil and contacts of the power window relay. The coil of the relay is supplied battery voltage through fuse 10 (w/o ETACM)/ P/WDW fusible link (with ETACM). Battery voltage is then supplied to the power window main switch through the closed relay contacts.

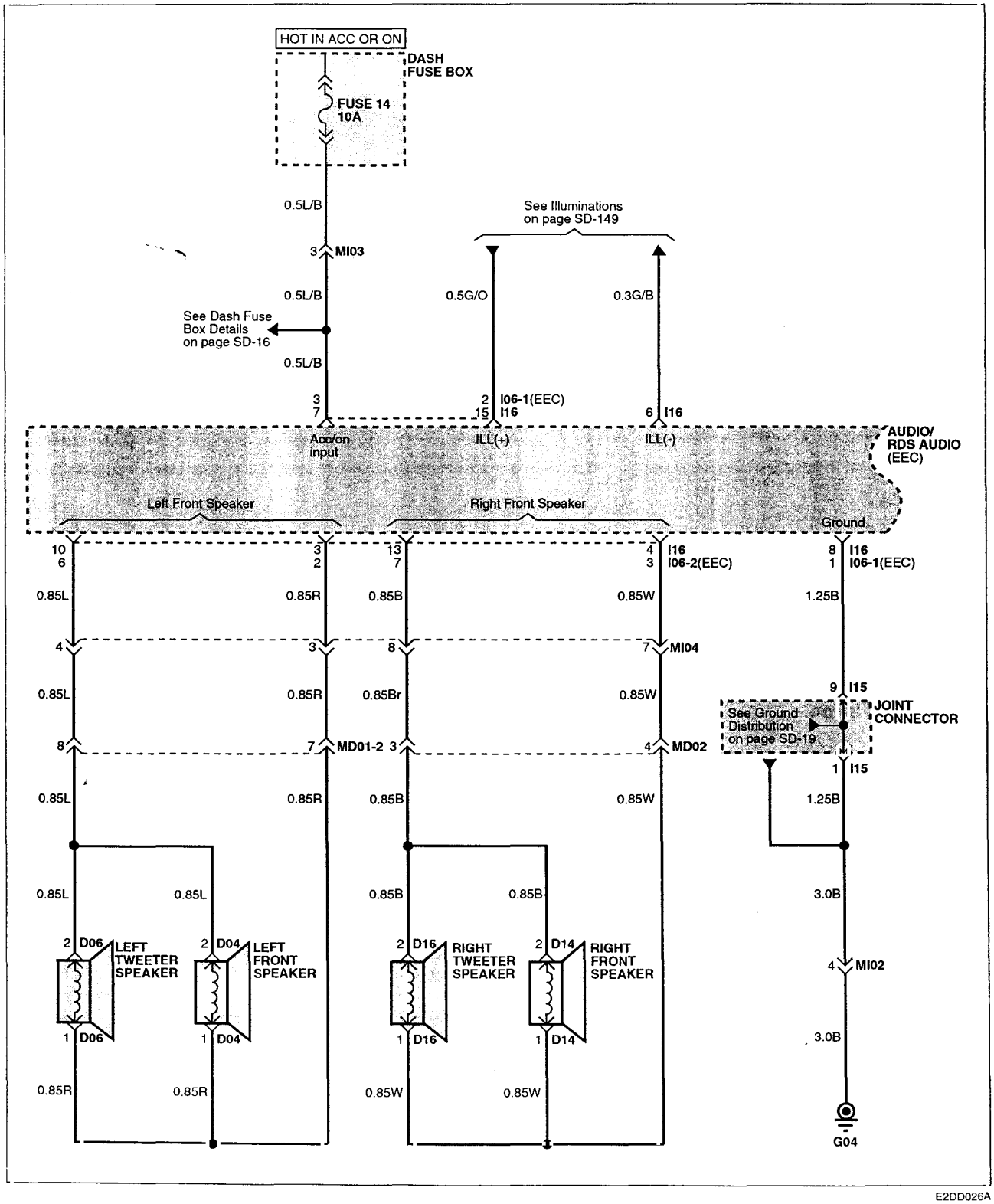
When any of the switches in the power window main switch are operated, battery voltage is applied to the power window motor. The power window motor is grounded through the opposite contact in the power window main switch. The power window motor runs to drive the window.

Window Switch Operation

When the power window relay coil is energized, battery voltage is supplied to the passenger window switches as long as the lock switch in the power window main switch is OFF (not depressed). When the passenger's window switchis operated, battery voltage is applied to one terminal of the power window motor and the other terminal is grounded through the opposite contact in the window switch and the main switch. The power window motor runs to drive the window.

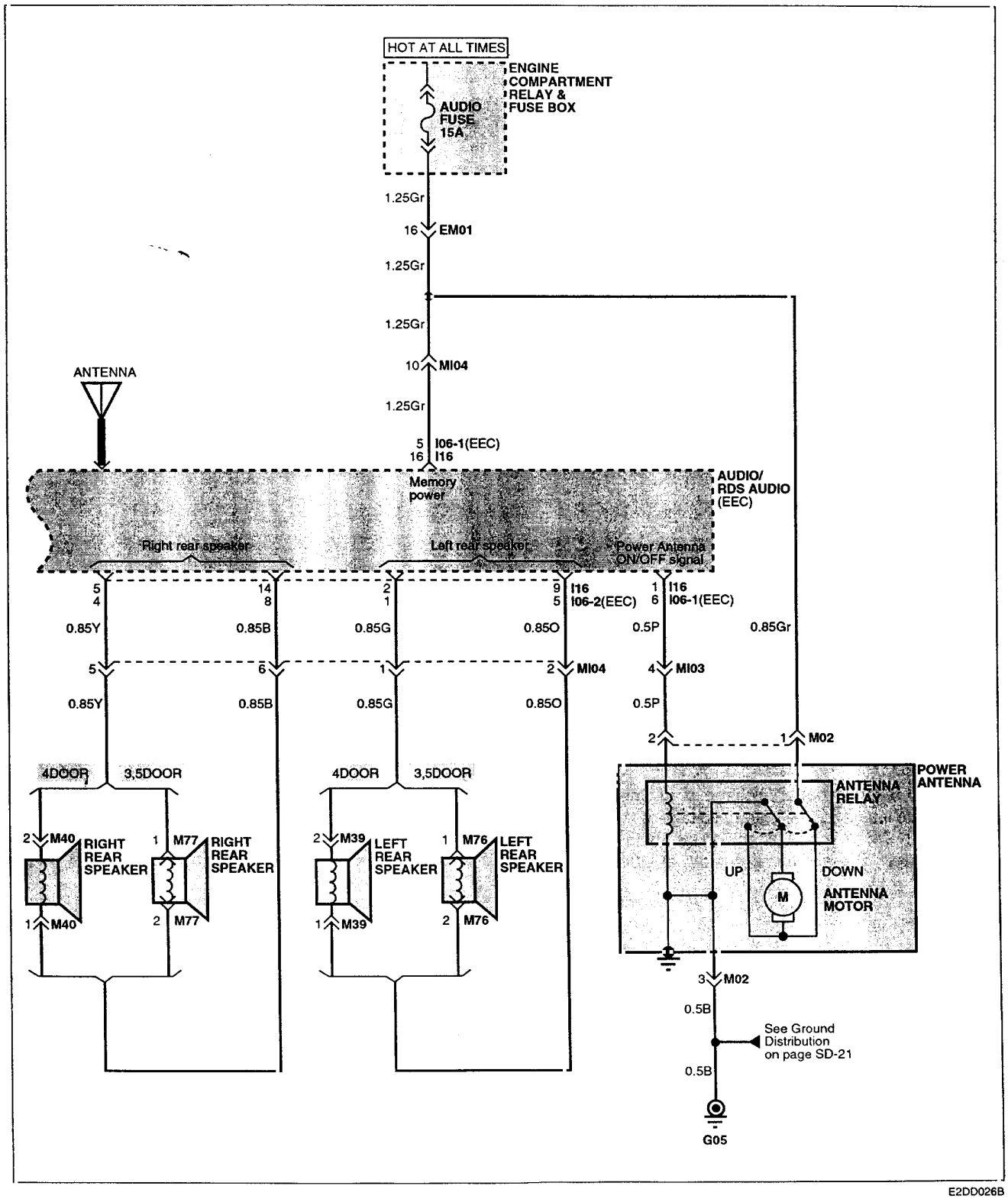
AUDIO E8C7CE37

AUDIO (1)



E2DD026A

AUDIO (2)



E2DD026B

COMPONENT LOCATION INDEX

Components		Location reference - page
D04	Left front speaker	CL-26
D14	Right front speaker	CL-26
I06-1	RDS Audio (EEC)	CL-17
I06-2	RDS Audio (EEC)	CL-17
I15	Joint connector	CL-17
I16	Audio	CL-17
I18	Digital clock	CL-17
M02	Power antenna	CL-2
M39	Left rear speaker (4 Door)	CL-4
M40	Right rear speaker (4 Door)	CL-4
M76	Left rear speaker (3.5 Door)	CL-8
M77	Right rear speaker (3.5 Door)	CL-8
Connectors		
EM01		CL-16
MD01-2		CL-10
MD02		CL-10
MI02		CL-11
MI03		CL-11
MI04		CL-11
Grounds		
G04		CL-28
G05		CL-28

Circuit Description

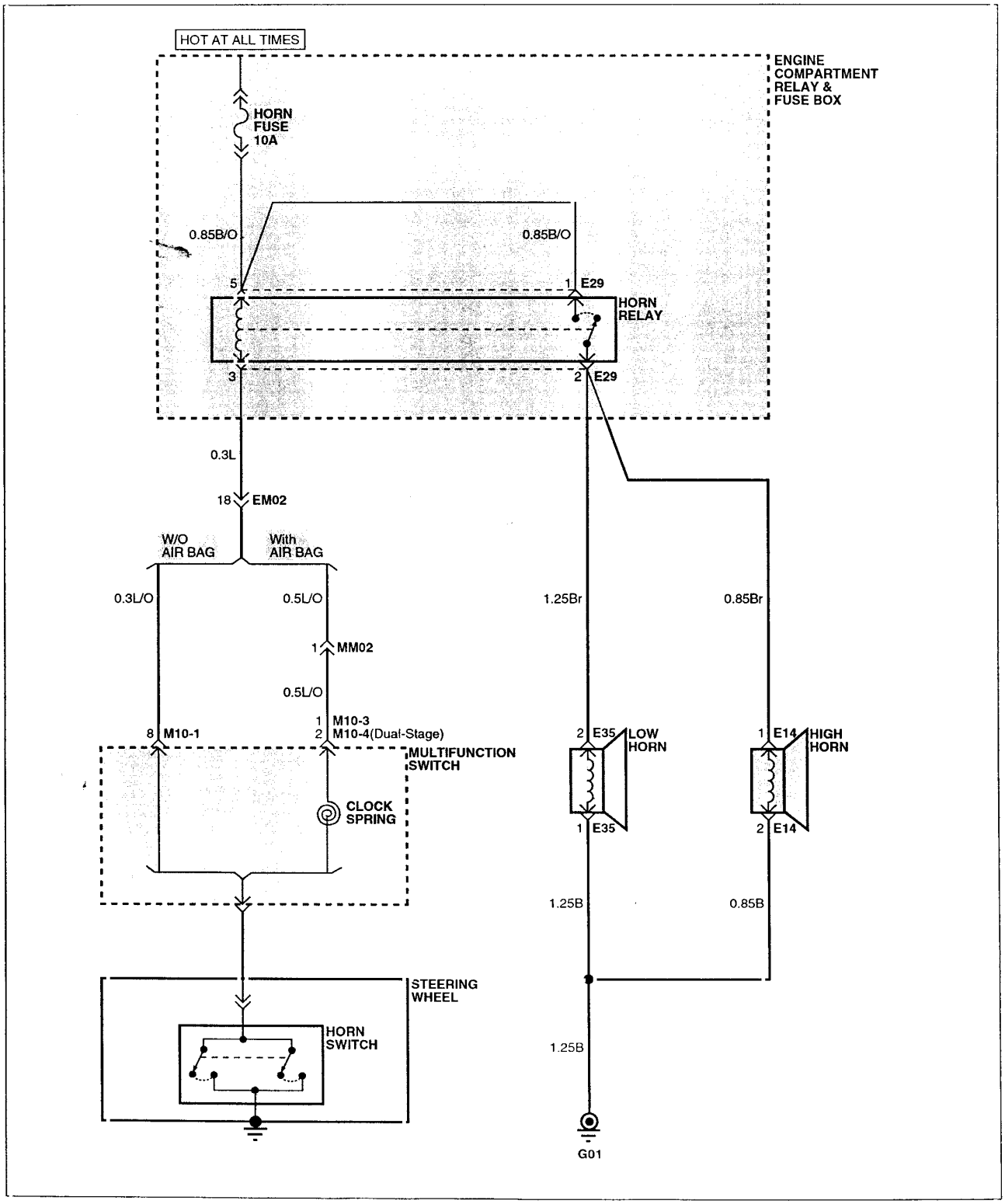
The audio receives battery voltage at all times from audio fuse. Audio fuse supplies battery voltage to the audio when the ignition switch is in ACC or ON for audio operation and displays. The audio is grounded at G04.

MEMO

MEMO

HORNS EC5BEBEA

HORNS (1)



E2DD027A

COMPONENT LOCATION INDEX

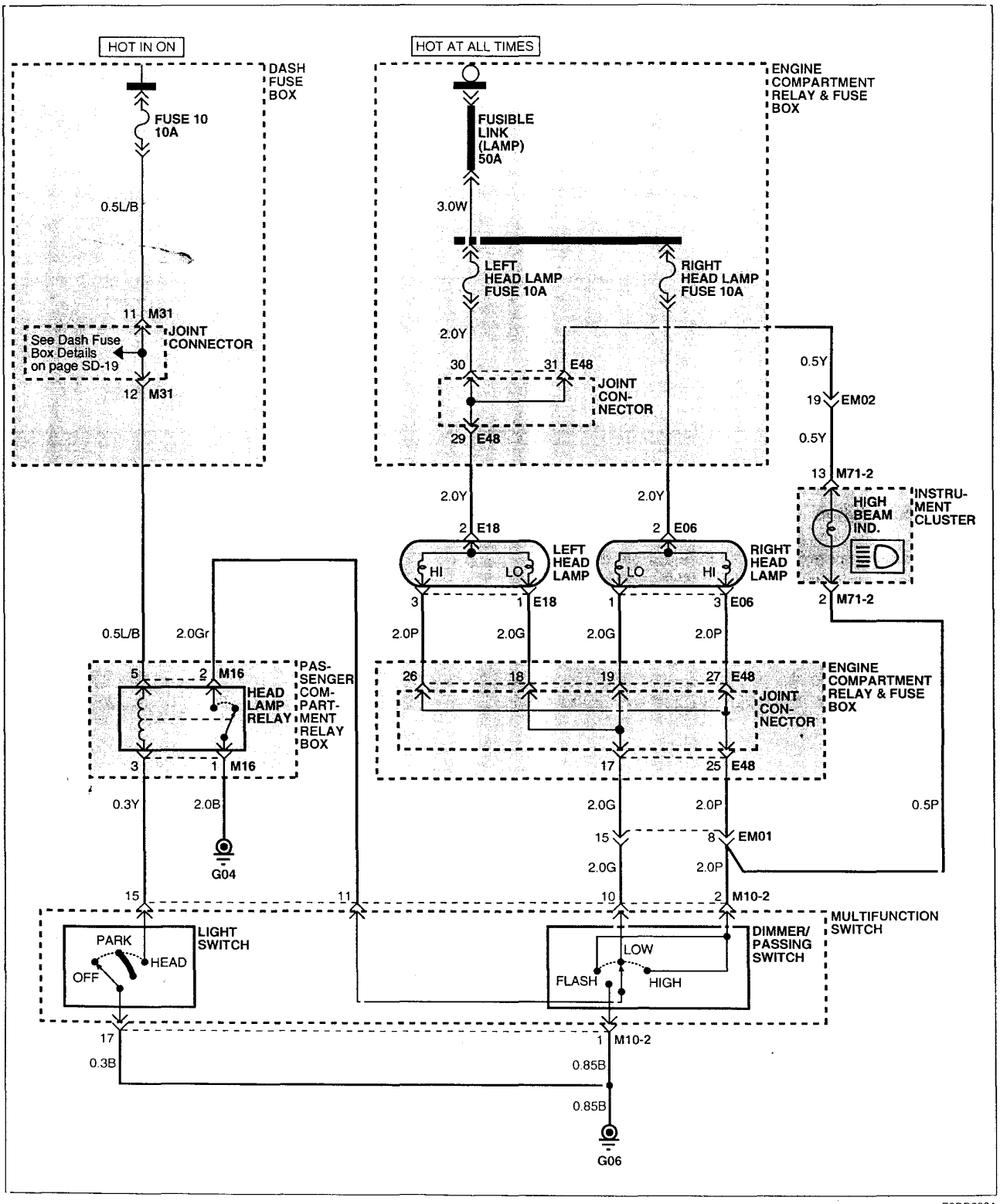
Components		Location reference - page
E14	High horn	CL-13
E29	Horn relay	CL-14
E35	Low horn	CL-14
M10-1	Multifunction switch (W/O Air Bag)	CL-2
M10-3	Multifunction switch (With Air Bag)	CL-2
M10-4	Multifunction switch (Dual-stage, With Air Bag)	CL-2
Connectors		
EM02		CL-16
MM02		CL-11
Grounds		
G01		CL-28

Circuit Description

Battery voltage is applied at all times to both the coil and the contacts of the horn relay. With the horn switch depressed, ground is provided to the coil of the horn relay through the horn switch. The relay contacts close and battery voltage is applied to the horn, and the horn sounds.

HEAD LAMPS EB7D0EC2

HEAD LAMPS (1)



E2DD028A

COMPONENT LOCATION INDEX

Components		Location reference - page
E06	Right head lamp	CL-12
E18	Left head lamp	CL-13
E48	Joint connector	CL-16
M10-2	Multifunction switch	CL-2
M16	Head lamp relay	CL-3
M31	Joint connector	CL-3
M71-2	Instrument cluster	CL-8
Connectors		
EM01		CL-16
EM02		CL-16
Grounds		
G04		CL-28
G06		CL-28

Circuit Description

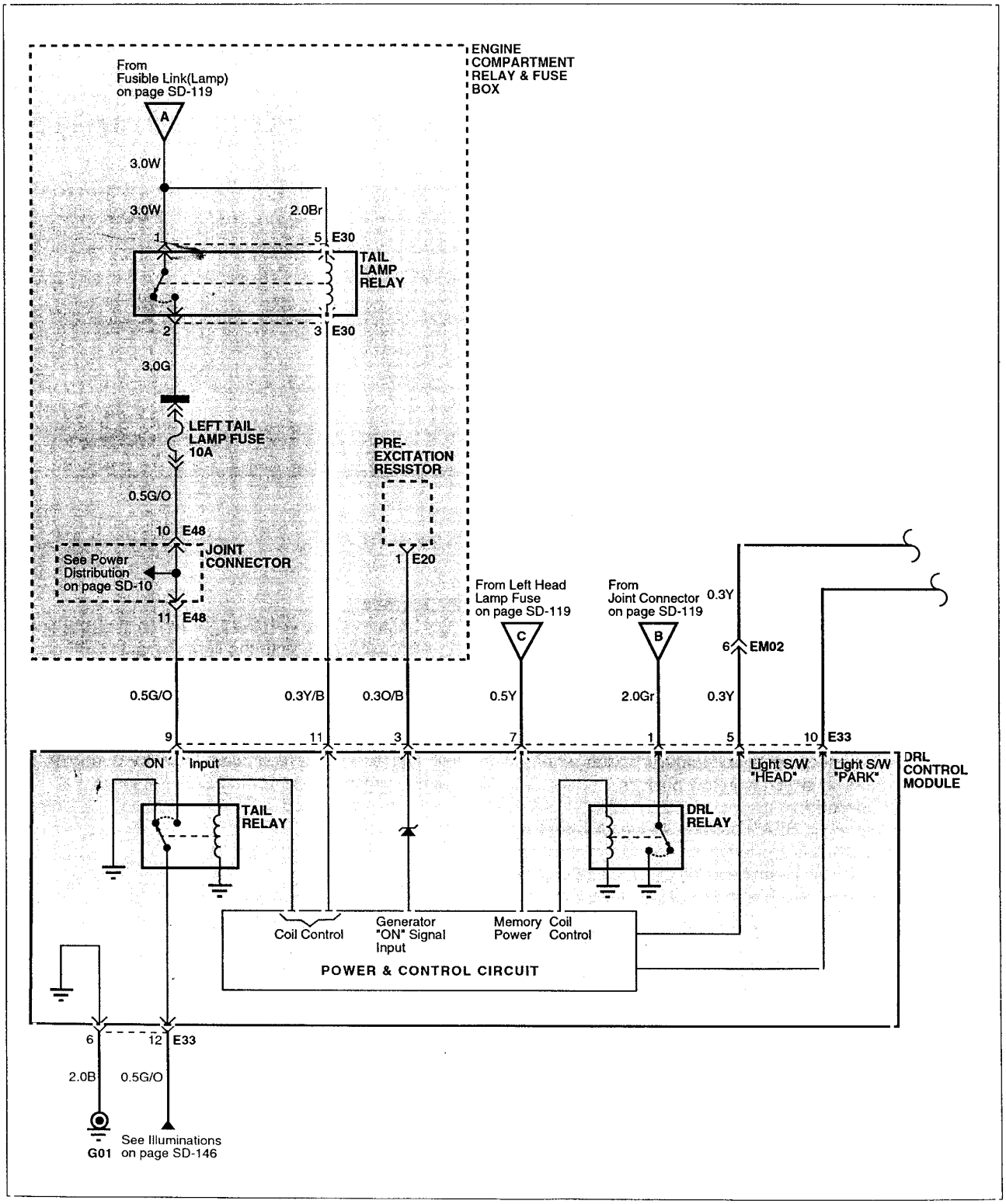
Low Beam Operation
With the ignition switch in ON and the light switch in HEAD position, battery voltage is applied to the coil of the head lamp relay from fuse 10 and then ground is provided to the coil of the head lamp relay through the light switch. Battery voltage from fusible link (Lamp) is then provided to the Left/Right head lamp through Left/Right head lamp fuses. The low beam head lamp illuminates when the Dimmer/Passing switch is in low position.

High Beam Operation
With the light switch in HEAD position and ignition switch in ON, battery voltage is applied to the head lamp relay coil from fuse 10. The high beam head lamps illuminates when the Dimmer/Passing switch is in FLASH or HIGH position.

Flash Operation
The flash feature works with the light switch in all positions (OFF, PARK or HEAD). With the light switch in OFF or PARK and the head lamp dimmer switch in FLASH, ground is provided to the high beam head lamps through the head lamp dimmer/passing switch. Battery voltage is applied to the high beam head lamp and the beam indicator, and the high beams and the high beam indicator illuminate as long as the switch is held in the FLASH position.

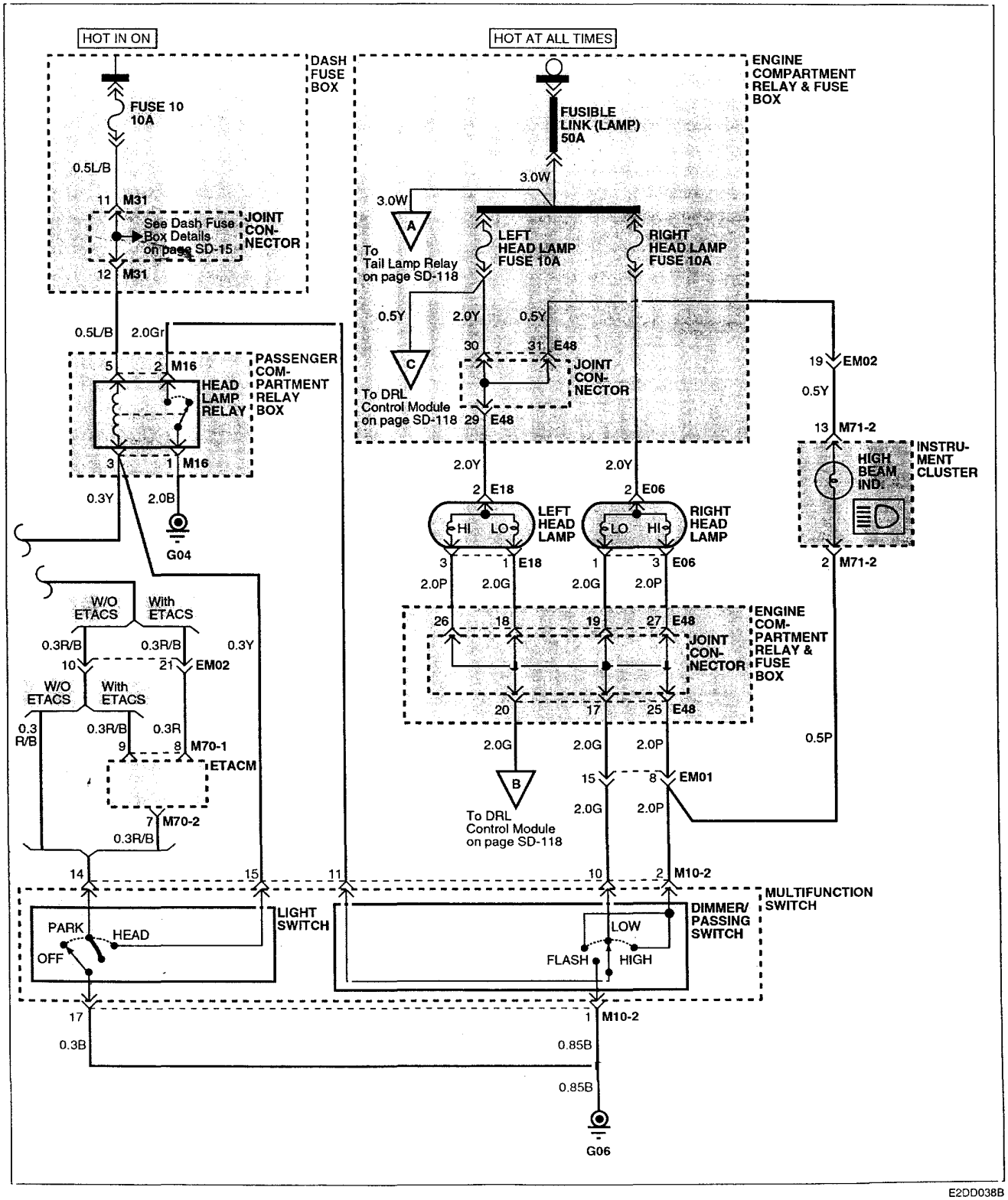
DAYTIME RUNNING LIGHTS E7E43C72

DAYTIME RUNNING LIGHTS (1)



E2DD038A

DAYTIME RUNNING LIGHTS (2)



E2DD038B

COMPONENT LOCATION INDEX

Components		Location reference - page
E06	Right head lamp	CL-12
E18	Left head lamp	CL-13
E20	PRE-excitation resistor	CL-14
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
M10-2	Multifunction switch	CL-2
M16	Head lamp relay	CL-3
M31	Joint connector	CL-3
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
M71-2	Instrument cluster	CL-8
Connectors		
EM01		CL-16
EM02		CL-16
Grounds		
G01		CL-28
G04		CL-28
G06		CL-28

Circuit Description

For the visibility of driver, the daytime running lights (head lamp low beam) go on automatically when the engine is running.
With the ignition switch in ON position, battery voltage is applied to the head lamp relay coils and daytime running lights (DRL) control module.

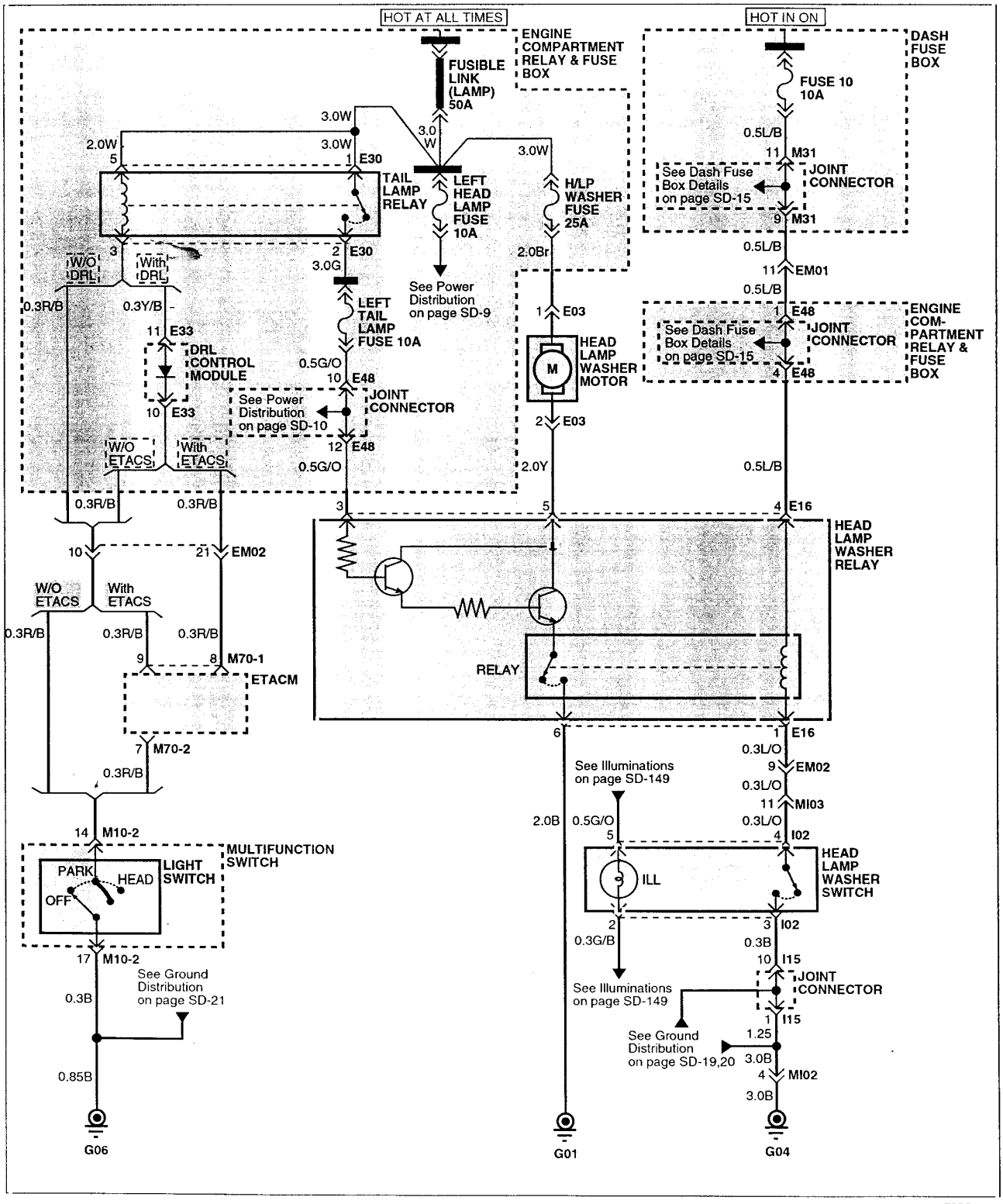
As the DRL control module detects the generator running signals (engine is running), ground is provided to the DRL relay.
battery voltage is then provided to the low beam head lamps and the low beam head lamps light.

MEMO

MEMO

HEAD LAMP WASHER E10382CF

HEAD LAMP WASHER (1)



E2DD041A

COMPONENT LOCATION INDEX

Components		Location reference - page
E03	Head lamp washer motor	CL-12
E16	Head lamp washer relay	CL-13
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
I02	Head lamp washer switch	CL-17
I15	Joint connector	CL-17
M10-2	Multifunction switch	CL-2
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
Connectors		
EM01		CL-16
EM02		CL-16
MI02		CL-11
MI03		CL-11
Grounds		
G01		CL-28
G04		CL-28
G06		CL-28

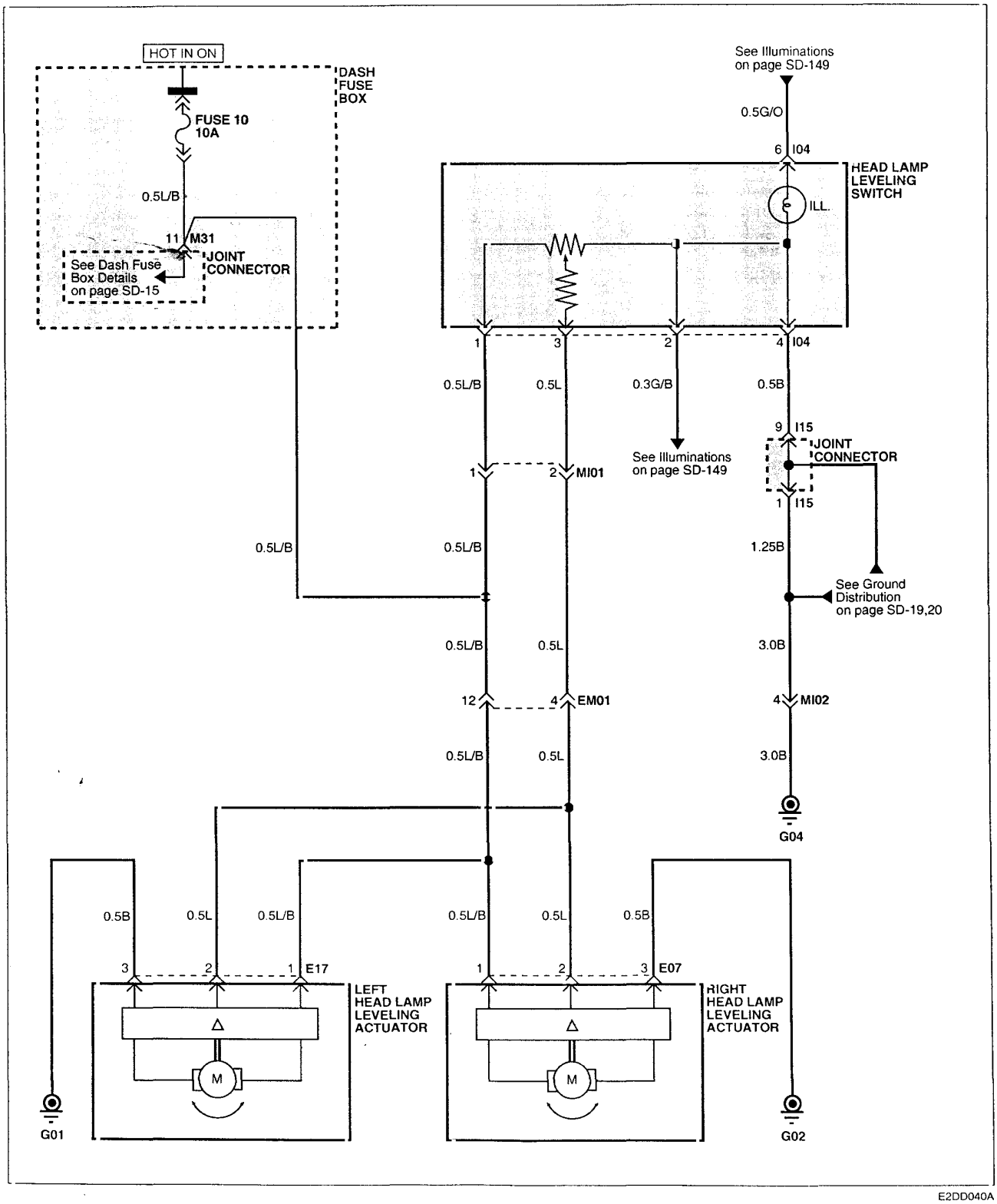
Circuit Description

With the light switch in PARK or HEAD position, battery voltage is supplied to the head lamp washer relay through the tail lamp relay contact.

When head lamp washer switch is closed, ground (G01) is provided to hte head lamp washer motor through the head lamp washer relay contact and then the motor operated.

HEAD LAMP LEVELING DEVICE E4E06B31

HEAD LAMP LEVELING DEVICE (1)



E2DD040A

COMPONENT LOCATION INDEX

Components		Location reference - page
E07	Right head lamp leveling actuator	CL-12
E17	Left head lamp leveling actuator	CL-13
I04	Head lamp leveling switch	CL-17
I15	Joint connector	CL-17
M31	Joint connector	CL-3
Connectors		
EM01		CL-16
MI01		CL-11
MI02		CL-11
Grounds		
G01		CL-28
G02		CL-28
G04		CL-28

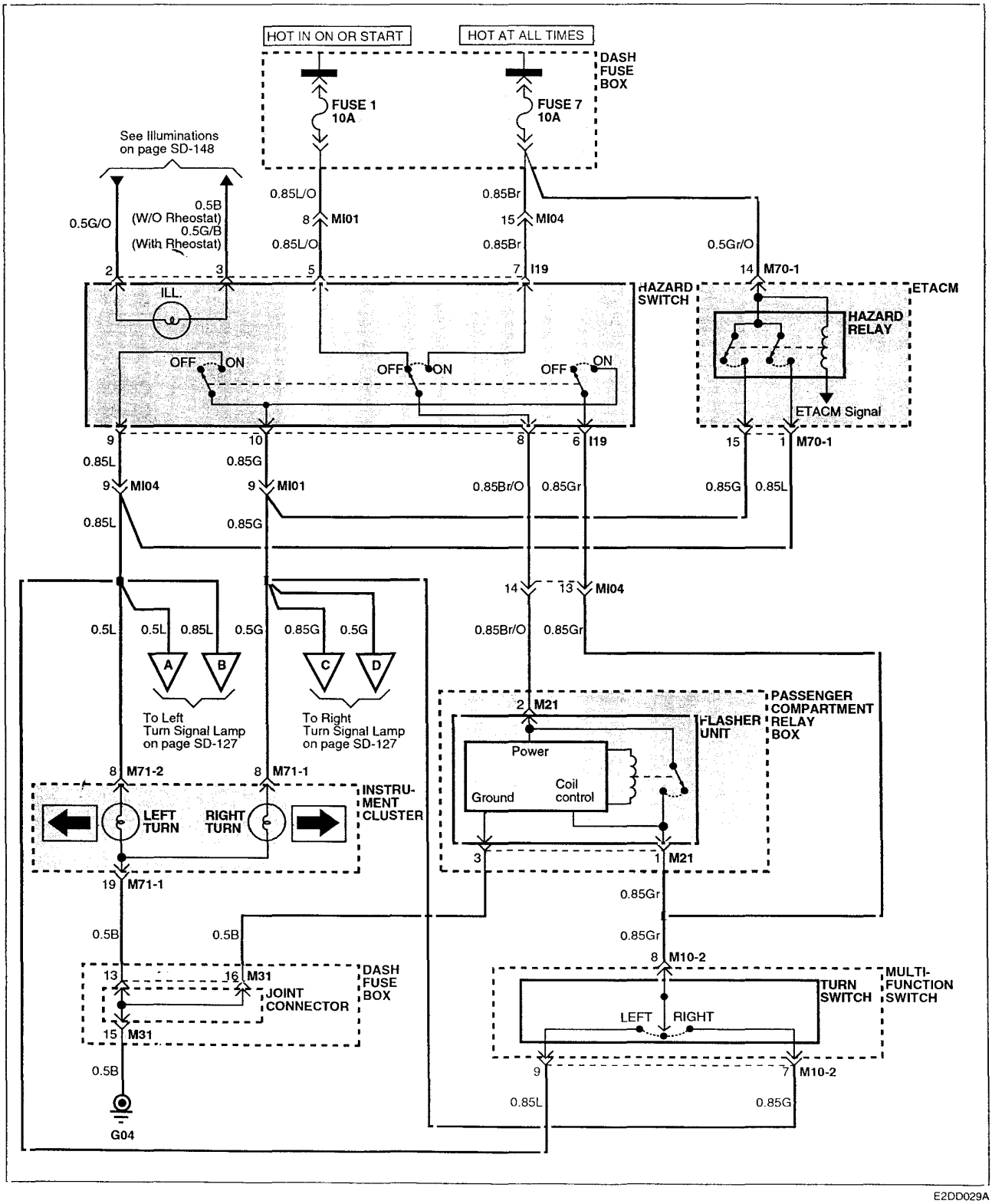
Circuit Description

The head lamps should be aimed properly according to the number of the passengers and the loading weight in the luggage area. To adjust the head lamps beam level, turn the beam leveling switch.

The higher the number of the switch position, the lower the head lamp beam level, Always keep the head lamps beam at the proper leveling poition, or head lamp may dazzle other road users.

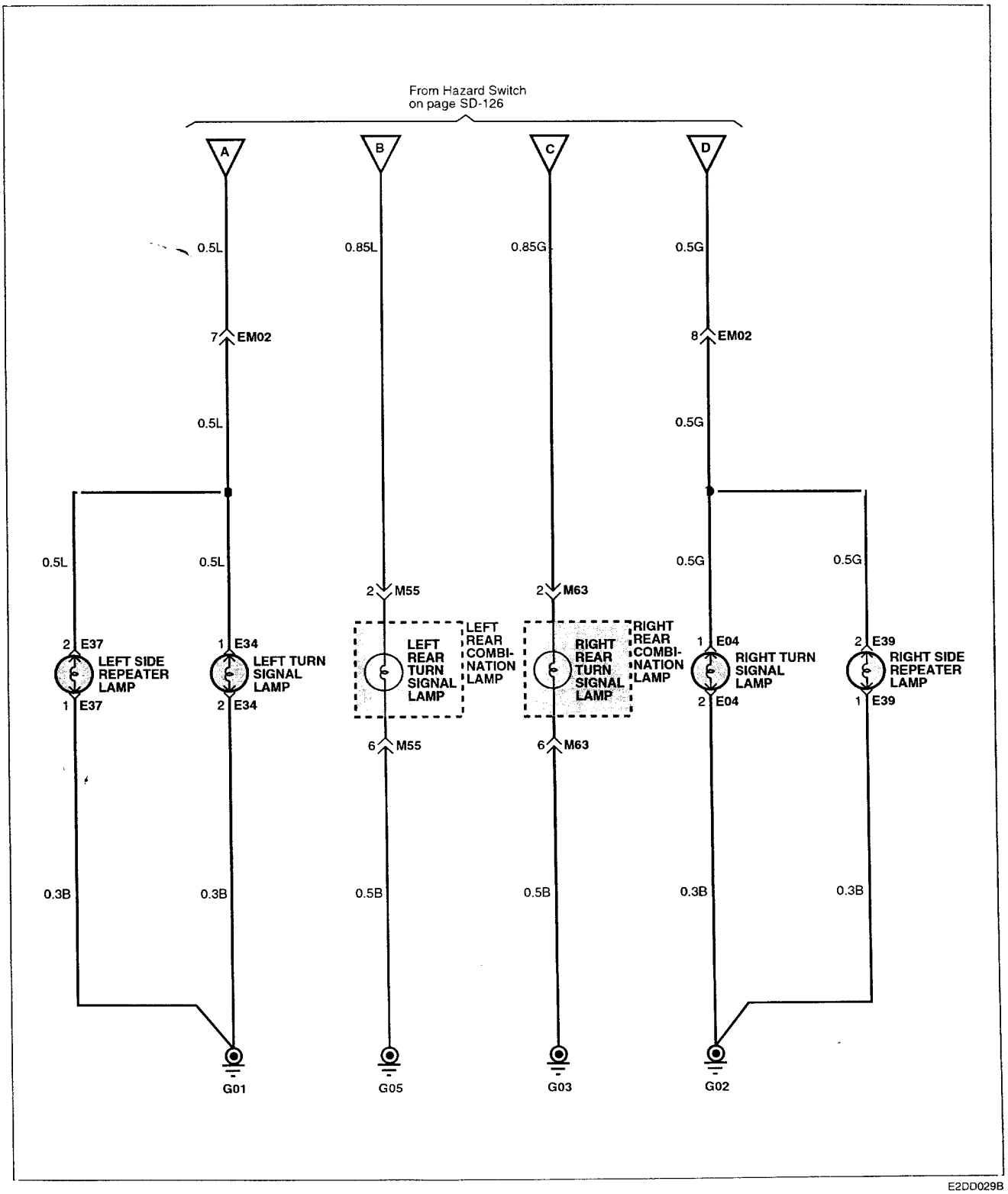
TURN & HAZARD LAMPS E6F00D6F

TURN & HAZARD LAMPS (1)



E2DD029A

TURN & HAZARD LAMPS (2)



E2DD029B

COMPONENT LOCATION INDEX

Components		Location reference - page
E04	Right turn signal lamp	CL-12
E34	Left turn signal lamp	CL-14
E37	Left side repeater lamp	CL-15
E39	Right side repeater lamp	CL-15
I19	Hazard switch	CL-17
M10-2	Multifunction switch	CL-2
M21	Flasher unit	CL-3
M31	Joint connector	CL-3
M55	Left rear combination lamp	CL-6
M63	Right rear combination lamp	CL-7
M70-1	ETACM	CL-7
M71-1	Instrument cluster	CL-8
M71-2	Instrument cluster	CL-8
Connectors		
EM02		CL-16
MI01		CL-11
MI04		CL-11
Grounds		
G01		CL-28
G02		CL-28
G03		CL-28
G04		CL-28
G05		CL-28

Circuit Description

Turn Signal Lamps
With the hazard switch in OFF, and ignition switch in ON or START, battery voltage is applied from fuse 1 to the flasher unit. The solid-state flasher unit senses the turn switch position through the coil control and alternately applies and removes battery voltage to the turn switch. Voltage is applied to the left turn or right turn lamps and indicators depending on the turn switch position.

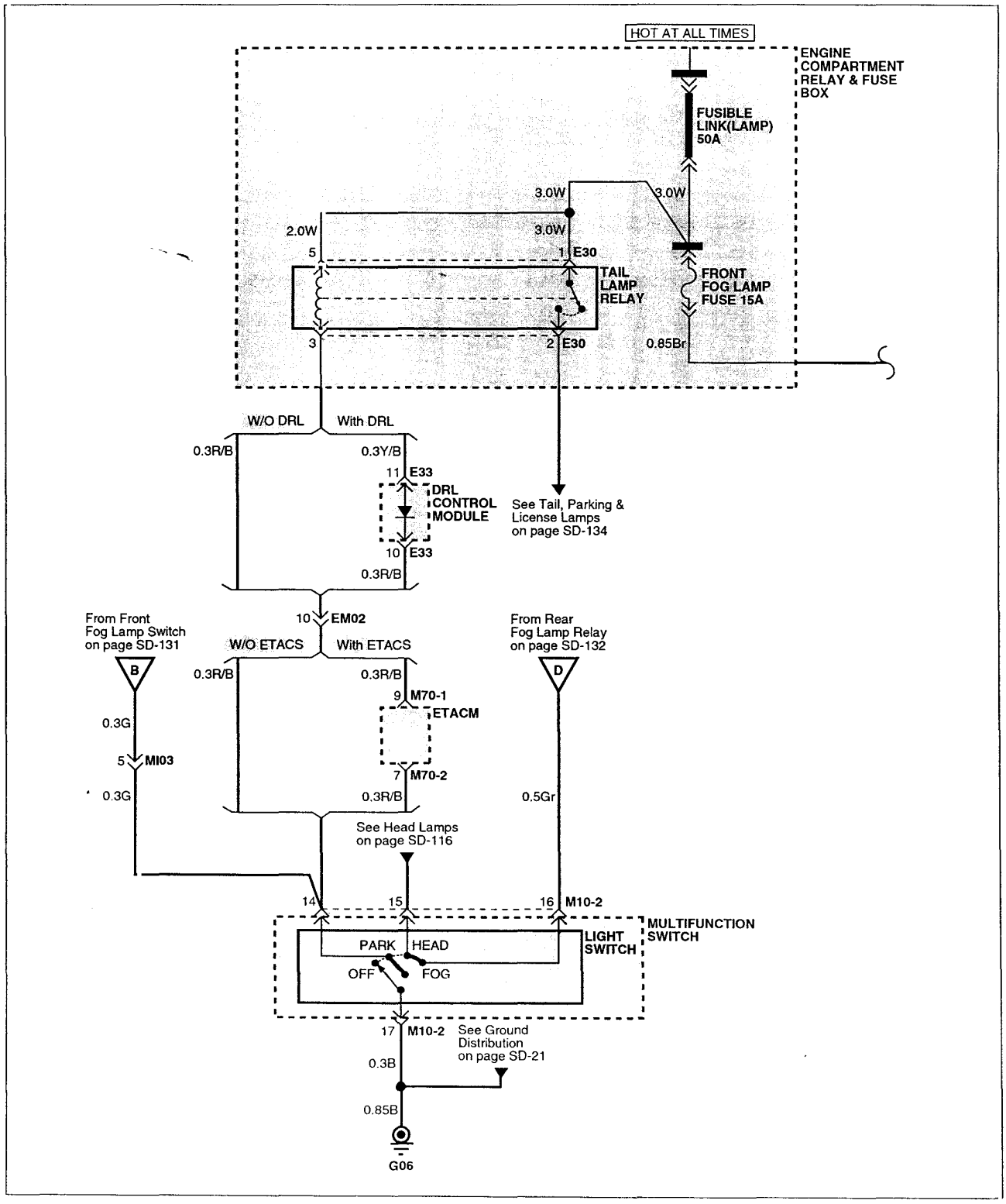
Hazard Lamps
With the hazard switch depressed (ON), battery voltage is applied from fuse 7 to the flasher.The soild -state flasher unit senses that the hazard switch is in the ON position and alternately applies and removes battery voltage to the left turn and right turn lamps and both indicators in the instrument cluster.

MEMO

MEMO

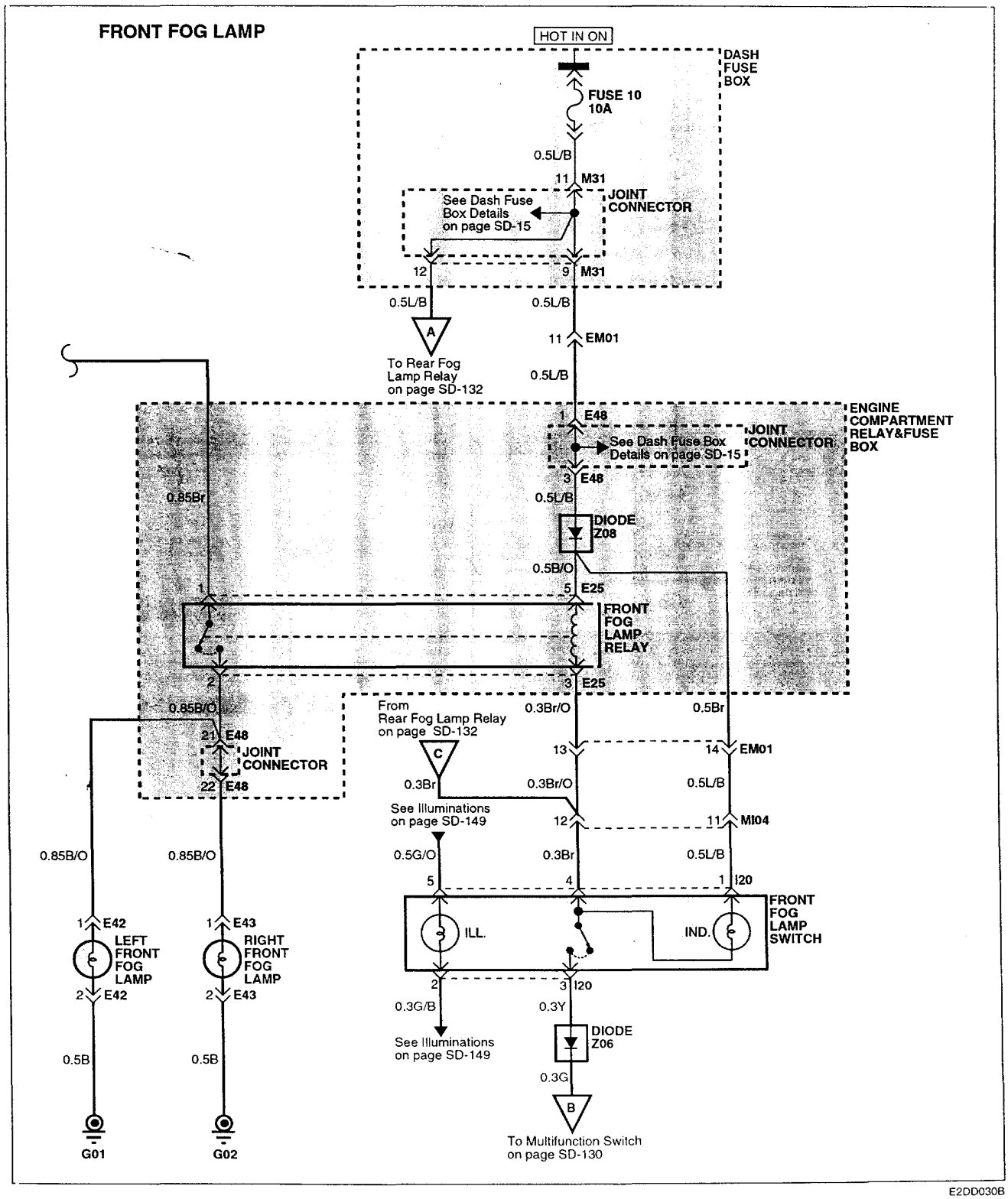
FRONT FOG & REAR FOG LAMPS ECEE8260

FRONT FOG & REAR FOG LAMPS (1)



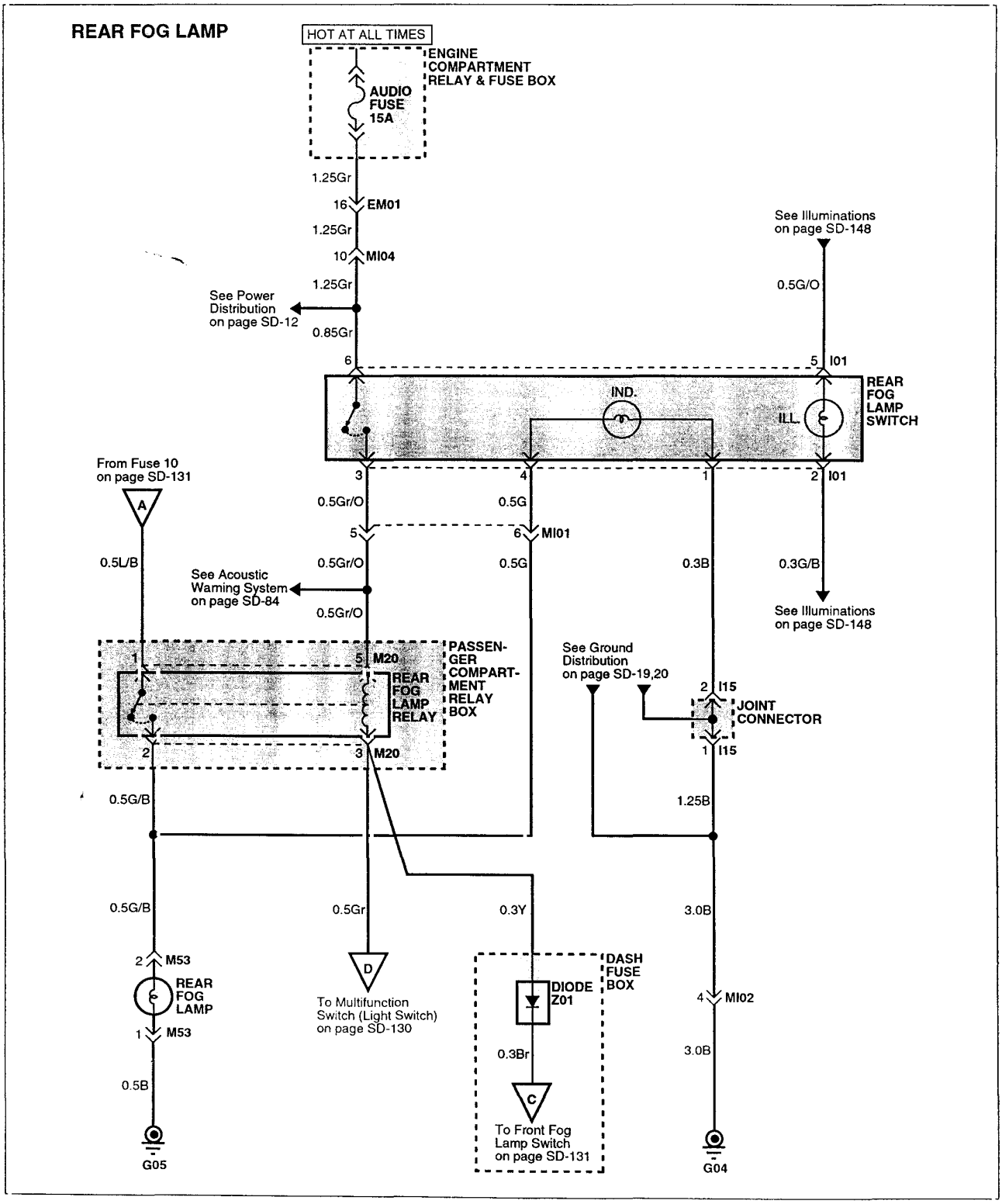
E2DD030A

FRONT FOG & REAR FOG LAMPS (2)



E2DD030B

FRONT FOG & REAR FOG LAMPS (3)



E2DD030C

COMPONENT LOCATION INDEX

Components		Location reference - page
E25	Front fog lamp relay	CL-14
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E42	Left front fog lamp	CL-15
E43	Right front fog lamp	CL-15
E48	Joint connector	CL-16
I01	Rear fog lamp switch	CL-17
I15	Joint connector	CL-17
I20	Front fog lamp switch	CL-17
M10-2	Multifunction switch	CL-2
M20	Rear fog lamp relay	CL-3
M31	Joint connector	CL-3
M53	Rear fog lamp (3.5 Door)	CL-6
Connectors		
EM01		CL-16
MI01		CL-11
MI02		CL-11
MI03		CL-11
MI04		CL-11
Grounds		
G01		CL-28
G02		CL-28
G04		CL-28
G05		CL-28
G06		CL-28
Diodes		
Z01		CL-30
Z06		CL-30

Circuit Description

W/O REAR FOG LAMPS

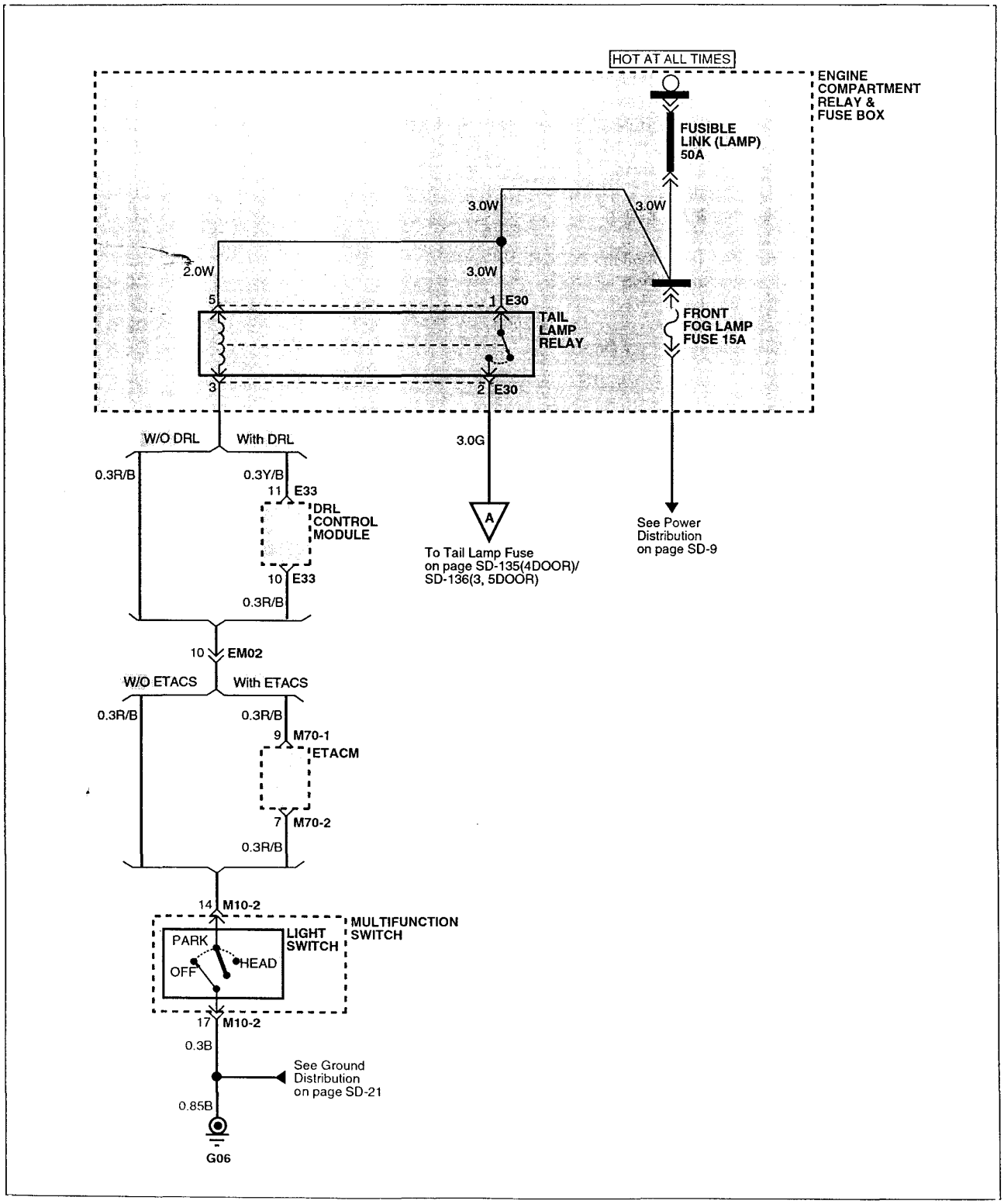
With the Light switch in PARK or HEAD position, battery voltage is appliedto the fog lamp relay coils from the fuse 10. When the front fog lamp switchis ON, ground is provided to the coil of the fog lamp relay through a diode. Battery from the front fog lamp fuse is then provided to the Left/Right frontfog through the closed contact of the front fog lamp relay. The Left/Rightfront fog lamps light.

With REAR FOG LAMPS

1. With the light switch in PARK position and front fog lamp switch is ON,the ground (G06) is provided to the rear fog lamp relay coils. When the rearfog lamp switch is ON, the rear fog lamp relay coil is energized and the batteryvoltage is applied to the rear fog lamps through the closed rear fog lamprelay contacts.
2. With the light switch in HEAD or FOG position, the ground (G06) is providedto the rear fog lamp relay coils. When the rear fog lamp switch is ON, therear fog lamp relay coil is energized. Battery voltage is supplied to the rear fog lamps through the closed rear fog lamp relay contacts and then thelamps light.

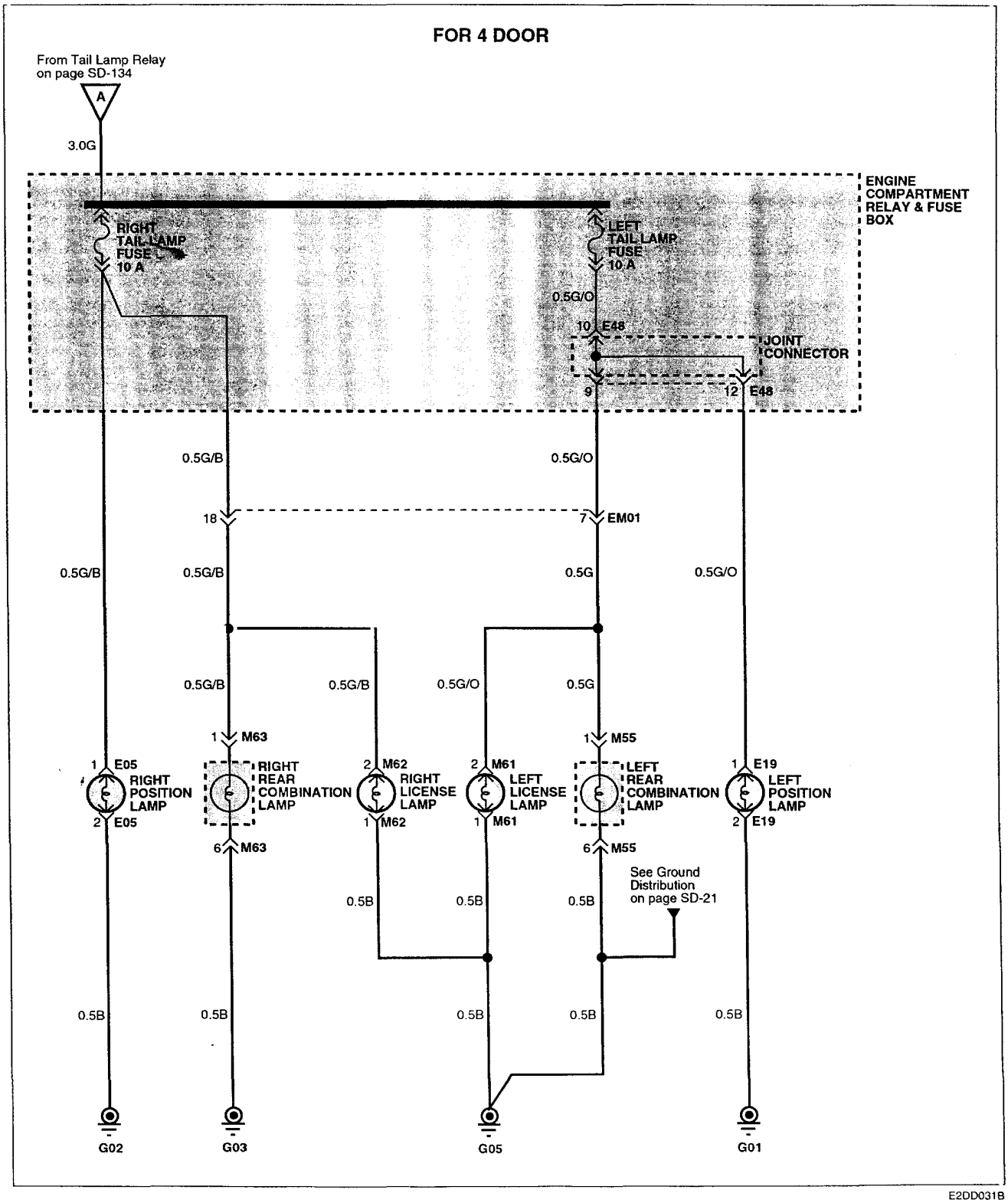
TAIL, PARKING & LICENSE LAMPS E6D11DA8

TAIL, PARKING & LICENSE LAMPS (1)



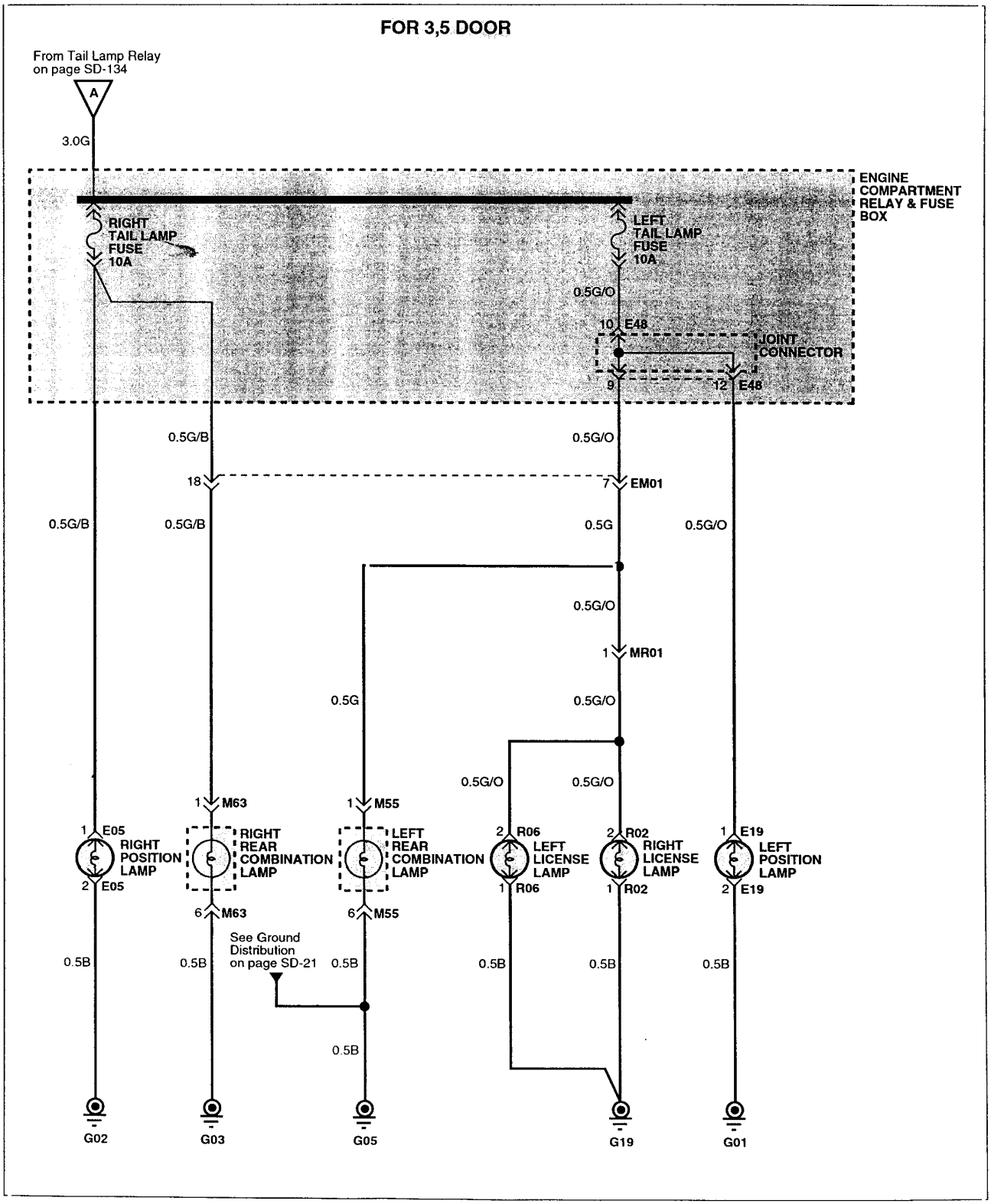
E2DD031A

TAIL, PARKING & LICENSE LAMPS (2)



E2DD031B

TAIL, PARKING & LICENSE LAMPS (3)



E2DD031C

COMPONENT LOCATION INDEX

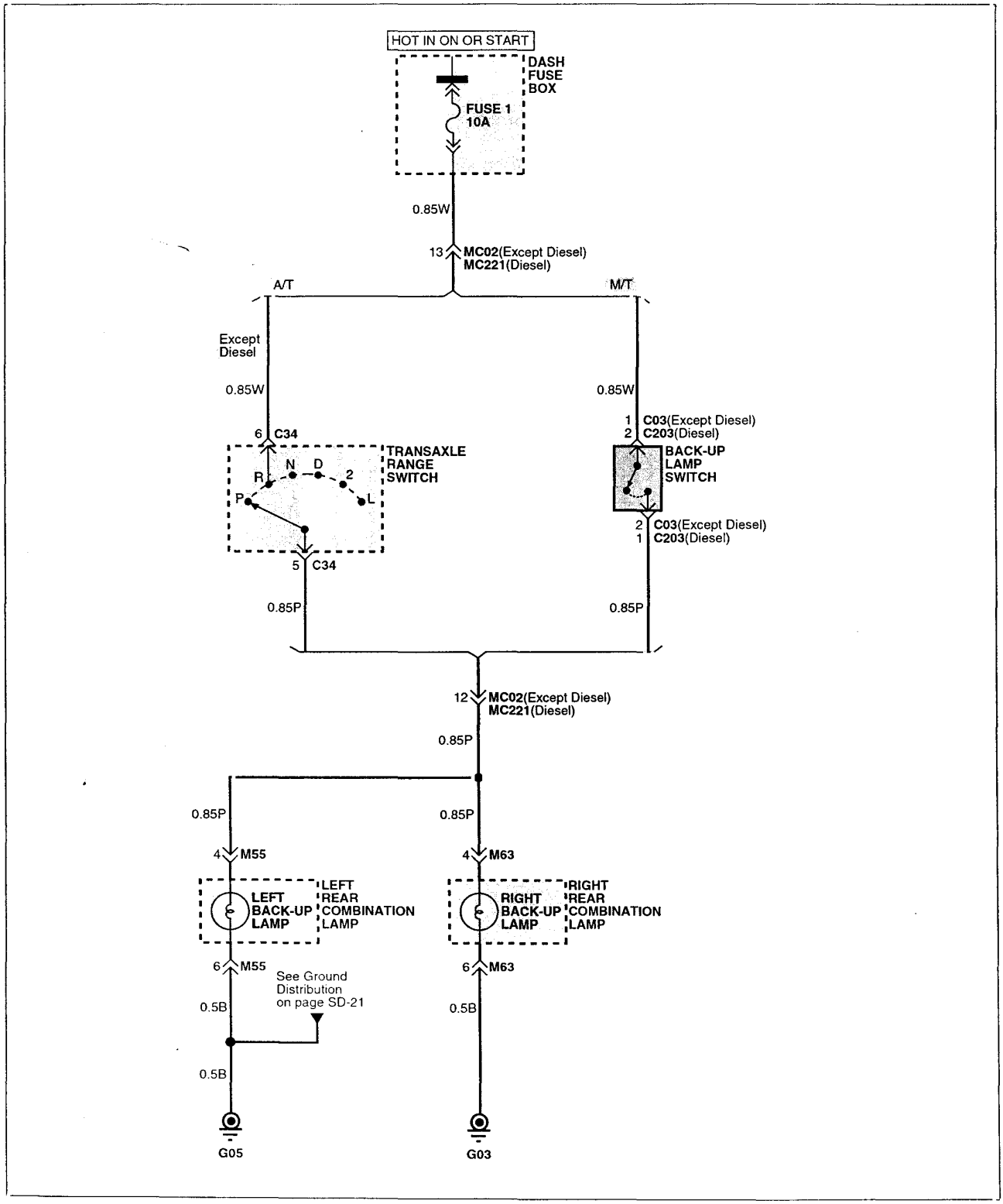
Components		Location reference - page
E05	Right position lamp	CL-12
E19	Left position lamp	CL-13
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
M10-2	Multifunction switch	CL-2
M55	Left rear combination lamp	CL-6
M61	Left license lamp (4 Door)	CL-7
M62	Right license lamp (4 Door)	CL-7
M63	Right rear combination lamp	CL-7
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
R02	Right license lamp (3.5 Door)	CL-27
R06	Left license lamp (3.5 Door)	CL-27
Connectors		
EM01		CL-16
EM02		CL-16
Grounds		
G01		CL-28
G02		CL-28
G03		CL-28
G05		CL-28
G06		CL-28
G19		CL-29

Circuit Description

Battery voltage is applied at all times to the coil and contacts of the tail lamp relay. With the light switch in PARK or HEAD, the coil of the tail lamp relay is grounded through the light switch. Battery voltage from the Left/Right tail lamp fuse is then provided to the lamps (Left/Right tail lamps, Left/Right park lamps and license lamp) through the tail lamp relay contact, and all the lamps illuminate.

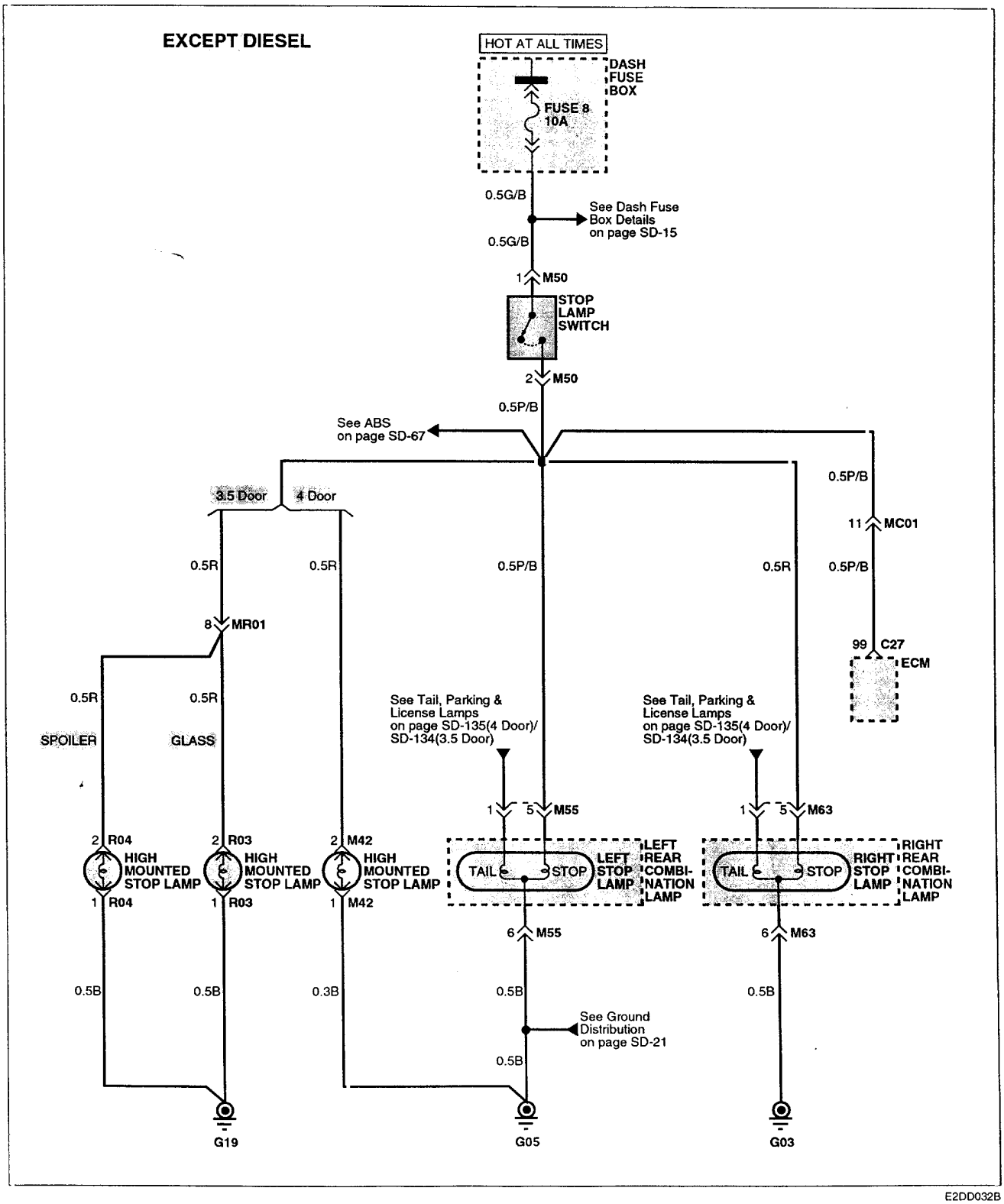
BACK-UP & STOP LAMPS EB65EBC9

BACK-UP & STOP LAMPS (1)



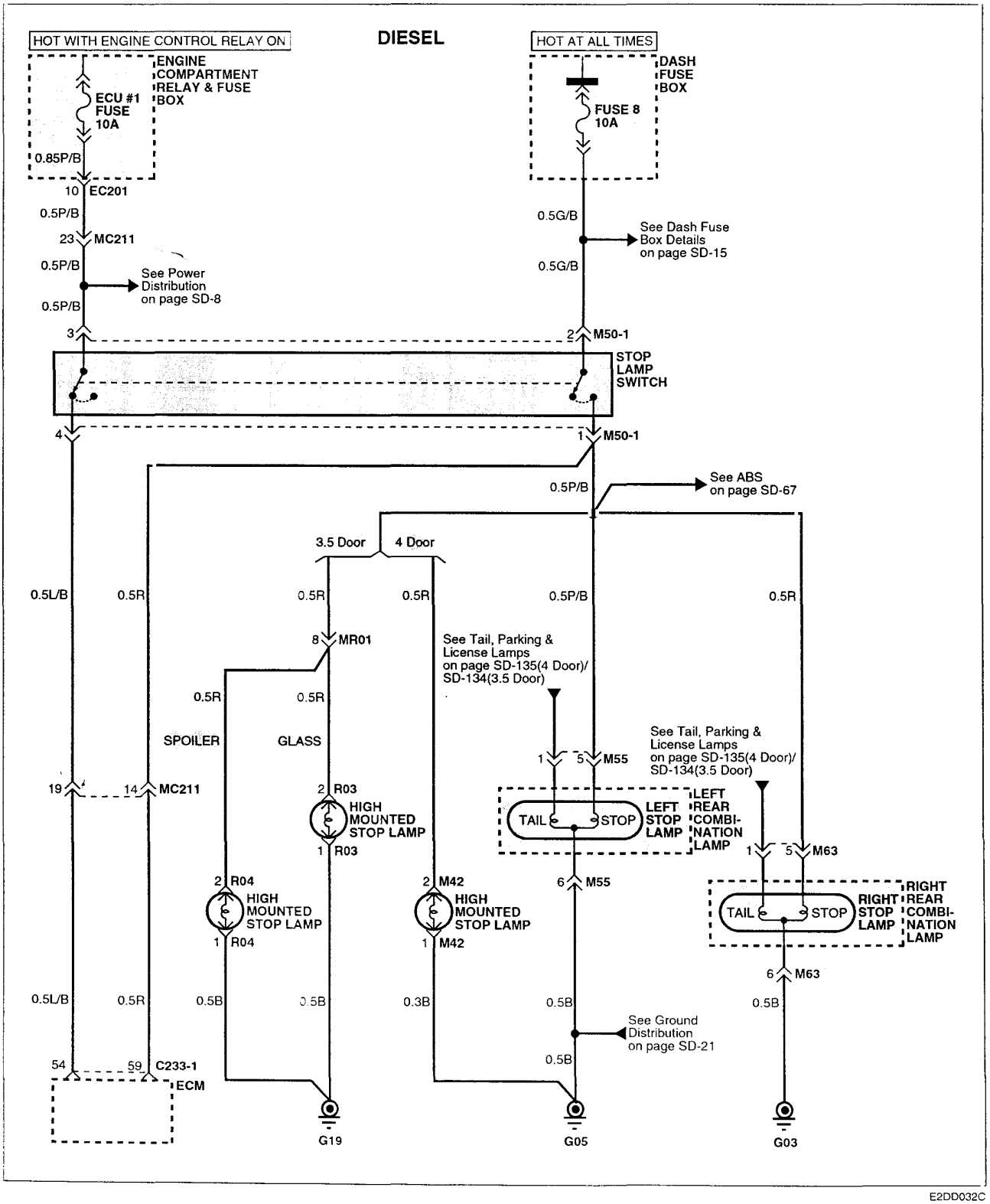
E2DD032A

BACK-UP & STOP LAMPS (2)



E2DD032B

BACK-UP & STOP LAMPS (3)



E2DD032C

COMPONENT LOCATION INDEX

Components		Location reference - page
C03	Back-up lamp switch (Except Diesel)	CL-18
C27	ECM (Except Diesel)	CL-20
C34	Transaxle range switch	CL-21
C203	Back-up lamp switch (Diesel)	CL-22
C233-1	ECM (Diesel)	CL-24
M42	High-mounted stop lamp (4 Door)	CL-5
M50	Stop lamp switch (Except Diesel)	CL-5
M50-1	Stop lamp switch (Diesel)	CL-5
M55	Left rear combination lamp	CL-6
M63	Right rear combination lamp	CL-7
R03	High-mounted stop lamp (3.5 Door)	CL-27
Connectors		
MC01		CL-10
MC02		CL-10
MC211		CL-10
MC221		CL-10
MR01		CL-11
Grounds		
G03		CL-28
G05		CL-28
G19		CL-29

Circuit Description

BACK-UP LAMPS

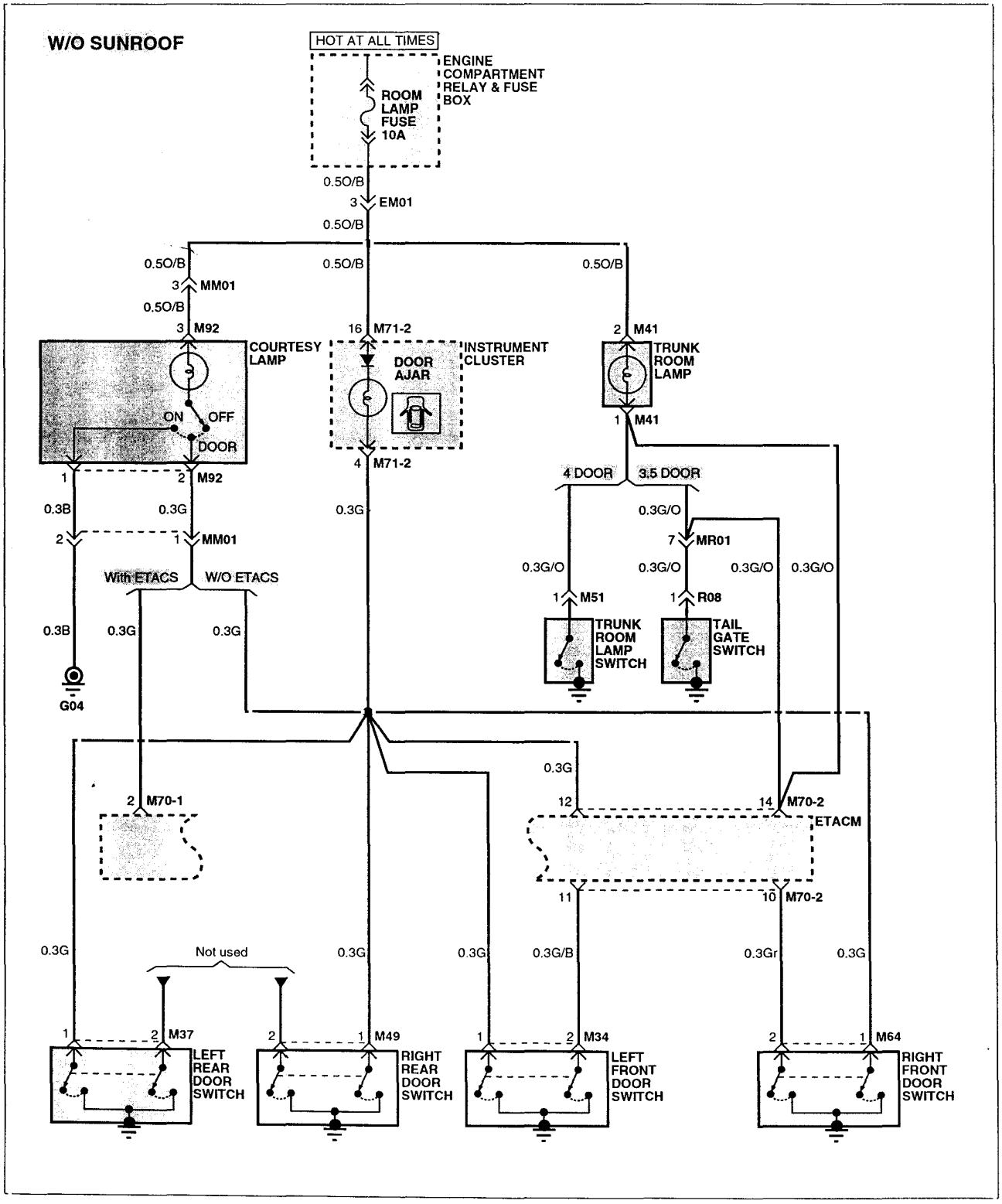
With the ignition switch in ON or START, battery voltage is applied from fuse 1 to the back-up lamp switch (Manual transaxle) or the transaxle range switch (Automatic transaxle). With the transaxle in reverse, battery voltage is applied to the back-up lamps and the back-up lamps go on.

STOP LAMPS

Battery voltage is applied to the stop lamp switch at all times from fuse 8. With the brake pedal depressed, the stop lamp switch is closed and battery voltage is applied to all the stop lamps (Left/Right stop lamps and high mounted stop lamps) and the lamps go on.

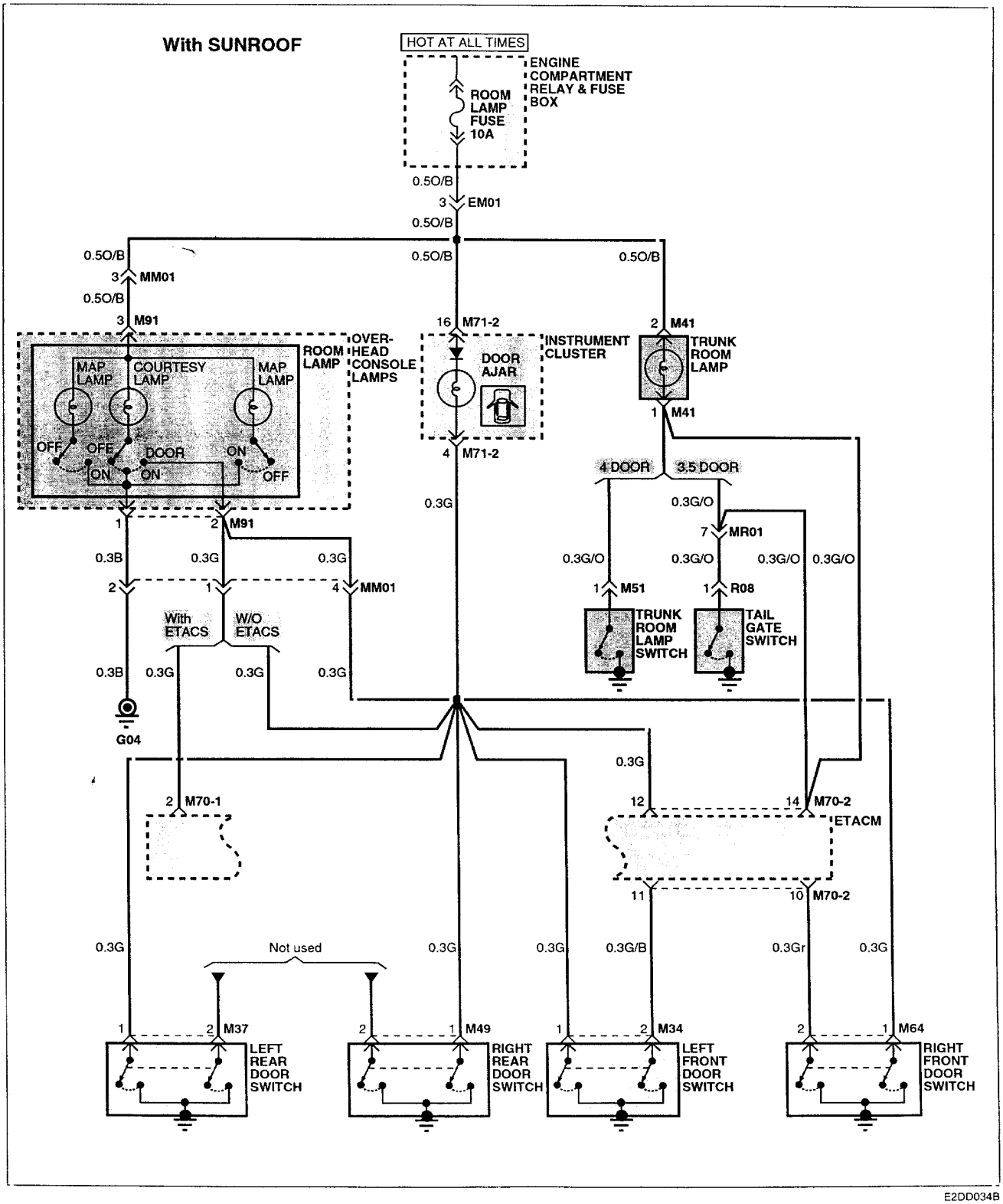
COURTESY LAMPS E4B446C5

COURTESY LAMPS (1)



E2DD034A

COURTESY LAMPS (2)



E2DD034B

COMPONENT LOCATION INDEX

Components		Location reference - page
M34	Left front door switch	CL-4
M37	Left rear door switch	CL-4
M41	Trunk room lamp	CL-4
M49	Right rear door switch	CL-5
M51	Trunk room lamp switch (4 Door)	CL-5
M64	Right front door switch	CL-7
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
M71-1	Instrument cluster	CL-8
M91	Courtesy lamp (With sunroof)	CL-9
M92	Courtesy lamp (W/O sunroof)	CL-9
R08	Tail gate switch (3.5 Door)	CL-27
Connectors		
EM01		CL-16
MM01		CL-11
MR01		CL-11
Grounds		
G04		CL-28

Circuit Description

Battery voltage is applied at all times from room lamp fuse to the trunk lamp, door ajar, trunk ajar warning indicators and so on. When the appropriate switch (see schematic) is closed, a ground path is provided to the respective lamps, causing the lamps to go on.

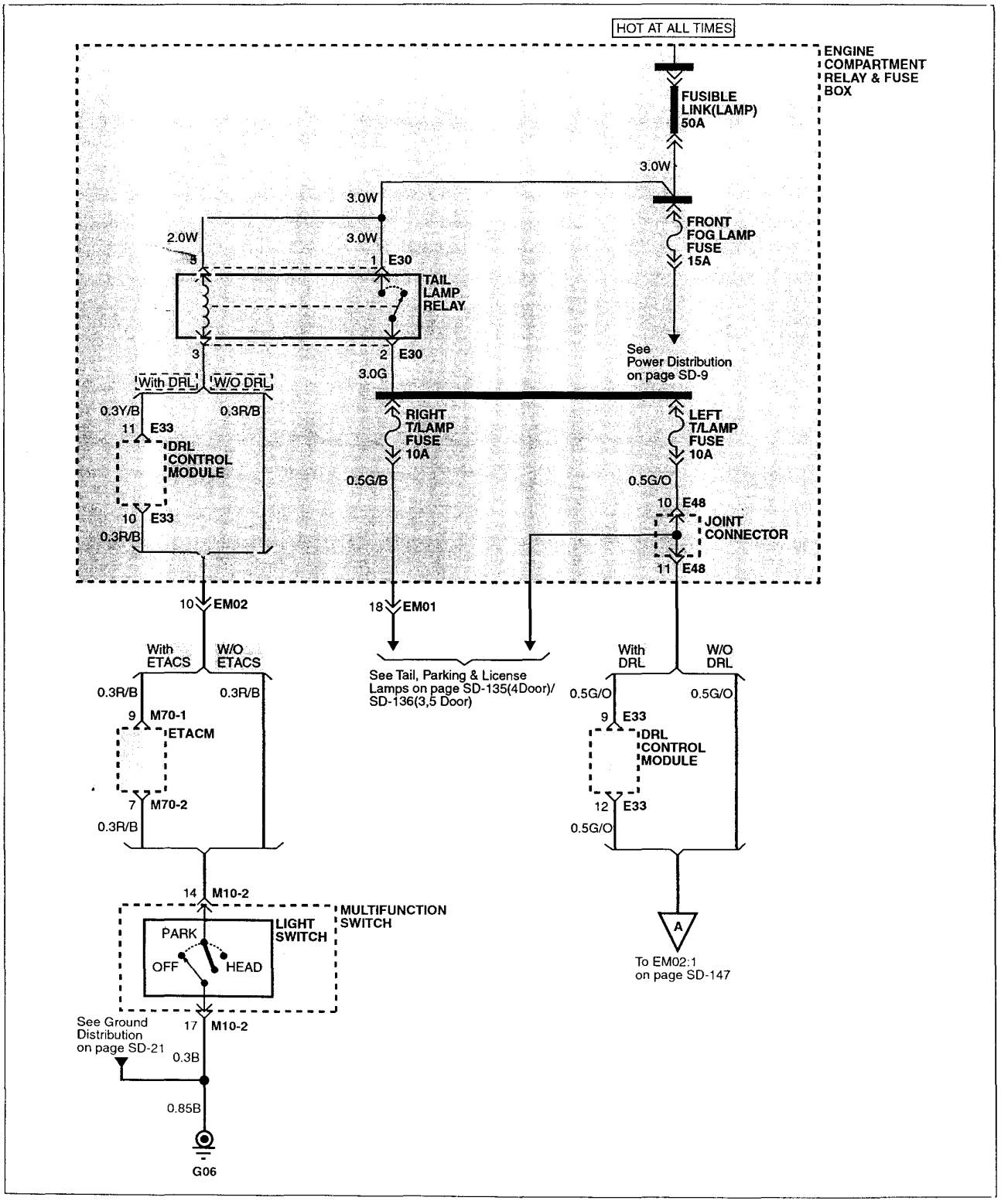
The front room lamp can be controlled by the door switches or turned on manually, depending on the position of the front room lamp switch. The front room lamp can also be turned off so it will not come on with the door open.

MEMO

MEMO

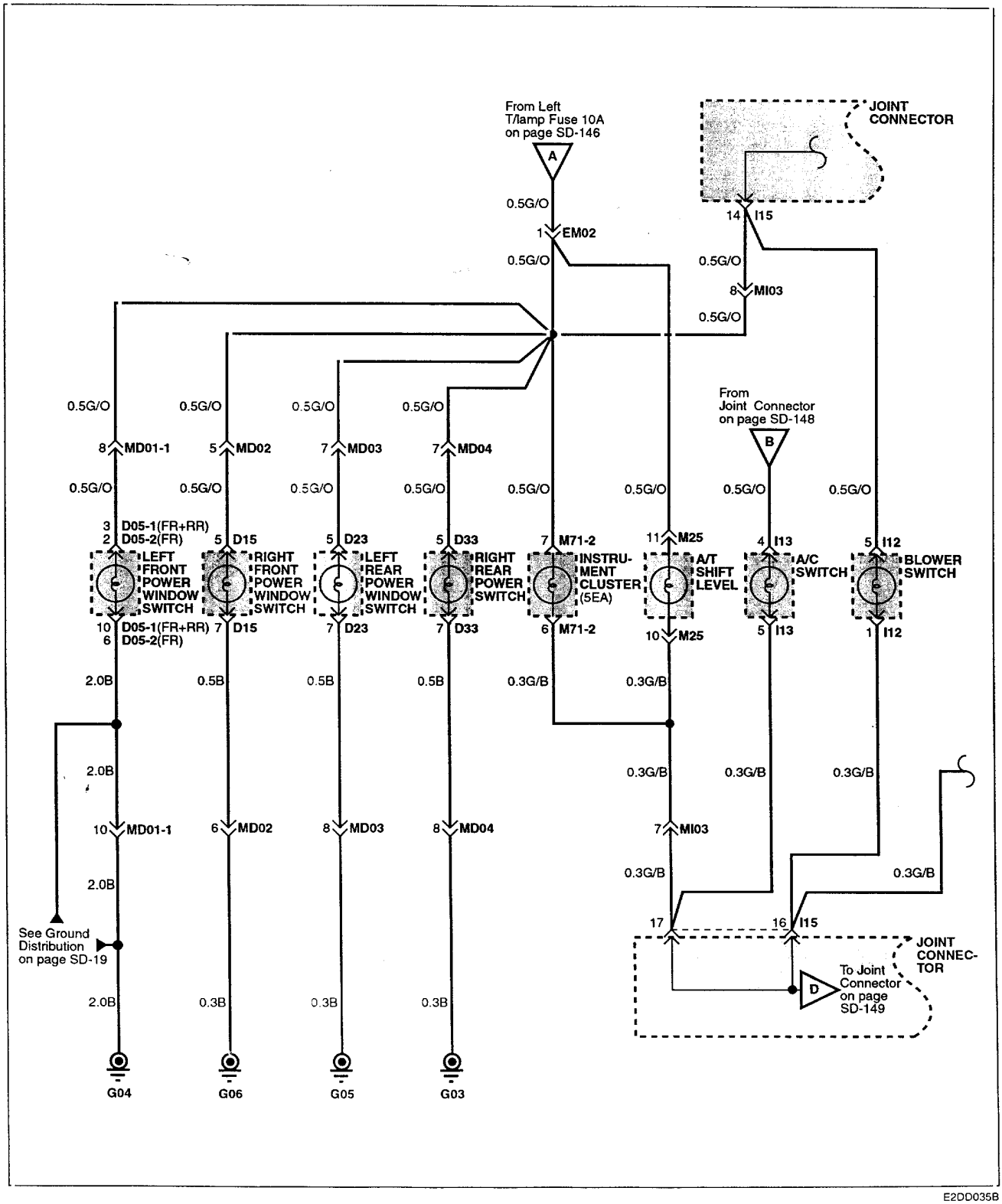
ILLUMINATIONS EB290DEF

ILLUMINATIONS (1)



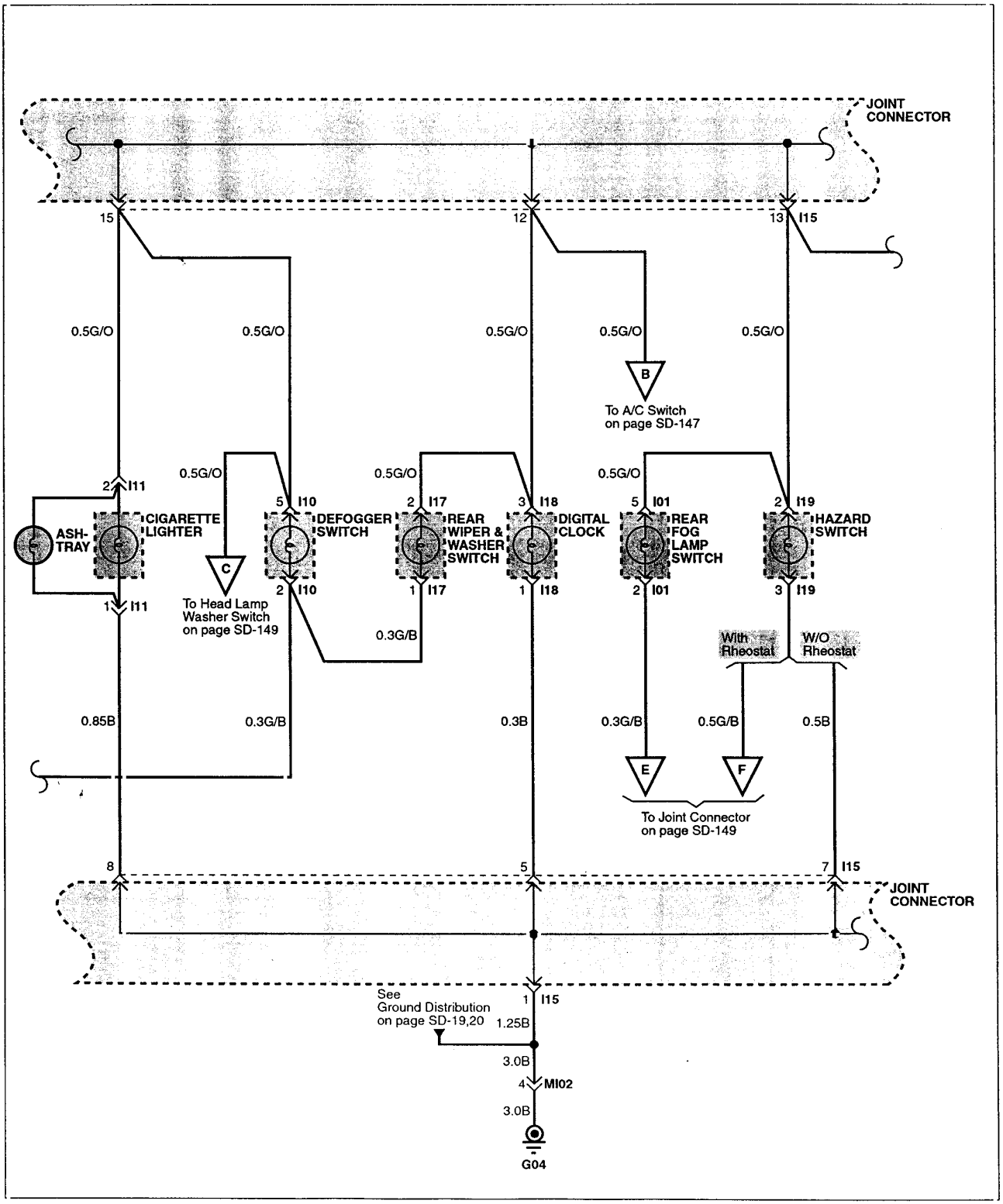
E2DD035A

ILLUMINATIONS (2)



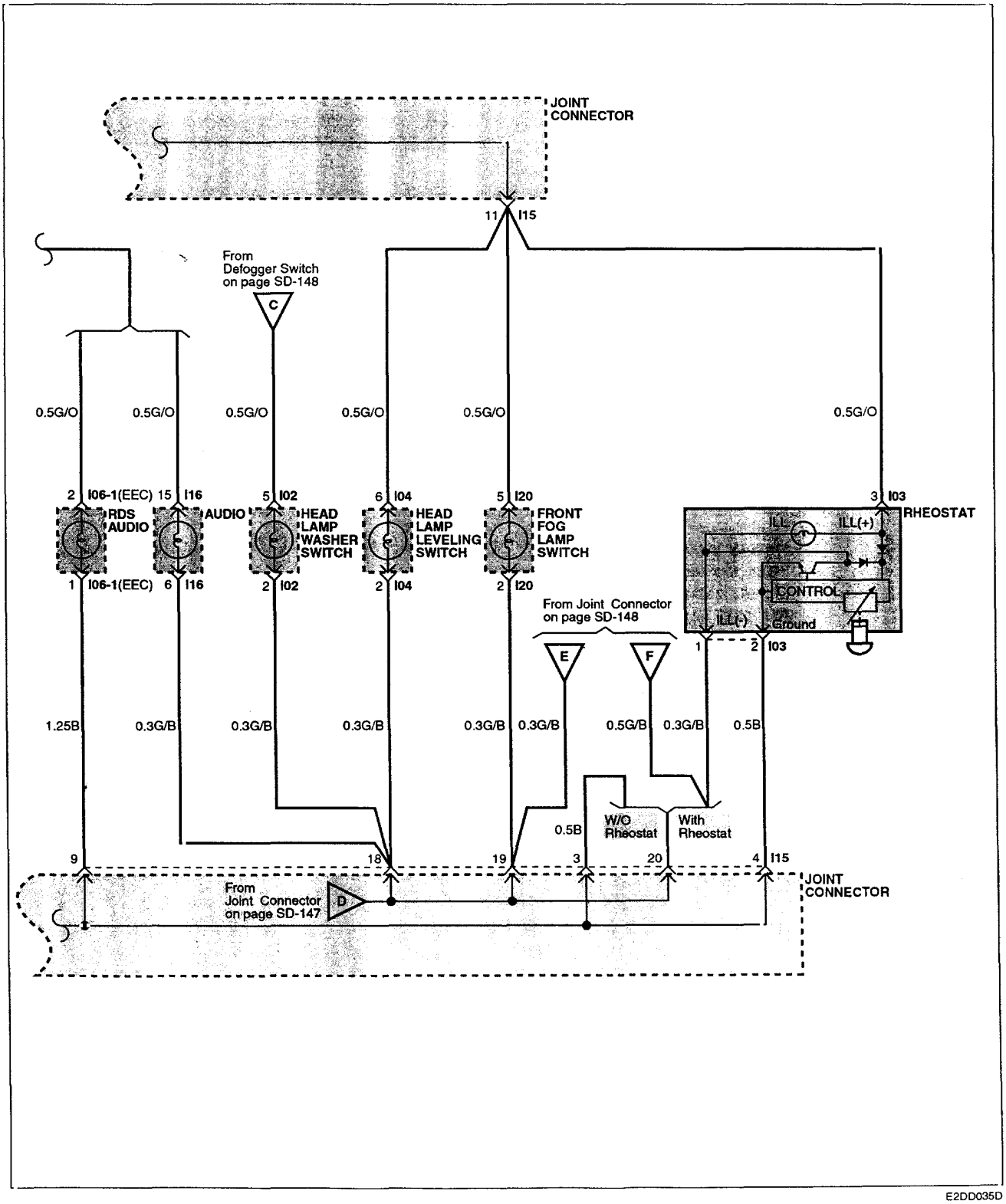
E2DD035B

ILLUMINATIONS (3)



E2DD035C

ILLUMINATIONS (4)



E2DD035D

COMPONENT LOCATION INDEX

Components		Location reference - page
D05-1	Left front power window switch	CL-26
D05-2	Left front power window switch	CL-26
D15	Right front power window switch	CL-26
D23	Left rear power window switch	CL-26
D33	Right rear power window switch	CL-26
E30	Tail lamp relay	CL-14
E33	DRL control module	CL-14
E48	Joint connector	CL-16
I01	Rear fog lamp switch	CL-17
I02	Head lamp washer switch	CL-17
I03	Rheostat	CL-17
I04	Head lamp leveling switch	CL-17
I06-1	RDS audio	CL-17
I10	Defogger switch	CL-17
I11	Cigarette lighter	CL-17
I12	Blower switch	CL-17
I13	A/C switch	CL-17
I15	Joint connector	CL-17
I16	Audio	CL-17
I17	Rear wiper & washer switch	CL-17
I18	Digital clock	CL-17
I19	Hazard switch	CL-17
I20	Front fog lamp switch	CL-17
M10-2	Multifunction switch	CL-2
M25	A/T shift lever	CL-3
M70-1	ETACM	CL-7
M70-2	ETACM	CL-7
M71-1	Instrument cluster	CL-8
Connectors		
EM01		CL-16
EM02		CL-16
MD01-1		CL-10
MD02		CL-10
MD03		CL-11
MD04		CL-11
MI03		CL-11
Grounds		
G03		CL-28
G04		CL-28
G05		CL-28
G06		CL-28

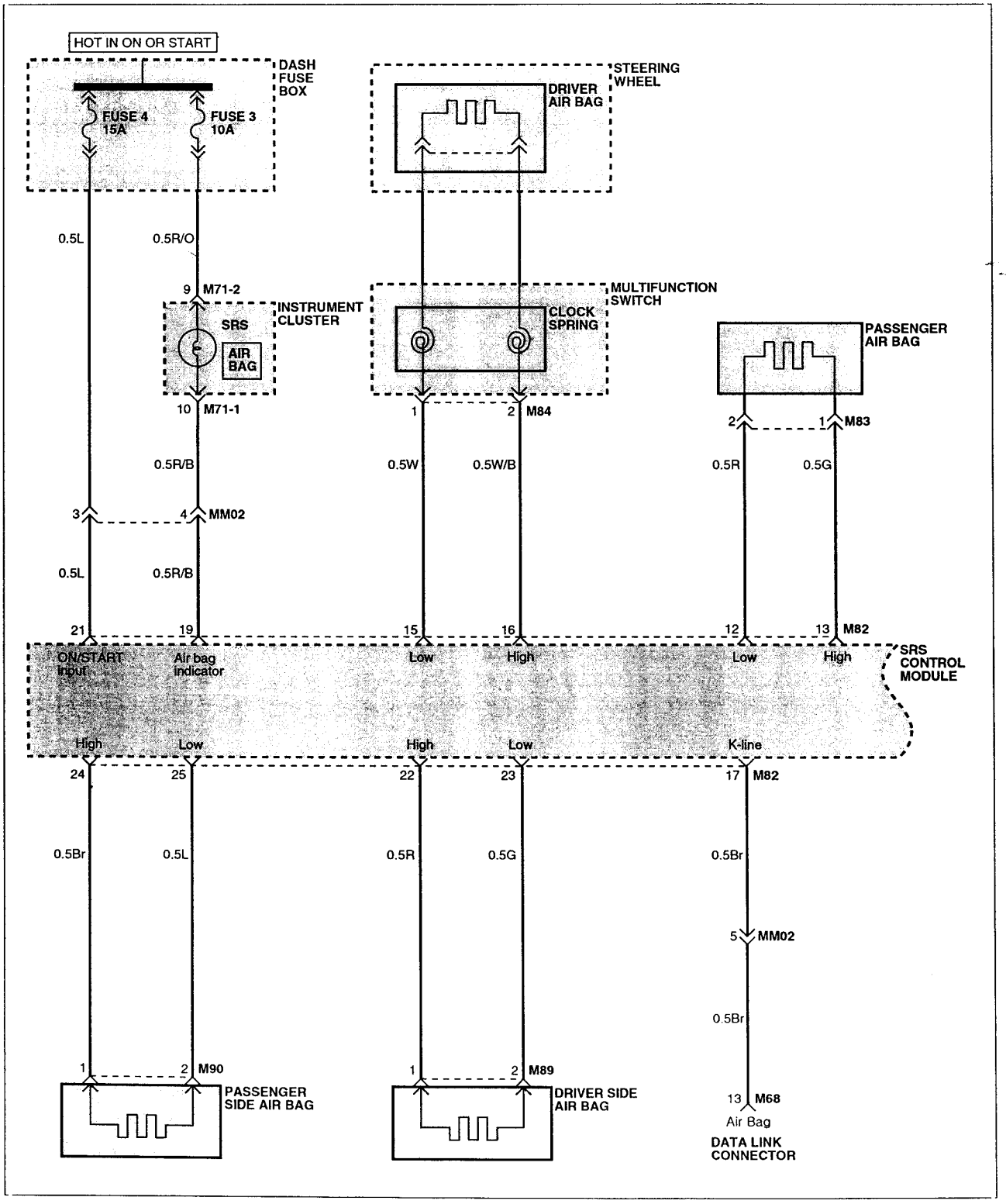
Circuit Description

Battery voltage is applied to the coil and contact of the tail lamp relay from fusible link (Lamp). With the light switch in the multifunction switch in PARK or HEAD, ground is provided to the tail lamp relay coil through the light switch.

Battery voltage from the Left tail lamp fuse is then provided to the illumination lamps through the closed contacts of the tail lamp relay. Ground is provided to the illumination lamps through the rheostat. The rheostat controls the brightness of the illumination lamp's light.

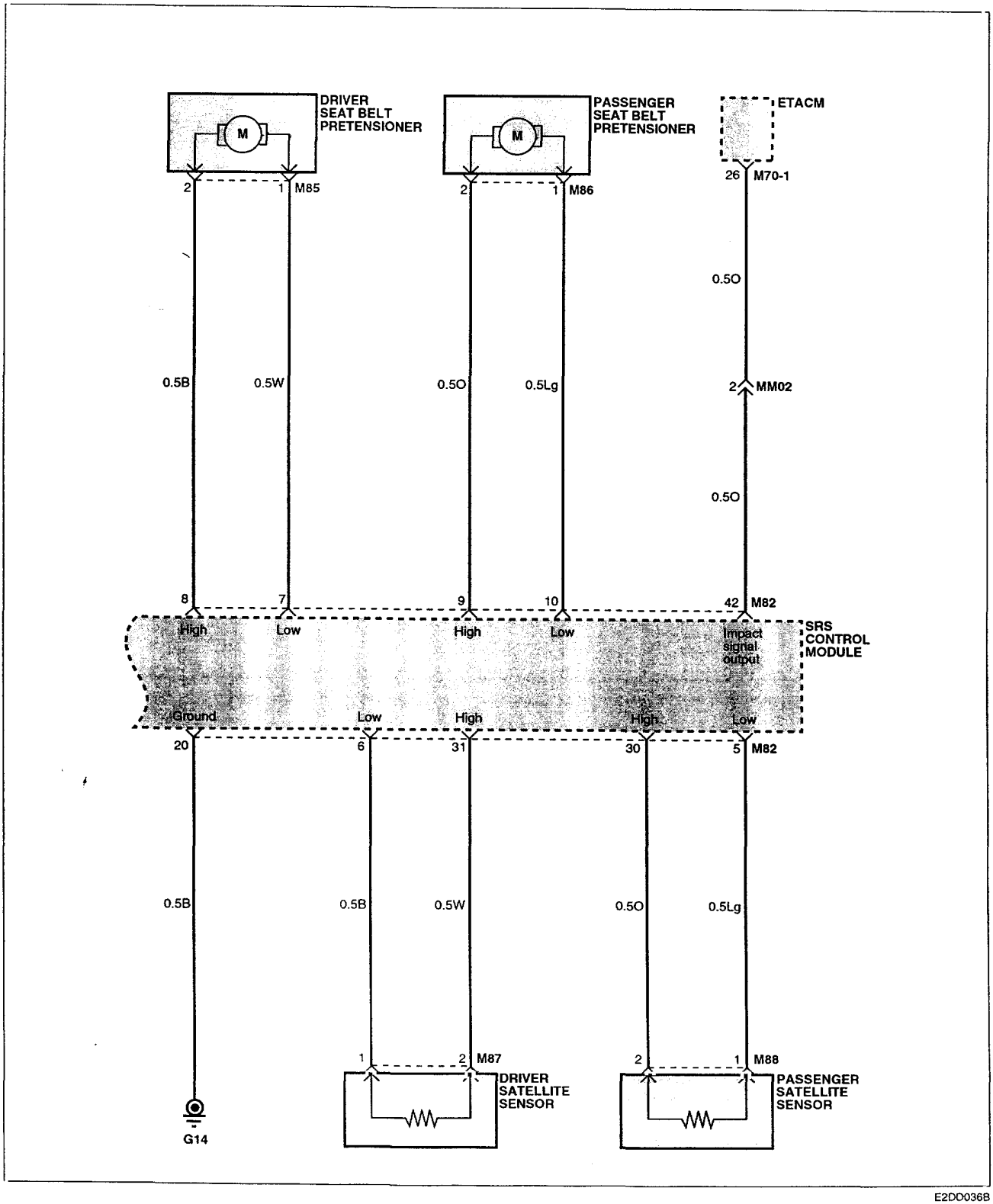
AIR BAG SYSTEM (SRS) EE04D97C

AIR BAG SYSTEM (SRS) (1)



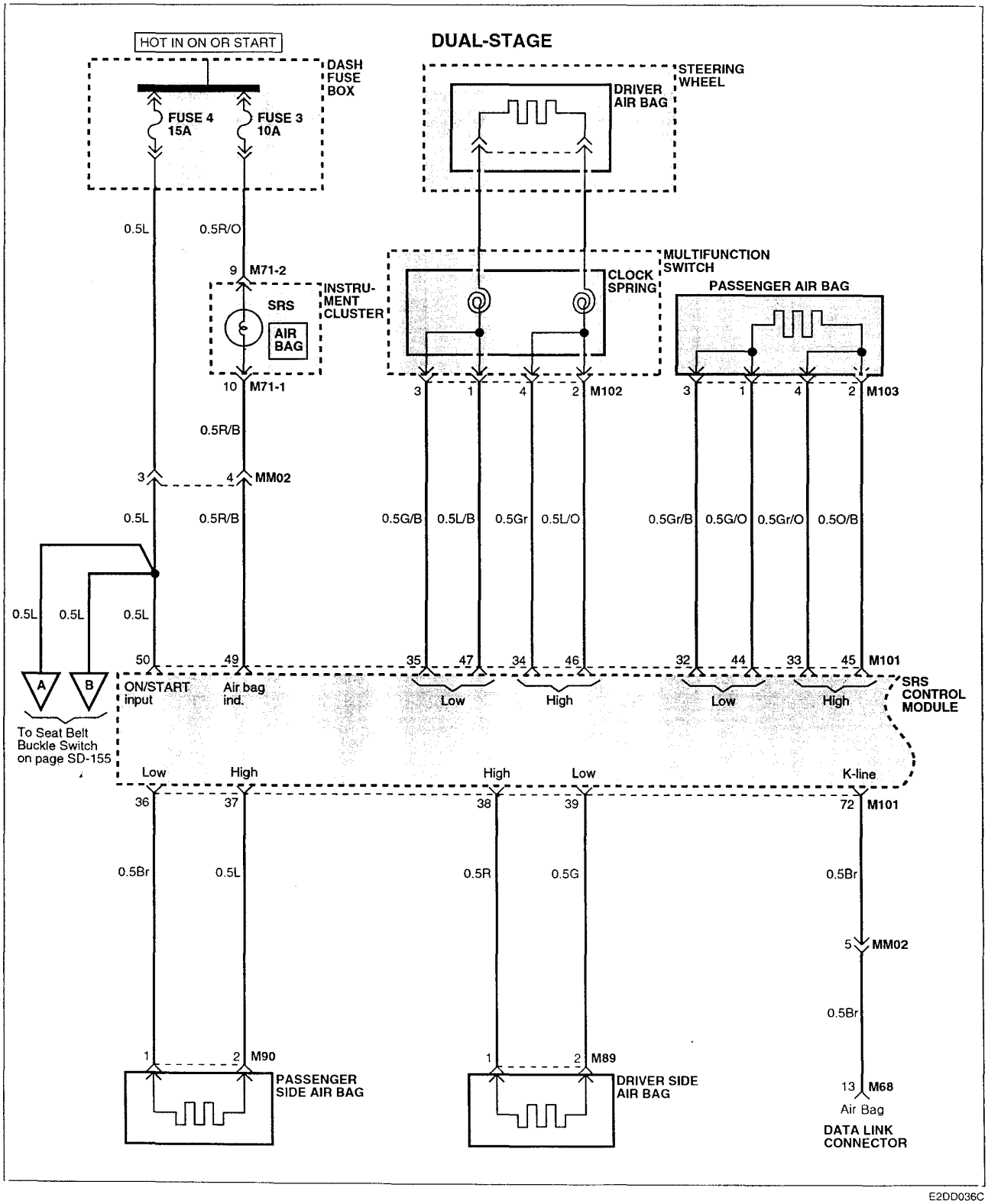
E2DD036A

AIR BAG SYSTEM (SRS) (2)



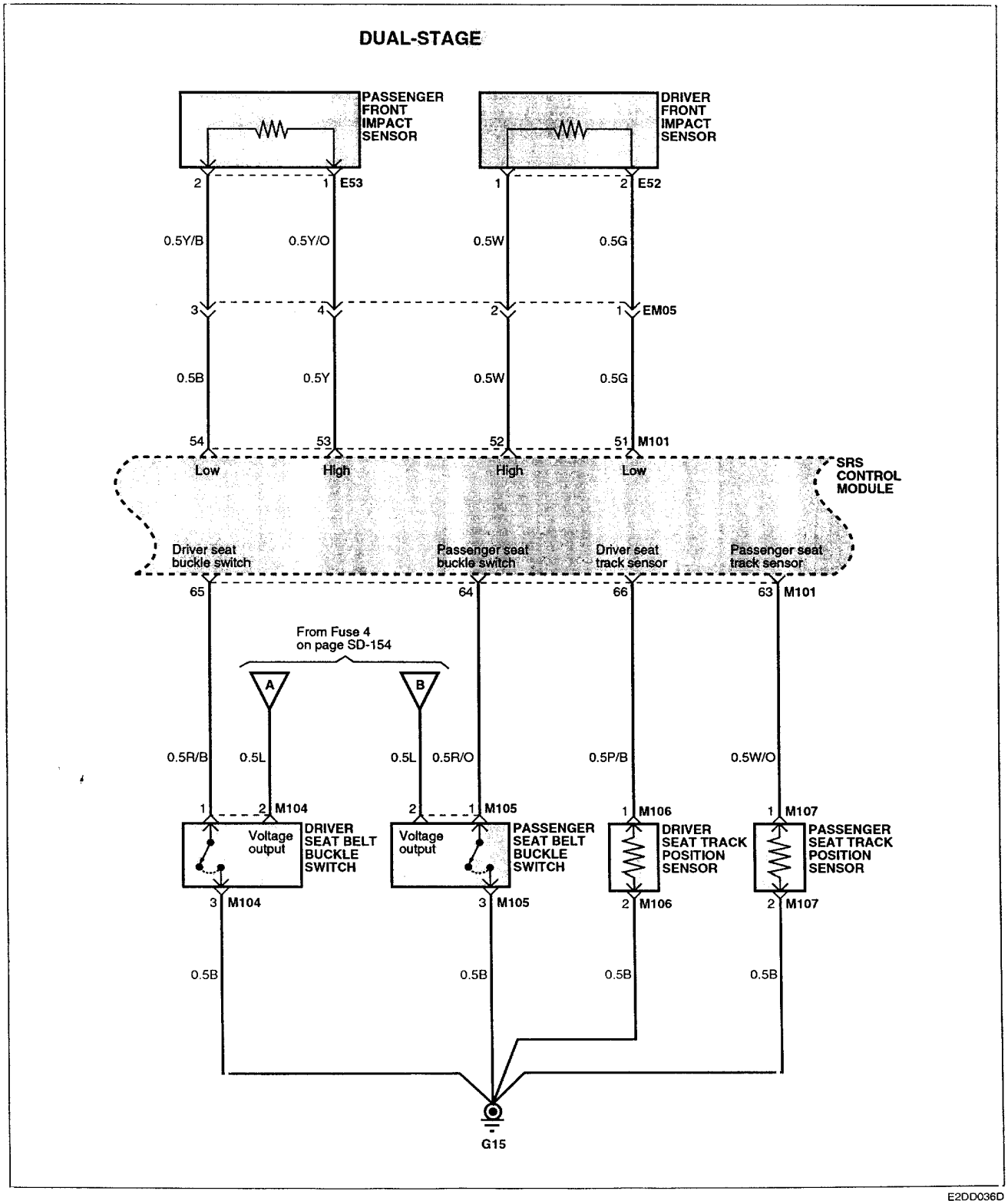
E2DD036B

AIR BAG SYSTEM (SRS) (3)



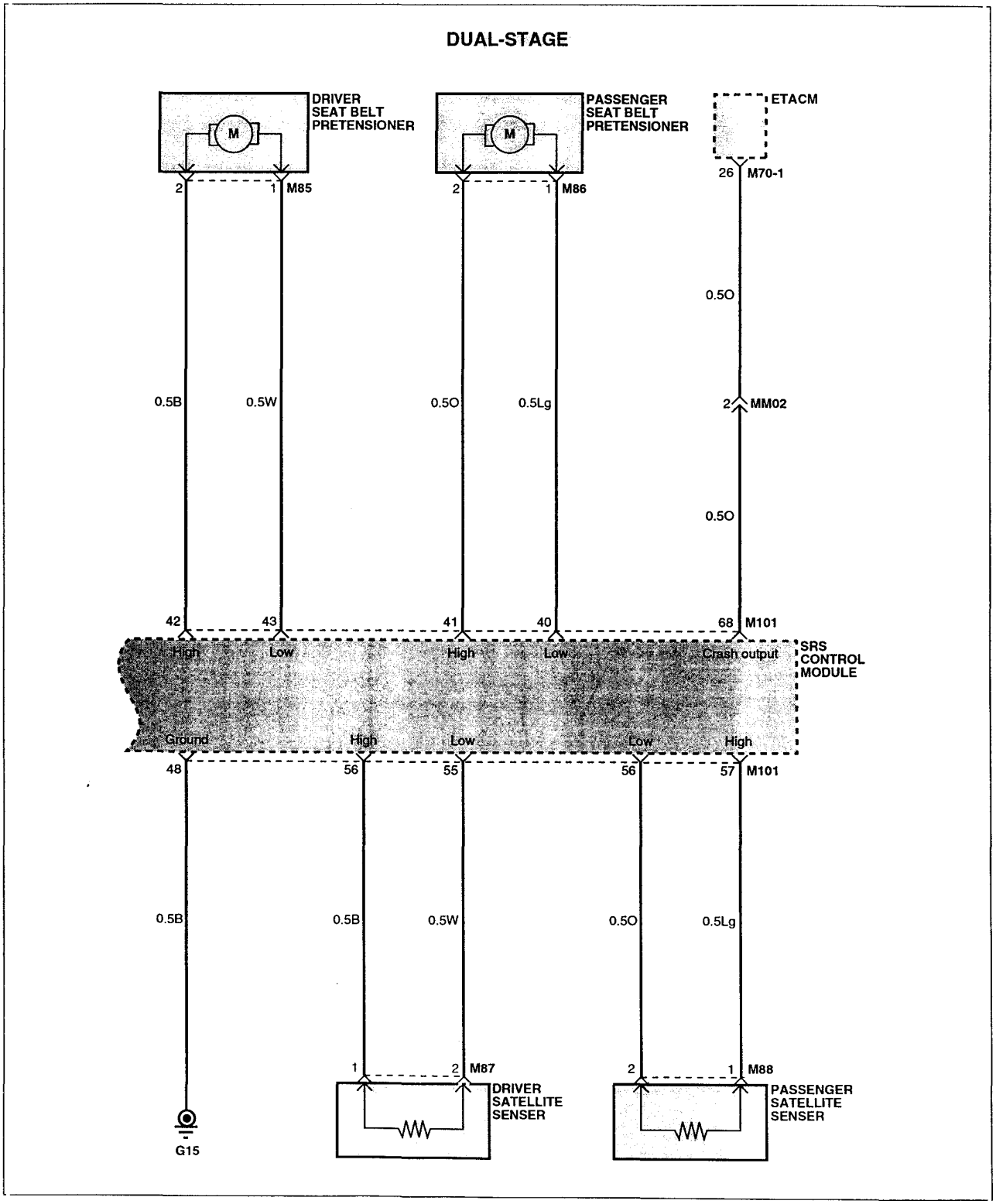
E2DD036C

AIR BAG SYSTEM (SRS) (4)



E2DD036D

AIR BAG SYSTEM (SRS) (5)



E2DD036E

COMPONENT LOCATION INDEX

Components		Location reference - page
M68	Data link connector	CL-7
M71-2	Instrument cluster	CL-8
M82	SRS control module	CL-8
M83	Passenger air bag	CL-8
M84	Driver air bag	CL-8
M85	Driver seat belt pretensioner	CL-9
M86	Passenger seat belt pretensioner	CL-9
M87	Driver satellite sensor	CL-9
M88	Passenger satellite sensor	CL-9
M89	Driver side air bag	CL-9
M90	Passenger side air bag	CL-9
M101	SRS control module (Dual-stage)	CL-9
M102	Driver air bag (Dual-stage)	CL-9
M103	Passenger air bag (Dual-stage)	CL-10
M104	Driver seat belt buckle switch (Dual-stage)	CL-10
M105	Passenger seat belt buckle switch (Dual-stage)	CL-10
M106	Driver seat track position sensor (Dual-stage)	CL-10
M107	Passenger seat track position sensor (Dual-stage)	CL-10
Connectors		
EM05		CL-16
MM02		CL-11
Grounds		
G14		CL-29
G15		CL-29

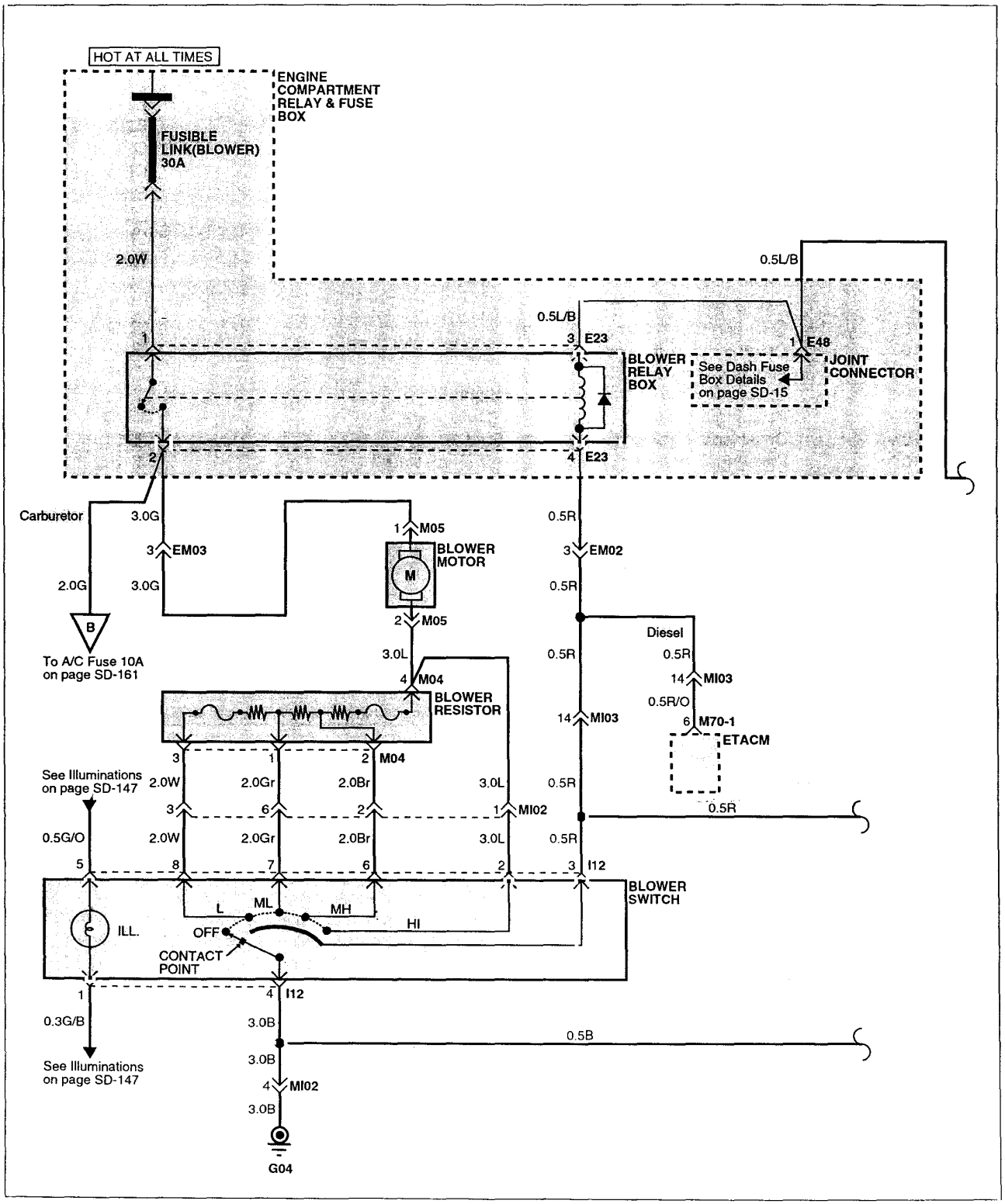
Circuit Description

Only authorized service personnel should do work on or around the supplemental restraint system (SRS) components. Service personnel should read section 56a of the service manual carefully before starting work on the supplemental restraint system (SRS).
The supplemental restraint system (SRS) is a safety device, which when used in conjunction with the seat belts, is designed to protect the driver and front seat passenger by deploying the air bags when the car receives a frontal impact exceeding a certain set limit.

With the ignition switch in ON or START, battery voltage is applied to the SRS control module from fuse 4 and to the SRS indicator in the instrument cluster from fuse 3. When the ignition switch is turned to the ON position, the SRS indicator in the instrument cluster will flash six times. If the SRS indicator does not flash six times, or stays ON, or comes on while driving, the SRS is not working properly.

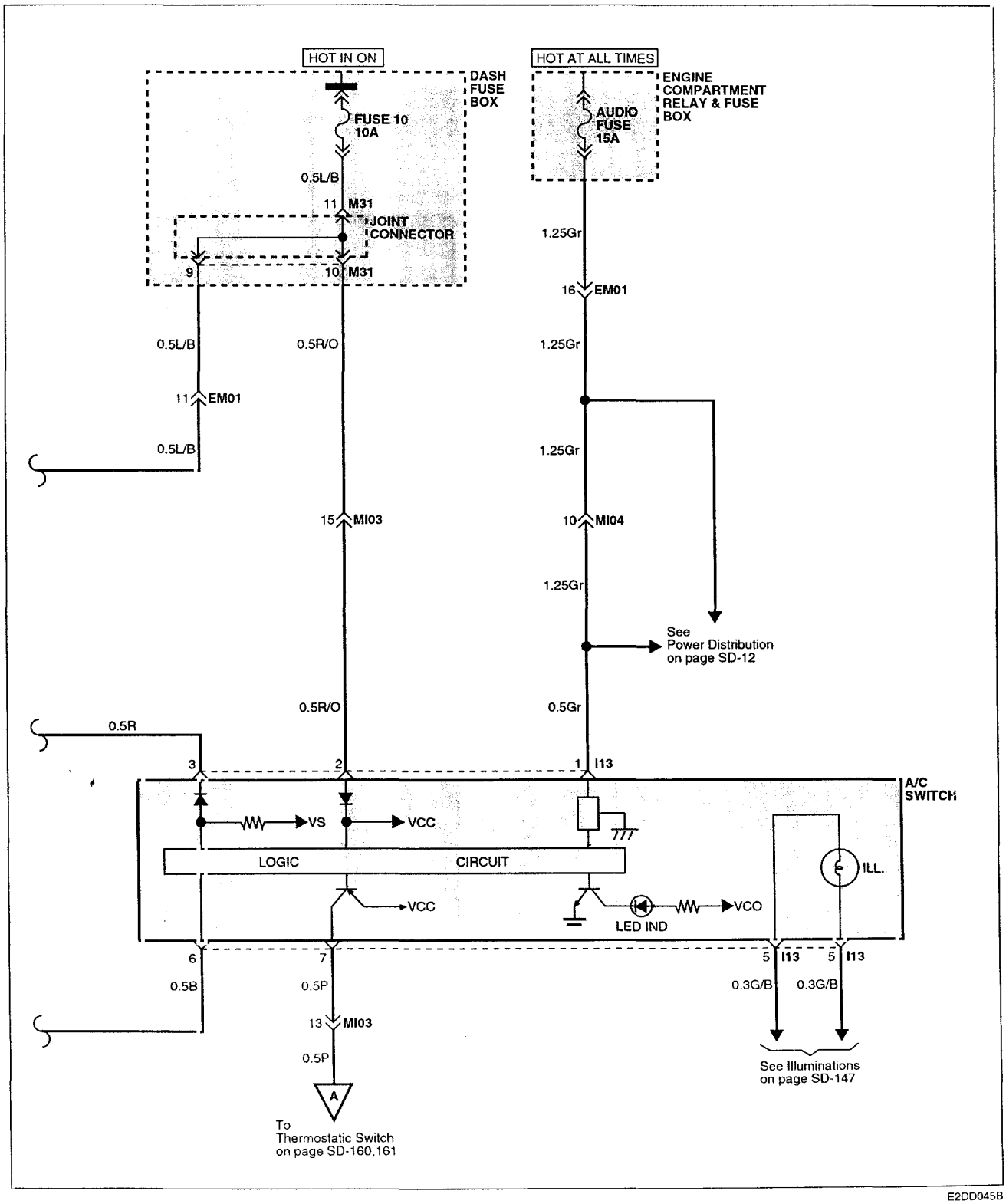
BLOWER & A/C CONTROLS E39F5D6C

BLOWER & A/C CONTROLS (1)



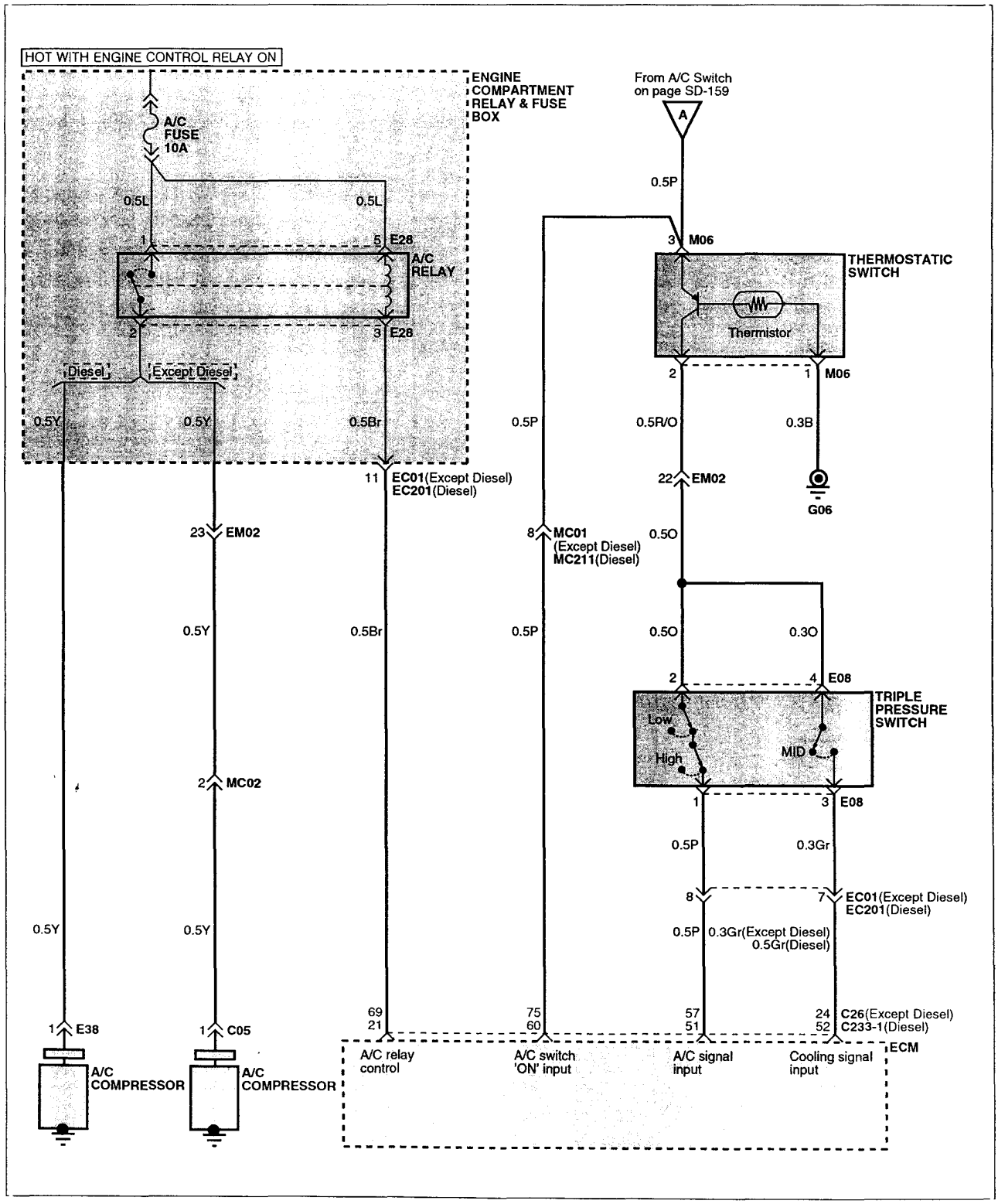
E2DD045A

BLOWER & A/C CONTROLS (2)



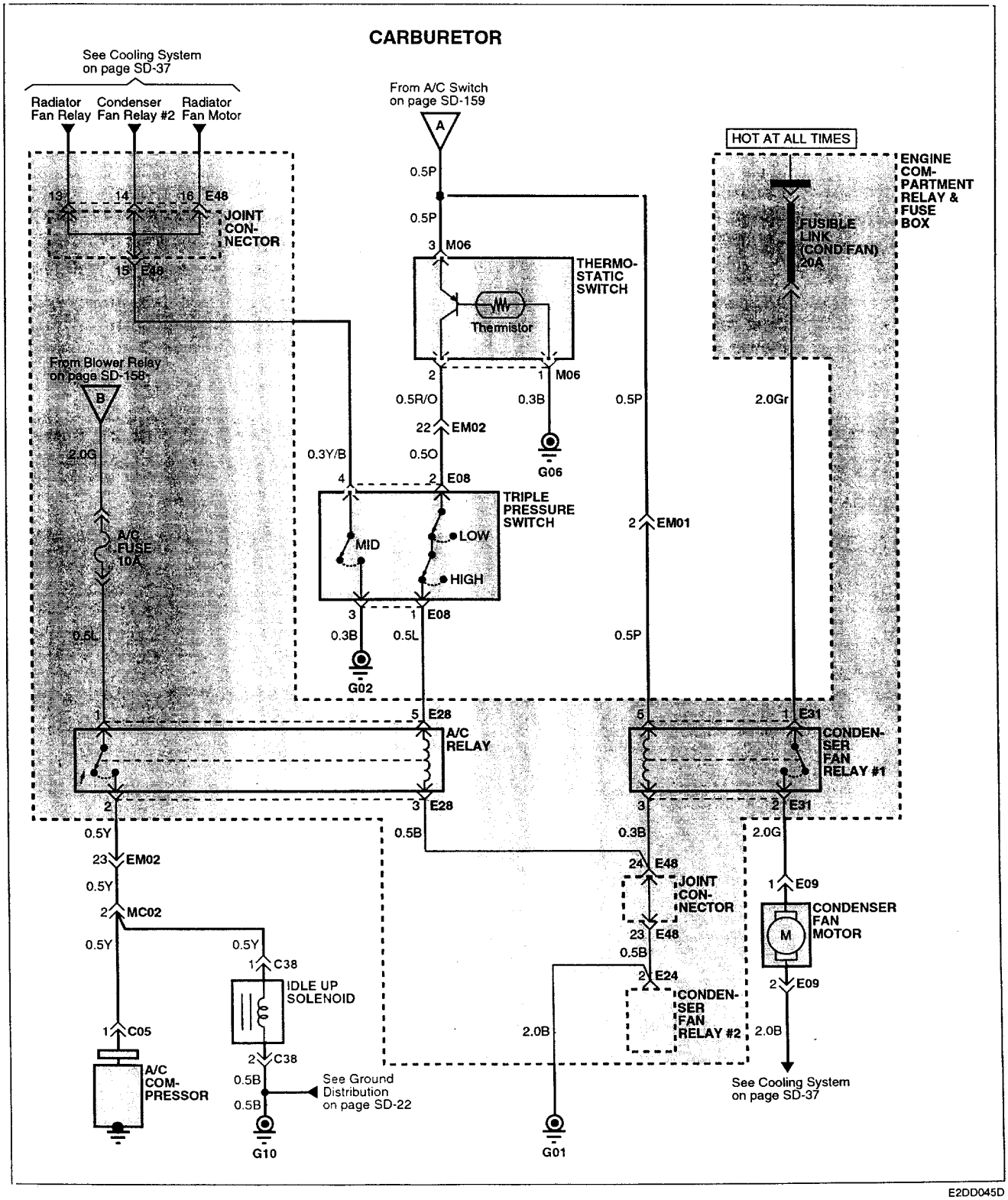
E2DD045B

BLOWER & A/C CONTROLS (3)



E2DD045C

BLOWER & A/C CONTROLS (4)



COMPONENT LOCATION INDEX

Components		Location reference - page
C05	A/C compressor	CL-18
C26	ECM (Except Diesel)	CL-20
C38	Idle up solenoid (Carburetor)	CL-22
C233-1	ECM (Diesel)	CL-24
E08	Triple pressure switch	CL-12
E09	Condenser fan motor	CL-12
E23	Blower relay	CL-14
E24	Condenser fan relay	CL-14
E28	A/C relay	CL-14
E31	Condenser fan relay	CL-14
E38	A/C compressor	CL-15
E48	Joint connector	CL-16
I12	Blower switch	CL-17
I13	A/C switch	CL-17
M04	Blower resistor	CL-2
M05	Blower motor	CL-2
M06	Thermostatic switch	CL-2
M31	Joint connector	CL-3
Connectors		
EC01		CL-16
EM01		CL-16
EM02		CL-16
EM03		CL-16
MC01		CL-10
MC211		CL-10
MI02		CL-11
MI03		CL-11
MI04		CL-11
Grounds		
G01		CL-28
G02		CL-28
G04		CL-28
G06		CL-28
G10		CL-29

Circuit Description

With the ignition switch in ON, battery voltage is applied to the coil of the blower relay. With the blower switch in any position except OFF, ground is provided to the coil of the blower relay through the blower switch. Battery voltage is then applied to the blower motor through the closed contacts of the blower relay, ground is provided to the blower motor through the blower resistor and blower switch for the desired blower motor speed.

As the blower switch is moved from OFF to position HI, resistors in the resistor block are bypassed. Decreasing the resistance will increase the voltage applied to the blower motor. This increases the blower motor speed. When the fan switch is in position HI, all of the resistors are bypassed. The maximum voltage is now applied to the blower motor so that is runs at the highest speed.

Steering System

GENERAL
- SPECIFICATIONS ..... ST -2
- LUBRICANTS ..... ST -3
- SPECIAL TOOLS ..... ST -4
- TROUBLESHOOTING ..... ST -7
- GENERAL ..... ST -9

STEERING COLUMN AND SHAFT
- STEERING COLUMN / SHAFT
  - COMPONENTS ..... ST -13
  - REMOVAL ..... ST -14
  - INSPECTION ..... ST -15
  - INSTALLATION ..... ST -16

MANUAL STEERING SYSTEM
- MANUAL STEERING GEAR BOX
  - COMPONENTS ..... ST -18
  - REMOVAL ..... ST -20
  - INSPECTION ..... ST -21
  - DISASSEMBLY ..... ST -22
  - REASSEMBLY ..... ST -23
  - INSTALLATION ..... ST -25

MECHANICAL POWER STEERING SYSTEM
- POWER STEERING GEAR BOX
  - COMPONENTS ..... ST -26
  - REMOVAL ..... ST -28
  - INSPECTION ..... ST -29
  - DISASSEMBLY ..... ST -30
  - INSPECTION ..... ST -33
  - REASSEMBLY ..... ST -33
  - INSTALLATION ..... ST -36
- POWER STEERING HOSES
  - COMPONENTS ..... ST -38
  - REMOVAL ..... ST -39
  - INSTALLATION ..... ST -40
  - INSPECTION ..... ST -42
- POWER STEERING OIL PUMP
  - COMPONENTS ..... ST -43
  - REMOVAL ..... ST -44
  - DISASSEMBLY ..... ST -44
  - INSPECTION ..... ST -46
  - REASSEMBLY ..... ST -46
  - INSTALLATION ..... ST -48

GENERAL

SPECIFICATIONS EDCEBEFE

Item	Specification
Manual steering	
Shaft and joint type	Collapsible, cross joints (two joints used)
Steering gear type	Rack and pinion
Rack stroke	134mm (lock to lock : 3.87 turns)
Power steering	
Shaft and joint type	Collapsible, cross joints, tilt column with pop-up
Steering gear type	Rack and pinion
Rack stroke	134mm (lock to lock : 2.93 turns)
Oil pump type	Vane type
Oil pump displacement	9.6cm³/rev. (0.59 in³/rev.)
Oil pump pressure switch operating pressure	1.5-2.0 MPa (15-20 kg/cm², 213-284 psi)

SERVICE STANDARD

Item	Specification
Manual steering	
Steering wheel free play	0-30 mm (0-1.1 in.)
Steering angle	
Inner wheel	37°37′ ± 1°30′
Outer whel	31°51′
Tie rod end ball joint starting torque	0.5-2.5 Nm (5-25 kg·cm, 0.4-1.8 lb·ft)
Total pinion preload	
±180° or less from neutral	0.4-1.1 Nm (4-11 kg·cm, 0.3-0.8 lb·ft)
±180° or more from neutral	0.3-1.6 Nm (3-16 kg·cm, 0.2-1.2 lb·ft)
Tie rod swing resistance	2-5 Nm (20-50 kg·cm, 1.4-3.6 lb·ft)
Power steering	
Steering wheel free play	0-30 mm (0-1.1 in.)
Steering angle	
Inner wheel	37°37′ ± 1°30′
Outer wheel	31°51′
Stationary steering effort	34.3 N (3.5 kg, 7.8 lbs) or less
Belt deflection [under 98N (10kg, 22lb) force]	7-10 mm
Oil pump relief pressure	5.9MPa (60 kg/cm², 853 psi)
Total pinion preload	0.6-1.3 Nm (6-13 kg·cm, 0.4-1.0 lb·ft.)
Tie rod swing resistance	2-5 Nm (20-50 kg·cm, 1.4-3.6 lb·ft)

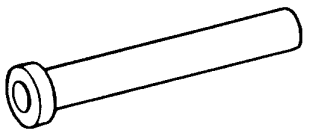
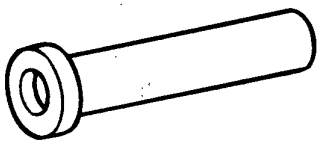
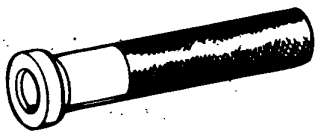
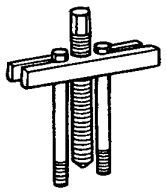
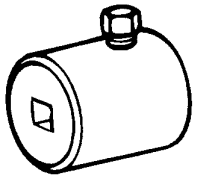
TIGHTENING TORQUE

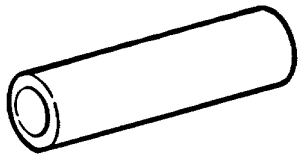
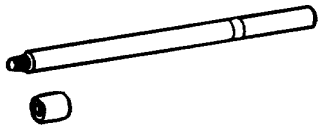
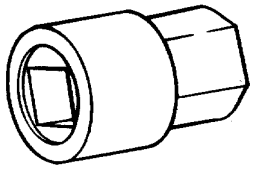
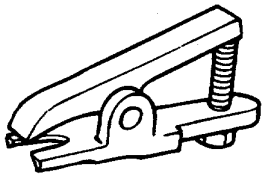
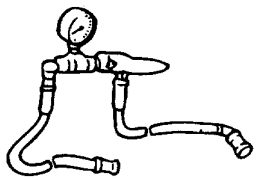
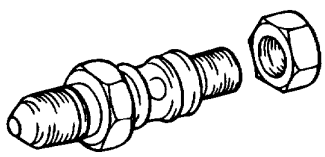
Item	Nm	kg·cm	lb·ft
Steering wheel lock nut	35-45	350-450	26-33
Steering column and shaft assembly mounting bracket	13-18	130-180	10-13
Steering shaft and joint	15-20	150-200	11-15
Pinion gear and joint	15-20	150-200	11-15
Dust cover mounting bolt	4-6	40-60	3-4.4
Gear box mounting bolt	60-80	600-800	44-59
Tie rod end lock nut	50-55	500-550	37-41
Tie rod ball joint slotted nut	16-34	160-340	12-25
Rack yoke plug nut	50-70	500-700	37-52
Tie rod to rack	80-100	800-1000	59-74
Power Steering Only			
Valve body housing to rack housing assembly	20-30	200-300	15-22
Pressure and return tube mounting clip	8-12	80-120	6-9
Pressure and return tube to gear box	12-18	120-180	9-13
Pinion and return valve assembly to self-locking nut	20-30	200-300	15-22
End plug	50-70	500-700	37-52
Oil pump mounting bracket bolt	20-27	200-270	15-20
Oil pump adjusting bolt	25-33	250-330	18-24
Pressure hose mounting bolt (to oil pump)	55-65	550-650	40.6-47.9
Oil reservoir mounting bolt	9-14	90-140	7-10
Suction hose mounting clamp (to oil pump suction connector)	3-5	30-50	2.2-3.6
Oil cooler tube mounting bolt	4-6	40-60	3-4.4

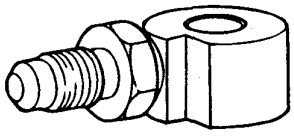
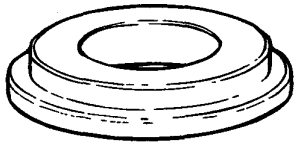
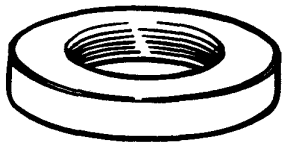
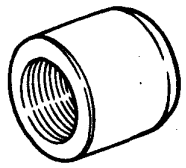
LUBRICANTS ECA8B4FF

Item	Recommended lubricant	Quantity
Horn contact ring of steering wheel	LONG TIME PD2 (OPTIMOL, GERMAN)	As required
Bearing of steering shaft	ALVANIA #2 or #3 (KEUK DONG SHELL, KOREA)	As required
Ball joint of tie rod end	VALIANT R-2 (SHOSEK I, JAPAN)	As required
Steering gear housing	ONE-LUBER RP (KYODOYUSHI, JAPAN)	As required
Inner ball joint of gear box	LONG TIME PD2 (OPTIMOL, GERMAN)	As required
Contact area of gear box bellows & tie rod	SILICON GREASE	As required
Power steering fluid	PSF-3 TYPE	0.9 liter (0.5 qts.)

SPECIAL TOOLS EF298104

Tool (Number and name)	Illustration	Use
09517-21400 Drift	 EPDA005A	Removal of pinion gear bearing
09222-21100 Valve stem oil seal installer	 EPDA005B	Installation of the pinion gear bearing
09432-21600 Bearing installer	 EPDA005C	Installation of oil pump oil seal.
09434-14200 Counter shaft bearing installer	 EPDA005D	Installation of the valve housing oil seal.
09561-11002 Steering wheel puller	 EPDA005E	Removal of the steering wheel
09565-11100 Preload socket	 EPDA005F	Measurement of the mainshaft pre-load.

Tool (Number and name)	Illustration	Use
09565-21000 Pinion bearing remover and installer	 EPDA005G	Removal & installation of pinion gear bearing and oil seal valve body housing.
09555-21000 Bar	 EPDA005H	Removal & installation of the oil seal from gear housing.
09565-21100 Yoke plug torque wrench socket	 EPDA005I	Removal, installation and adjustment of steering gear yoke plug.
09568-34000 Ball joint	 EPDA005J	Separation of the tie rod end ball joint.
09572-21000 Oil pressure gauge	 EPDA005K	Measurement of the power steering oil pressure. (use with 09572-21200, 09572-22100)
09572-21200 Oil pressure gauge adapter (Hose side)	 EPDA005L	Measurement of the power steering oil pressure. (use with 09572-21000, 09572-22100)

Tool (Number and name)	Illustration	Use
09572-22100 Oil pressure gaug adapter	 EPDA005M	Measurement of the power steering oil pressure. (use with 09572-21000, 09572-21200)
09573-21000 Oil seal installer guide	 EPDA005N	Installation of the oil seal (use with 09573-21100, 09573-21200, 09517-11000, 09555-21000)
09573-21100 Oil seal installer	 EPDA005O	Installation of the back-up washer and oil seal (use with 09573-21000, 09573-21200, 09555-21000)
09573-21200 Oil seal guide	 EPDA005P	1. Removal of gear box oil seal and,back washer. (use with 09555-21000) 2. Installation of gear box oil seal and back washer. (use with 09555-21000, 09573-21000).

TROUBLESHOOTING (MANUAL STEERING) EF47124B

Symptom	Probable cause	Remedy
Excessive play in steering wheel	Loose rack support cover	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie-rod end	Retighten or replace as necessary
Steering wheel operation is hard	Excessive turning resistance of tie-rod ball joint	Replace
	Excessively tightened rack support cover	Adjust
	Inner tie rod and/or ball joint cannot turn smoothly	Lubricate or replace ball joint
	Distorted rack	Replace
	Worn steering shaft joint and/or body grommet	Replace
	Damaged pinion bearing	Replace
Steering wheel does not return properly	Excessive turning resistance of tie-rod ball joint	Replace
	Excessively tightened rack support cover	Adjust
	Inner tie rod and/or ball joint cannot turn smoothly	Replace
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace

TROUBLESHOOTING (POWERSTEERING) EA89E9AB

Symptom	Probable cause	Remedy
Excessive play in steering wheel	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	Drive slippage	Check
	Damaged Drive belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace

Symptom	Probable cause	Remedy
Steering wheel does not return properly	Excessive turning resistance of tie-rod end	Replace
	Excessively tightened rack support cover	Adjust
	Inner tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
Noise	**Hissing Noise in Steering Gear** There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving.This noise will be most evident then turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

NOTE

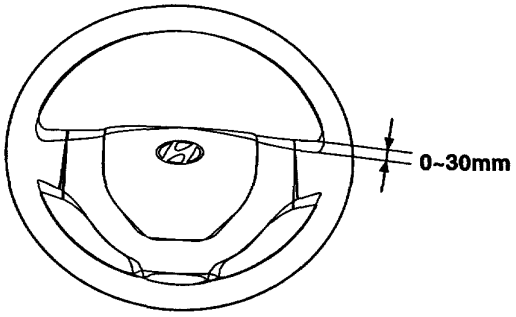
A slight "grinding noise" may be heard immediately after the engine is started in extremely cold whether conditions (below-20°C) : This is due to power steering fluid characteristics in extreme cold conditions and is not an indication of malfunction.

GENERAL E20AA984

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine with the steering wheel in the straight ahead position.
2. Measure the play at the circumference of the steering wheel.

Standard value
Steering wheel free play : 0~30 mm (0~1.1 in.)



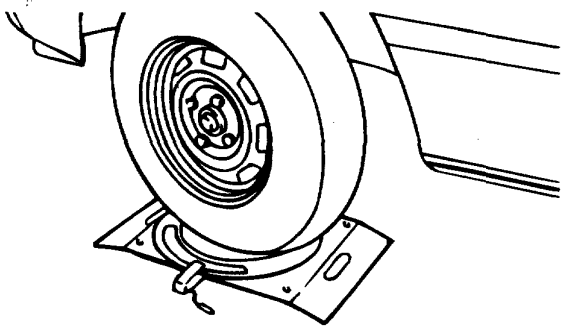
KPPD024A

3. If the play exceeds the standard value, inspect the connection between the steering shaft and steering linkage.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.

Standard value
Wheel angle (Unladen state)
Inner wheel : 37°37′ ± 1°30′
Outer wheel : 31°51′

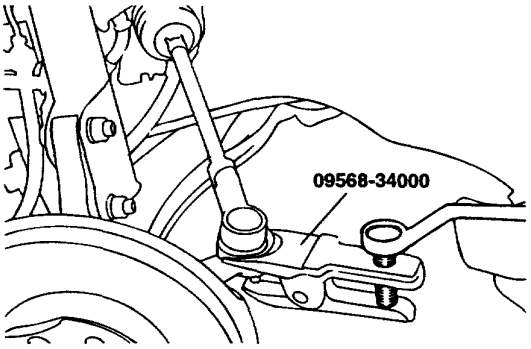


EPA9002A

2. If the measured value is not within the standard value, adjust the toe and inspect again.

CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

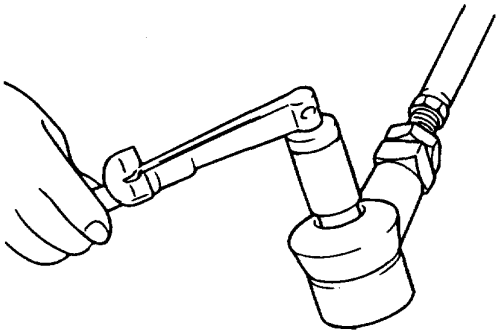
1. Disconnect the tie rod and knuckle by using the special tool.



EPDA022B

2. Move the ball joint stud in a circular motion several times to check for looseness.
3. Mount the nuts on the ball joint, and then measure the ball joint starting torque.

Standard value
0.5~2.5 Nm (5~25 kg·cm, 0.36~1.78 lb·ft)



EPA9003A

4. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
5. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

CHECKING STATIONARY STEERING EFFORT

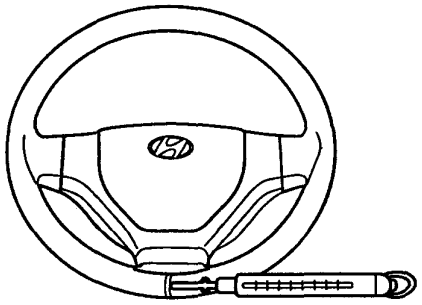
1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.
2. Increase the engine speed to 1000 ± 100 rpm.

NOTE

After checking, reset the engine speed to the standard value (idling speed).

3. Measure the turning force with a spring scale by turning the steering wheel clockwise and counterclockwise one and a half turns.

Standard value
Stationary steering effort : 34.3N (3.5 kg, 7.8 lbs)



KPPD026A

4. Check that there is no sudden change of force while turning the steering wheel.

5. If the stationary steering effort is excessive, check and adjust the following points.

   1) Damage or cracks on the dust cover and tie rod end ball joint.

   2) Pinion preload of the steering gear box and starting torque of the tie rod end ball joint.

   3) Starting torque of the ball joint.

CHECKING STEERING WHEEL RETURN

Check the steering wheel return and confirm the following points :

1. The force required to turn the steering wheel and the wheel return should be the same for both left and right in case of moderate or sharp turns.

2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 35kph, the steering wheel should return at least 70° from the neutral position when it is released.

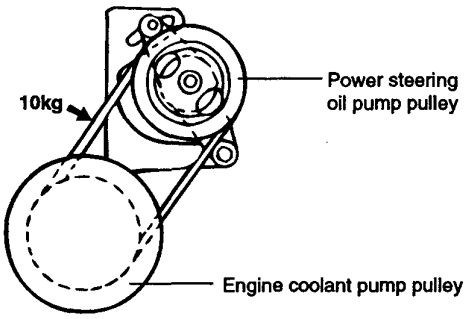
NOTE

If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.

CHECKING POWER STEERING BELT TENSION

1. Press the V belt, applying a pressure of 98N (10kg, 22lb) at the specified point and measure the deflection to confirm that it is within the standard value.

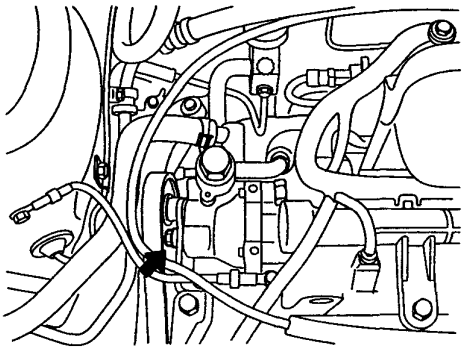
Standard value
V belt deflection : 7~10 mm



EPKB085A

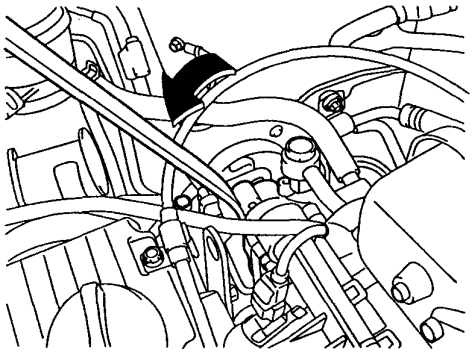
2. If the belt deflection is beyond the standard value, adjust the belt tension as follows.

   1) Loosen the bolt adjusting the power steering "V" belt tension.



KPDD011B

   2) Put a bar or equivalent between the bracket and the oil pump and adjust the tension so that the belt deflection is within the standard value.



KPDD019A

3) Tighten the bolt adjusting the power steering "V" belt tension.

4) Check the belt deflection and adjust it again if necessary.

⚠ *CAUTION*

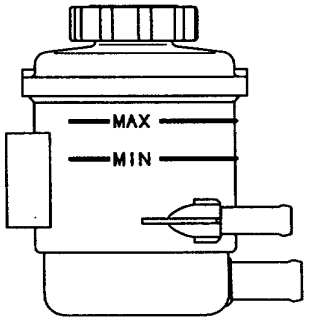
After turning the V belt in the normal rotation direction more than once, recheck the belt deflection.

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50~60°C (122 to 140°F).
3. With the engine at idle, turn the steering wheel fully clockwise and counterclockwise several times.
4. Make sure there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine to check for any difference in fluid level between a stationary and a running engine.

📖 *NOTE*

1. *If the fluid level varies 5 mm (0.2 in.) or more, bleed the system again.*
2. *If the fluid level suddenly rises after stopping the engine, further bleeding is required.*
3. *Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump*



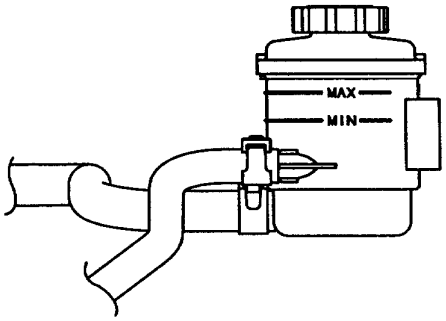
KPDD030A

REPLACING POWER STEERING FLUID

1. Jack up the front wheels and support them with rigid racks.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a vinyl hose to the disconnected return hose, and drain the oil into a container.
4. Disconnect the high-tension cable at the ignition coil side.
   While operating the starter motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hose and fix it with a clip securely.
6. Fill the power steering fluid reservoir with the specified fluid.

PSF-3 : 0.9 lit. (0.95 qts.)

7. Start the engine.
   Check for fluid leaks from the hose, then stop the engine.
8. Pour the fluid into the bottom of the oil filter in the power steering fluid reservoir.
9. Bleed the air.



KPDD031A

AIR BLEEDING

1. Disconnect the ignition coil high tension cable, and then, while operating the starter motor intermittently (for 15 to 20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

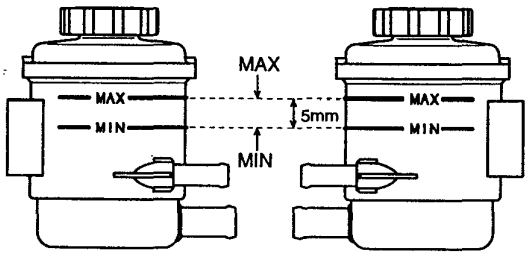
   NOTE

   1. *During air bleeding, replenish with the fluid so that the level does not fall below the lower position of the filter.*
   2. *If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.*

2. Connect the high tension cable, and then start the engine (idling).
3. Turn the steering wheel to the left and then to the right, until there are no air bubbles in the oil reservoir.
4. Confirm that the fluid is not milky and that the level is between "MAX" and "MIN" marks on the reservoir.
5. Check that there is a little change in the fluid level when the steering wheel is turned left and right.

   NOTE

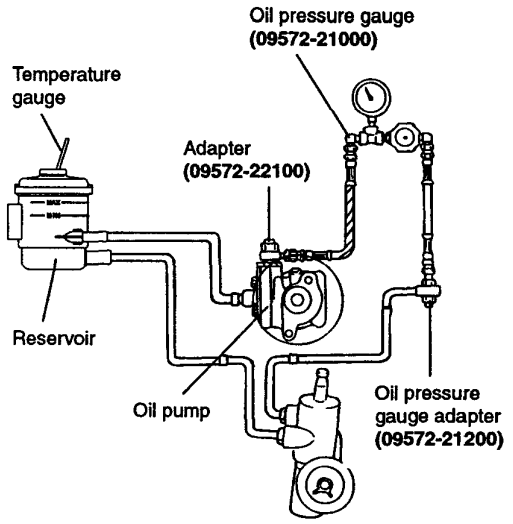
   1. *If the fluid level varies 5mm (0.2 in.) or more, bleed the system again.*
   2. *If the fluid level suddenly rises after stopping the engine, further bleeding is required.*
   3. *Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.*



KPDD032A

OIL PUMP PRESSURE TEST

1. Disconnect the pressure hose from the pump. Connect the special tool between the pump and the pressure hose as illustrated.



EPDD033A

2. Bleed the air, and then start the engine and turn the steering wheel several times so that the fluid temperature can rise to approximately 50-60°C (122-132°F) operating temperature.
3. Increase the engine speed to 1,000 ± 100 rpm.
4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the standard value range.

Standard value
Relief pressure :
5.9 MPa (60 kg·cm², 853 psi)

CAUTION

Do not keep the shut-off valve on the pressure gauge closed for more than ten seconds.

5. If the fluid pressure is not within the standard value range, overhaul the oil pump.
6. Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening torque
55~65 Nm (550~650 kg·cm, 40.6~47.9 lb·ft)

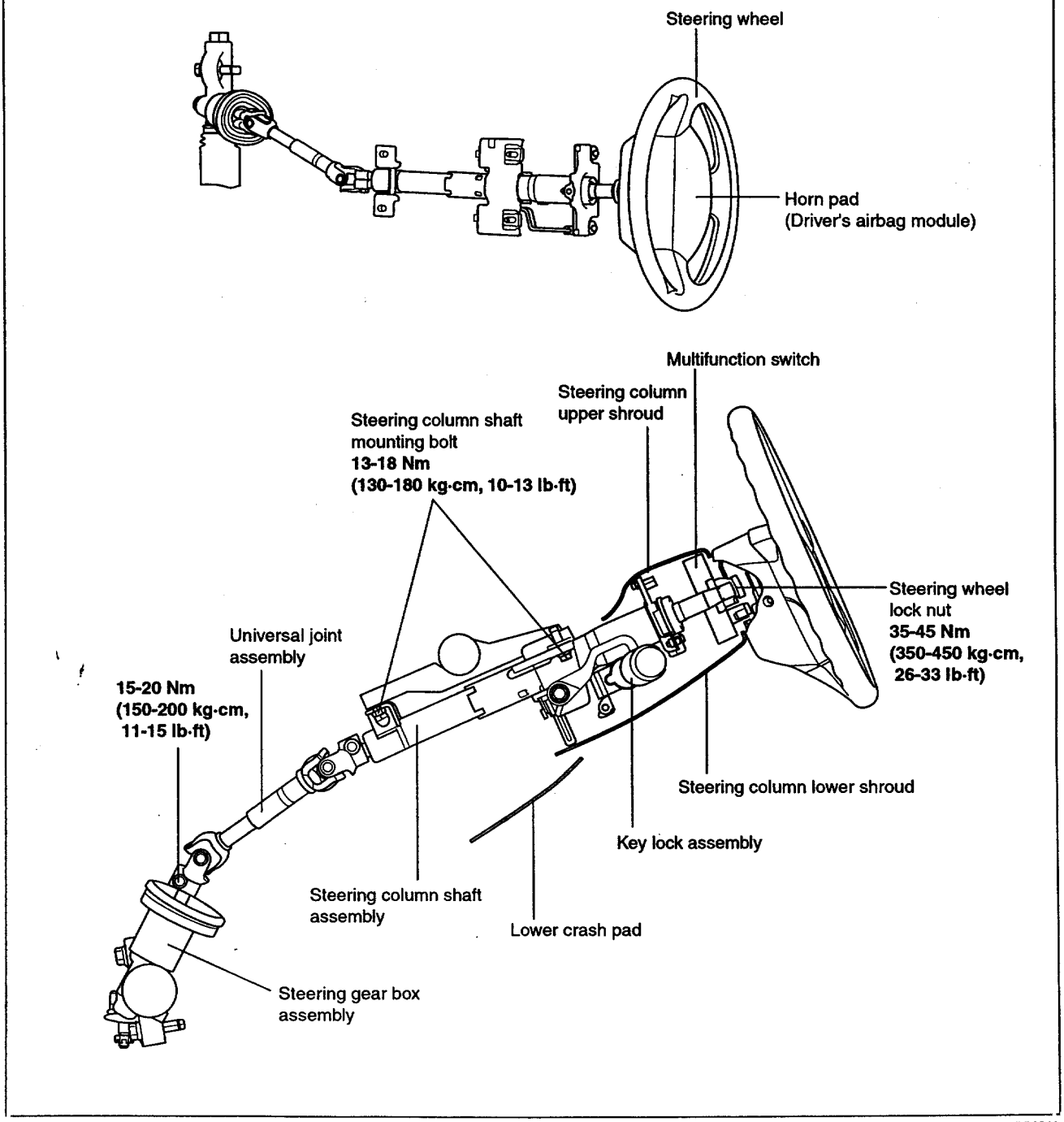
7. Bleed the system.

STEERING COLUMN AND SHAFT

STEERING COLUMN / SHAFT

COMPONENTS E86B6718

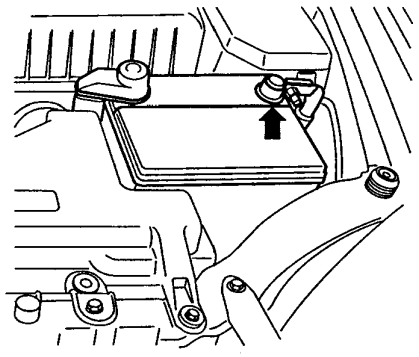
[WITH TILT STEERING]



EPDD024A

REMOVAL EB8EFC27

1. Disconnect the (-) negative terminal from the battery.

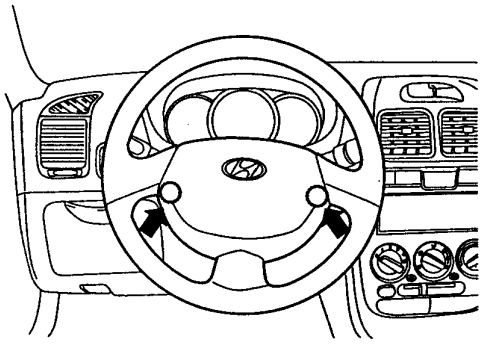


KPDD013A

2. After removing the bolts in the illustration, remove the driver's airbag module.

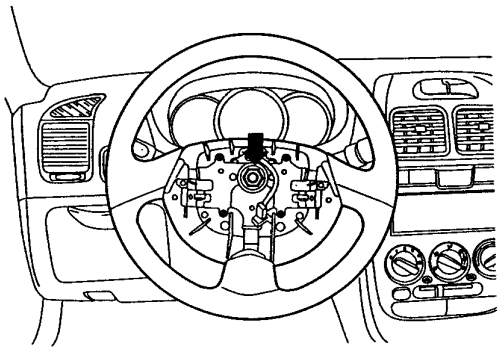
NOTE

For the vehicles not equipped with SRS airbag, remove the horn cover assembly.



KPDD001A

3. Remove the steering wheel lock nut.

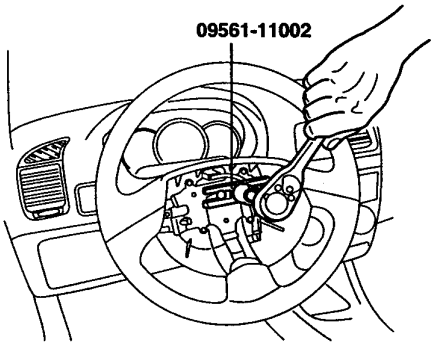


KPDD002A

4. After aligning the marks on the steering shaft and wheel, remove the steering wheel using the special tool.

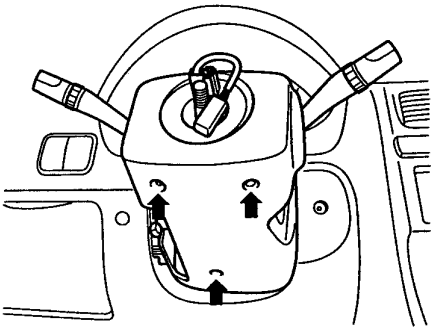
NOTE

Do not hammer on the steering wheel to remove it, doing so it may damage the steering column.



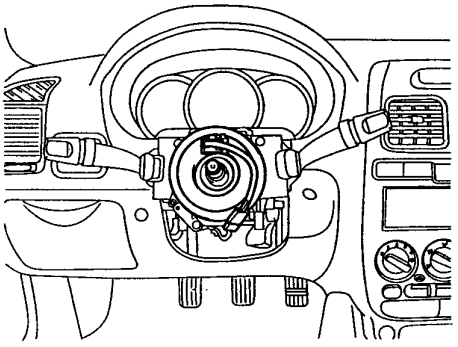
KPDD006A

5. After removing the 3 bolts in the illustration, remove the steering column shroud.



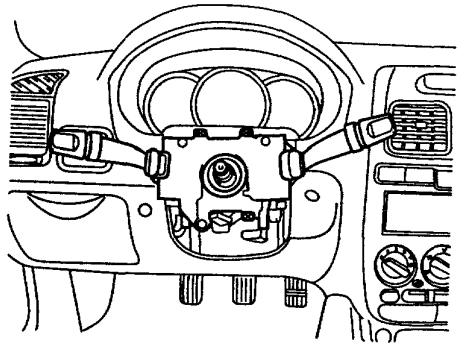
KPDD014A

6. Remove the connectors of the airbag clock spring and the multifunction switch.



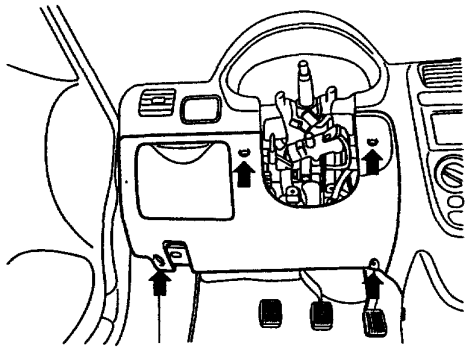
KPDD003A

7. Remove the multifunction switch assembly from the steering shaft.



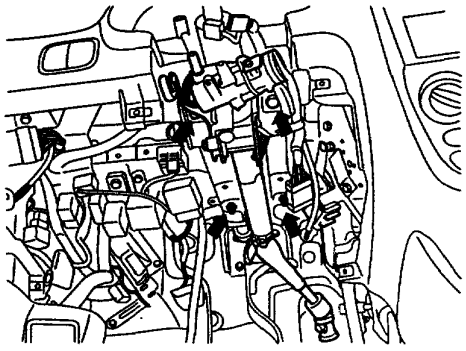
KPDD004A

8. After removing 4 connecting bolts, remove the lower crash pad.



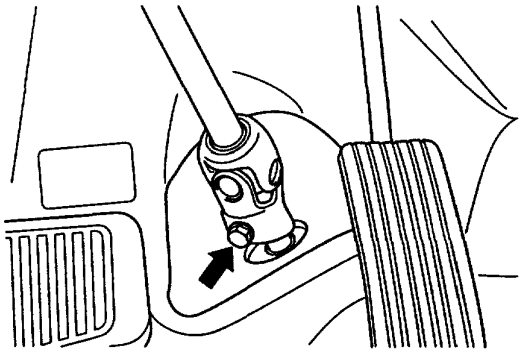
KPDD012A

9. Remove the 4 bolts fixing the steering column shaft.



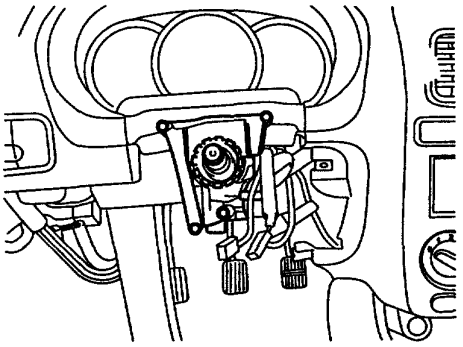
KPDD015A

10. Remove the bolt from the universal joint and gear box connecting portion.



KPPD014A

11. Remove the steering column shaft assembly.



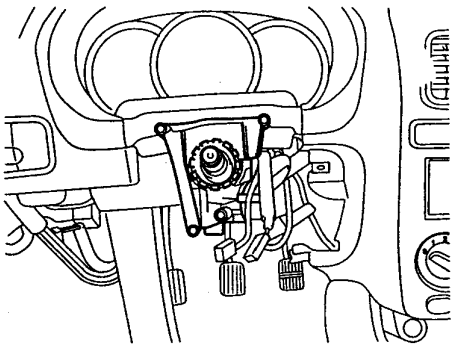
KPDD005A

INSPECTION E3F4BFCB

1. Check the steering column shaft for damage and deformation.
2. Check connections for play, damage and smooth operation.
3. Check the ball joint bearing for wear and damage.

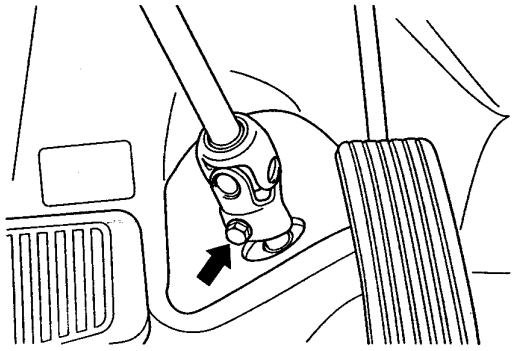
INSTALLATION EEAEDBB1

1. Place the steering columnshaft in position and install the 4 mounting bolts temporarily.



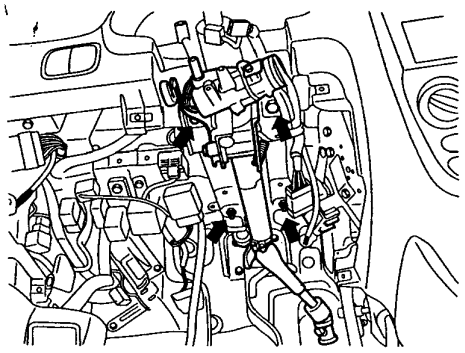
KPDD005A

2. Install the bolt on the universal joint and gear box connecting part in the driver's side brake pedal lower portion.



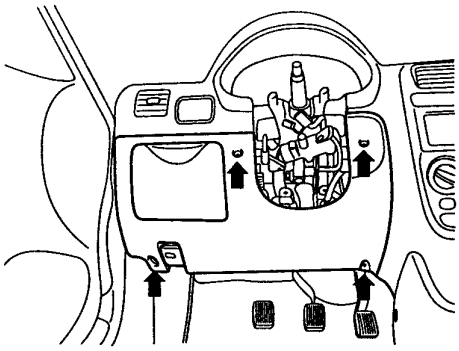
KPPD014A

3. Completely tighten the temporarily installed 4 mounting bolts on the steering column shaft.



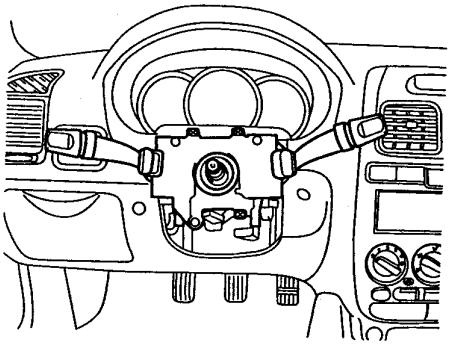
KPDD015A

4. After installing the lower crash pad, tighten the 4 bolts.



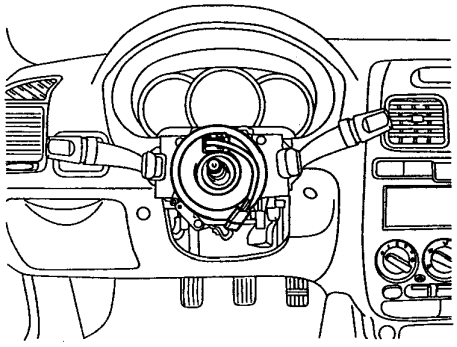
KPDD012A

5. Install the multi-function switch to the steering column shaft by pushing it until it reashes the marked portion.



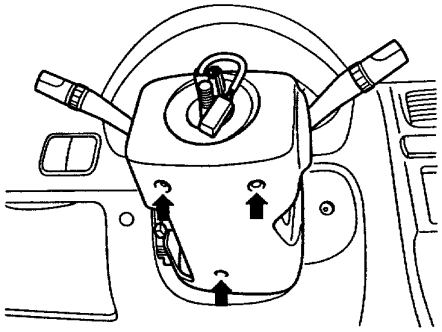
KPDD004A

6. Install the SRS clock spring and multi-function switch connector.



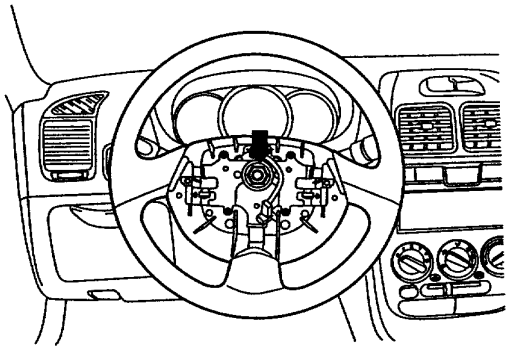
KPDD003A

7. After installing the upper/lower column shroud, tighten the 3 bolts.



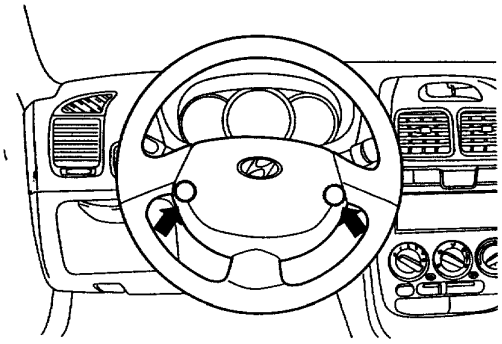
KPDD014A

8. Fix the steering wheel with a lock nut.



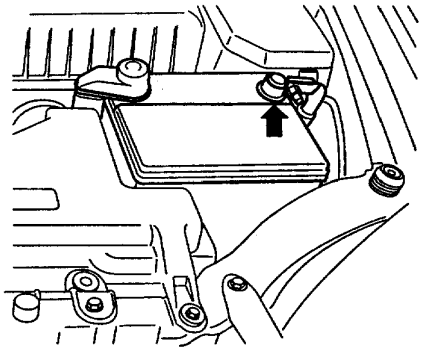
KPDD002A

9. Fix the SRS module to the steering wheel with 2 bolts.



KPDD001A

10. Connect the (-) negative battery cable.

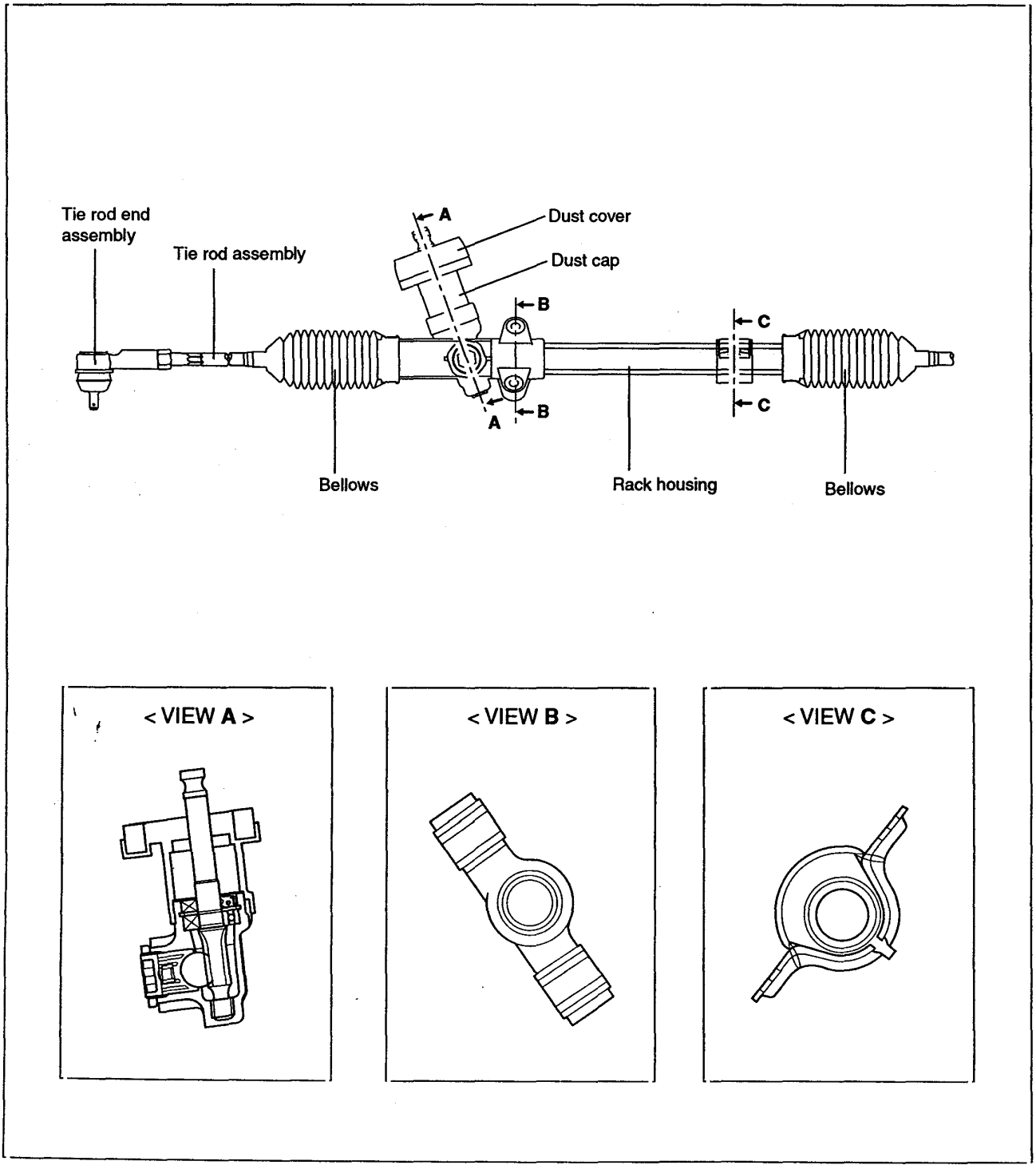


KPDD013A

MANUAL STEERING SYSTEM

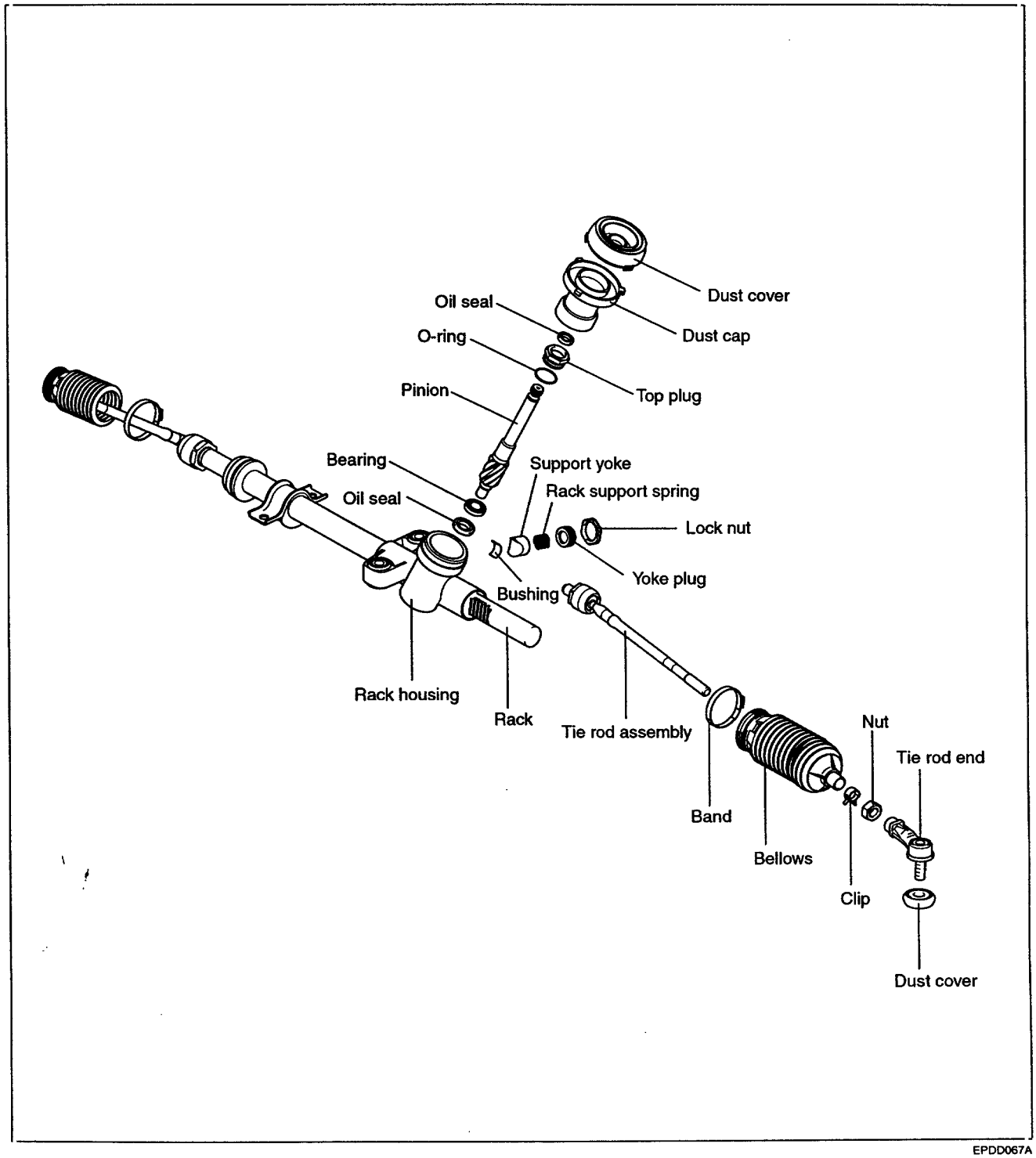
MANUAL STEERING GEAR BOX

COMPONENTS EDA5A9A6



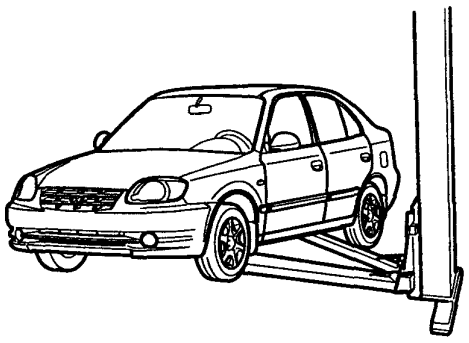
EPDD100A

COMPONENTS EA25D611



REMOVAL EB85541F

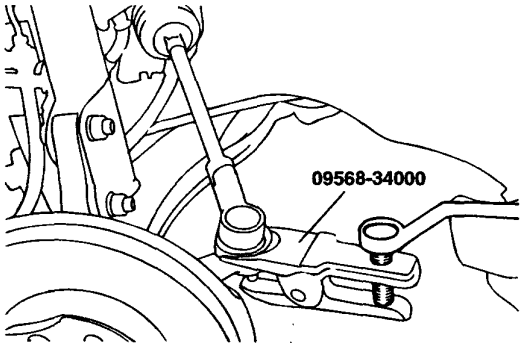
1. Support the specified point of the vehicle with a lift.



KPDD044A

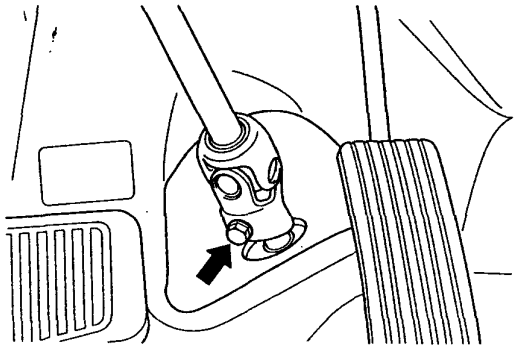
2. Remove the front tires (RH/LH).

3. After removing the split pin, disconnect the tie rod from the knuckle by using the speicial tool.



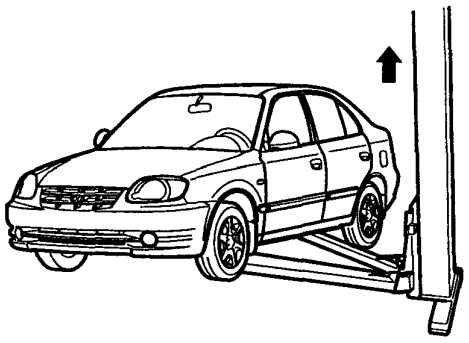
EPDA022B

4. Disconnect the shaft assembly from the gear box inside the passenger compartment.



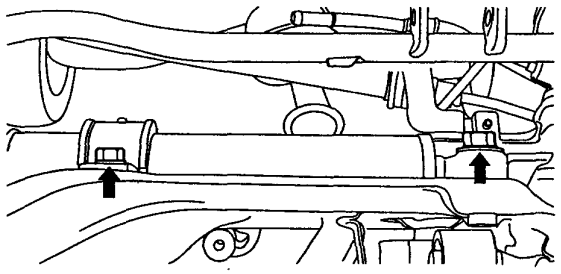
KPPD014A

5. Raise up the vehicle.



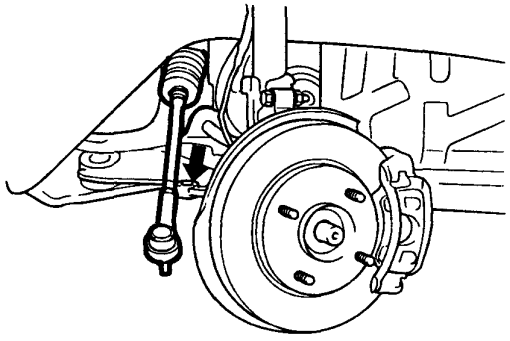
KPDD044B

6. Remove the manual steering gear box mounting bolt and clamp.



KPPD040B

7. Separate the manual steering gear box assembly by pulling it toward the right side of the vehicle.



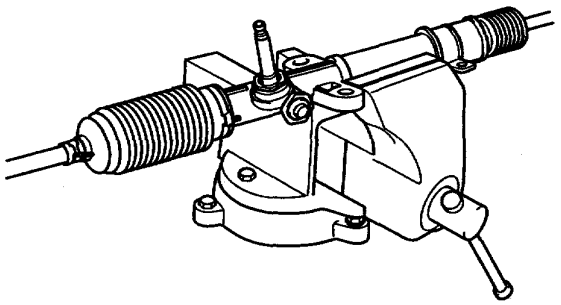
KPDD100G

INSPECTION AND ADJUSTMENT BEFORE DISASSEMBLY EA1DEAB1

Fix a brass plate or aluminum plate for protection to the jaws of a vise and mount the gear box in a vise.

⚠ ***CAUTION***

When mounting the gear box in a vise, let the installation section of it be fixed to the jaws. If other section is fixed the gear box may be damaged.



KPDD045A

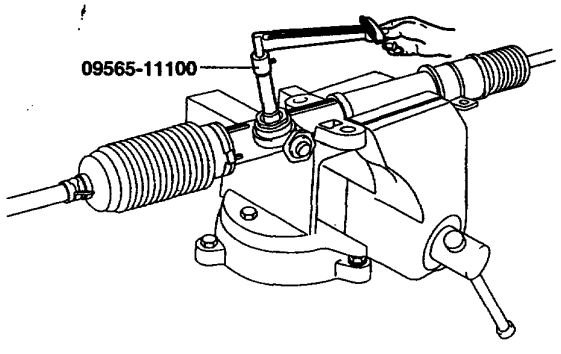
TOTAL PINION PRELOAD

1. Rotate the pinion gear for approximately 4 to 6 seconds for one rotation to measure the total pinion preload.

Standard value
0.6~1.3 Nm (6~13 kg·cm, 0.4~1.0 lb·ft)

📖 ***NOTE***

Measure the pinion preload through the entire stroke of the rack.



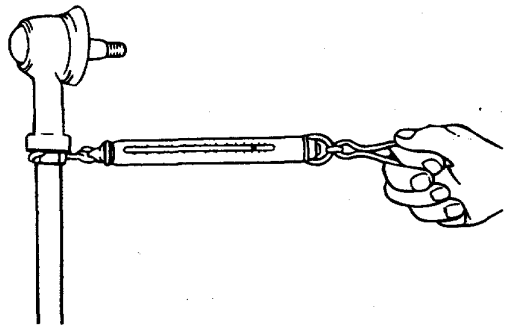
KPDD046A

2. If the measured value is out of specifications, first adjust the yoke plug, then recheck the total pinion preload.
3. If you adjust the yoke plug but do not obtain the total pinion preload, check or replace the yoke plug components.

TIE ROD SWING RESISTANCE

1. Rotate the tie rod severely ten times.
2. Measure the tie rod swing resistance with a spring scale.

Standard value
2~5 Nm (20~50 kg·cm, 1.4~3.6 lb·ft)



EPKB200A

3. If the measured value exceeds the standard value, replace the tie rod assembly.

⚠ ***CAUTION***

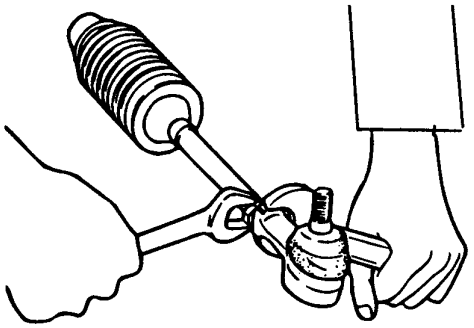
Even if the measured value is below the standard value, the tie rod that swings smoothly without excessive play may be used. If the measured value is below 0.44 kg·cm, replace the tie rod.

BELLOWS INSPECTION

1. Inspect the bellows for damage or deterioration.
2. Make sure the bellows are secured in the correct position.
3. If the bellows are defective, replace them with new ones.

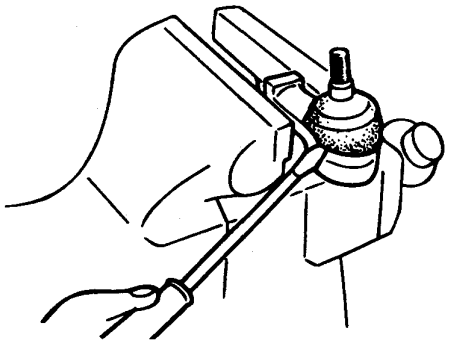
DISASSEMBLY E9ACB6CF

1. Remove the tie rod end from the tie rod.



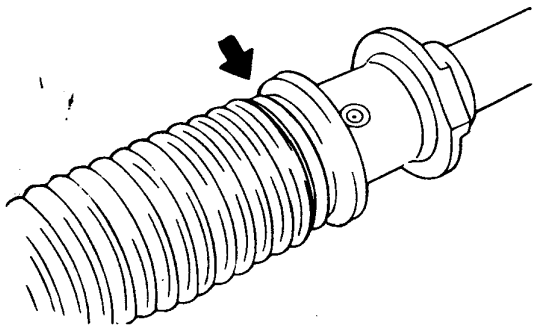
EPA9013F

2. After mounting the tie rod end in a vise, remove the dust cover from the ball joint.



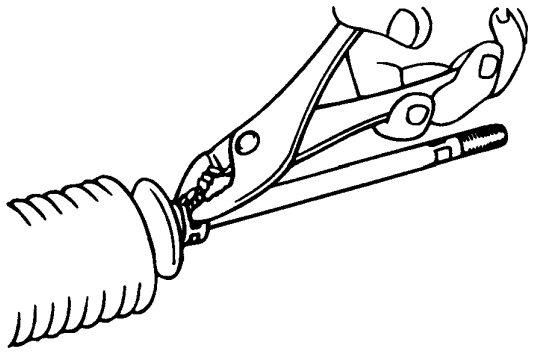
EPA9013G

3. Remove the bellows band.



EPDA029A

4. Remove the bellows clip.



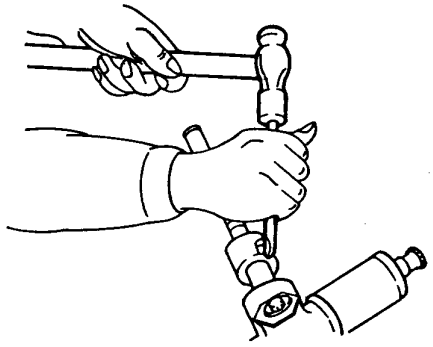
EPA9013I

5. Pull the bellows out toward the tie rod.

NOTE

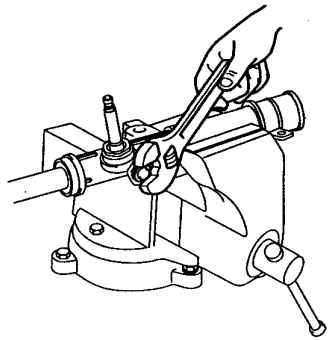
Check for rust on the rack when the bellows are replaced.

6. Unstake the tab washer which fixes the tie rod and rack with a chisel.



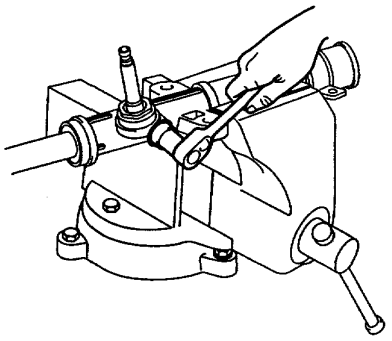
KPKA037A

7. Remove the yoke plug lock nut.



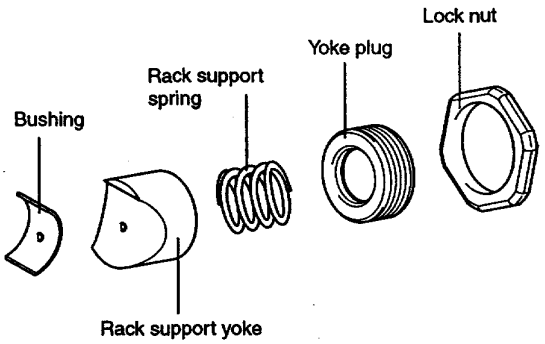
KPDD050A

8. Remove the yoke plug with a 14mm socket.



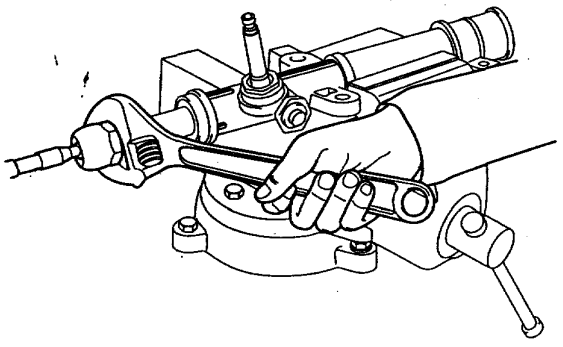
KPDD047A

9. Remove the lock nut, yoke plug rack support spring, rack support yoke and bushing.



EPPD049A

10. Move the rack completely toward the housing and mount the rack tooth portion in a brass plate of a vise. At the state of step 11, loosen the tie rod ball joint, then remove the tie rod assembly from the rack.

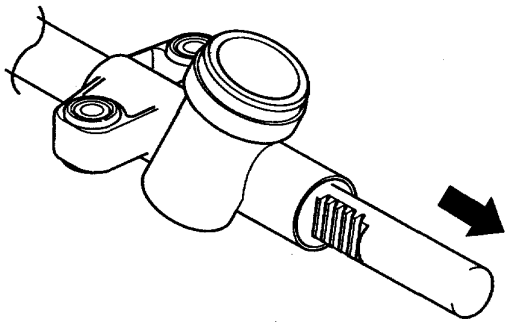


KPDD048A

11. Remove the rack from the gear housing.

⚠ ***CAUTION***

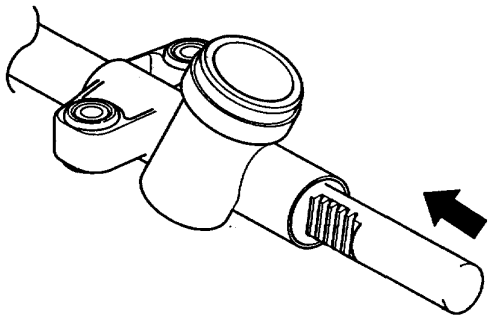
Remove the rack toward the left side of the vehicle so as not to damage the bushing by the rack teeth.



KPDD049A

REASSEMBLY E5A19CC9

1. Apply the specified grease to the rack, insert the rack into the gear housing, and then insert the pinion into the gear housing.
   - Make sure that the rack is inserted into the gear housing from the left side.
   - When inserting the pinion into the gear housing, the pinion gear should be in mesh with the rack gear.
   - Wipe off excessive grease.



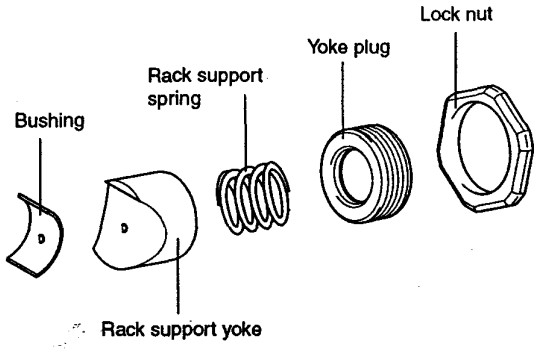
KPDD051A

2. Prior to oil seal installation in the gear box, apply grease to the surface of the oil seal.

📖 ***NOTE***

Be sure to use a new oil seal.

3. Install the rack support yoke, rack support spring, yoke plug, and lock nut to the pinion gear box.

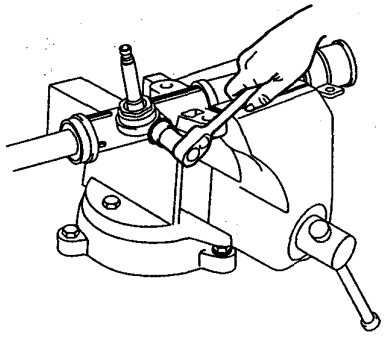


EPPD049A

4. Tighten the yoke plug to 11Nm (112 kg·cm, 8 lb·ft) and then back off 30°~60°. Secure the yoke plug with the lock nut.

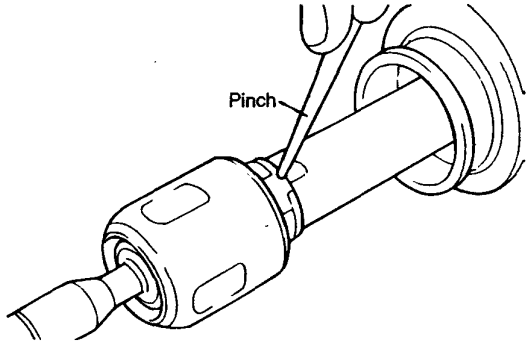
⚠ ***CAUTION***

1. ***Adjust the yoke plug with the rack in the neutral position.***
2. ***Apply a sealer between the lock nut and the housing.***



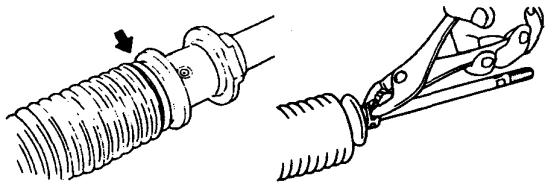
KPDD047A

5. After installing the tie rod to the rack, punch on a point over the tie rod with a chisel.



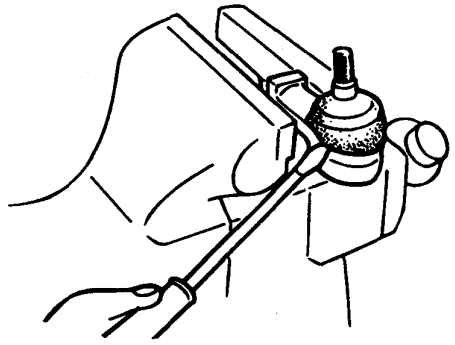
EPDA031A

6. Install the bellows in position and fix it with the band and clip.



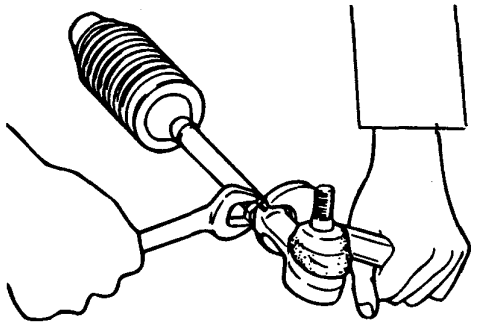
KPPD200A

7. Mount tie rod end in a vise and install the dust cover to the tie rod end.



EPA9013G

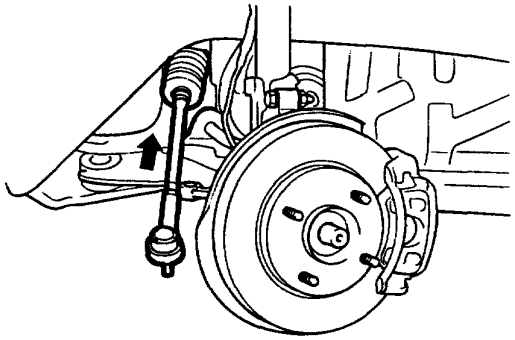
8. Install the tie rod to the tie rod end.



EPA9013F

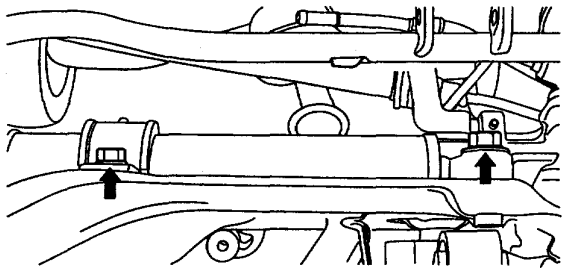
INSTALLATION EA6FC125

1. Install the manual steering gear box assembly by inserting it from the right side.



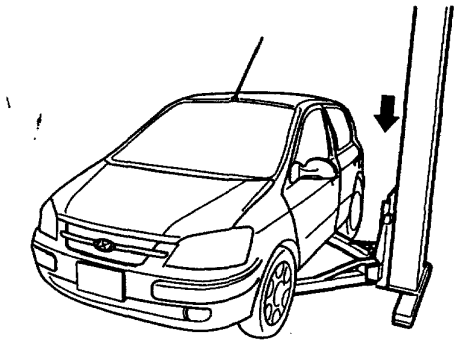
KPDD100H

2. Fix the manual steering gear box to the crossmember.



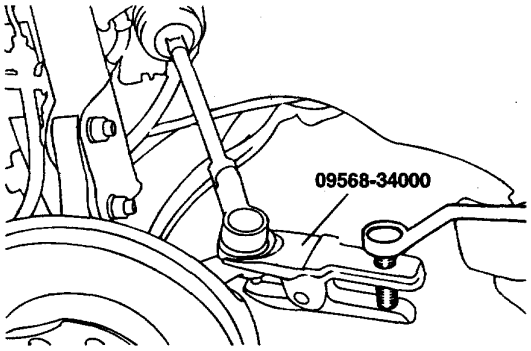
KPPD040B

3. Lower the vehicle.



KPPD035C

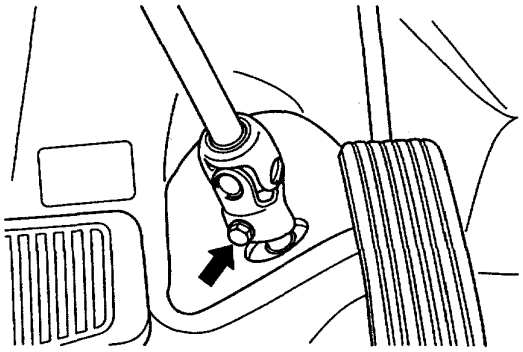
4. Connect the tie rod to the LH/RH knuckles.



EPDA022B

5. Install the tires (LH/RH).

6. Connect the steering shaft assembly to the gear box in the passenger compartment.

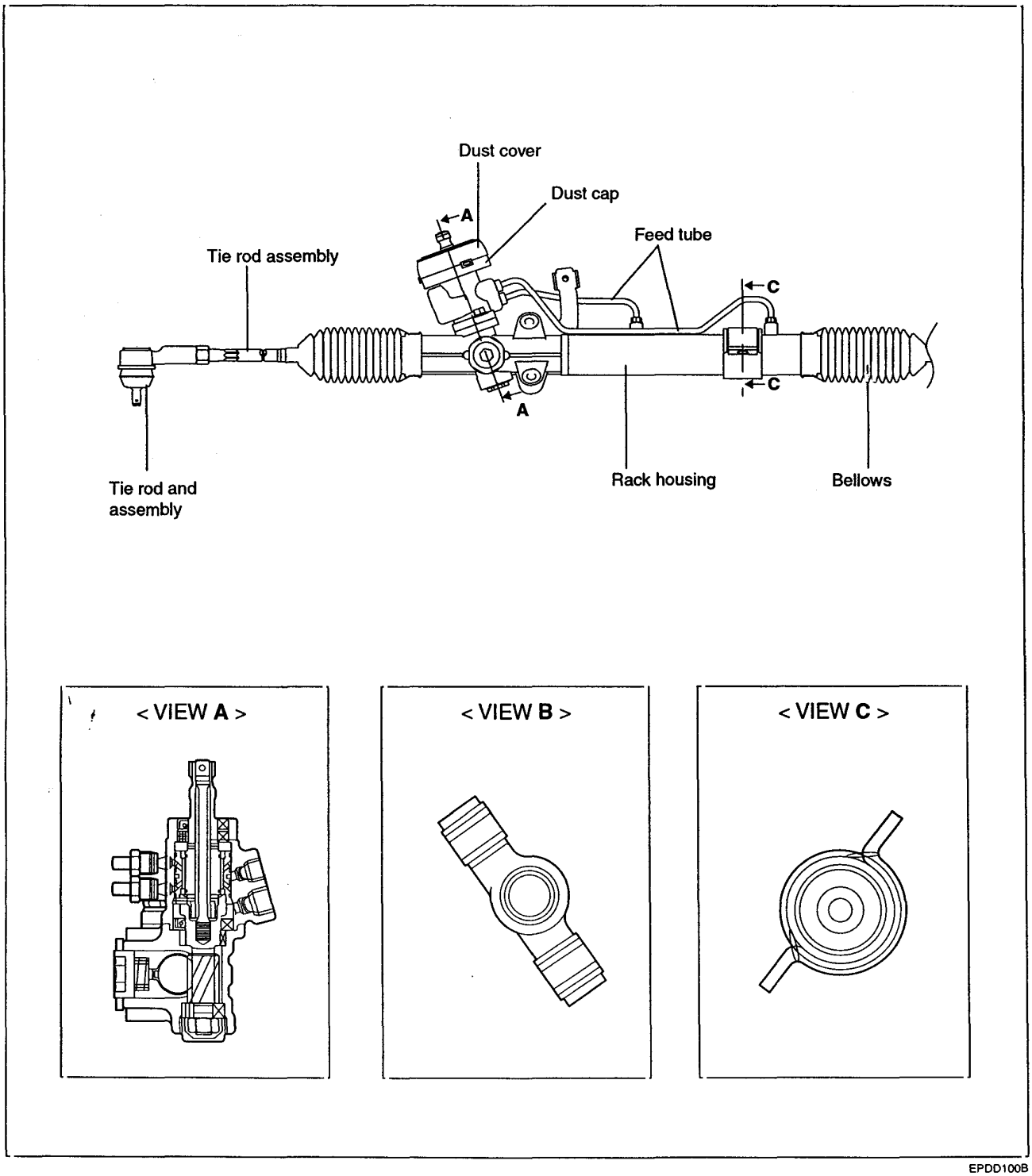


KPPD014A

MECHANICAL POWER STEERING SYSTEM

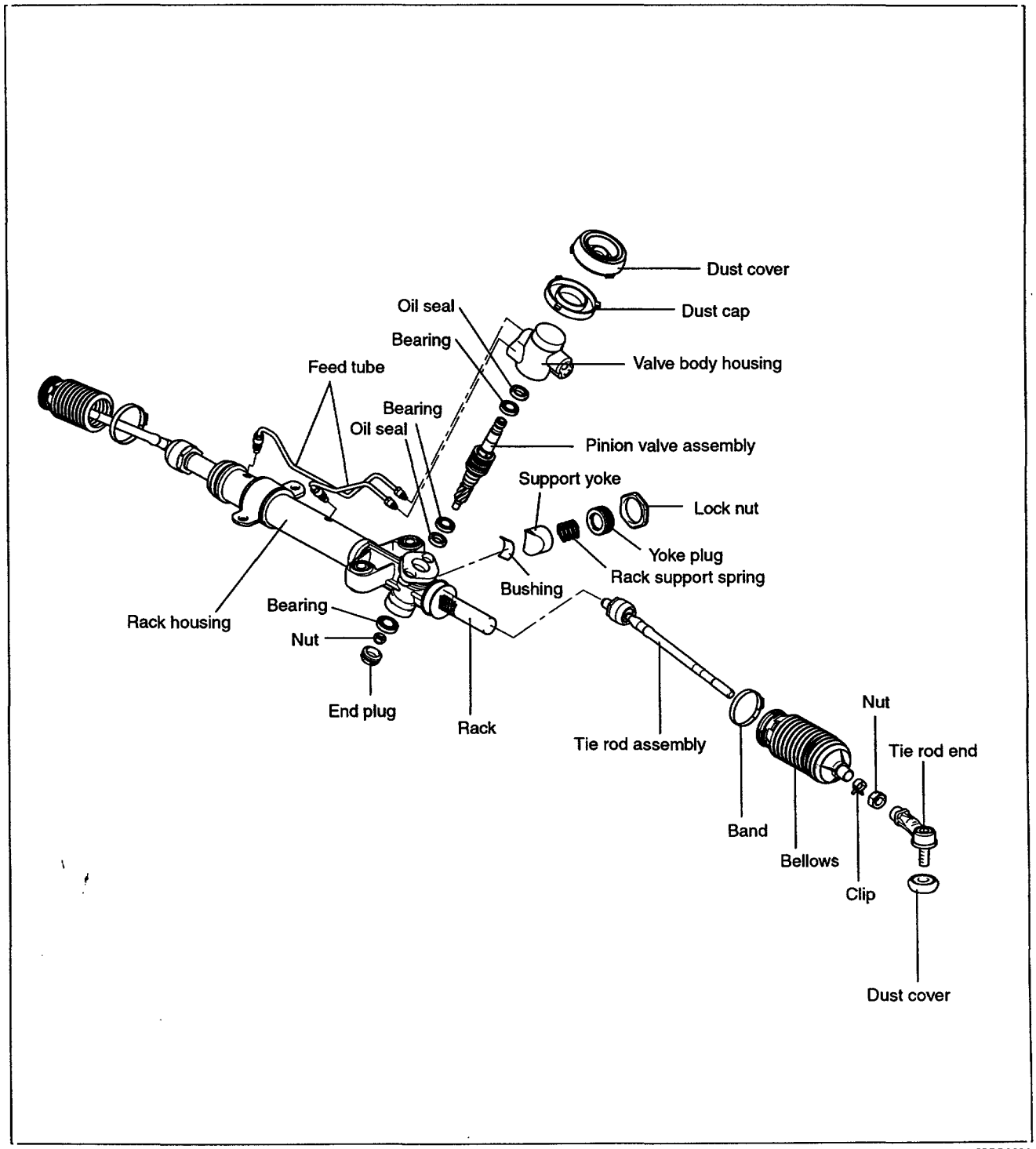
POWER STEERING GEAR BOX

COMPONENTS E641CECD



EPDD100B

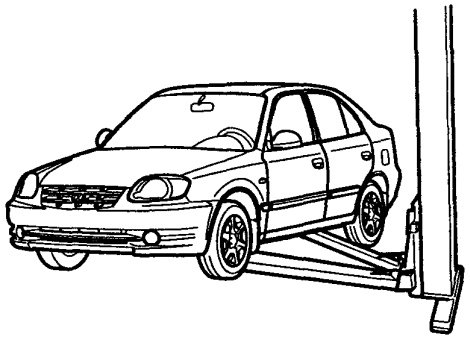
COMPONENTS E4ABC4C7



EPDD066A

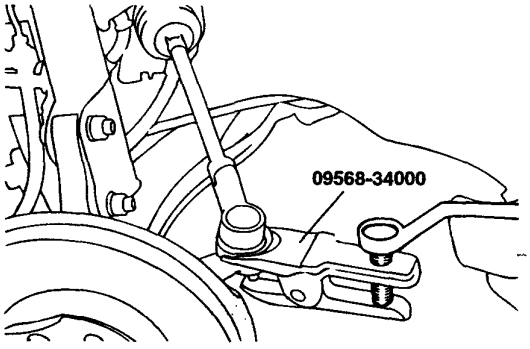
REMOVAL E912F15B

1. Support the specified portion of the vehicle with a lift.



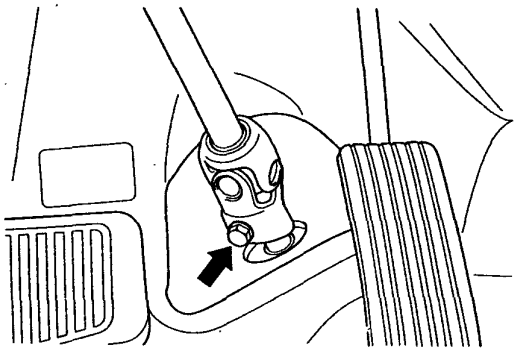
KPDD044A

2. Drain the power steering fluid.
3. Remove the front tires (RH/LH).
4. After removing the split pin, disconnect the tie rod from the knuckle by using the special tool.



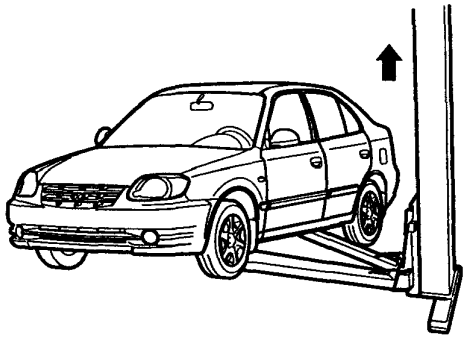
EPDA022B

5. Disconnect the steering shaft assembly from the gear box inside the passenger compartment.



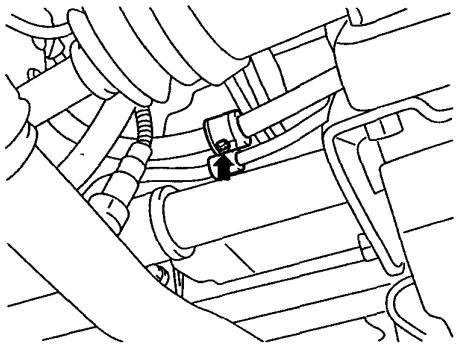
KPPD014A

6. Raise up the vehicle.



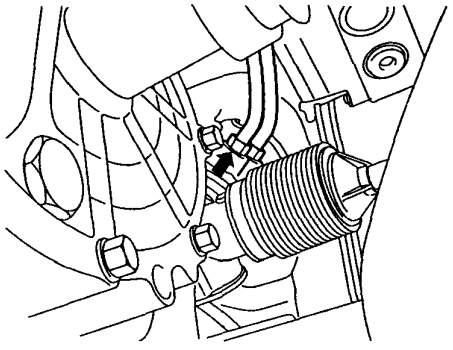
KPDD044B

7. Loosen the power steering pressure tube mounting clamp and return tube mounting clamp mounting bolt.



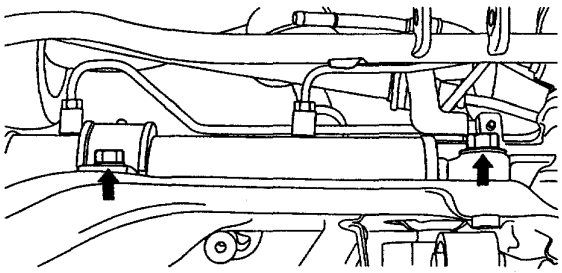
KPDD009A

8. Disconnect the pressure tube and return tube fitting from the power steering gear box.



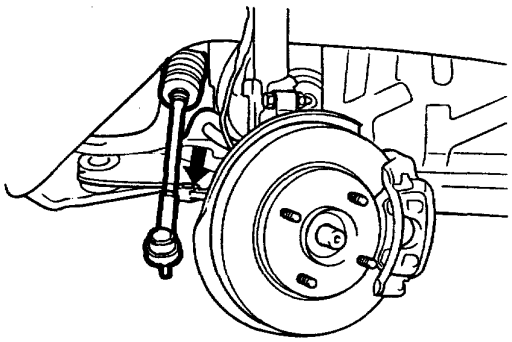
KPDD016A

9. Remove the power steering gear box mounting bolt and clamp.



KPPD040A

10. Separate the power steering gear box assembly by pulling it toward the rights side of the vehicle.



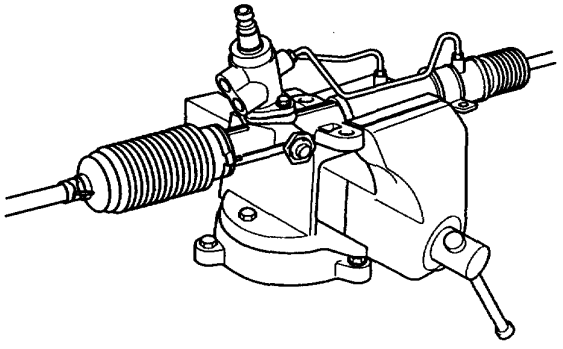
KPDD100G

INSPECTION AND ADJUSTMENT BEFORE DISASSEMBLY KFCA7BDB

Fix a brass plate or aluminum plate for protection to the jaws of a vise and mount the gear box in a vise.

⚠ CAUTION

When mounting the gear box in a vise, let the installation section of it be fixed to the jaws. If other section is fixed, the gear box may be damaged.



KPDD052A

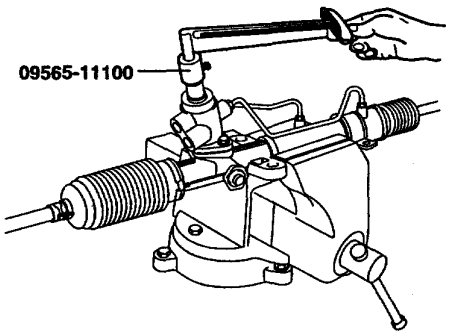
TOTAL PINION PRELOAD

1. Rotate the pinion gear for approximately 4 to 6 seconds for one rotation to measure the total pinion preload.

Standard value
0.6~1.3 Nm (6~13 kg·cm, 0.4~1.0 lb·ft)

NOTE

Measure the pinion preload through the entire stroke of the rack.



KPDD053A

2. If the measured value is out of specifications, first adjust the yoke plug, then recheck the total pinion preload.

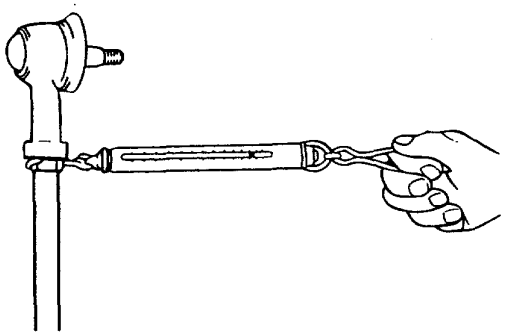
3. If not obtain the total pinion preload after adjusting the yoke plug check or replace the yoke plug components.

TIE ROD SWING RESISTANCE

1. Rotate the tie rod severely ten times.

2. Measure the tie rod swing resistance with a spring scale.

Standard value
2~5 Nm (20~50 kg·cm, 1.4~3.6 lb·ft)



EPKB200A

3. If the measured value exceeds the standard value, replace the tie rod assembly.

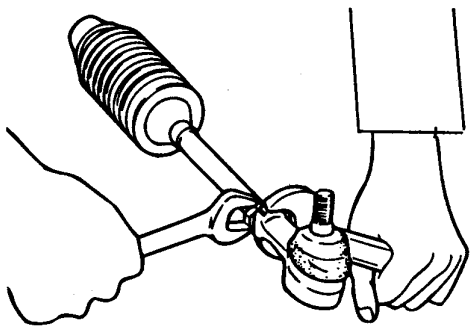
> ⚠ ***CAUTION***
>
> ***Even if the measured value is below the standard value, the tie rod that swings smoothly without excessive play may be used. If the measured value is below 0.44 kg-cm, replace the tie rod.***

BELLOWS INSPECTION

1. Inspect the bellows for damage or deterioration.
2. Make sure the bellows are secured in the correct position.
3. If the bellows are defective, replace them with new ones.

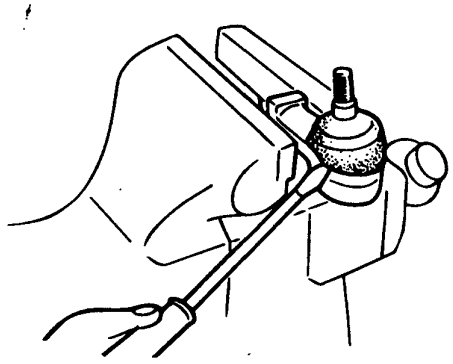
DISASSEMBLY ECEDDC89

1. Remove the tie rod end from the tie rod.



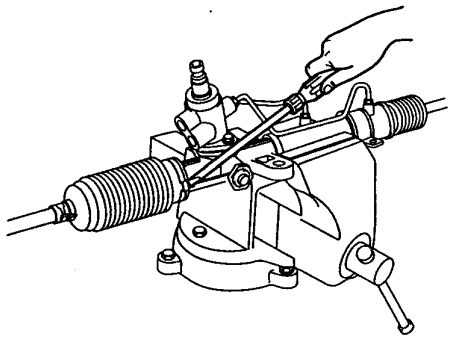
EPA9013F

2. After mounting the tie rod end in a vise, remove the dust cover from the ball joint.



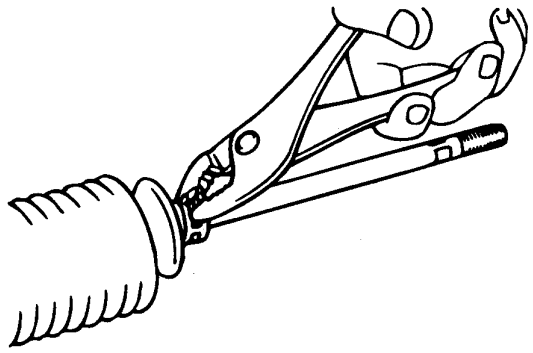
EPA9013G

3. Remove the bellows band.



KPDD054A

4. Remove the bellows clip.

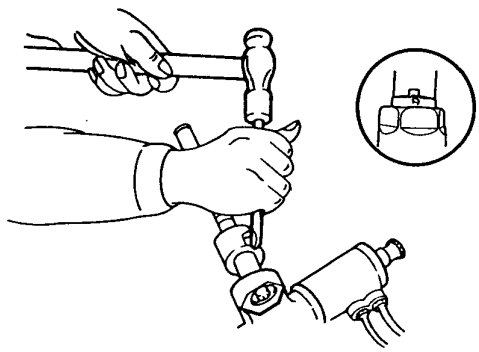


EPA9013I

5. Pull the bellows out toward the tie rod.

> 📖 ***NOTE***
>
> *Check for rust on the rack when the bellows are replaced.*

6. While moving the rack slowly, drain the fluid from the rack housing.
7. Unstake the tab washer which fixes the tie rod and rack with a chisel.

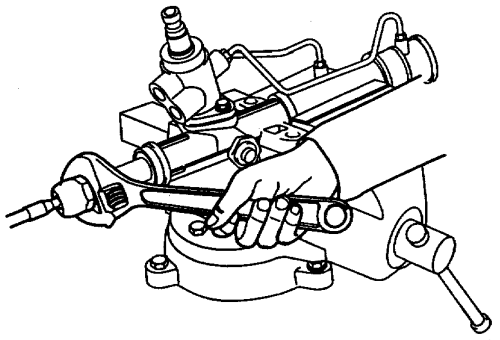


KPPD051A

8. Remove the tie rod from the rack.

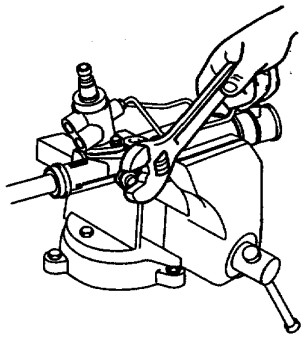
⚠ ***CAUTION***

Remove the tie rod from the rack, taking care not to twist the rack.



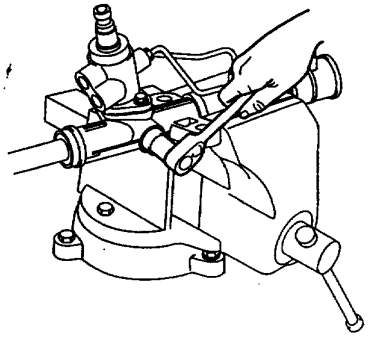
KPDD055A

9. Remove the yoke plug lock nut.



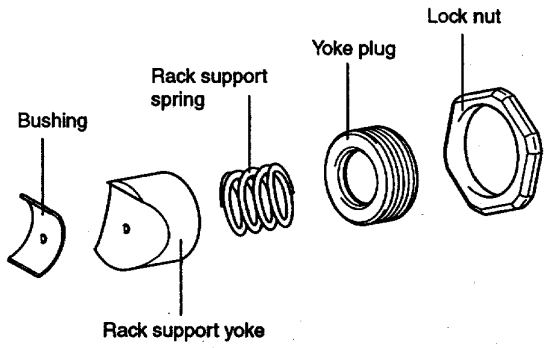
KPDD056A

10. Remove the yoke plug with a 14mm socket.



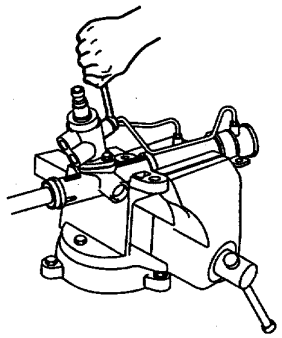
KPDD057A

11. Remove the lock nut, yoke plug, rack support spring, rack support yoke and bushing from the gear box.



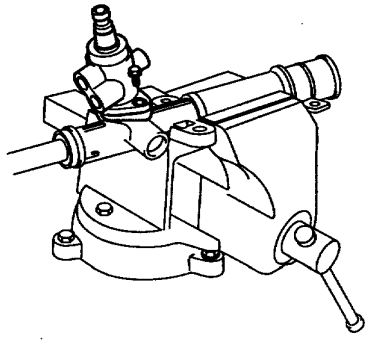
EPPD049A

12. Remove the feed tube from the rack housing.



KPDD058A

13. Remove the valve body housing by loosening the two bolts.

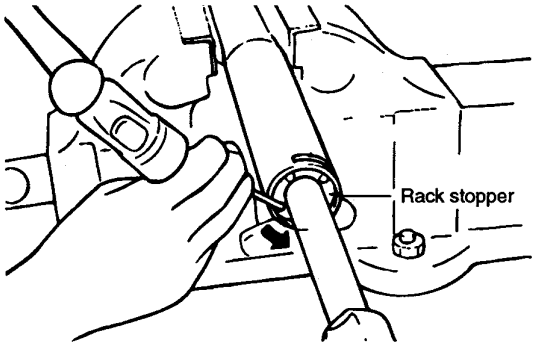


KPDD059A

14. When the end of the circlip comes out of the notched hole of the housing rack cylinder, turn the rack stopper counterclockwise and remove the circlip.

⚠ ***CAUTION***

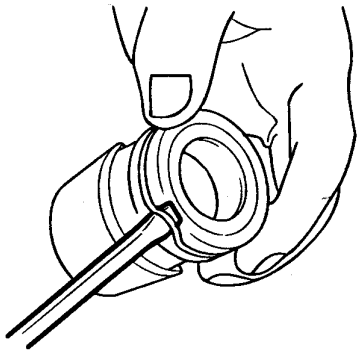
Be careful not to damage the rack.



EPKB210C

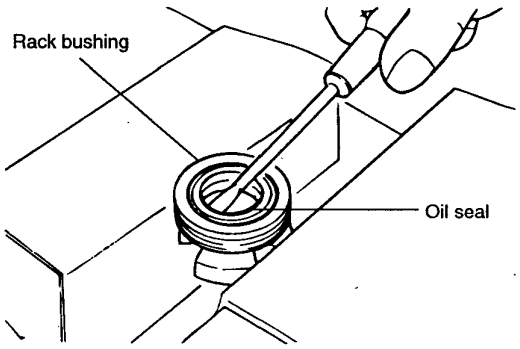
15. Remove the rack bushing and rack from the rack housing.

16. Remove the O-ring from the rack bushing.



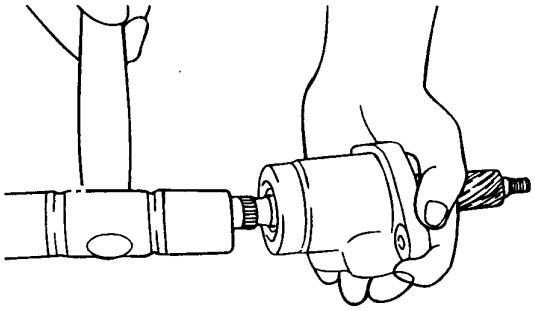
KPKA054A

17. Remove the oil seal from the rack bushing.



EPKB210D

18. Remove the valve body from the valve body housing with a soft hammer.



EPKB210A

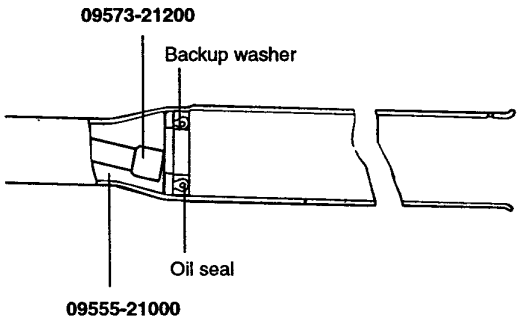
19. Remove the oil seal and ball bearing from the valve body housing.

20. Remove the oil seal and O-ring from the rack housing.

⚠ ***CAUTION***

Be careful not to damage the pinion valve cylinder bore of the rack housing.

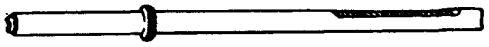
21. Using the special tool, remove the oil seal and ball bearing from the valve body housing.



EPKB210B

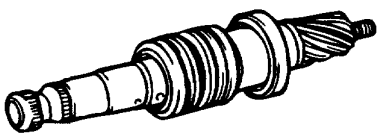
INSPECTION EFAF91F8

1. **Rack**
   1) Check for rack tooth face damage or wear
   2) Check for oil seal contact surface damage
   3) Check for rack bending or twisting
   4) Check for oil seal ring damage or wear
   5) Check for oil seal damage or wear



KPKB220A

2. **Pinion valve**
   1) Check for pinion gear tooth face damage or wear
   2) Check for oil seal contact surface damage
   3) Check for seal ring damage or wear
   4) Check for oil seal damage or wear



EPA9013Z

3. **Bearing**
   1) Check for seizure or abnormal noise during a bearing rotation
   2) Check for excessive play
   3) Check for missing needle bearing rollers

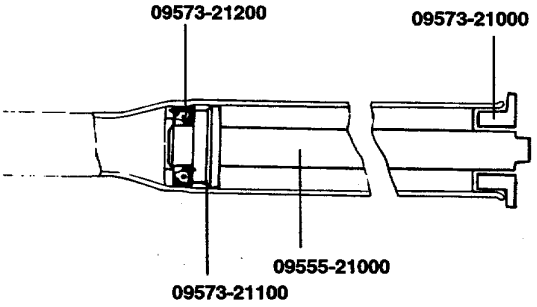
4. **Others**
   1) Check for damage of the rack housing cylinder bore
   2) Check for boot damage, cracking or aging

REASSEMBLY EC1F4F9B

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-3

2. Install the oil seal to the specified position in the rack housing.

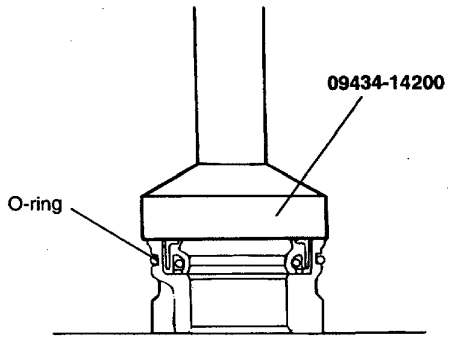


EPKB230A

3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-3

4. Install the oil seal in the rack bushing.



EPKB230B

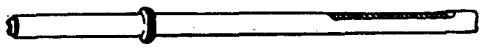
5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.

6. Apply the specified grease to the rack teeth.

Recommended grease :
Multipurpose grease SAE J310a, NLGI #2 EP

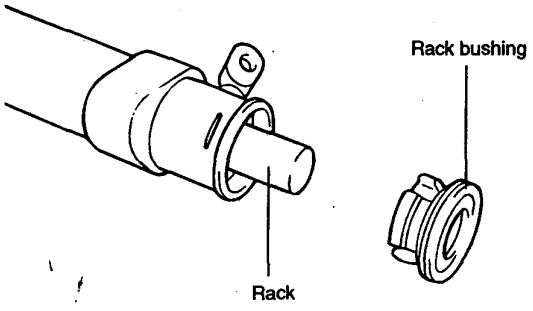
NOTE

Do not plug the vent hole in the rack with grease.



KPKB220A

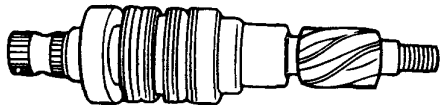
7. Insert the rack into the rack housing and push in the rack bushing until it is aligned with the notched hole of the rack housing, then install it.



EPPC230A

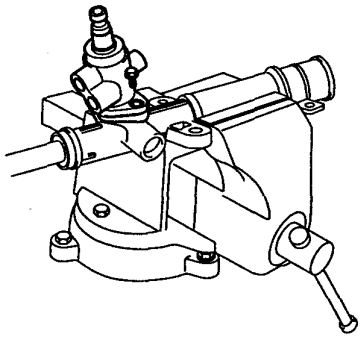
8. Using a special tool, install the oil seal and the ball bearing in the valve body housing.

9. After applying the specified fluid and grease to the pinion valve assembly, install it in the rack housing assembly.



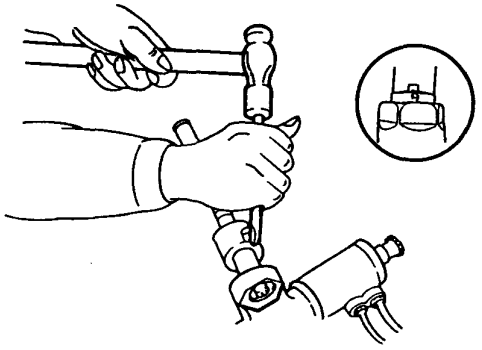
EPKB230E

10. After applying the specified fluid to the oil seal, install it in the rack housing, and fix the valve body assembly and O-ring in the gear box.



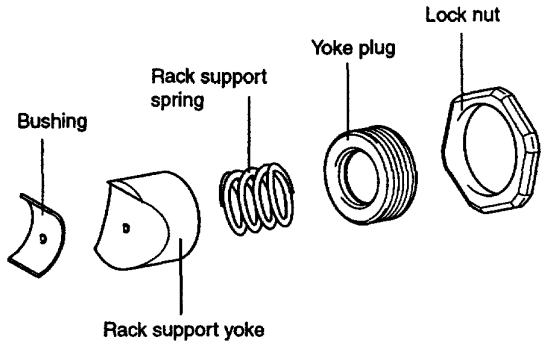
KPDD059A

11. Install the tie rod and punch on a point over the tie rod with a chisel.



KPPD051A

12. Install the bushing, rack support yoke, rack support spring and yoke plug in the order shown in the illustration. Apply semi-drying sealant to the threaded section of the yoke plug before installation.



EPPD049A

13. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket. Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

Tightening torque
50~70 Nm (500~700 kg·cm, 37~52 lb·ft)

14. Tighten the feed tube to the specified torque and install the mounting rubber using adhesive.

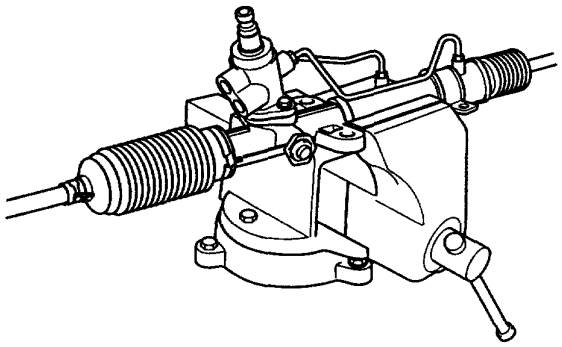
15. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease

16. Install the new attaching band to the bellows.

NOTE
When the bellows are installed, a new band must be used.

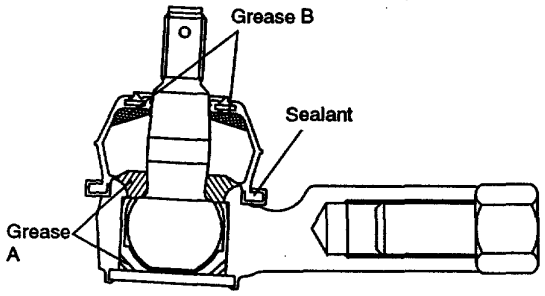
17. Install the bellows in position, taking care not to twist it.



KPDD052A

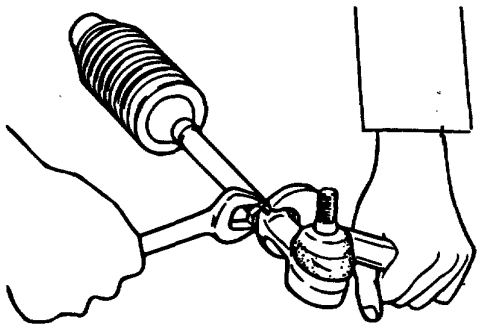
18. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

Recommended grease
A : POLY LUB GLY 801K or equivalent
B : SHOWA SUNLIGHT MB2 or equivalent
Dust cover inner side and lip : THREE BOND



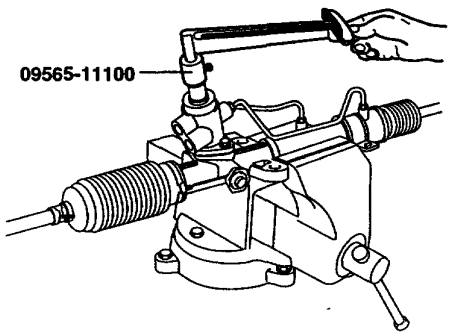
EPPD052A

19. Install the tie rod to the tie rod end.



EPA9013F

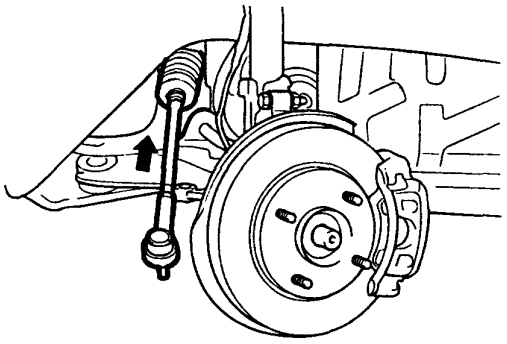
20. Check for total pinion preload.



KPDD053A

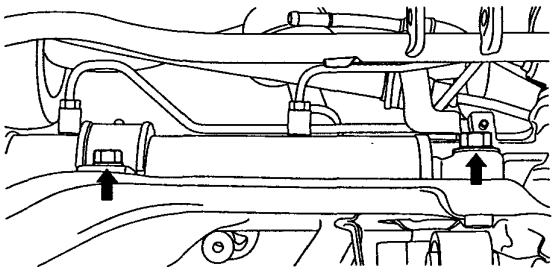
INSTALLATION E17B8959

1. Push in the power steering gear box assembly in the right side of the vehicle.



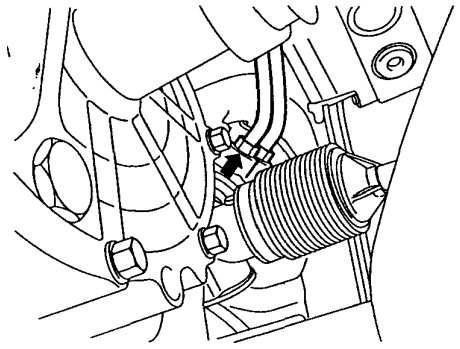
KPDD100H

2. Fix the power steering gear box to the crossmember.



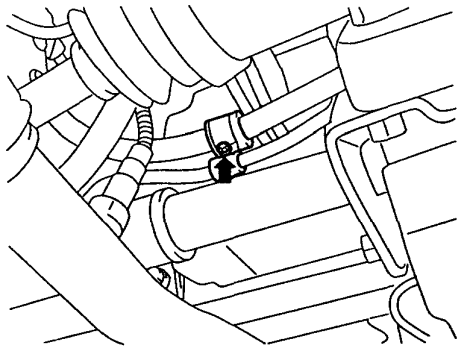
KPPD040A

3. Install the pressure tube and return tube fitting to the power steering gear box.



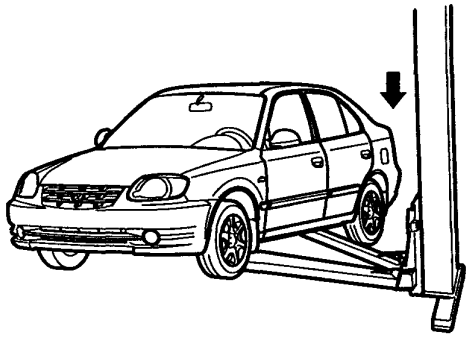
KPDD016A

4. Fix the power steering pressure hose and return tube mounting clamp with the bolt.



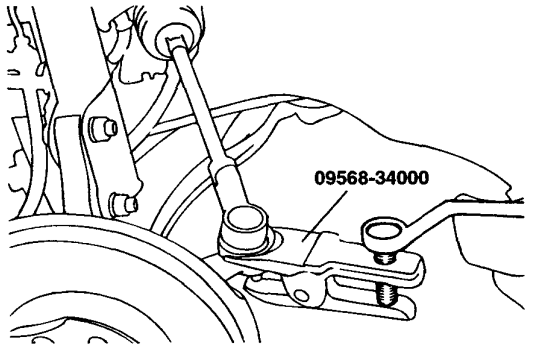
KPDD009A

5. Slowly lower the vehicle.



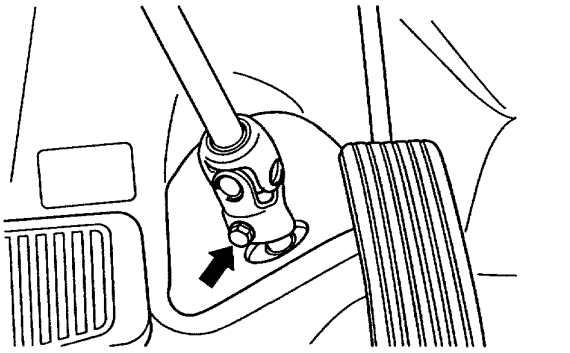
KPDD044C

6. Connect the tie rod to the knuckles (RH/LH)



EPDA022B

7. Install the tires (RH/LH)
8. Connect the steering shaft to the driver side gear box.

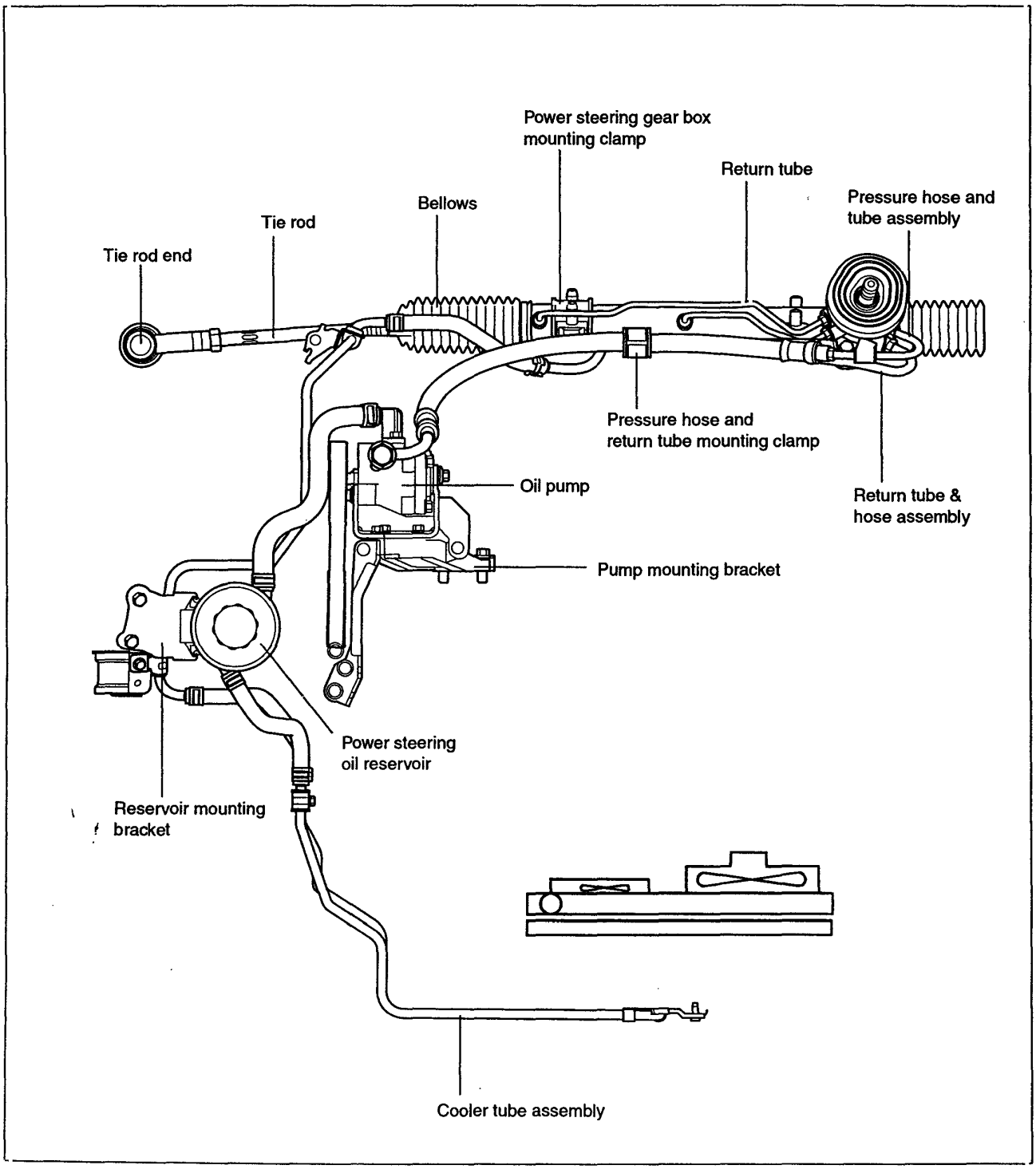


KPPD014A

9. Apply the power steering fluid.
10. Bleed the air.

POWER STEERING HOSES

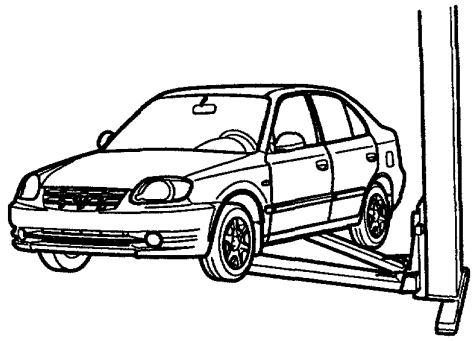
COMPONENTS EA16160B



EPDD025A

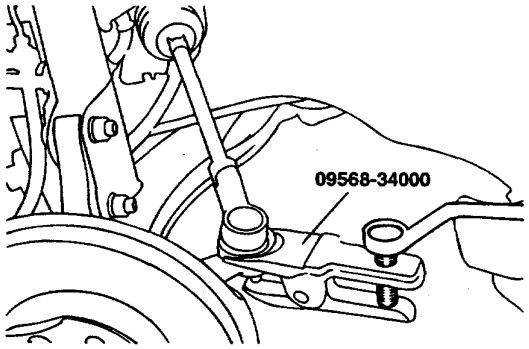
REMOVAL E3D334AD

1. Support the specified point of the vehicle with a lift.



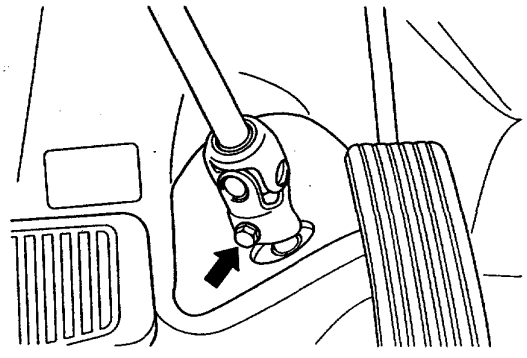
KPDD044A

2. Drain the power steering fluid.
3. Remove the front tires (RH/LH).
4. After removing the split pin, disconnect the tie rod from the knuckle using a special tool (09568-34000).



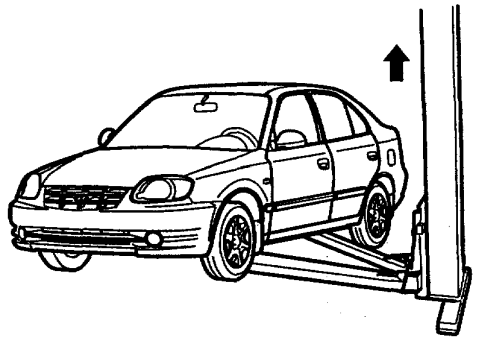
EPDA022B

5. Disconnect the shaft assembly from the gear box inside the passenger compartment.



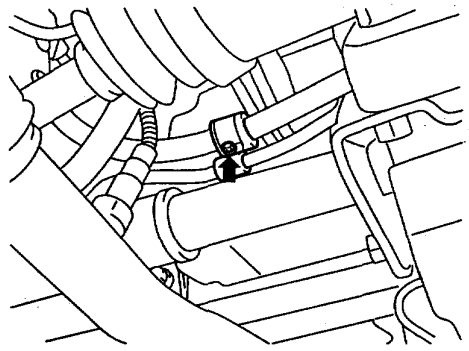
KPPD014A

6. Raise up the vehicle.



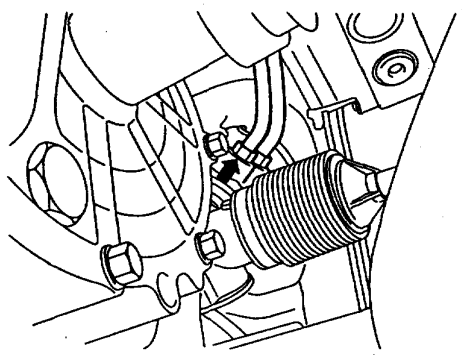
KPDD044B

7. Loosen the power steering pressure tube mounting clamp and return tube mounting clamp mounting bolt.



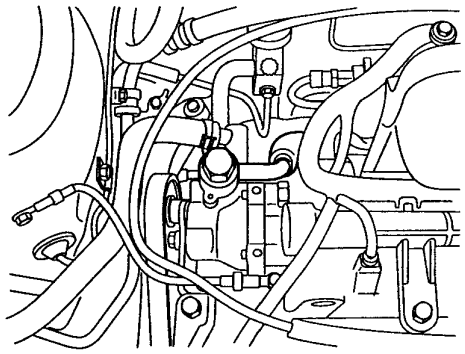
KPDD009A

8. Disconnect the pressure tube and return tube fitting from the power steering gear box.



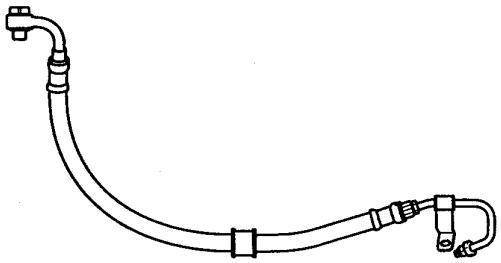
KPDD016A

9. Lower the vehicle and disconnect the pressure hose connector from the oil pump. (When removing the pressure hose)



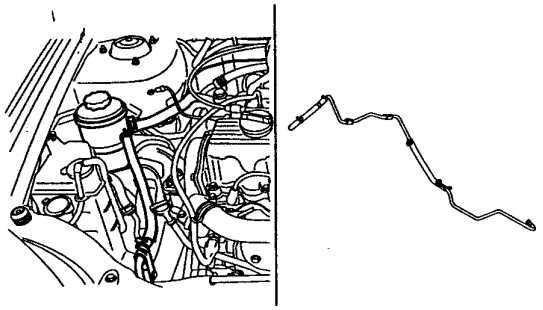
KPDD011C

10. Disconnect the pressure hose assembly. (When removing the pressure hose)



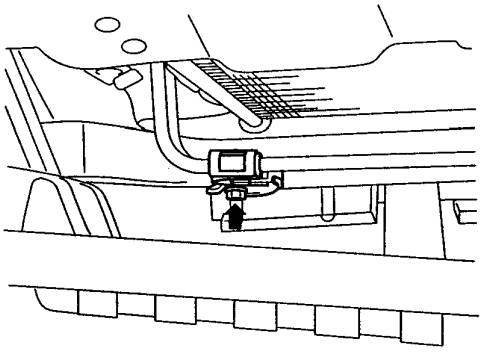
KPDD020A

11. After removing the clip from the color tube, removing the return tube and hose. (When removing the return tube and hose)



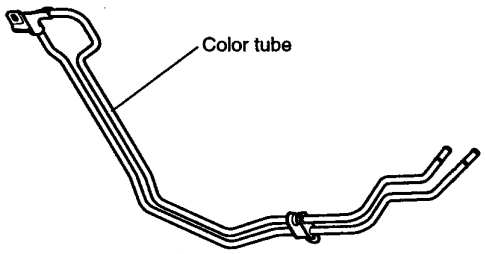
KPDD100E

12. Remove the 10mm color tube mounting clip bolt. (When removing the color tube)



EPDD007A

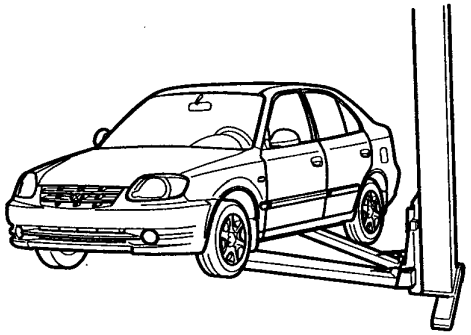
13. Disconnect the remove the color tube from the power steering oil reservoir tank side hose. (When working on the color tube)



EPDD100C

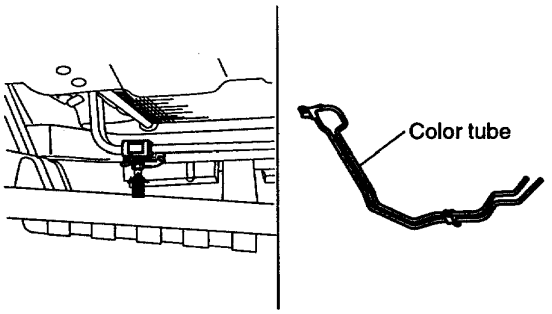
INSTALLATION EEF7E21D

1. Support the specified portion of the vehicle with a lift.



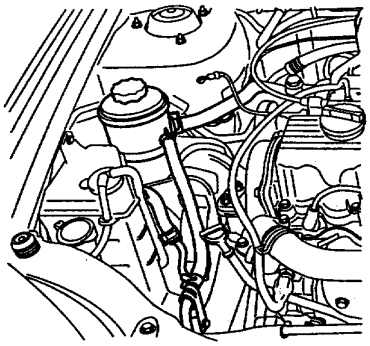
KPDD044A

2. Insert the color tube from the front pump upper part to the lower part and install 2 mounting bolts.



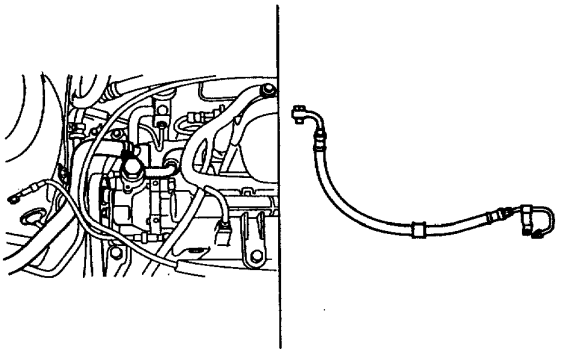
EPDD100F

3. Connect the color tube to the power steering oil reservoir tank side hose, return tube and hose side and fix it with clips. (When installing the color tube)



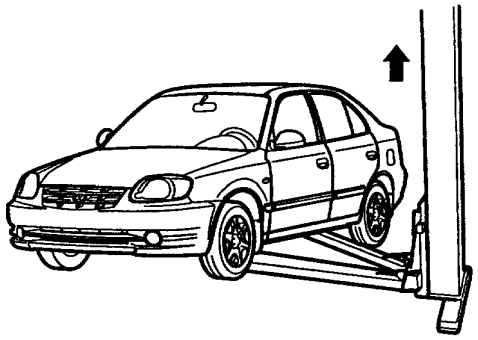
KPDD010B

4. Place the pressure hose and tube assembly in position and connect it to the oil pump. (When installing the pressure hose and tube)



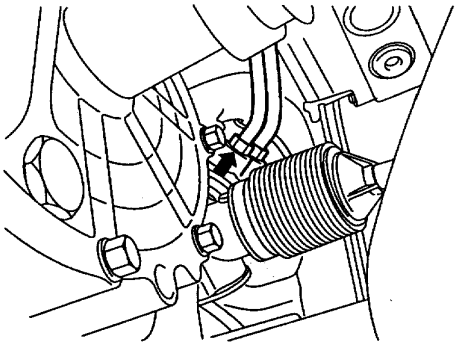
KPDD100D

5. Raise the vehicle with a lift.



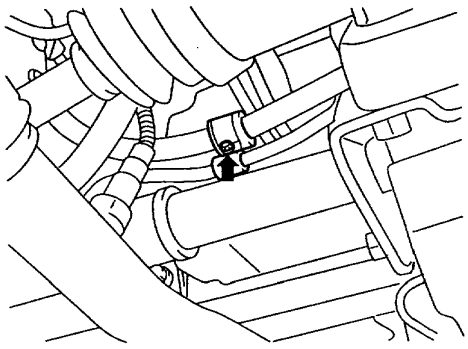
KPDD044B

6. Fix the pressure tube and return tube fitting to the power steering gear box.



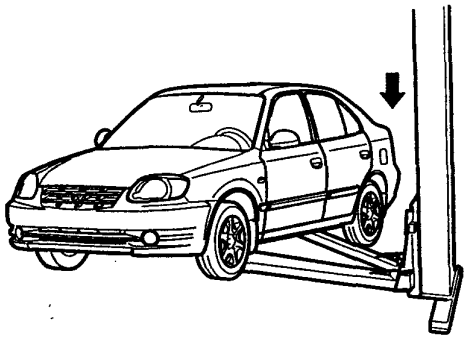
KPDD016A

7. Fix the power steering pressure tube and return tube mounting clamp with a bolt.



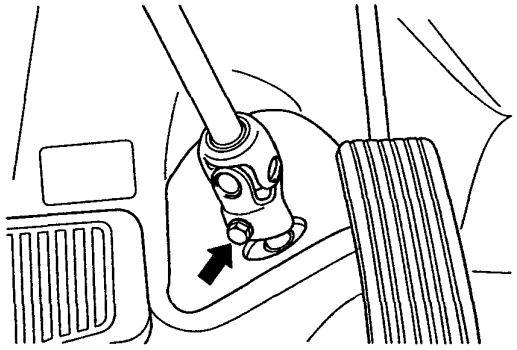
KPDD009A

8. Lower the vehicle.



KPDD044C

9. Connect the gear box and steering column shaft universal joint in the passenger compartment.



KPPD014A

10. Connect the tie rod end to the LH/RH knuckles.
11. Install the tires (LH/RH).
12. Fill the power steering oil reservoir with fluid.

INSPECTION EB9719BA

1. Twisting the hose by hand, check for cracks.
2. Check that the hose does not contact with other components.

HOW TO FILL WITH POWER STEERING FLUID

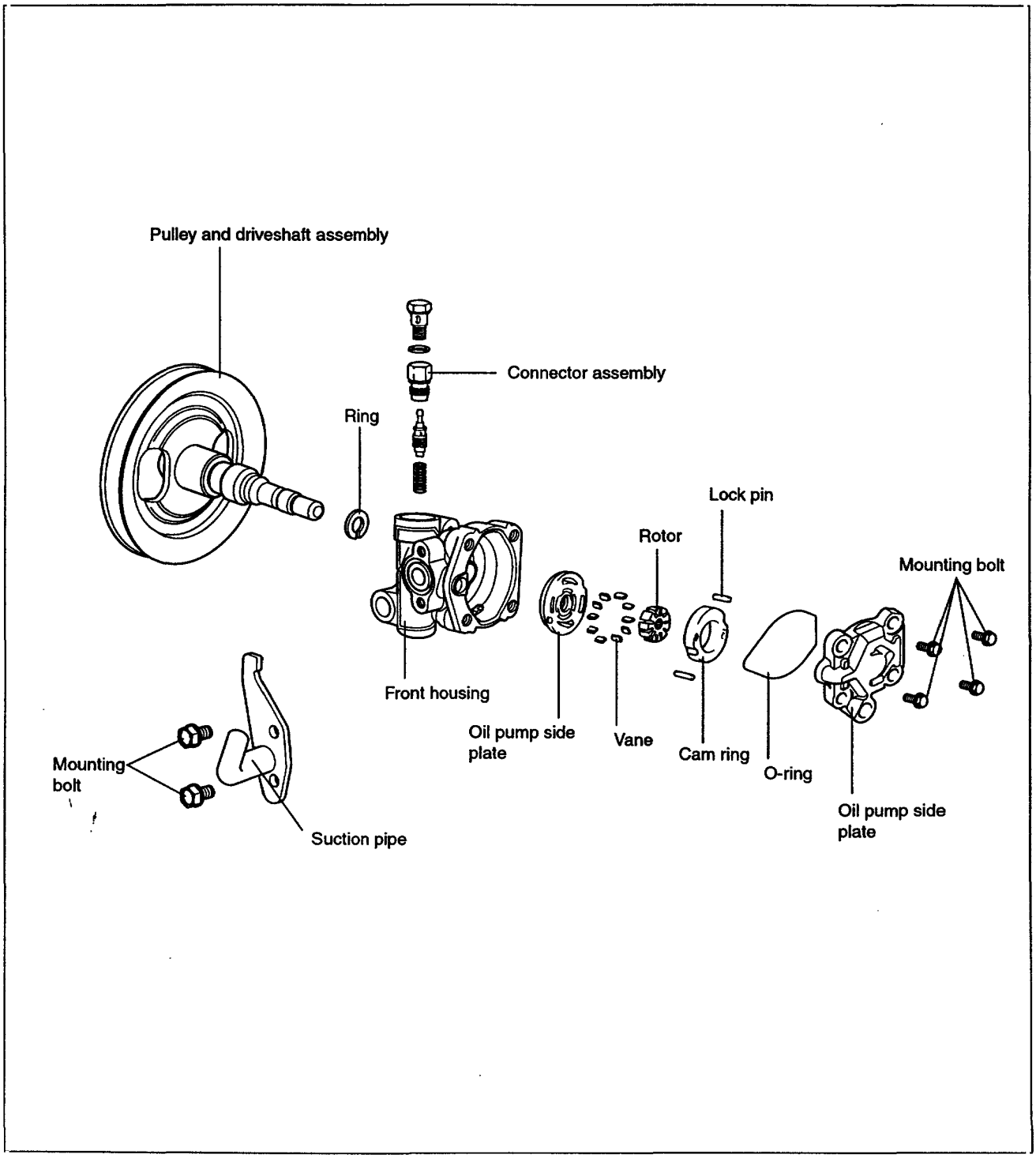
1. Fill the power steering reservoir with the power steering fluid to the "Max." position
2. Lift the front wheels with a jack and turn the steering wheel fully to the left and right 5~6 times at 13 rpm, while driving the pulley only by operating the start motor.
3. Start the engine, let it idle and turn the steering wheel fully left and right several times until bubbles disappear from the power steering reservoir.
4. If the oil color does not become milk-white and the oil level is constant at the "MAX" position, fluid level is O.K.

⚠ ***CAUTION***

If the oil level changes when turning the steering wheel, and the oil overflows when stopping the engine, it shows that air bleeding wasn't performed perfectly. As it can cause noise and early damage, you must repeat the above procedures.

POWER STEERING OIL PUMP

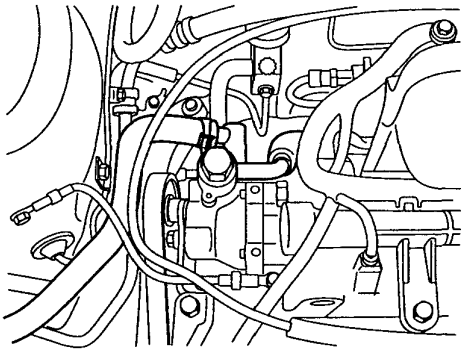
COMPONENTS E8FDFEB0



EPDD063A

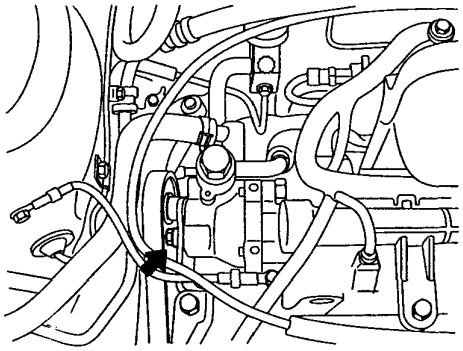
REMOVAL ED697C3E

1. Remove the pressure hose from the oil pump. Disconnect the suction hose from the suction pipe and drain the fluid into a container.



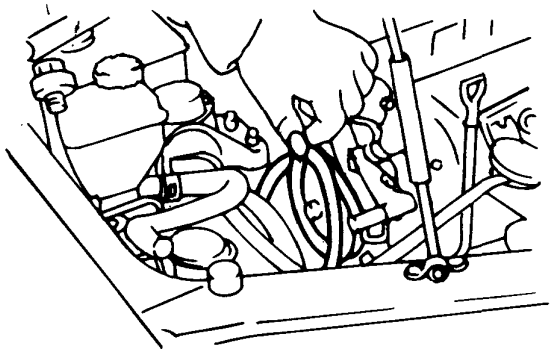
KPDD011D

2. Loosen the power steering "V" belt tension adjusting bolt.



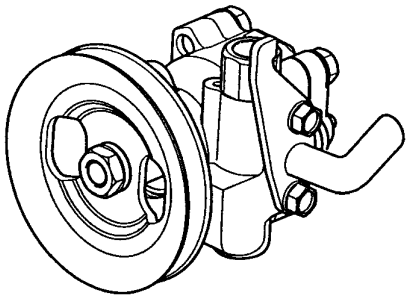
KPDD011B

3. Remove the "V" belt from the power steering oil pump pulley.



KPKA047A

4. After removing the power steering oil pump mounting bolts and the tension adjusting bolt, remove the power steering oil pump assembly.

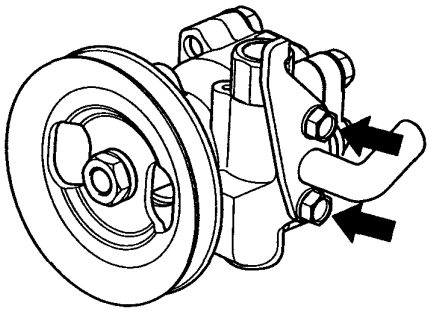


KPDD064A

5. Remove the power steering oil pump mounting bracket.

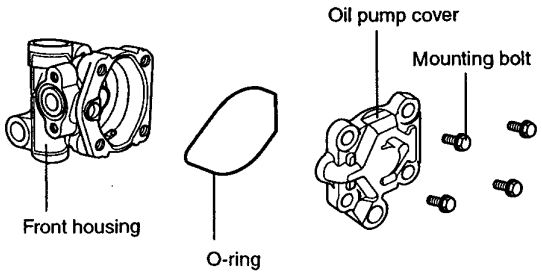
DISASSEMBLY E4A35FC0

1. After removing the 2 bolts(10mm), remove the suction pipe and the O-ring from the oil pump body.



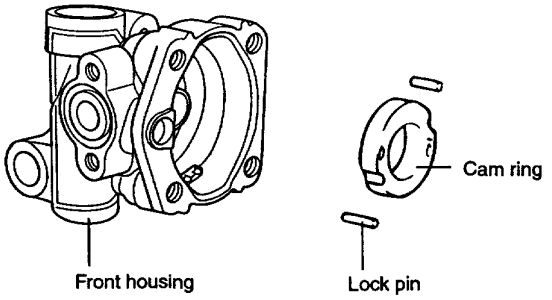
KPDD065A

2. Loosen the four bolts(12mm) and remove the oil pump cover assembly.



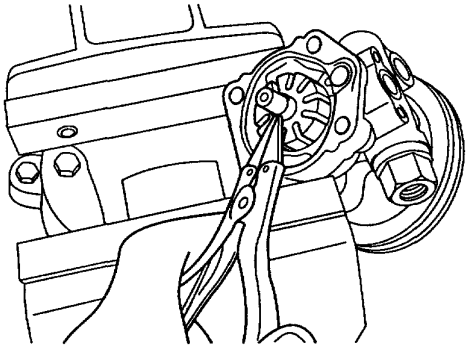
EPPD067B

3. Remove the cam ring.



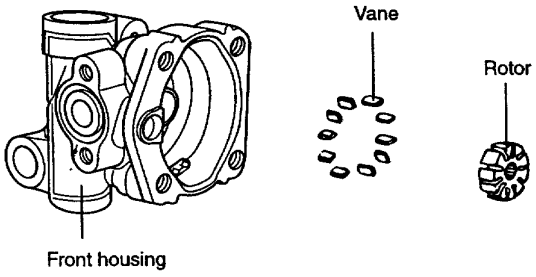
EPPD067C

4. Remove the shaft fixing ring using snap ring pliers.



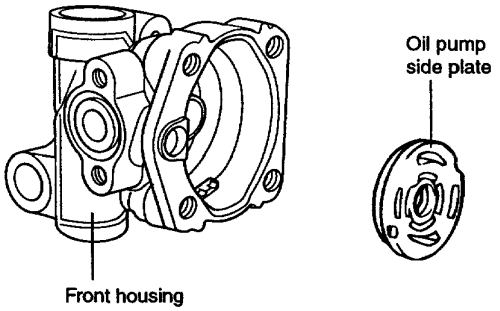
KPPD069A

5. Remove the rotor and vanes.



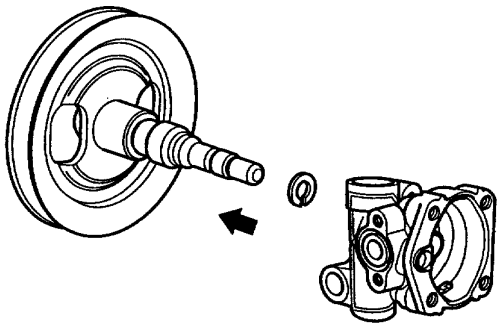
EPPD067D

6. Remove the oil pump side plate.



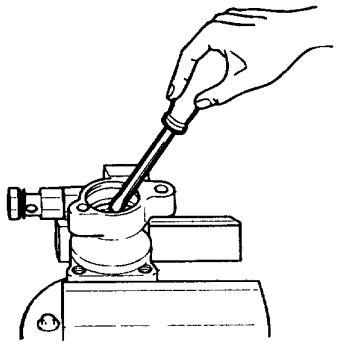
EPPD067E

7. Remove the pulley and shaft assembly from the oil pump body.



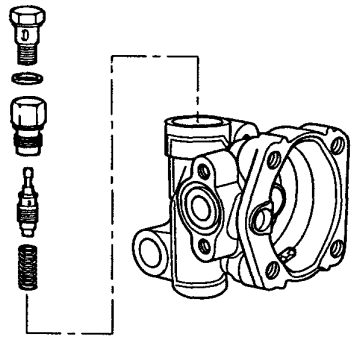
KPPD066B

8. Remove the oil seal from the oil pump body.



KPKA059A

9. Remove the connector(24mm) from the oil pump body, and take out the flow control valve and the flow control spring.



KPPD068A

10. Remove the O-ring from the connector.

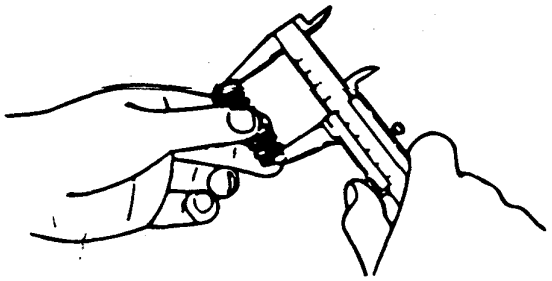
⚠ ***CAUTION***

Do not disassemble the flow control valve.

INSPECTION E00A265A

1. Check the free length of the flow control spring.

Free length of the flow control spring : 36.5mm

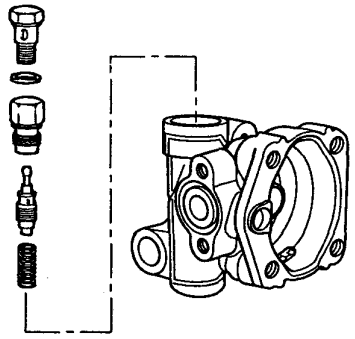


KPKA068A

2. Check that the flow control valve is not bent.
3. Check the shaft for wear and damage.
4. Check the V-belt for wear and deterioration.
5. Check the grooves of the rotor and vanes for stratified abrasion.
6. Check the contact surface of the cam ring and vanes for stratified abrasion.
7. Check vanes for damage.
8. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

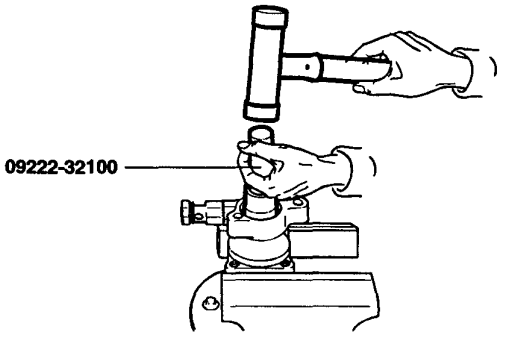
REASSEMBLY ECCE4CD4

1. After installing the O-ring to the connector, install the flow control spring, the flow control valve and the connector into the pump body.



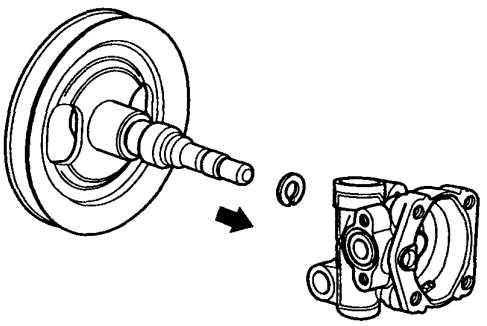
KPPD068A

2. Install the oil seal in the pump body by using the special tool.



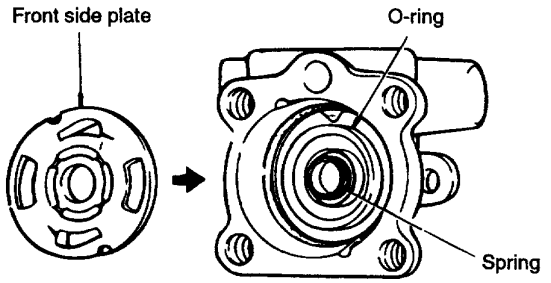
KPKA061A

3. Install the pulley and shaft assembly to the oil pump body.



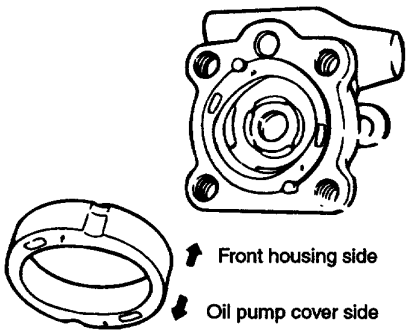
KPPD066C

4. Install the oil pup side plate and rotor.



EPKB300A

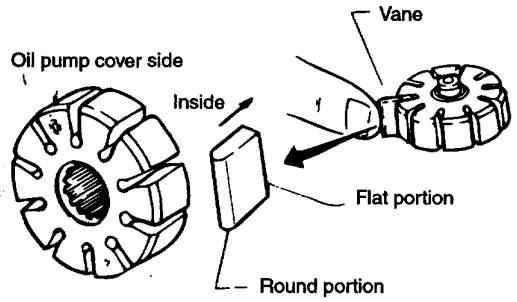
5. After inserting the lock pin into the groove of the front housing, install the cam ring attending to the direction.



EPKB300B

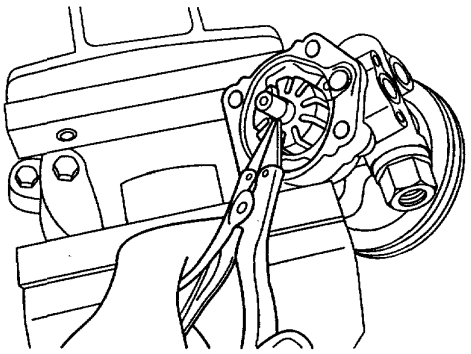
6. Install the rotor.

7. Install vanes so that the rounded edges face outward.



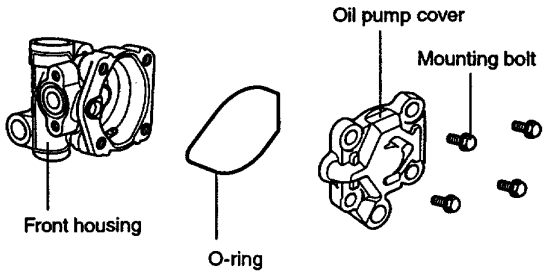
EPKB300C

8. Install the shaft fixing clip with snap ring pliers.



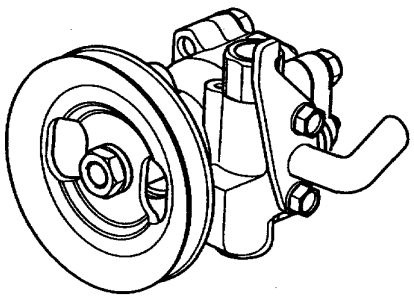
KPPD069A

9. Install the O-ring and oil pump cover assembly.



EPPD067B

10. Install the suction pipe and O-ring.

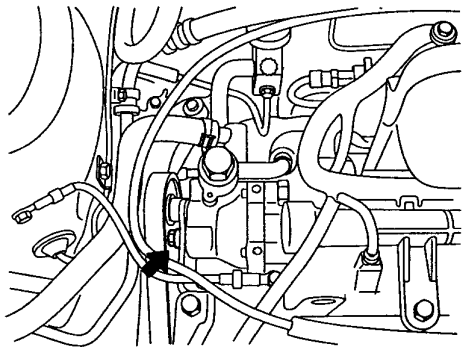


KPDD064A

INSTALLATION E9920B3D

1. After installing the oil pump to the oil pump bracket, install the "V" belt and tighten the bolt adjusting tension to the specified torque.

Standard value
Oil pump adjusting bolt : 25~33 Nm (250~330 kg·cm, 18~24 lb·ft)



KPDD011B

2. Install the suction hose.

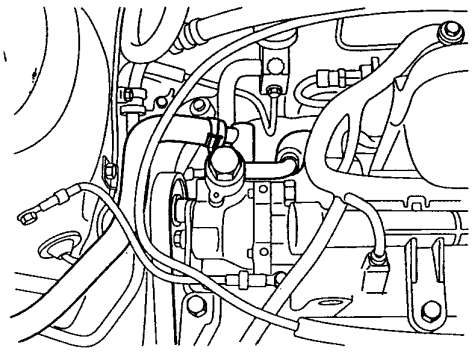
⚠ ***CAUTION***

Install the pressure hose to the oil pump, facing the painted part on the hose toward the oil pump.

3. Install the pressure hose to the oil pump.

NOTE

Install the pressure hose being careful so that it does not twist and come in contact with other components.



KPDD011D

4. Add power steering fluid (PSF-3).
5. Air bleed the system.
6. Check the oil pump pressure.

Suspension System

GENERAL
- SPECIFICATIONS ..... SS -2
- LUBRICANTS ..... SS -4
- SPECIAL TOOLS ..... SS -5
- TROUBLESHOOTING ..... SS -8

FRONT SUSPENSION SYSTEM
- STRUT ASSEMBLY
  - COMPONENTS ..... SS -10
  - REMOVAL ..... SS -11
  - DISASSEMBLY ..... SS -11
  - INSPECTION ..... SS -11
  - REASSEMBLY ..... SS -12
  - INSTALLATION ..... SS -12
- LOWER ARM
  - COMPONENTS ..... SS -13
  - REMOVAL ..... SS -14
  - DISASSEMBLY ..... SS -14
  - INSPECTION ..... SS -16
  - INSTALLATION ..... SS -17
- FRONT STABILIZER BAR
  - COMPONENTS ..... SS -18
  - REMOVAL ..... SS -18
  - INSPECTION ..... SS -19
  - INSTALLATION ..... SS -19

REAR SUSPENSION SYSTEM
- REAR STRUT
  - COMPONENTS ..... SS -20
  - REMOVAL ..... SS -21
  - DISASSEMBLY ..... SS -21
  - INSPECTION ..... SS -21
  - REASSEMBLY ..... SS -22
  - INSTALLATION ..... SS -22
- UPPER ARM, LOWER ARM AND ASSIST LINK
  - COMPONENTS ..... SS -23
- TRAILING ARM
  - REPLACEMENT ..... SS -24
- REAR SUSPENSION ARM
  - REPLACEMENT ..... SS -25
- REAR STABILIZER BAR
  - REPLACEMENT ..... SS -26

TIRES / WHEELS
- TIRES
  - ADJUSTMENT ..... SS -27
- WHEELS
  - ADJUSTMENT ..... SS -29

GENERAL

SPECIFICATIONS E11E6B36

Front suspension system	Macpherson strut with coil spring

Coil spring

Model	Free height mm (in.)	Identification color
Standard		
M/T	324 (12.8)	Green -1
A/T	333.8 (13.1)	Green-1, White-1
Sporty suspension		
M/T	313.7 (12.4)	Green-2
A/T	322.7 (12.7)	Green-1, Pink-1
High suspension		
M/T	334 (13.1)	Pink-2
A/T	343.8 (13.5)	Pink-1, Yellow-1
Diesel (TCI)	349.2 (13.7)	Violet-1

Shock absorber

Item	Specification		
Type	Oil type/Gas type		
Stroke mm (in)	161 (6.3)		
Damping force at piston speed 0.3 m/s	Standard	India	Sporty suspension
Expansion N(kg)	620±100 (62±10)	690±110 (69±11)	1090±160 (109±6)
Compression N(kg)	340±70 (34±7)	290±70 (29±7)	490±100 (49±10)

EHDD010A

Rear suspension system	Dual link

Coil spring

Model	Free height mm (in.)	Identification color
Standard	345.7 (13.6)	Yellow-1
Sporty suspension	337.5 (13.3)	Pink-1
High suspension	355.7 (14.0)	Green-1
Diesel (TCI)	347.5 (13.7)	Violet-1

Shock absorber

Item		Specification		
Type		Oil type/Gas type		
Stroke	mm (in.)	211 (8.3)		
Damping force at piston speed 0.3 m/s		Standard	India	Sporty suspension
Expansion	N(kg)	490±60 (49±6)	520±90 (52±9)	590±100 (59±10)
Compression	N(kg)	260±60 (26±6)	200±50 (20±5)	230±60 (23±6)

EHDD010B

Tire size	175/70 R13 185/60 HR14 185/55 R15
Tire pressure kPa (psi)	207 (30)
Wheel size	Steel - 5J x 13, 5J x14 Al - 5J x 14 ('B' type), 5.5J x 15 ('B' type)

EHDD010C

SERVICE STANDARD

Standard value	Front		Rear	
	General	High suspension	General	High suspension
Toe-in mm(in.)	0±3 (0±0.12)	0±3 (0±0.12)	3±2 (0.12±0.0787)	3±2 (0.12±0.0787)
Camber	0±30′	8′±30′	-41′±30′	-34′±30′
Caster	1°48′±30′	1°45′±30′		
King pin inclination angle	11°03′±30′	10°47′±30′		
King pin offset mm(in.)	5.8 (0.23)	6.1 (0.24)		
Wheel runout Radial Axial	**Steel wheel** 0.6 mm (0.028 in.) : Average of LH & RH 0.8 mm (0.032 in.)		**Aluminum wheel** 0.3 mm (0.012 in.) 0.3 mm (0.012 in.)	

TIGHTENING TORQUE

Items	Nm	kgf·cm	lb·ft
Castle nut	220-260	2200-2600	162-192
Strut upper installation nut	20-30	200-300	14-22
Strut assembly to knuckle	75-90	750-900	55-66
Front strut mounting self locking nut	60-70	600-700	43-51
Lower arm ball joint to knuckle	60-72	600-720	43-52
Lower arm/lower arm bracket mounting bolt	95-120	950-1200	69-87
Tie rod end ball joint to knuckle	15-34	150-340	11-25
Rear roll stopper to sub-frame bolt	30-40	300-400	22-29
Rear roll stopper mounting nut	45-60	450-600	33-44
Rear strut mounting self locking nut	45-50	450-500	33-37
Rear stabilizer link to stabilizer bar	35-45	350-450	26-33
Rear stabilizer bar bracket bolt	17-26	170-260	13-19
Rear suspsension arm (A,B) to axle carrier	130-150	1300-1500	96-110
Rear suspension arm (A) to body frame	100-120	1000-1200	74-88
Rear suspension arm (B) to body frame	80-100	800-1000	59-74
Trailing arm to axle carrier nut	130-150	1300-1500	96-110
Trailing arm to bracket nut	100-120	1000-1200	74-88
Trailing bracket to body frame	40-50	400-500	30-37

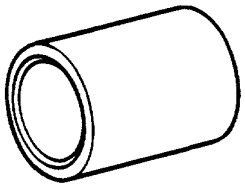
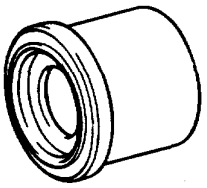
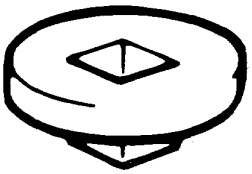
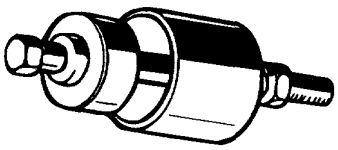
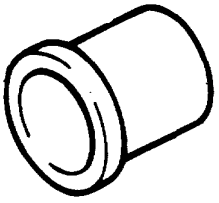
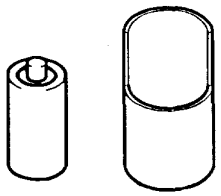
⚠ ***CAUTION***

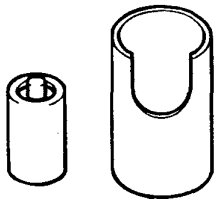
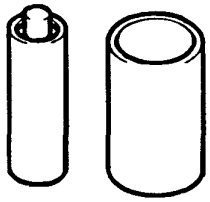
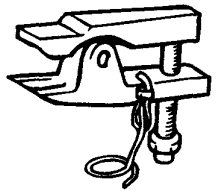
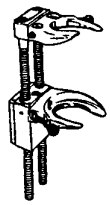
Replace the self-locking nuts with new ones after removal.

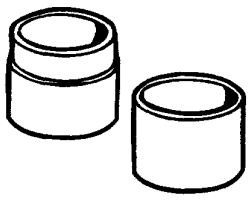
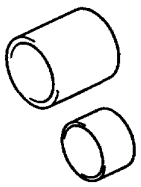
LUBRICANTS E9D2A0CD

Location	Recommended lubricant	Quantity
In ball joint of lower arm	Variant R-2 grease or poly lub gly 801 K	As required
In insulator bearing strut	SAE J310a, Chassis grease (NLGI No. 0 or equivalent)	As required
In rear statilizer link case	Lubchem SB 6042M or Sunlight MB2	As required

SPECIAL TOOLS ECFE5CBA

Tool (Number and Name)	Use	Illustration
09216-21100 Mount bushing remover	 EHDA140A	Removal & installation of lower arm bushing (G) (use with 09216-21200, 09545-02000)
09216-21200 Mount bushing remover and installer base	 EHDA140B	Removal & installation of the lower arm bushing (G) (use with 09216-21100, 09545-02000)
09532-11600 Preload socket	 EHDA140C	Measurement of the lower arm ball joint and stabilizer link starting torque
09545-02000 Lower arm bushing remover and installer	 EHDA140D	Installation of the lower arm ball joint
09545-21100 Ball joint dust cover installer	 EHDA140E	Installation of the lower arm ball joint snap ring
09545-25000 Lower arm bushing remover and installer	 EHDA140F	Removal & installation of the lower arm bushing (A)

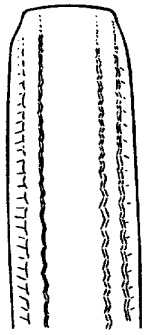
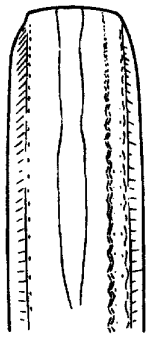
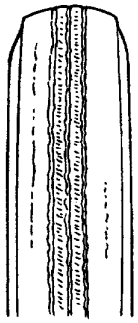
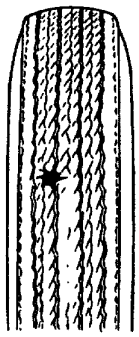
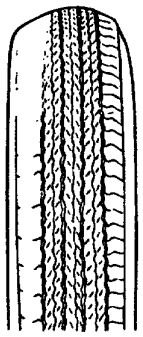
Tool (Number and Name)	Use	Illustration
09551-25000 Trailing arm bushing remover and installer	 EHDA140G	Removal & installation of the trailing arm bushing
09552-25000 Rear suspension arm remover and installer	 EHDA140H	Removal & installation of the rear suspension arm bushing
09568-34000 Ball joint puller	 EHDA140I	Separation of the lower arm ball joint
A-20 Strut compressor adapter	 EHDA140J	Compression of the rear coil spring (use with J38402)
A-42 Strut compressor adapter	 EHDA140J	Compression of front coil spring (use with J38402)
J38402 Strut spring compressor	 EHDA140K	Compression of the front & rear coil spring (use with A-42 or A-20)

Tool (Number and Name)	Use	Illustration
09545-11000 (A,B) Ball joint remover and installer	 E54511000	Installation of the front lower arm ball joint
09545-3A000 Lower arm bush remover	 S5SS005D	Removal of lower arm bushing

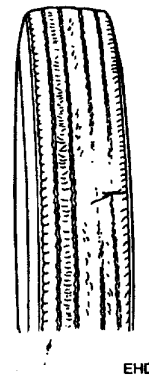
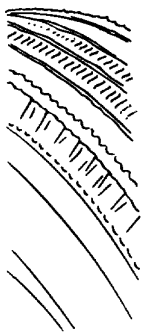
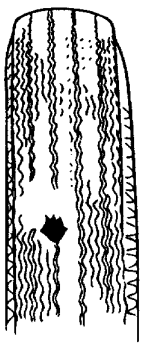
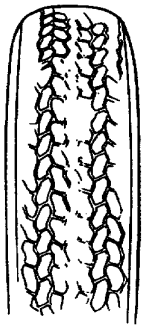
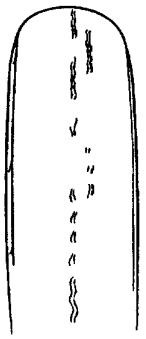
TROUBLESHOOTING EAFFFAF8

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring Worn lower arm bushing	Correct Repair or replace Replace Replace Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistnace of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignemtn Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

WHEEL AND TYPE DIAGNOSIS

CENTER OF TREAD		BOTH SIDES OF TREAD WORN	CHUNKING OF TIRE	ONE SIDE OF TIRE WORN
 EHDA150A	 EHDA150B	 EHDA150C	 EHDA150D	 EHDA150E
Over-Inflation	Center-tread down to fabric due to excessive over-inflation	Under-Inflation Bulge at the shoulder Rapid wear	When a patch of tread has loosened, torn off the tire by centrifugal force at high speed	Incorrect camber angle

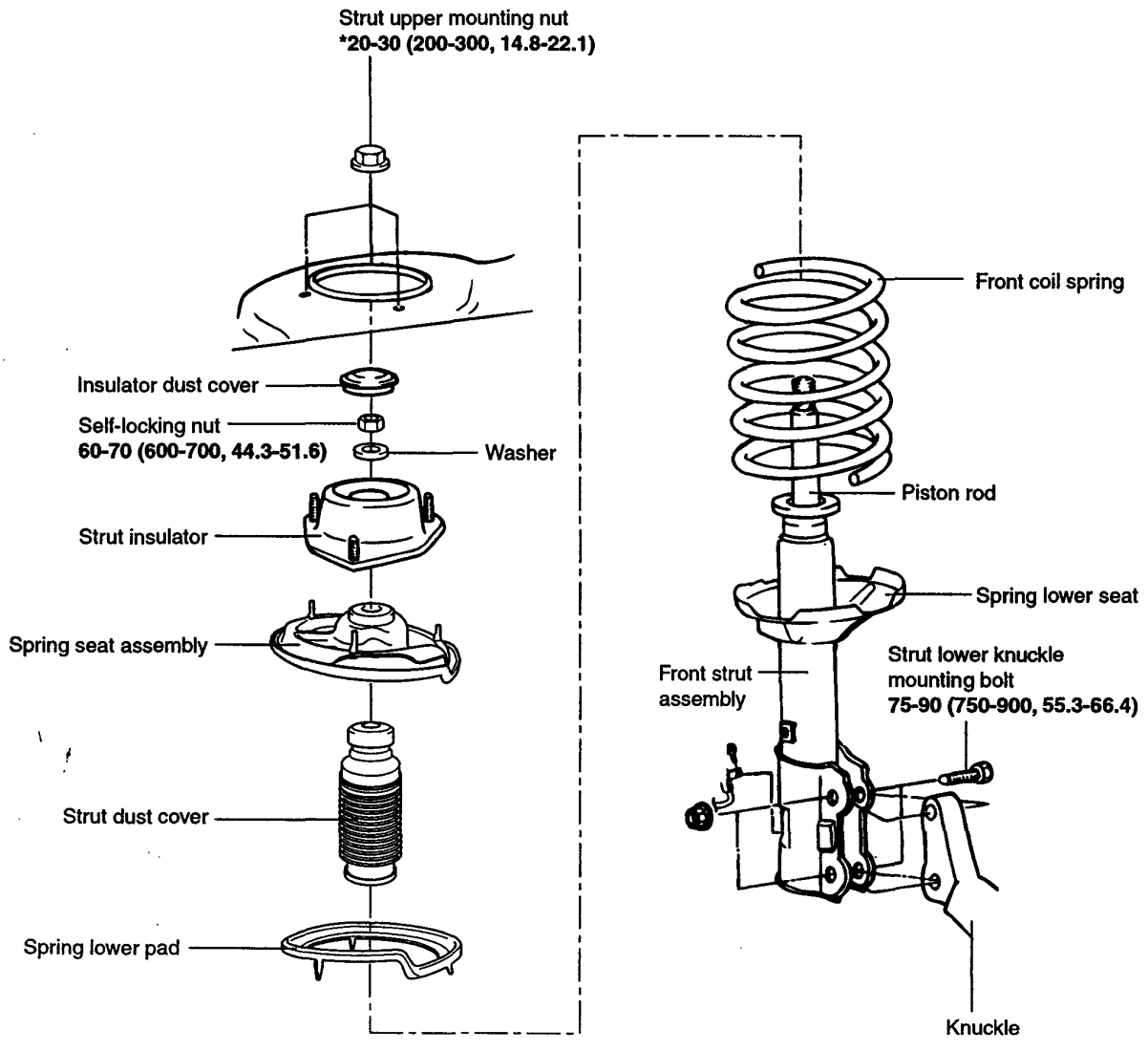
WHEEL AND TYPE DIAGNOSIS

FLAT SPOT	FEATHERING	BAD PLUGGING	UNEVEN TIRE WEAR	TOTALLY UNSAFE TIRE
 EHDA150F	 EHDA150G	 EHDA150H	 EHDA150I	 EHDA150J
Caused by heavy braking which makes the wheels lock and scrubs tires along the road surface	Excessive toe-in toe-out	Using more than one plug distorts the tread, resulting in carcass failure	Bad wheel balance, fault in suspension, steering gear or bearing	Tread worn below the limit

FRONT SUSPENSION SYSTEM

STRUT ASSEMBLY

COMPONENTS ED58B07B



CAUTION

* **Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in an unladen condition.**

TORQUE : Nm (kg·cm, lb·ft)

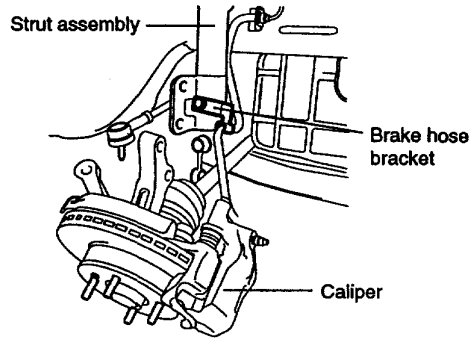
ELCSD01A

REMOVAL E5071996

1. Remove the front wheel.
2. Detach the brake hose bracket from the strut assembly.

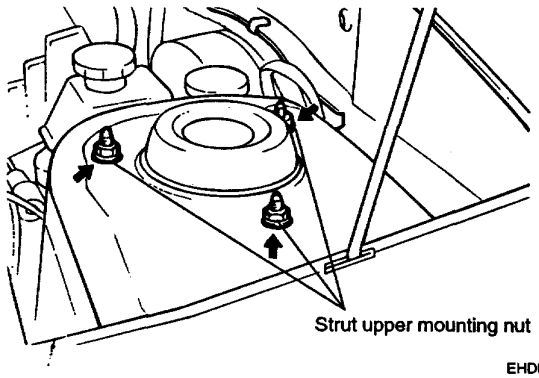
NOTE

Do not pry or force the components excessively.



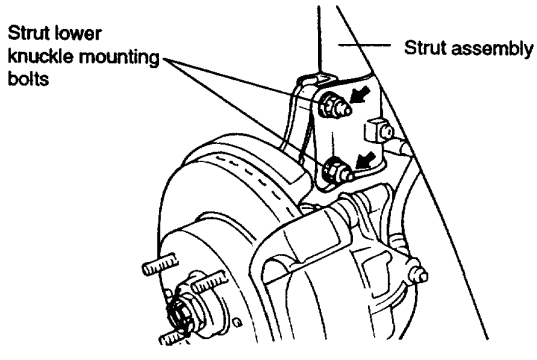
ELCSD02A

3. Remove the strut upper mounting nuts(3).



EHDD201B

4. Remove the strut lower kunckle mounting bolts(2).



EHDD201C

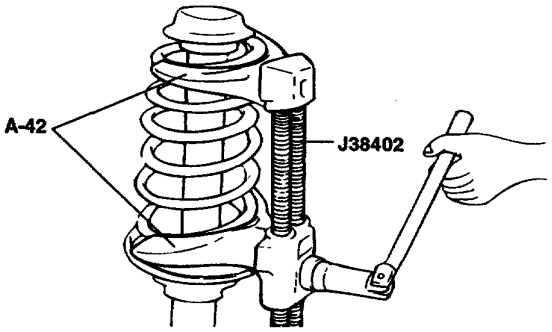
5. Remove the strut assembly.

DISASSEMBLY EFDCDFF4

1. Remove the insulator dust cover with a flat-tip screw driver.
2. Using the Special Tool(J38402), compress the coil spring until there is only a little tension on the strut.

NOTE

Do not use an impact gun.

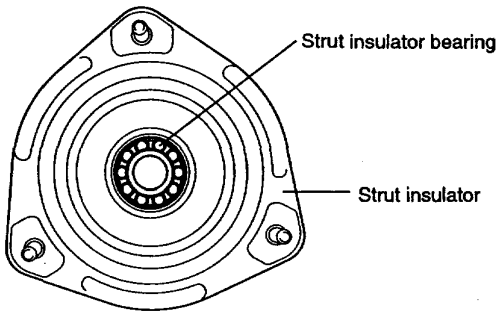


EHDA202A

3. Remove the lock-nut at the top end of the shock absorber.
4. Remove the strut insulator, spring seat assembly, coil spring and strut dust cover.

INSPECTION E4EF38E3

1. Check the strut insulator bearing for wear or damage.

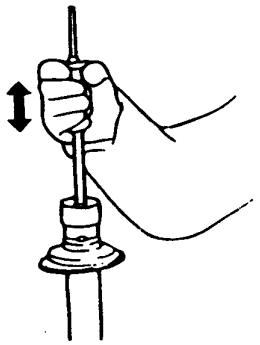


ELCSD06A

2. Check the rubber parts (Insulator dust cover, Strut insulator, Spring seat assembly, Strut dust cover, Spring lower pad) for damage or deterioration.
3. Check the coil spring for sagging and weakness.
4. Reassembly all the parts, and except for the coil spring.

5. Repeat pushing and pulling the damper assembly as shown.

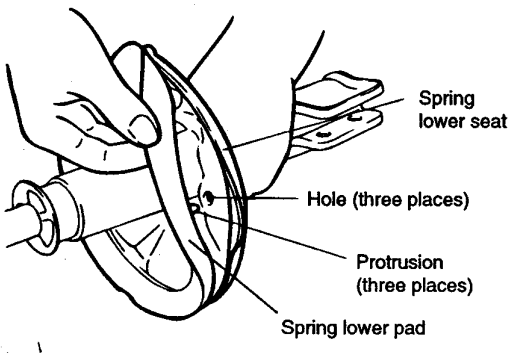
6. Check for smooth operation through a full stroke.
If there is no compression or no extension, the gas is leaking and it is stroughly recommended that the damaper should be replaced.



EHDA203A

REASSEMBLY E3F06DCA

1. Install the spring lower pad with the protrusions fitted in the holes of the spring lower seat.



EHDD204A

2. Install the strut dust cover on the shock absorber.

3. Using Special Tool(J38402, A-42), compress the coil spring.
After the spring is fully compressed, install it on the shock absorber.

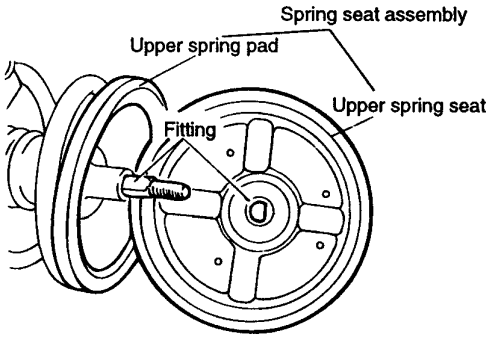
NOTE

Install the coil spring with the identification color mark facing toward the knuckle.

4. After fully extending the piston rod, install the spring seat assembly and the strut insulator.

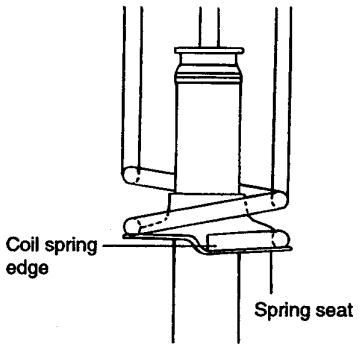
NOTE

Align the D-shaped hole in the spring seat assembly with the indentation on the piston rod.



EHDD204B

5. After having correctly seated the upper and lower ends of the coil springin the upper and lower spring seat grooves, install the new self-lockingnut but do not tighten it.



EHDA204C

6. Remove the Special Tool (J38402, A-42).

7. Tighten the self-locking nut to the specified torque.

Tightening torque
60-70 Nm (600-700 kg·cm, 43-51 lb·ft)

8. Pack grease in the strut insulatior bearing and install the insulator dust cover.

CAUTION

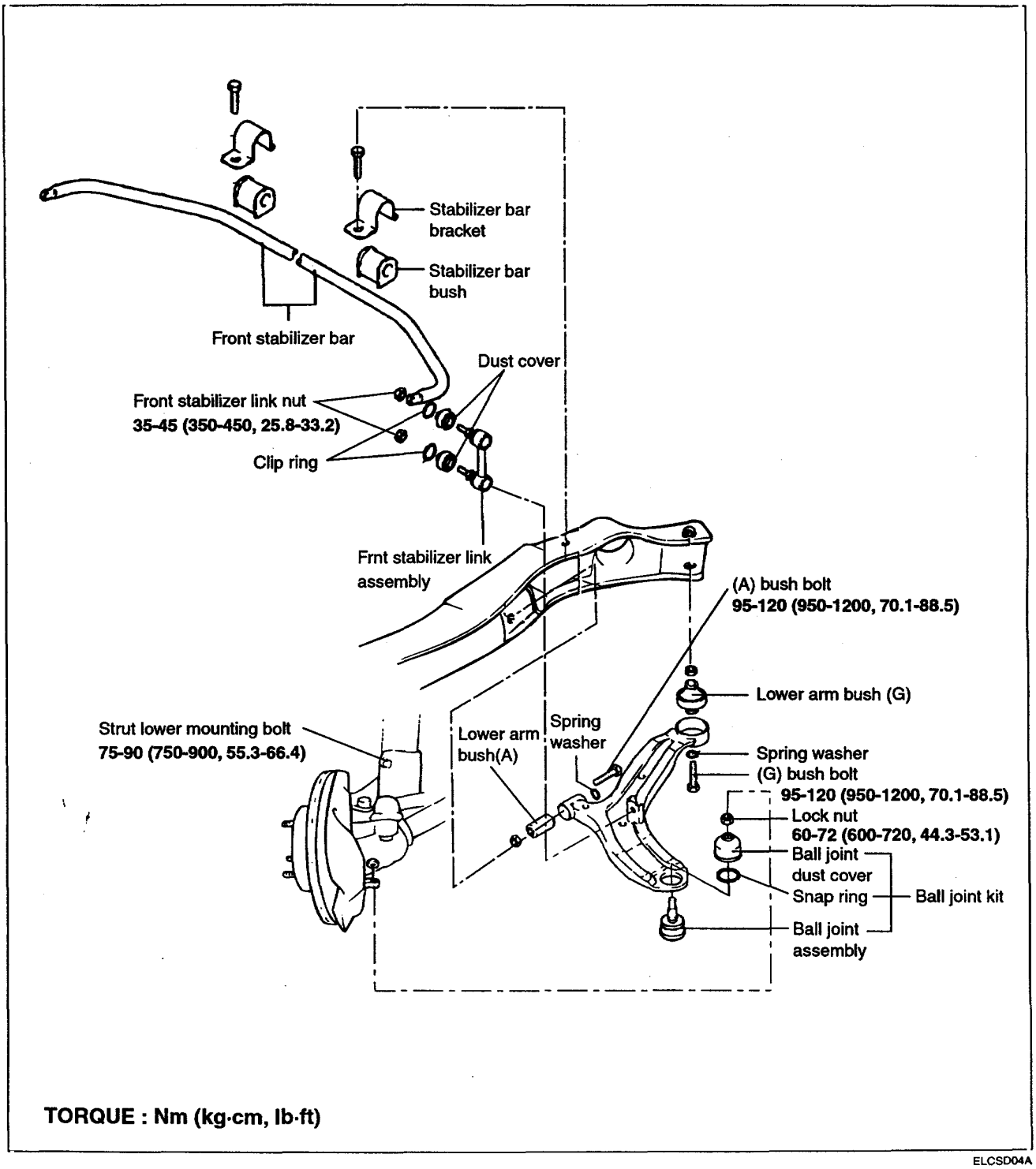
Make sure that no grease is on the insulator rubber. (refer to 'LUBRICANTS', SS-p.3).

INSTALLATION EEFADBA4

Installation is in the reverse order of removal. (See page SS-p.11)

LOWER ARM

COMPONENTS EC74726D

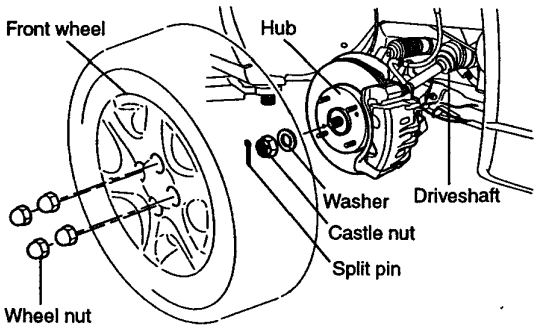


TORQUE : Nm (kg·cm, lb·ft)

ELCSD04A

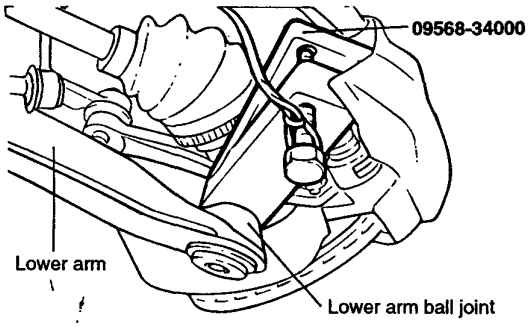
REMOVAL EBDAA1AA

1. Remove the front wheel and tire.
2. Remove the split pin, the castle nut and the washer.



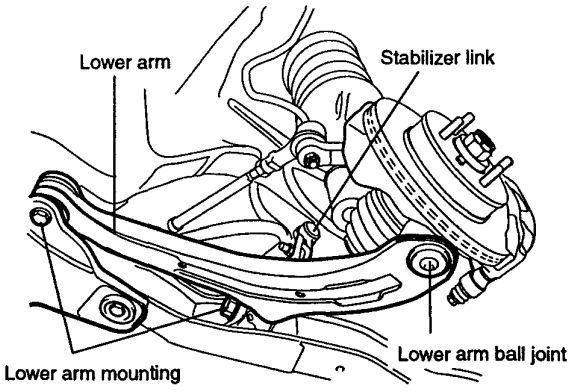
ELCDS02A

3. Loosen the lower arm ball joint nut, but do not remove it.
4. Remove the strut lower mounting bolts(2).
5. Push the axle hub outward to disconnect the drive shaft from the axle hub.
6. Using the Special Tool(09568-34000), disconnect the lower arm ball joint from the lowerarm.



EHDD251A

7. Install the strut lower mounting bolt temporarily.
8. Remove the stabilizer link nut.
9. Remove the lower arm bush (A) and bush (G) mounting bolts(2).



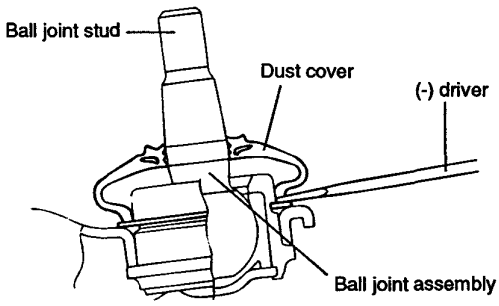
ELCSD14A

10. Remove the lower arm assembly.

DISASSEMBLY E481B1D8

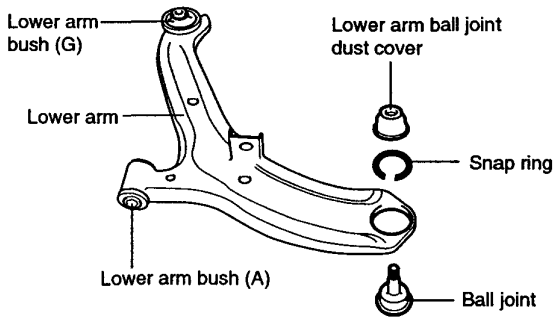
BALL JOINT AND DUST COVER REPLACEMENT

1. Using a screwdriver, remove the dust cover from the lower arm ball joint.
   If the driver is used with a vice-flier, the work would be even easier.



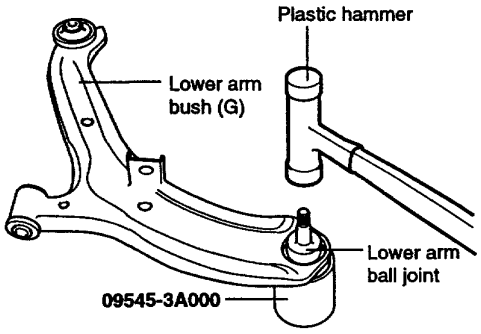
EHDA253D

2. Remove the snap ring.



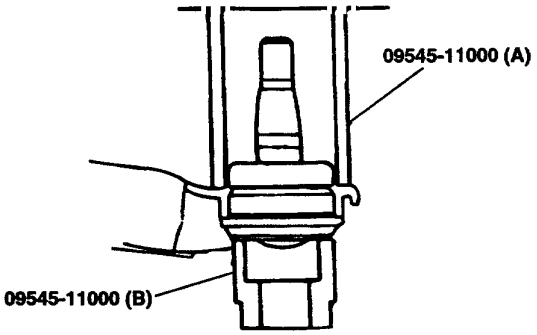
ELCSD18A

3. Using a plastic hammer, disconnect the ball joint from the lower arm.
   Hammering with the special tool(09545-3A000) placed under the lower arm as shown may prevent the deformation of the lower arm.



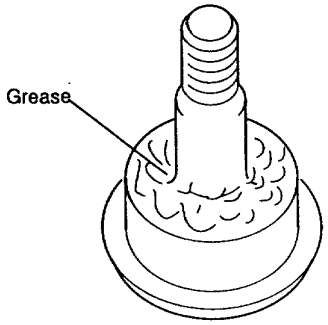
ELCSD19A

4. Using Special Tool(09545-11000), press the ball joint into the lower arm assembly.
   Unless it it pressed firmly, the snap ring will not fit perfectly to the groove.



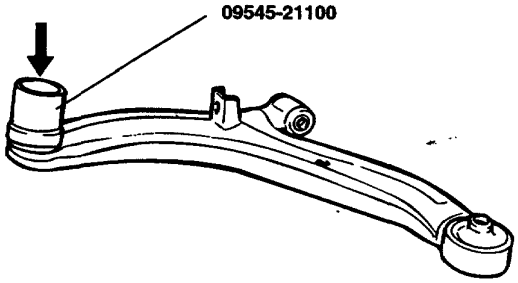
EHDA253E

5. Install the snap ring.
6. If there is not sufficient grease on the ball joint assembly.



ELCSD10A

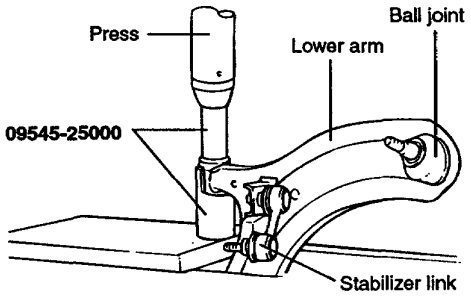
7. Using special tool(09545-21100), install the dust cover. The Special Tool will make the installing operation even easier.



EHDA253B

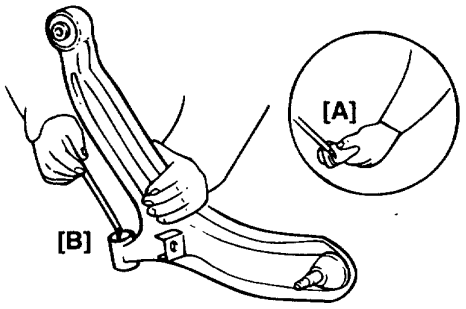
LOWER ARM BUSHING (A) REPLACEMENT

1. Install the Special Tool(09545-25000) and the lower arm on the press-machine.
2. Remove the bush (A).



EHDD253F

3. Apply soap solution to the following parts.
   - Outer surface of the new bush (A).
   - Inner surface of the lower arm bushing mount (B).



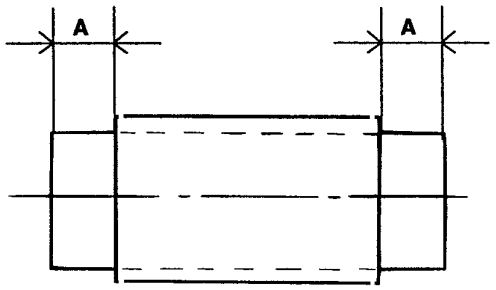
EHDD253G

4. Install the new bushing onto the lower arm by using special tool.

5. Center the bushing by using by the following procedure, if necessary.
   - Reset the Special Tool and lower arm.
   - Center the bushing.

NOTE

After centering the bushing, wipe off the soap solution.



EHDA253H

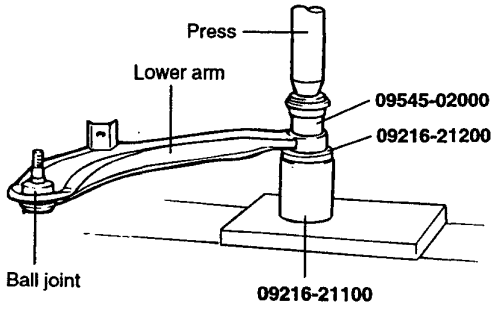
LOWER ARM BUSHING (G) REPLACEMENT

1. Install the Special Tool(09216-21100, 09216-21200, 09545-02000) and the lower arm.

2. Press out the bush (G).

3. Apply soap solution to the following parts.
   - Outer surface of the bushing
   - Inner surface of the lower arm bushing mount.

4. Install the new bushing onto the lower arm by using Special Tool. (09216-21100, 09216-21200, 09545-02000)



EHDD253C

INSPECTION EE7D3FCB

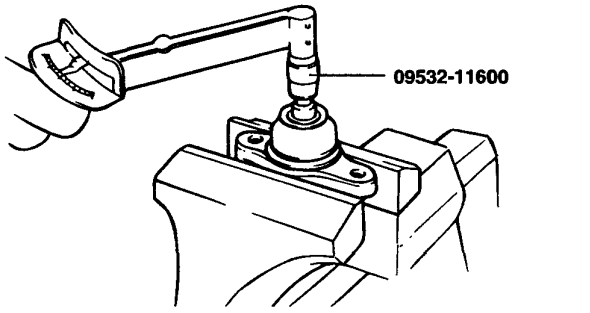
1. Check the bushing for wear and deterioration.

2. Check the lower arm for bending or breakage.

3. Check the ball joint dust cover for cracks.

4. Check all bolts.

5. Check the lower arm ball joint for rotating torque.



EHDA254A

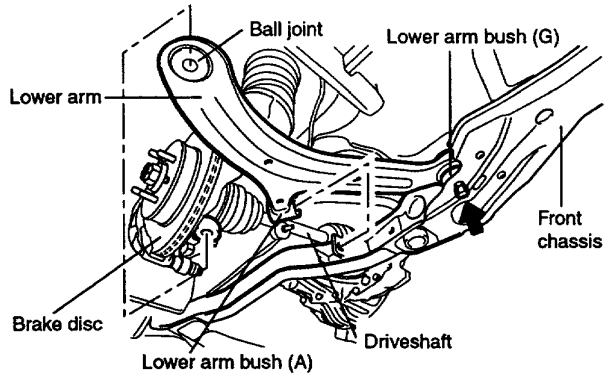
- If a crack is noted in the dust cover, replace the ball joint assembly.
- Shake the ball joint stud several times. (See page SS-p.12)
- Measure the balll joint rotating torque.

Standard value
2.5-9 Nm (25-90 kg·cm, 1.8-6.6 lb·ft)

- If the rotating torque exceeds the upper limit of the standard value, replacethe ball joint assembly.
- Even if the rotating torque is below the lower limit of the standard value, theball joint may be reused, unless it has drag and excessive play.

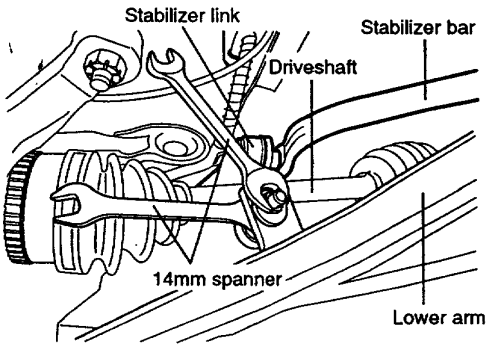
INSTALLATION E847E9C4

1. First, fix the lower arm bush (G) and then bolt up slightly.



ELCSD15A

2. It would be better to insert the driveshaft spline and the ball joint in the knuckle nearly at the same time.
3. Install the stabilizer link in the lower arm assembly the moment the driveshaft is inserted gradually.
   Do not, however, tighten the self-locking nut in this procedure yet.
4. Push the brake disc and hub inward in order to assemble the lower arm bush (A) to the front chassis.
5. Tighten the lower arm bush (A) bolt.
6. Tighten the lower arm bush (G) bolt completely which was fixed slightly.
7. After fixing the stabilizer link using 14mm spanner, tighten the self-locking nut.

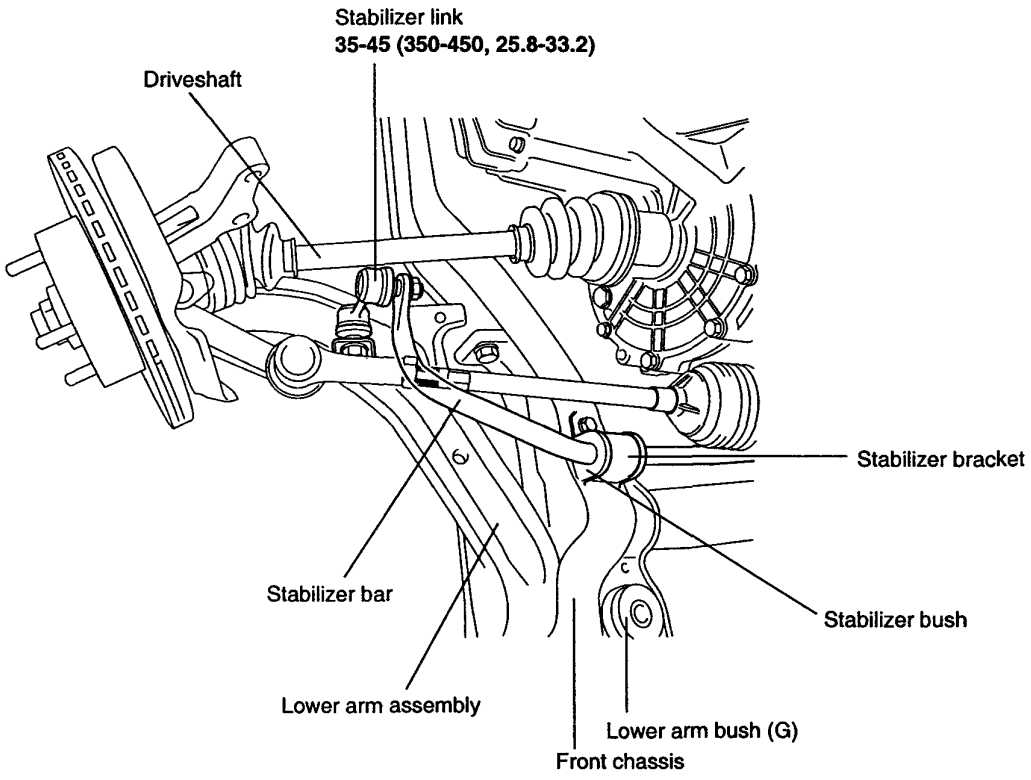


ELCSD16A

8. Assemble the washer, the castle nut and the split pin.
9. Install the wheel and tire.

FRONT STABILIZER BAR

COMPONENTS EB8ADDBB

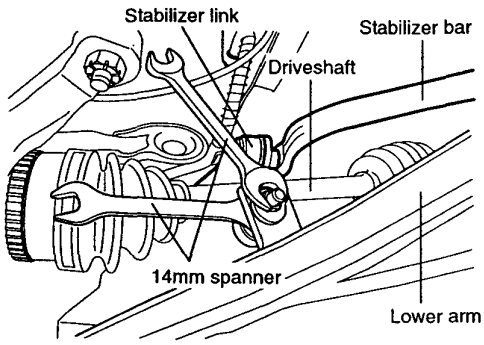


TORQUE : Nm (kg·cm, lb·ft)

ELCSD11A

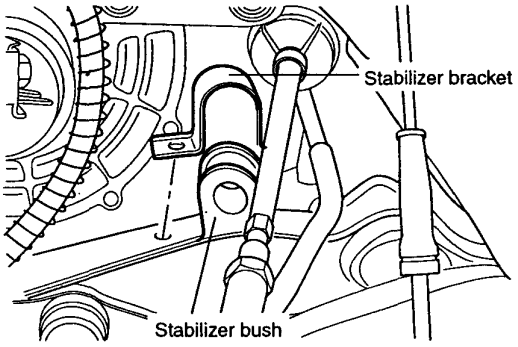
REMOVAL E3B7B146

1. Remove the front wheel.
2. Remove the stabilizer link assembly.



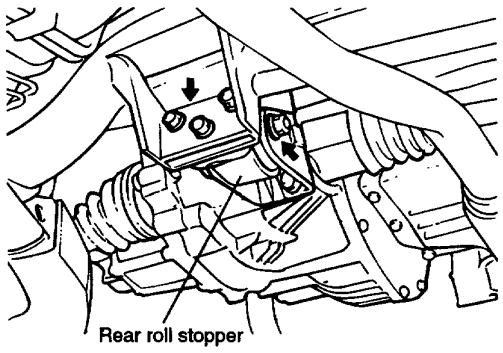
ELCSD16A

3. Remove the stabilizer bracket and bush.



ELCSD27A

4. Remove the rear roll stopper.

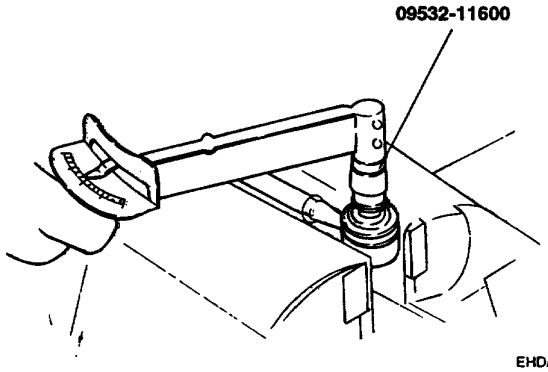


EHDD009B

5. Remove the stabilizer bar.

INSPECTION E7A9EB9F

1. Check the stabilizer bar for deterioration and damage.
2. Check all bolts for condition and straightness.
3. Check the stabilizer link dust cover for cracks or damage.
4. Check the stabilizer link ball joint rotating torque.



EHDA302A

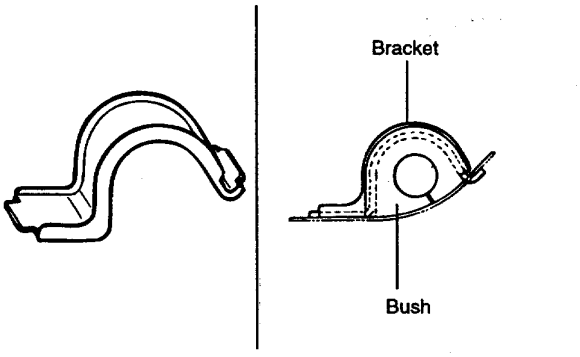
- If there is a crack in the dust cover, replace it and add grease.
- Shake the stabilizer link ball joint stud several times.
- Mount the self-locking nut on the ball joint, and then measure the ball jointrotating torque.

Standard value
1.7-3.2 Nm (17-32 kc·gm, 1.3-2.4 lb·ft)

- If the rotating torque exceeds the upper limit of the standard value, replacethe stabilizer link.
- Even if the rotating torque is below the lower limit of the standard value,the ball joint may be reused unless it has drag and excessive play.

INSTALLATION E0DFBD2F

1. Install the bush onto the stabilizer bar.
2. Align the bracket with the bush.
   Make sure the projections are securely in the space of the bracket.



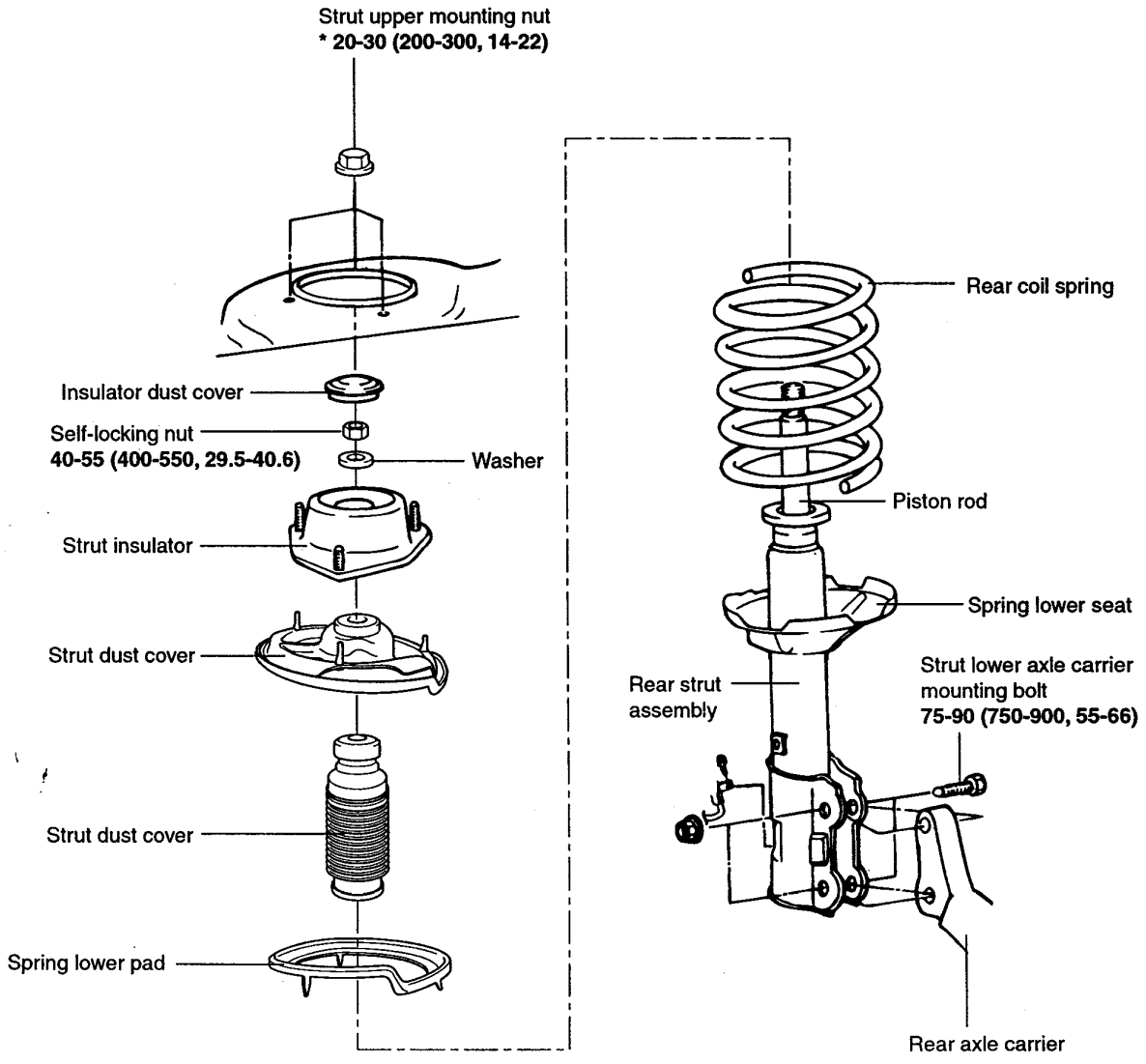
EHDA303A

3. Using the access opening, temporarily tighten the bush fixtures then positionthe bush on the opposite side.
4. Secure the stabilizer link with a open-end wrench (14 mm) theninstall the self locking nut.
5. Install the rear roll stopper.

REAR SUSPENSION SYSTEM

REAR STRUT

COMPONENTS E7F457D9



CAUTION

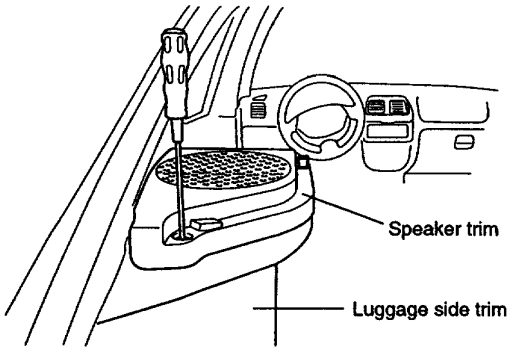
* **Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in an unladen condition.**

TORQUE : Nm (kg·cm, lb·ft)

EHDD600A

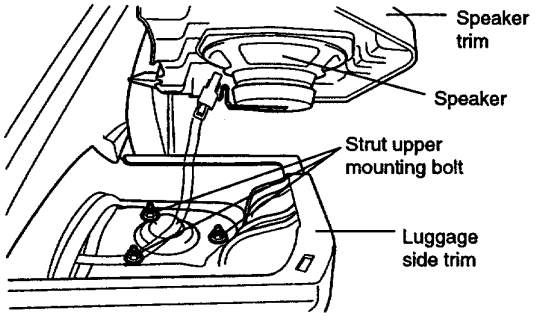
REMOVAL EBD1A95F

1. Fold down the rear seat back assembly.
2. Remove the speaker trim and the luggage side trim.



ELCSD32A

3. Remove the rear strut upper mounting nuts(3).



ELCSD33A

4. Remove the wheel and tire.
5. Disconnect the brake hose and wheel speed sensor wiring from the rear strut.
6. Remove the strut and carrier mounting bolts(2).

⚠ CAUTION

Be careful not to drop the rear strut.

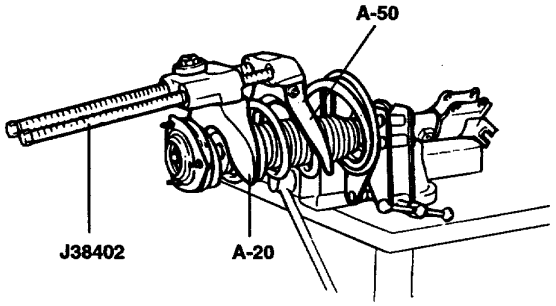
7. Remove the rear strut assembly.

DISASSEMBLY E82E5B09

1. Using the Special Tool, compress the coil spring until there is only a littletension on the strut.

NOTE

Do not use an impact gun.

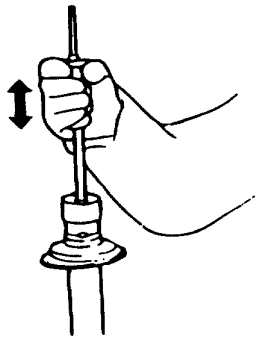


EHDA602A

2. Remove the nut at the top end of the shock absorber.
3. Remove the spring upper seat, coil spring, dust cover and strut assembly.

INSPECTION E7C55CAF

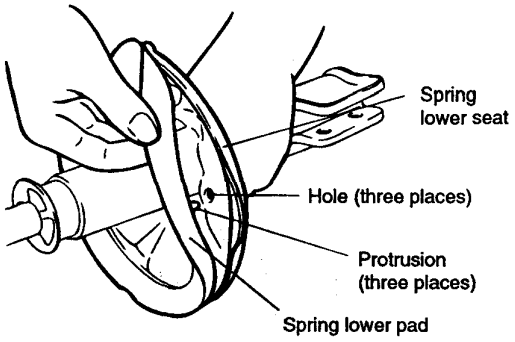
1. Check the insulator for wear or damage.
2. Check the rubber parts for damage or deterioration.
3. Check the coil spring for sagging and weakness.
4. Check the shock absorber for abnormal resistance or unusual sounds.



EHDA603B

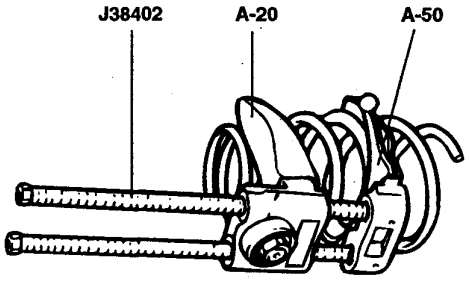
REASSEMBLY EACCBE9A

1. Install the lower spring pad so that the protrusions fit in the holes in thespring lower seat.



EHDD204A

2. Install the dust cover on the shock absorber.
3. Using the Special Tool, compress the coil spring. After spring is fully compressed, install it on the shock absorber.



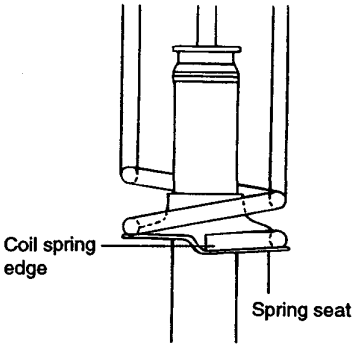
EHDA604C

4. After fully extending the piston rod, install the spring seat and insulatorassembly.

NOTE

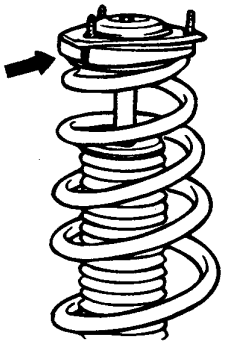
Align the D-shaped hole in the spring seat upper assembly with the indentationon the piston rod.

5. After having correctly seated the upper and lower ends of the coil springin the upper and lower spring seat grooves, fully install the new self-lockingnut but do not tighten.



EHDA204C

6. Position the bolt of the spring seat to align with the projection of the padas shown in the illustration.



EHDA603A

7. Remove the Special Tool.
8. Tighten the self-locking nut to the specified torque.

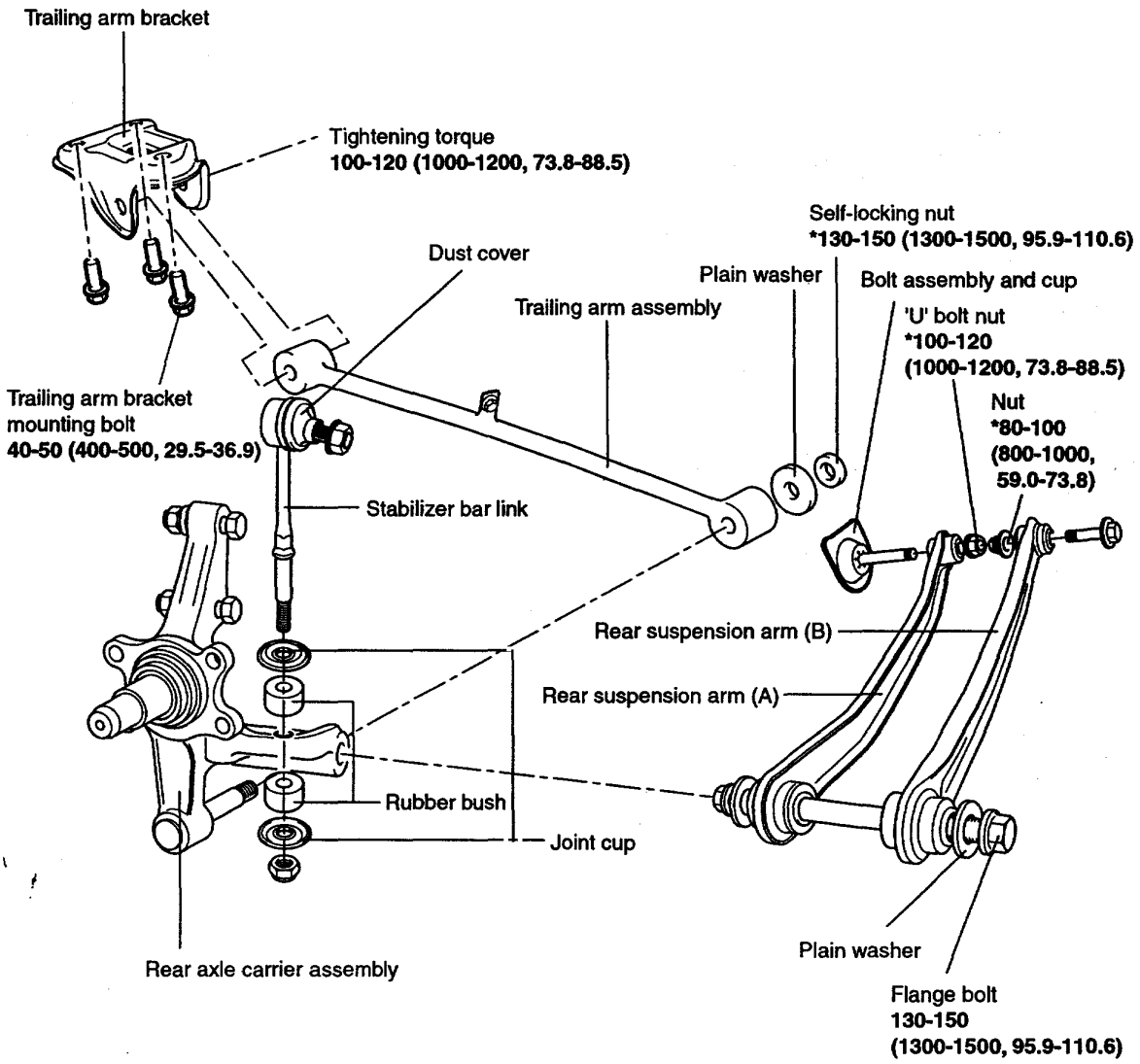
Tightening torque
40-55 Nm (400-550 kg·cm, 29.5-40.6 lb·ft)

INSTALLATION E58BF062

Installation is in the reverse order of removal. (See page SS-p.21)

UPPER ARM, LOWER ARM AND ASSIST LINK

COMPONETS EFDA3BFC



CAUTION

* **Indicates parts which should be temporaily tightened, and then fully tightened with the vehicle on the ground in an unladen condition.**

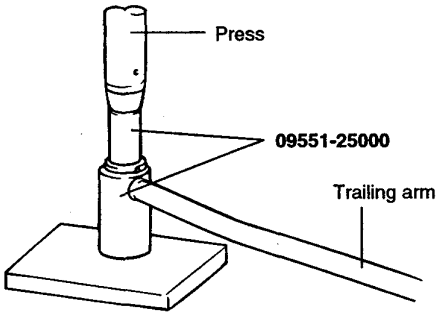
TORQUE : Nm (kg·cm, lb·ft)

ELCSD96A

TRAILING ARM

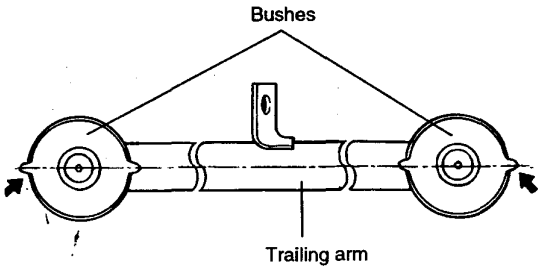
TRAILING ARM BUSH REPLACEMENT EFE06B4E

1. Install the Special Tool(09551-25000) and the trailing arm on a press.



EHDD651A

2. Press out the bush.
3. Apply soap solution to the new bush and the trailing arm bush mount.
4. Position the projection of the bush in a line as shown in the illustration.



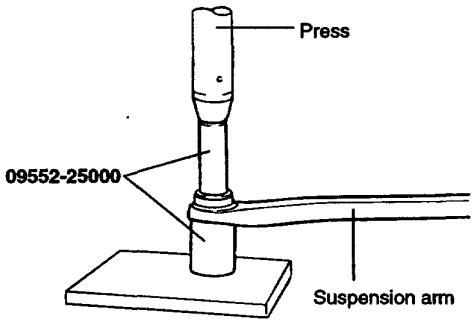
EHDD651B

5. Using the Special Tool (09551-25000), press fit the bushing.

REAR SUSPENSION ARM

REAR SUSPENSION ARM (A,B) BUSH REPLACEMENT EA0C9FE0

1. Install the Special Tool(09552-25000) and the suspension arm on a press.



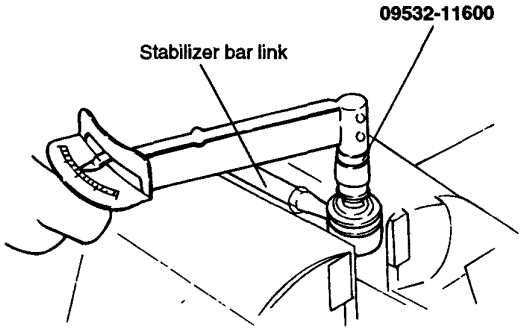
EHDD652A

2. Press out the bushing.
3. Apply soap solution to the new bushing and suspension arm.
4. Using the Special Tool (09552-25000), press fit the bushing.

REAR STABILIZER BAR

REAR STABILIZER BAR E3A9266B

1. Remove the stabilizer bar and link assembly.
2. Check the stabilizer link ball joint rotating torque.



EHDD653A

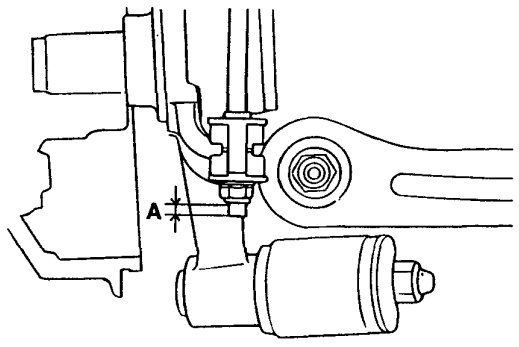
- If there is a crack in the dust cover, replace it and add grease. (refer to 'Lubricants'. See page SS-p.4)
- Shake the stabilizer link ball joint stud several times.
- Mount the self-locking nut on the ball joint, and then measure the ball jointrotating torque.

Standard value
0.3-1.0 Nm (3-10 kg·cm, 0.22-0.73 lb·ft)

- If the rotating torque exceeds the upper limit of the standard value, replacethe stabilizer link.
- Even if the rotating torque is below the lower limit of the standard value,the ball joint may be reused unless it has drag and excessive play.

3. Install the stabilizer link lower mounting nut so that the distance (A) isat the standard value.

Standard value (A) : 4-6 mm (0.157-0.236 in.)



EHDA653B

TIRES / WHEELS

TIRES

E1C42C9F

TIRE WEAR

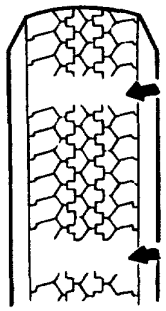
1. Measure the tread depth of the tires.

Tread depth of tire [Limit] : 1.6mm (0.06 in.)

2. If the remaining tread depth is less than the limit, replace the tire.

NOTE

When the tread depth of the tires is less than 1.6 mm (0.06 in.) the wear indicators will appear.



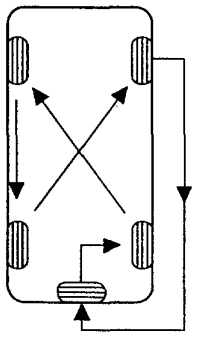
EHA9850E

TIRE ROTATION

Rotate the tires in the pattern illustrated.

NOTE

The temporary spare tire should not used in the wheel rotation.

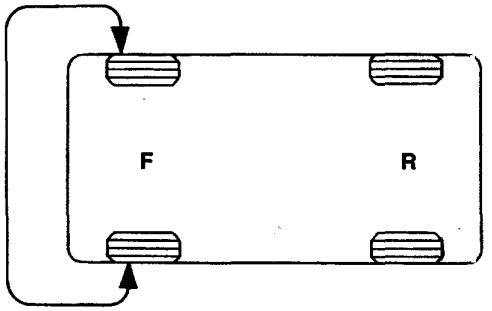


KLCSD21A

CHECKING FOR PULL AND WANDER

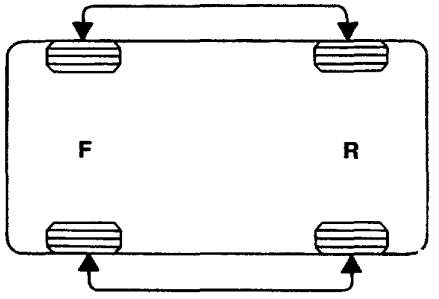
If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

1. Switch the front right and front left tires, and perform the road test inorder to confirm vehicle statility.



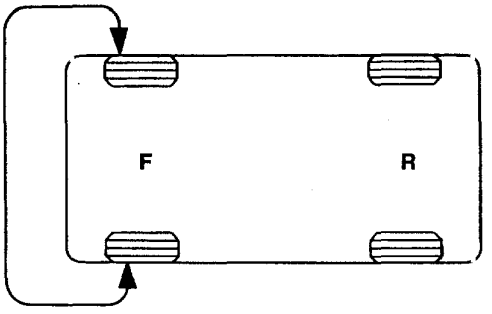
EHDA854B

2. If the steering pulls to opposite side, switch the front and rear tires, and again perform the road test.



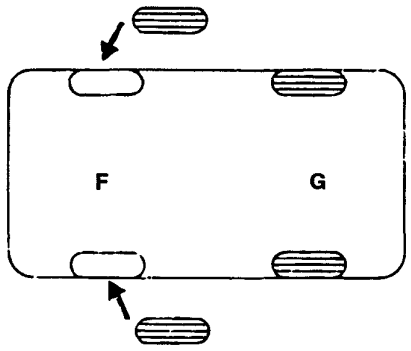
EHDA854C

3. If the steering continues to pull to one side, switch the front right and left tires again, and again perform the road test.



EHDA854B

4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.



EHDA854D

TIRE CHAINS AND SNOW TIRES

1. Use tire chains only on the front wheels. Do not use tire chains on rear wheels.
2. When using snow tires, use them on all four wheels for maneuverability andsafety.

WHEELS

EDEAAFA9

FRONT WHEEL ALIGNMENT

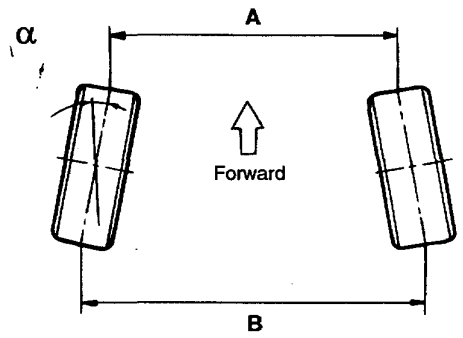
When using commercally-available computerized four wheel alignment equipment (caster, camber, toe and turning angle) to inspect the front wheel alignment, always position the car on a level surface with the front wheels facing straight ahead. Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the wheels and tires face straight ahead and the tires are inflated to the specified pressure.

TOE-IN

Toe-in (B-A or angle α) is adjusted by turning the tie rod turnbuckles. Toe-in on the left front wheel can be reduced by turning the tie rod toward the of the car. Toe change is achieved by turning the tie rod for the right and left wheels by the same amount simultaneously as follows :

Standard value
Toe-in (B-A) : 0±3 mm (0±0.12 in.)

Description		Toe changes mm (in.)/deg.
No. of turns of tie rod (Same amount for right and left)	1/2	Approx. 5.5(0.217)/32.5′
	1	Approx. 11(0.433)/1°

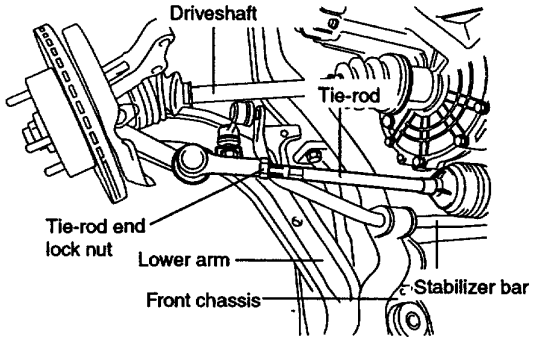


EHDA850A

NOTE

- *Toe-in adjustment should be made by turning the right and left tie rods at the same amount.*
- *When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.*
- *After the adjustment, tighten the tie rod end lock nuts firmly and reinstall the bellows clip.*

Tightening torque
Tie rod end lock nuts :
50~55 Nm (500~550 kgf·cm, 36~40 lb·ft)



ELCSD99A

CAMBER

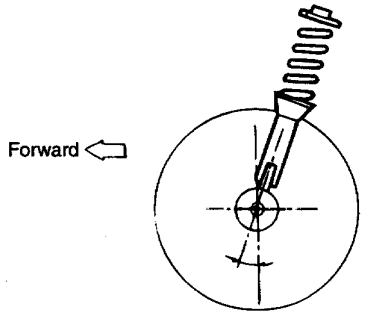
The steering knuckle which is integral with the strut assembly is pre-adjustedto the specified camber at the factory and requires no adjustment.

Standard value
Front camber : 0° ± 30′

CASTER

Caster is pre-set at the factory and can not be adjusted. If the caster measured is not within the standard value below, replace the bent or damaged parts.

Standard value
Front caster : 1°48′ ± 30′



EHHA850C

NOTE

1. *The front suspension assembly must be free of worn, loose or damaged partsprior to measuring front wheel alignment.*
2. *Measure wheel alignment by using the special tool (09529-21000).*
3. *Camber and caster are pre-set at the factory and cannot be adjusted.*

REAR WHEEL ALIGNMENT

TOE-IN

Standard value
Rear toe-in : 3 ± 2mm (0.12 ± 0.079 in.)

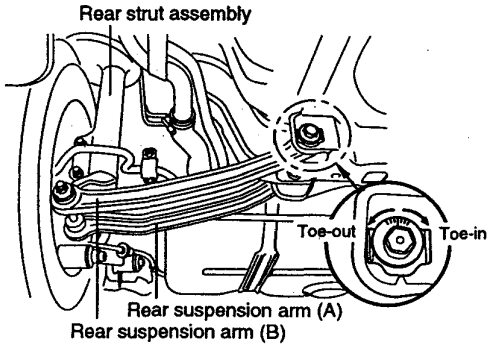
NOTE

- *Release parking brake for the better measurement.*
- *The rear suspension arm (B) mounting bolt should be turned an equal amount on both sides when adjusting.*

Inside of the vehicle : toe-in
Outside of the vehicle : toe-out
The scale has graduations of approximately
2.4 mm (0.09 in.)
(single side toe angle quivalent to 14')

CAUTION

The eccentric bolt should be adjusted within a 90° range left and rightfrom the center position.



ELCSD98A

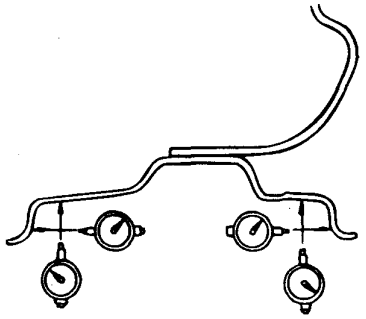
CAMBER

Standard value
Rear camber : -41' ± 30'

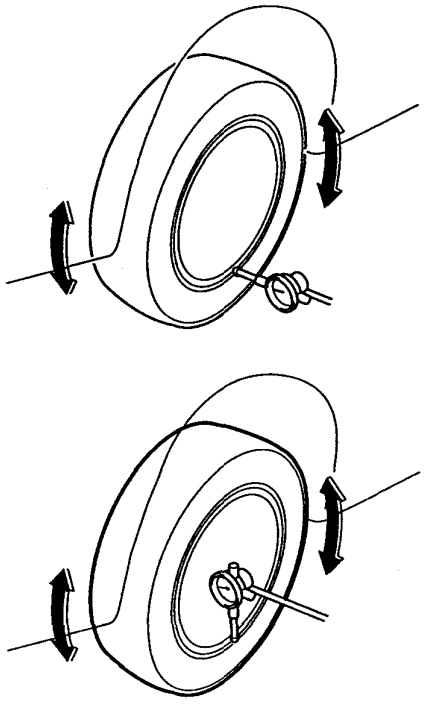
Rear camber is also pre-set at factory and can not be adjusted.
If the camber measured is not within the standard value below, replace the bent or dmaged parts.

WHEEL RUNOUT

1. Jack up a vehicle and support it with a jack stand.
2. Measure the wheel runout with a dial indicator as illustrated.



EHDA852B



KLCSD97A

3. Replace the wheel if the wheel runout exceeds the limit. (refer to 'SERVICE STANDARD'. see page SS-p.3)

Wheel runout [Limit]
Steel wheel
- Radial : 0.6mm (0.028 in.) : Average of LH & RH)
- Axial : 0.8mm (0.032 in.)

Aluminum wheel
- Radial : 0.3mm (0.012 in.)
- Axial : 0.3mm (0.012 in.)

WHEEL NUT TIGHTENING

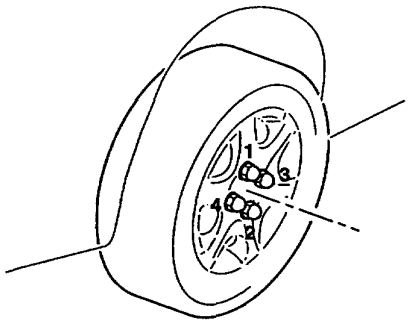
1. Tightening torque.
   Steel and aluminum alloy wheel.

Specified torque
90-110 Nm (900-1,100 kg·cm, 65-80 lb·ft)

⚠ ***CAUTION***

When using an impact gun, final tightening torque should be checked using a torque wrench.

2. Tightening order.
   Go around the wheel tightening every other nut until they are all tight.
   Then double-check each nut for tightness.



KLCSD20A

INSTRUCTIONS FOR ALUMINUM TYPE WHEELS

1. Aluminum is vulnerable to alkalies. If the vehicle has been exposed to automobilewashing detergent, or salt from sea water, or road chemicals, rinse the vehicleas soon as possible. Then apply wax to the wheels to prevent corrosion.

2. When steam cleaning the vehicle, do not direct the steam onto the aluminumwheels.
   When tightening nuts for aluminum wheels, observe the following :

   1) Clean the hub surface.

   2) After finger-tightening the wheel nuts, tighten to specifications.

   3) Do not use an impact gun or push the wrench by foot to tighten the wheel nuts.

   4) Do not apply oil to the threaded portions.

Transaxle / Transmission

GENERAL

MANUAL TRANSAXLE
- SPECIFICATIONS ..... TR -2
- TROUBLESHOOTING ..... TR -3
- SPECIAL TOOLS ..... TR -8

AUTOMATIC TRANSAXLE
- SPECIFICATIONS ..... TR -8
- LUBRICANTS ..... TR -9
- SPECIAL TOOLS ..... TR -10

AUTOMATIC TRANSAXLE SYSTEM

TROUBLESHOOTING ..... TR -11
DIAGNOSTIC ITEM ..... TR -55
AUTOMATIC TRANSAXLE HYDRAULIC CIRCUIT ..... TR -86

AUTOMATIC TRANSAXLE
- GENERAL INFORMATION ..... TR -98
- COMPONENTS ..... TR -99
- REMOVAL ..... TR -105
- INSTALLATION ..... TR -110

AUTOMATIC TRANSAXLE SHIFT CONTROL
- COMPONENTS ..... TR -111
- REMOVAL ..... TR -112
- INSTALLATION ..... TR -113
- INSPECTION ..... TR -116

SHIFT LEVER
- COMPONENTS ..... TR -117
- INSPECTION ..... TR -118
- REASSEMBLY ..... TR -118

MANUAL TRANSAXLE SYSTEM

GENERAL ..... TR -119

MANUAL TRANSAXLE
- COMPONENTS ..... TR -120
- REMOVAL ..... TR -122
- INSTALLATION ..... TR -126
- INSPECTION ..... TR -126

MANUAL TRANSAXLE SHIFT CONTROL
- COMPONENTS ..... TR -128
- REMOVAL ..... TR -129
- INSTALLATION ..... TR -130
- INSPECTION ..... TR -130

SHIFT LEVER
- COMPONENTS ..... TR -131
- INSPECTION ..... TR -132
- REASSEMBLY ..... TR -132

GENERAL

SPECIFICATIONS (M/T) EC68EDFB

Model		M5AF3			
Type		Forward 5 speed, reverse 1 speed			
Engine displacement		1.3SOHC	1.5SOHC	1.5DOHC	1.6DOHC
Gear ratio	First	3.615	3.615	3.615	3.615
	Second	2.053	2.053	2.053	2.053
	Third	1.370	1.370	1.370	1.370
	Fourth	0.971	0.971	0.971	1.031
	Fifth	0.825	0.825	0.780	0.825
	Reverse	3.250	3.250	3.250	3.250
Final gear ratio		3.842	3.842	3.842	3.842
Transaxle fluid		HYUNDAI GENUINE PARTS MTF 75W/90			
Capacity (Lit., u.s.qts, Imp.qts)		2.15 (2.27, 1.89)			

SERVICE SPECIFICATIONS (M/T)

Item	End play
Input shaft rear bearing end play	0.01L - 0.09L
Output shaft bearing end play	0.05T - 0.10T
Differential bearing end play	0.15T - 0.20T
Differential pinion end play	0.025L - 0.15L
Input shaft front bearing end play	0.01L - 0.12L

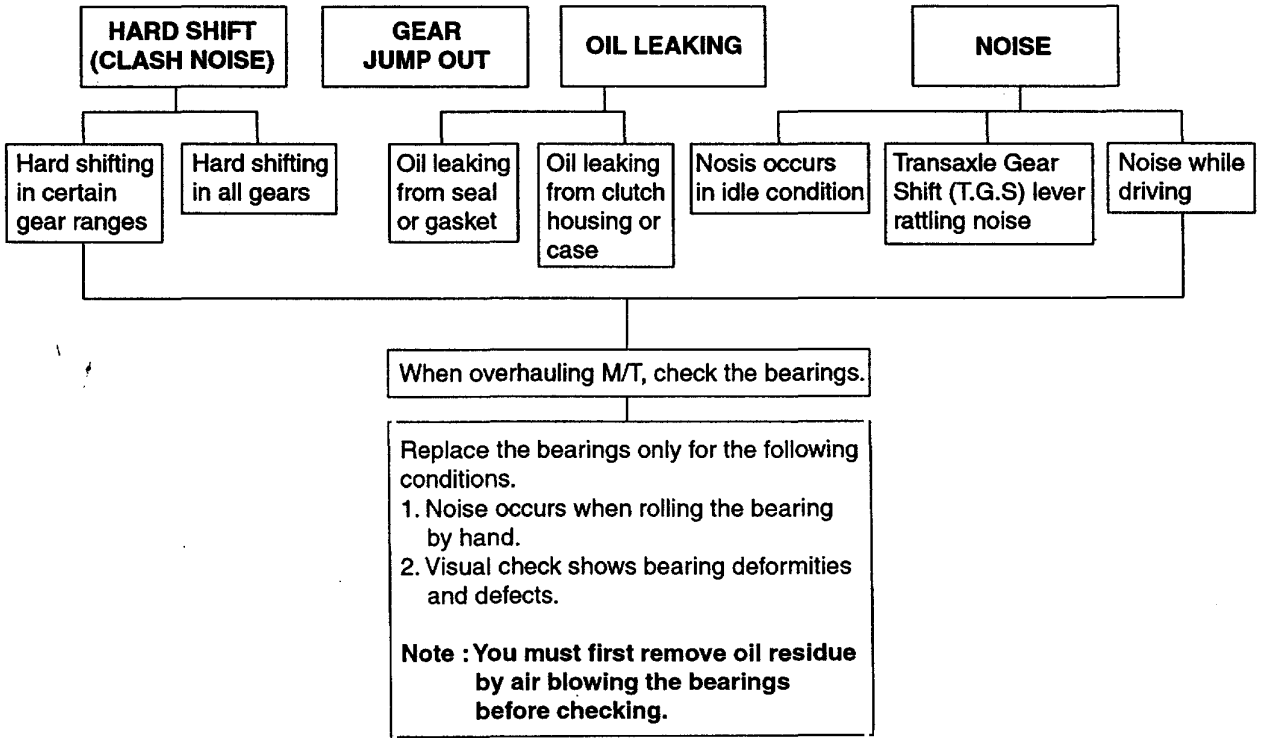
TIGHTENING TORQUE (M/T)

Item	N·m	Kg·cm	lb·ft
Shift lever mounting bolt	9-14	90-140	6-10
Clutch release cylinder	15-22	150-220	11-16
Control cable bracket	12-15	120-150	8-11
Front roll stopper to sub frame	30-40	300-400	21-28
Front roll stopper insulator bolt	45-60	450-600	33-44
Rear roll stopper to subframe bolt	30-40	300-400	21-28
Rear roll stopper insulator bolt	45-60	450-600	33-44
Transaxle mounting bracket to body frame	30-40	300-400	21-28
Transaxle mounting insulator bolt	90-110	900-1100	63-77

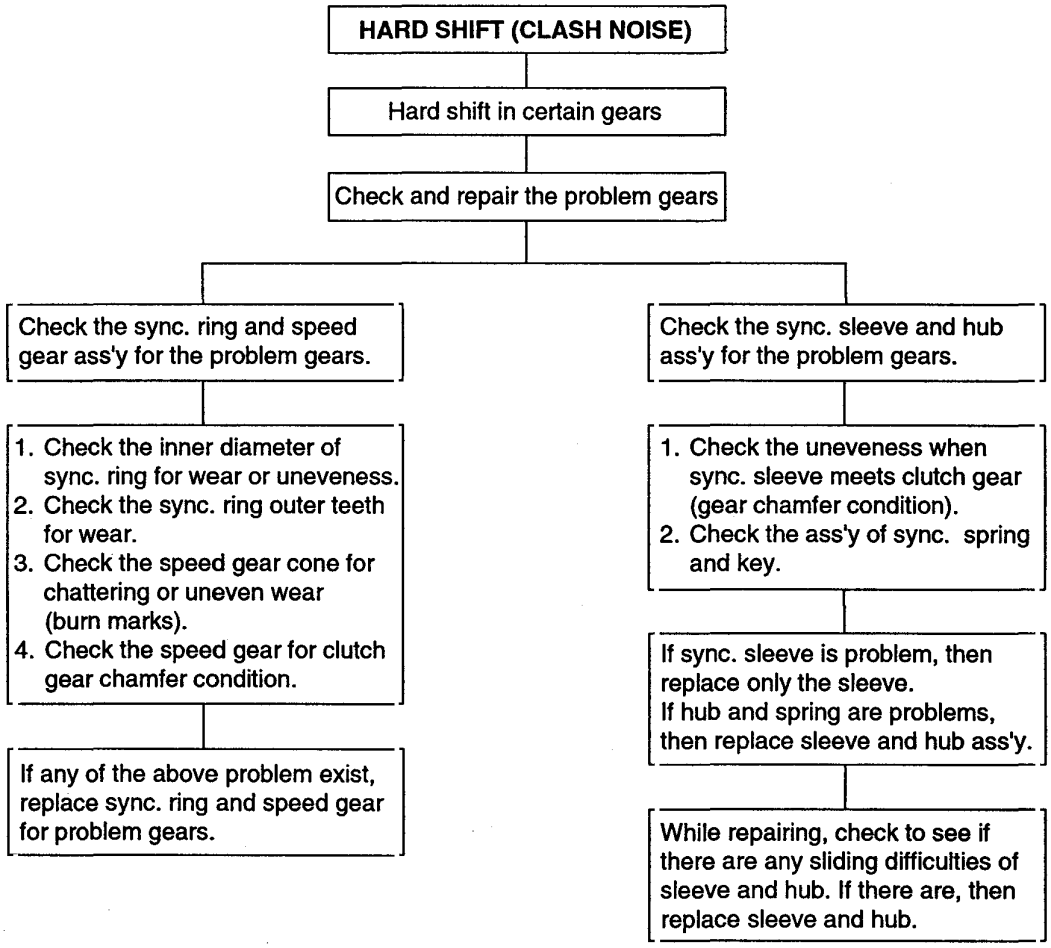
TROUBLESHOOTING (M/T) E3A2DAFD

Symptom	Probable cause	Remedy
Vibration, noise	Loose or damaged transaxle and engine mounts	Tighten or replace mounts
	Inadequate shaft end play	Correct end play
	Worn or damaged gears	Replace gears
	Inadequate grade of oil	Replace with specified oil
	Low oil level	Replenish
	Inadequate engine idle speed	Adjust idle speed
Oil leakage	Broken or damaged, oil seal or O-ring	Replace control cable
Hard shift	Faulty control cable	Replace control cable
	Poor contact or wear of synchronizer ring and gear cone	Correct or replace
	Weakened synchronizer spring	Replace synchronizer spring
	Inadequate grade of oil	Replace with specified oil
Jumps out of gear	Worn gear shift fork or broken poppet spring	Replace shift fork or poppet spring
	Synchronizer hub-to-sleeve spline clearance too large	Replace synchronizer hub and sleeve

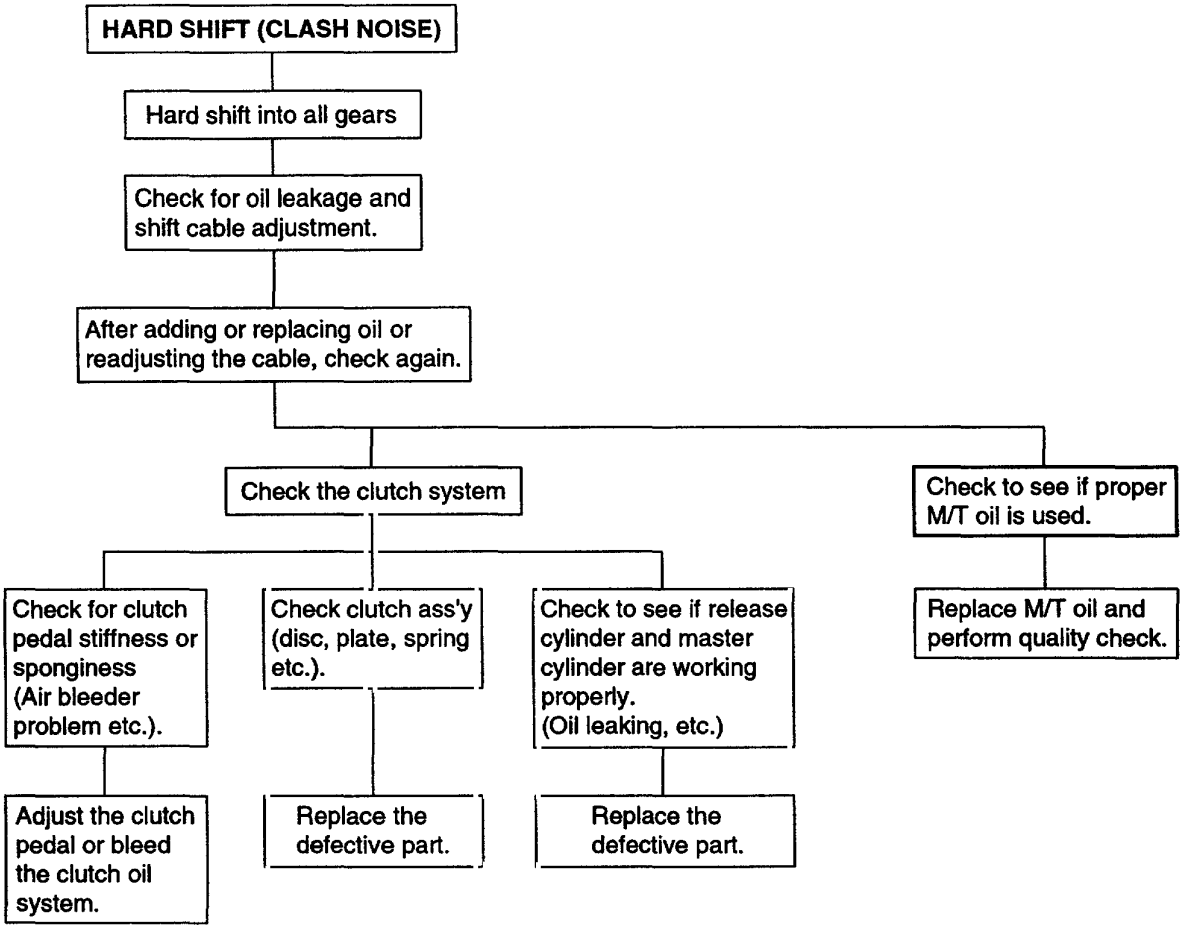
PROBLEM CHART (M/T)



EMDD900A

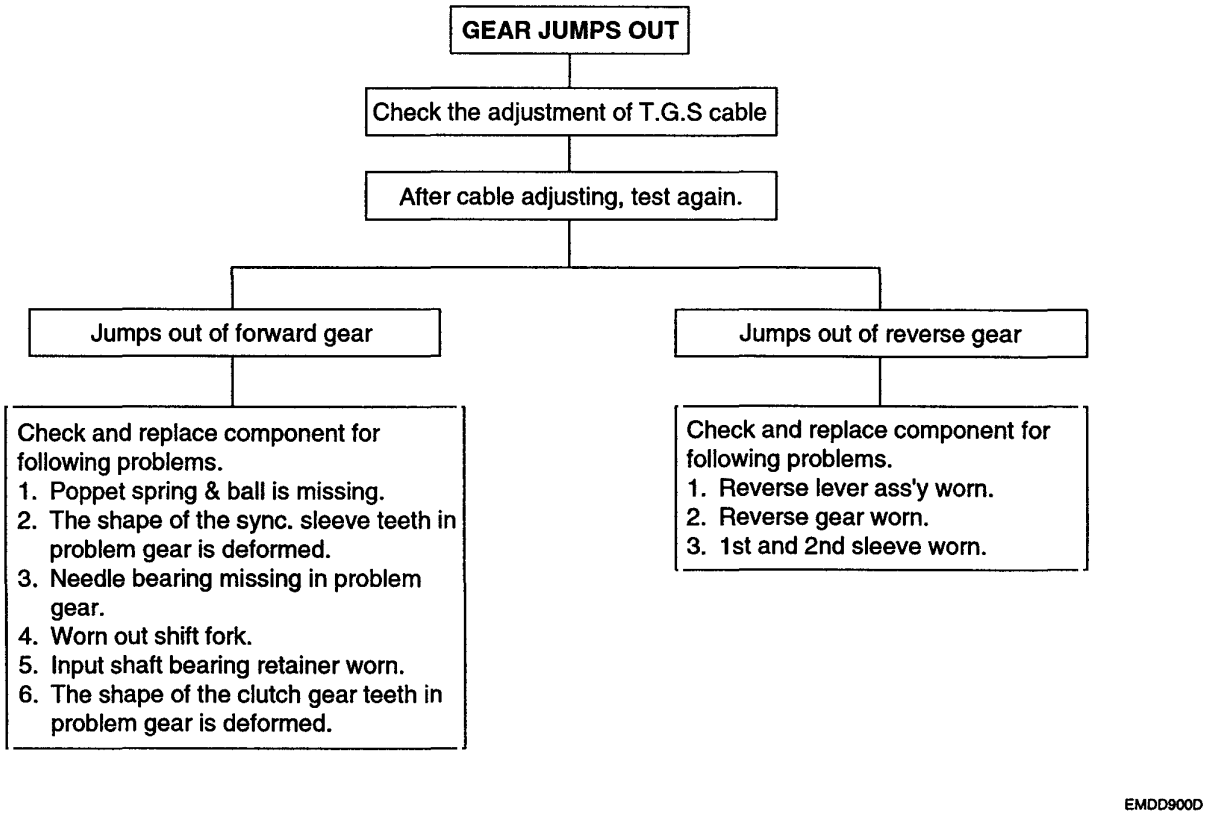

HARD SHIFT (CLASH NOISE)
Hard shift in certain gears
Check and repair the problem gears
Check the sync. ring and speed gear ass'y for the problem gears.
1. Check the inner diameter of sync. ring for wear or uneveness.
2. Check the sync. ring outer teeth for wear.
3. Check the speed gear cone for chattering or uneven wear (burn marks).
4. Check the speed gear for clutch gear chamfer condition.
If any of the above problem exist, replace sync. ring and speed gear for problem gears.
Check the sync. sleeve and hub ass'y for the problem gears.
1. Check the uneveness when sync. sleeve meets clutch gear (gear chamfer condition).
2. Check the ass'y of sync. spring and key.
If sync. sleeve is problem, then replace only the sleeve.
If hub and spring are problems, then replace sleeve and hub ass'y.
While repairing, check to see if there are any sliding difficulties of sleeve and hub. If there are, then replace sleeve and hub.

EMDD900B

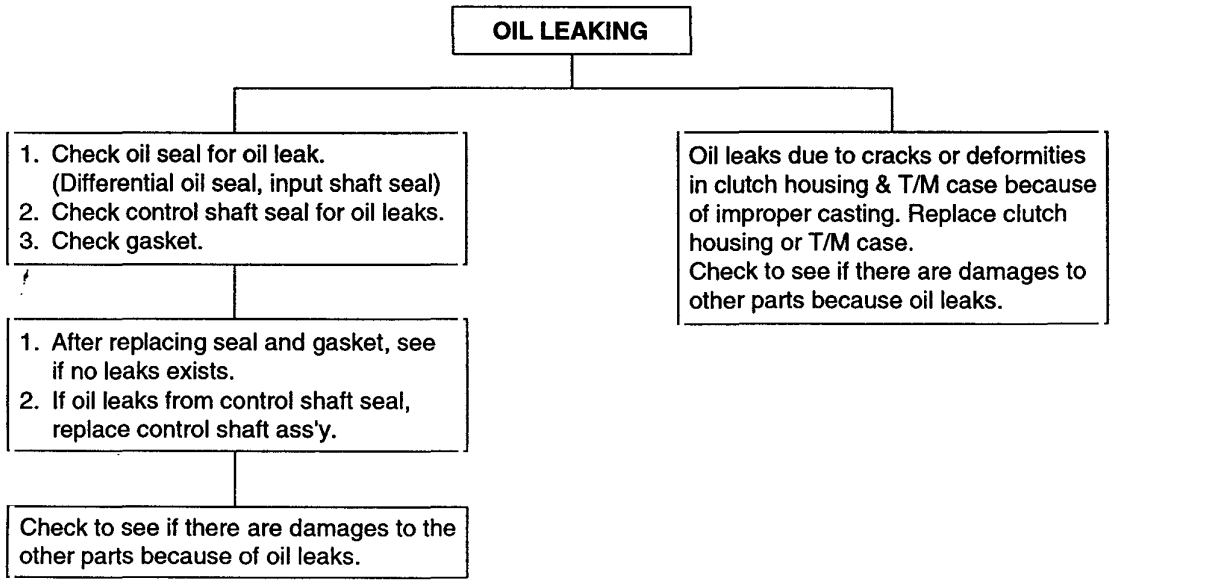


Before performing any work, check the driving habits of customers :
If shifting occurs as the clutch is being pressed, then hard shifting would occur in all gears.

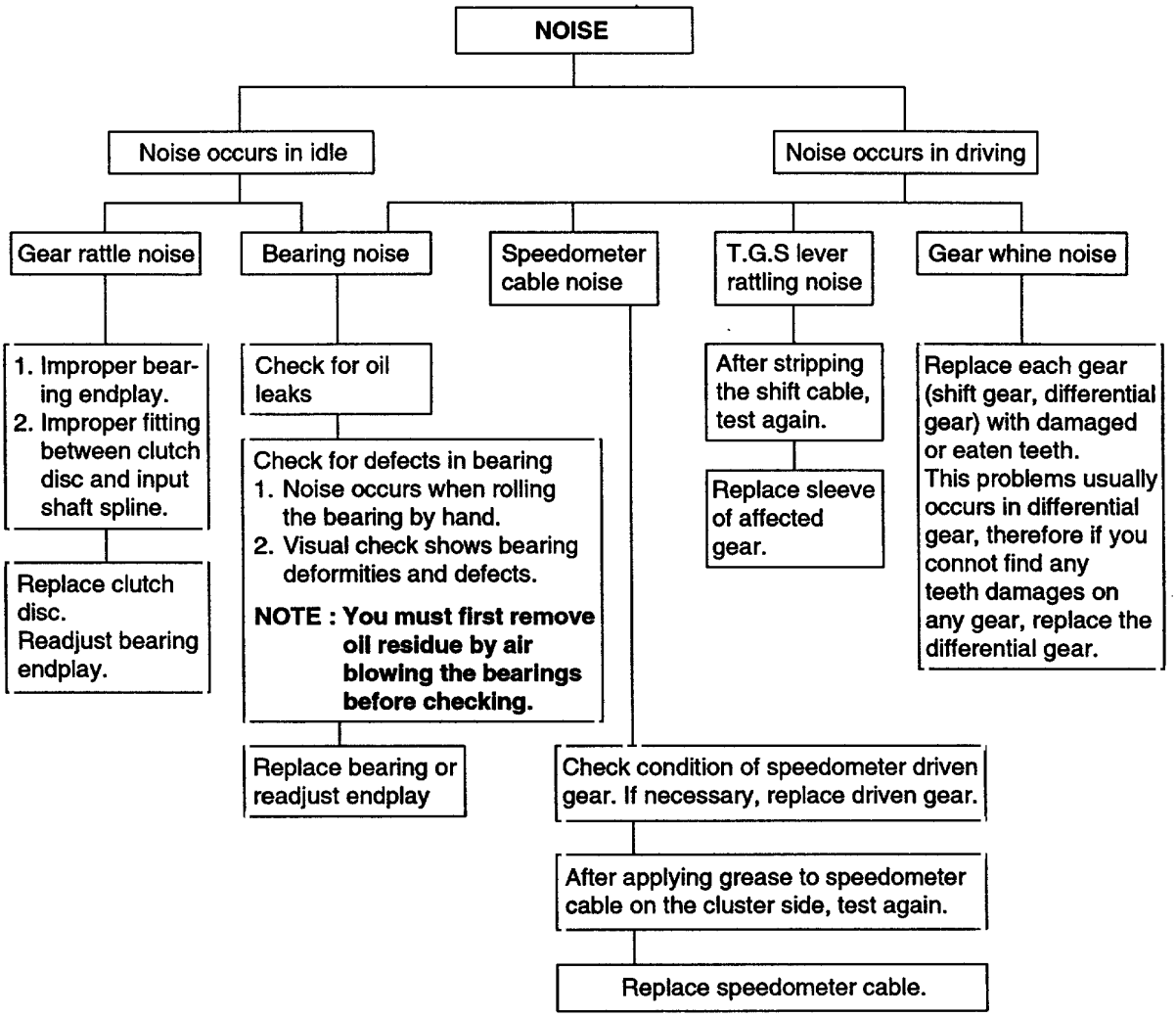
EMDD900C



EMDD900D

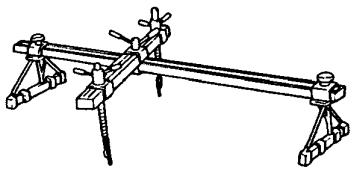


EMDD900E


NOISE
Noise occurs in idle
Noise occurs in driving
Gear rattle noise
Bearing noise
Speedometer cable noise
T.G.S lever rattling noise
Gear whine noise
1. Improper bearing endplay.
2. Improper fitting between clutch disc and input shaft spline.
Replace clutch disc.
Readjust bearing endplay.
Check for oil leaks
Check for defects in bearing
1. Noise occurs when rolling the bearing by hand.
2. Visual check shows bearing deformities and defects.
NOTE : You must first remove oil residue by air blowing the bearings before checking.
Replace bearing or readjust endplay
After stripping the shift cable, test again.
Replace sleeve of affected gear.
Replace each gear (shift gear, differential gear) with damaged or eaten teeth.
This problems usually occurs in differential gear, therefore if you connot find any teeth damages on any gear, replace the differential gear.
Check condition of speedometer driven gear. If necessary, replace driven gear.
After applying grease to speedometer cable on the cluster side, test again.
Replace speedometer cable.

EMDD900F

SPECIAL TOOLS (M/T) EA56D3F2

Tool (Number and Name)	Illustration	Use
09200-38001 Engine support fixture	 D0038001	Removal and installation of transaxle assembly

SPECIFICATIONS (A/T) E4AB01A4

Item		A4AF3			
Torque converter type		3-element, 1-stage, 2-phase type			
Transaxle type		4-speed forward, 1-speed reverse			
Engine displacement		1.3SOHC	1.5SOHC	1.5DOHC	1.6DOHC
Gear ratio	1st	2.846			←
	2nd	1.581			←
	3rd	1.000			←
	4th	0.685			←
Reverse		2.176			←
Final gear ratio		3.656			4.041
End play (mm)	Front clutch snap ring	0.5±0.1			
	Rear clutch snap ring	0.8±0.1			
	End clutch snap ring	0.5±0.1			
	Low and reverse brake snap ring	0.675~0.987			

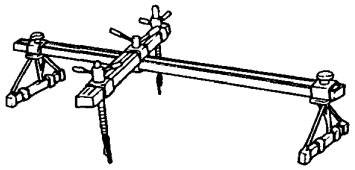
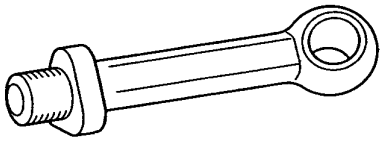
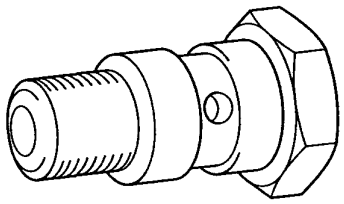
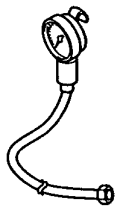
TIGHTENING TORUQE (A/T)

Item	N·m	kg·cm	lb·ft
Shift lever mounting bolt	12-15	120-150	8-11
Starter motor mounting bolt	27-34	270-340	19-25
Shift lever cam rod nut	14-20	140-200	10-14
Knob and lever assembly	More than 2	More than 20	More than 1.4
Bell housing cover to engine	8-10	80-100	6-7
Transaxle mounting bracket to body frame	30-40	300-400	21-28
Transaxle mounting insulator bolt	90-110	900-1100	63-77
Front roll stopper to subframe	30-40	300-400	21-28
Front roll stopper insulator bolt	45-60	450-600	33-44
Rear roll stopper to subframe bolt	30-40	300-400	21-28
Rear roll stopper insulator bolt	45-60	450-600	33-44
Kick down servo lock nut	15-22	150-220	11-16
Lever indicator panel	More than 15	More than 150	More than 11
Oil drain plug, filler plug	30-35	300-350	22-25
Transaxle range switch	10-12	100-120	7-9

LUBRICANT EA9DF82A

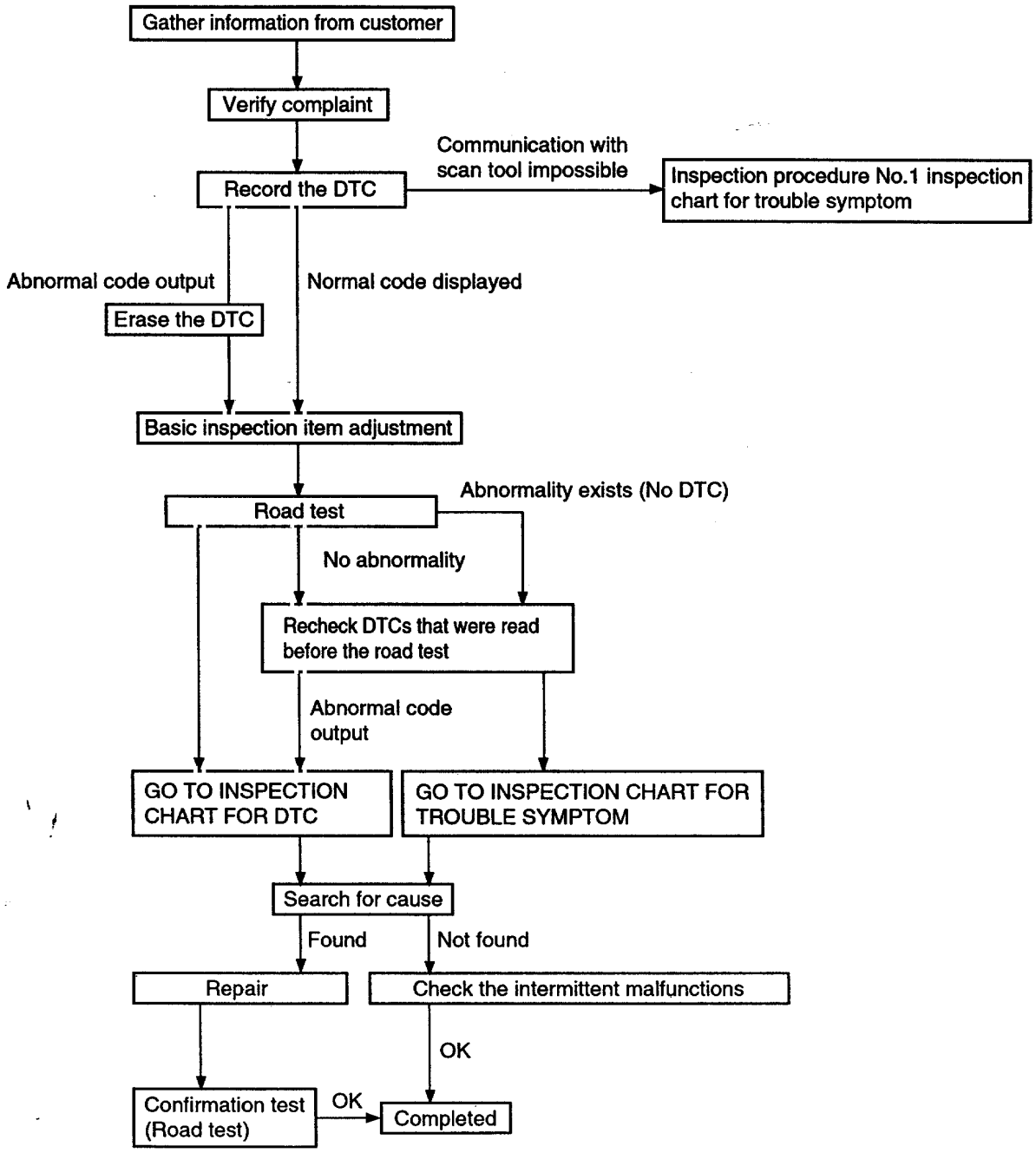
Items	Specified lubricant	Quantity
Transaxle fluid Lit. (U.S. qts., Imp.qts.)	GENUINE HYUNDAI ATF SP-III	6.1 (6.3, 5.3)
Drive shaft oil seal lip	Automatic transaxle fluid	As required
Sliding part of bushing	Chassis grease SAE J310, NLGI No.0	As required
Selector lever sliding portion	Multipurpose grease SAE J310, NLGI No.2	As required

SPECIAL TOOLS (A/T) E5B92D2F

Tool (Number and Name)	Illustration	Use
09200-38001 Engine support fixture	 D0038001	Removal and installation of transaxle assembly
09452-21001 Oil pressure gauge adapter	 EKAA006A	Measurement of the oil pressure (Use with 092452-21002, 09452-21500)
09452-21002 Oil pressure gauge adapter	 EKAA006B	Measurement of the oil pressure (Use with 09452-21500 and 09452-21001)
09452-21500 Oil pressure gauge	 EKAA006C	Measurement of the oil pressure (Use with 09452-21001 and 09452-21002)

AUTOMATIC TRANSAXLE SYSTEM

TROUBLESHOOTING (A/T) E1D3E8AE



EKFA102A

ROAD TEST

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure if there is an abnormality
1	Ignition switch : ON Engine stopped	Overdrive switch • ON • OFF	• OD • OD-OFF	Overdrive switch	Overdrive switch system
2	Engine : Stopped	Starting test with lever in P or N range	Starting should be possible	Starting possible or impossible	Starting impossible (will not crank)
3	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature 70~110°C	Gradually rises to 70~110°C	Oil temperature sensor	Codes - P0712, P0713 Oil temperature sensor system
4	Engine : Idling Selector lever : N	Accelerator pedal • Fully closed • Depressed • Fully open (for at least 2 seconds)	• 2~18% • Gradually rises from (1) • 80 ~ 100%	TPS	TPS system
		Selector lever operation • N→D shift • N→D shift	Should be no abnormal shifting shocks. Time lag should be within 2 seconds.	Malfunction when starting	Engine stalling during shifting
					Shocks when changing from N to D and long lag time
					Shocks when changing from N to R and long lag time
					Shocks when changing from N to D, N to R and long lag time
	Engine : Idling (Vehicle stopped) Selector lever position : D	Selector lever operation • N→D • N→R shift	Should be no abnormal shifting shocks. Time lag should be within 2 seconds.	Driving impossible	Does not move forward
					Does not move (forward or reverse)

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure if there is an abnormality
5	Engine : Idling (Vehicle stopped) Selector lever position : D	Accelerator pedal • Fully closed • Depressed [Driving at 5km/h (3.1 mph)]	• 75~90% • 100%	Pressure control solenoid valve (PCSV) - A, B	Code P0745, P0775 - Pressure control solenoid valve system
		Accelerator pedal • Fully closed • Depressed	• C • 1	Shift control solenoid valve A (SCSV-A)	Code P0750 - Shift control solenoid valve A system
					Code P0755 - Shift control solenoid valve B system
					Code P0760 - Shift control solenoid valve C system
6	Selector lever position : D Overdrive : OFF	Engine • Idling (vehicle stopped) • Driving at 10km/h • Driving at constant speed of 50km/h (31mph) (20 seconds or more) • Driving at constant speed of 40km/h (25mph) with selector lever in 2 range • Driving at constant speed of 70km/h (43mph) with selector lever in D range	• C • 1 • 3 • 2	Shift control solenoid valve A (SCSV-A)	Code P0750 - Shift control solenoid valve A system
				Shift control solenoid valve B (SCSV-B)	Code P0755 - Shift control solenoid valve B system
				Shift control solenoid valve C (SCSV-C)	Code P0760 - Shift control solenoid valve C system
			• OFF • ON • ON • OFF	Kickdown servo switch	Code P1709 - Kickdown servo switch system
			• 0km/h • 10km/h • 50km/h • 40km/h	Vehicle speed sensor	Vehicle speed sensor system
			(3) 1,500~2,000rpm	Pulse generator A (PG-A)	Code P0717 - Pulse generator A system
			(3) 1,500~2,000rpm	Pulse generator B (PG-B)	Code P0722 - Pulse generator B system
			(3) 100~300rpm (5) 0~10rpm	Torque converter clutch solenoid	Code P0743 - Torque converter clutch solenoid
			(5) TCCS Duty : 40~85	Torque converter clutch solenoid	Code P0743 - Torque converter clutch solenoid
			For (3) and (5), acceleration should be smooth with no abnormal vibration	Malfunction while driving	Poor acceleration
					Vibration

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure if there is an abnormality
7	Selector lever position : D Overdrive : ON	Engine (1) Driving at constant speed of 50km/h (31mph) (20 seconds or more)	(1) 3 speed gear (1) 1,500~2,000rpm	Shift control solenoid valve A (SCSV-A)	Code P0750 - Shift control solenoid valve A system
				Shift control solenoid valve B (SCSV-B)	Code P0755 - Shift control solenoid valve B system
				Shift control solenoid valve C (SCSV-C)	Code P0760 - Shift control solenoid valve C system
				Pulse generator A (PG-A)	Code P0717 - Pulse generator A system
				Pulse generator B (PG-B)	Code P0722 - Pulse generator B system
8	Selector lever position : D Overdrive : ON	• Accelerate to 4th gear at TPS output of 1.5V (opening angle 30%) • Slowly decelerate to a standstill • Accelerate to 4th gear at TPS output of 2.5V (opening angle 50%) • At 50km/h (31mph) in 4th gear, turn overdrive OFF • At 50km/h (31mph) in 3rd gear, move selector lever to 2 range • At 20km/h (12mph) in 2 range, move selector lever to L range.	For (1), (2) and (3) should match the specified output shaft speed (vehicle speed0, and there should be no abnormal shocks. For (4), (5) and (6), down shifting should be made immediately after operation.	Malfunction when shifting	Shocks and flare shifts
				Displaced shifting points	All points
				Does not shift	No fail-safe codes
					Code P0717 - Pulse generator A system
					Code P0722 - Pulse generator B system
					Code P0750 - Shift contorl solenoid valve A system
					Code P0755 - Shift control solenoid valve B stystem
					Code P0760 - Shift contorl solenoid valve C system
					Code P0745, P0775 - Pressure control solenoid valve system
					Code P0731 - 1st gear incorrect ratio
					Code P0732 - 2nd gear incorrect ratio
					Code P0733 - 3rd gear incorrect ratio
					Code P0734 - 4th gear incorrect ratio

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

DTC NO	Diagnosis items	Trouble area (Remedy)	MIL
P0703	Brake switch	• Check the brake switch	X
P0712	Fluid temperature sensor -short circuit-	• Fluid temperature sensor connector inspection • Fluid temperature sensor inspection • Fluid temperature sensor wiring harness inspection	O
P0713	Fluid temperature sensor -open circuit-		
P1709	Kickdown servo switch -open circuit- Kickdown servo switch -short circuit-	• Check the kicdown servo switch connector • Check the kicdown servo switch • Check the kicdown servo switch wiring harness	X
P0717	Pulse generator A -open circuit-	• Check the pulse generator A and pulse generator B • Check the vehicle speed reed switch (for chattering) • Check the pulse generator A and B wiring harness	O
P0722	Pulse generator B -open circuit-		
P0750	Shift control solenoid valve A	• Check the solenoid valve connector • Check the shift control solenoid valve A • Check the shift control solenoid valve A wiring harness	O
P0755	Shift control solenoid valve B	• Check the solenoid valve connector • Check the shift control solenoid valve B • Check the shift control solenoid valve A wiring harness	O
P0760	Shift control solenoid valve C	• Check the solenoid valve connector • Check the shift control solenoid valve C • Check the shift control solenoid valve A wiring harness	O
P0707	Transaxle range switch -No signal-	• Check the transaxle range switch connector and harness	O
P0708	Transaxle range switch -Multi signal-		
P0745	Pressure control solenoid - A valve open circuit	• Check the pressure control solenoid valve • Check the pressure control solenoid valve wiring harness	O
P0775	Pressure control solenoid - B valve shor circuit		
P0743	Damper clutch control solenoid	• Inspection of solenoid valve connector • Individual inspection of damper clutch control solenoid valve • Check the damper clutch control solenoid valve wiring harness • Check the PCM • Inspection of damper clutch hydraulic system	O
P0741	Damper clutch -Stuck OFF-		
P0742	Damper clutch -Stuck ON-		

DTC NO	Diagnosis items	Trouble area (Remedy)	MIL
P0731	First gear system -Malfunction-	• Check the pulse generator A and pulse generator B connector • Check the one way clutch or rear clutch • Check the pulse generator wiring harness	O
P0732	Second gear system -Malfunction-		
P0733	Third gear system -Malfunction-	• Check the rear clutch or control system • Check the pulse generator A and pulse generator B connector • Check the front clutch slippage or control system • Check the pulse generator wiring harness • Check the rear clutch slippage or control system	O
P0734	Fourth gear system -Malfunction-	• Check the pulse generator A and pulse generator B connector • Kickdown brake slippage • Check the end clutch or control system • Check the pulse generator wiring harness	O

FAIL-SAFE ITEM

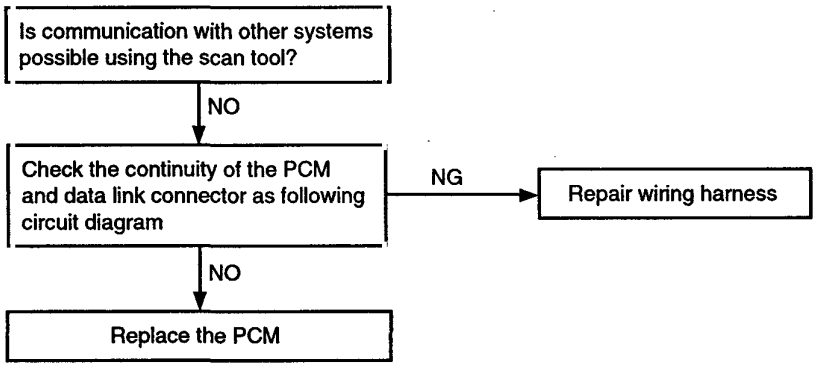
DTC NO	Description	Fail-safe	Note (Relation to diagnostic trouble code)
P0717	Open-circuited pulse generator A	Locked in third (D) or second (2, L) gear	When code P0717 is generated fourth time
P0722	Open-circuited pulse generator B	Locked in third (D) or second (2,L) gear	When code P0722 is generated fourth time
P0750	Open-circuited or shorted shift control solenoid valve A	Lock in third gear	When code P0750 is generated fourth time
P0755	Open-circuited or shorted shift control solenoid valve B	Lock in third gear	When code P0755 is generated fourth time
P0760	Open-circuited or shorted shift control solenoid valve C	Lock in third gear	When code P0760 is generated fourth time
P0745 P0775	Open-circuited shorted pressure control solenoid valve	Lock in third (D) or second (2,L)	When codes P0745 or P0775 are generated fourth time
P0731 P0732 P0733 P0734	Gear shifting does not match the engine speed	Lock in third (D) or second (2,L)	When either codes P0731, P0732, P0733 or P0734 are generated fourth time

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with scan tool is not possible		1	TR-18
Driving impossible	Starting impossible (will not crank)	2	TR-19
	Does not move forward	3	TR-20
	Does not back-up	4	TR-21
	Does not move (forward or reverse)	5	TR-22
Malfunction when starting	Engine stalling during shifting	6	TR-23
	Shocks when shifting from N to D and long lag time	7	TR-24
	Shocks when shifting from N to R and long lag time	8	TR-25
	Shocks when shifting from N to D, N to R and long lag	9	TR-26
Malfunction when shifting	Shocks and flare shifts	10	TR-27
Early, late shift points	All points	11	TR-28
	Some points	12	TR-29
Does not shift	Does not shift	13	TR-30
Malfunction while driving	Poor acceleration	14	TR-31
	Vibration	15	TR-32
	Overdrive switch system	16	TR-33

INSPECTION PROCEDURE 1

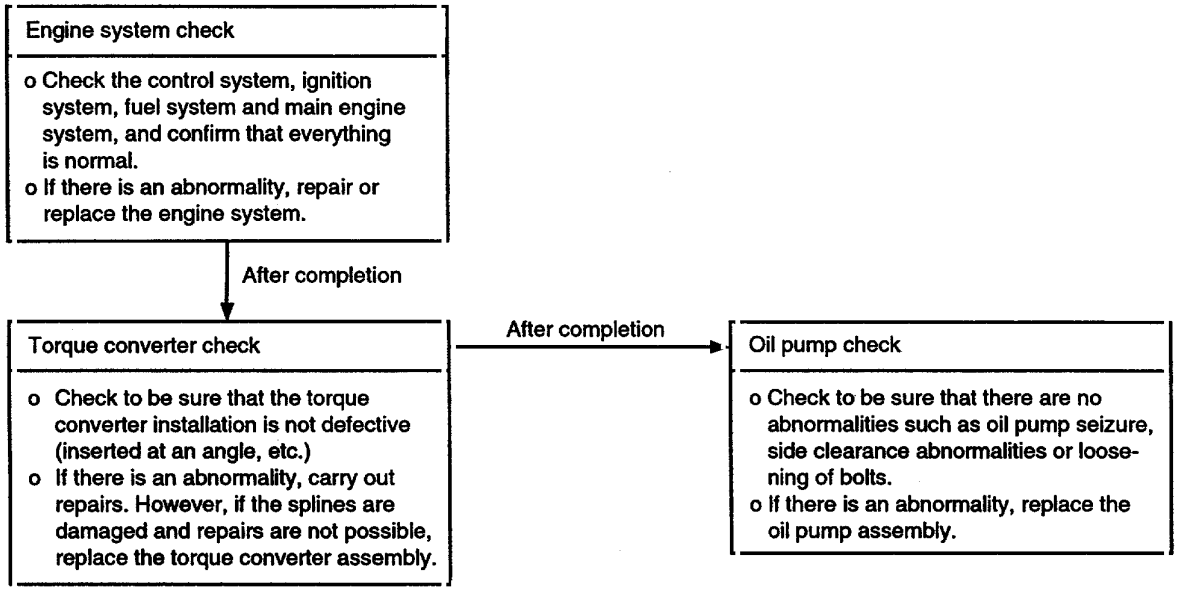
Communication with scan tool is not possible	Possible cause
If communiction with the scan tool is not possible, the cause may be a defective diagnosis line or PCM is not functioning	• Malfunction of diagnosis line • Malfunction of PCM power • Malfunction of PCM ground circuit • Malfunction of PCM



EKDA021A

INSPECTION PROCEDURE 2

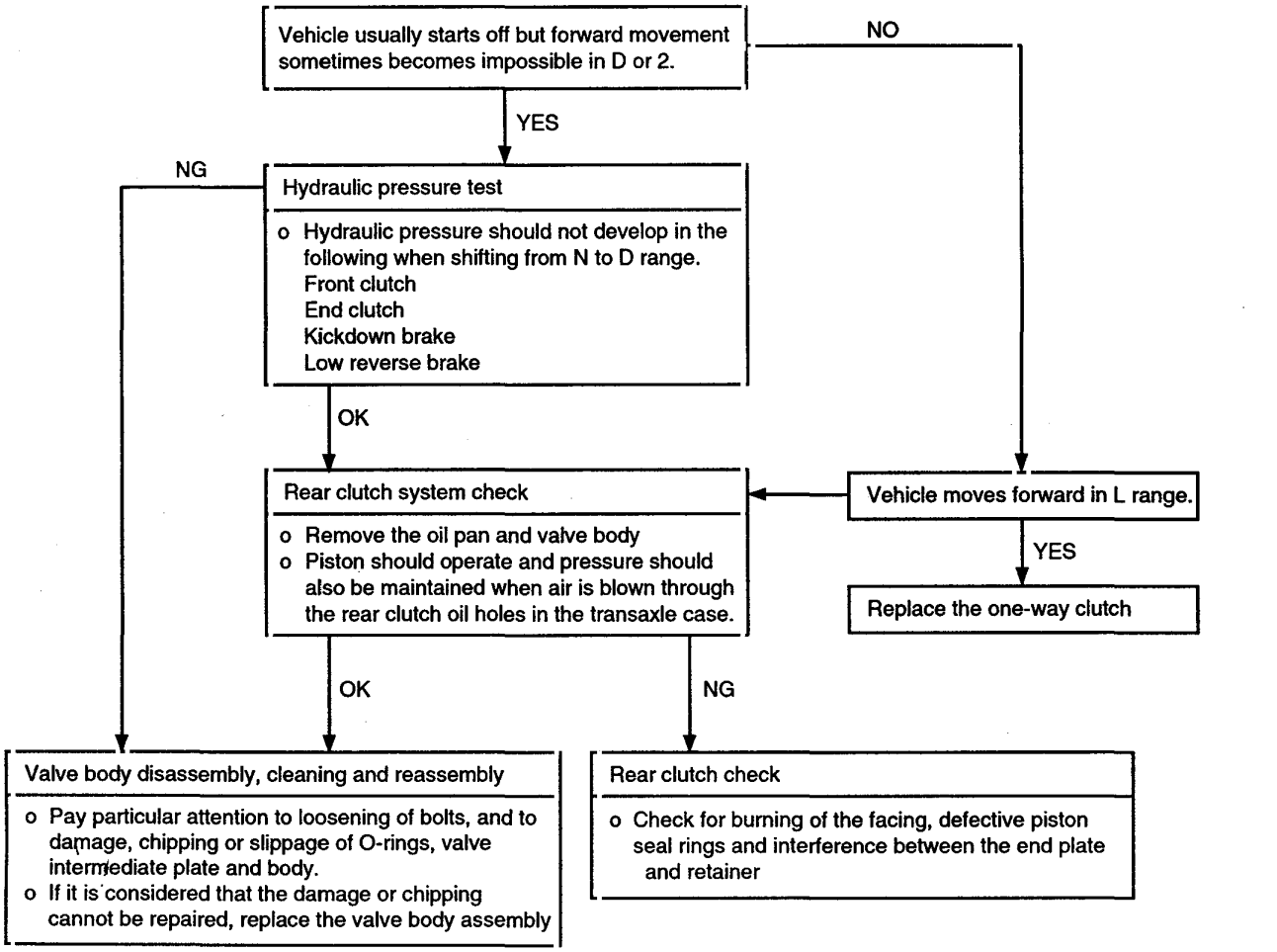
Starting Impossible (will not crank)	Possible cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause may be a defective engine system, torque converter or oil pump.	• Malfunction of the engine system • Malfunction of the oil pump • Malfunction of the torque converter



EKDA021C

INSPECTION PROCEDURE 3

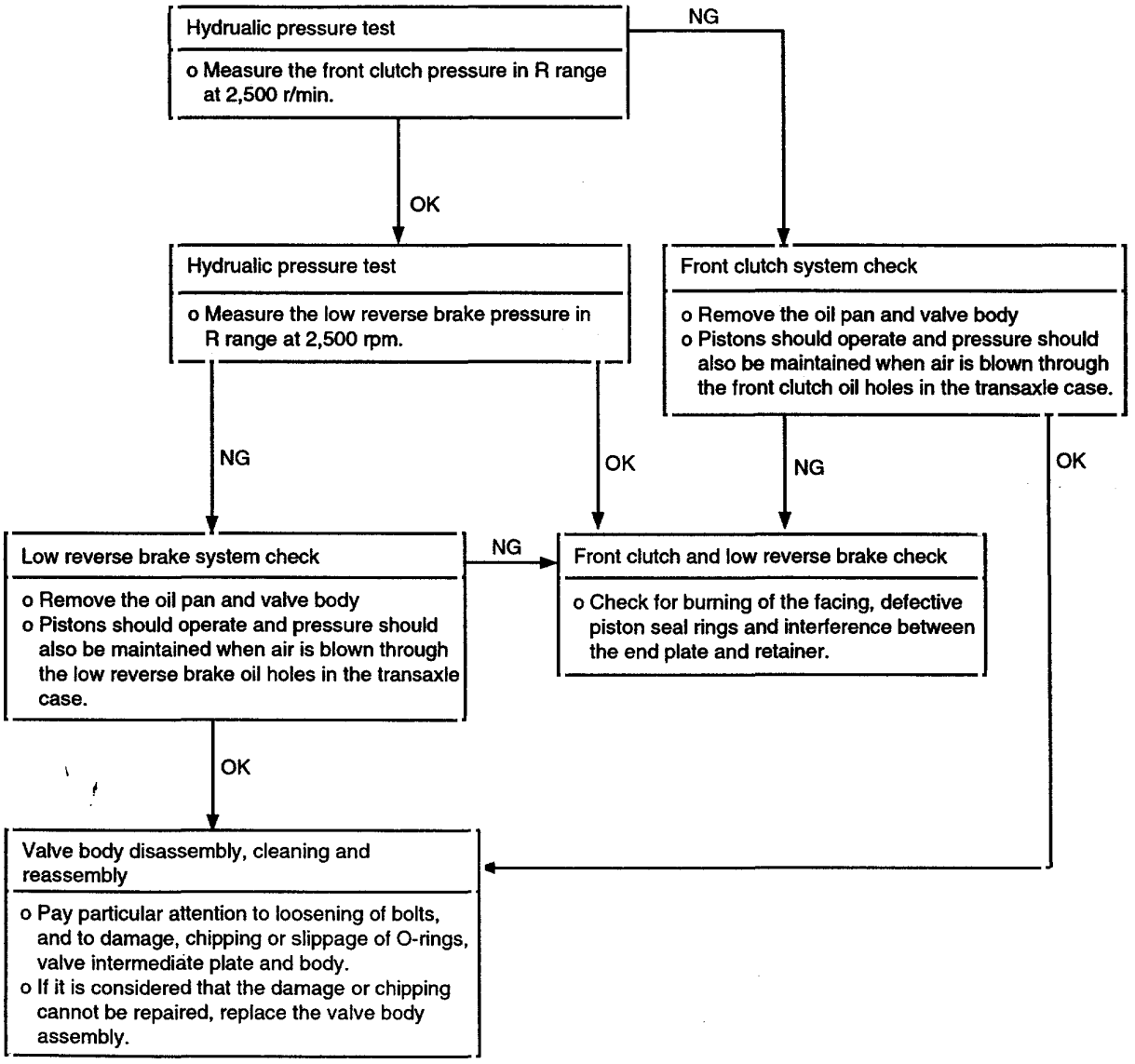
Does not move forward	Possible cause
When the engine is idling, the vehicle does not move forward even if the selector lever is shifted from N to D, 2 or L range. In such cases, the cause may be abnormal line pressure, or a defective rear clutch or one-way clutch.	• Abnormal line pressure • Malfunction of rear clutch • Malfunction of one-way clutch • Malfunction of valve body



EKDA021D

INSPECTION PROCEDURE 4

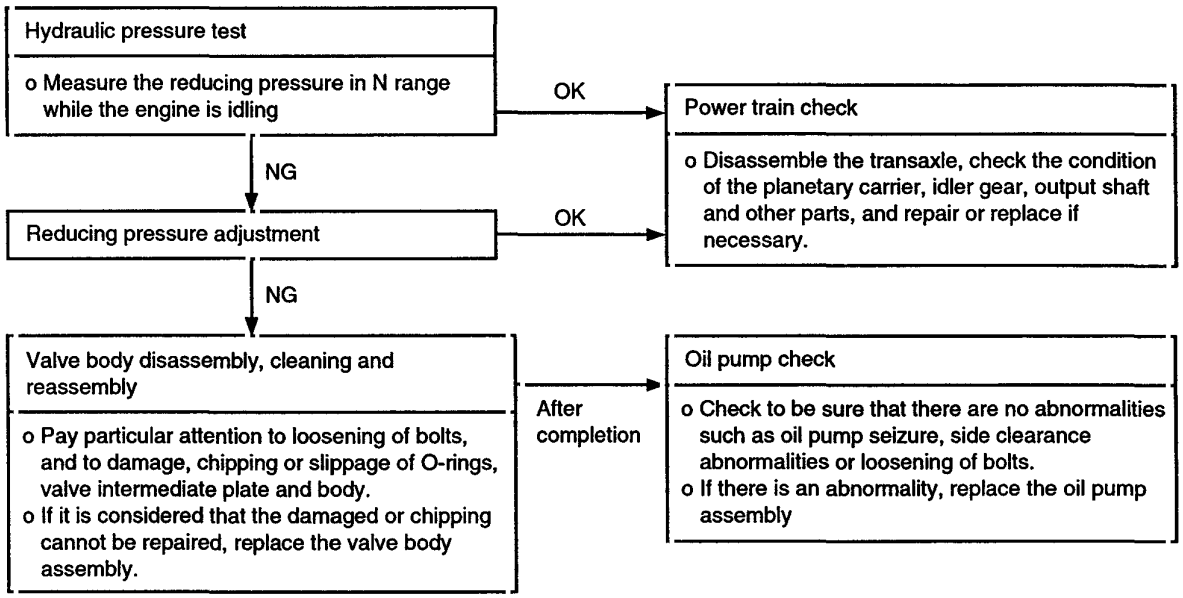
Does not move back-up	Possible cause
When the engine is idling, the vehicle does not back-up even if the selector lever is shifted from N to R range. In such cases, the cause may be abnormal pressure in the low reverse brake or front clutch, or a defective low reverse brake or front clutch.	• Abnormal low reverse brake pressure • Abnormal front clutch pressure • Malfunction of front clutch • Malfunction of low reverse brake • Malfunction of valve body



EKFA121E

INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Possible cause
When the engine is idling, the vehicle does not move forward or reverse even if the selector lever is shifted from N to D, 2, L or R range. In such cases, the cause may be abnormal reducing pressure, or a defective oil pump or power train.	• Abnormal reducing pressure • Malfunction of power train • Malfunctin of oil pump • Malfunction of valve body



EKFA121F

INSPECTION PROCEDURE 6

Engine stalling during shifting	Possible cause
When the engine is idling, the engine stalls when the selector lever is shifted from N to D, 2, L or R range. In such cases, the cause may be a defective engine system or damper clutch control solenoid valve.	• Malfunction of engine system • Malfunction of torque converter clutch solenoid • Malfunction of valve body • Malfunction of torque converter

Engine system check

o Check the control system, ignition system, fuel system and main engine system, and confirm that everything is normal.
o If there is an abnormality, repair or replace the engine system.

After completion

Solenoid valve connector check

o Check to be sure that there is no water in the connector.
o Check to be sure that none of the terminals are shorted to each other.

After completion

Torque converter clutch solenoid check

o Check to be sure that the valve is not sticking due to foreign materials packed inside solenoid.
o If there is an abnormality, replace the solenoid valve assembly.

After completion

Transaxle cooling system check

o Check for plugged cooler lines.
o Check for plugged oil cooler.

After completion

Valve body disassembly, cleaning and reassembly

o Pay particular attention to loosening of bolts, and to damage, chipping or slippage of O-rings, valve intermediate plate and body.
o If it is considered that the damage or chipping cannot be repaired, replace the valve body assembly.

After completion

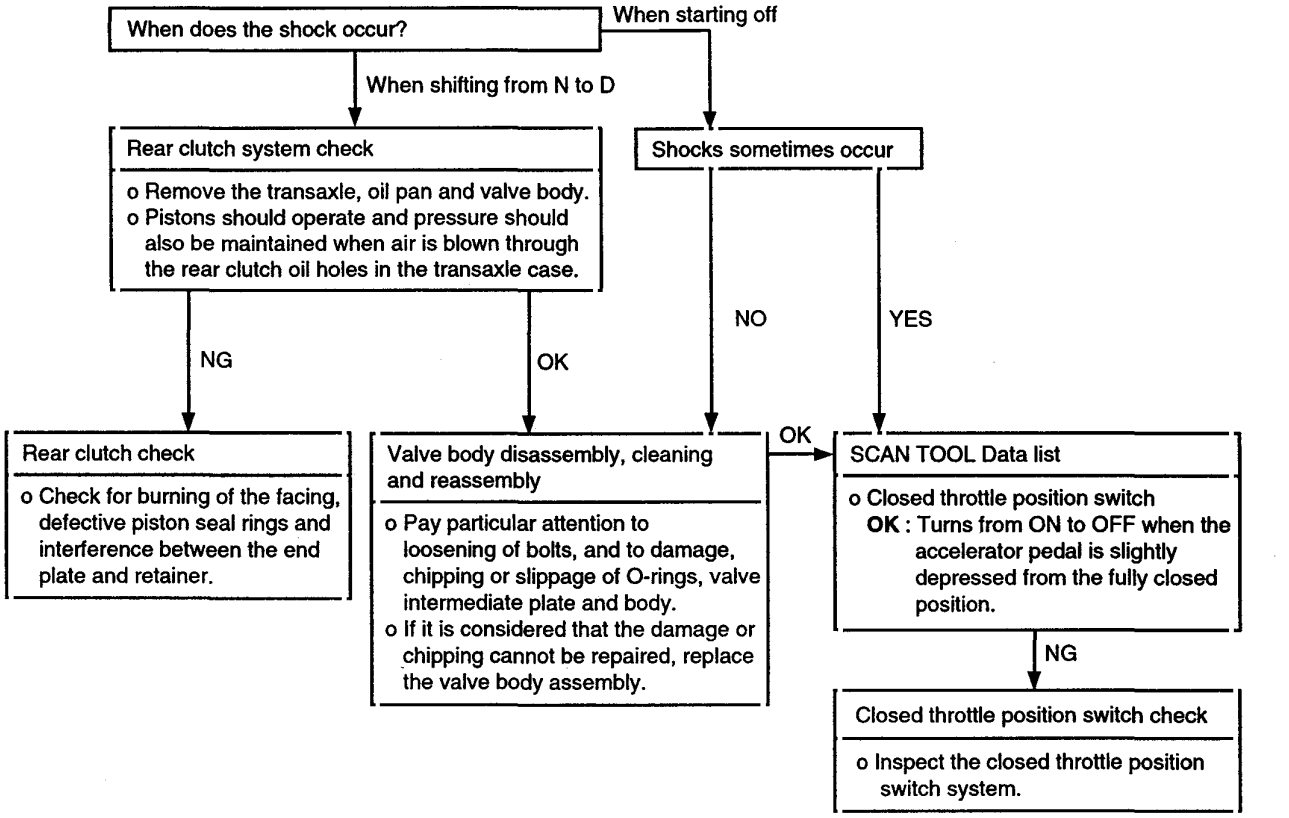
Torque converter check

o Check to be sure that there is no sticking due to separation from the damper clutch.
o If there is an abnormality, replace the torque converter assembly.

EKDA021G

INSPECTION PROCEDURE 7

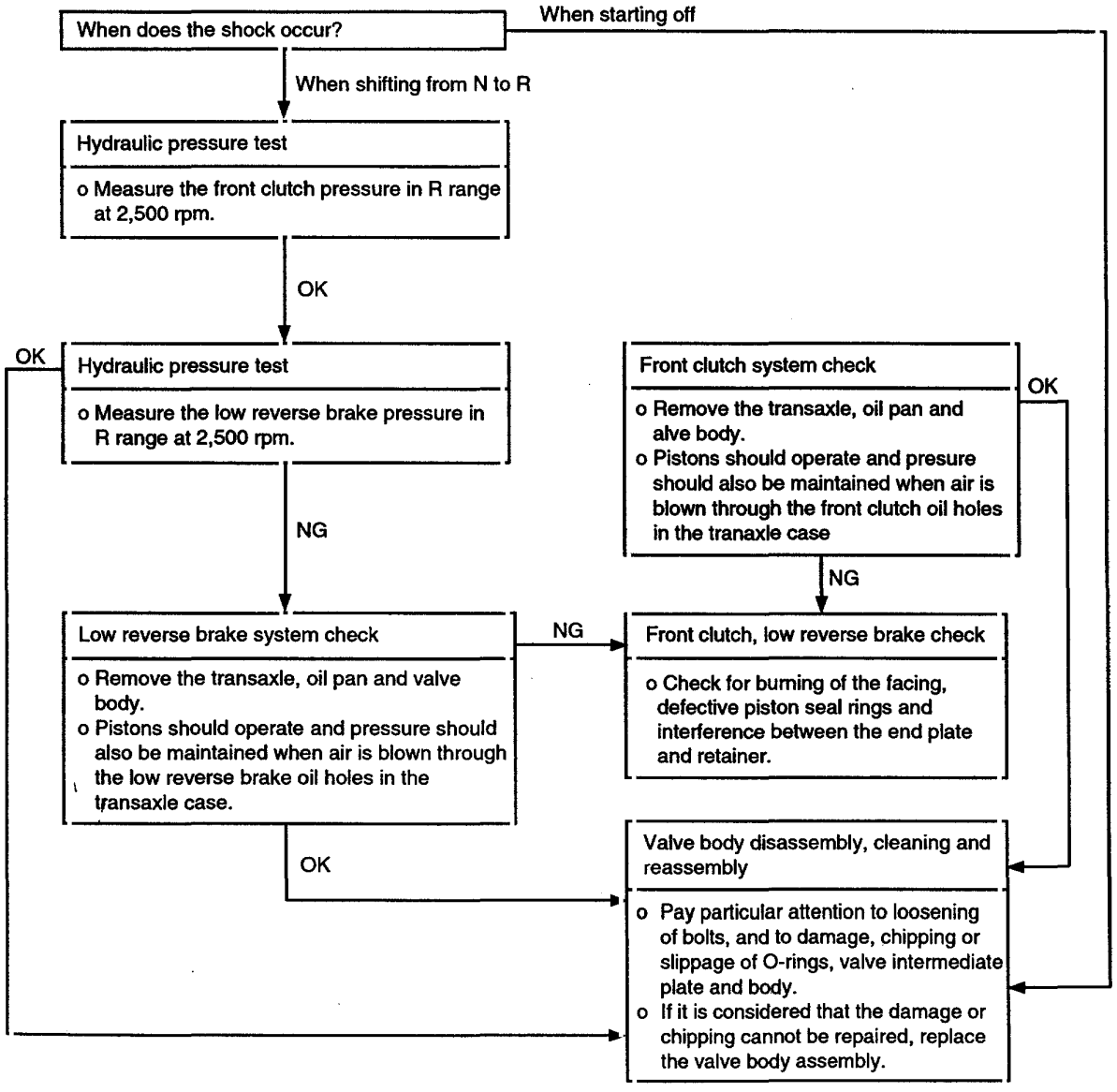
Shocks when shifting from N to D and long lag time	Possible cause
When the engine is idling, abnormal shocks or a lag time of 2 seconds or more occur when the selector lever is shifted from N to D range. In such case, the cause may be a defective rear clutch or valve body.	• Malfunction of rear clutch • Malfunction of valve body • Malfunction of closed throttle position switch



EKNB121C

INSPECTION PROCEDURE 8

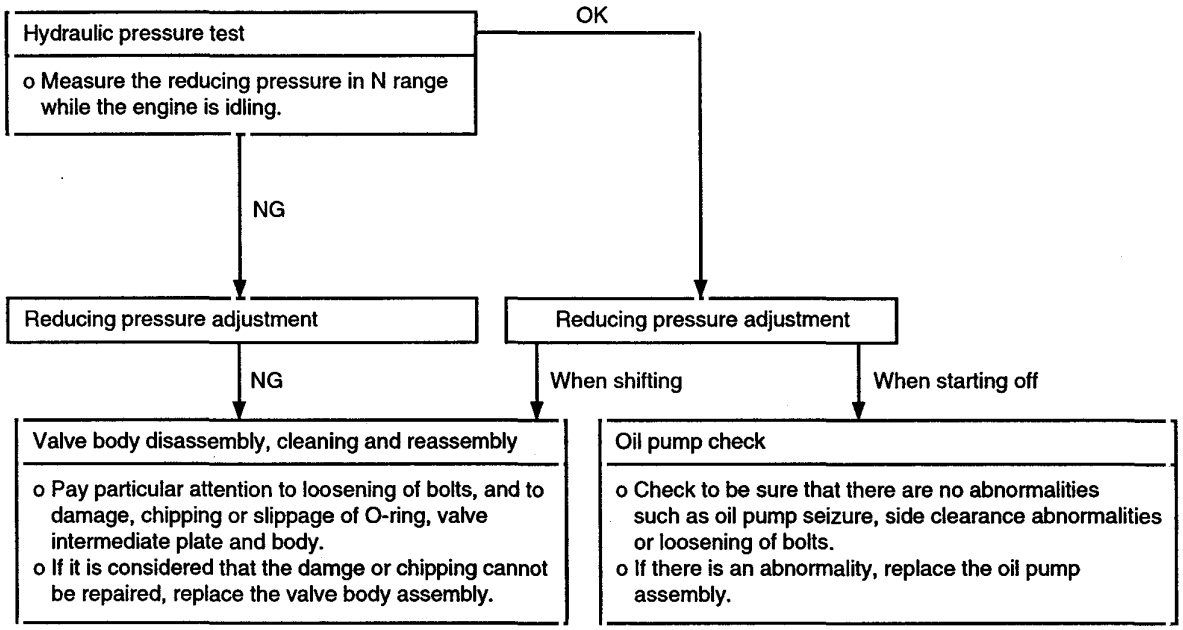
Shocks when shifting from N to R and long lag time	Possible cause
When the engine is idling, abnormal shocks or a lag time of 2 seconds or more occurs when the selector lever is shifted from N to R range. In such cases, the cause may be abnormal low reverse brake or front clutch pressure, or a defective low reverse brake or front clutch.	• Abnormal front clutch pressure • Abnormal low reverse brake pressure • Malfunction of front clutch • Malfunction of low reverse brake • Malfuntion of valve body



EKFA121I

INSPECTION PROCEDURE 9

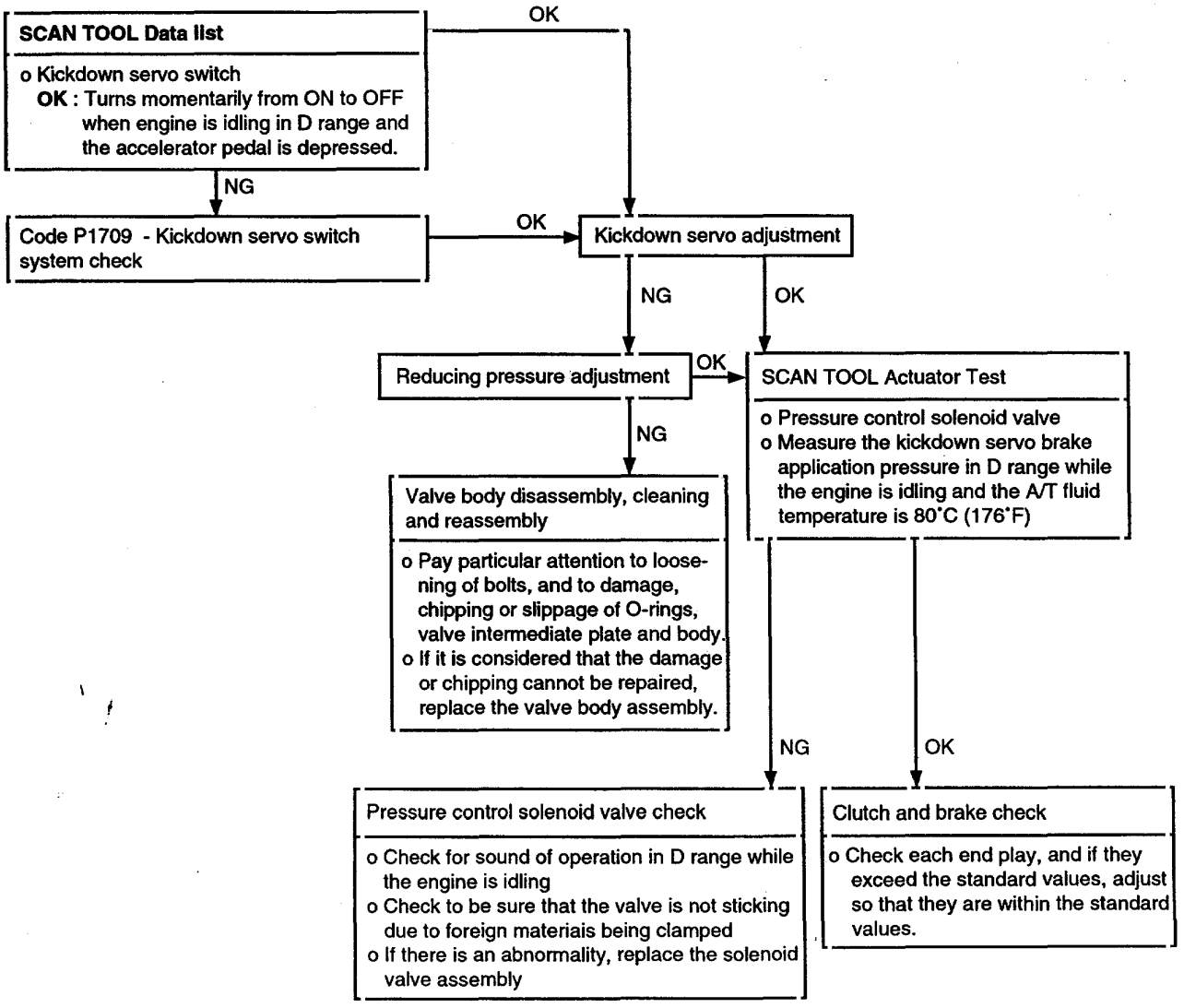
Shocks when shifting from N to D,N to R and long lag time	Possible cause
When the engine is idling, abnormal shocks or a lag time of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range. In such cases, the cause may be abnormal reducing pressure or a defective oil pump.	• Abnormal reducing pressure • Malfunction of oil pump • Malfunction of valve body



EKFA121J

INSPECTION PROCEDURE 10

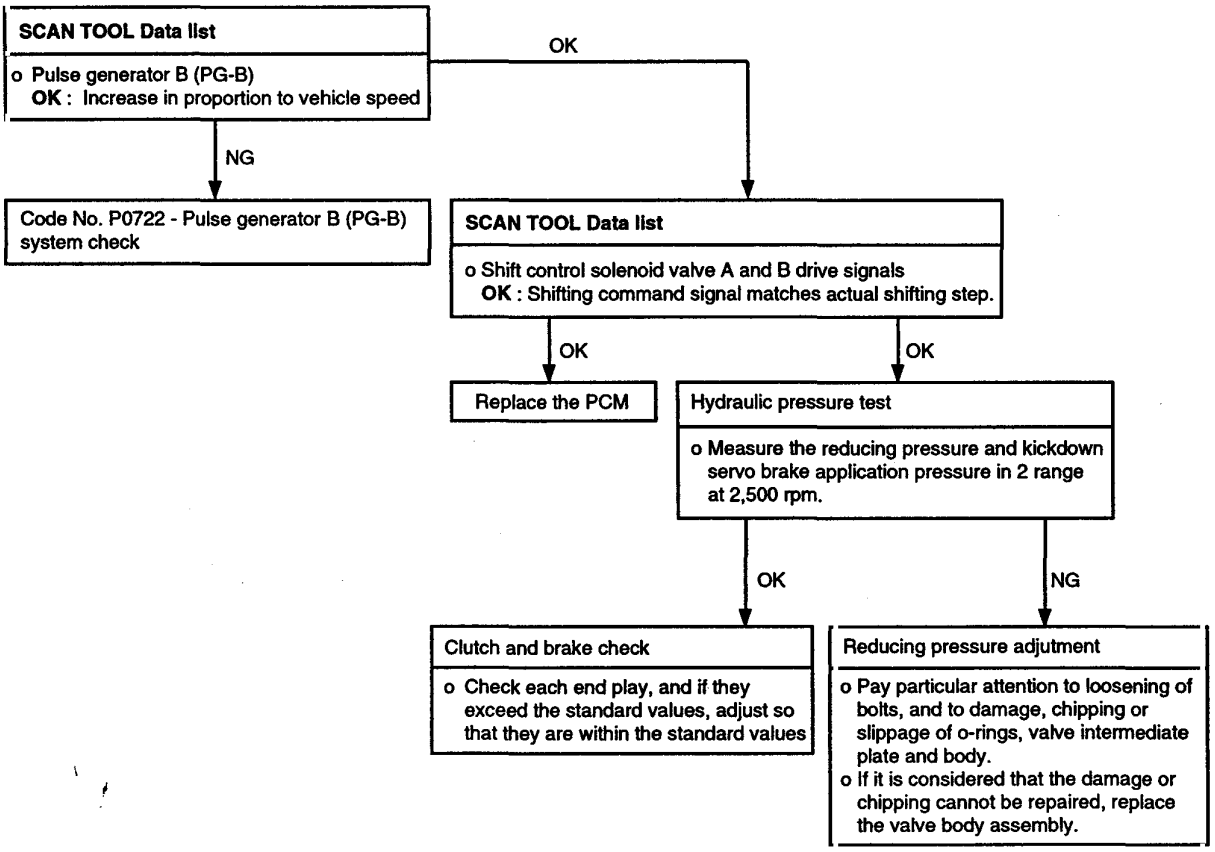
Shocks and flare shifts	Probable cause
Shocks occur when driving due to upshifting or downshifting. In addition,the engine speed during shifting increases abnormally in comparison to normal shifting. In such cases, the cause is probably abnormal reducing pressure or a defective kickdown servo switch.	• Malfunction of kickdown servo switch • Abnormal reducing pressure • Malfunction of valve body • Malfunction of closed throttle position switch • Malfunction of pressure control solenoid valve • Malfunction of clutches and brakes



EKKB121B

INSPECTION PROCEDURE 11

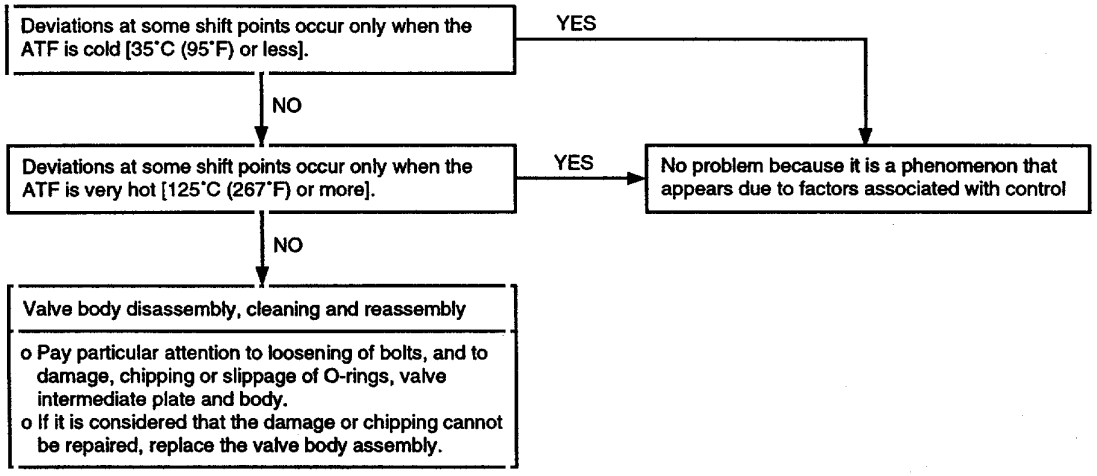
All points (Early, late shifting points)	Possible cause
All shift points occurs early, late while driving. In such cases, the cause may be a defective pulse generator B (PG-B) or shift control solenoid valve A or B (SCSV-A, B).	• Malfunction of pulse generator B (PG-B) • Malfunction of shift control solenoid valve A or B (SCSV-A, B) • Malfunction of PCM • Abnormal reducing pressure or kickdown servo brake application pressure • Malfunction of clutches and brake



EKFA121L

INSPECTION PROCEDURE 12

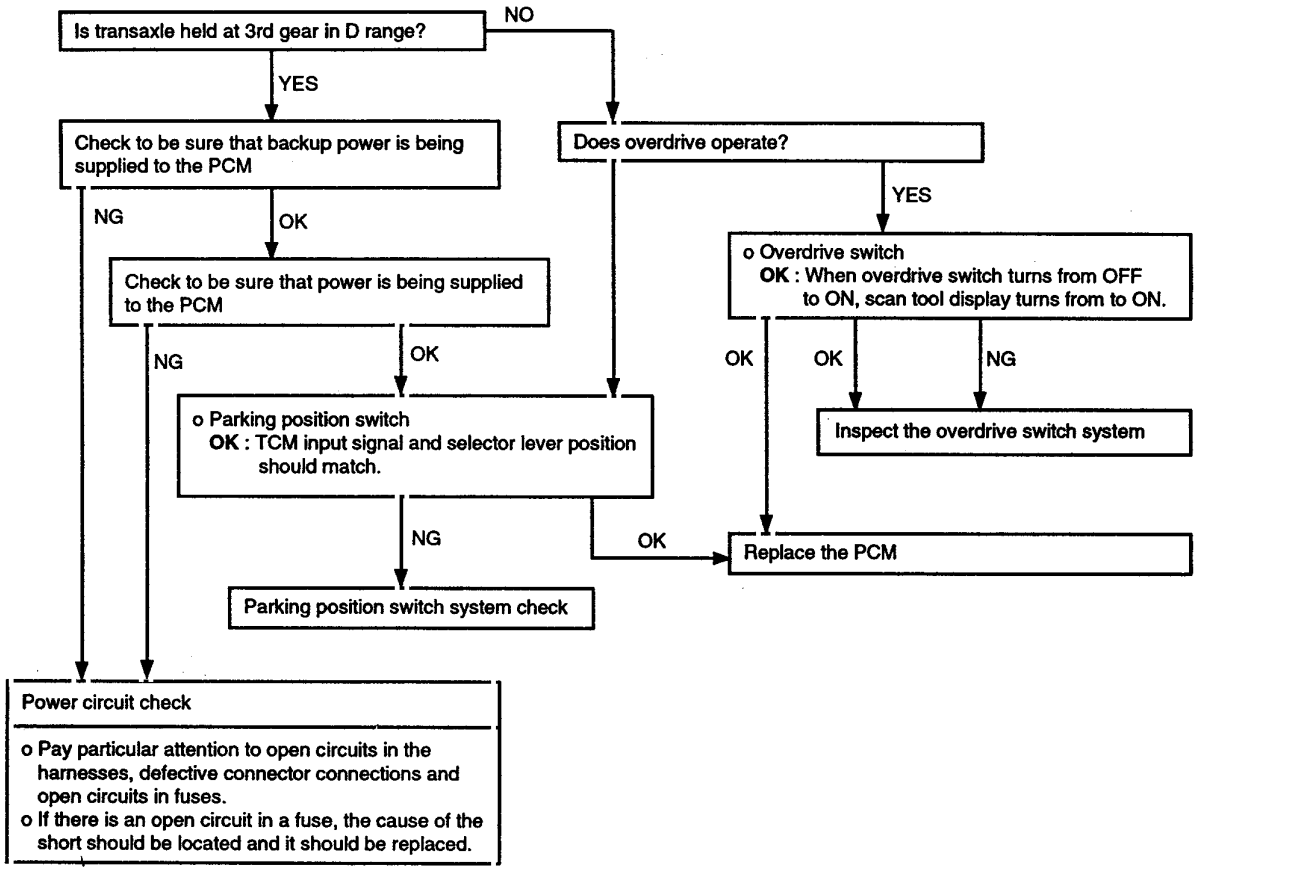
Some points (Early, late shifting points)	Possible cause
Some shift points occurs early, late while driving. In such cases, the causemay be a defective valve body, or it is phenomenon related to control and is not an abnormality.	• Malfunction of valve body



EKDA021M

INSPECTION PROCEDURE 13

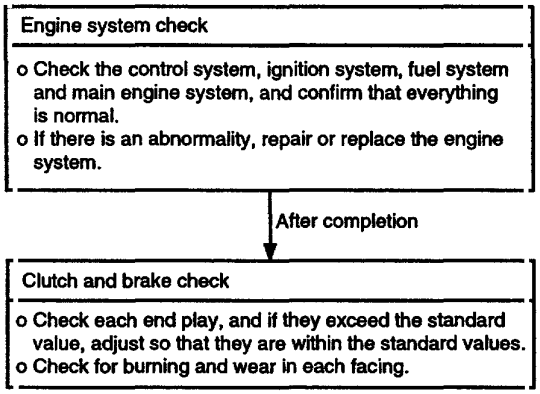
Does not shift	Possible cause
Shifting does not occur while driving, and no fail-safe codes are output.In such cases, the cause may be a defective overdrive switch or parking switch.	• Malfunction of overdrive switch • Malfunction of parking position switch • Malfunction of power supply circuit • Malfunction of PCM



EKNB121D

INSPECTION PROCEDURE 14

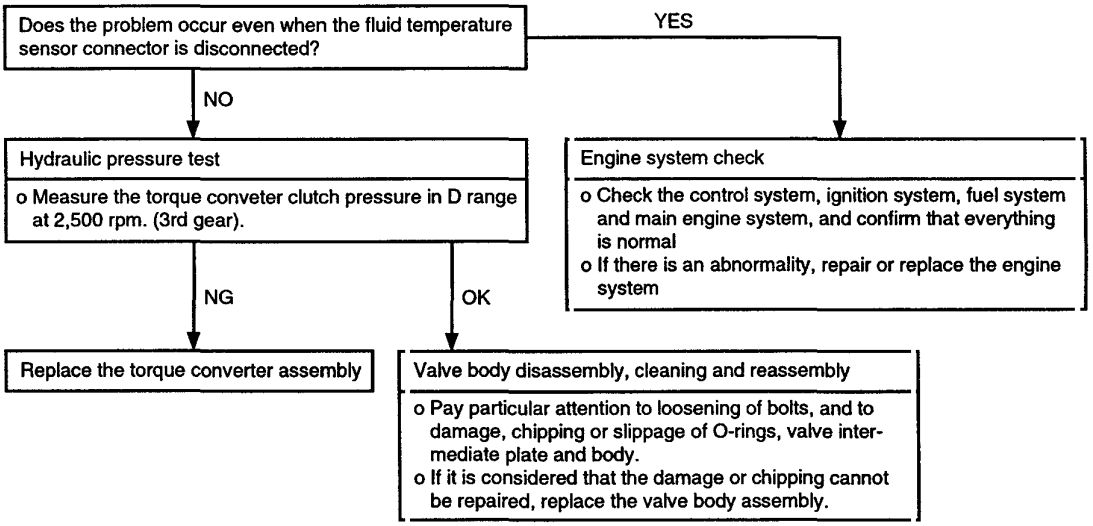
Poor acceleration	Possible cause
While driving, acceleration is poor even if downshifting is performed. In such cases, the cause may be a defective clutch or brake, or a defective engine system.	• Malfunction of clutch and brakes • Malfunction of engine system



EKDA021O

INSPECTION PROCEDURE 15

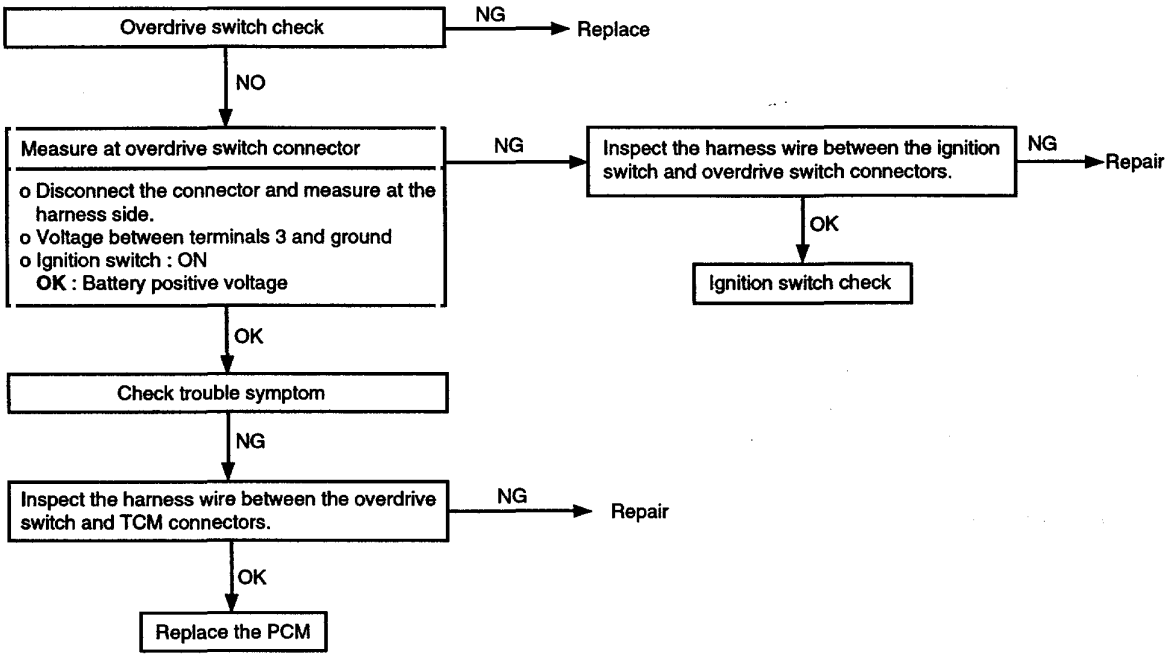
Vibration	Possible cause
Vibration occurs when driving at constant speed or when accelerating in top range. In such case, the cause may be abnormal torque converter clutch pressure or a defective torque converter.	• Abnormal torque converter clutch pressure • Malfunction of engine system • Malfunction of torque converter • Malfunction of valve body



EKFA121P

INSPECTION PROCEDURE 16

Overdrive switch system	Possible cause
In cases such as the above, the cause may be a defective overdrive switch circuit or defective ignition switch circuit.	• Malfunction of overdrive switch • Malfunction of connector • Malfunction of ignition switch • Malfunction of PCM



EKDA021Q

OBTAINING DIAGNOSTIC TROUBLE CODES

[USING HI-SCAN PRO]

1. Turn the ignition switch OFF.
2. Connect the Hi-Scan Pro to the data link connector.
3. Turn the ignition switch ON.
4. Use the Hi-Scan Pro to check the diagnostic trouble code.
5. Repair the faulty part from the diagnosis chart.
6. Erase the diagnostic trouble code.
7. Disconnect the Hi-Scan Pro.

MALFUNCTION INDICATOR LIGHT (MIL)

An on-board diagnostic light comes on to notify the driver that there is problems in the vehicle. However, when an irregular state returns to normal, the malfunction indicator light will go out automatically after 3 driving cycles that have no same fault. Immediately after the ignition switch is turned on, the malfunction indicator light operates normally. (See FL-section)

THE FOLLOWING ITEMS WILL BE INDICATED BY THE MIL

- Fluid temperature sensor
- Pulse generator A (PG-A)
- Pulse generator B (PG-B)
- Shift control solenoid valve A (SCSV-A)
- Shift control solenoid valve B (SCSV-B)
- Shift control solenoid valve C (SCSV-C)
- Pressure control solenoid valve (PCSV-A)
- Pressure control solenoid valve B (PCSV-B)
- Damper clutch solenoid valve (DCCSV)
- Shift stage synchronize
- Transaxle range switch

SERVICE DATA (WHEN A HI-SCAN PRO IS USED)

Diagnosis items	Checking procedures		Checking items (Remedy)
	Check conditions	Normal value	
Throttle position sensor (TPS)	Accelerator pedal fully released	2 ~ 18 %	• TPS or circuit harness if no change occurs • TPS or accelerator pedal cable if gradual change is not noted
	Press accelerator pedal slowly	Varies with accelerator opening	
	Accelerator pedal pressed to floor	80 ~ 100%	
Fluid temperature sensor	Cold engine (before starting)	Equivalent to outside air temperature	• Fluid temperature sensor or circuit harness
	While warming up engine	Gradual increase	
	After warming up engine	70 ~ 110°C	
Kickdown servo switch	L range : Idling	ON	• Kickdown servo misadjusted • Kickdown servo switch or circuit harness • Kickdown servo
	D range : First or third gear	ON	
	D range : Second or fourth gear	OFF	
Engine speed	P range : Idling Accelerator pedal : Fully closed	600 ~ 800rpm	• Ignition system • Ignition signal pick-up circuit harness
	P range : Idling Accelerator pedal : depressed		
Air conditioning relay signals	P range : Idle, air conditioning ON	ON	• Air conditioning power relay circuit harness
	P range : Idle, air conditioning OFF	OFF	
Shift position	1st speed : 10km/h	First	• PCM • Transaxle range switch system • TPS system
	2nd speed : 30km/h	Second	
	3rd speed : 50km/h	Third	
	4th speed : 80km/h	Fourth	
Pulse generator A	D range (OD OFF) : driving at 50 km/h (31 mph) in third gear	1,500 ~ 2,000rpm	• Pulse generator A or circuit harness • Pulse generator A shielded wire • Incoming noise from outside
	D range (OD ON) : driving at 80 km/h (50 mph) in fourth gear	1,700 ~ 2,000rpm	
Pulse generator B	D range (OD OFF) : driving at 50 km/h (31 mph) in third gear	1,500 ~ 2,000rpm	• Pulse generator B or circuit harness • Pulse generator B shielded wire • Incoming noise from outside
	D range (OD ON) : driving at 80 km/h (50 mph) in fourth gear	1,500 ~ 2,000rpm	

Diagnosis items	Checking procedures		Checking items (Remedy)
	Check conditions	Normal value	
Overdrive switch	• Ignition switch : ON • Engine : stopped • Overdrive switch is turned ON	OD-ON	• Overdrive switch or circuit harness
	• Ignition switch : ON • Engine : stopped • Overdrive switch is turned OFF	OD-OFF	
Transaxle range switch	Shift selector lever to P range	P	• Transaxle range switch misadjusted • Transaxle range switch or circuit harness • Manual control cable • If selector lever is inoperative, check shift lock mechanism
	Shift selector lever to R range	R	
	Shift selector lever to N range	N	
	Shift selector lever to D range	D	
	Shift selector lever to 2 range	2	
	Shift selector lever to L range	L	
Vehicle speed sensor	Keep vehicle stopped	0km/h	• Vehicle speed sensor if high speed signal is delivered while vehicle is stopping • In other cases, vehicle speed sensor or circuit harness
	Driving at 40 km/h (25 mph) in 2 range	40km/h (25 mph)	
	Driving at 50 km/h (31 mph) in D range, OD OFF	50km/h (31 mph)	
PCSV-A duty	D range : Idling	75 ~ 90%	• When accelerator pedal is slightly pressed while idling in D range, duty should become 100% • PCM • TPS system
	D range : first gear	100%	
PCSV-B duty	D range : Idling	0%	• PCM • TPS system
	D range : first gear	0%	

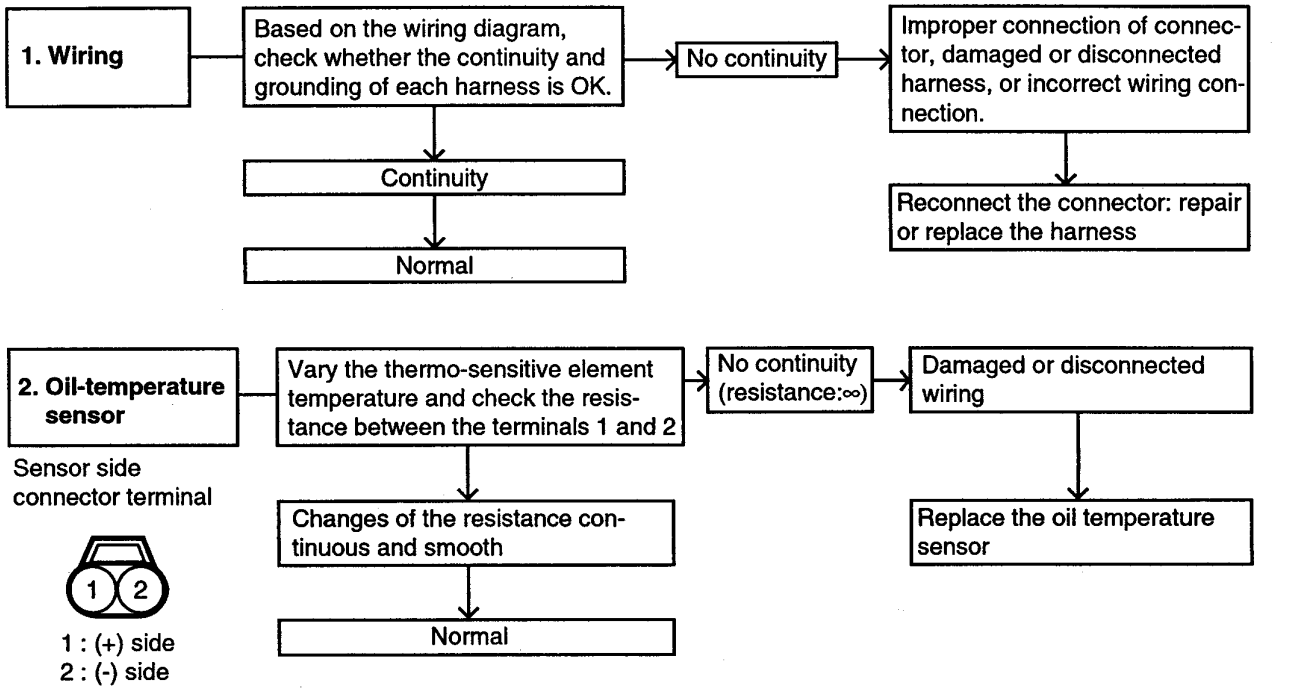
Diagnosis items	Checking procedures		Checking items (Remedy)
	Check conditions	Normal value	
Torque converter slip amount	D range : third gear, 70km/h, OD OFF	0~50rpm	• Torque converter • Ignition signal wire or pulse generator A system • Inappropriate transaxle fluid pressure • Torque converter control solenoid valve
DCCSV duty	D range : third gear, 70km/h, OD OFF	40 ~ 85%	• PCM • TPS system • Pulse generator A system • Torque converter control solenoid valve

ELEMENTS IN USE IN EACH GEAR

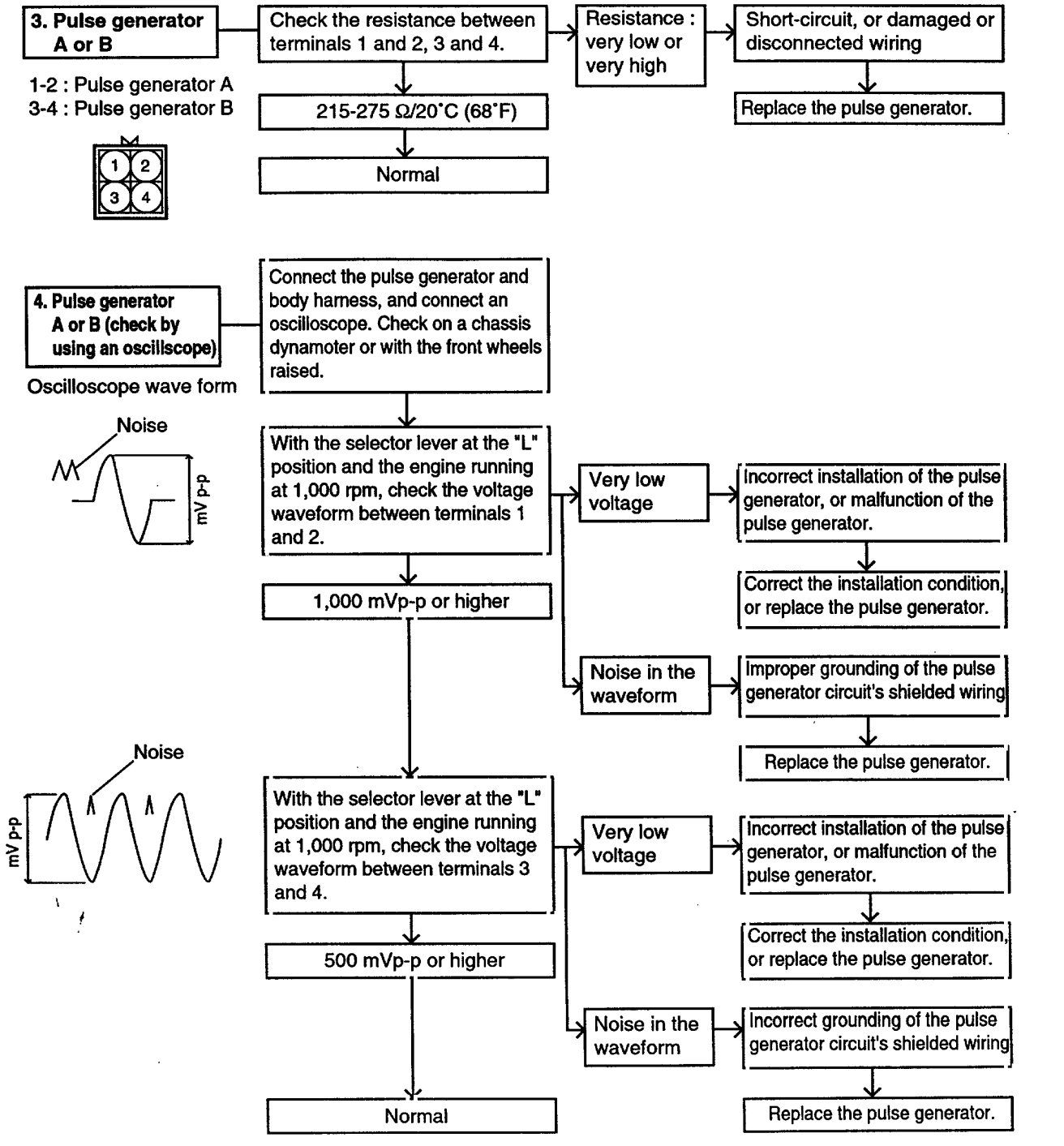
Select or lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					O
N	-	Neutral	Possible							
D	ON	First				O		O		
		Second				O			O	
		Third			O	O	O			
		Fourth					O		O	
D	OFF	First				O		O		
		Second				O			O	
		Third			O	O	O			
2	-	First				O		O		
		Second				O			O	
L	-	First				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

INSPECTION OF ELECTRONIC CONTROL SYSTEM COMPONENTS



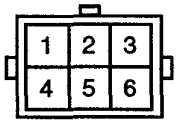
EKFA125A


3. Pulse generator A or B
Check the resistance between terminals 1 and 2, 3 and 4.
Resistance : very low or very high
Short-circuit, or damaged or disconnected wiring
Replace the pulse generator.
1-2 : Pulse generator A
3-4 : Pulse generator B
215-275 Ω/20°C (68°F)
Normal
1
2
3
4
4. Pulse generator A or B (check by using an oscillscope)
Connect the pulse generator and body harness, and connect an oscilloscope. Check on a chassis dynamoter or with the front wheels raised.
Oscilloscope wave form
Noise
mV p-p
With the selector lever at the "L" position and the engine running at 1,000 rpm, check the voltage waveform between terminals 1 and 2.
Very low voltage
Incorrect installation of the pulse generator, or malfunction of the pulse generator.
Correct the installation condition, or replace the pulse generator.
1,000 mVp-p or higher
Noise in the waveform
Improper grounding of the pulse generator circuit's shielded wiring
Replace the pulse generator.
Noise
mV p-p
With the selector lever at the "L" position and the engine running at 1,000 rpm, check the voltage waveform between terminals 3 and 4.
Very low voltage
Incorrect installation of the pulse generator, or malfunction of the pulse generator.
Correct the installation condition, or replace the pulse generator.
500 mVp-p or higher
Noise in the waveform
Incorrect grounding of the pulse generator circuit's shielded wiring
Replace the pulse generator.
Normal

EKFA125B

5. Pressure control solenoid valve (PCSV-A,B)

Solenoid valve side connector terminal



1. SCSV-C
2. PCSV-A
3. PCSV-B
4. SCSV-B
5. SCSV-A
6. DCCSV

Check the resistance between terminal 2, 3 of the solenoid valve connector and the transaxle case.

→ Resistance : too low or too high → Short-circuit, or damaged or disconnected wiring → Replace the PCSV-A,B

2.9 ± 0.3Ω/20°C (68°F)

Connect 12V between the transaxle case and terminal 2, 3; switch ON and OFF and check for operation noise.

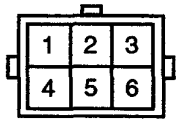
→ No operation noise. (Stroke : 0.3 mm (0.012 in.) or less) → Foreign materiall caught between the valve and guide → Replace the PCSV-A,B

Noise exists

Normal

6. Shift-control solenoid valve (SCSV) A, B, C

Solenoid valve side connector terminal



1. SCSV-C
2. PCSV-A
3. PCSV-B
4. SCSV-B
5. SCSV-A
6. DCCSV

Check the resistance between terminal 1, 4 or 5 of the solenoid valve connector and transaxle case.

→ Resistance : too low or too high → Short-circuit, of damaged or disconnected wiring → Replace the SCSV.

22.3 ± 1.5Ω/20°C (68°F)

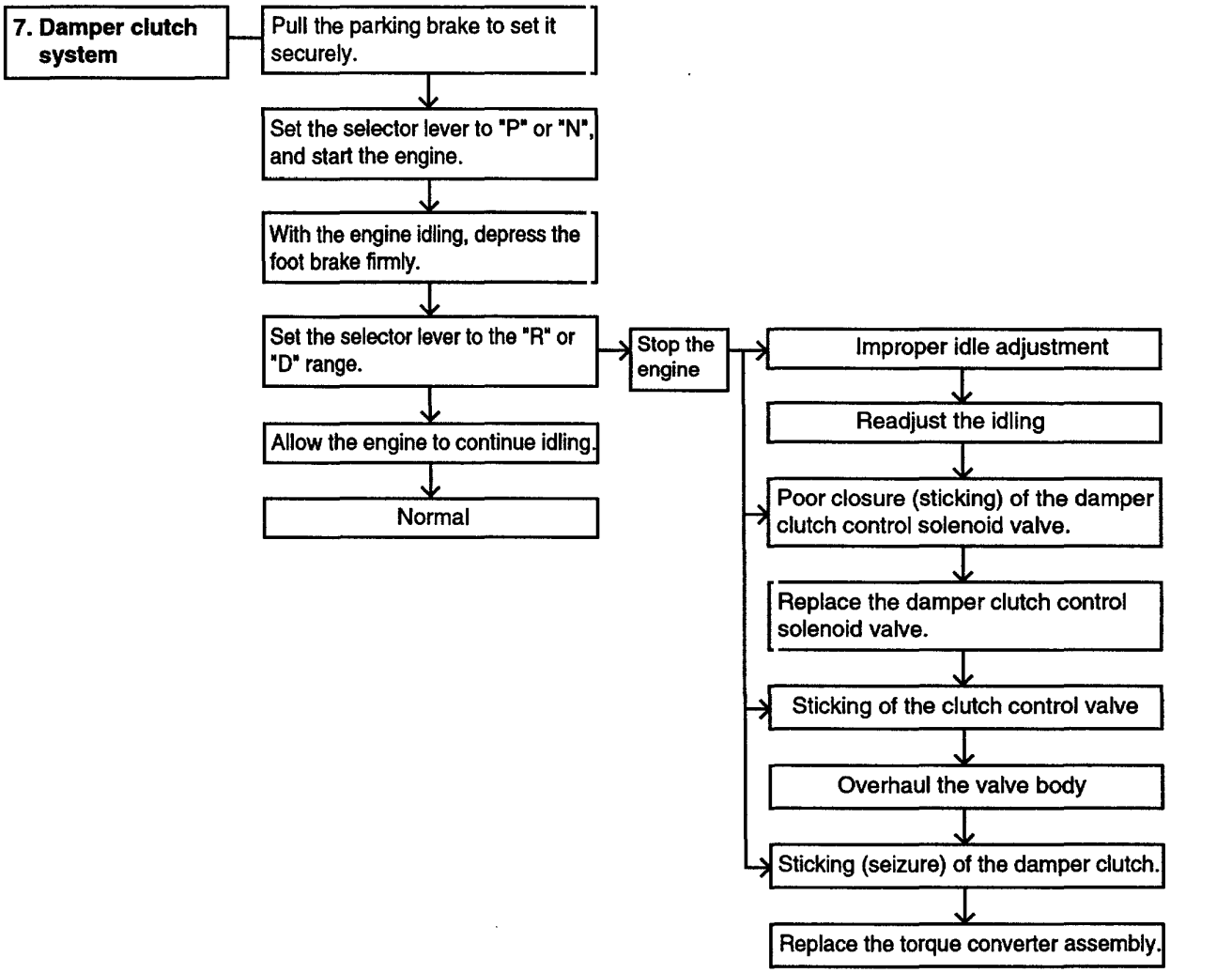
Connect 12V between the transaxle case and terminal 1, 4 or 5; switch ON and OFF and check for operation noise of the solenoid valve, and check the valve stroke.

→ No operation noise. (stroke : 0.25 mm (0.010 in. or less) → Residue accumulated in valve and core. → Replace the SCSV.

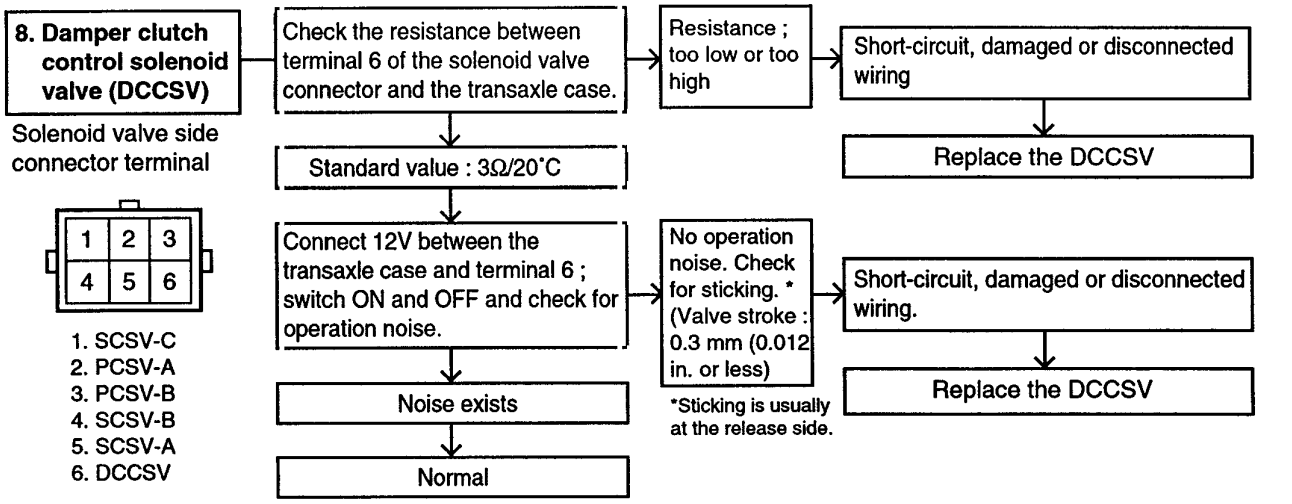
Noise exists

Normal

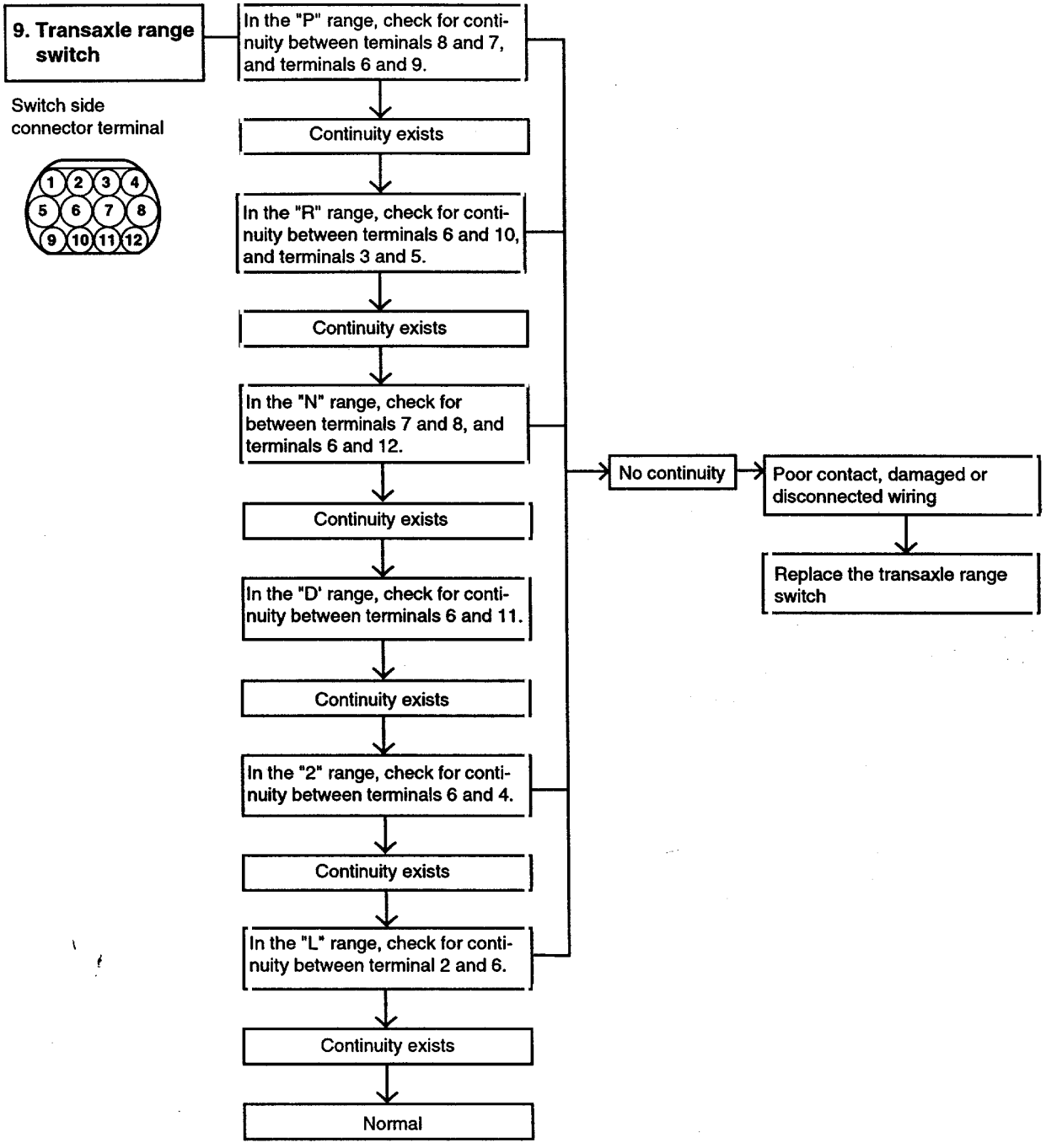
EKDD025A


7. Damper clutch system
Pull the parking brake to set it securely.
Set the selector lever to "P" or "N", and start the engine.
With the engine idling, depress the foot brake firmly.
Set the selector lever to the "R" or "D" range.
Allow the engine to continue idling.
Normal
Stop the engine
Improper idle adjustment
Readjust the idling
Poor closure (sticking) of the damper clutch control solenoid valve.
Replace the damper clutch control solenoid valve.
Sticking of the clutch control valve
Overhaul the valve body
Sticking (seizure) of the damper clutch.
Replace the torque converter assembly.

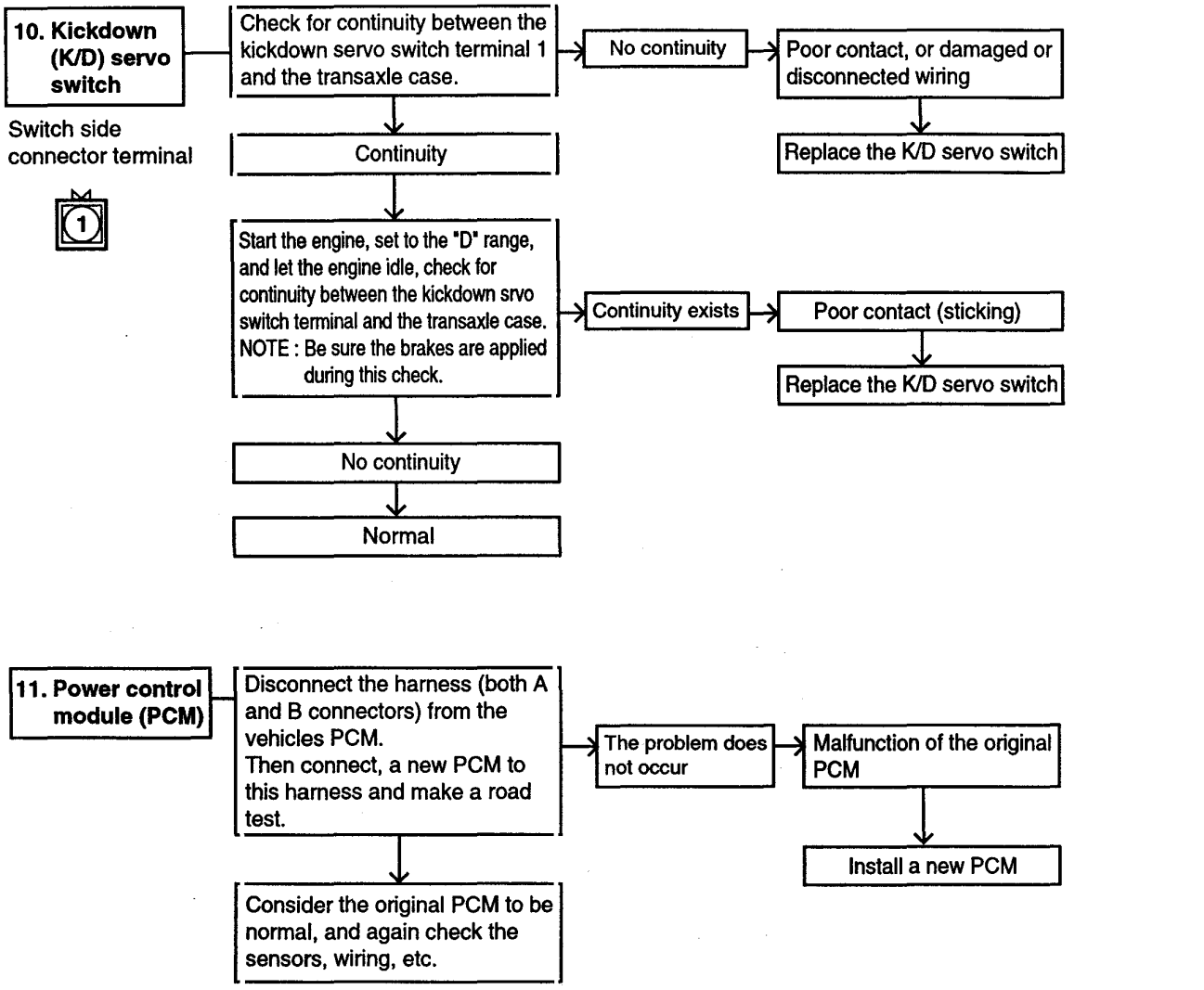
EKDA025D


8. Damper clutch control solenoid valve (DCCSV)
Solenoid valve side connector terminal
1 2 3
4 5 6
1. SCSV-C
2. PCSV-A
3. PCSV-B
4. SCSV-B
5. SCSV-A
6. DCCSV
Check the resistance between terminal 6 of the solenoid valve connector and the transaxle case.
Standard value : 3Ω/20°C
Connect 12V between the transaxle case and terminal 6 ; switch ON and OFF and check for operation noise.
Noise exists
Normal
Resistance ; too low or too high
Short-circuit, damaged or disconnected wiring
Replace the DCCSV
No operation noise. Check for sticking. * (Valve stroke : 0.3 mm (0.012 in. or less)
*Sticking is usually at the release side.
Short-circuit, damaged or disconnected wiring.
Replace the DCCSV

EKDD025B


9. Transaxle range switch
Switch side connector terminal
1 2 3 4
5 6 7 8
9 10 11 12
In the "P" range, check for continuity between terminals 8 and 7, and terminals 6 and 9.
Continuity exists
In the "R" range, check for continuity between terminals 6 and 10, and terminals 3 and 5.
Continuity exists
In the "N" range, check for between terminals 7 and 8, and terminals 6 and 12.
Continuity exists
In the "D' range, check for continuity between terminals 6 and 11.
Continuity exists
In the "2" range, check for continuity between terminals 6 and 4.
Continuity exists
In the "L" range, check for continuity between terminal 2 and 6.
Continuity exists
Normal
No continuity
Poor contact, damaged or disconnected wiring
Replace the transaxle range switch

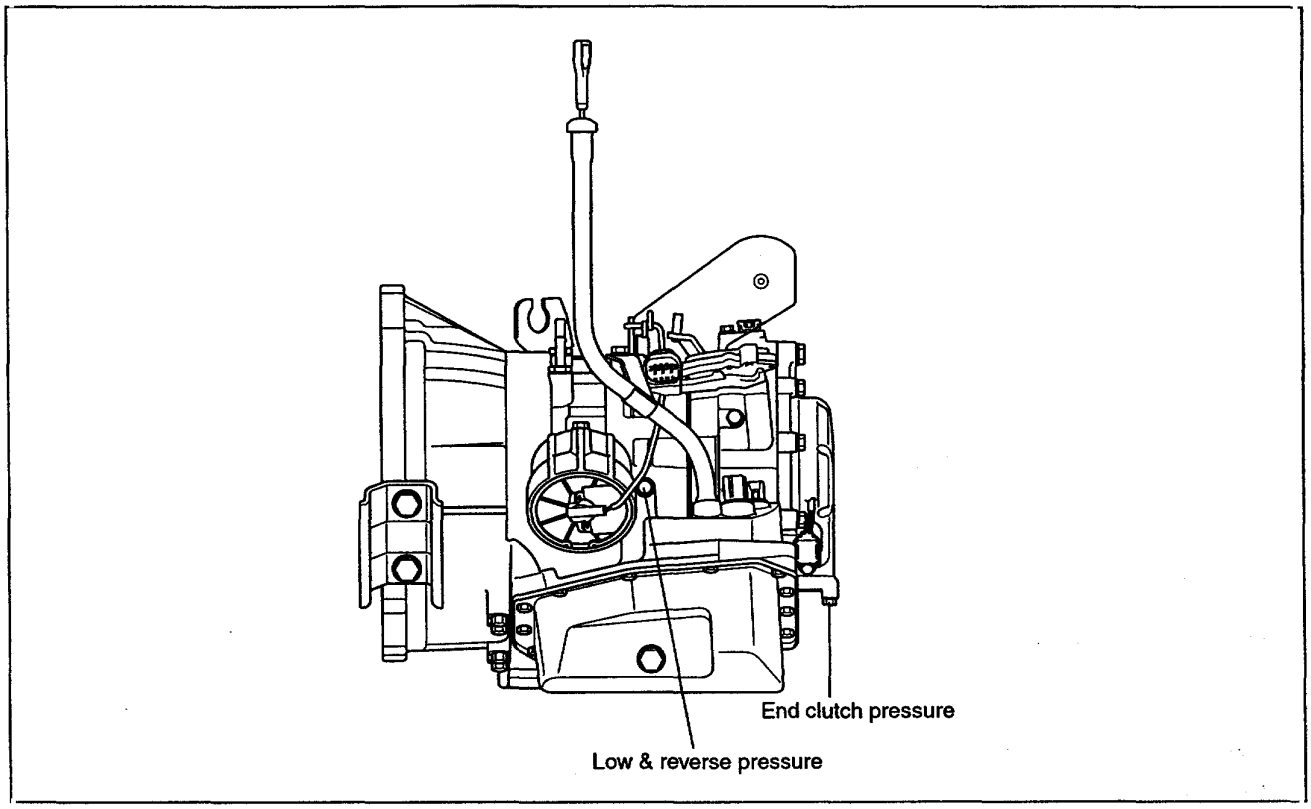
EKFA125F


10. Kickdown (K/D) servo switch
Switch side connector terminal
1
Check for continuity between the kickdown servo switch terminal 1 and the transaxle case.
No continuity
Poor contact, or damaged or disconnected wiring
Replace the K/D servo switch
Continuity
Start the engine, set to the "D" range, and let the engine idle, check for continuity between the kickdown srvo switch terminal and the transaxle case.
NOTE : Be sure the brakes are applied during this check.
Continuity exists
Poor contact (sticking)
Replace the K/D servo switch
No continuity
Normal
11. Power control module (PCM)
Disconnect the harness (both A and B connectors) from the vehicles PCM.
Then connect, a new PCM to this harness and make a road test.
The problem does not occur
Malfunction of the original PCM
Install a new PCM
Consider the original PCM to be normal, and again check the sensors, wiring, etc.

EKDA025G

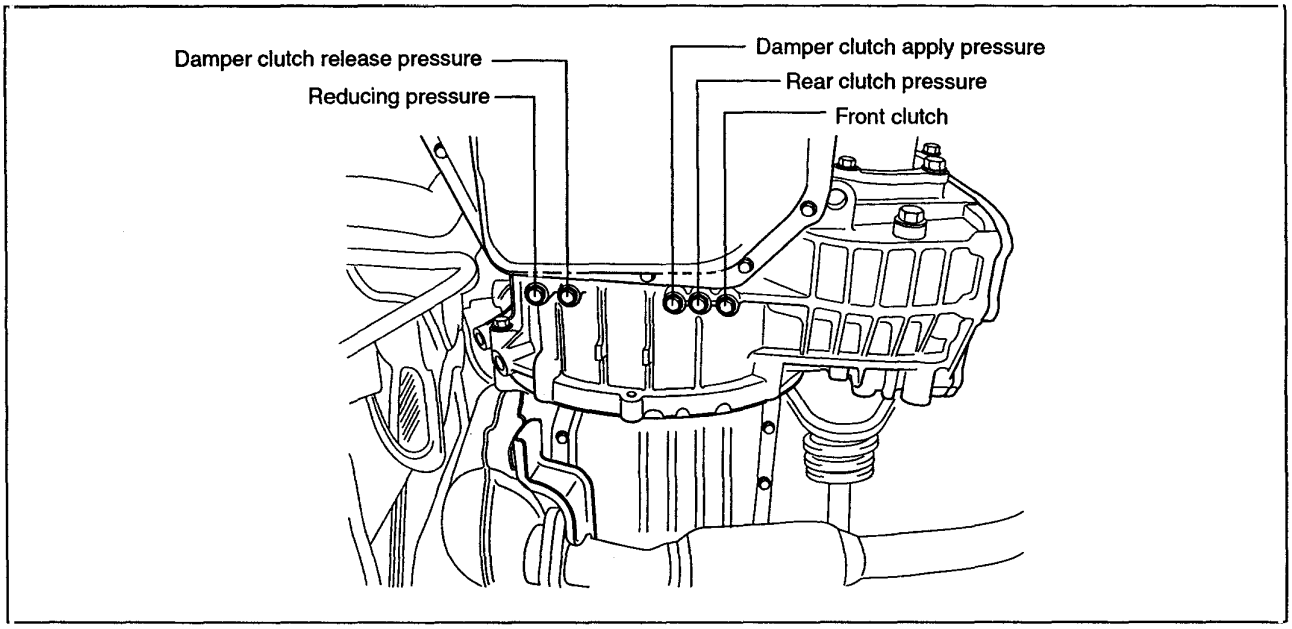
OIL PRESSURE TESTS

1. Completely warm up the transaxle.
2. Raise the front of the vehicle so that the front wheels can be rotated.
3. Connect an engine tachometer and place it in a position where it's easy to see.
4. Attach the special oil-pressure gauge (09452-21500) and the adapter (09452-21002) to each oil-pressure outlet port.
   When the reverse pressure is to be tested, the 3,000 kpa (400 psi) type of gauge should be used.



EKPC008A

5. Measure the oil pressure under various conditions. check to be sure that the measured results are within the standard value range shown in the "Standard oil pressure table" below. If the oil pressure is not within the specified range, check and repair as described in the section "Preliminary Steps if Oil Pressure Is Not Normal" on the next page.



EKPC395A

STANDARD OIL PRESSURE TABLE

No.	Conditions				Standard oil pressure kPa (psi)							
	Selector lever position	(Reference) vehicle speed km/h (mph)	Engine speed rpm	Shift position	1 Reducing pressure	2 Kickdown brake pressure	3 Front Clutch pressure	4 End clutch pressure	5 Low-reverse brake pressure	6 Damper clutch pressure (Apply)	7 Damper clutch release pressure (Release)	8 Rear clutch pressure
1	N	0 (0)	Idling	Neutral	400-440 (58-63)	-	-	-	-	-	-	-
2	D	0 (0)	Idling	2nd gear	↑	58-147 (8-21)	-	-	-	-	-	-
3	D (SW-ON)	110 (68)	2,500 Approx	4th gear	↑	637-695 (92-100)	-	650-710 (94-102)	-	637-793 (92-114)	-	833-911 (120-132)
4	D (SW-OFF)	75 (47)	2,500 Approx	3rd gear	↑	840-900 (122-130)	813-872 (117-126)	833-911 (120-132)	-	↑	-	833-911 (120-132)
5	2	50 (31)	2,500 Approx	2nd gear	↑	840-900 (122-130)	-	-	-	↑	-	833-911 (120-132)
6	L	0 (0)	2,500 Approx	1st gear	↑	-	-	-	235-294 (34-42)	245-400 (35-58)	510-610 (74-88)	833-911 (120-132)
7	R	35 (22)	2,500 Approx	Reverse	420-480 (60-69)	-	1,666-2,058 (241-298)	-	1,666-2,058 (241-298)	254-450 (36-65)	450-646 (65-93)	-

EKNB026A

NOTE

Must be 19.6 kPa (2.8 psi) or less.

PRELIMINARY STEPS IF OIL PRESSURE IS NOT NORMAL

Trouble symptom	Probable cause	Remedy
Line pressures are all low (or high). Line pressure refers to oil pressures 2, 3, 4, 5, 6, 7 and 8 in the "Standard oil pressure table" on the previous page.	• Obstructed oil filter • Improper adjustment of oil pressure (line pressure) regulator valve • Sticking of regulator valve • Looseness of valve body tightening part • Improper oil pump discharge pressure	• Visually inspect the oil filter; replace the oil filter if it is restricted. • Measure line pressure 2 (kickdown brake pressure); if the pressure is notthe standard value, readjust the line pressure, or if necessary, replace thevalve body assembly. • Check the operation of the regulator valve; repair if necessary, or replacethe valve body assembly. • Tighten the valve body tightening bolt and installation bolt. • Check the side clearance of the oil pump gear; replace the oil pump assembly if necessary.
Improper reducing pressure	• Improper line pressure • Clogging of the filter (L-shaped type) of the reducing-pressure circuit • Improper adjustment of the reducing pressure • Improper adjustment of the reducing pressure • Sticking of the reducing valve • Looseness of valve body tightening part	• Check the 2 kickdown brake pressure (line pressure); if the line pressure is not the standard value, check as described in item 1 above. • Disassemble the valve body assembly and check the filter; replace the filter if it is restricted. • Measure the 1 reducing pressure; if it is not the standard value, readjust, or replace the valve body assembly. • Check the operation of the reducing valve; if necessary, repair it, or replace the valve body assembly. • Tighten the valve body tightening bolt and installation bolt.
Improper kickdown brake pressure	• Malfunction of the D ring or seal ring or the sleeve or kickdown servo piston. • Looseness of valve body tightening part. • Functional malfunction of the valve body assembly.	• Disassemble the kickdown servo and check whether the seal ring or D-ring is damaged. If it is cut or has scratches, replace the seal ring or D-ring. • Tighten the valve body tightening bolt and installation bolt. • Replace the valve body assembly.
Improper front clutch pressure	• Malfunction of the D-ring of the sleeve or kickdown servo piston. • Looseness of valve body tightening part • Malfunction of the valve body assembly. • Wear of the front clutch piston or retainer, or malfunction of the D-ring. (Refer to the figure on the next page.) • Oil pump gasket or seal ring (2) damaged.	• Disassemble the kickdown servo and check whether the seal ring is damaged.If it is cut or has scratches, replace the seal ring or D-ring. • Tighten the valve body tightening bolt and installation bolt. • Replace the valve body assembly. • Disassemble the transaxle itself and check whether or not there is wear of the front clutch piston and retainer inner circumference, or damage of the D-ring. If there is any wear or damage, replace the piston, retainer, D-ring and or seal ring.

Trouble symptom	Probable cause	Remedy
Improper end clutch pressure	• Malfunction of a D-ring, seal ring of the end clutch or O-ring of the pipe (Refer to the figure on the next page.) • Looseness of valve body tightening part. • Malfunction of the valve body assembly	• Disassemble the end clutch and check the seal ring, D-ring of the piston, seal ring of the retainer, etc.; replace if there are cuts, scars, scratcher or damage. • Tighten the valve body tightening bolt and installation bolt. • Replace the valve body assembly.
Improper low-reverse brake pressure	• O-ring between valve body and transaxle damaged or missing • Looseness of valve body tightening part • Malfunction of the valve body assembly • Malfunction of the O-ring of the low-reverse brake piston or the O-ring of the retainer (Refer to the figure on the next page.)	• Remove the valve body assembly and check to be sure that the O-ring at the upper surface of the upper valve body is not missing or damaged; install or replace the O-ring if necessary. • Tighten the valve body tightening bolt and installation bolt. • Replace the valve body assembly. • Disassemble the transaxle itself and check the O-ring for damage; replace if there are cuts, scars, scratches or damage.
Improper torque converter pressure	• Sticking of the damper clutch control solenoid valve (DCCSV) • Clogging or leaking of the oil cooler and/or lines. • Damaged seal ring of the input shaft. • Malfunction of the torque converter.	• Check the operation of the damper clutch system and the DCCSV. • Repair or replace, as necessary, the cooler and/or lines. • Disassemble the transaxle itself and check for damage of the seal ring; replace the seal ring if there is damage. • Replace the torque converter.
Improper rear clutch pressure	• Malfunction of the D-ring or seal ring of the rear clutch. • Looseness of valve body tightening part. • Functional malfunction of the valve body assembly.	• Tighten the value body tightening bolt and installation bolt. • Replace the valve body assembly.
Improper damper clutch release pressure.	Same as the probable cause of damper clutch release pressure	Same as the remedy of damper clutch release pressure.

CONVERTER STALL TEST

A stall test determines the maximum engine speed obtained at full throttle in "D" and "R" range. This test checks the torque converter stator overrunning clutch operation, and the holding ability of the transaxle clutches and the low-reverse brake.

⊗ WARNING

During this test, make sure that nobody stands in front of or behind the vehicle.

1. Check transaxle fluid level. Fluid should be at normal operating temperature [80~90°C (176~194°F)]. Engine coolant should also be at normal operating temperature [80~90°C (176~194°F)].
2. Apply chocks to both rear wheels.
3. Attach an engine tachometer.
4. Apply the parking and service brakes fully.
5. Start the engine.
6. With the selector lever in the "D" position, depress the accelerator pedal fully to read maximum engine rpm. Do not hold the throttle wide open any longer than is necessary to obtain maximum engine rpm reading, and never longer than 5 seconds at a time. If more than one stall test is required, operate the engine at approximately 1,000 rpm in neutral for 2 minutes to cool the transaxle fluid between tests.

Stall speed : 2,200~2,800rpm

7. Place the selector lever in the "R" position and perform the stall test by the same procedure as previously described.

STALL SPEED ABOVE SPECIFICATION IN "D"

If stall speed is higher than specification, the rear clutch or overrunning clutch of the transaxle is slipping. In this case, perform a hydraulic test to locate the cause of slippage.

STALL SPEED ABOVE SPECIFICATION IN "R"

If the stall speed is higher than specification, the front clutch of the transaxle or low-reverse brake is slipping. In this case, perform a hydraulic test to locate the cause of slippage.

STALL SPEED BELOW SPECIFICATION IN "D" AND "R"

If the stall speed is lower than specification, insufficient engine output or a faulty torque converter is suspected. Check for engine misfiring, improper ignition timing, or valve clearance etc. If these are good, the torque converter is faulty.

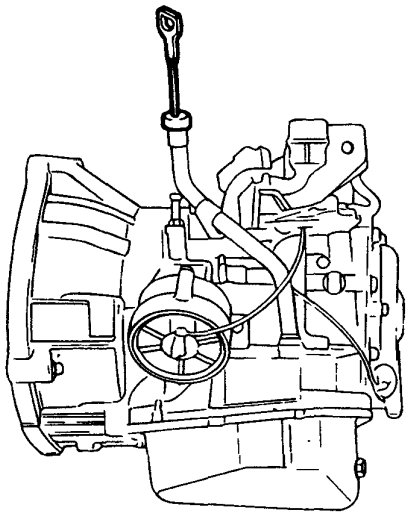
TRANSAXLE FLUID LEVEL INSPECTION

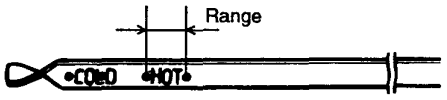
1. Drive the vehicle until the fluid reaches normal operating temperature [80~90°C (176~194°F)].
2. Place the vehicle on a level surface.
3. Move the selector lever through all gear position. This will fill the torque converter and hydraulic system with fluid, then place lever in "N" (Neutral) position.
4. Before removing the dipstick, wipe all contaminants from around the dipstick. Then take out the dipstick and check the condition of the fluid. The transaxle should be overhauled under the following conditions.
   - If there is a "burning" door.
   - If the fluid color has become noticeably blacker.
   - If there is a noticeably excessive amount of metal particles in the fluid.
5. Check to see if the fluid level is in the "HOT" range on dipstick. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" range.

Transaxle fluid : GENUINE DIAMOND ATF SP-III

Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles which are compressable. Therefore, pressures will be erratic, causing delayed shifting, sliping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Be sure to examine the fluid on the dipstick closely.





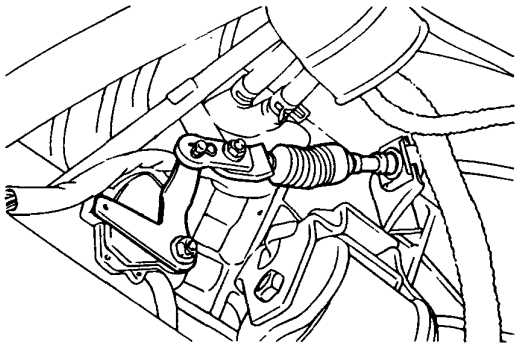
EKPD028A

SELECTOR LEVER OPERATION CHECK

1. Shift the selector lever to each range and check to see that the lever moves smoothly and is controlled. Check to see that the position indicator is correct.
2. Check to be sure that the selector lever can be shifted to each position.
3. Start the engine and check to see if the vehicle moves forward when the selector lever is shifted from "N" to "D" and moves backward when shifted to "R".
4. When the shift lever malfunctions, adjust the control cable and the selector lever sleeve. Check for worn shift lever assembly sliding parts.

TRANSAXLE RANGE SWITCH ADJUSTMENT

1. Place selector lever in "N" (Neutral) position.
2. Loosen the manual control lever lock nut to seperate the cable and lever.



EKDA028C

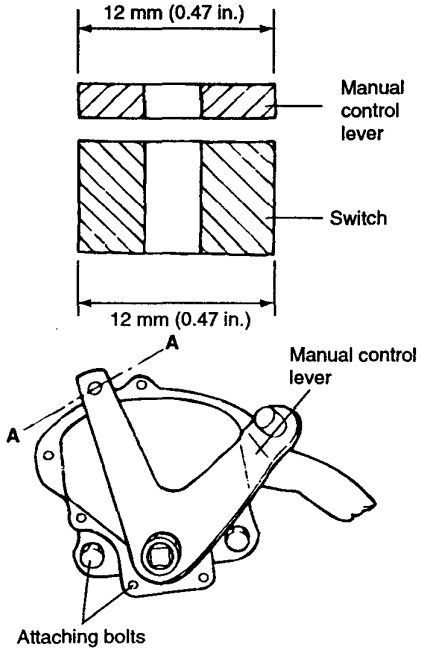
3. Place the manual control lever in the "N" (Neutral) position.
4. Turn the transaxle range switch body until the 12 mm (0.47 in.) wide end of the manual control lever aligns with the switch body flange [12 mm (0.472 in.) wide portion].
5. Tighten the attaching bolts (2 pcs.) to the specified torque.

Transaxle Range Switch Attaching Bolt :
10~12 Nm (100~120 kg·cm, 7~9 lb·ft)

NOTE

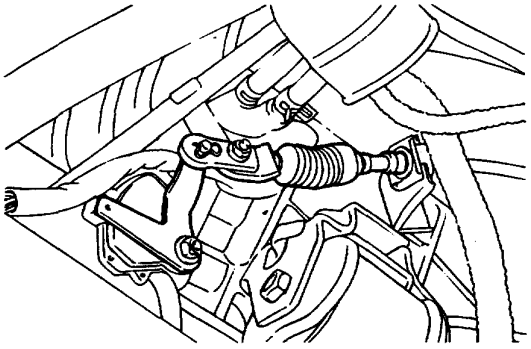
When setting up the switch body, be careful that the O-ring does not drop from the switch body. Tighten the attaching bolts carefully.

Section A-A



EKPD028D

6. Make sure that the selector lever is in the "N" (Neutral) position.
7. Adjust the flange nut so that there is no slack in the control cable and make sure that the selector lever operates smoothly.
8. Run the vehicle and confirm that the transaxle is set in each range when the selector lever is shifted to each position.



EKDA028E

KICKDOWN SERVO ADJUSTMENT

1. Completely remove all dirt and other contaminating materials adhered around the kickdown adjust screw.
2. Loosen the lock nut.
3. Loosen and tighten the adjust screw two times by torque of 5 Nm (3.6 lb·ft)
4. Tighten adjust screw by torque of 5 Nm and then, loosen the adjust screw 3 to 3-1/3 turns.
5. Tighten the lock nut to the specified torque.

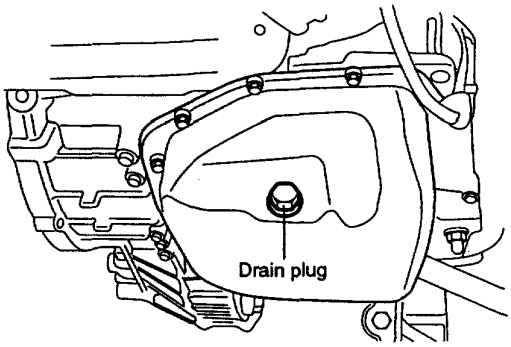
Lock nut : 15~22 Nm (150~220 kg·cm, 11~16 lb·ft)

NOTE

Before assembling, apply sealant (DC780) to the center portion of the adjust screw.

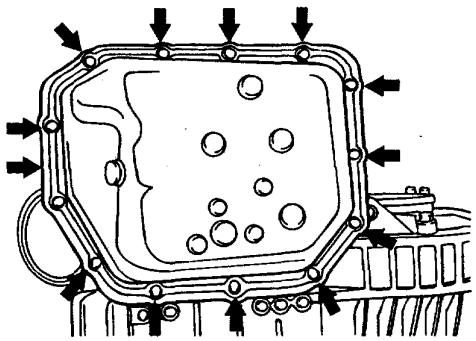
LINE PRESSURE ADJUSTMENT

1. Drain out the automatic transaxle fluid.



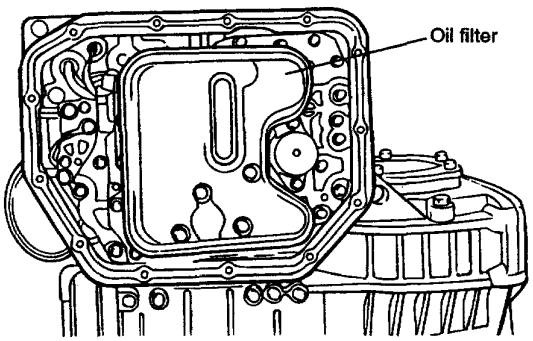
EKPC023A

2. Remove the oil pan.



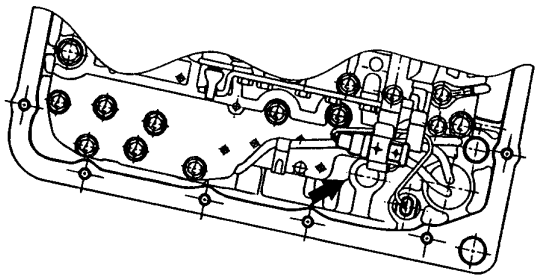
T8AT030B

3. Remove the oil filter.



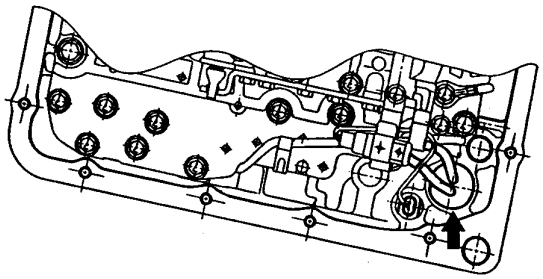
EKPD030I

4. Remove the oil-temperature sensor.



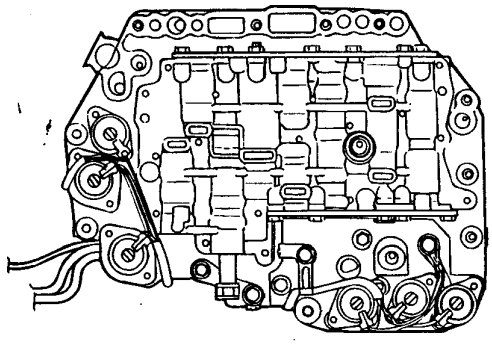
KKNB011A

5. Press the tab of the solenoid valve harness grommet and push in.



KKNB011B

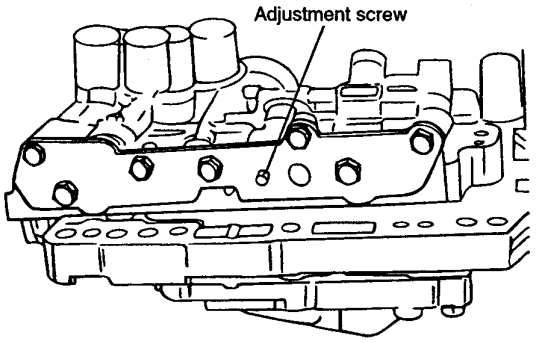
6. Remove the valve body assembly. The manual valve can come out, so be careful not to drop it.



T8AT030H

7. Turn the adjustment screw of the regulator valve and adjust so that the line pressure (kickdown brake pressure) reaches the standard value. When the adjustment screw is turned clockwise, the line pressure becomes lower; when it is turned counter-clockwise, it becomes higher.

Standard value :
860~900 kPa (122~129 psi, 8.77~9.18 kg/cm²)
Oil pressure change for each turn of adjustment screw :
38 kPa (5.4 psi, 0.39 kg/cm²)

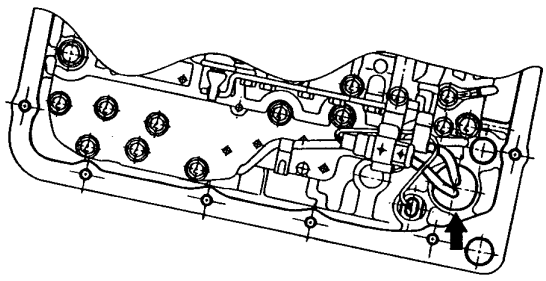


EKDA028J

8. Check to be sure that the O-ring is installed on the upper surface of the valve body at the place.

9. Replace the O-ring of the solenoid valve connector with a new one.

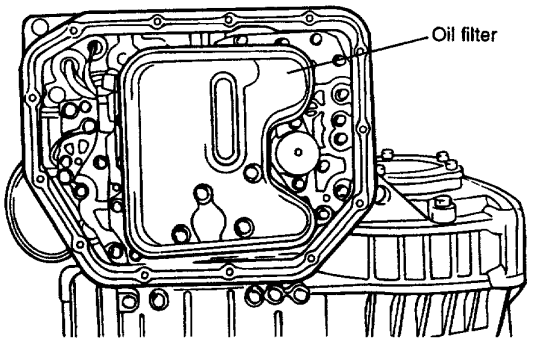
10. Install the valve body assembly to the case and then insert the solenoid valve connector into the case. Be sure, at this time, that the notched part of the connector faces as shown in the figure. Also be careful that the lead wiring isn't caught.



KKNB011B

11. Tighten the valve body assembly mounting bolts to 10-12 Nm (100-120 kg·cm, 7-9 lb·ft).

12. Install the oil filter.



EKPD030I

13. Install a new oil pan gasket with the oil pan.
14. Pour in the specified amount of automatic transaxle fluid.
15. Perform the oil pressure test. Readjust if necessary.

REDUCING PRESSURE ADJUSTMENT

If the Scan Tool is not abailable

1. Remove parts up to the oil filter in the same way as for adjustment of the line pressure. The valve body need not be removed.
2. Turn the adjustment screw of the lower valve body and adjust so that the reducing pressure is the standard value. When the adjustment screw is turned clockwise, the reducing pressure becomes lower; when it is turned counter clockwise, it becomes higher.

NOTE

When adjusting the reducing pressure, aim for the center value (425 kPa, 60 psi) of the standard value allowance.

Standard value :
420 kPa (60 psi, 4.2±0.2 kg·cm²)
Oil pressure change for each turn of the adjustment screw :
22 kPa (4.3 psi, 0.22 kg·cm²)

3. Install the oil filter and oil pan in the same way as for adjustment of the line pressure.
4. Peform the oil pressure test. Readjust if necessary.

If the Scan Tool is used

5. Adjust the pressure control solenoid so that the kick-down brake pressure is the standard value when activated to 50% duty by the Scan Tool.

Standard value :
320±30 kPa (39±1 psi, 3.2±0.3 kg·cm²)
Oil pressure change for each turn of the adjustment screw :
30 kPa (3 psi, 0.3 kg·cm²)

6. Check to be sure that the reducing pressure (after the adjustment is completed) is within the range of 370~490 kPa (53~70 psi, 3.8~5.0 kg·cm²).

CAUTION

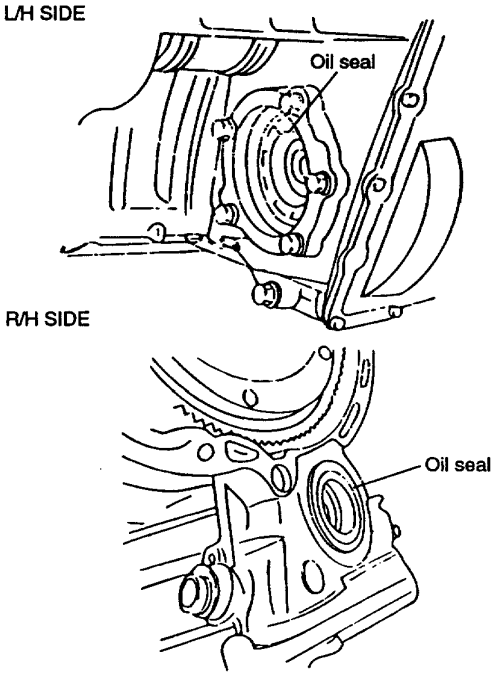
This adjustment should be made with an oil temperature of 80-90°C (176-194°F). If the adjustment is made at a temperature that is too high, the line pressure will drop during idling, with the result that it might not be possible to make the correct adjustment.

THROTTLE POSITION SENSOR INSPECTION

Refer to GROUP FUEL SYSTEM.

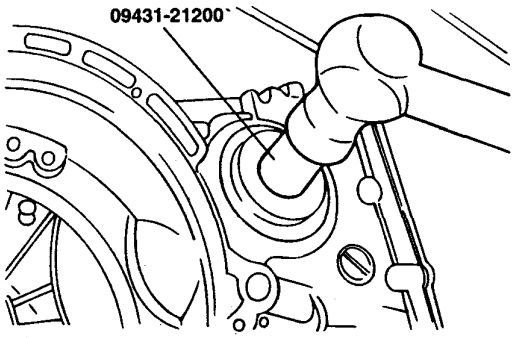
DRIVE SHAFT OIL SEALS REPLACEMENT

1. Disconnect the drive shaft from the transaxle. (Refer to DRIVE SHAFT & FRONT AXLE)
2. Using a flat-tip (-) screwdriver, remove the oil seal.



EKDA028M

3. Using the special tool (09431-21200), tap the drive shaft oil seal into the transaxle.

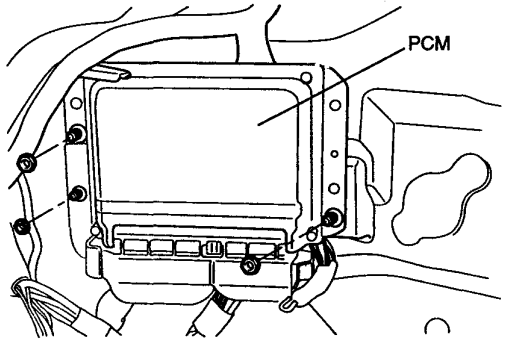


EKDA028N

4. Apply a coating of the transaxle fluid to the lip of the oil seal.

PCM REPLACEMENT

PCM (Power Control Module) is located at the dash panel of the upper side of brake pedal in the driver side.



KKPC020C

DIAGNOSTIC ITEM EDE42512

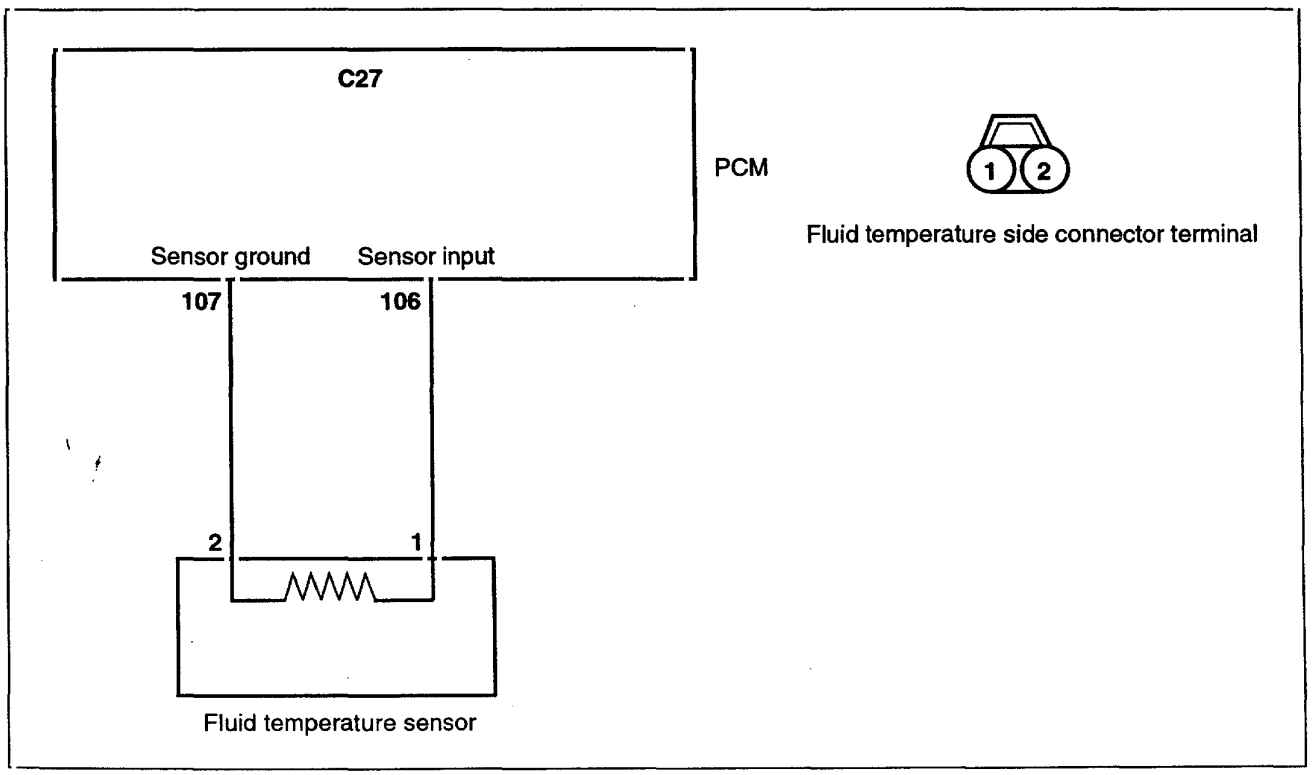
P0712/P0713

DTC NO	DIAGNOSTIC ITEM	
P0712	FLUID (OIL) TEMPERATURE SENSOR SYSTEM	Short to ground side
P0713	FLUID (OIL) TEMPERATURE SENSOR SYSTEM	Open

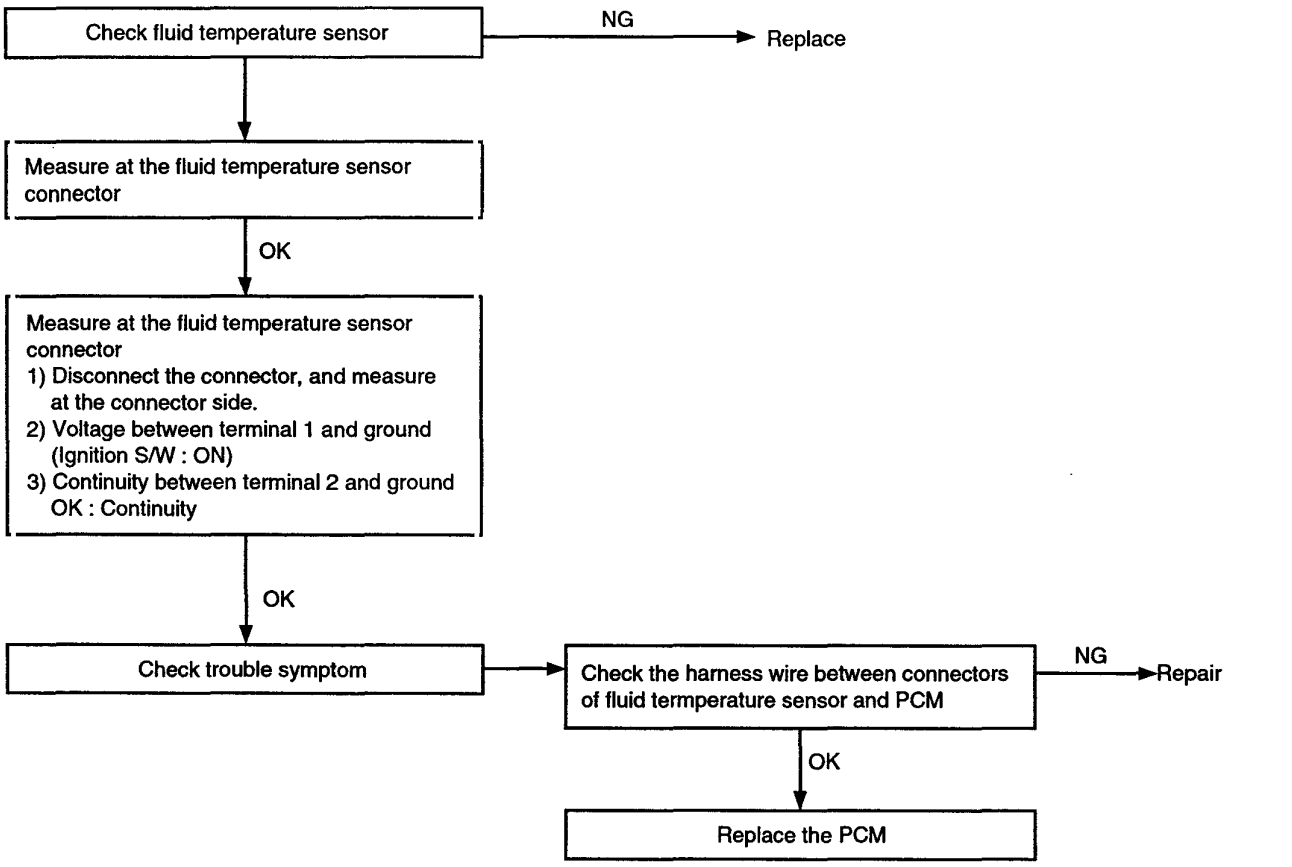
TROUBLESHOOTING GUIDE

Detection condition	Possible cause	Check item
• 10 minutes after engine speed > 1000 rpm • 10 minutes after pulse generator B > 1000 rpm • Low temperature side output voltage > 4.3 V **SYMPTOM** • Shift shock • Power shift pattern will not be available	**Malfunction** • Fluid temperature sensor • PCM	• Fluid temperature sensor • Harness & connector

CIRCUIT DIAGRAM



EKDD106A


Check fluid temperature sensor
NG
Replace
Measure at the fluid temperature sensor connector
OK
Measure at the fluid temperature sensor connector
1) Disconnect the connector, and measure at the connector side.
2) Voltage between terminal 1 and ground (Ignition S/W : ON)
3) Continuity between terminal 2 and ground OK : Continuity
OK
Check trouble symptom
Check the harness wire between connectors of fluid termperature sensor and PCM
NG
Repair
OK
Replace the PCM

EKDA006B

DIAGNOSTIC ITEM ED18A0B6

P1709

DTC NO	DIAGNOSTIC ITEM	
P1709	KICK DOWN SERVO SWITCH	- Open, short circuit -

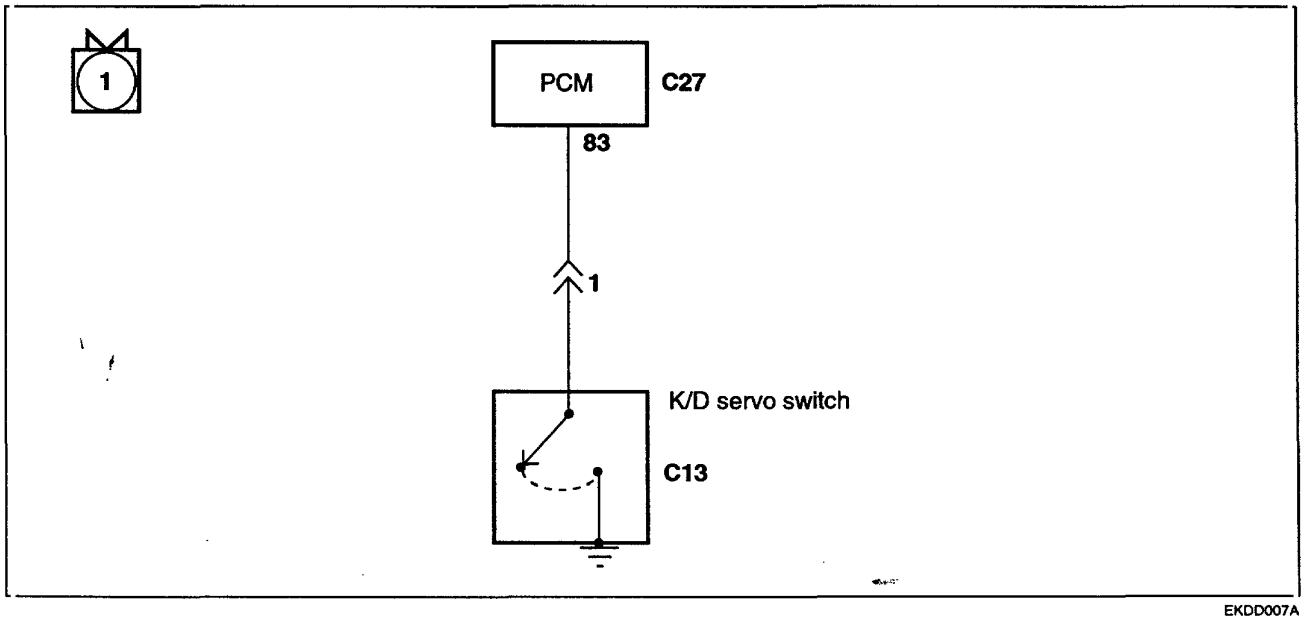
DESCRIPTION

- Detects the point of time when K/D band starts operation to control fluid pressure when K/D band operates.

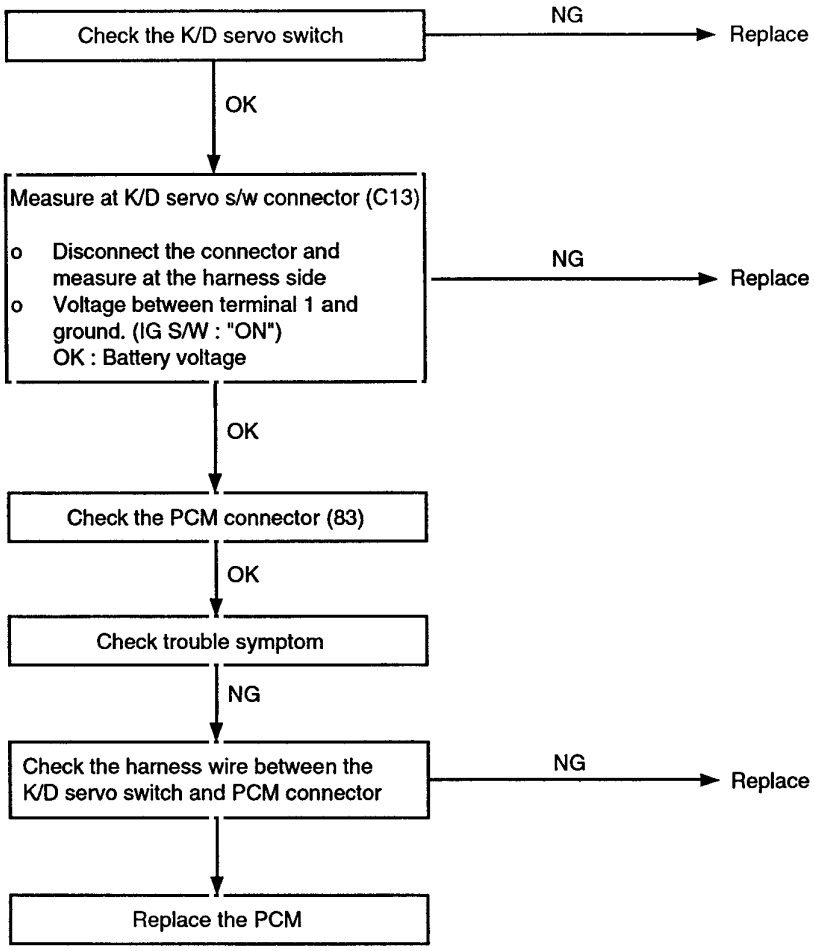
TROUBLESHOOTING GUIDE

Detection condition	Possible cause	Check item
• 1st or 3rd gear signal is present for more than 5 sec. • Transfer shaft speed is greater than 900rpm • Fluid temperature is above 60°C • PCM receives an "OFF" signal from K/D servo s/w	• Malfunction of K/D servo s/w • Malfunction of connector • Malfunction of PCM	• Harness & connnector • K/D servo s/w • K/D servo assembly
SYMPTOM • Shift shock is experienced as transaxle shifts into 2nd and 4th gears.		

CIRCUIT DIAGRAM



EKDD007A


Check the K/D servo switch
NG
Replace
OK
Measure at K/D servo s/w connector (C13)
o Disconnect the connector and measure at the harness side
o Voltage between terminal 1 and ground. (IG S/W : "ON")
OK : Battery voltage
NG
Replace
OK
Check the PCM connector (83)
OK
Check trouble symptom
NG
Check the harness wire between the K/D servo switch and PCM connector
NG
Replace
Replace the PCM

EKDD007B

DIAGNOSTIC ITEM E94B38B5

P0717

DTC NO	DIAGNOSTIC ITEM	
P0717	PULSE GENERATOR A	- Open, short circuit -

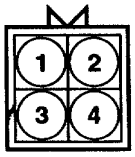
DESCRIPTION

- Detects non-operating area of damper clutch
- Detects turbine rpm for control of fluid pressure during a shift

TROUBLESHOOTING FLOW

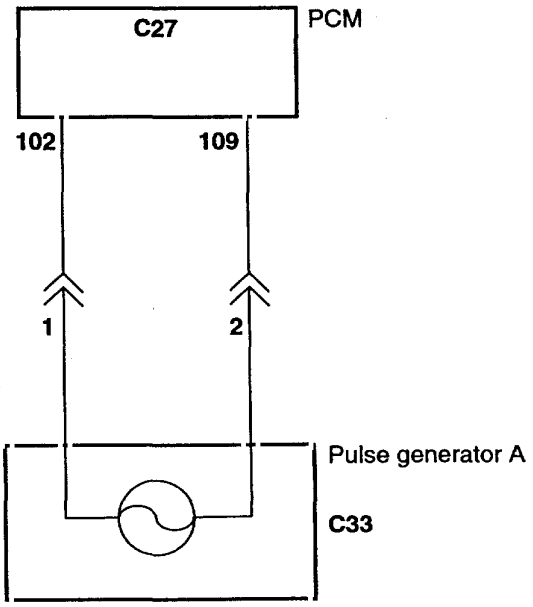
Detection condition	Possible cause	Check item
• Vehicle speed sensor speed > 30km/h • Transaxle range : D, 2 or L • Engine speed > 3,000rpm • Shift position : 2nd, 3rd or 4th gear **SYMPTOM** • Shift shock during 2nd and 4th gear shifting. • When code P0717 is generated, automatic transaxle hold in 3rd gear ("D" range) or 2nd gear ("2", "L" range). • Codes P0731, P0732, P0733 and P0734 may also be set.	• Malfunction of PG-A • Malfunction of connector • Malfunction of PCM • Malfunction of end clutch retainer	• Harness & connector

TROUBLESHOOTING GUIDE



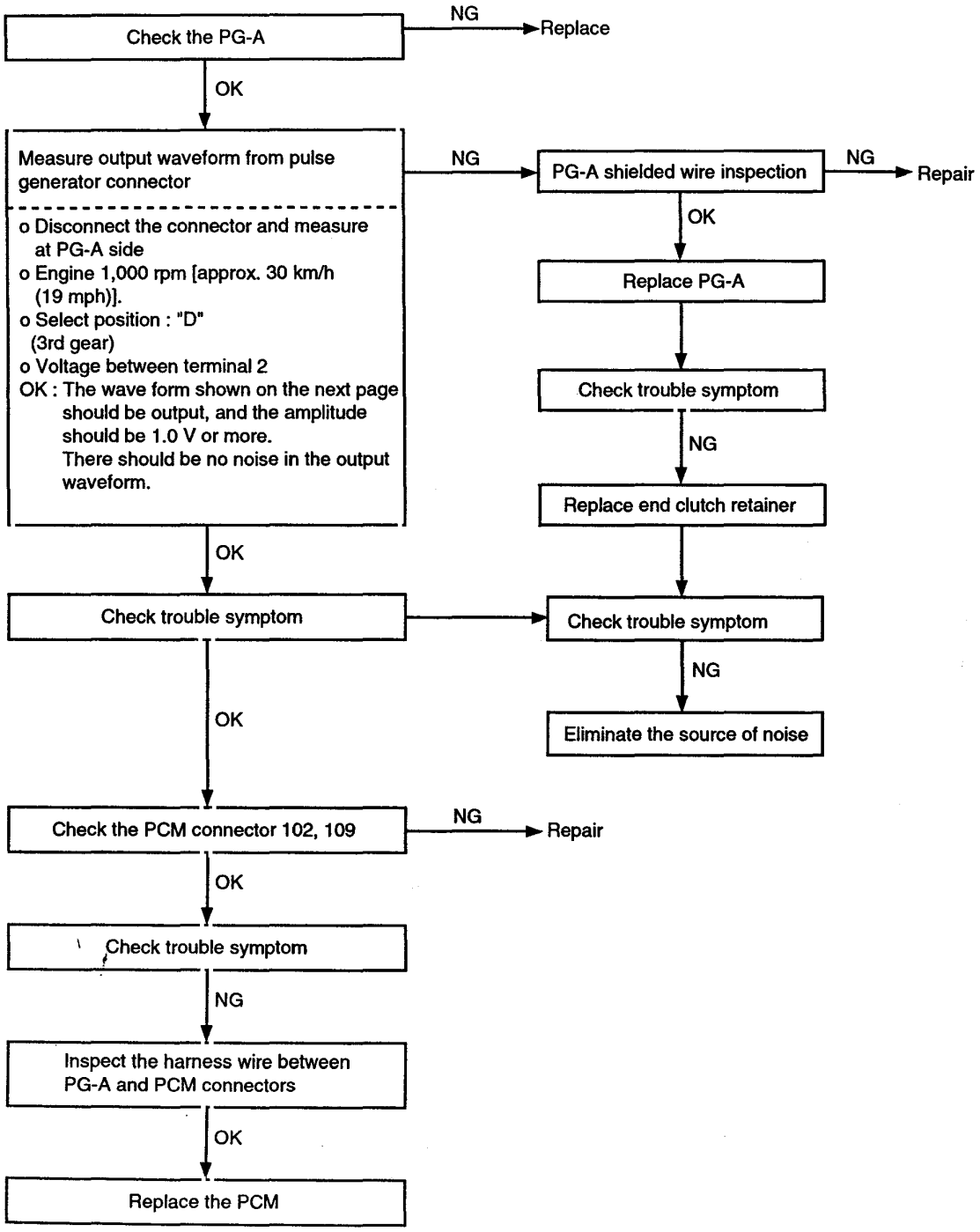
Pulse generator side connector terminals

1-2 : PG-A
3-4 : PG-B



EKDD009A

TROUBLESHOOTING FLOW



EKDD009B

DIAGNOSTIC ITEM E4DBF6C0

P0722

DTC NO	DIAGNOSTIC ITEM	
P0722	PULSE GENERATOR B	- Open, short-

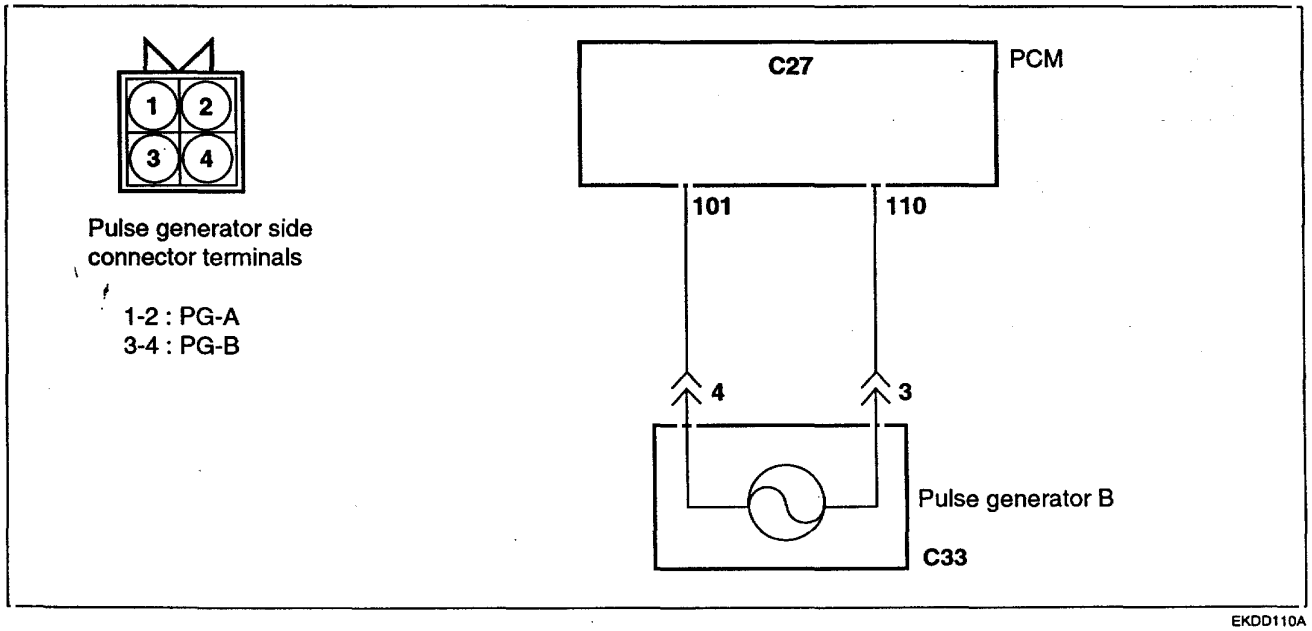
DESCRIPTION

- Detects number of revolutions of the transfer driven gear to monitor vehicle speed.

TROUBLESHOOTING FLOW

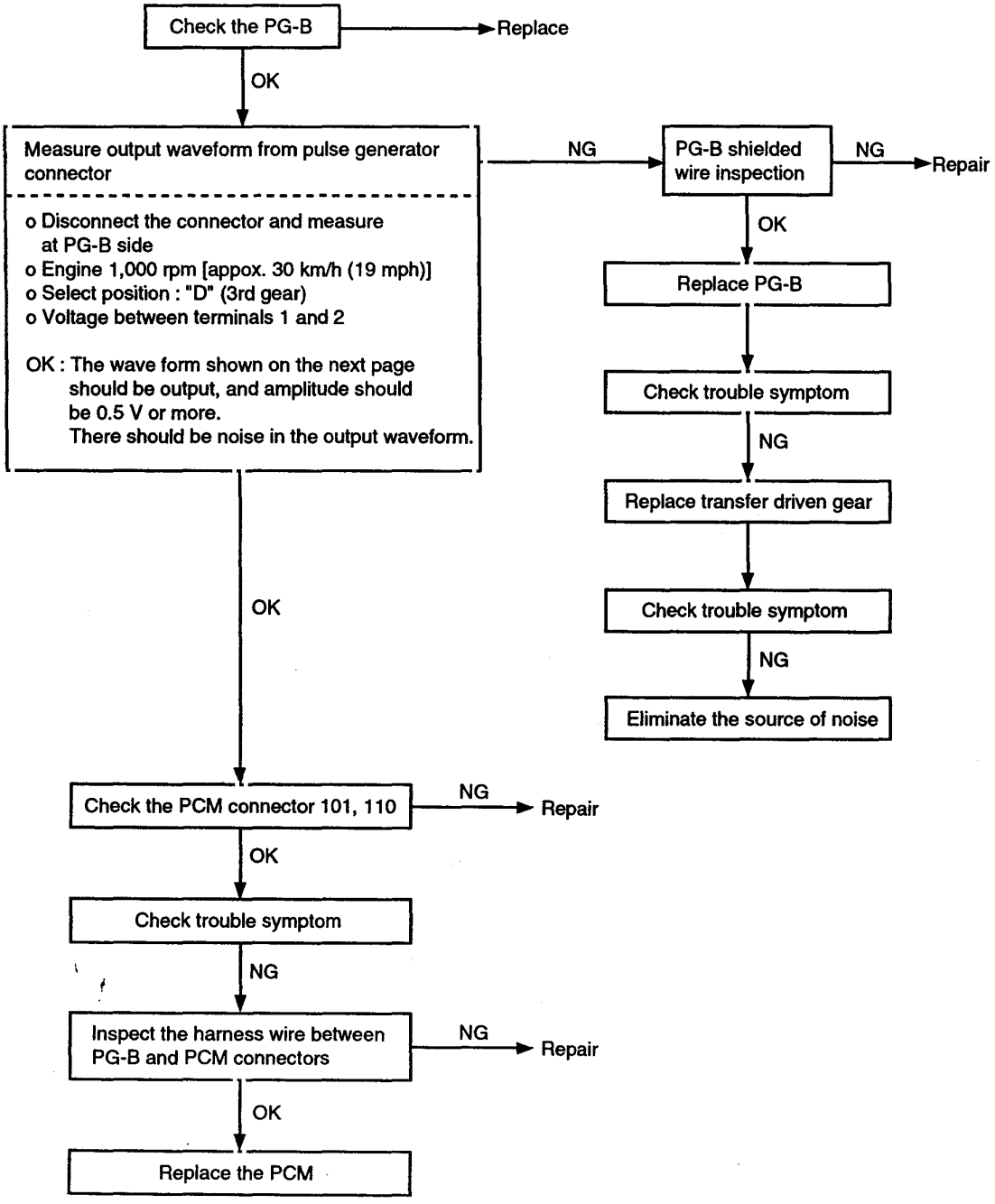
Detection condition	Possible cause	Check item
• Vehicle speed sensor speed > 30 km/h • Engine speed > 3,000 rpm • Shift position : 2nd, 3rd or 4th gear	• Malfunction of PG-B • Malfunction of connector • Malfunction of PCM • Malfunction of transfer driven gear	• Open in PG-B circuit • Malfunction of PG-B • Noise in signal (Poor or defective shielding) • Chattering of vehicle speed sensor
SYMPTOM • Shift shock during 2nd and 4th gear shifting • When fail-safe code P0722 is generated, automatic transaxle will hold in 3rdgear (D) or 2nd gear (2,L) • Codes P0731, P0732, P0733 and P0734 may also be set		

CIRCUIT DIAGRAM



EKDD110A

TROUBLESHOOTING FLOW



EKDD110B

DIAGNOSTIC ITEM E0C9DBCA

P0750

DTC NO	DIAGNOSTIC ITEM	
P0750	SHIFT CONTROL SOLENOID VALVE A	- Open -, - Short circuit -

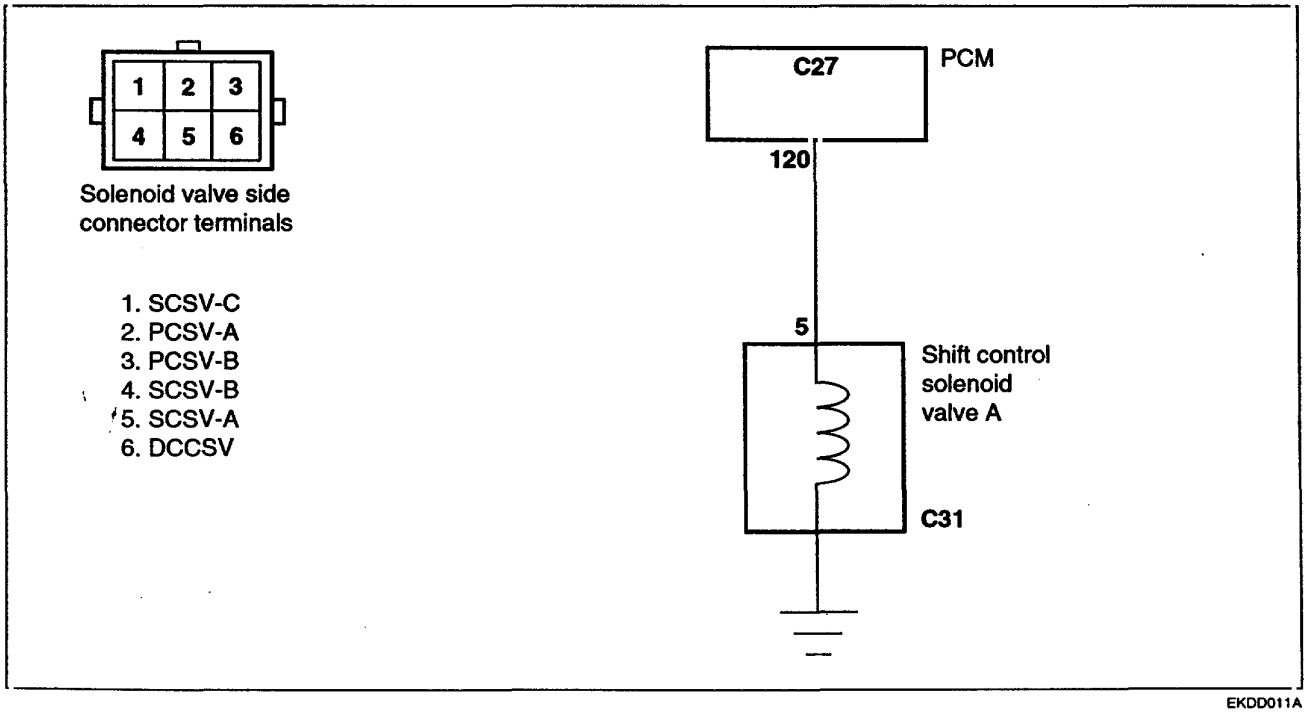
DESCRIPTION

- Control fluid pressure that is acting on the shift control valve (SCV) through ON/OFF signals from the PCM to control shifting.

TROUBLESHOOTING FLOW

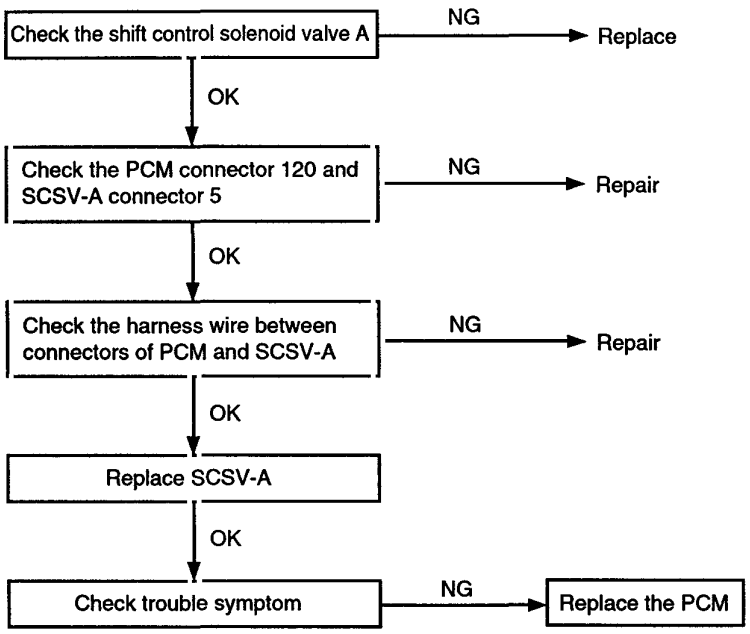
Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open/short in the SCSV-A	• Malfunction of PG-A • Malfunction of connector • Malfunction of PCM	• Open/short in SCSV-A circuit • Malfunction of SCSV-A
SYMPTOM • Automatic transaxle will hold 3rd gear when code P0750 is generated.		

CIRCUIT DIAGRAM



EKDD011A

TROUBLESHOOTING FLOW



EKDD011B

DIAGNOSTIC ITEM EC9DE14C

P0755

DTC NO	DIAGNOSTIC ITEM	
P0755	SHIFT CONTROL SOLENOID VALVE B	- Open -, - Short circuit -

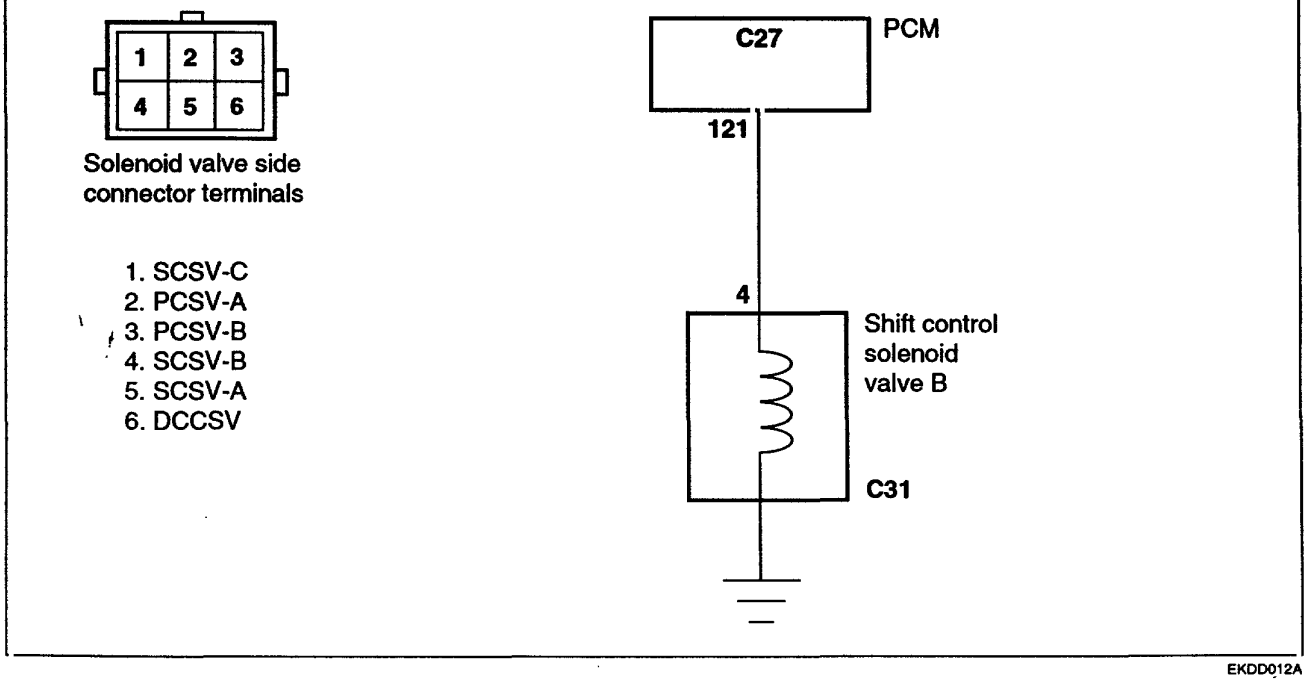
DESCRIPTION

- Controls fluid pressure that is acting on the shift control valve (SCV) through ON/OFF signals from the PCM to control shifting.
- If resistance value of SCSV-B is too high or low, P0755 is output. (open or short circuit).

TROUBLESHOOTING FLOW

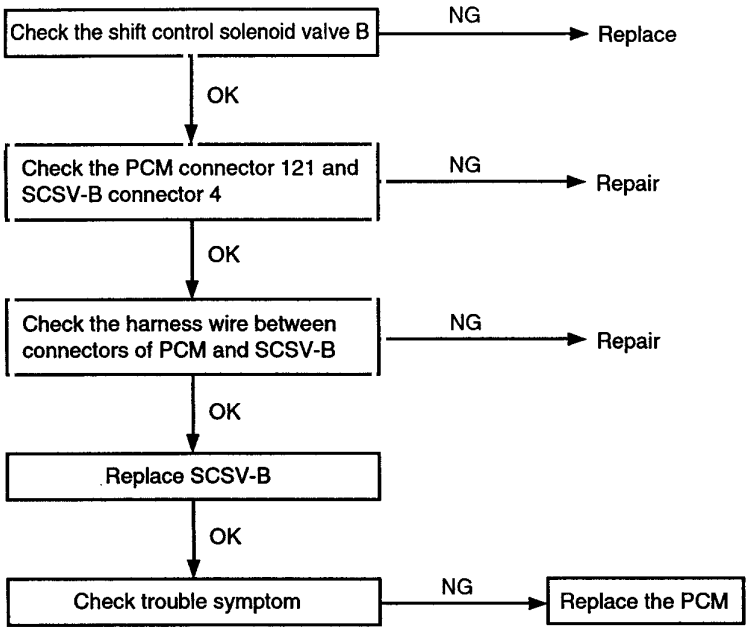
Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open/short in the SCSV-B	• Malfunction of SCSV-B • Malfunction of connector • Malfunction of PCM	• Open/short in SCSV-B circuit • Malfunction of SCSV-B
SYMPTOM • Automatic transaxle will hold 3rd gear when code P0755 is generated.		

CIRCUIT DIAGRAM



EKDD012A

TROUBLESHOOTING FLOW



EKDD012B

DIAGNOSTIC ITEM EBDEE855

P0760

DTC NO	DIAGNOSTIC ITEM	
P0760	SHIFT CONTROL SOLENOID VALVE C	- Open -, - Short circuit -

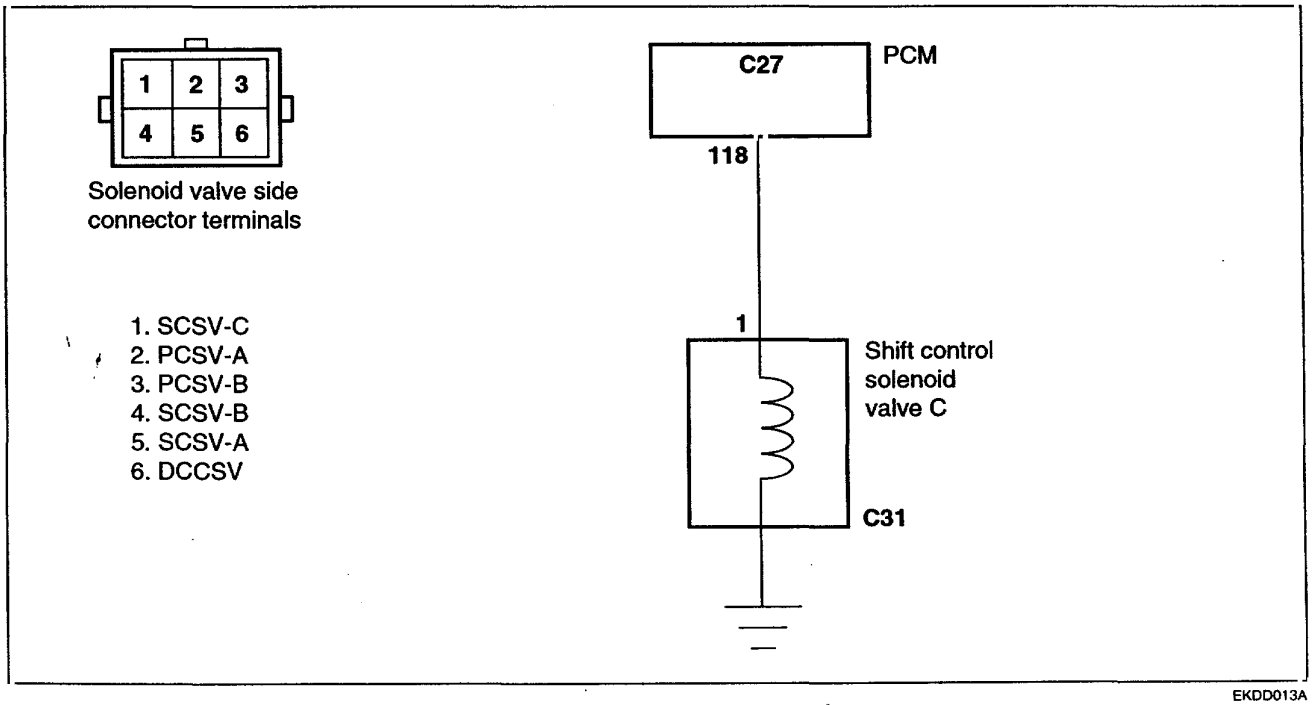
DESCRIPTION

- Controls fluid pressure that is acting on the control switch valve (CSV) through ON/OFF signals from the PCM to control shifting.
- If resistance value of SCSV-C is high, P0760 is output. (open circuit).

TROUBLESHOOTING FLOW

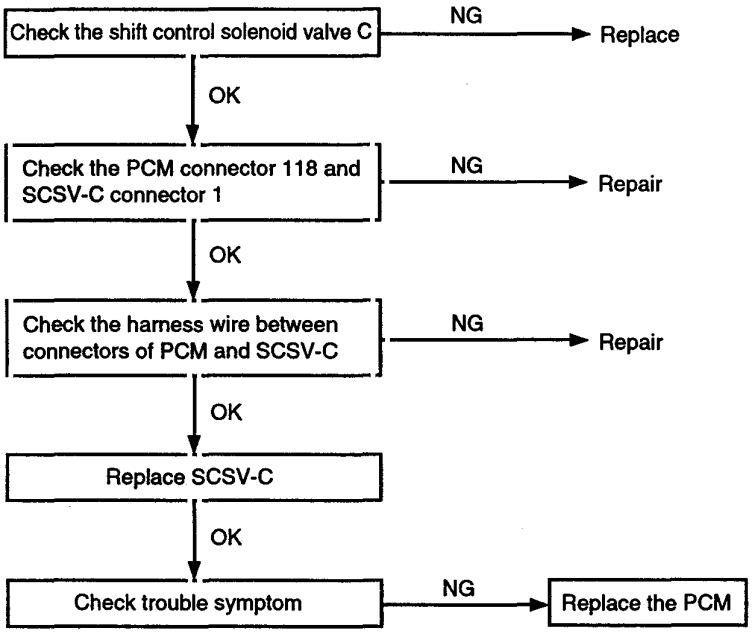
Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open/short in the SCSV-C	• Malfunction of SCSV-C • Malfunction of connector • Malfunction of PCM	• Open/short in SCSV-C circuit • Malfunction of SCSV-C
SYMPTOM • Automatic transaxle will hold 3rd gear when code P0760 is generated.		

CIRCUIT DIAGRAM



EKDD013A

TROUBLESHOOTING FLOW



EKDD013B

DIAGNOSTIC ITEM EE6EBDDA

P0745

DTC NO	DIAGNOSTIC ITEM	
P0745	PRESSURE CONTROL SOLENOID VALVE-A	- Open -, - Short circuit -

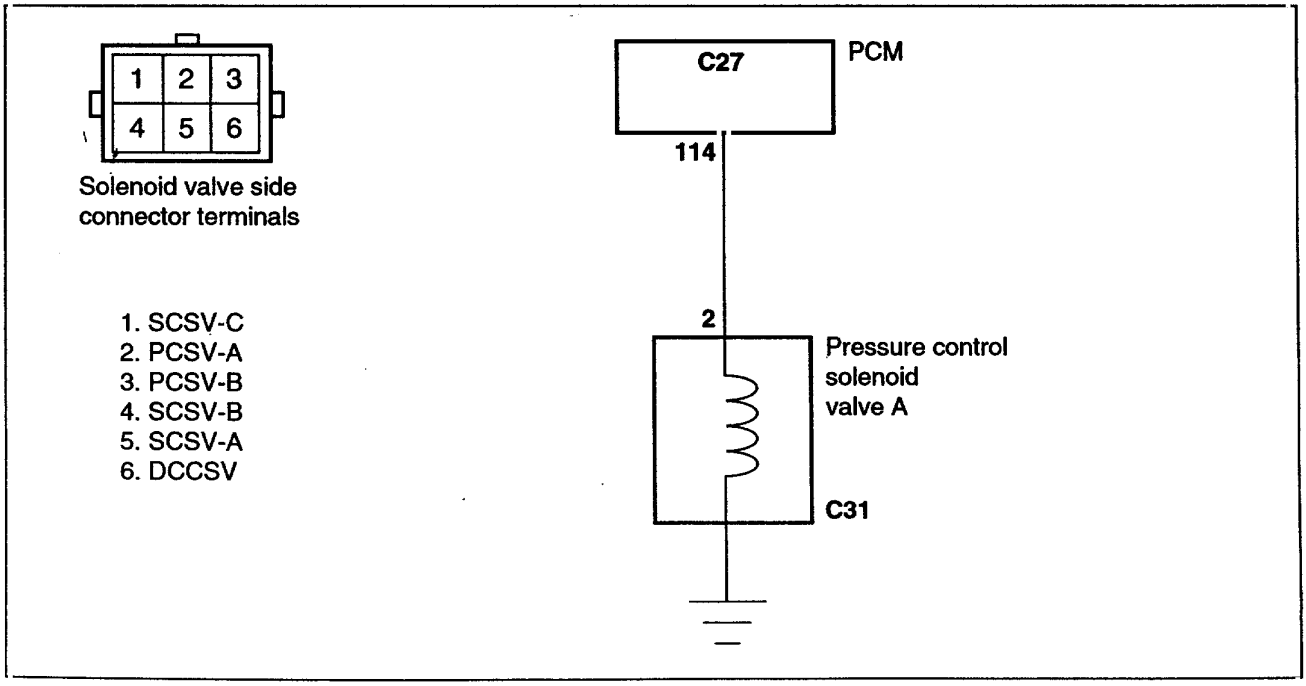
DESCRIPTION

- Controls fluid pressure that is acting on the pressure control valve-A (PCV-A) through Pulse Width Modulation signals from the PCM to control pressure during a shift.

TROUBLESHOOTING FLOW

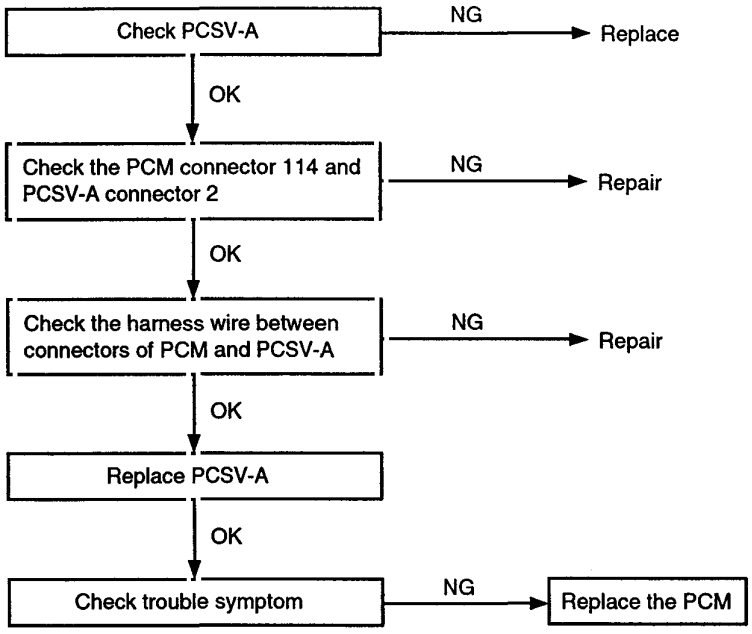
Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open • Short in the PCSV-A circuit	• Malfunction of PCSV-A • Malfunction of connector • Malfunction of PCM	• Open/short in PCSV-A circuit • Malfunction of PCSV-A
SYMPTOM • Shock felt as transaxle is engaged • Shift shock is felt as transaxle shifts through gears • Abrupt increase of engine rpm • When code P0745 is generated for the 4th time, automatic transaxle will hold 3rd gear (D) or 2nd gear (2,L)		

CIRCUIT DIAGRAM



EKDD014A

TROUBLESHOOTING FLOW



EKDD014B

DIAGNOSTIC ITEM EF2E2C67

P0775

DTC NO	DIAGNOSTIC ITEM	
P0775	PRESSURE CONTROL SOLENOID VALVE-B	- Open -, - Short circuit -

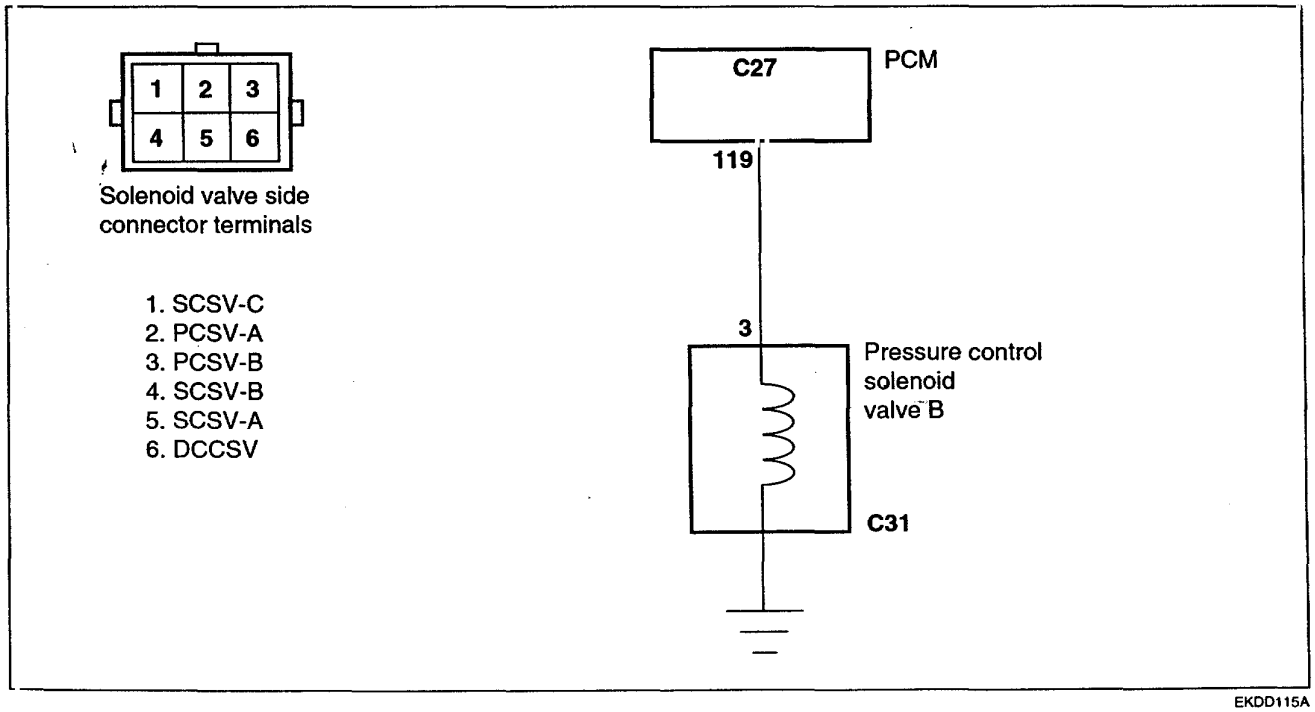
DESCRIPTION

- Controls fluid pressure that is acting on the pressure control valve-B (PCV-B) through Pulse Width Modulation signals from the PCM to control pressure during a shift.

TROUBLESHOOTING FLOW

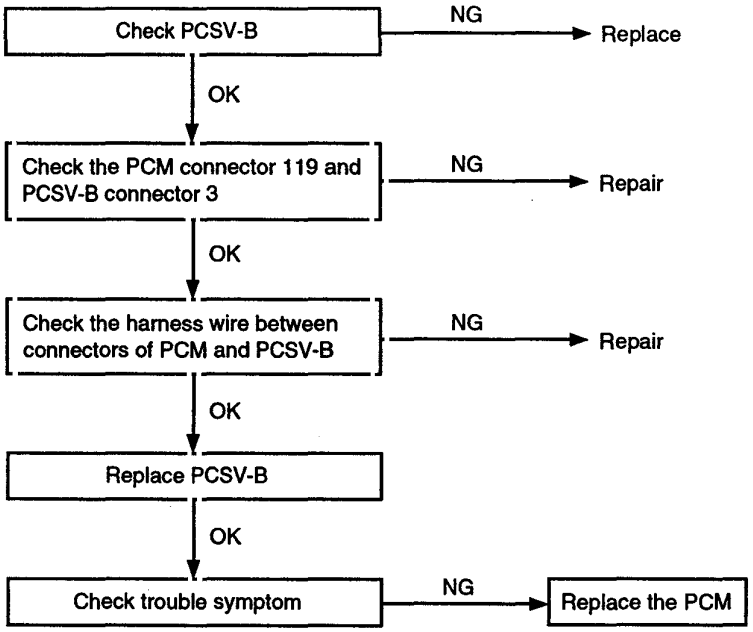
Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open • Short in the PCSV-B circuit	• Malfunction of PCSV-B • Malfunction of connector • Malfunction of PCM	• Open/short in PCSV-B circuit • Malfunction of PCSV-B
SYMPTOM • Shock felt as transaxle is engaged • Shift shock is felt as transaxle shifts through gears • Abrupt increase of engine rpm • When code P0775 is generated for the 4th time, automatic transaxle will hold 3rd gear (D) or 2nd gear (2,L)		

CIRCUIT DIAGRAM



EKDD115A

TROUBLESHOOTING FLOW



EKDD115B

DIAGNOSTIC ITEM E6A1A0EC

P0743/P0742/P0741

DTC NO	DIAGNOSTIC ITEM	
P0743	DAMPER CLUTCH CONTROL SOLENOID VALVE	- Open, Short circuit -
P0742	DAMPER CLUTCH SYSTEM	- Stuck ON -
P0741	DAMPER CLUTCH SYSTEM	- Stuck OFF -

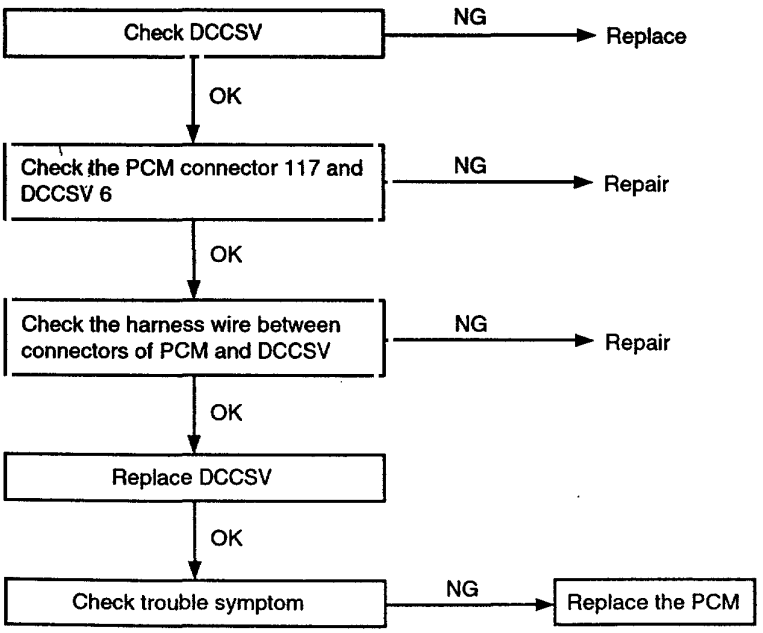
DESCRIPTION

- Controls fluid pressure that is acting on the damper clutch control valve through Pulse Width Modulation signals from the PCM to control the operation of the damper clutch.
- If damper clutch solenoid drive duty continues at 100% for 4 sec. or more, there is an abnormality in the damper clutch control system at DTC P0743 is output.

TROUBLESHOOTING FLOW

Detection condition	Possible cause	Check item
• IG S/W "ON" or start release • PCM senses an open • Short in DCCSV circuit	• Malfunction of connector • Malfunction of PCM	• Open/short in DCCSV circuit • Malfunction of DCCSV
SYMPTOM • Excessive fuel consumption • Poor performance		

TROUBLESHOOTING FLOW



EKDD016A

DIAGNOSTIC ITEM EA3548EB

P0731

DTC NO	DIAGNOSTIC ITEM	
P0731	FIRST GEAR INCORRECT RATIO	- MALFUNCTION -

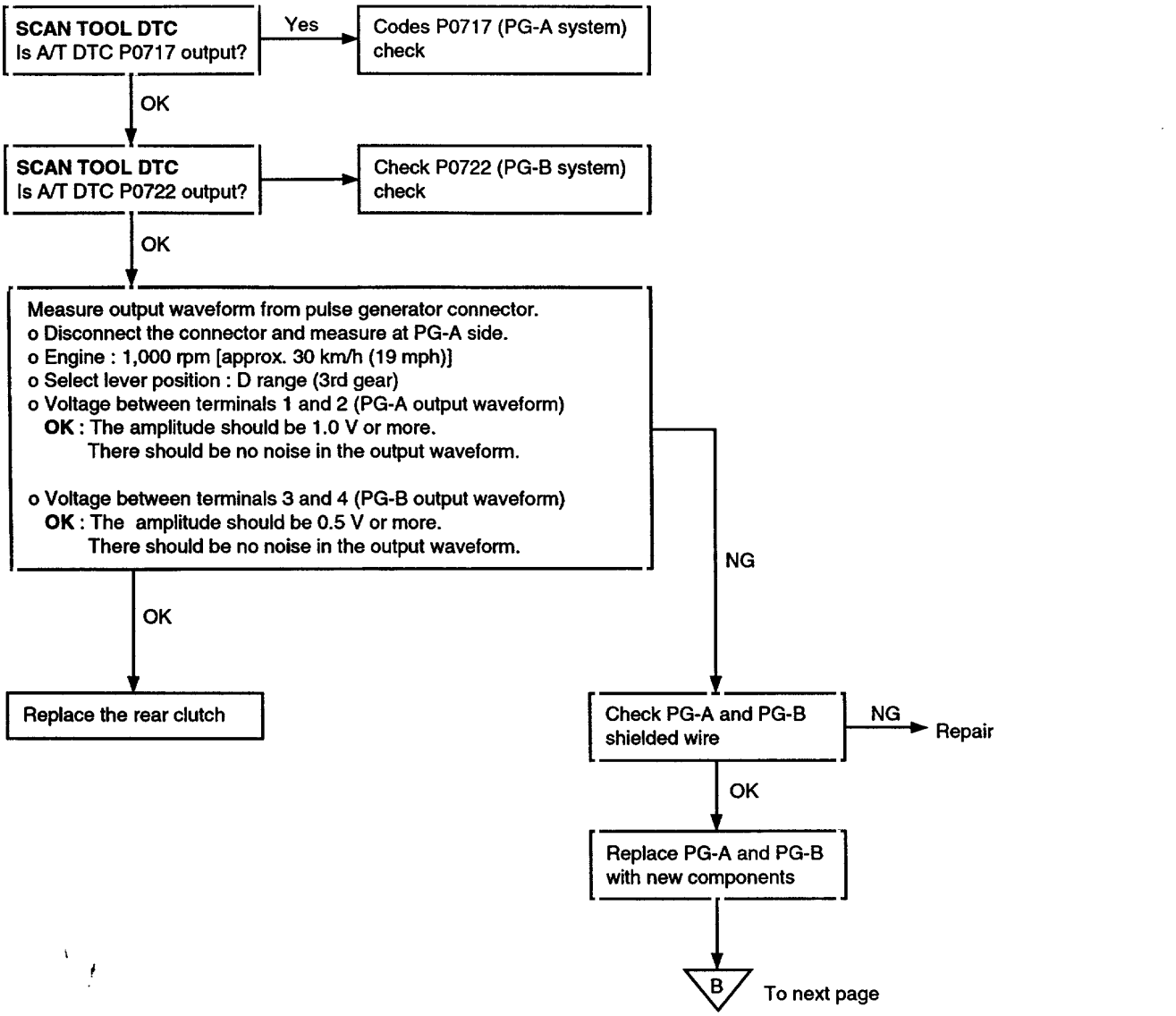
DESCRIPTION

- If the value resulting from driving the PG-A output (input shaft rotation speed) by the 1st gear ratio does not match the PG-B output (output shaft rotation speed) after 1st gear is engaged, DTC P0731 is output.

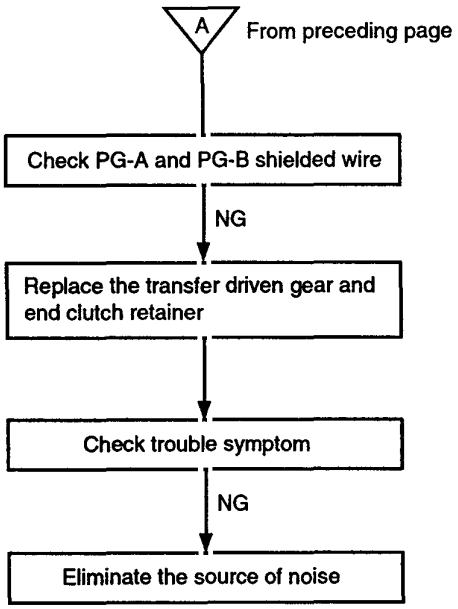
TROUBLESHOOTING FLOW

Detection condition	Possible cause	Check item
• Engine speed > 400rpm • Transfer shaft speed > 900rpm • Fluid temperature > 60°C • PCM senses a signal that does not fall into the preprogrammed parameters	**Malfunction** • PG-A or PG-B • Transfer driven gear • Rear clutch • One-way clutch	• Malfunction of pulse generator circuit • Rear clutch slippage • One-way clutch slippage
SYMPTOM • Automatic transaxle will hold 3rd gear (D) or 2nd gear (2,L) • Code P0717 or P0722 may also be set (pulse generator codes)		

TROUBLESHOOTING FLOW



EKDA017A


A
From preceding page
Check PG-A and PG-B shielded wire
NG
Replace the transfer driven gear and end clutch retainer
Check trouble symptom
NG
Eliminate the source of noise

EKDA017B

DIAGNOSTIC ITEM EDC50587

P0732

DTC NO	DIAGNOSTIC ITEM	
P0732	SECOND GEAR SYSTEM	- MALFUNCTION -

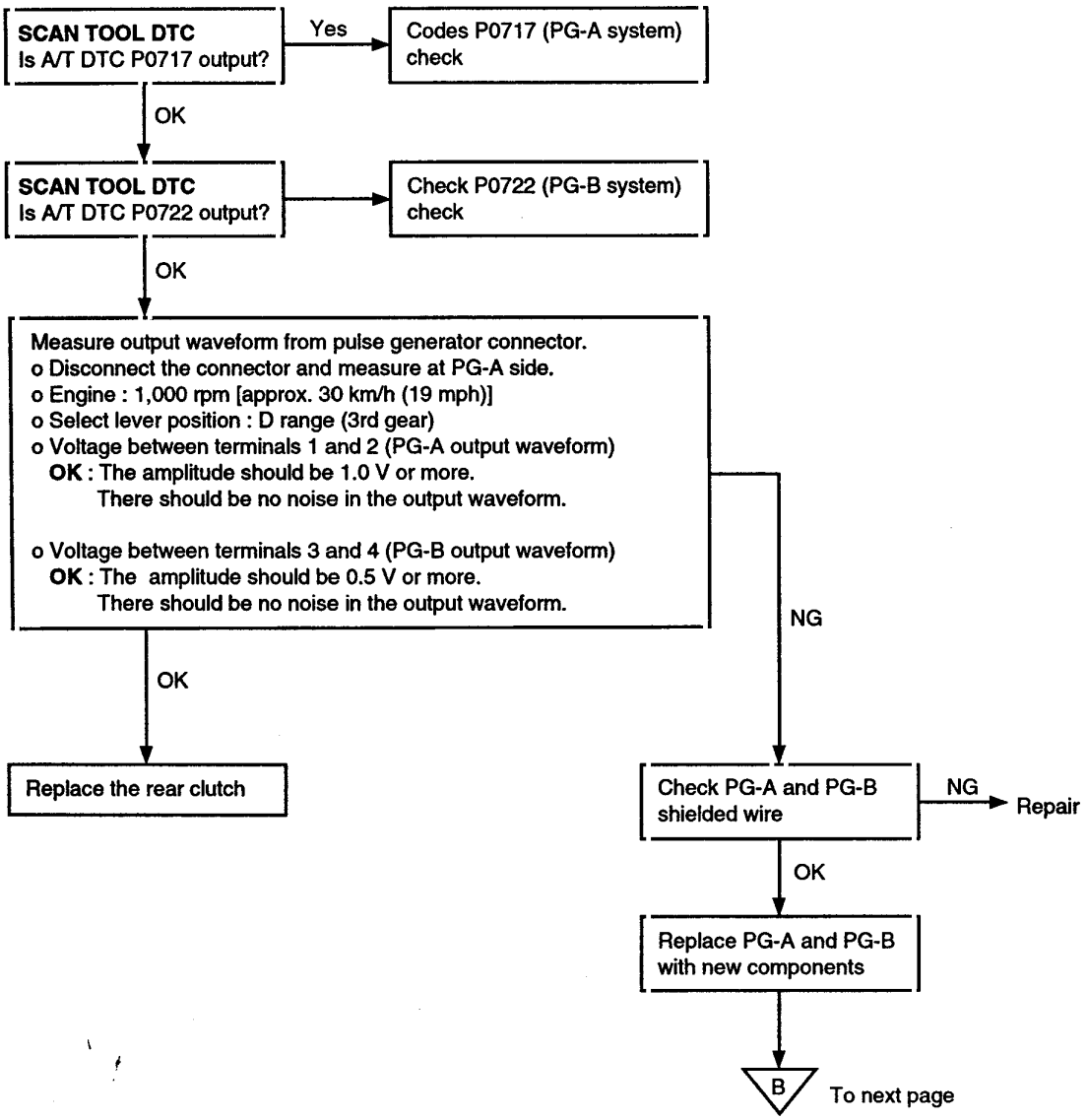
DESCRIPTION

- If the value resulting from driving the PG-A output (input shaft rotation speed) by the 2nd gear ratio does not match the PG-B output (output shaft rotation speed) after 2nd gear is engaged, DTC P0732 is output.

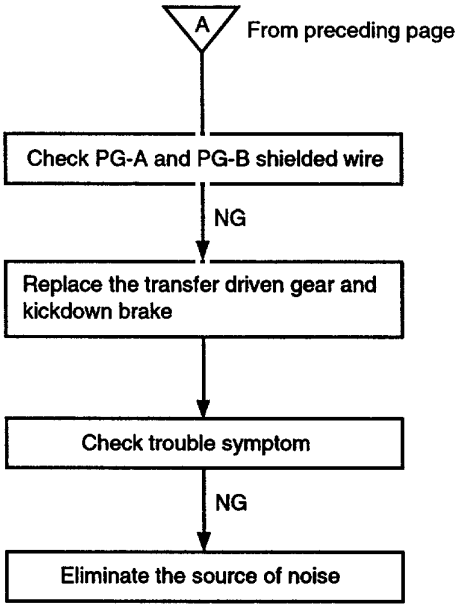
TROUBLESHOOTING GUIDE

Detection condition	Possible cause	Check Item
• If the value resulting from driving the PG-A output (input shaft rotation speed) by the 2nd gear ratio does not match the PG-B output (output shaft rotation speed) after 2nd gear is engaged, DTC P0732 is output	**Malfunction** • PG-A or PG-B • Transfer driven gear • Rear clutch • Kickdown brake	• Malfunction of pulse generator circuit • Rear clutch slippage • Kickdown brake slippage
SYMPTOM • Automatic transaxle will hold in 3rd gear (D) or 2nd gear (2,L)		

TROUBLESHOOTING FLOW



EKDA017A


A
From preceding page
Check PG-A and PG-B shielded wire
NG
Replace the transfer driven gear and kickdown brake
Check trouble symptom
NG
Eliminate the source of noise

EKNB118A

DIAGNOSTIC ITEM E1CB6B98

P0733

DTC NO	DIAGNOSTIC ITEM	
P0733	THIRD GEAR SYSTEM	- MALFUNCTION -

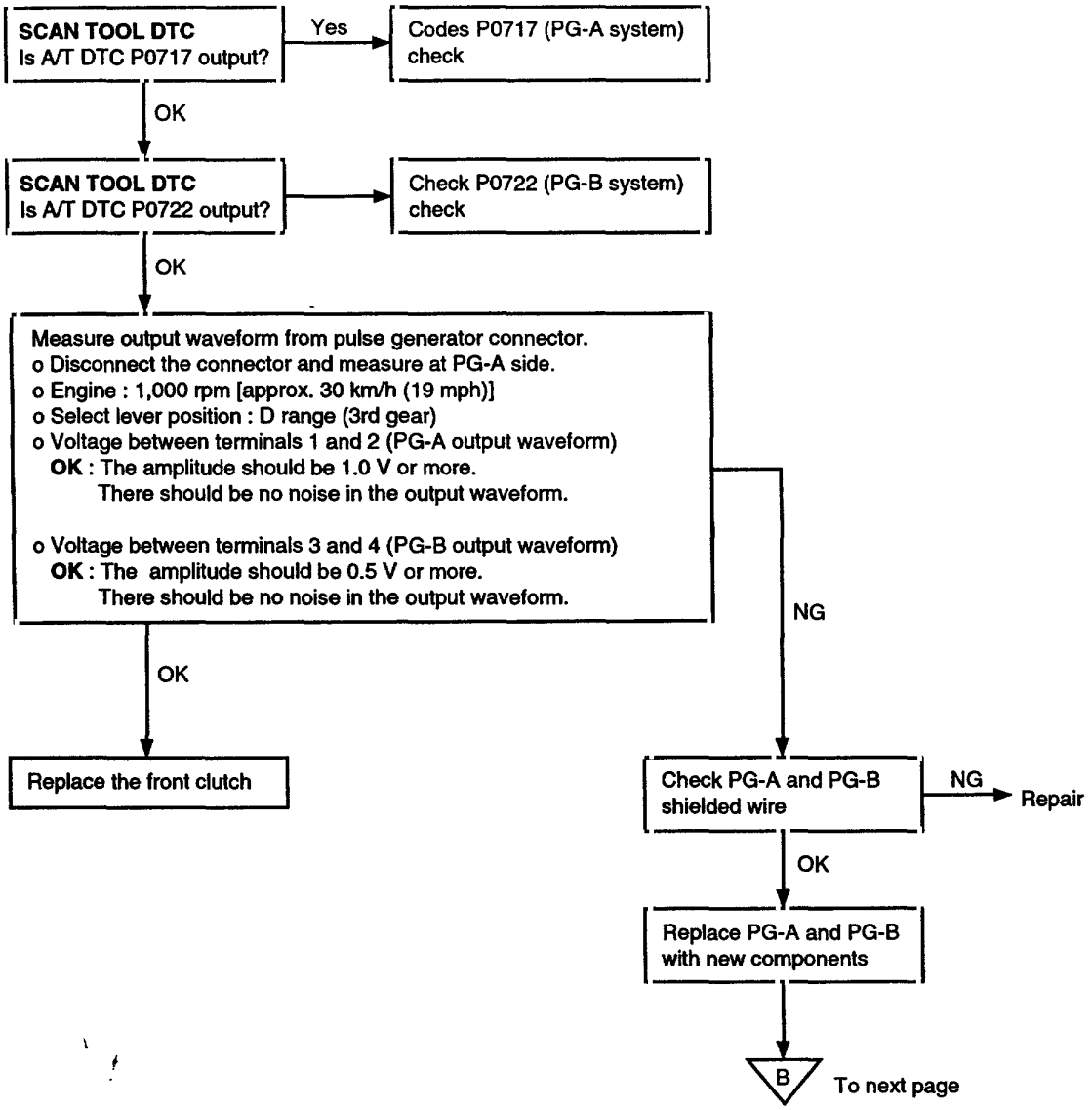
DESCRIPTION

- If the value resulting from driving the PG-A output (input shaft rotation speed) by the 3rd gear ratio does not match the PG-B output (output shaft rotation speed) after 3rd gear is engaged, DTC P0733 is output.

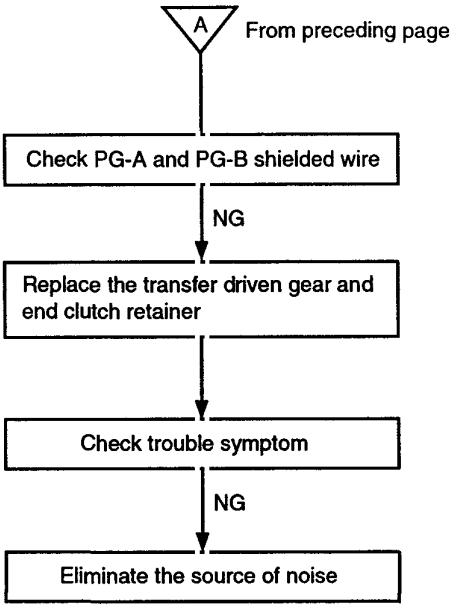
TROUBLESHOOTING GUIDE

Detection condition	Possible cause	Check item
• Engine speed > 400 rpm • Transfer shaft speed > 900 rpm • Fluid temperature > 60°C • PCM senses a signal that does not fall into the preprogrammed parameters	**Malfunction** • PG-A or PG-B • Transfer driven gear • End clutch retainer • Front clutch	• Malfunction of pulse generator circuit • Rear clutch slippage • Front clutch slippage
SYMPTOM • Automatic transaxle will hold 3rd gear (D) or 2nd gear (2,L) when code P0731, P0732, P0733,P0734 is output • Code P0717 or P0722 may also be set (pulse generator codes)		

TROUBLESHOOTING FLOW



EKNB119A


A
From preceding page
Check PG-A and PG-B shielded wire
NG
Replace the transfer driven gear and end clutch retainer
Check trouble symptom
NG
Eliminate the source of noise

EKDA017B

DIAGNOSTIC ITEM E48F8101

P0734

DTC NO	DIAGNOSTIC ITEM	
P0734	FOURTH GEAR SYSTEM	- MALFUNCTION -

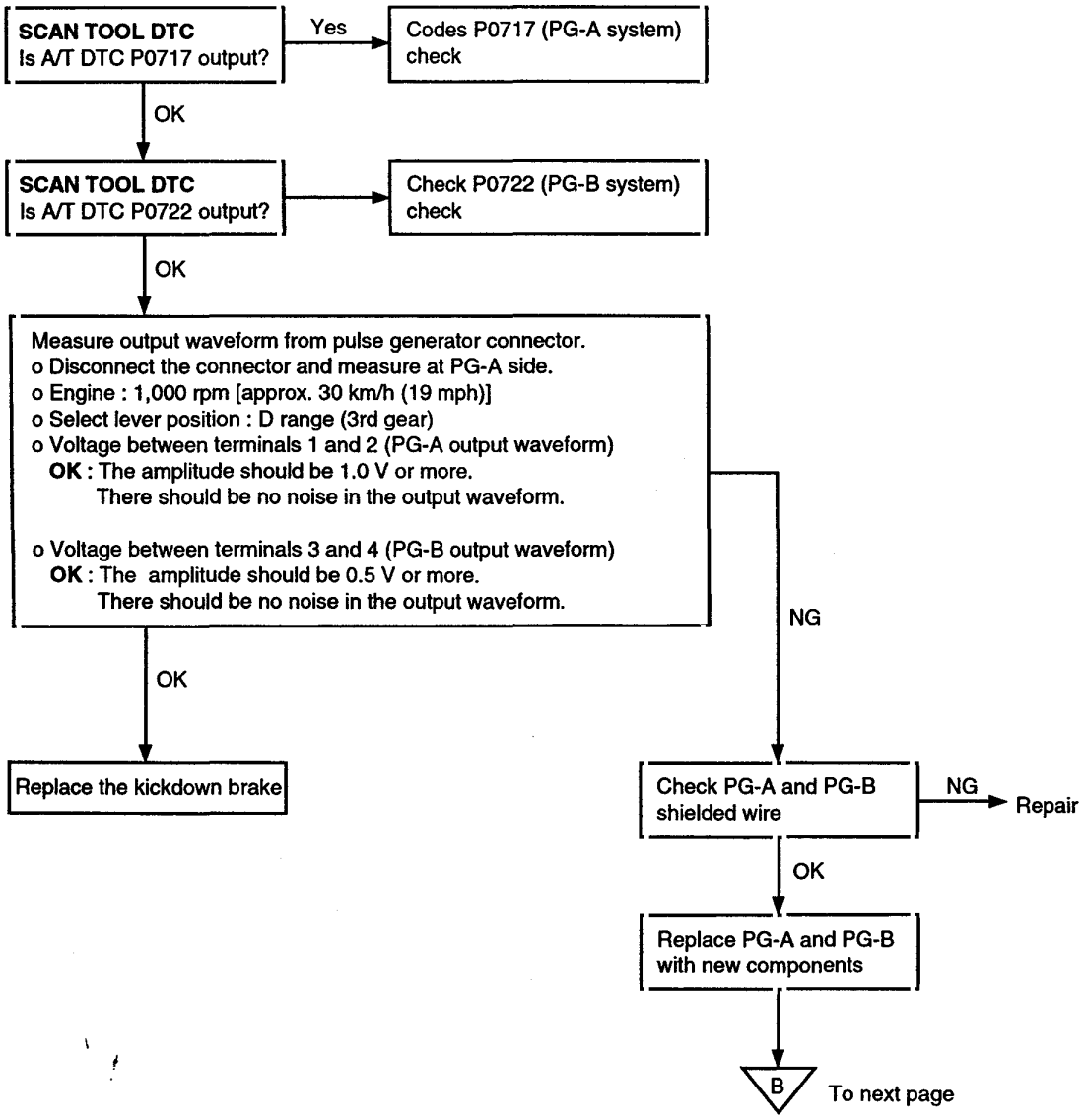
DESCRIPTION

- If the value resulting from driving the PG-A output (input shaft rotation speed) by the 4th gear ratio does not match the PG-B output (output shaft rotation speed) after 4th gear is engaged, DTC P0734 is output.

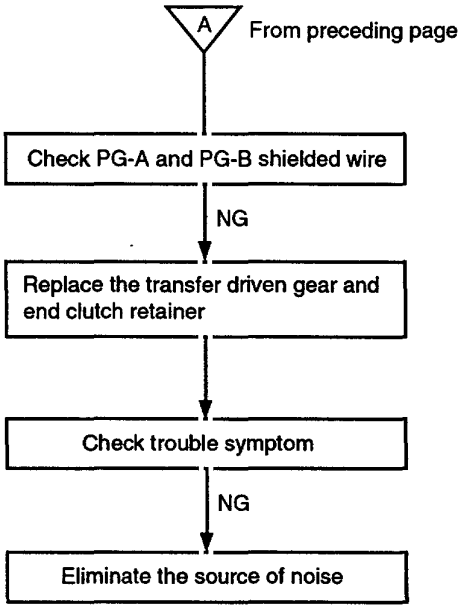
TROUBLESHOOTING GUIDE

Detection condition	Possible cause	Check Item
• Engine speed > 400rpm • Transfer shaft speed > 900rpm • Fluid temperture > 60°C • PCM senses a signal that does not fall into the preprogrammed parameters.	**Malfunction** • PG-B • Transfer driven gear • End clutch retainer • Kickdown brake • End clutch	• Malfunction of pulse generator circuit • Kickdown brake slippage
SYMPTOM • Automatic transaxle will hold in 3rd gear (D) or 2nd gear (2,L) when code P0731, P0732, P0733, P0734 is output. • Code P0717 or P0722 may also be set (pulse generator codes).		

TROUBLESHOOTING FLOW



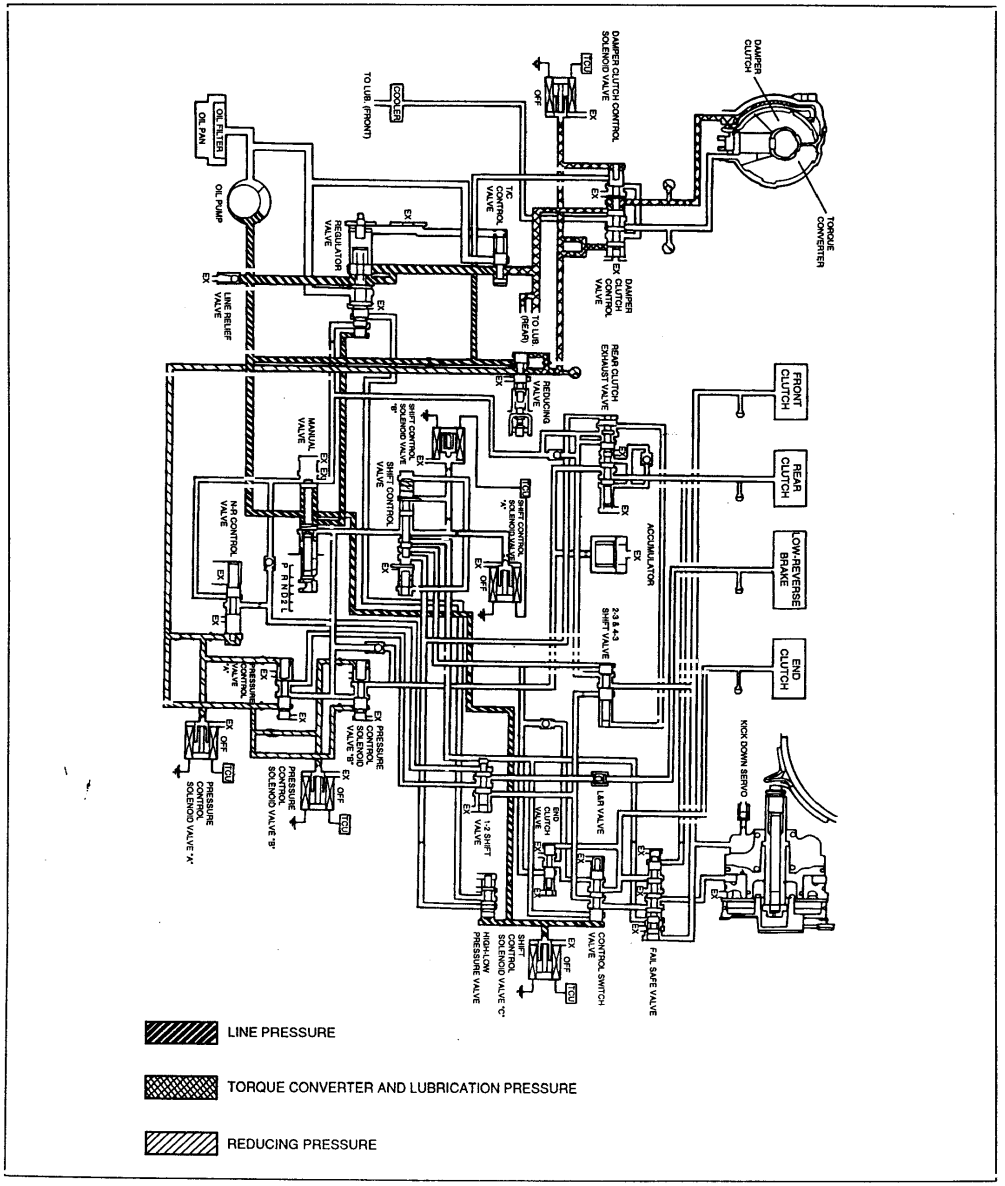
EKNB121A


A
From preceding page
Check PG-A and PG-B shielded wire
NG
Replace the transfer driven gear and end clutch retainer
Check trouble symptom
NG
Eliminate the source of noise

EKDA017B

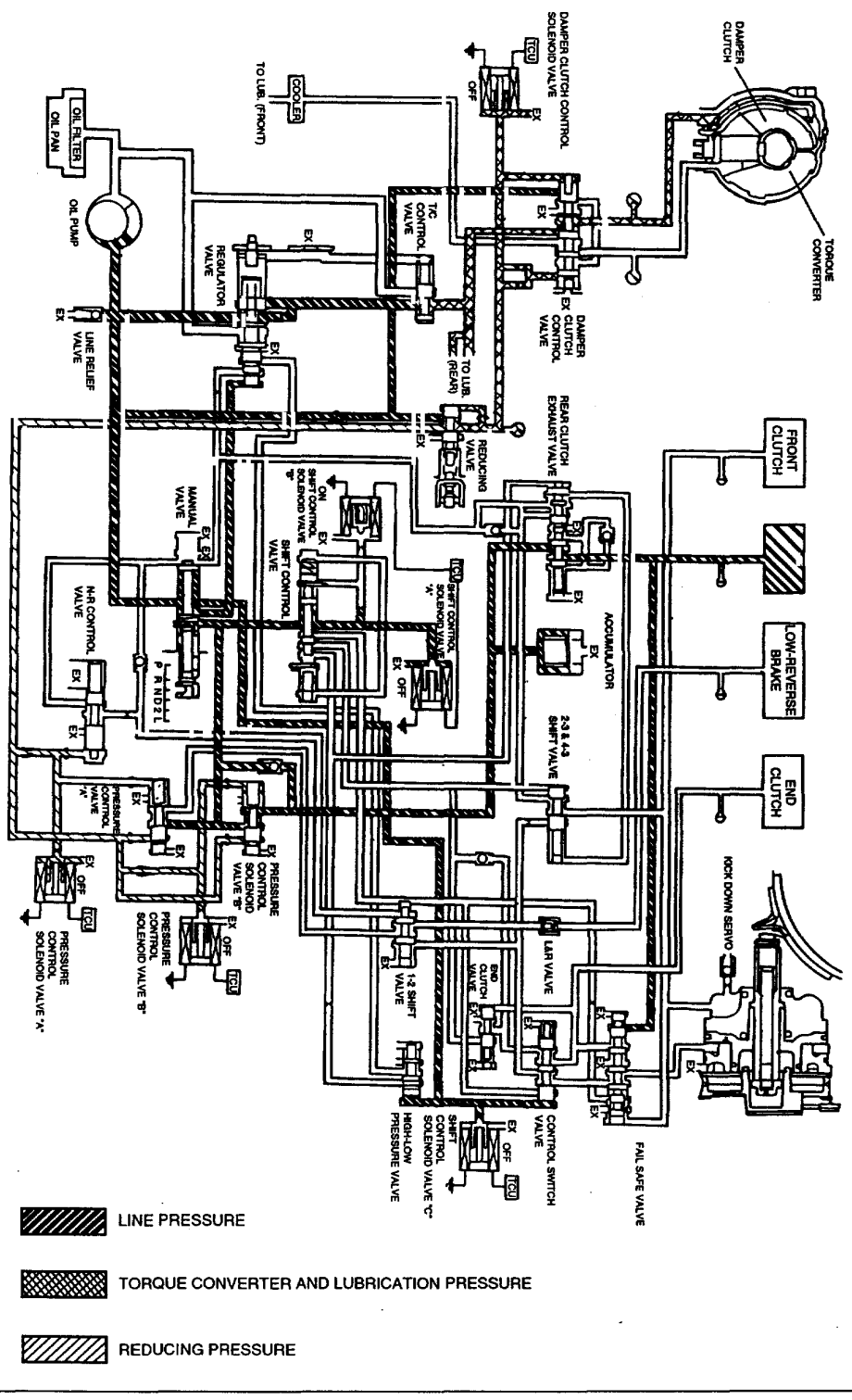
AUTOMATIC TRANSAXLE HYDRAULIC CIRCUIT E81BB800

NEUTRAL & PARK



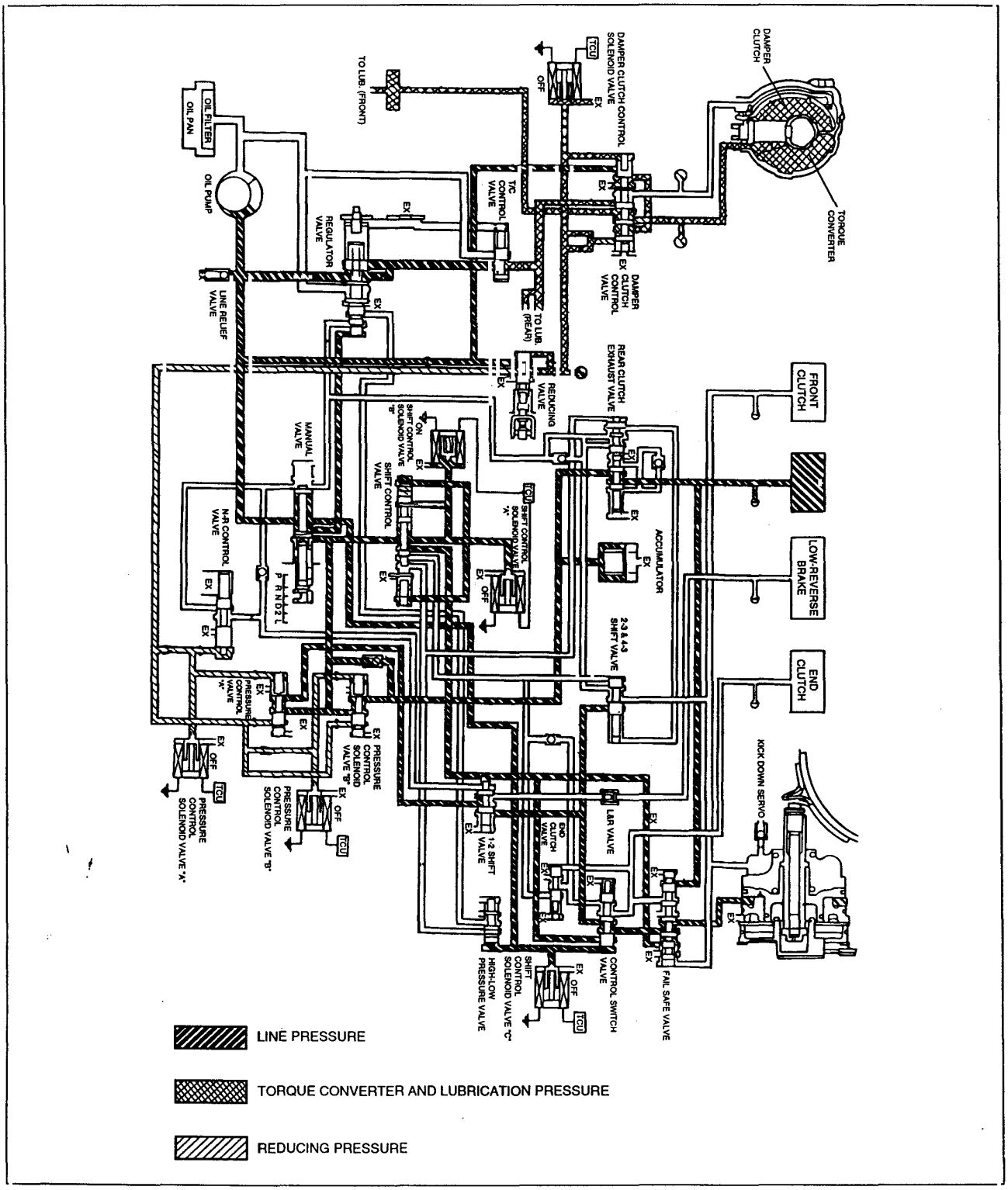
EKKB039A

DRIVE (FIRST)



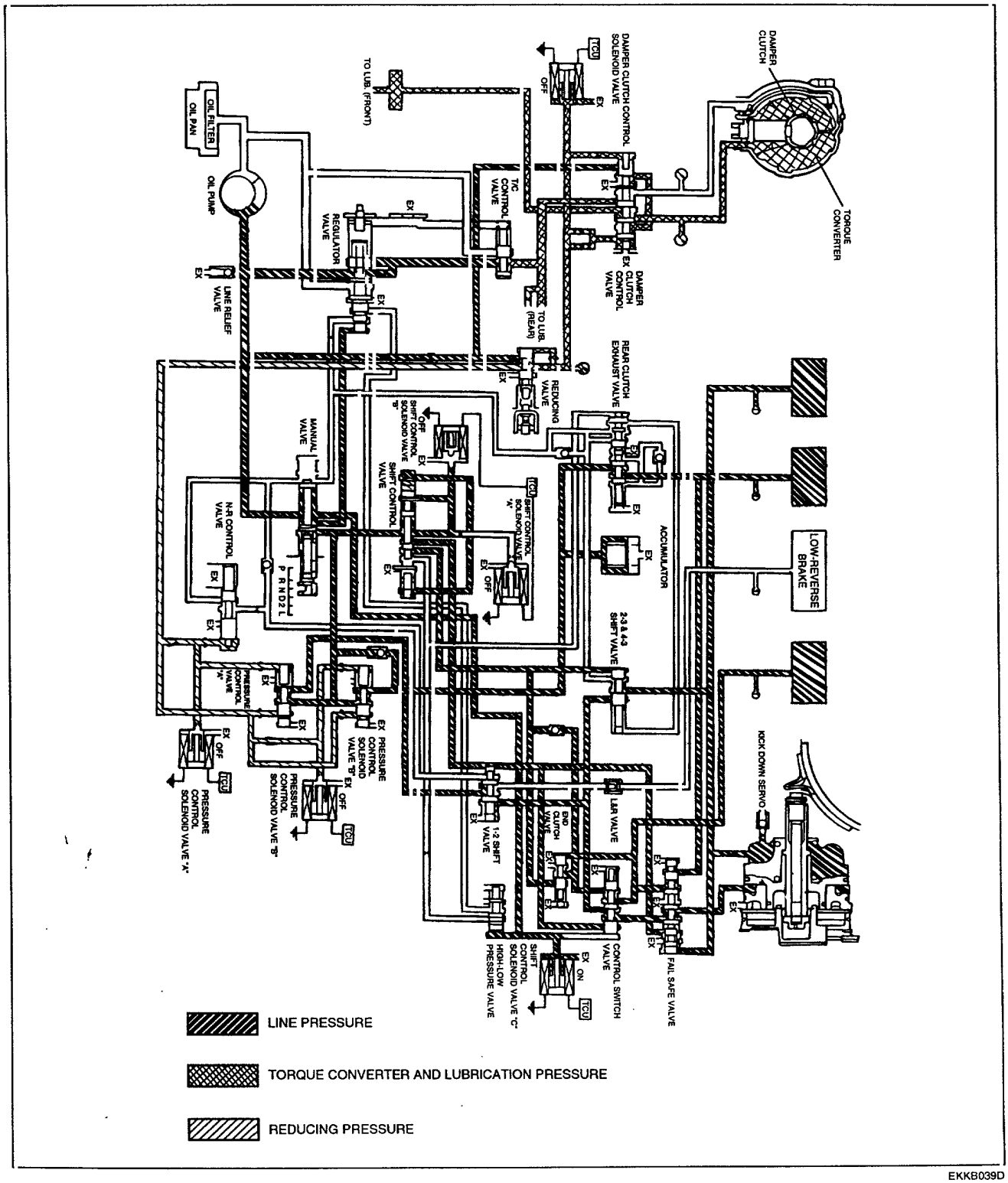
EKKB039B

DRIVE (SECOND)



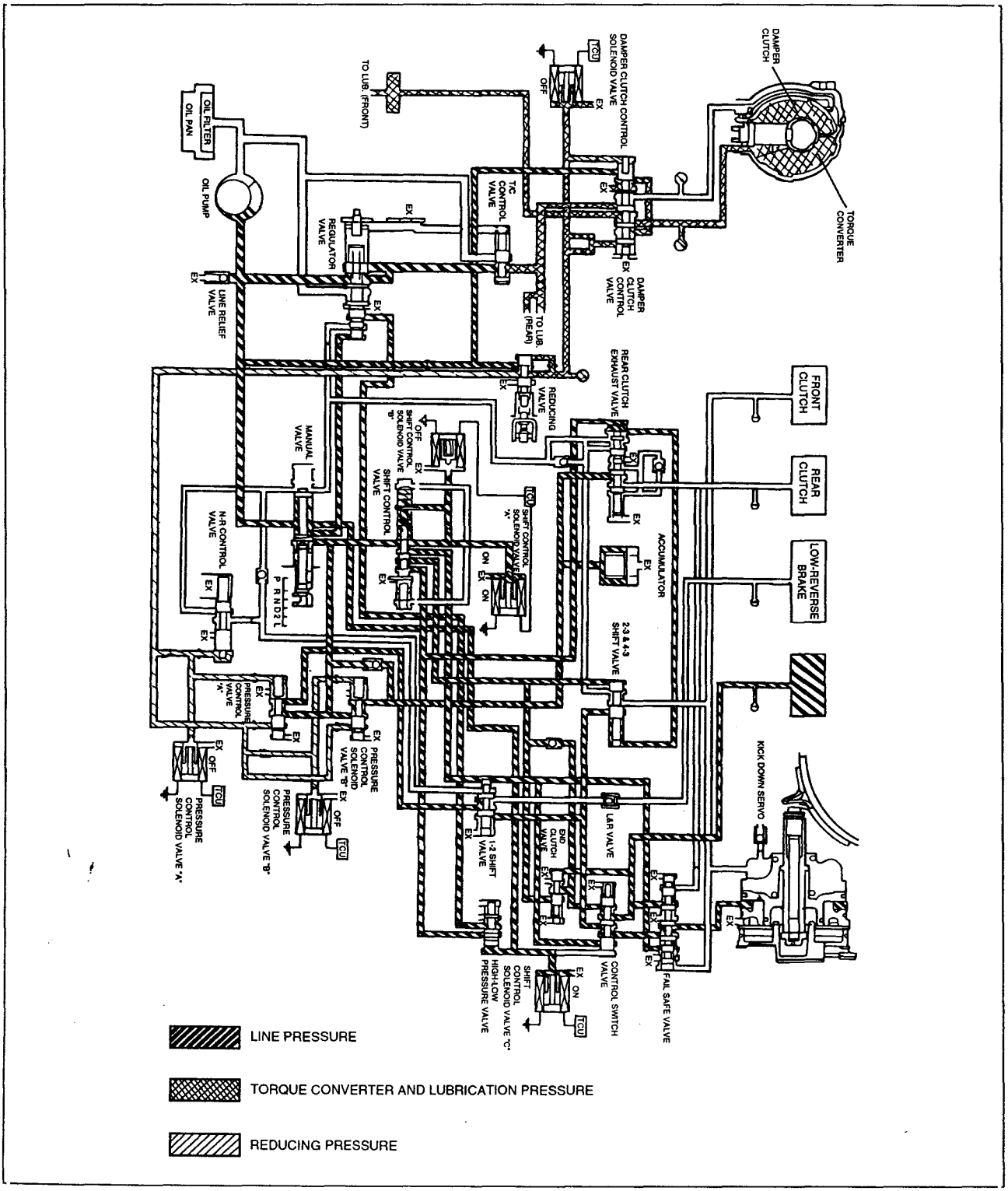
EKKB039C

DRIVE (THIRD)



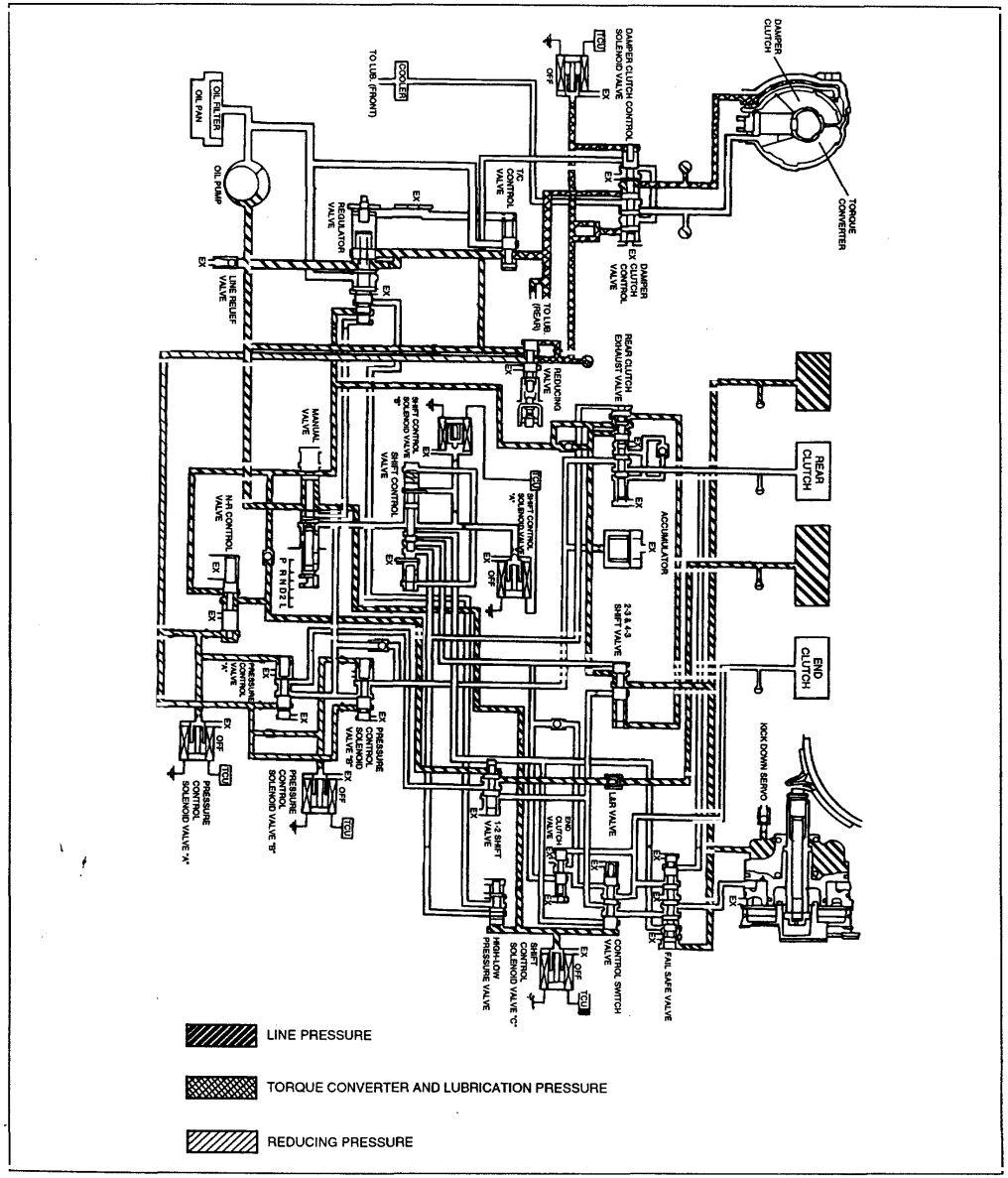
EKKB039D

DRIVE (FOURTH)



EKKB039E

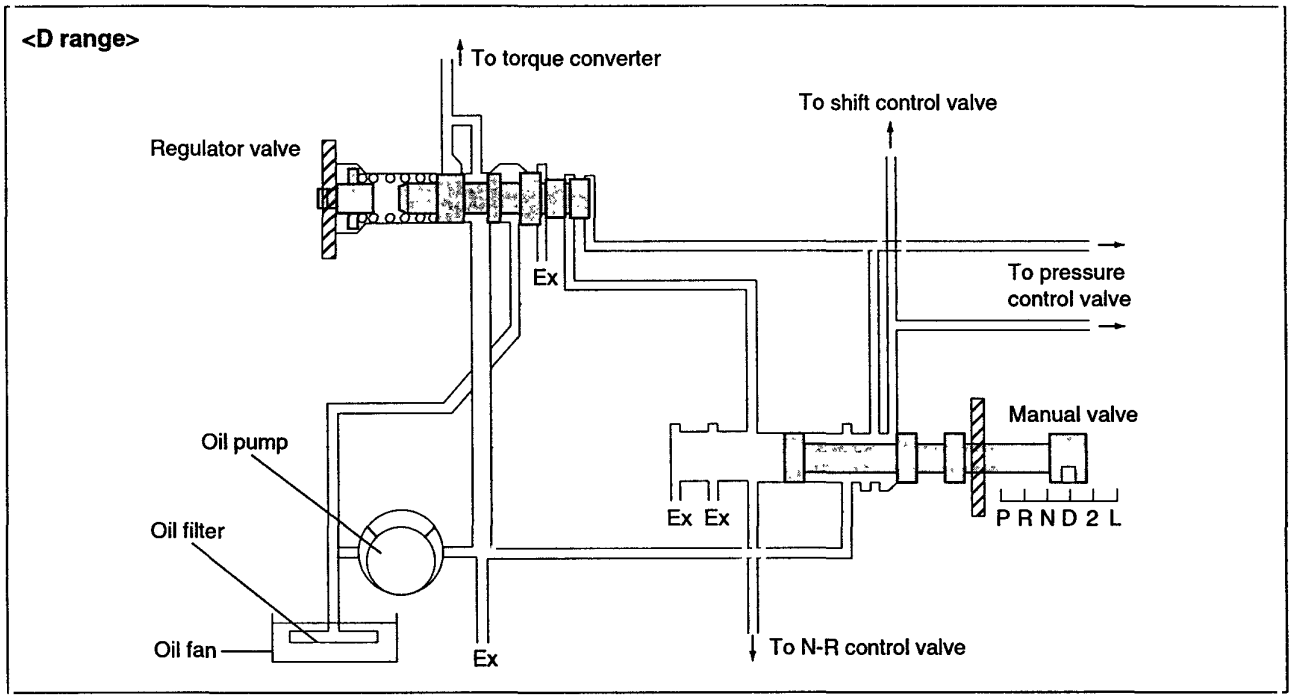
REVERSE



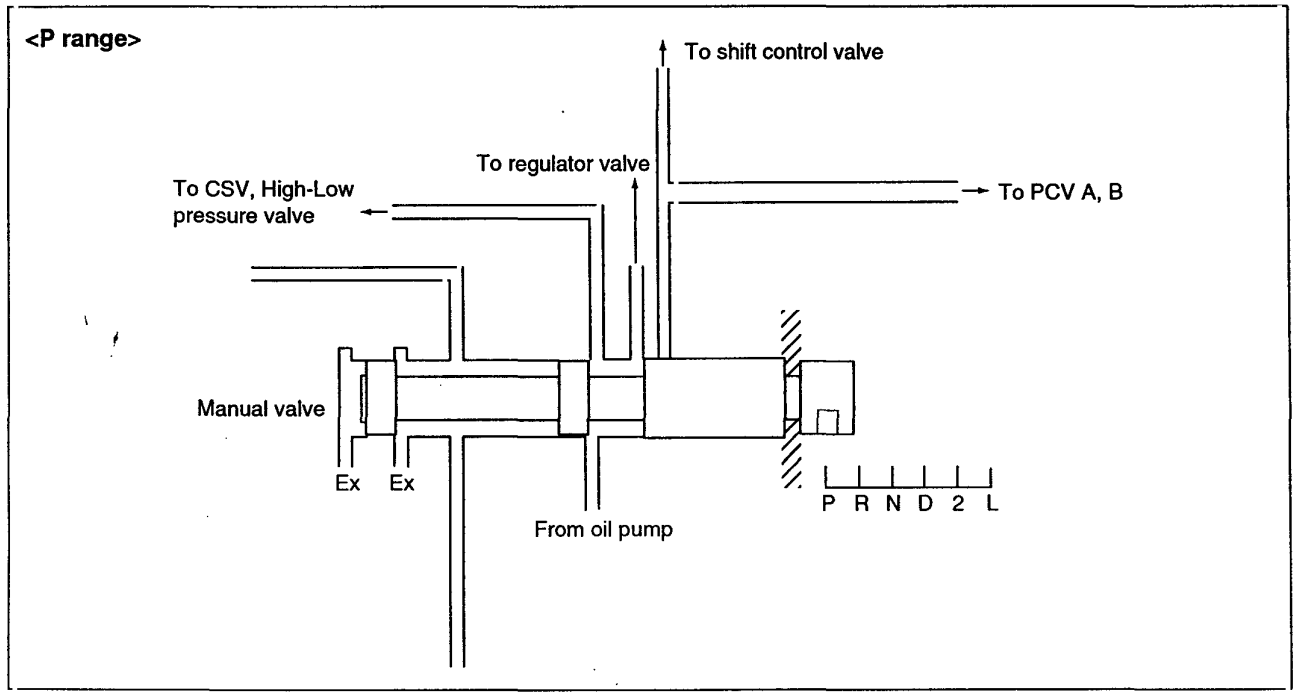
EKKB039G

HYDRAULIC CONTROL SYSTEM

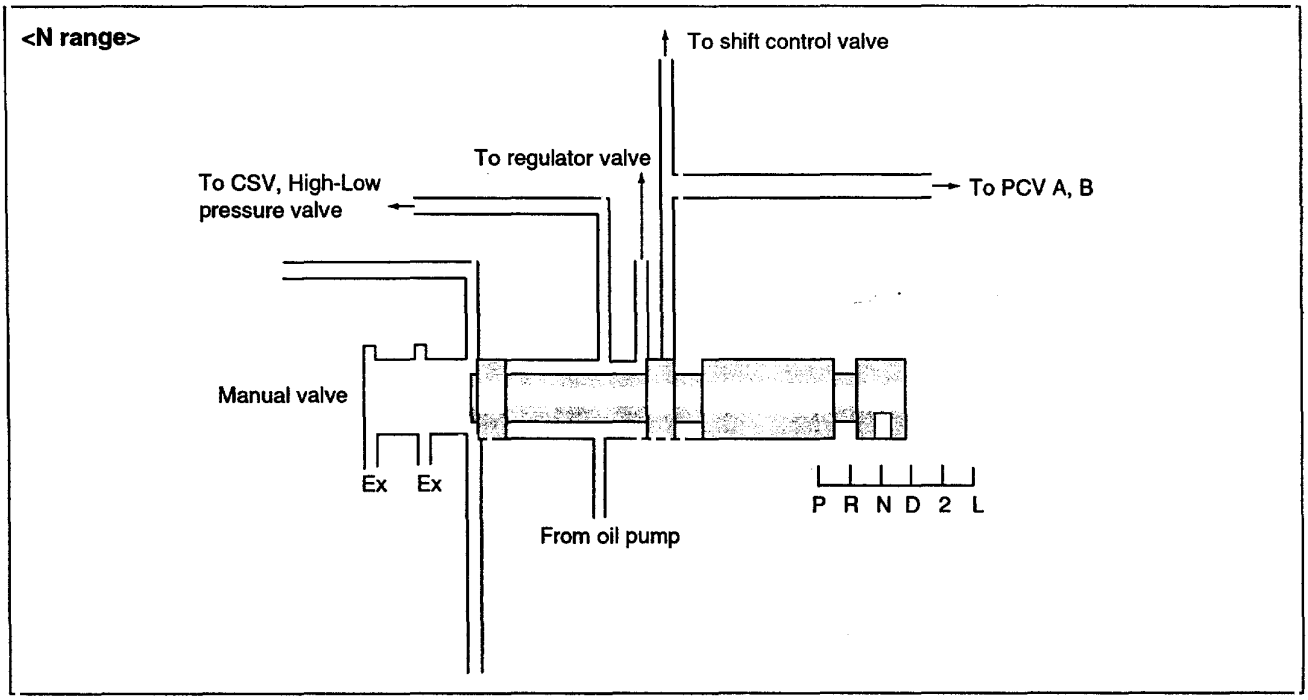
MANUAL VALVE



EKPD100C



EKPD100D

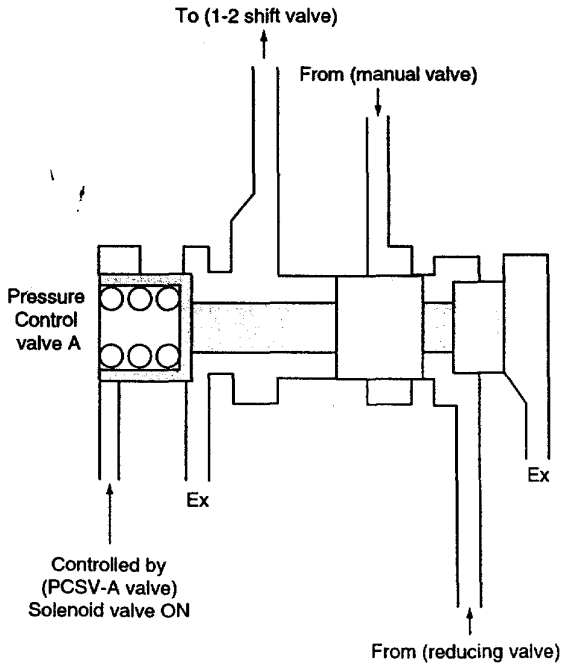


EKPD100E

PRESSURE CONTROL VALVE A, B

Pressure control valve A, B regulate the pressure supplied to each clutch under the control of the pressure control solenoid valve A, B to eliminate shock at the time of shifting.

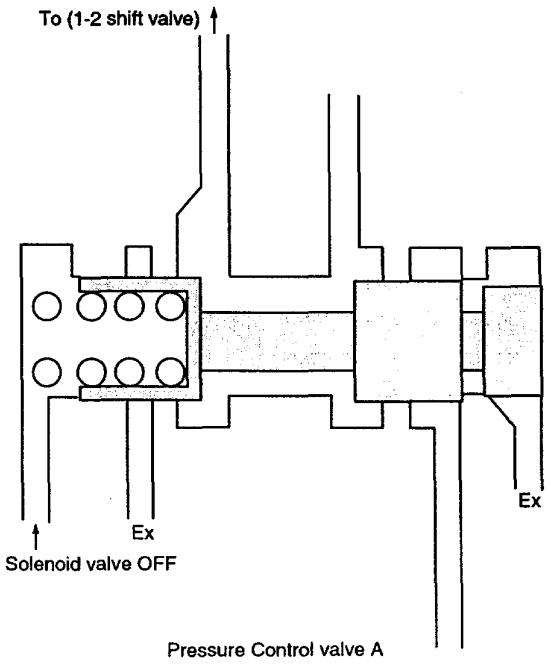
(1) pressure control valve A - Not operated



EKPD100G

PRESSURE CONTROL VALVE A, B

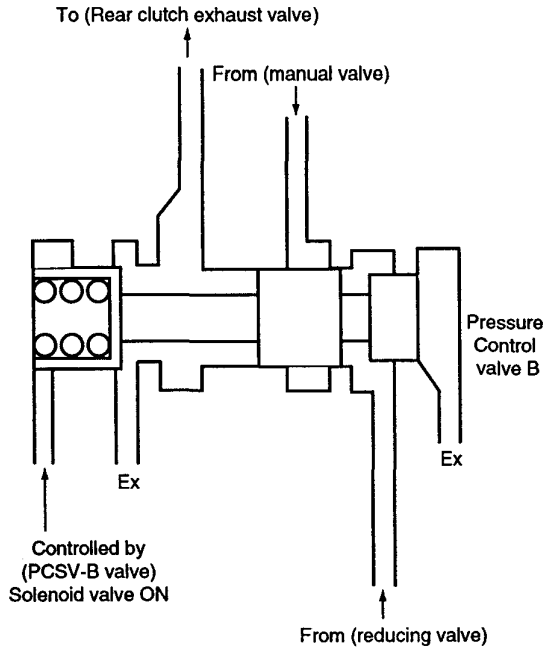
(1) Pressure control valve A - Operation



EKPD100H

PRESSURE CONTROL VALVE A, B

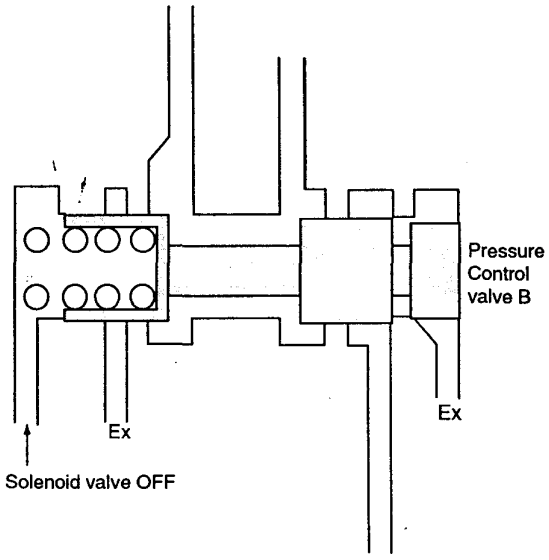
(2) Pressure control valve B - Not Operated



EKPD100K

PRESSURE CONTROL VALVE A, B

(2) Pressure control valve B - Operation



EKPD100L

The main function of this valve controls the rear clutch independently.

SHIFT CONTROL VALVE AND SOLENOID VALVE A, B, C

The line pressure acting upon the shift control valve is controlled by the two shift control solenoid valves (which are switch ON and OFF according to the shifting gear by the transaxle control module command), and the shift control valve is activated according to the shifting gear, thus switching the oil passages.

The relationship of the shifting gear and the ON-OFF switch of shift control solenoid valve "A", "B" and "C" are shown in the table below.

Operation	Shift control solenoid valve		
Position	A	B	C
1st gear	ON	ON	OFF
2nd gear	OFF	ON	OFF
3rd gear	OFF	OFF	ON
4th gear	ON	OFF	ON

PRESSURE CONTROL VALVE A, B

Comparisons with A4AF2

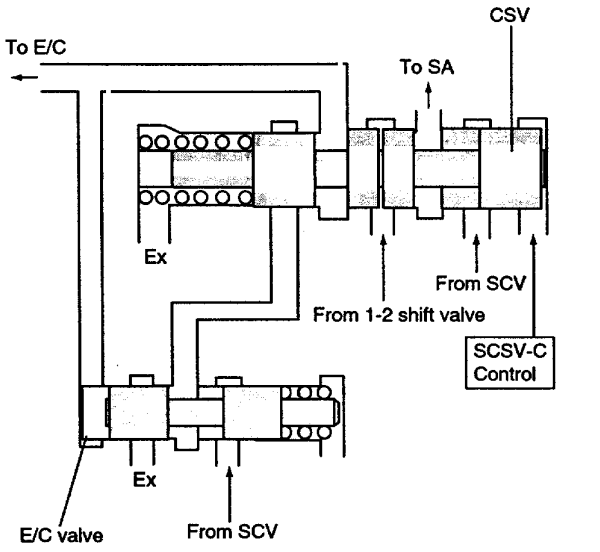
Items	A4AF2	A4AF3
Pressure Control for SA, E/C	PCV + PCSV PCV N-D V/v 1-2Shift V/v	PCV-A + PCSV-A PCV-A, 1-2Shift V/v
Pressure Control for R/C	PCV + PCSV PCV N-D V/v RCE V/v	PCV-B + Another Sol. V/v (PCSV-B) PCV-B, RCE V/v (with accumulator)

CHANGED POINTS :

- N-D valve has been eliminated.
- PCSV-B has been added for Rear clutch pressure control independently.
- Mechanical accumulator has been adopted.
- E/C release control : PCV-A, Switching of SA, E/C :CSV

Control Switch Valve & E/C valve

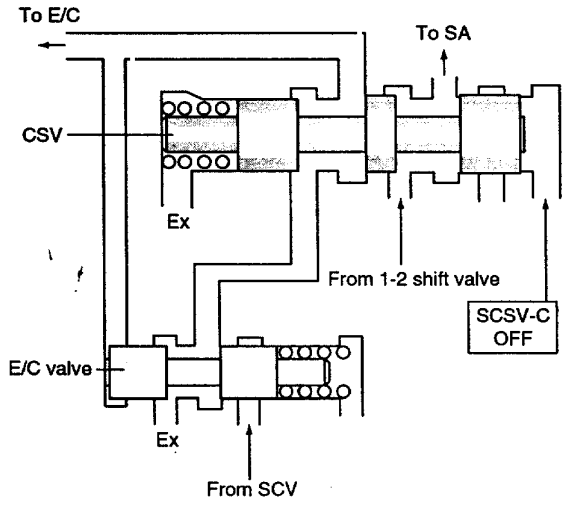
- Function
  Switching the pressure of E/C and SA.



EKPD101A

Control Switch Valve & E/C valve

- 2nd. Gear

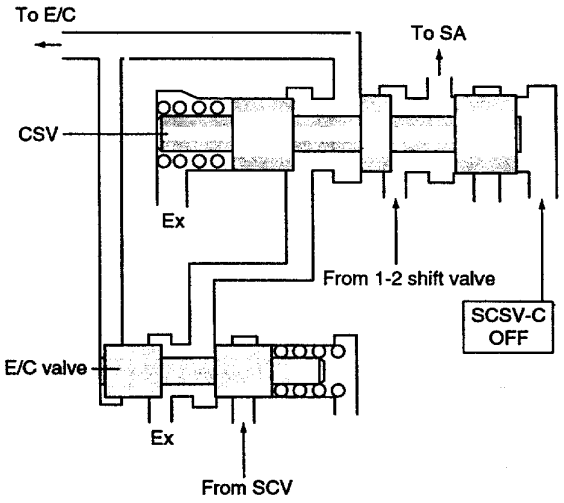


EKPD102E

  - The 2nd. pressure is supplied to SA through CSV.
  - SCSV-C is OFF as well as 1st. gear.

Control Switch Valve & E/C valve

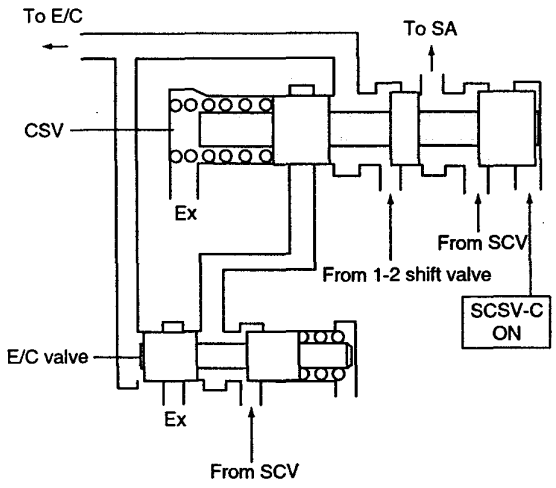
- 2nd.→3rd. gear
  - SCSV-C maintains OFF as well as 2nd gear.
  - The E/C pressure from shift control valve is intercepted at the E/C valve during up-shifting from 2nd to 3rd gear.
  - SA pressure is supplied from 1-2 shift valve, but the front clutch and SR pressure is also supplied from the 2-3/4-3 shift valve, so the both SR and SA pressure will be set off.



EKPD102E

Control Switch Valve & E/C valve

- 3rd. gear
  - SCSV-C is changed from OFF to ON.
  - The E/C pressure is supplied from 1-2 shift valve at the CSV after finishing the up-shifting from 2nd to 3rd gear.
  - SA pressure is supplied from shift control valve, but the front clutch and SR pressure is also supplied from the 2-3/4-3 shift valve, so the both SR and SA pressure will be set off.



EKPD100Q

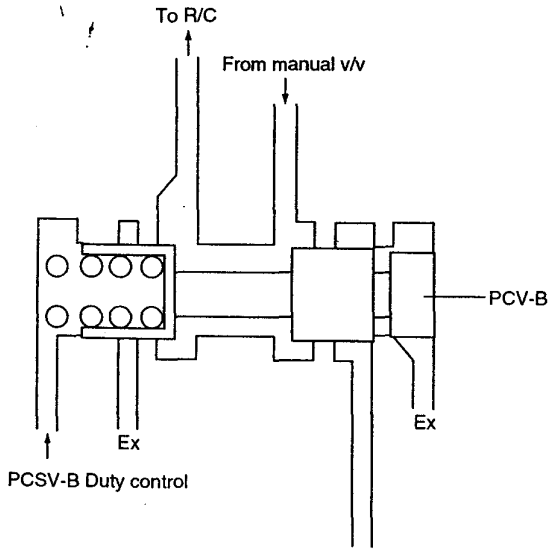
4→2 Skip shift

1. Operating elements

Speed	R/C	E/C	K/D
4th.	-	O	O
2nd.	O	-	O

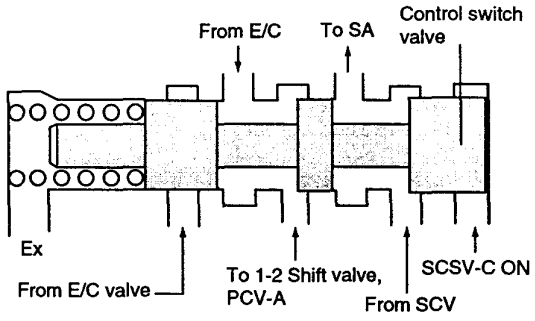
2. Controls
   a. R/C engaging duty control
   b. E/C releasing duty control
   c. Continuous switching to SA

3. Description
   a. R/C engaging duty control



EKPD102A

b. E/C releasing duty control
   4→2 Skip shift only (SCSV-C ON)



EKPD101B

When releasing the E/C clutch pressure, it is controlled by duty of PCSV-A only in case of 4→2 skip shift.

c. Continuous switching to SA
   - From (SCV) to SA through (CSV)

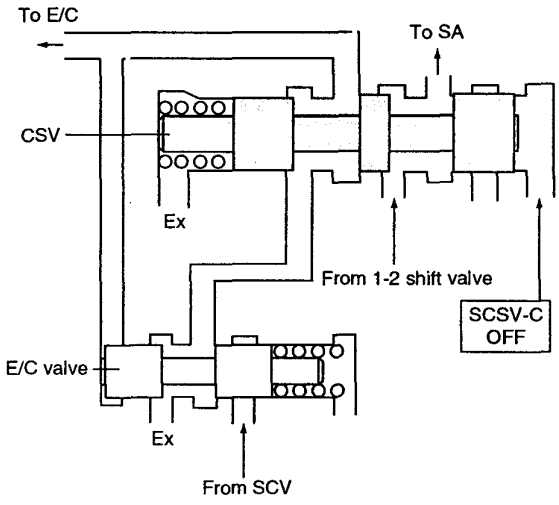
Fail Safe Function

1. TCM fail when drive with 1st or 2nd speed.

Cutting off the E/C pressure by E/C valve

Speed	F/C	R/C	E/C	K/D
1st.		O		
2nd.		O		O
Fail	O	O		

- F/C, SR : from 2-3/4-3 shift valve
- R/C : from PCV-B
- SA : from 1-2 shift valve



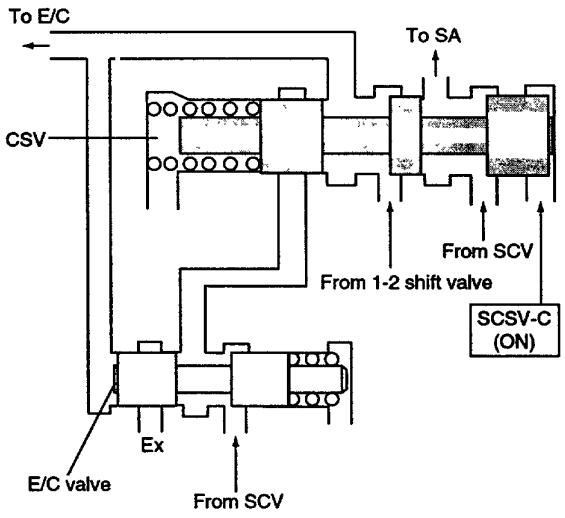
EKPD102E

2. TCM fail when drive with 1st or 2nd speed.

   If the hydraulic pressure is supplied to E/C and the F/C, SR pressure is delayed?

Speed	F/C	R/C	E/C	K/D
1st.		O		
2nd.		O		O
Fail		O	O	O

- R/C, E/C, SA : Interlock



EKPD102F

NOTE

- *SA : Servo Apply pressure*
- *F/C : Front Clutch pressure*
- *R/C : Rear Clutch pressure*
- *K/D : Kick Down*
- *SCV : Shift Control Valve*
- *CSV : Control Switch Valve*
- *PCSV : Pressure Control Solenoid Valve*
- *SCSV : Shift Control Solenoid Valve*
- *PCV : Pressure Control Valve*
- *RCEV : Rear Clutch Exhaust Valve*

AUTOMATIC TRANSAXLE

A4AF3 overhaul section was included in the overhaul manual.

GENERAL INFORMATION (A4AF3) E3BC66A5

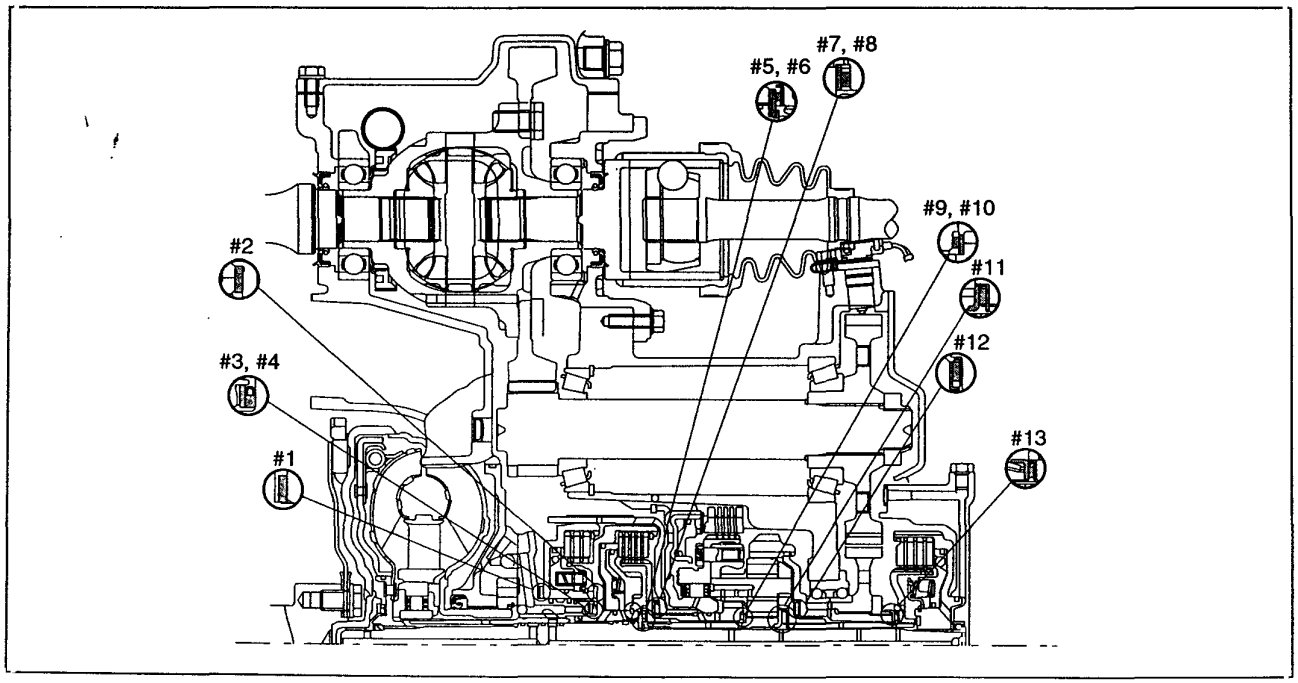
Automatic transaxle overhaul section has been separated from the shop manual.

SELECTION OF SHIM

THRUST BEARING (4,6,8,9,11,12,13), THRUST RACE (3,7,10), THRUST WASHER (1,2,5)

O.D	I.D	Thickness	Code No.	O.D	I.D	Thickness	Code No.
70	55.7	1.4	#1	48.1	34.4	-	#4
70	55.7	1.8		40	21	2.4	#5
70	55.7	2.2		42.6	28	2.5	#6
70	55.7	2.6		54	38.7	1.6	#7
70	55.7	1.8	#2	52	36.4	2.8	#8
48.9	37	1.0	#3	41	28	2.0	#9
48.9	37	1.2		39	28	1.2	#10
48.9	37	1.4		38	22.2	-	#11
48.9	37	1.6		52	36.4	2.8	#12
48.9	37	1.8		58	44	5.0	#13
48.9	37	2.0					
48.9	37	2.2					
48.9	37	2.4					

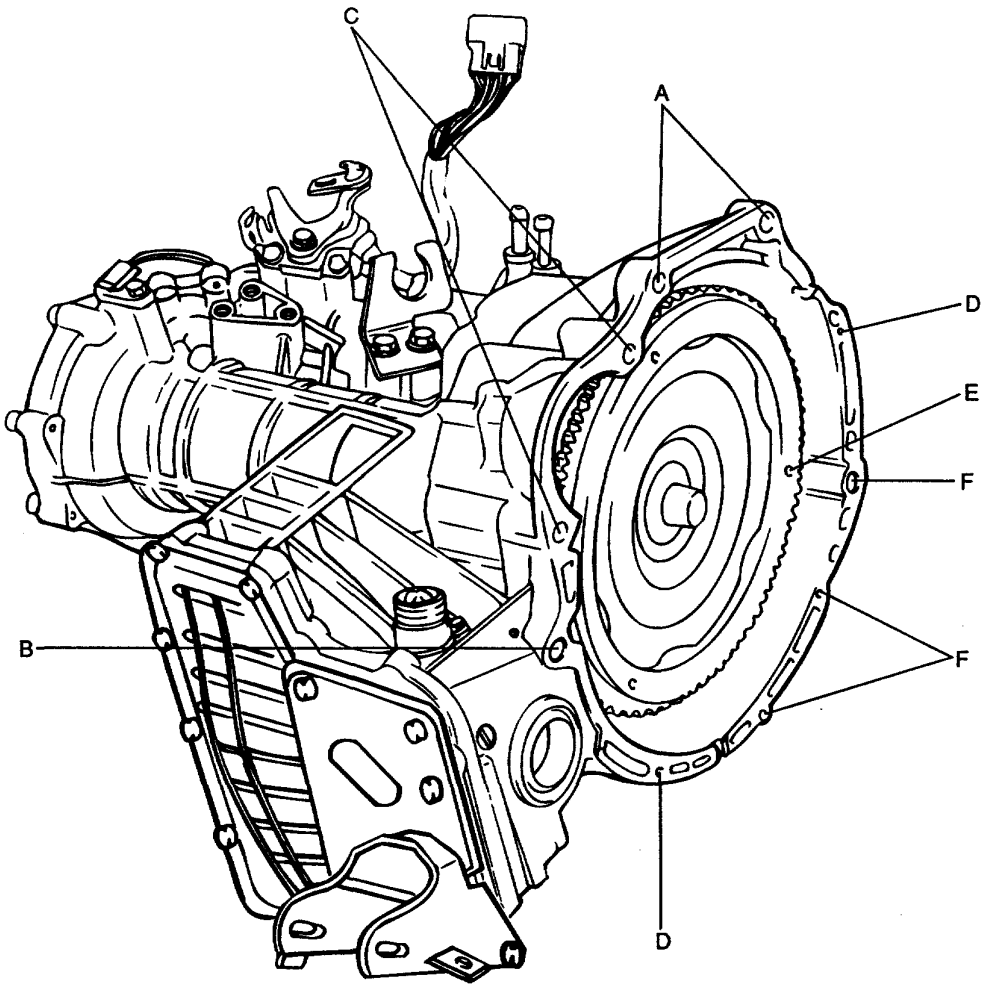
Unit : mm



EKPD019B

AUTOMATIC TRANSAXLE E9113CBD

COMPONENTS

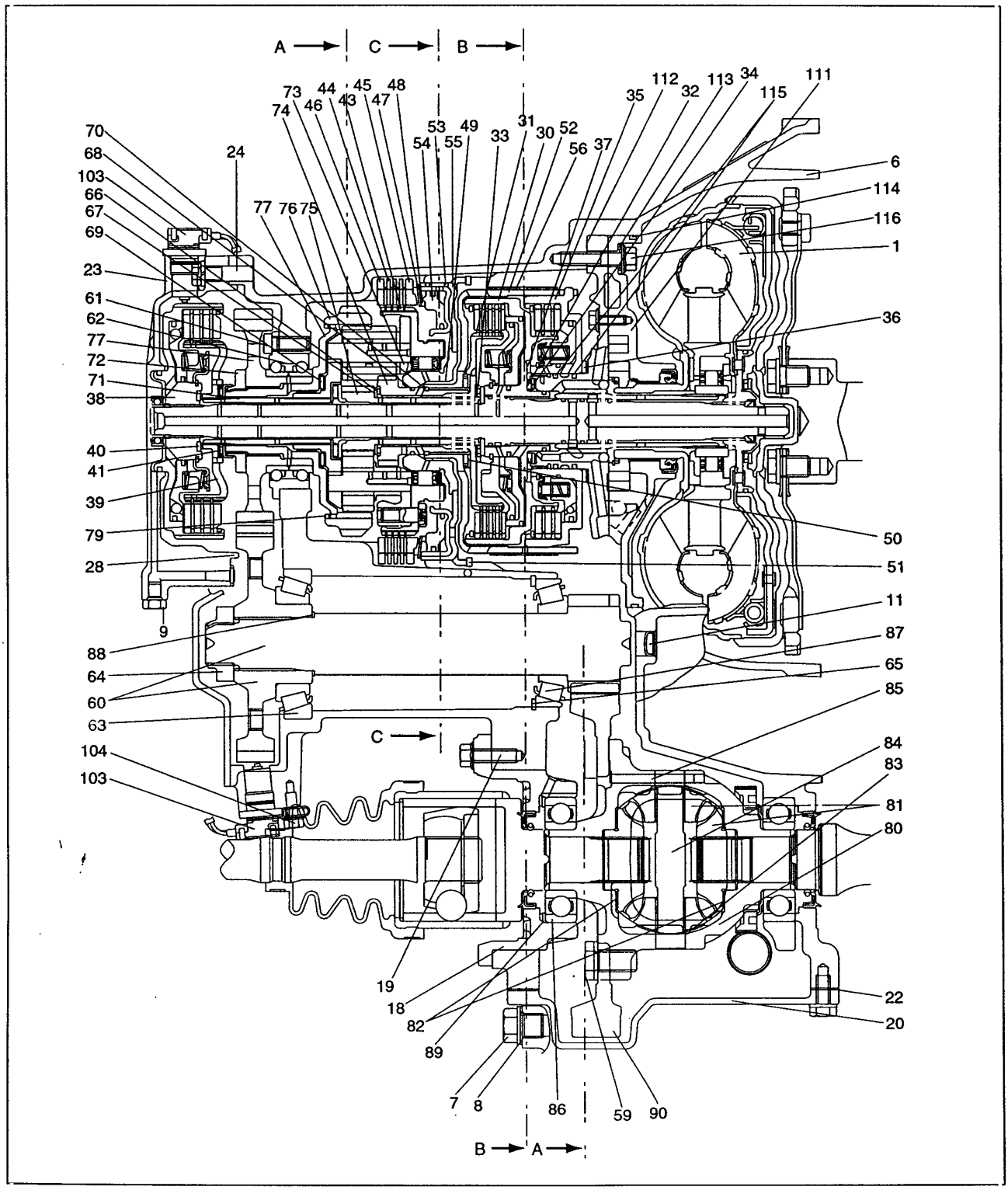


KKKA015A

	Torque (kg·m)	O.D x Length (mm)	Identification Mark
A	6~8	[7] 12x40	[7] AxB
B	4.3~5.5	[7] 10x70	
C	2.7~3.4	[7] 10x55	
D	0.8~1.0	[7] 6x10	
E	4.6~5.3	[7] 10x11	

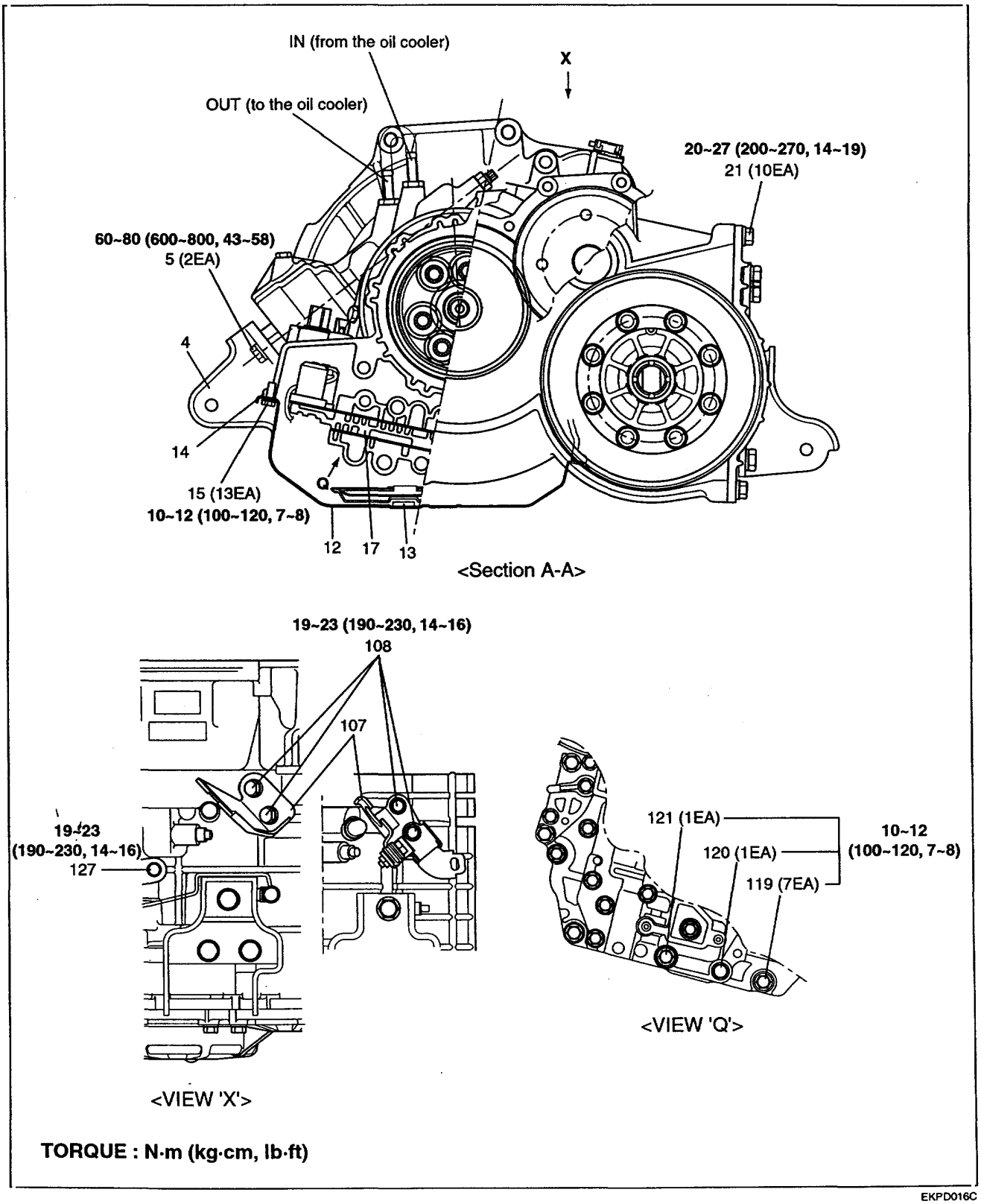
EKNB015A

COMPONENTS (1)



KKPC016B

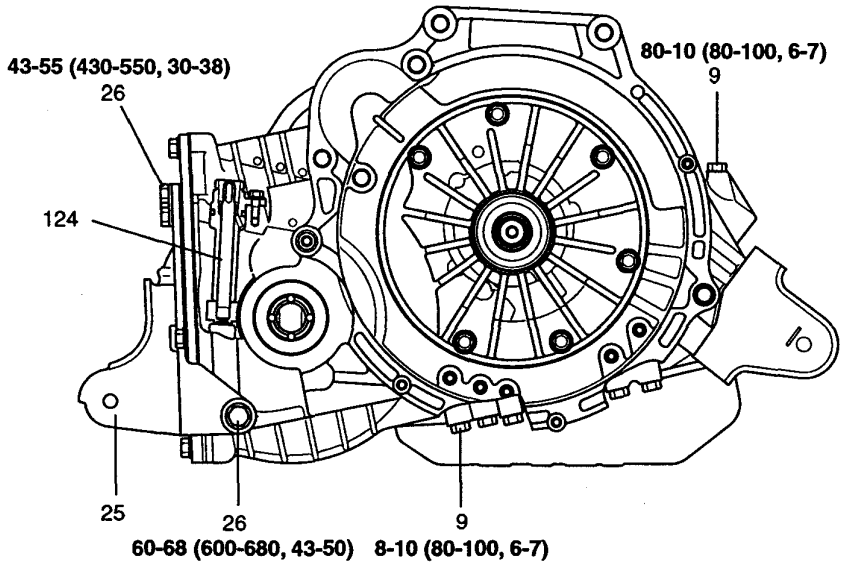
COMPONENTS (2)



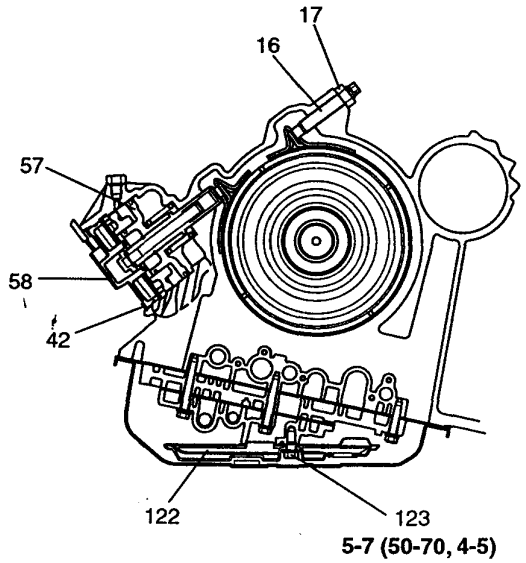
TORQUE : N·m (kg·cm, lb·ft)

EKPD016C

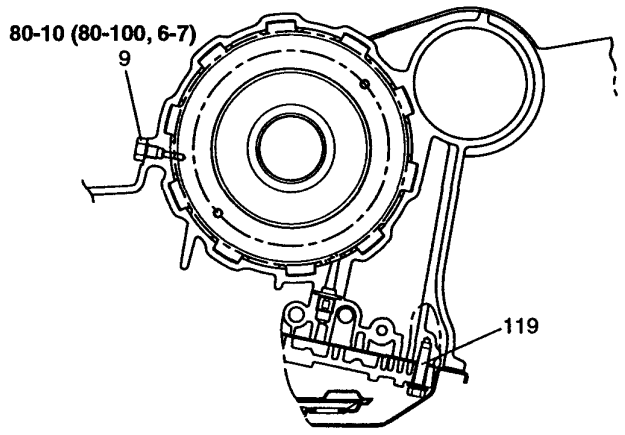
COMPONENTS (3)



<Front view>



<Section B-B>

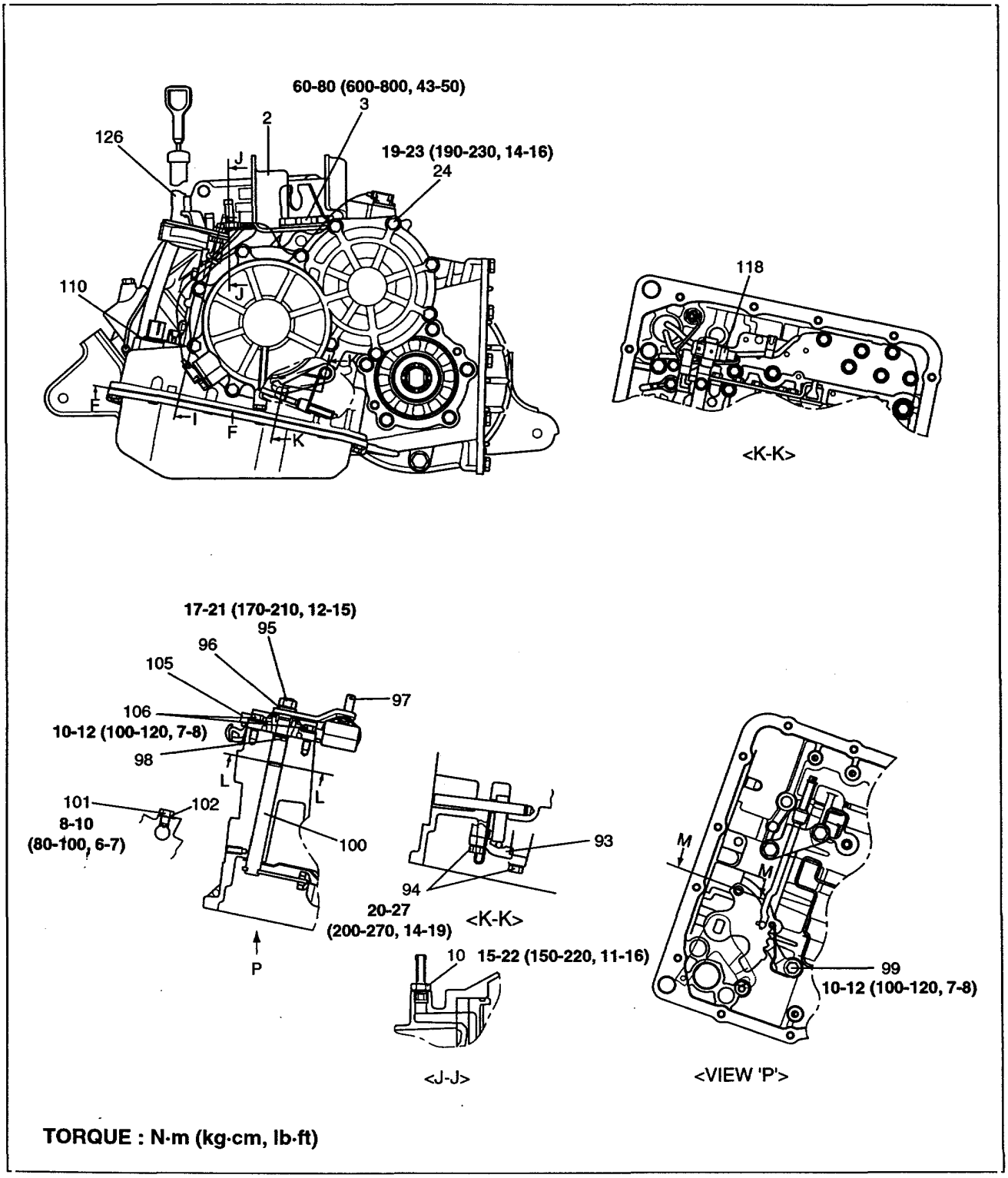


<Section C-C>

TORQUE : N·m (kg·cm, lb·ft)

EKPD016D

COMPONENTS (4)



TORQUE : N·m (kg·cm, lb·ft)

EKPD016E

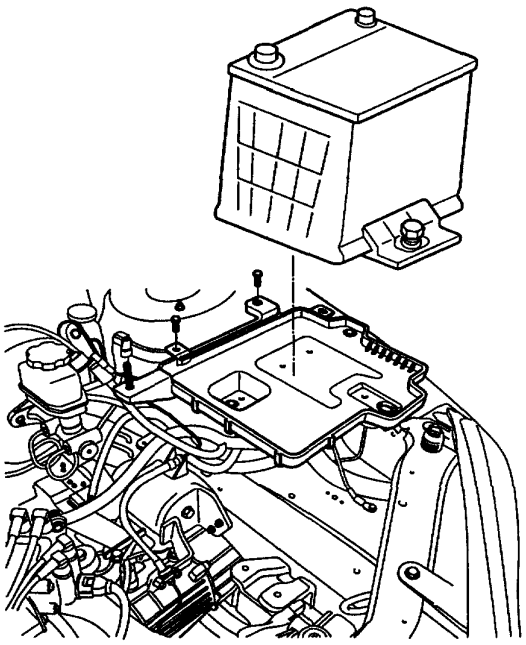
COMPONENTS (5)

1. Torque converter
2. Transaxle support bracket
3. Bolt washer
4. Front roll support bracket
5. Bolt washer
6. Transaxle case
7. Drain plug
8. Gasket
9. Oil pressur check plug
10. Oil cooler connector
11. Sealing cap
12. Oil pan
13. Magnet
14. Oil pan gasket
15. Bolt
16. Adjuster screw
17. Nut
18. Differential bearing retainer
19. Flange bolt (8x25)
20. Differatial cover
21. Bolt washer
22. Gasket
23. End cover
24. Flange bolt
25. Rear roll support bracket
26. Seal bolt
27. Bolt (10x20)
28. O-ring
29. Air bleeder cap
30. Rear clutch
31. Rear clutch hub
32. Thrust bearing
33. Thrust bearing
34. Thrust bearing
35. Front clutch
36. Thrust washer
37. Thrust washer
38. End clutch
39. End clutch hub
40. Thrust washer
41. Thrust bearing
42. Snap ring
43. Brake disc
44. Brake plate
45. Brake pressure plate
46. Brake reaction plate
47. Return spring
48. Wave spring
49. Thrust bearing
50. Thrust race
51. Snap ring
52. Kick down drum
53. Packing
54. Low & reverse brake piston
55. Center support
56. Kick down band
57. Kick down servo & spring piston
58. Kick down servo switch
59. Flywheel bolt
60. Transfer driven gear set
61. Bolt
62. Double angular
63. Taper roller bearing
64. Locking nut
65. Snap ring
66. Thrust bearing
67. Thrust race
68. Seal ring
69. Thrust bearing
70. Snap ring
71. End clutch shaft
72. Locking nut
73. Planetary carrier
74. Reverse sun gear
75. Forward sun gear
76. Anulus gear
77. Transfer drive gear
78. Output flange
79. Snap ring
80. Differential case
81. Differential gear
82. Differential gear spacer
83. Washer
84. Pinion shaft
85. Lock pin
86. Ball bearing
87. Side bearing
88. Spacer
89. Spacer
90. Differential drive gear
91. Speedometer drive gear
92. Stopper plate
93. Sprag rod support
94. Flange bolt (8x25)
95. Nut
96. Spring washer
97. Manual control lever
98. O-ring
99. Bolt
100. Manual control
101. Screw
102. Sealing washer
103. Pulse generator
104. Flange bolt (6x14)
105. Transaxle range switch
106. Flange bolt
107. Shift cable bracket
108. Flange bolt
109. Clamp
110. Snap ring
111. Oil pump
112. Oil pump gasket
113. Seal washer
114. O-ring
115. Seal ring
116. Seal bolt
117. Valve body
118. Oil temperature sensor
119. Bolt (6x26)
120. Bolt (6x36)
121. Bolt (6x41)
122. Oil filter
123. Flange bolt (6x12)
124. Speedometer driven gear sleeve
125. Flange bolt (6x14)
126. Oil level gauge & filler tube
127. Flange bolt (8x16)
128. Oil level gauge

EKPD016F

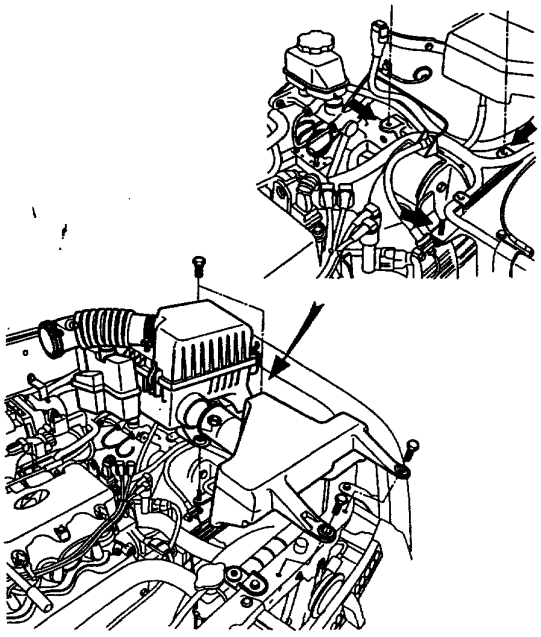
REMOVAL EDFD2A22

1. Remove the battery terminal and the battery.



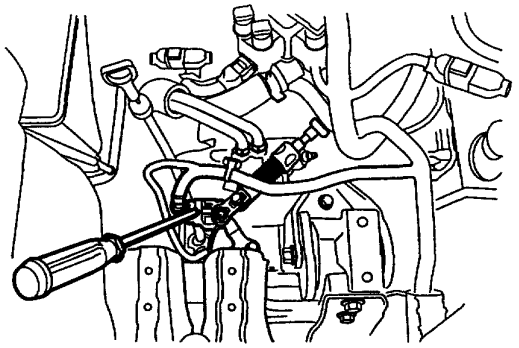
KDDC009B

2. Removal the air cleaner.



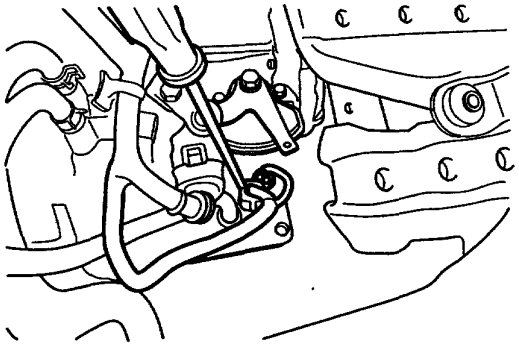
KKDD010B

3. Remove the transaxle range switch connector.



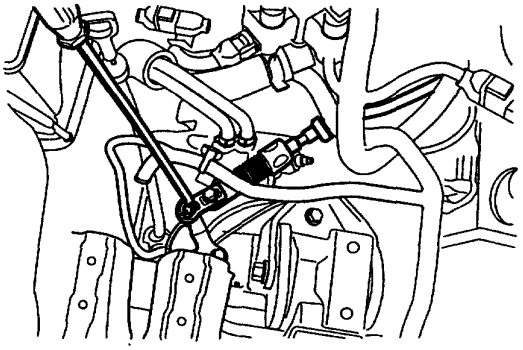
KKPC022G

4. Remove the solenoid valve connector and the oil temperature sensor connector.



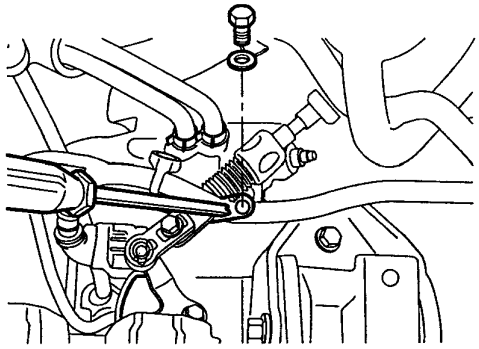
KKPC022H

5. Remove the cotter pin of the control cable.



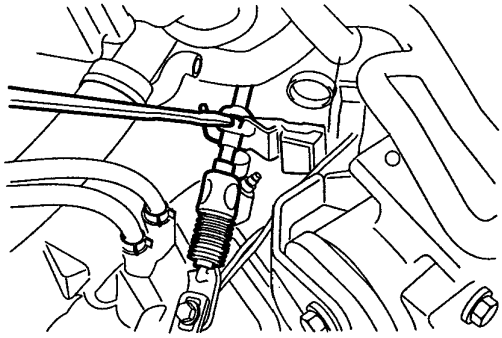
KKPC022I

6. Remove the oil filler tube.



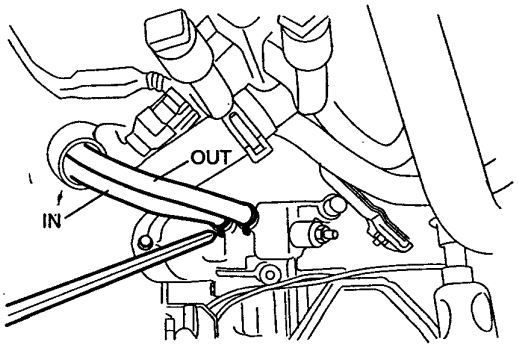
KKPC022J

7. Remove the clip of the control cable.



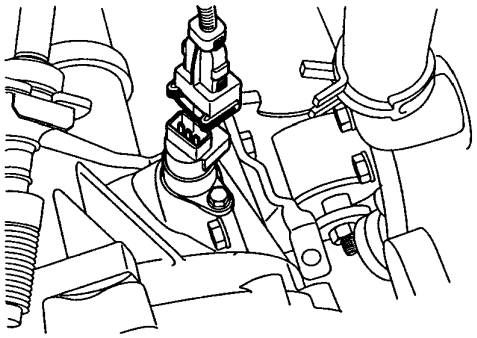
KKPC022K

8. Remove the oil cooler hose.



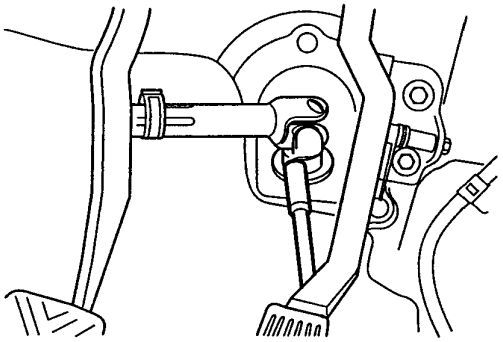
EKPC022L

9. Remove the speedometer driven gear connector. (speed sensor connector)



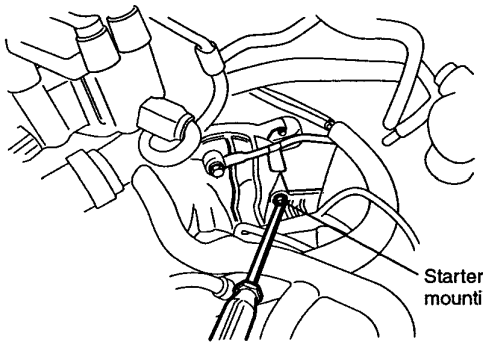
KDDC010F

10. Remove the u-joint.



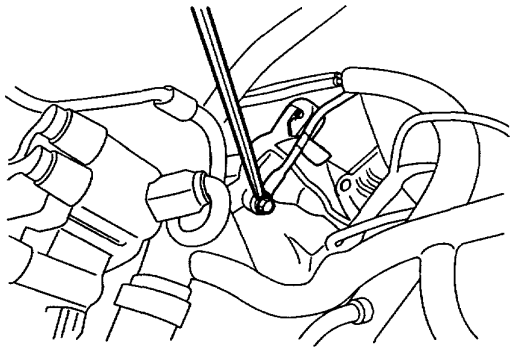
KMOB016A

11. Remove the power steering return hose.
12. Remove the tire.
13. Remove the starter motor.



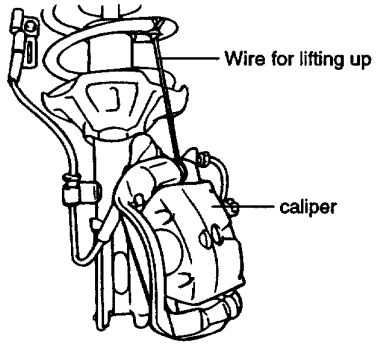
EKPC022M

14. Remove the bolt for the upper connection of the engine and the transaxle.



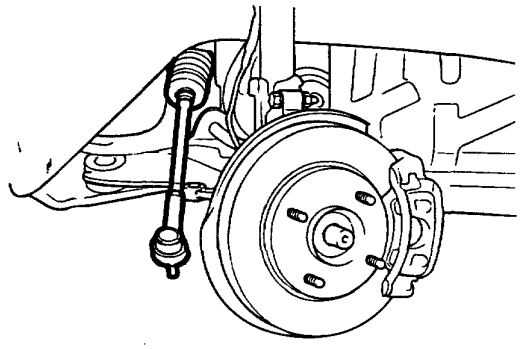
KKPC022N

15. Remove the caliper after lifting up the vehicle.



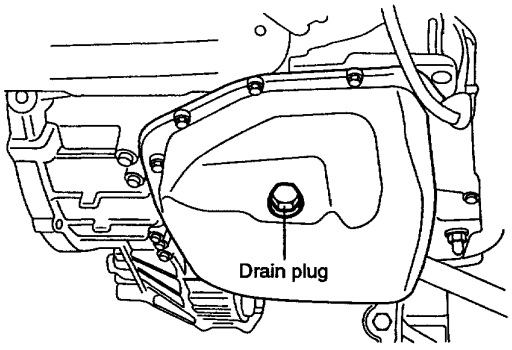
ECTC040F

16. Separate the tie rod end from the pin and nut.



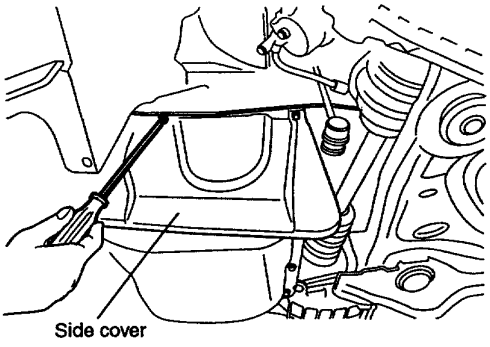
KPKA032A

17. Remove the oil drain plug and drain the oil.



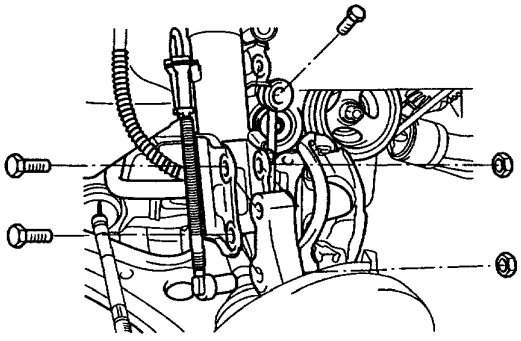
EKPC023A

18. Remove the transaxle side cover.



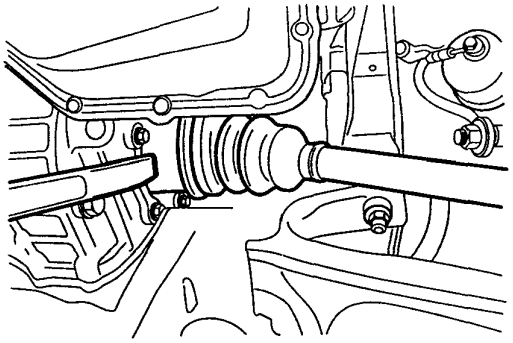
EKPC023B

19. Remove the wheel speed sensor and the knuckle mounting bolt.



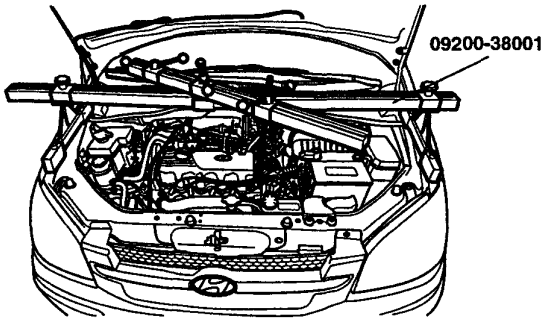
KCPC003I

20. Remove the drive shaft and the left side hub nut.



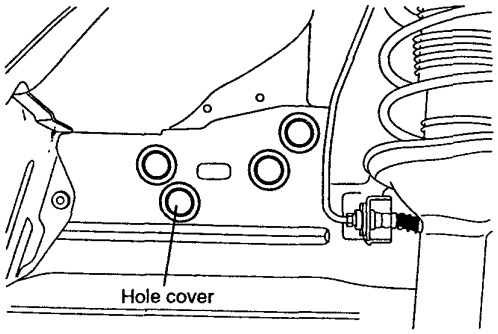
KKPC023C

21. Install the special tool, the engine support fixture on the engine assembly.



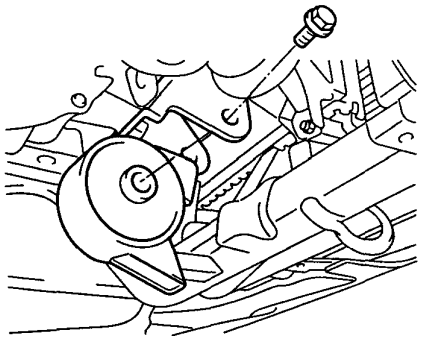
KKDC023E

22. Remove the transaxle mounting bracket after removing the hole cover and the mounting bolts.



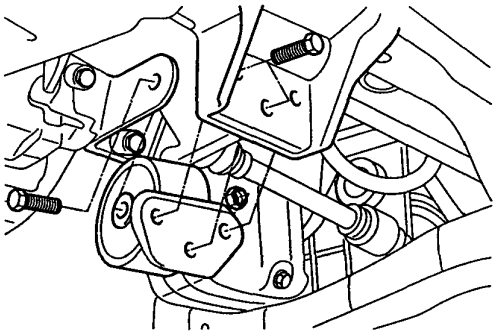
EKDD120A

23. Remove the front roll stopper.



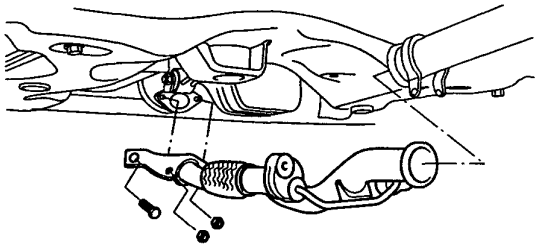
KDDC015B

24. Remove the rear roll stopper.



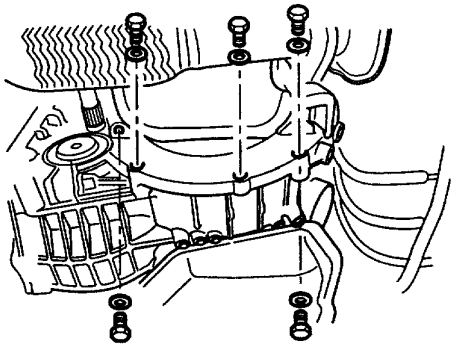
KDDC015C

25. Remove the front muffler.



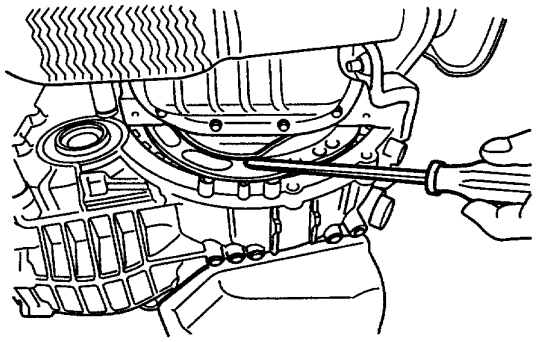
KCPC003G

26. Remove the bell housing cover. (Bolts : 5EA)



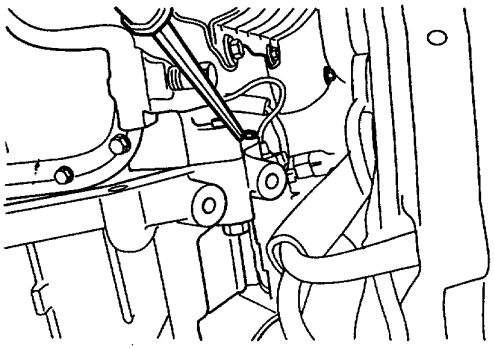
KKPC023J

27. Remove the torque converter mounting plate bolts (3EA).



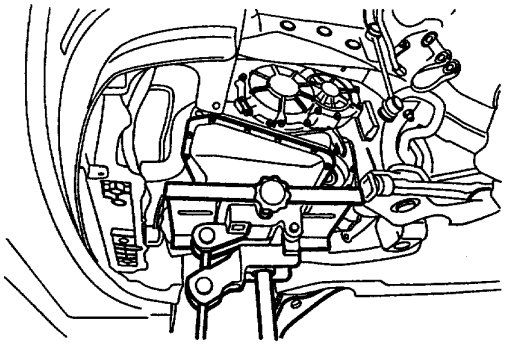
KKPC023K

28. Remove the cylinder block plate bolt.



KKPC023L

29. Install the jack for supporting transaxle.

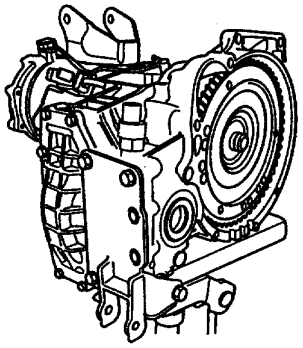


KKPC023O

30. Remove the lower mounting bolts (2EA) of the transaxle.

31. Remove the sub frame.

32. Remove the transaxle.



KKPC023P

INSTALLATION EABF5831

1. Attach the torque converter on the transaxle side and mount the transaxle assembly onto the engine.

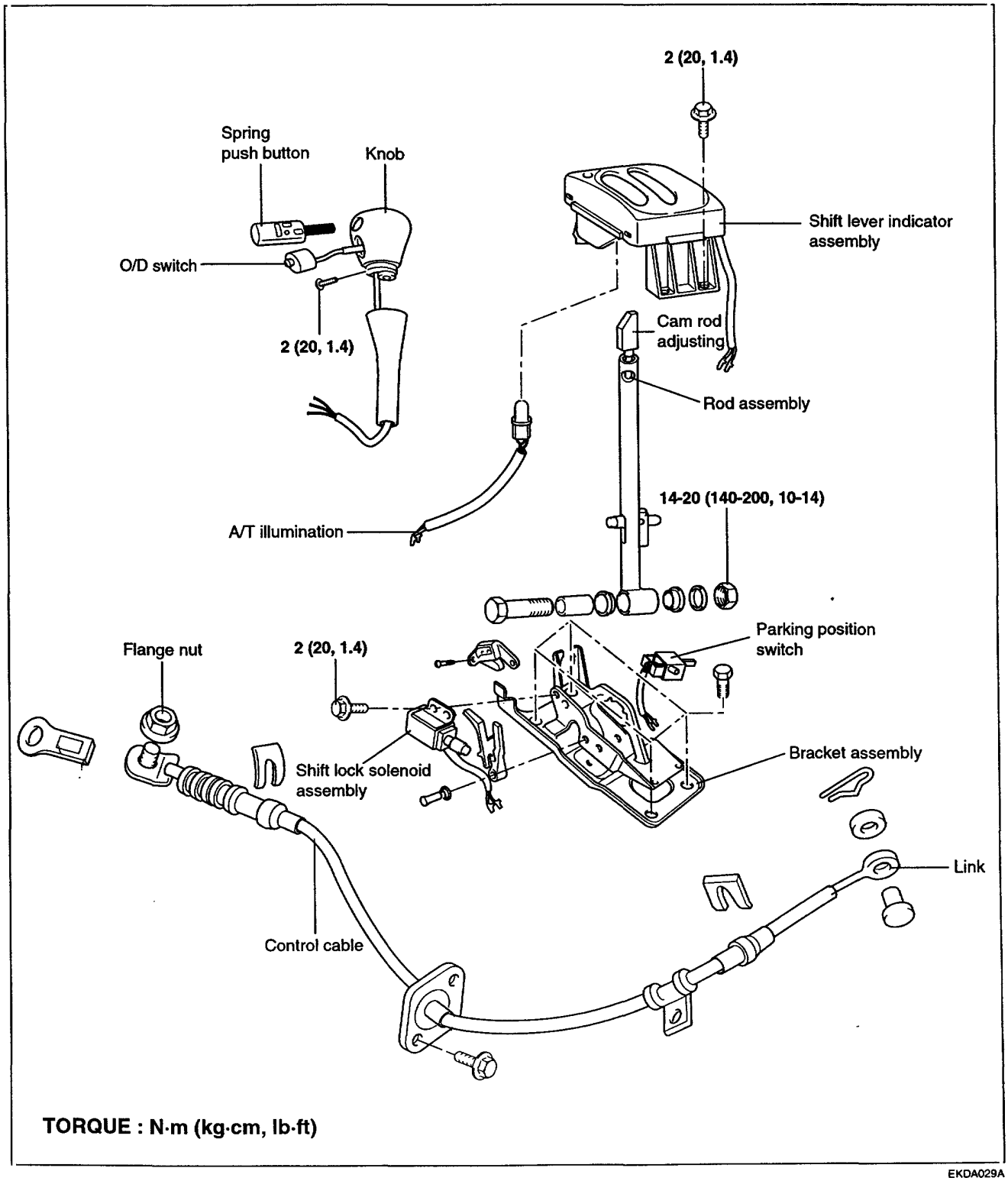
   ⚠ ***CAUTION***

   - ***If the torque converter is mounted on the engine first, the oil seal on the transaxle side may be damaged. Therefore, be sure to first assemble the torque converter to the transaxle.***
   - ***When installing the roll stopper mounting bracket, be careful not to crush the insulator. If crushed, idle vibration may occur.***

2. Install the transaxle control cable and adjust as follows:
   a. Move the shift lever and the transaxle range switch to the "N" position and install the control cable.
   b. When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts to the control cable.
   c. Remove any free-play in the control cable by adjusting the nut and then check to see that the selected lever moves smoothly.
   d. Check to see that the control cable has been adjusted correctly.

AUTOMATIC TRANSAXLE SHIFT CONTROL

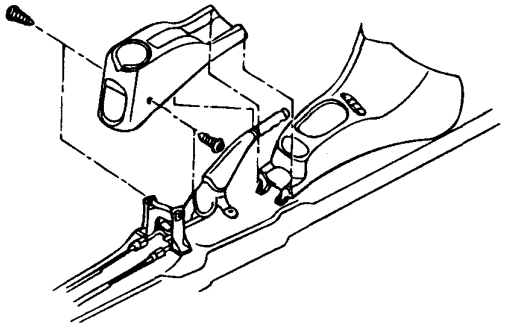
COMPONENTS EF06B8DF



EKDA029A

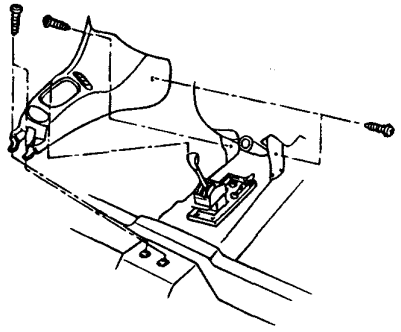
REMOVAL ECA7E663

1. Remove the rear console.



ESDA150A

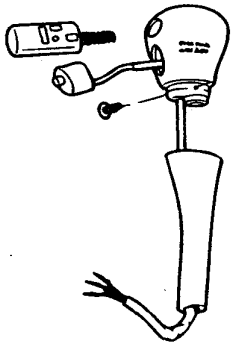
2. Remove the front console.



ESDA150B

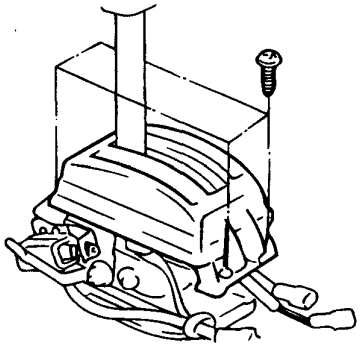
3. Remove the knob installation screws.

4. Disconnect the overdrive switch connector, remove the 3 connector pins from connector with small driver, and then remove selector knob assembly.



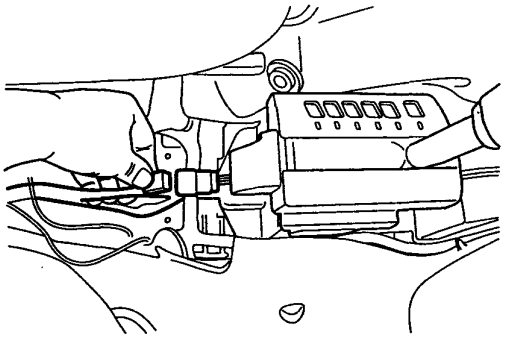
EKDA030A

5. Disconnect the position indicator light connector.



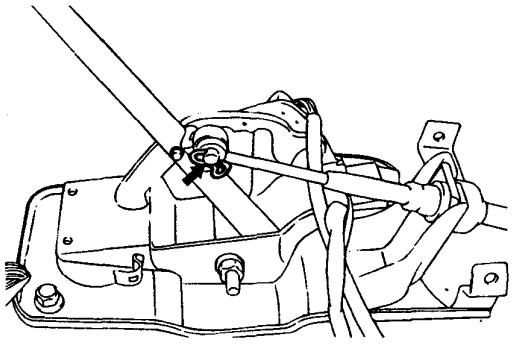
EKDA030B

6. Remove the shift lever indicator assembly.



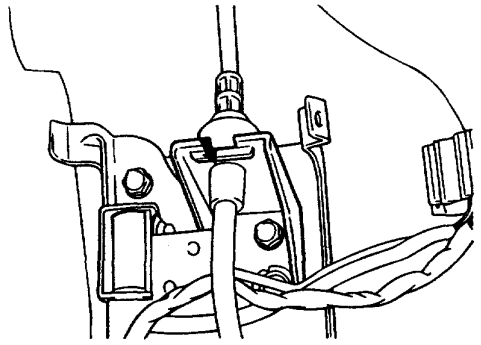
KKPC060G

7. Remove the cotter pin.



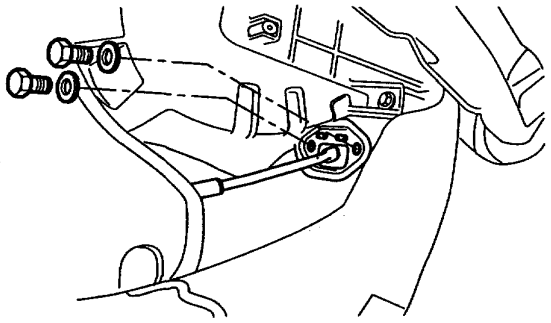
EKDA030C

8. Remove the clip from the shift lever side.



EKDA030D

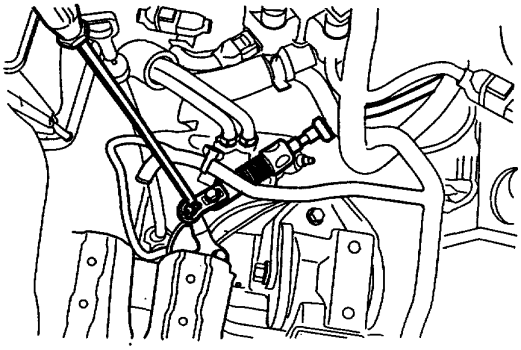
9. Remove the bolt-washer assembly located on dash panel.



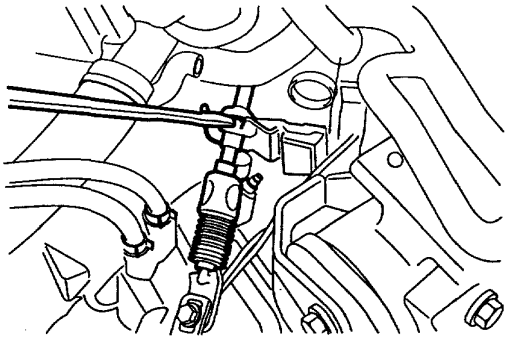
KKPC060I

10. Remove the shift lever assembly.

11. Remove the transaxle control cable assembly.



KKPC022I

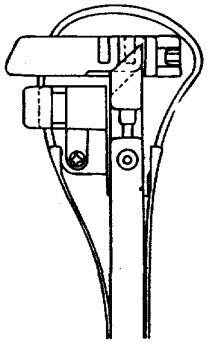


KKPC022K

INSTALLATION EAACCCE3

1. Apply a coating of the specified grease to the interior of the bushing.

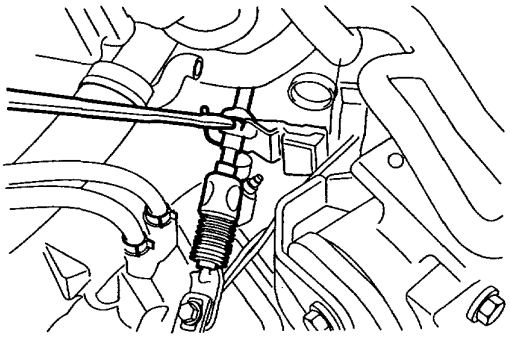
Specified grease :
Chassis grease SAE J310, NLGI No.0



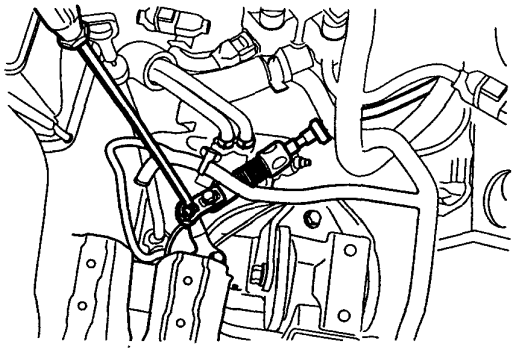
EKDA032A

2. Move the shift lever and the transaxle range switch to the N position, and install the control cable.

3. When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts the control cable.

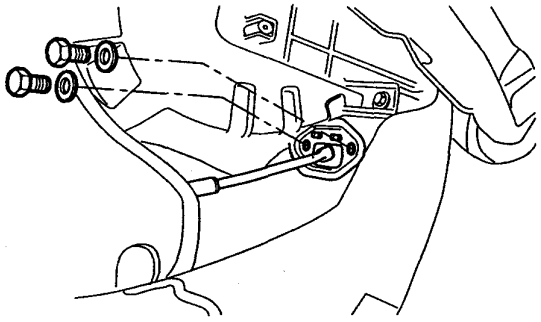


KKPC022K



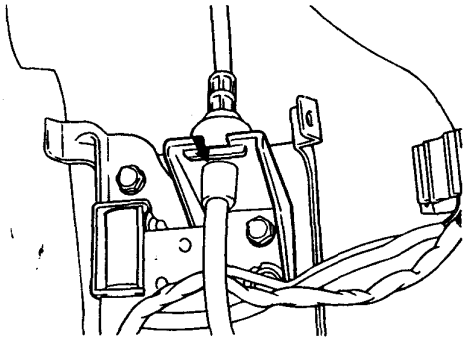
KKPC022I

4. Install the bolt-washer assembly and nut.



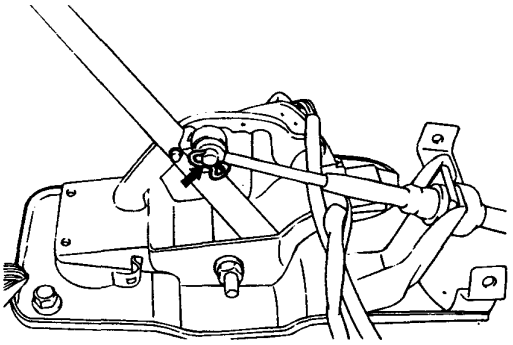
KKPC060I

5. Install the clip pin and self lock pin.



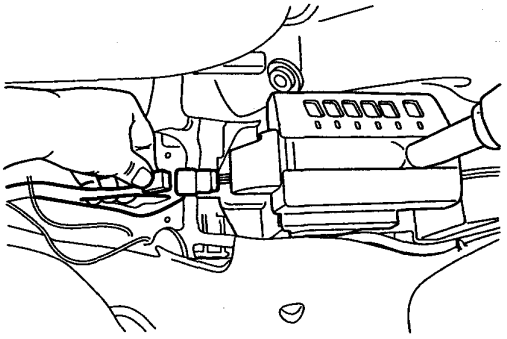
EKDA030D

6. Install the cotter pin.



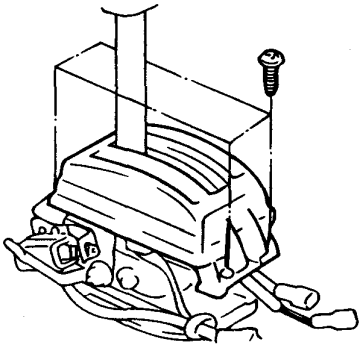
EKDA030C

7. Connect the position indicator light connector, the O/D switch connector, the parking position switch connector, normal/economy select switch connector and the shift lock solenoid connector.



KKPC060G

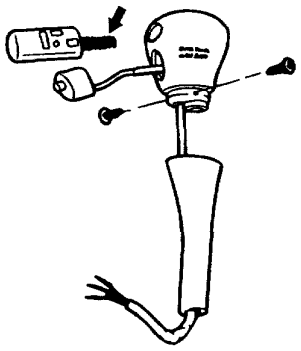
8. Install the shift lever indicator assembly.



EKDA032F

9. Apply the specified grease at the place shown in the figure.

Specified grease :
Multipurpose grease SAE J310, NLGI No.2



EKDA032G

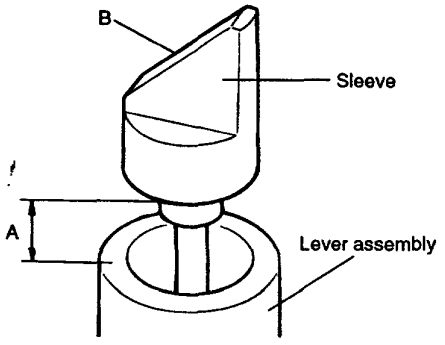
10. Install the shift lever assembly.

11. Place the shift lever in the N position, and then turn the cam adjusting so that the clearance between the cam adjusting and the lever assembly end in within the standard value.

Standard value (A) : 15.2-15.9 mm (0.598-0.625 in.)

NOTE

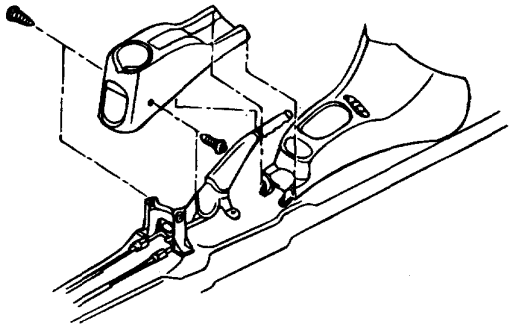
Be sure to face B of the adjusting cam to the push button (driver's side).



EKDA032H

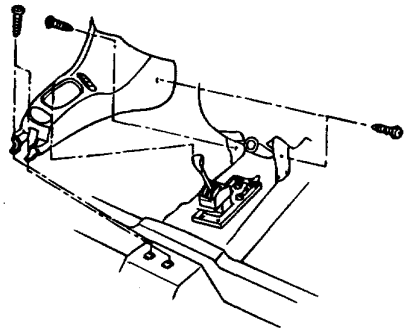
12. Insert the O/D switch wiring to the shift lever cover, and then assemble the pin into the O/D switch connector.

13. Install the front console.



ESDA150A

14. Install the rear console.

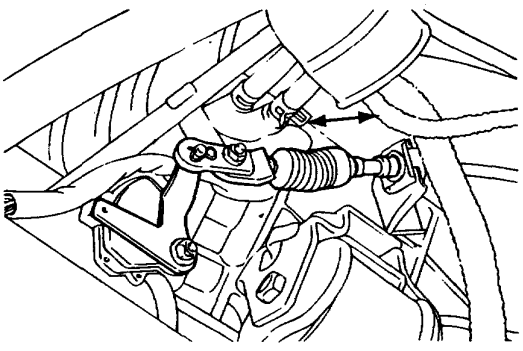


ESDA150B

ADJUSTMENT OF CONTROL CABLE

1. Eliminate slack from the control cable with the adjusting flange nut and check that the select lever operates smoothly.

2. Driving the car, check that the transaxle is set in the proper range when the select lever is shifted to each position.



EKDA032J

INSPECTION EEF83A70

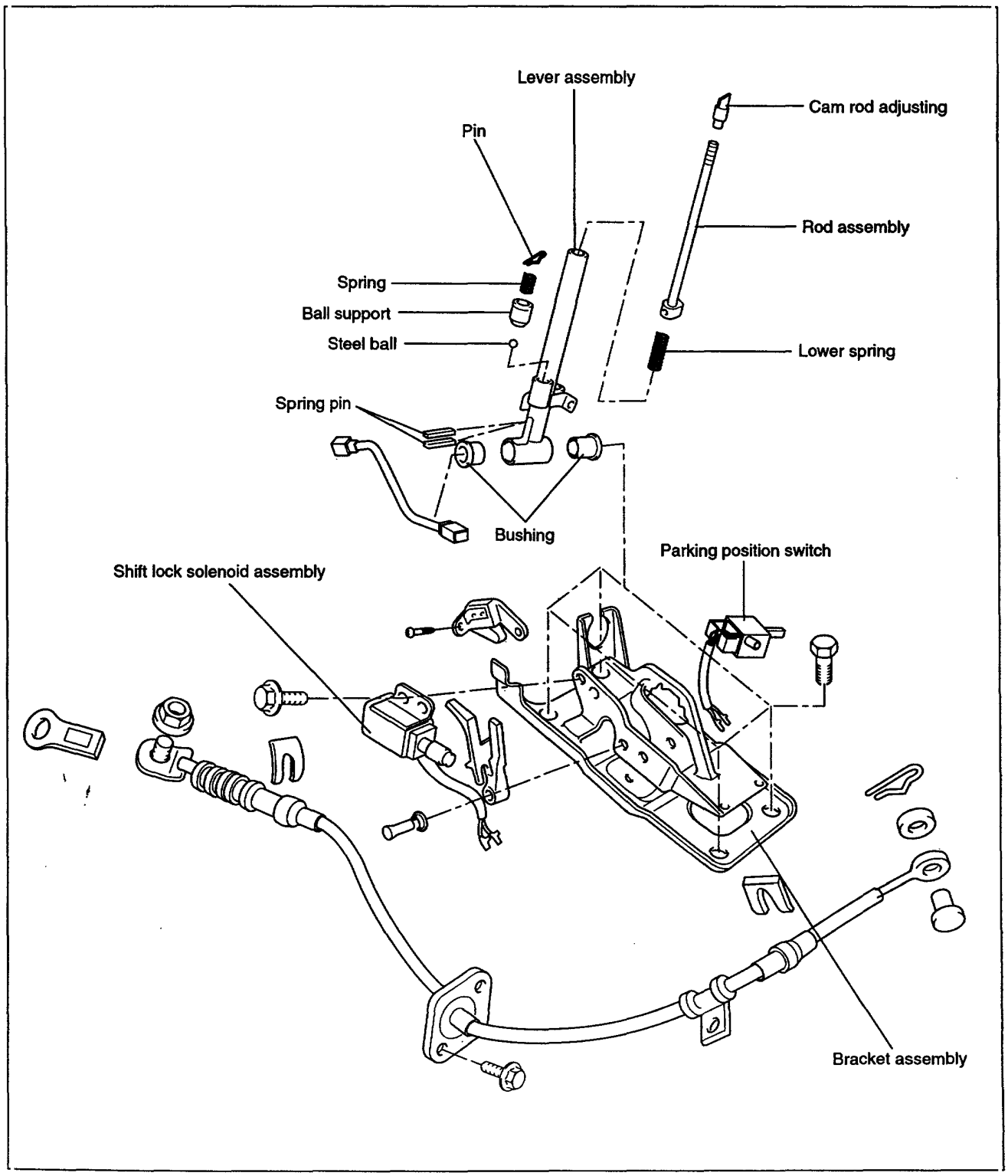
1. Check the control cable for function and damage.
2. Check the bushing for wear or damage.
3. Check the spring for damage or deterioration.
4. Check the overdrive switch for continuity.

Terminal / Switch position	1	2	3
Overdrive activation	○	○	
Overdrive non-activation	○		○

EKDA031A

SHIFT LEVER

SHIFT LEVER ASSEMBLY ED3F0D3D



EKDA034A

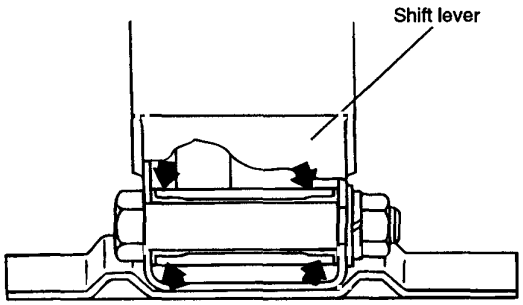
INSPECTION EBB67346

- Check the detent place for wear.
- Check the bushing for wear or damage.
- Check the spring for damage or deterioration.
- Check the pin at the end of the rod assembly for wear.

REASSEMBLY E47390DF

1. Apply a coating of grease to the sliding part of the bushing.

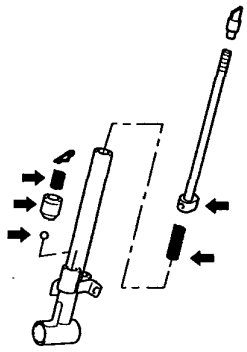
Specified grease :
Chassis grease SAE J310, NLGI No.2



EKDA036A

2. Apply the specified grease at the places shown in the figure.

Specified grease :
Multipurpose grease SAE J310, NLGI No.2



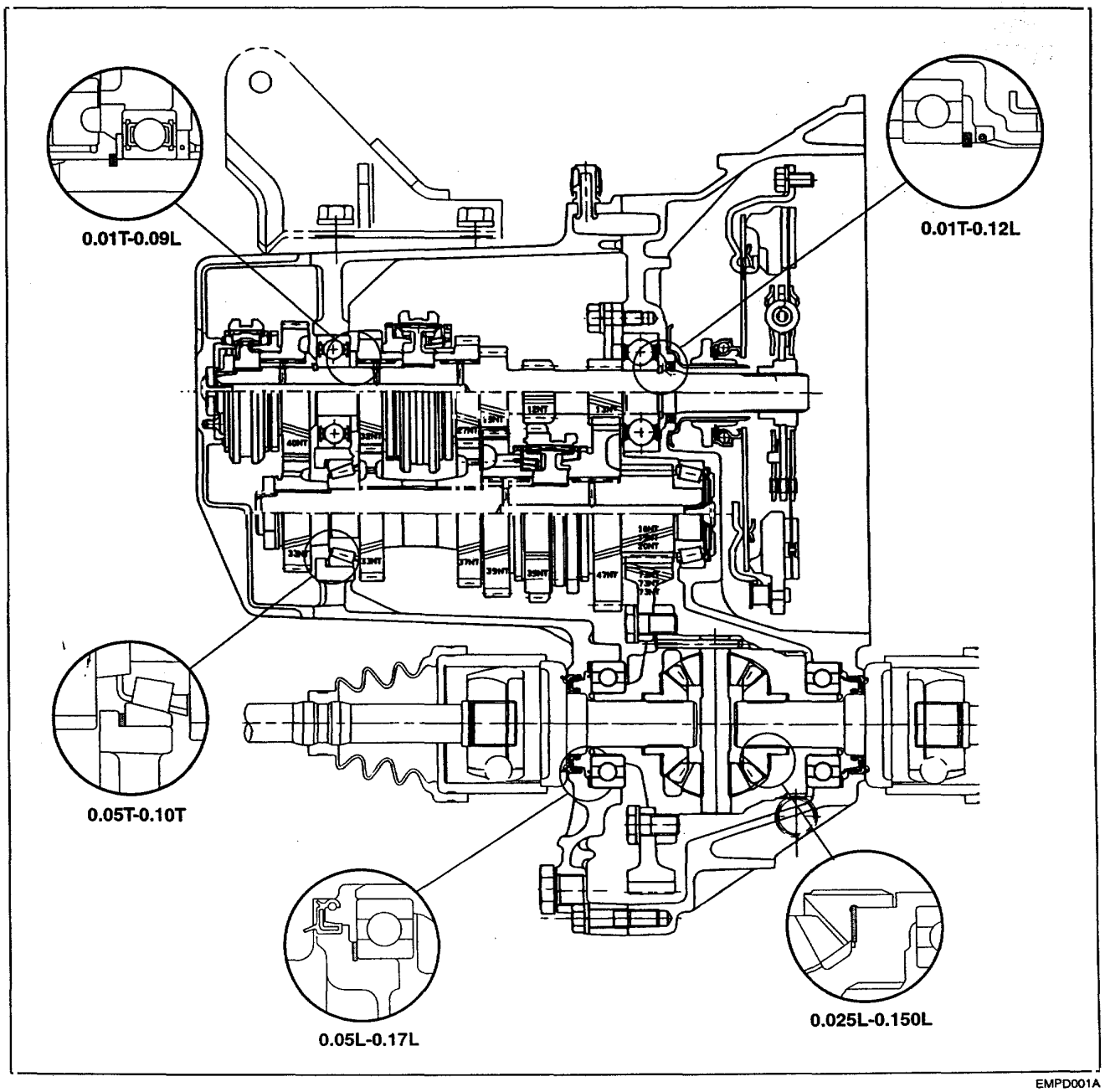
EKDA036B

MANUAL TRANSAXLE SYSTEM

GENERAL INFORMATION (M5AF3) EDF70DAE

Manual transaxle overhaul section has been separated from the shop manual.
M5AF3 overhaul section was included in the overhaul manual.

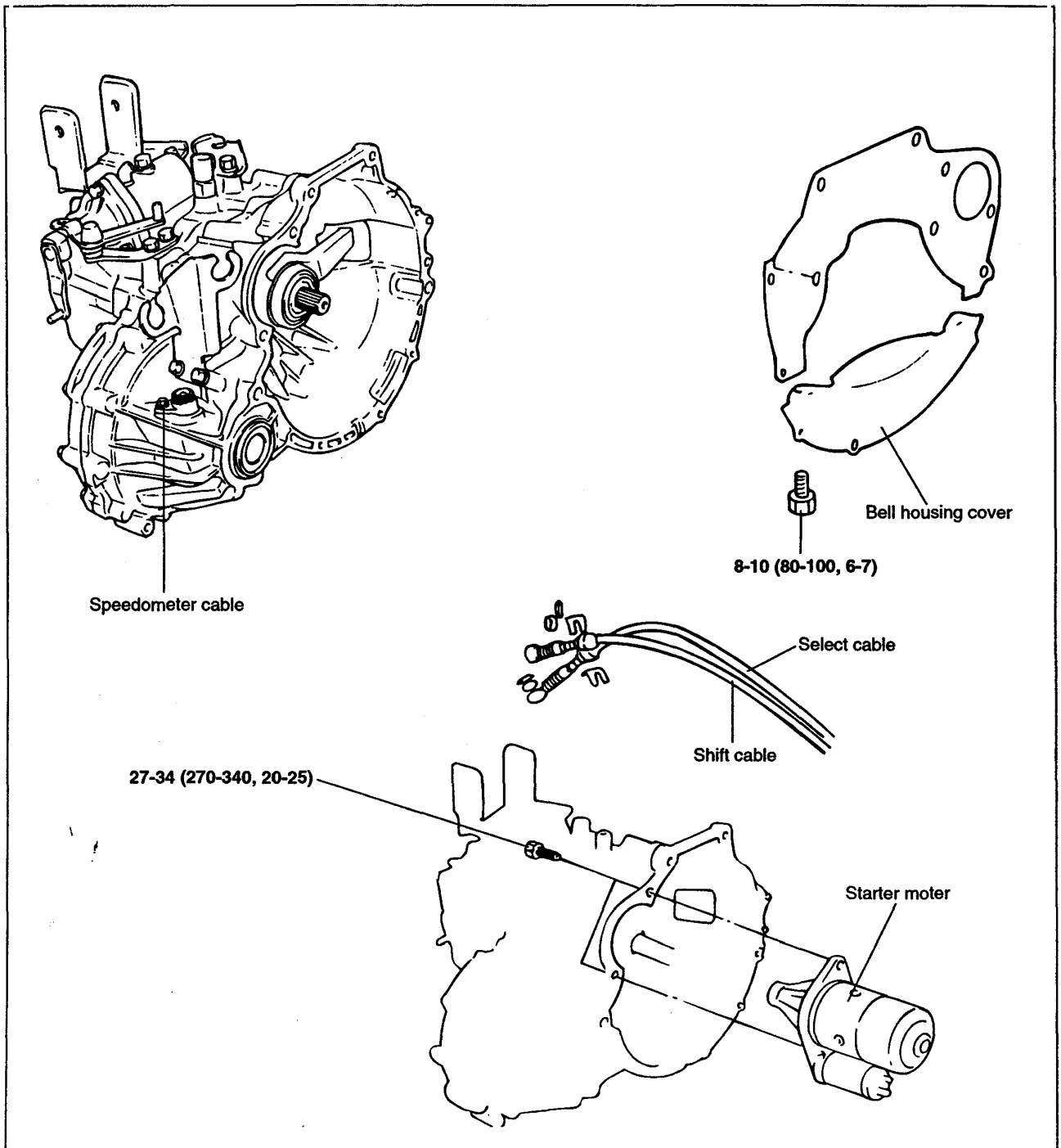
SECTION VIEW



EMPD001A

MANUAL TRANSAXLE

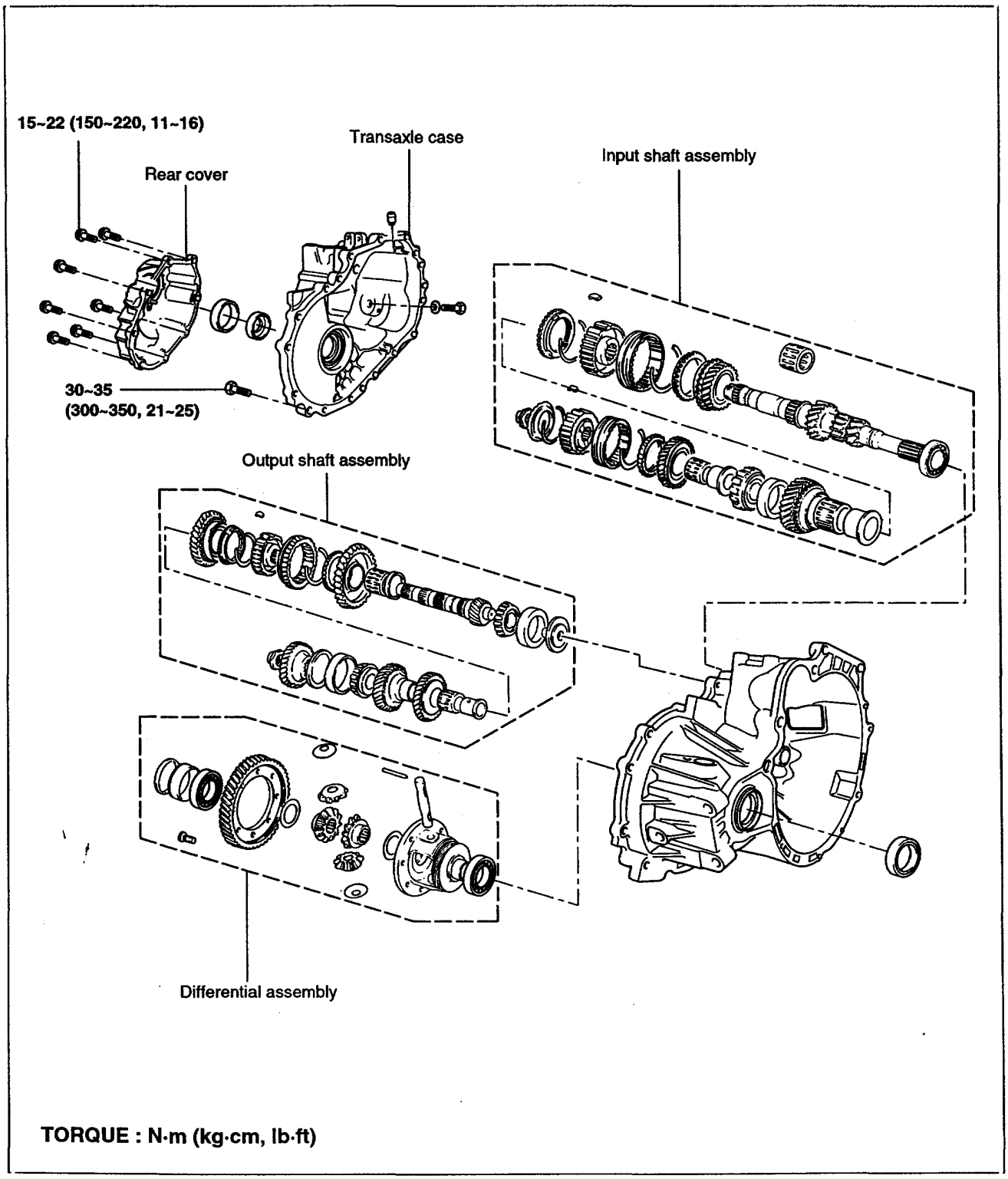
COMPONENTS (1) EA8473B7



TORQUE : Nm (kg·cm, lb·ft)

EMDA011A

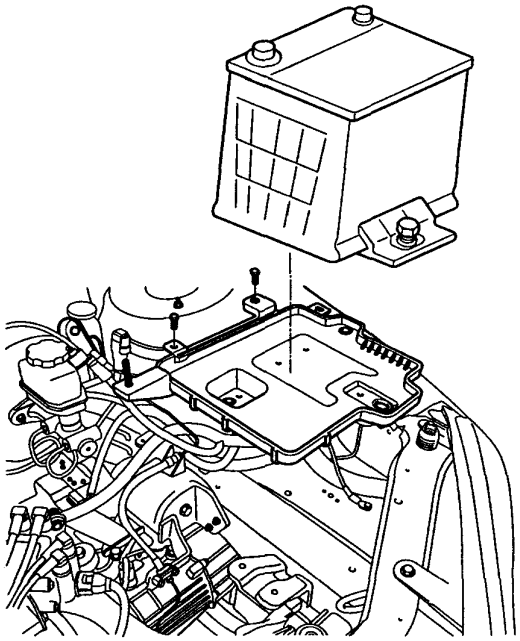
COMPONENTS (2)



EMDD018B

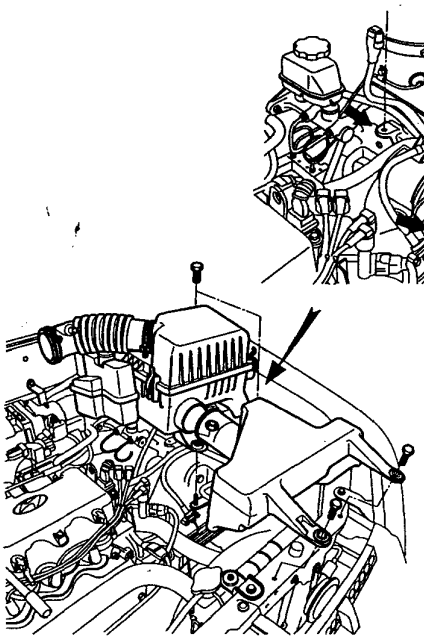
REMOVAL E4B18A20

1. Remove the battery terminal and the battery.



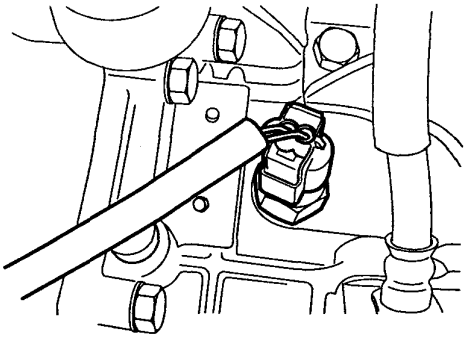
KDDC009B

2. Removal the air cleaner.



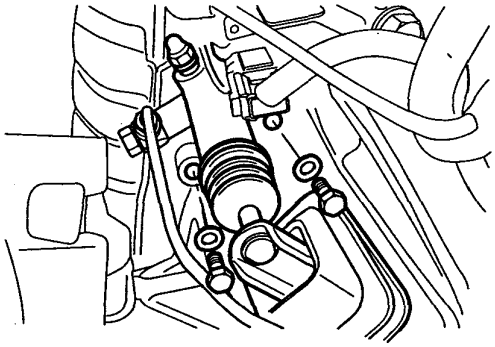
KKDD010B

3. Remove the back-up lamp switch.



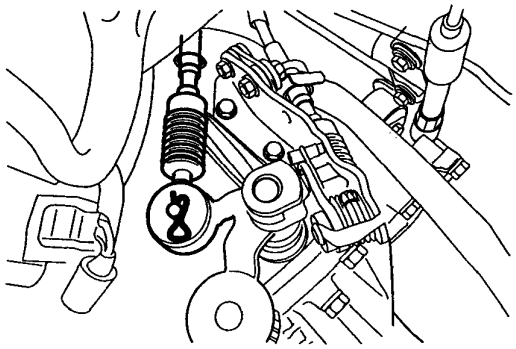
KMPC678A

4. Remove the clutch release mounting bolts.



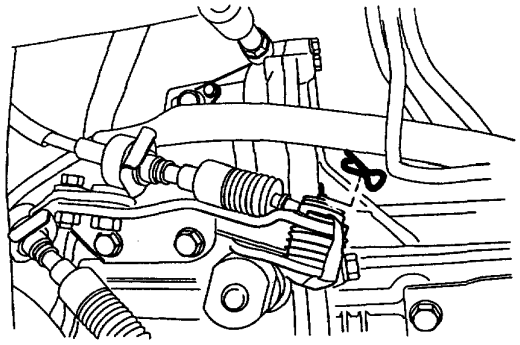
KMPC677A

5. Remove the cotter pin of the shift cable.



KMPC680A

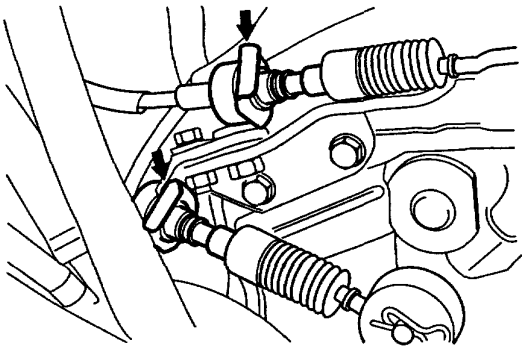
6. Remove the cotter pin of the selector cable.



KMPC681A

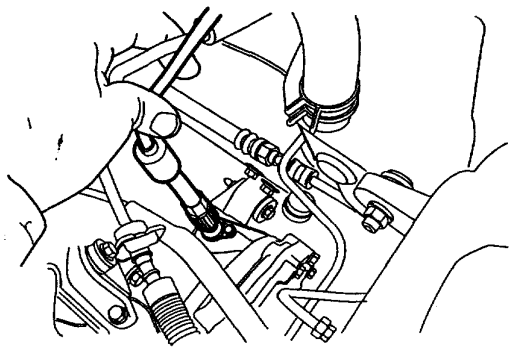
7. Remove the clip of the shift cable.

8. Remove the clip of the selector cable.



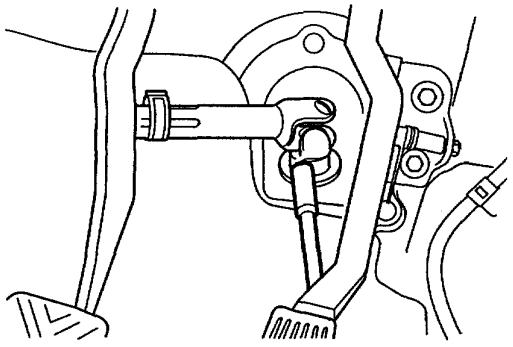
KMPC682A

9. Remove the speedometer driven gear connector.



KMPC679A

10. Remove the u-joint.

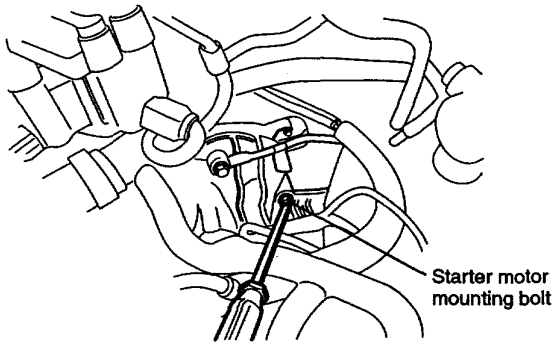


KMOB016A

11. Remove the power steering return hose.

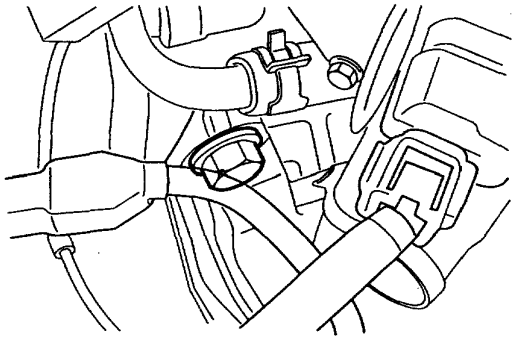
12. Remove the tire.

13. Remove the starter motor upward the transaxle.

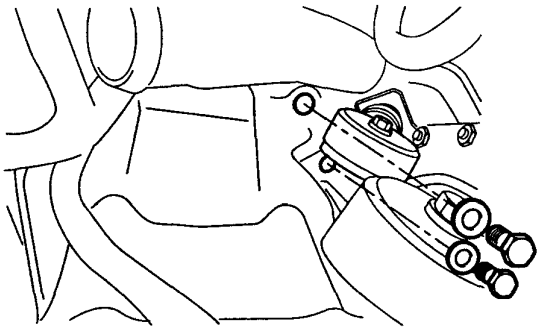


EKPC022M

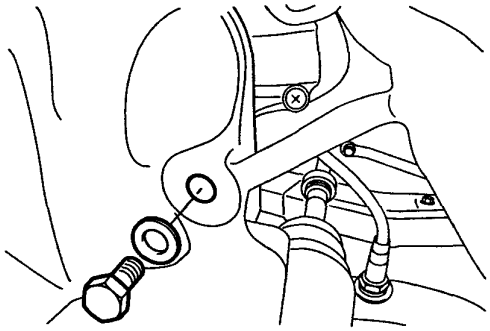
14. Remove the bolt for the upper connection of the engine and the transaxle.



KMPC685A

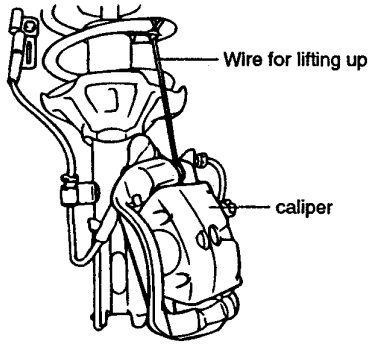


KMPC687A



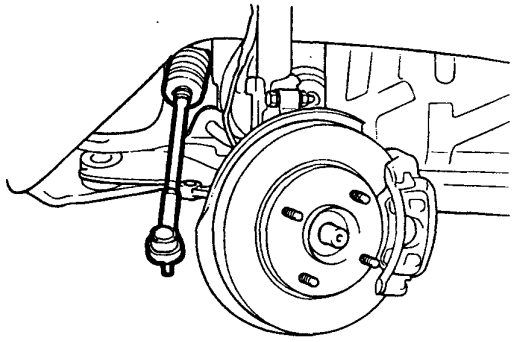
KMPC688A

15. Remove the caliper after lifting up the vehicle.



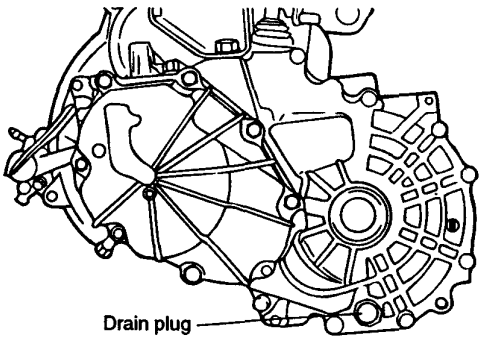
ECTC040F

16. Separate the tie rod end from the pin and nut.



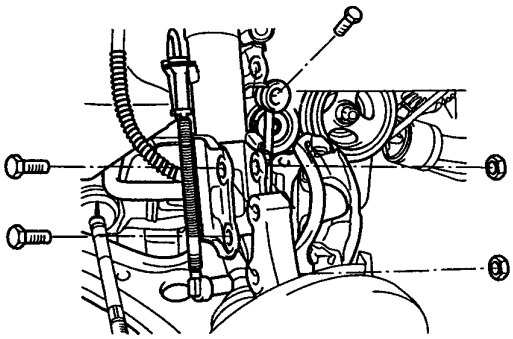
KPKA032A

17. Remove the oil drain plug and drain the oil.



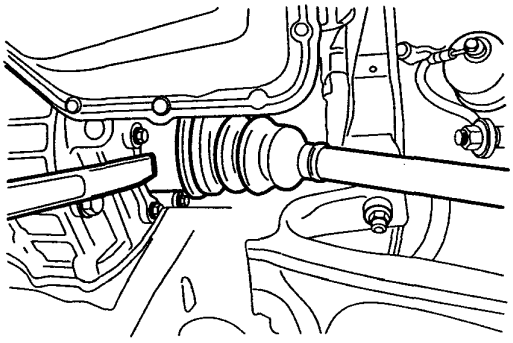
E43008A

18. Remove the wheel speed sensor and the knuckle mounting bolt.



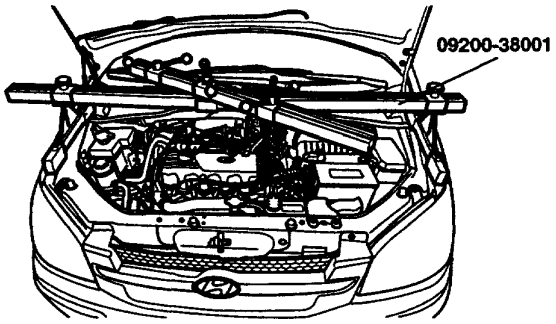
KCPC003I

19. Remove the drive shaft and the hub nut.



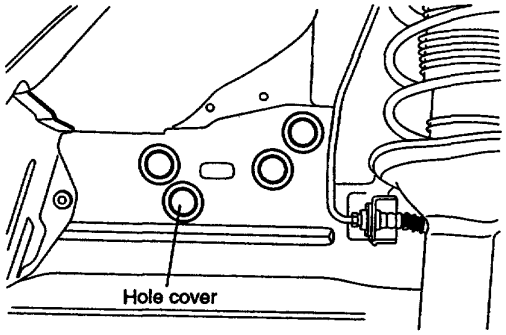
KKPC023C

20. Install the special tool, the engine support fixture on the engine assembly.



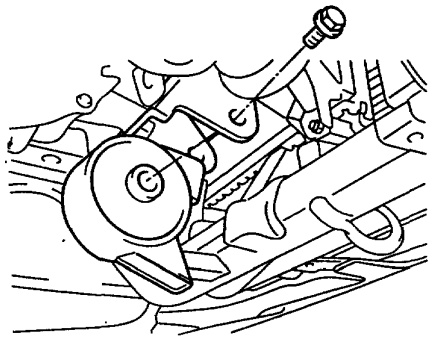
KKDC023E

21. Remove the transaxle mounting bracket after removing the hole cover and the mounting bolts.



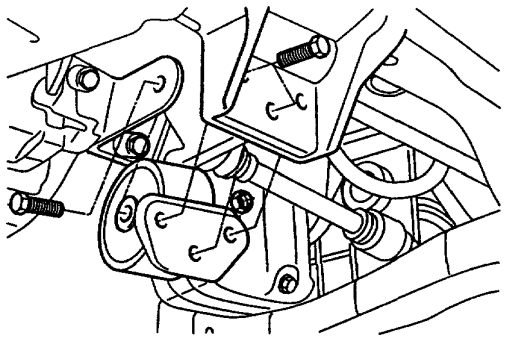
EKDD120A

22. Remove the front roll stopper.



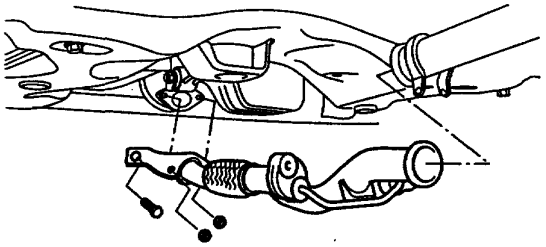
KDDC015B

23. Remove the rear roll stopper.



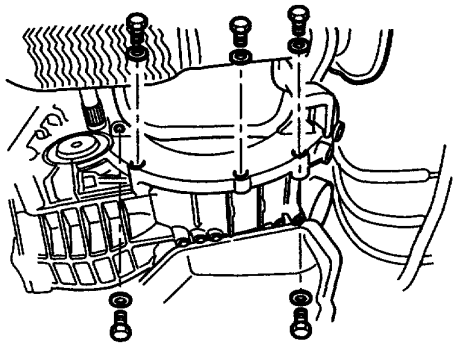
KDDC015C

24. Remove the front muffler.



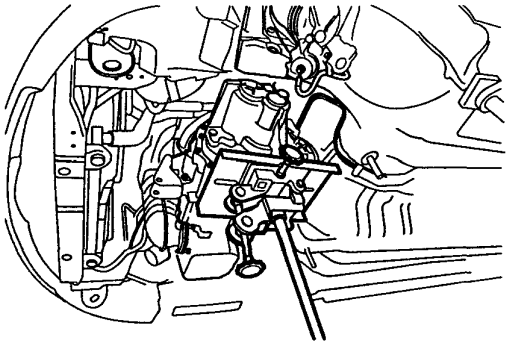
KCPC003G

25. Remove the bell housing cover. (Bolt : 5EA)



KKPC023J

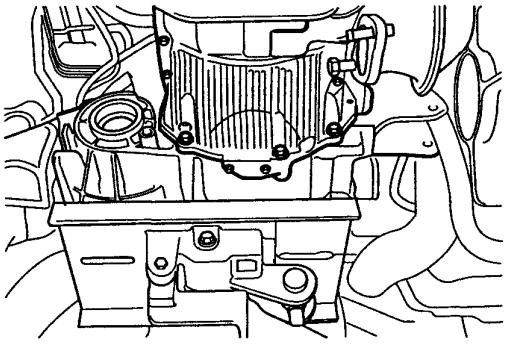
26. Install the jack for supporting transaxle.



KMOB033A

27. Remove the sub frame.

28. Remove the lower mounting bolts of the transaxle.



KMOB034A

29. Remove the transaxle.

INSTALLATION EFD5BFBF

Installation is the reverse of removal.

INSPECTION EC7D7D34

TRANSAXLE GEAR OIL LEVEL INSPECTION

Inspect the transaxle for evidence of leakage. Check the gear oil level by removing the filler plug. If the oil is contaminated, it is necessary to replace it with new oil.

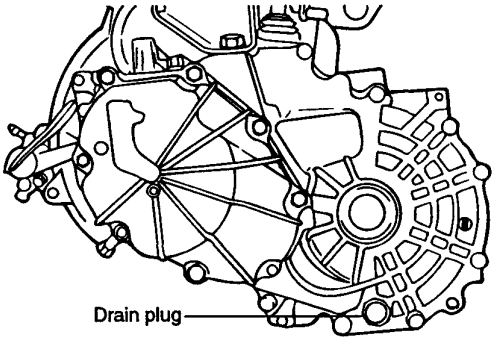
1. Remove the oil filler plug and check the level with finger.
2. Oil level must be up to the filler hole. If it is below the hole, add oil until it runs out, then reinstall the plug.
3. Replace the oil if the transaxle gear oil is noticeably dirty, or it is not of a suitable viscosity.

REPLACEMENT OF TRANSAXLE GEAR OIL

USE HP GEAR OIL SAE 75W/90 (API-GL-4)

1. With the vehicle parked on a level surface, remove the drain plug and drain the transaxle oil.
2. Replace the gasket with a new one and install the drain plug.

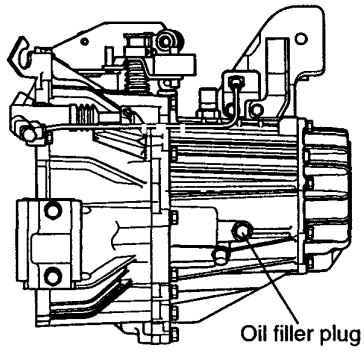
Tightening torque :
Drain plug : 30~35 Nm (300~350 kg·cm, 22~25 lb·ft)



EMDA003A

3. Add new oil the through the filler plug, filling to the same level as the opening plug.

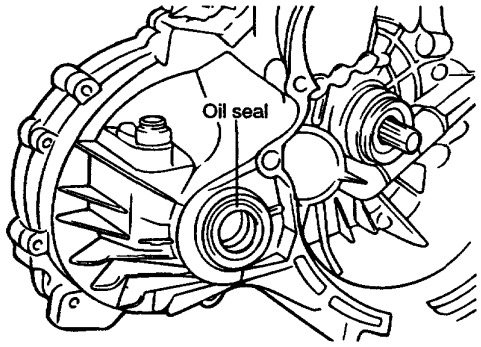
Transaxle oil total capacity :
2.15 Liters (2.27 U.s.qts., 1.89 Imp.qts.)
Tightening torque :
Filler plug : 30~35 Nm (300~350 kg·cm, 22~25 lb·ft)



EKPC011A

DRIVE SHAFT OIL SEAL REPLACEMENT

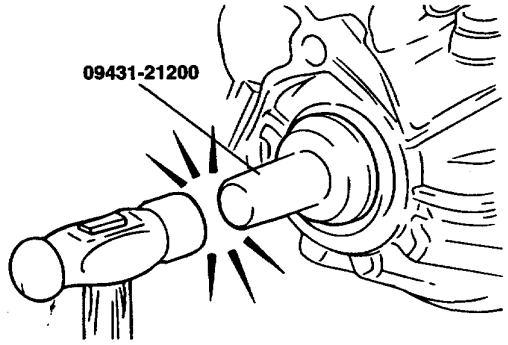
1. Disconnect the drive shaft from the transaxle (Refer to DS GROUP).
2. Using a flat-tip screwdriver, remove the oil seal.



EMDA003C

3. Using the special tool (09431-21200), tap the drive shaft oil seal into the transaxle.
4. Apply a coating of gear oil to the lip of the oil seal.

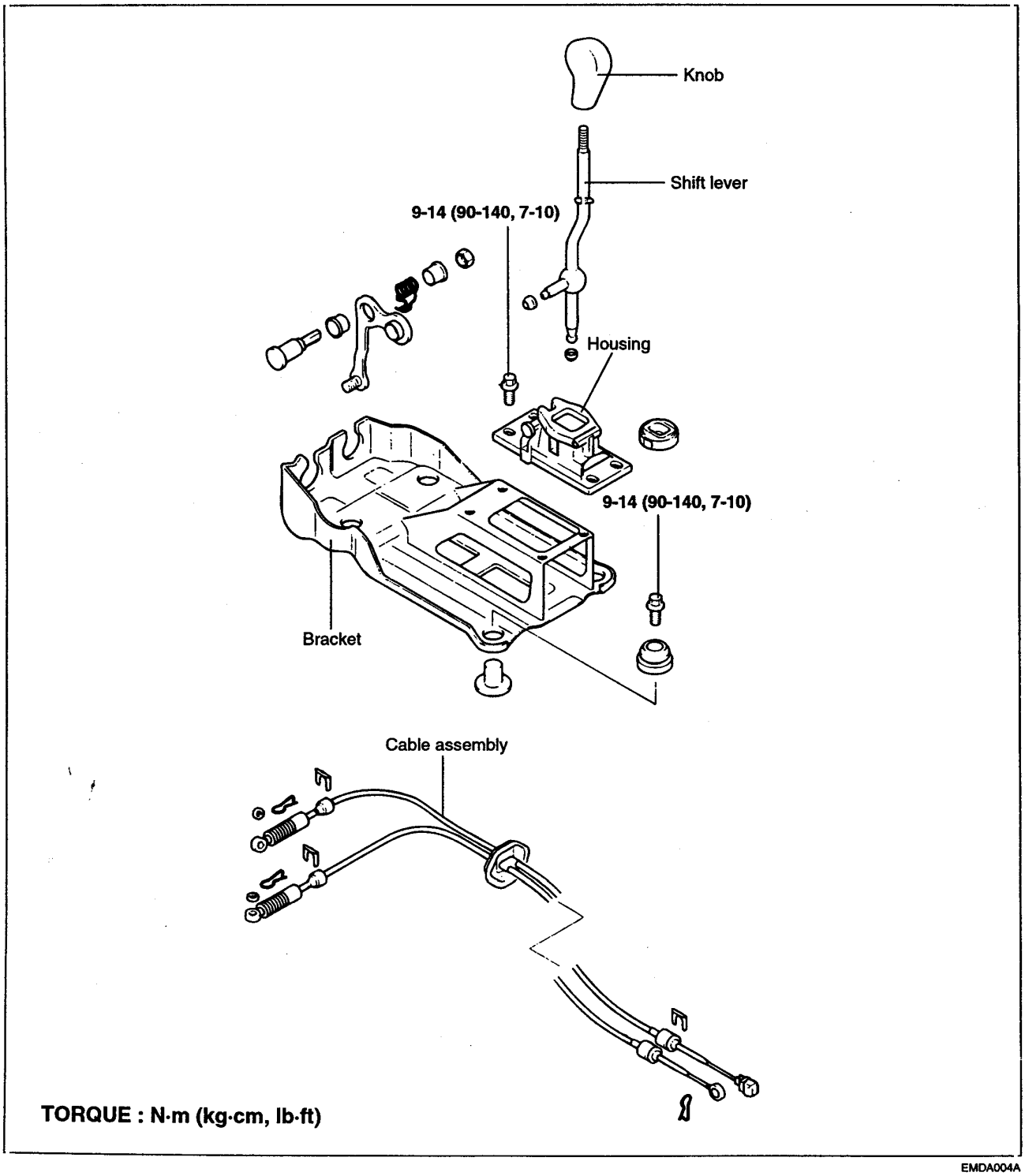
Transaxle gear oil :
HYUNDAI GENUINE PARTS MTF 75W/90
conforming to API GL-4 or higher



EMDA003D

MANUAL TRANSAXLE SHIFT CONTROL

COMPONENTS E96BC34C

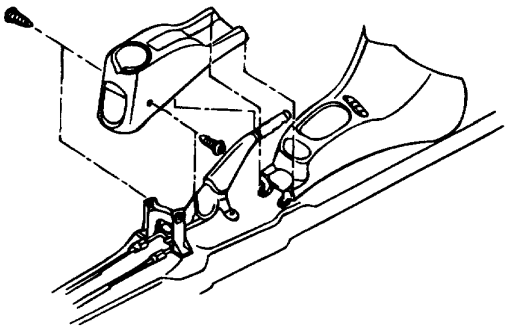


TORQUE : N·m (kg·cm, lb·ft)

EMDA004A

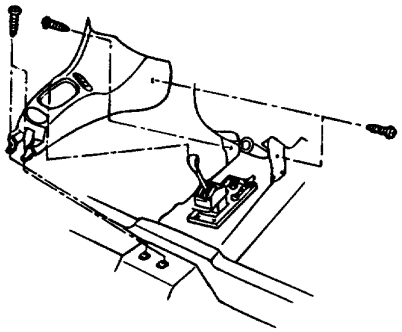
REMOVAL EE4620D1

1. Remove the shift knob and the rear console.



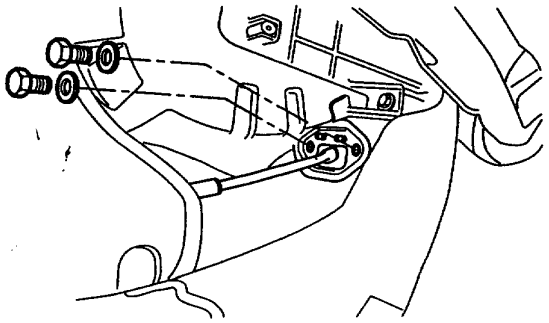
ESDA150A

2. Remove the front console.



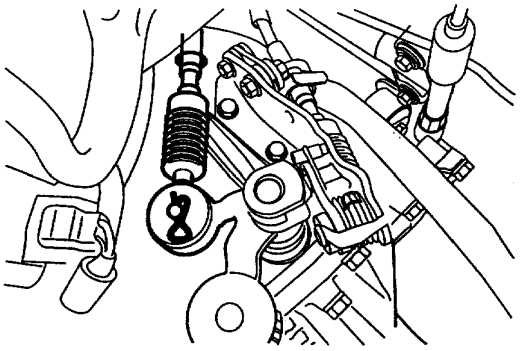
ESDA150B

3. Remove the cable mounting bolts of the lower dash board.



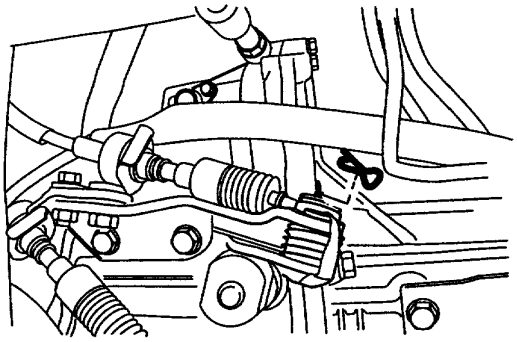
KKPC060I

4. Remove the cotter pin of the shift cable.



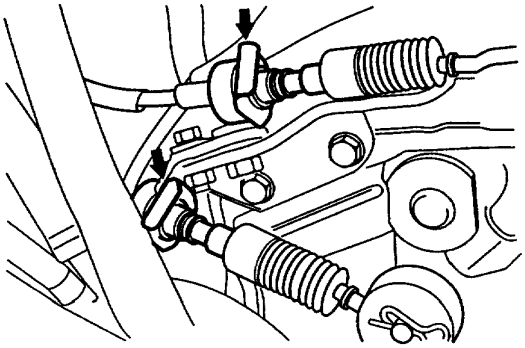
KMPC680A

5. Remove the cotter pin of the selector cable.



KMPC681A

6. Remove the clip of the shift cable and the selector cable.



KMPC682A

7. Remove the shift lever assembly.

INSTALLATION E070DED0

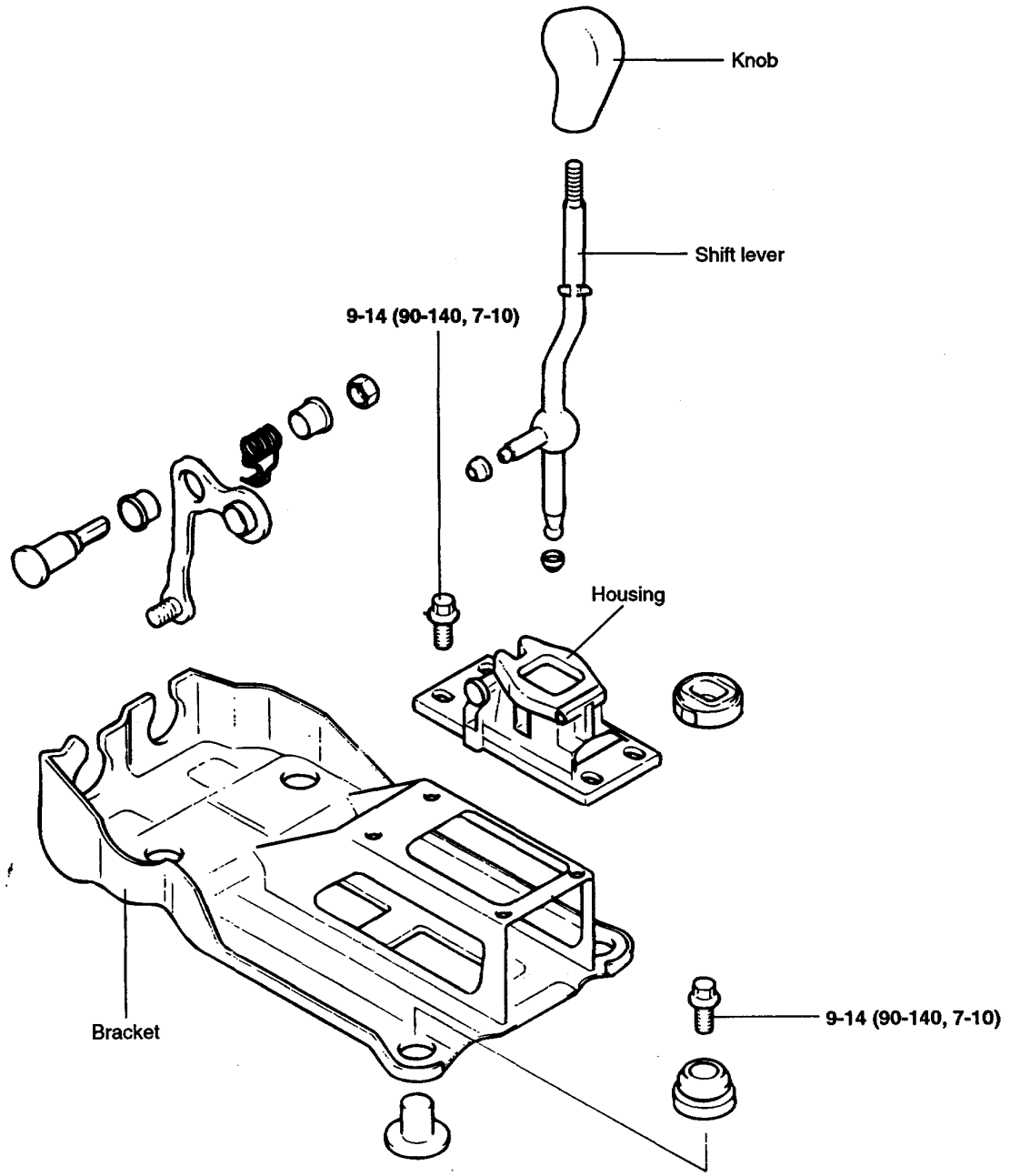
Installation is the reverse of the removal.

INSPECTION E5EA1564

1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boot for damage.
4. Check each bushing for wear, abrasion, sticking, restricted movement or damage.
5. Check for a weak or damaged spring.

SHIFT LEVER

COMPONENTS EBEE8B7D



TORQUE : Nm (kg·cm, lb·ft)

EMDA008A

INSPECTION ED2C907F

1. Check the bushing for wear or damage.
2. Check the return spring for damage or deterioration.

REASSEMBLY EF5FBF8E

1. Apply multi-purpose grease to the sliding part of the bushings.
2. Reassembly is the reverse of disassembly.